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Mineral Land Assessment
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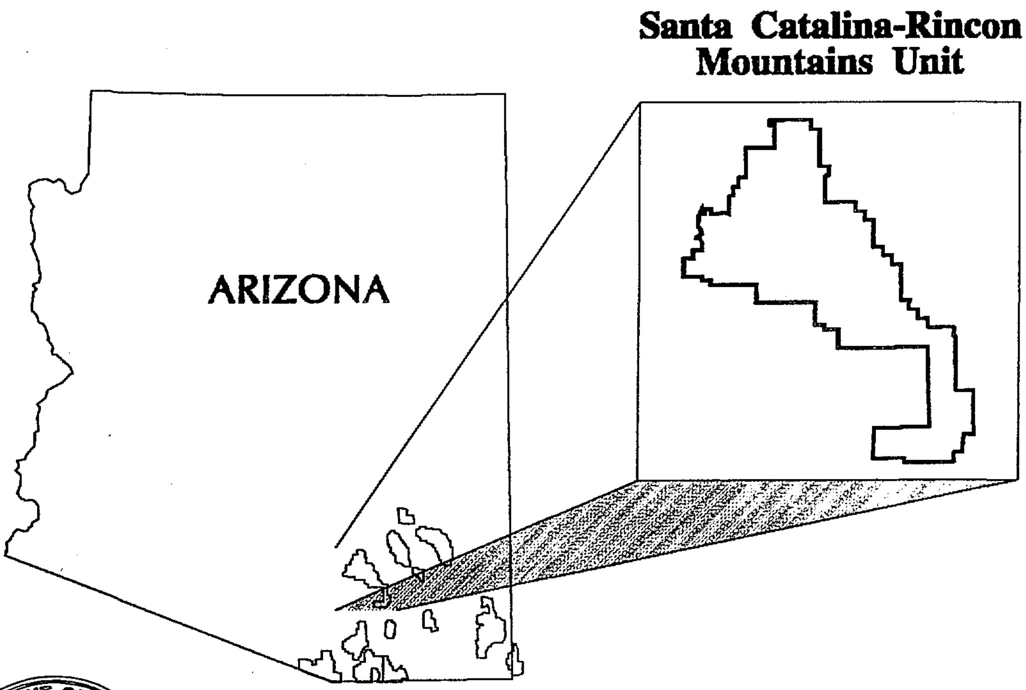
MINERAL APPRAISAL OF CORONADO NATIONAL FOREST, PART 5

Santa Catalina-Rincon Mountains Unit
Cochise, Pima and Pinal Counties, Arizona



U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

MINERAL APPRAISAL OF CORONADO NATIONAL FOREST
PART 5

SANTA CATALINA-RINCON MOUNTAINS UNIT
COCHISE, PIMA, AND PINAL COUNTIES, ARIZONA

by

Staff
U.S. Bureau of Mines

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This report is an economic mineral assessment and inventory of mines and prospects in the 263,103-acre Santa Catalina-Rincon Mountains Unit of Coronado National Forest. Collection of field data, including locating and mapping of mine and prospect workings and sampling mineralized zones, was done from 1989 to 1992. Data were evaluated for this economic assessment between 1991 and 1994, to complete this all-commodity mineral resource appraisal of the Unit. Deposits or areas most likely to experience future development are characterized in terms of their economics. Numerous mine maps, rock-chip sample assays, and detailed descriptions of mine and prospect sites are in this report and its enclosed appendixes.

Most past mining and exploration has been for base and precious metals, including gold, silver, copper, lead, zinc, and tungsten; some placer gold was mined. Nearly all the past metallic mineral production came from Oracle Ridge Mine, which is the only active mine. An open-pit mine on cupriferous skarn (Korn Kob Mine) has been proposed for development inside the Unit; no official mine plan was submitted to the government as of 1993. Metallization in much of the Santa Catalina Mountains has been suggested as originating from a copper-porphyry environment. Discovery of a concealed copper-porphyry system within the Unit could carry major economic impacts.

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PREFACE

A January 1987 Interagency Agreement between the U.S. Bureau of Mines, U.S. Geological Survey, and the U.S. Forest Service describes the purpose, authority, and program operation for the forest-wide studies. The program is intended to assist the Forest Service in incorporating mineral resource data in forest plans as specified by the National Forest Management Act (1976) and Title 36, Chapter 2, Part 219, Code of Federal Regulations, and to augment the Bureau's mineral resource data base so that it can analyze and make available minerals information as required by the National Materials and Minerals Policy, Research and Development Act (1980). This report is based upon available information, extensive field investigations to verify or collect additional information, and contacts with mine operators and prospectors active on lands administered by the Coronado National Forest.

This open-file report summarizes the results of a U.S. Bureau of Mines forest-wide study. The report is preliminary and has not been edited or reviewed for conformity with the U.S. Bureau of Mines editorial standards. This study was conducted by personnel from the Resource Evaluation Branch, Intermountain Field Operations Center, P.O. Box 25086, Building 20, Denver Federal Center, Denver, CO 80225-0086.

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CONVERSION FACTORS

% to ppm	multiply % by 10,000
ppm to %	multiply ppm by 0.0001
ppm to ppb	multiply ppm by 1,000
ppb to ppm	multiply ppb by 0.001

USE OF CHEMICAL SYMBOLS TO ABBREVIATE NAMES OF ELEMENTS

See pages C-1 and D-1 for specific abbreviations. Use in text with concentration amounts implies the elemental form of that material; e.g., 0.05% Cu represents five hundredths of a percent copper in elemental form, not as copper carbonate or oxide.

UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

acre	ac
cubic yard(s)	yd^3
day	d
degree(s)	°
dollar(s) (U.S.)	$
foot (feet)	ft
greater than	>
horsepower	hp
inch(es)	in.
kilowatt(s)	kw
mile(s)	mi
million	M
part(s) per billion	ppb
part(s) per million	ppm
percent	%
pound(s)	lb
short ton(s) (2,000 lb)	st
short ton unit (20 lb WO_3)	stu
square mile(s)	mi^2
short ton(s) per day	st/d
troy ounce(s)	oz
troy ounce(s) per short ton	oz/st
year	y

MINERAL APPRAISAL OF CORONADO NATIONAL FOREST, PART 5
SANTA CATALINA-RINCON MOUNTAINS UNIT

by Staff[1], U.S. Bureau of Mines

SUMMARY

This report is an economic mineral assessment and inventory of mines and prospects in the 263,103-acre Santa Catalina-Rincon Mountains Unit[2] of Coronado National Forest, Pima, Pinal, and Cochise Counties, Arizona. Collection of field data, including locating and mapping of mine and prospect workings and sampling mineralized zones, was done from 1989 to 1992. Data were evaluated for this economic assessment between 1991 and 1994, to complete this all-commodity mineral resource appraisal of the Unit. Deposits or areas most likely to experience future development are characterized in terms of their economics. This study is one part of a fifteen-part series of U.S. Bureau of Mines reports concerning mines and mineral deposits in Coronado National Forest, a series designed to assist Forest Service personnel in incorporation of mineral resource data into future land-use plans. Numerous mine maps, rock-chip sample assays, and detailed descriptions of mine and prospect sites are in this report and its appendixes.

Santa Catalina and Rincon Mountain Ranges are composed mainly of Tertiary-age granitic rocks that do not contain mineral deposits. Metallic mineral deposits occur primarily: 1) along the Mogul and Geesaman fault zones; 2) along two range-bounding faults; and 3) at localities where Paleozoic sedimentary strata have been preserved and altered by certain igneous intrusive rocks. Specific mineral commodities present include base-and-precious metals (lode and placer), tungsten, silica flux, sand and gravel, fill material, limestone, dolomite, and marble. The bulk of past mining and exploration activity has been related to base-and-precious metals (gold, silver, copper, lead, zinc) and tungsten. Placer gold was mined in the Santa Catalina Mountains as early as the 1700's. Nearly all the past metallic mineral production came from Oracle Ridge Mine, the only active mine. A cupriferous skarn inside the Santa Catalina Mountains part of the Unit (Korn Kob Mine) has been considered for open-pit development by a private company; no mine plan for this action was submitted for government approval as of 1993. Metallization in much of the Santa Catalina Mountains has been suggested as originating from a copper-porphyry environment. Discovery of a concealed copper-porphyry system within the Unit could carry major economic impacts.

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[1] Geologists, Resource Evaluation Branch, Intermountain Field Operations Center, Denver, CO.

[2] Referred to as "the Unit" or "Forest Unit" in this report for the purpose of simplicity.

INTRODUCTION

The following text focuses on sites and areas in the Unit at which future exploration and/or mineral development may occur, based on the results of economic modeling, and taking into consideration available literature, assay data from U.S. Bureau of Mines (USBM) samples, market conditions, commodity prices, status of domestic production and reserves, and foreign competition and sources of supply. Additional details on economic modeling, geology, and historical mining is in appendix A. Geochemical samples that were collected from mined and/or mineralized zones are described in appendix B. Assays are in appendixes C and D; samples from this Unit carry a "SC" prefix. Numerous maps of mines and prospects are enclosed, following the cited references section; large mine maps are in the map pockets in the back of this report. Inset maps, expanded-scale maps that detail intensely mined areas, were prepared for reader convenience. Plate 1, located in a map pocket, affords a quick reference to the locations of these inset maps, and the sample numbers/mine sites contained on them. Sites or areas of projected future mineral exploration are on pl. 2 (in pocket).

Geographic setting

The Santa Catalina-Rincon Mountains Unit (fig. 1) includes 263,103 ac, the vast majority of which are in Pima County, AZ. About 40 mi^2 of the Unit is in Pinal County, AZ, and 12 mi^2 are in Cochise County, AZ. Caliente Canyon is roughly the physiographic division line between the Santa Catalina Mountains (approximately the north half of the Unit) and the Rincon Mountains (approximately the south half of the Unit) (pl. 1). Less than 1/3 of the total area of the Rincon Mountains are within the National Forest; that range's most prominent peaks, Mica Mountain and Rincon Peak, are outside of the Forest.

Overall, in this Forest Unit, elevations range from 3,000 ft to over 9,000 ft. Mount Lemmon, in the Santa Catalinas, is the highest point in the Unit (9,157 ft). Snow accumulates on the higher elevations during some of the winter months.

Santa Catalina Mountains is a high-use recreational, scientific, and utility area, encompassing the community of Summerhaven, the Mount Lemmon Ski Valley, Mount Lemmon Observatory, numerous campgrounds, an extensive group of radio and other transmission towers, a heliport, two Natural Areas (Butterfly Peak and Santa Catalina), and two Wilderness Areas (the 88-mi^2 Pusch Ridge Wilderness, and the 98-mi^2 Rincon Wilderness Study Area, about 3/4 of which has been established as the Rincon Wilderness Area). Catalina State Park has been incorporated into the Forest Unit. The Unit shares a 25-mi common boundary with the Saguaro National Monument. About 12,800 ac of the Santa Catalina-Rincon Mountains Unit are state or privately owned land.

Access to the Unit is by the Mt. Lemmon Highway, which receives heavy traffic from the Tucson, AZ, area, by Forest Routes 38, 371, and 35, and by numerous four-wheel drive roads (pl. 1). Railroads are within 5-mi north (San Manuel) and 5-mi south (along Interstate

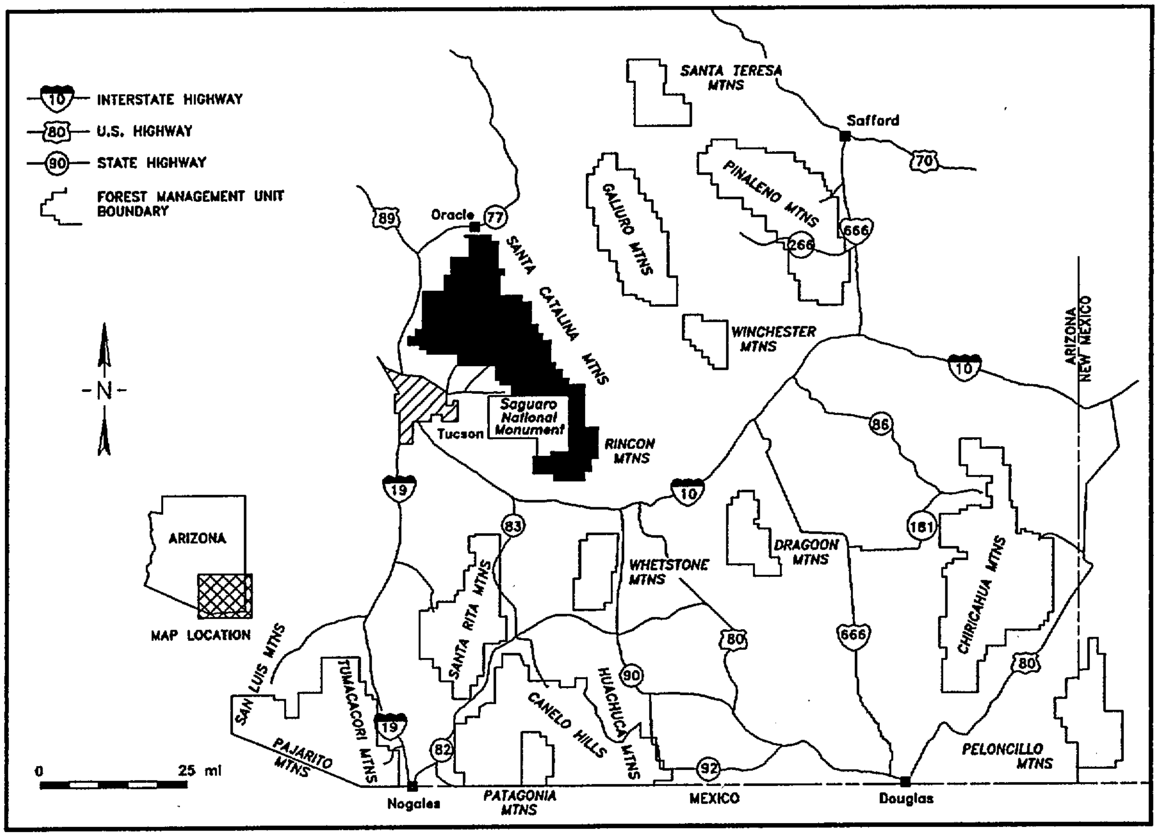

Figure 1.--Location map of the Santa Catalina-Rincon Mountains Unit, Coronado National Forest, Cochise, Pima, and Pinal Counties, Arizona.

10) of the Unit. Steep canyons and valleys border both of the mountain ranges and large parts of the Unit are accessible only on foot or horseback. The northern perimeter of metropolitan Tucson, AZ borders the Unit, as does the southern perimeter of Oracle, AZ.

Previous mineral resource investigations

Pusch Ridge Wilderness Area (pl. 1) was investigated for mineral resources by the USBM and U.S. Geological Survey (USGS) in 1979. The USBM investigation included mapping and sampling of 45 mines and prospects, fire assaying of 55 rock samples for gold and silver, and spectrographic analyses of selected samples. The USGS collected stream-sediment samples and panned concentrates from 147 locations for analysis by spectrographic and wet-chemical methods (Hinkle and Ryan, 1982; Hinkle and Ryan, 1984; Ryan, 1982a; Ryan, 1982b; and Hinkle and others, 1981.)

Rincon Wilderness Study Area (pl. 1) was investigated for mineral resources by the USBM and USGS in 1977. The USBM investigation included mapping and sampling of 51 mines and prospects, collection of 108 rock samples and 8 stream-sediment samples, fire assaying of the samples for gold and silver, and spectrographic analyses of all of the samples. The USGS collected of 122 stream-sediment and 43 rock-chip samples for spectrographic analysis. The size of the study area was subsequently reduced to the current Rincon Wilderness Area (pl. 1) (Thorman and others, 1981; and Thorman and Lane, 1984).

These investigations did not result in the identification of any mineral resources in either Pusch Ridge Wilderness Area or Rincon Wilderness Study Area. Mineral resource possibilities in these wilderness areas are discussed below (p. 18-20).

Methods of investigation

Field work was preceded by comprehensive literature review, and examination of: 1) unpublished mine and prospect data of Arizona Department of Mines and Mineral Resources (ADMMR), Tucson and Phoenix, AZ; 2) USBM Mineral Industry Location System (MILS) data; 3) mine and prospect data from Anaconda Geological Document Collection, University of Wyoming, Laramie; and 4) land status data of the Forest Service and Arizona Department of Revenue. Mineral patent owners were contacted for permission to investigate properties and publish results of the investigation; in instances where owners did not grant access to USBM personnel, the patents are not included in this study, except to report published literature or other pre-existing public information.

Field work, conducted under the direction of Darwin K. Marjaniemi, was undertaken between 1989 and 1992. Mines and prospects with significant surface or underground workings were mapped (maps follow references cited section) and 266 rock-chip samples and two mill-tailings samples were collected. The rock-chip samples are most commonly from veins or mineralized fault zones; some mine dumps, surface float, and outcrops were sampled as was some altered wall rock and country rock around mine workings.

Preparation of the samples for laboratory analyses involved crushing, homogenization, splitting, and pulverizing, but not sieving (in order to minimize the loss of free gold, which is malleable and does not crush easily). After a final splitting, the 268 pulp samples were submitted to two separate laboratories for multi-element analyses by both the inductively coupled plasma-atomic emission spectroscopy and the neutron activation methods. Analytical results and detection limits are presented in appendixes C and D; specifics of sample preparation procedures are detailed at the beginning of appendix B (lithologic sample descriptions). Samples for which the analyses for selected elements (gold, silver, copper, lead, zinc, molybdenum, and manganese) exceeded the initial maximum detection limits were re-assayed at higher detection limits; results are incorporated into appendixes C and D. Twelve samples were selected for a screening analysis for platinum and palladium (p. 18).

Economic analyses of some of the more favorable properties were performed by staff of the Resource Evaluation Branch, mainly in mid-1994, using the USBM mine and economic modeling software package known as PREVAL (documentation in Smith, 1992) in order to derive the estimated Net Present Value (NPV) of properties at a projected 15% Rate of Return (ROR).

Geology, mineral setting, and mine production

The vast majority of the Santa Catalina-Rincon Mountains Unit is underlain by three rock types (pl. 1), none of which are known to host any significant metallic mineral deposits. Tertiary-age granite and mylonite is the most common of the three rock types. Also present are Precambrian-age mylonite, with lesser quantities of Proterozoic rocks: Apache Group stratified rock, Troy Quartzite, diabase dikes, and Pinal Schist. The Tertiary-age Catalina granitic pluton occupies nearly 40 mi^2 of area in the northwestern part of the Unit. These rocks are known to be metallized essentially only along major faults that bound the northeast front of the Santa Catalina Mountains and the southwest fronts of the Santa Catalina and Rincon Mountains (pl. 1). These faults are the Pirate normal fault and the Catalina detachment fault (pl. 1). All other metallization in the Unit occurs exclusively where allochthons and [possibly] erosional remnants and pendants or xenoliths of Paleozoic-age sedimentary rocks are present. At places where the two major east-west trending faults within the Santa Catalina Mountains (Mogul and Geesaman faults) dissect these sedimentary rocks are the loci of the main metallic mineral deposits of the Unit. All important mineral deposits occur within the Santa Catalina Mountains. The only type of metal deposit with a significant economic history is base- and precious-metal skarn and replacement. Deposits of this type are the Oracle Ridge Mine, currently operating and a producer of copper and silver, the Korn Kob Mine (a proposed open-pit mine for copper), and several small prospects on peripheral parts of those skarns. Other metallic mineral deposits spatially related to the Paleozoic sedimentary rocks are: auriferous, sulfidic, quartz veins; sulfidic silver-lead-zinc veins and fractures; and scheelite veins. The vein-and-fracture type deposits have been mined only on a small scale and no significant resources are thought to occur in them, with the possible exception of the Southern Belle auriferous vein deposit. Geologic data presented above are from mapping by Dickinson (1991).

Geologic mapping by Creasey (1967), which includes the northernmost part of the Unit, defines the Cretaceous-age granodiorite porphyry in the Santa Catalina Mountains (across and near the Pima-Pinal county line) as the same rock type as the copper-porphyry source/host rock of the San Manuel Mine (see pl. 1 or 2 for mine location). Keith and others (1983a) interpret the metallization in all parts of the Santa Catalina Mountains, except for the Oracle district (pl. 1, fig. 9), as forming in a Laramide copper-porphyry environment.

<u>Mining history and production</u>

Available mining history of the Santa Catalina-Rincon Mountains Unit is sketchy and incomplete. Exploration of the Oracle Ridge and Korn Kob copper deposits, the Southern Belle gold deposit, and the Burney claims (silver-copper-lead-zinc deposits) are believed to have started around 1870. Significant mining activity at the Oracle Ridge Mine began around 1881 when a 20-st/d smelter was constructed. Major subsequent developments at the Oracle Ridge Mine included: 6,000 ft of mine development between 1910 and 1913; production of 112,500 st of copper ore between 1937 and 1944; 100,000 ft of diamond drilling and 2,600 of underground drifting between 1968 and 1974; 125,000 ft of surface drilling, 47,000 ft of underground drilling, and 28,000 ft of underground drifting between 1980 and 1983; construction of an 850-st/d concentrator in 1990; and production of the first salable concentrates in 1991. The Korn Kob Mine produced a small amount of copper ore between 1913 and 1942, and 35,000 ft of surface drilling was completed from the 1960's through 1986. The Southern Belle Mine produced around 9,000 oz of gold from about 19,000 st of ore between 1885 and 1888. The Burney claims produced 4,500 st of silver-copper-lead-zinc ore between 1931 and 1967. The Maudina and Morning Star Mines produced 17,700 stu of tungsten trioxide between 1908 and 1944. Further general information on the mining history of the Santa Catalina-Rincon Mountains Unit is in Harrison (1972).

Only the Oracle Ridge Mine is currently producing (1994). Annual production rate is 285,000 st of ore containing primarily copper and silver. The total production of base-and-precious metal ore from the Santa Catalina-Rincon Mountains Unit, through October, 1993, is about 875,000 st, of which about 97% is from the Oracle Ridge Mine (table 1). The Gold Hill Mine in the northwestern Santa Catalina Mountains has shipped 60,000 st of silver-bearing silica flux to the Hayden copper smelter. Sand, gravel, and fill material, in excess of 40,000 yd^3 have been produced from several locations in the Unit, mostly for use within the National Forest.

Table 1.--Past metal production from Santa Catalina-Rincon Mountains Unit

Production figures for the Marble Peak area are primarily for the Oracle Ridge Mine and are computed through October, 1993, based on data provided by Carter (1991) and Dillard (1992). Other production figures are from Keith and others (1983b) and Harrison (1972). NR = none reported.

MINERALIZED AREA (DEPOSIT TYPE) PRODUCTION YEARS	ORE (st)	GOLD (oz)	SILVER (oz)	COPPER (lb)	LEAD (lb)	ZINC (lb)	TUNGSTEN (stu)
Marble Peak area (skarn) 1905-93	849,500	4,550	580,500	38,837,000	81,000	37,000	NR
Korn Kob Mine area (skarn) 1913-42	100	NR	150	12,000	NR	NR	NR
Oracle area (vein, replacement) 1881-1964	20,666	9,800	33,000	16,000	125,000	NR	>21,020
Burney claims (vein, replacement) 1931-67	4,500	NR	6,000	81,000	85,000	80,000	NR
Total	874,766	14,350	619,650	38,946,000	291,000	117,000	>21,020

MINERAL DEPOSIT APPRAISAL

Mineral commodities occurring in the Santa Catalina-Rincon Mountains Unit include the base and precious metals, tungsten, silica flux, sand and gravel, fill material, limestone, dolomite, and marble. All of the sample locations are indicated on plate 1. Plate 2 contains projected sites and areas of future mineral exploration and development.

Base- and precious-metal skarn deposits

Four areas of skarn deposits are recognized within the Forest Unit. Combined, they contain about 19 million st of 0.4% to 2.3% copper, varying amounts of silver, and small amounts of gold. Geology of the Geesaman fault part of this metallization is described in Braun (1969), Creasey and Theodore (1975), Dickinson (1991) and Suemnicht (1977a). Wilson (1977) mapped geology of the area encompassing the Korn Kob deposit.

Oracle Ridge Mine deposit (fig. 2)

Oracle Ridge deposit is primarily a contact metamorphic skarn, formed where Paleozoic-age marbles of Marble Peak were intruded by Leatherwood quartz diorite and, in places, lamprophyre dikes; the former apparently formed the majority of the minable deposit. The adjacent Geesaman fault (pl. 1 and fig. 2) is a likely conduit for intrusion of the Laramide quartz diorite. Parts of the workings were formerly known as the Geesaman Mine and Daily

Mine. Leatherwood Mine (fig. 2), represents a separate attempt to develop the southern part of the deposit. Hartman-Homestake and Stratton mines (fig. 2) exploited metallized fracture zones which adjoin the skarn area. References and more details concerning the property are in appendix A, p. A29.

Oracle Ridge Mine is currently (1994) an operating, underground property of Oracle Ridge Mining Partners[3], that produces annually 0.285 million st of 2.33% Cu, 0.67 oz Ag/st, and about 0.011 oz Au/st. An 850 st/d single-product flotation mill is operated on the property. Current mining and most of the ore reserves are in ore blocks in the northern part of the patent block. Reserves are reported at 4 million st at the 1.5% Cu cutoff. The ore is dominantly chalcopyrite, although considerable amounts of bornite and chalcocite are in the upper reaches of the ore body; the deposit is 10% to 30% magnetite.

USBM economic modeling of the deposit, using deposit data from Carter (1991) and Dillard (1992), suggests a net present value (NPV) of $5.1 million, based on mining costs of about $14/st of ore and milling costs of about $5/st of ore (table 2). A 13-year optimum mine life was a result of the USBM modeling, whereas Dillard (1992, p. 8A) estimated a 20- to 30-year mine life.

Other metallization along the Geesaman fault

It is notable that most of the Geesaman fault strike length that cuts through the Marble Peak pendant of Paleozoic sedimentary rocks (pl. 1, fig. 2) has already been explored, and the metallized skarn therein has been delineated. Other metallized skarns have formed along and near the Geesaman fault (area A21, pl. 1) where carbonate rocks and quartzite of the Cambrian-age Abrigo Formation or quartzites of the Precambrian-age Apache Group have been caught up in the fault zone (sites SC215-231, figs. 4, 5; pl. 1). Presence of Tertiary-age Leatherwood quartz diorite is noted at many of these sites. The only part of the Geesaman fault sampled in any detail by USBM is a 750-ft-long segment at Catalina camp (figs. 4, 5). Copper and silver concentrations are elevated to levels of economic interest at only sites SC216-217 and SC218, which are zones of secondary enrichment dominated by the presence of copper-oxide minerals. Copper concentrations there are around 1% Cu and silver reaches a maximum of 1.5 oz Ag/st (see appendix C). The lack of any considerable structural width to the metallized zone at these sites (4-ft-wide, maximum) precludes any consideration for further exploration or development for copper or silver. A more closely defined part of that strike length is described further in appendix A (p. A13); it contains insufficient tonnage to be considered as a resource. The composite area along the Geesaman fault zone in which

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[3] A joint venture of South Atlantic Ventures and Continental Materials.

Table 2--Modeling of base- and precious-metal deposits in the Santa Catalina-Rincon Mountains Unit

All modeling is done using the PREVAL software package. Abbreviations: W:O = waste-to-ore ratio, PP = preproduction development, ML = mine life, M = million, and NA = not applicable.

MINERALIZED AREA, MINE OR PROSPECT	RESOURCE CLASSIFICATION[1]	TYPE OF DEPOSIT	RESOURCE (TONNAGE, GRADE)	MINING SUMMARY (TYPE, RATE, WASTE-TO-ORE RATIO, DAYS/Y, PREPRODUCTION YEARS, MINE LIFE, CAPITAL COST, COST/st)	MILLING SUMMARY (METHOD, RATE, DAYS/Y, CAPITAL COST, COST/st)	SMELTER, REFINERY, AND TRANSPORTATION CHARGES	NET PRESENT VALUE AT 15.0% RATE OF RETURN[2]
Oracle Ridge Mine (fig. 2)	reserves	skarn	4,000,000 st grading 0.011 oz/st gold, 0.67 oz/st silver, and 2.33% copper	Cut and fill, 1,145 st/d, 0.01:1 W:O, 260 d/y, 3 y PP, 13 y ML, $3.2M, $13.76/st	One product flotation, 851 st/d, 350 d/y, $5.8M, $4.61/st	$42.4M	$5.1M
Korn Kob deposit (fig. 6)	reserves	skarn	20,000,000 st grading 0.42% copper	Large open pit, 3,500 st/d, 0.75:1 W:O, 350 d/y, 2 y PP, 16 y ML, $7.9M, $1.34/st	SX/EW, 3,500 st/d, 350 d/y, $3.8M, $0.92/st	NA	$2.38M
Southeast extension, Korn Kob deposit (fig. 6)	inferred, sub-economic	skarn	1.9 million st grading 2.3% copper	Cut-and-fill, 930 st/d, 260 d/y, 3 y PP, 7 y ML, $1.6M, $37.50/st	SX/EW, 700 st/d, 350 d/y, $1.2M, $1.16/st	NA	-$50M
Combined analysis of three tungsten mines[3]	inferred, subeconomic	replacements and veins	131,300 st grading 1.51% WO_3	Shrinkage stope, 152 st/d, 0.01:1 W:O, 260 d/y, 3 y PP, 3 y ML, $5.6M, $38.72/st	Gravity concentration, 113 st/d, 350 d/y, $3.7M, $13.26/st	NA	-$10.1M (-$4.4)[4]
Southern Belle and Apache Girl properties with free milling-gravity recovery	indicated	quartz vein	85,200 st at 0.28 oz Au/st	Room-and-pillar, 100 st/d, 260 d/y, 3 y PP, 3 y ML, $2.0M, $17/st	Free-milling gravity concentration, 76% recovery, 80 st/d, $1.4M, $14/st	NA	$2.1M based on $387/oz Au
Southern Belle and Apache Girl properties with heap-leach recovery	indicated	quartz vein	85,200 st at 0.28 oz Au/st	Room-and-pillar, 100 st/d, 260 d/y, 3 y PP, 3 y ML, $2.0M, $17/st	Heap-leach, 76% recovery, 80 st/d, $3.0M, $18/st	NA	$-4.0M based on $387/oz Au
Southern Belle and Apache Girl properties with free milling-gravity recovery	inferred	quartz vein	618,800 st at 0.28 oz Au/st	Room-and-pillar, 388 st/d, 260 d/y, 3 y PP, 6 y ML, $4.6M, $13/st	Free-milling gravity concentration, 76% recovery, $2.7M, $8.60/st	NA	$0.4M based on $387/oz Au

Table 2--Modeling of base- and precious-metal deposits in the Santa Catalina-Rincon Mountains Unit

All modeling is done using the PREVAL software package. Abbreviations: W:O = waste-to-ore ratio, PP = preproduction development, ML = mine life, M = million, and NA = not applicable.

MINERALIZED AREA, MINE OR PROSPECT	RESOURCE CLASSIFICATION[1]	TYPE OF DEPOSIT	RESOURCE (TONNAGE, GRADE)	MINING SUMMARY (TYPE, RATE, WASTE-TO-ORE RATIO, DAYS/Y, PREPRODUCTION YEARS, MINE LIFE, CAPITAL COST, COST/st)	MILLING SUMMARY (METHOD, RATE, DAYS/Y, CAPITAL COST, COST/st)	SMELTER, REFINERY, AND TRANSPORTATION CHARGES	NET PRESENT VALUE AT 15.0% RATE OF RETURN[2]
Southern Belle and Apache Girl properties with heap-leach recovery	inferred	quartz vein	618,800 st at 0.28 oz Au/st	Room-and-pillar, 388 st/d, 260 d/y, 3 y PP, 6 y ML, $4.6M, $13/st	Heap-leach, 76% recovery, $5.8M, $10.50/st	NA	$-2.7M based on $387/oz Au
Southern Belle and Apache Girl properties with free-milling gravity recovery	inferred	quartz vein	3 million st at 0.28 oz Au/st	Room-and-pillar, 1,400 st/d, 260 d/y, 3 y PP, 8 y ML, $10M, $10/st	Free milling gravity, $5.4M, $5.40/st	NA	$24.6M based on $387/oz Au
Southern Belle and Apache Girl properties with heap-leach recovery	inferred	quartz vein	3 million st at 0.28 oz Au/st	Room-and-pillar, 1,400 st/d, 260 d/y, 3 y PP, 8 y ML, $10.4M, $10/st	Heap-leach, 76% recovery, $10.4M, $6.75/st	NA	$18.5M based on $387/oz Au
Birthday vein at Birthdy Mine and Birthday Extension Mine	inferred	quartz vein/fault gouge	140,000 st at 0.02 oz Au/st, 7.5 oz Ag/st, 1.2% Cu, 10.3% Pb (assumed all in sulfide form)	Shrinkage stope, 130 st/d, 260 d/y, 3 y PP, 4 y ML, $3.7M, $35/st	Flotation for Cu, Pb (capture of Au, Ag assumed), recoveries: 91% Cu, 90% Pb, 76% Au, 80% Ag; $2.0M, $48/st	not tabulated separately	$-8M[6]

[1]Resources are classified in accordance with U.S. Bureau of Mines and U.S. Geological Survey (1980).
[2]The Net Present Value is an "after-tax analysis that equals the present worth of cash-flow minus the present worth of after-tax investments" calculated at the indicated rate of return (Smith, 1992, p. 21). Based on late 1992 metal prices of $350/oz gold, $4.00/oz silver, $0.40/lb lead, $0.80/lb zinc, and $1.25/lb copper, except as noted otherwise.
[3]Maudina, Morning Star, and Old Maudina Mines (see appendix A for tonnage and grade of each), modeled as if a single mill were used. These steps are involved in deriving the "common mill" model: Compute the total tonnage and weighted average grade of the constituent mines (shown in column 4 of table); model each constituent mine so that it produces over the mine-life of the largest constituent mine; from the individual constituent mine models, compute (and provide as input to PREVAL; shown in column 5) the total mine production rate (st/d), total mine capital cost, and weighted average mine operating cost; and, in PREVAL, modify the mill recovery (here taken to be 75%), concentrate grade (15% WO_3), mill capital cost ($3.7M), mill operating cost ($13.26/st), truck distance (104 mi.), and rail distance (774 mi.), based on current USBM information for a comparable tungsten operation. The price of tungsten trioxide (WO_3), from the 1993 USBM "Mineral Commodity Summaries" (p. 186), is $58 per metric ton unit (equal to 22.04 lb) or $2.63/lb.
[4]Modeled using three times the 1993 price for tungsten trioxide, or $7.89/lb WO_3. This price was reached in 1977.
[5]Refinery charges only.
[6]Based on Au at $387/oz, Ag at $5.55/oz, Pb at $0.35/lb, Cu at $0.98/lb.

similar metallization may occur is highlighted on pl. 2 (area A21). Most of that expanse was not sampled by USBM; the above data do not encourage further exploration there.

Korn Kob skarn deposit

Economic copper concentrations in calc-silicate minerals occur at the Korn Kob skarn deposit (fig. 6), which is northeast-dipping, up to 400 ft thick, and has formed in limestone at the base of the Devonian-age Martin Formation near a contact with an intrusion of probable Laramide age. Two main skarn bodies have been outlined by drilling. Combined reserves are 20 million tons of 0.42% acid soluble copper; the larger of the two skarn bodies is within the National Forest and has reserves of 12 to 14 million tons of 0.42% acid soluble copper. A mine plan developed by Keystone Minerals, Inc., Tucson, AZ, calls for two open pits to be constructed, one in the Forest and one immediately north of the Forest[4], with a mining rate of 3,500 st ore/d. Copper recovery is through leaching operations; two proposed leach sites are within the Forest Unit (fig. 6) and a third is about 1,000 ft east of the section corner (secs. 13, 14, 23, 24) that marks the National Forest boundary in T. 12 S., R. 17 E. Maximum depth of ore to be mined is 600 ft, average stripping ratio is 1.5:1, average overall copper recovery using the solvent extraction-electrowinning (SX/EW) process is 74%, and average daily output of electrowon copper is 10 st. The pit in the National Forest is to be 1,800 ft by 800 ft and 600 ft deep. Overburden is to be dumped on Forest surface. The mill site is outside of the Forest (fig. 6). A PREVAL analysis of the mine indicates a 3,500 st/d optimum mining rate and a 16-year mine-life. (See summary of PREVAL results in table 2; deposit shown as A13 on pl. 2.)

Adjoining skarn, southeast of the Korn Kob deposit

Contiguous skarn, extending 2,000 ft southeastward from the planned southern open pit of the Korn Kob deposit (fig. 6), is thinner skarn (average outcrop thickness of 20 ft) and is vein-like, dipping an average of 30° to the northeast. Overall geologic characteristics are: (1) copper-mineral staining and/or veinlets of copper minerals at most of the localities; (2) trace sphalerite and bornite; (3) predominantly limestone host rock; (4) local skarn development, brecciation, fracturing, shearing, alteration, recrystallization, and replacement of the host rock by silica; (4) veins, pockets, and lenses (up to 2 ft thick) of quartz in most of the localities; (5) veins of calcite less common than veins of quartz; (6) presence of epidote, indicating metamorphism, in many of the localities; and (7) absence of dominant structural attitudes.

[4] Plan still (1992) subject to approval by U.S. Dep. Agriculture, Forest Service.

Measured dimensions of this skarn include only the width. Strike length is from published geologic mapping and down-dip extent is assumed to be the same as the mining depth at Korn Kob deposit (600 ft). These dimensions allow for 1.9 million st of possibly metallized skarn resources (inferred resource classification). Ten USBM samples of this skarn (SC241, 244-248, 252, 253, 256, 257) have a weighted average copper concentration of 2.3%. A skarn of this thickness and grade is not economically minable because of the necessity of more costly underground mining of this deposit. (See summary of PREVAL results in table 2; shown as area A14 on pl. 2.)

Other skarn

Small-scale skarn formation, with silicification and copper mineralization occurs for distances of up to 1,500 ft north and 1,500 ft south of the Korn Kob and adjoining skarn deposits (A22 on pl. 2); future exploration and development is possible. The host rock to the north of the Korn Kob skarns is the Devonian Martin Formation and the maximum copper value obtained in this area is 0.23% Cu (sample SC236, fig. 6). The host rocks to the south of the Korn Kob skarns are the Precambrian Catalina Gneiss and Cambrian Abrigo Formation. Maximum copper value obtained in this area is 2.5% (sample SC255, fig. 6). Absence of mapping of these skarns precludes resource estimation.

Base- and precious-metal veins and shears

Gold

Proximity of mines, mining claims, and mineral patents, and loci of production to the Mogul fault (pl. 1, fig. 9) all exemplify the importance of that fault zone in localizing mineralization of the auriferous quartz veins in the Oracle mining district. Some uncertainty remains as to the age of these veins. They are offset by shears thought to be part of the Mogul fault zone, but still could be contemporaneous with movement along the Mogul fault (Creasey, 1967, p. 80). USBM investigation of the auriferous veins and shears was hampered by lack of access to 22 of the 26 mineral patents within the National Forest along or near the Mogul fault (fig. 9). Most of these sites were staked between 1881 and 1910 for gold. However, with the exception of the Southern Belle Mine (fig. 9), tungsten mineralization found on these same patents and prospects ultimately was the economic commodity (Heylmun, 1989, p. 13). Tungsten deposits are described below, under a separate heading.

Southern Belle Mine and Apache Girl prospect

Data and assessment are based on literature, since permission to examine the mine was not granted to USBM. The mine is one of the few in the Santa Catalina Mountains which has produced any significant quantity of auriferous ore (fig. 9). From 1881 to 1906, 18,666 st of auriferous quartz vein were mined. The vein is hosted in Precambrian-age Dripping Springs Quartzite and is reportedly near-flat lying, 6-ft-thick, and continuous for 500 ft along strike where it was stoped (Heylmun, 1989, p. 13). Reported grades of the past production vary considerably, from 0.5 oz Au/st to 0.71 oz Au/st [Heylmun, 1989, p. 13; ADMMR files (see appendix A, p. A4, A40)]. A weighted-average grade from the mined area (fig. 10), based on 1934-era assays reported in Brinkerhoff (1934), is 0.28 oz Au/st in an average 2.6-ft wide vein. Mapping of the vein and its shear zone host by Creasey (1967, p. 83) shows a strike length of 2,500-ft. The stoped area was worked for 160-ft down dip (fig. 10). Using these dimensions (2,500 ft by 160 ft and 2.6-ft-wide), there are an estimated 85,200 st of indicated resources of auriferous vein material along the full strike length.

Economics.--USBM PREVAL mine and economic modeling estimates suggest that this low tonnage (85,200 st) could be mined economically (table 2) if the reports of free gold are correct. If the gold particle size is too small or if there is too much oxide-form gold so that heap leaching must be employed, then the property is not economic (table 2). Estimates are based on the mid-1994 gold price of $387/oz. The value of silver, which averages less than 0.5 oz/st, can help to improve the economics; it was not utilized in this modeling because of its low grade and the inherent problems of counting on recoverability of multiple commodities in a deposit for which there are no first-hand tests of the recoverability. Silver recovery should be investigated if or when future development work takes place on the property.

Earlier field work on the site reported in ADMMR files (see appendix A, p. A40) utilized a more favorable average vein width (5 ft). Over the full strike length to the Apache Girl property, this earlier work estimates 618,800 st of auriferous vein material, but no grade was reported. That tonnage can be considered as inferred resources for this exercise. USBM PREVAL estimates suggest that a deposit of this size and grade (0.28 oz Au/st was used) could be mined at about the break even point (table 2) if the gold could be recovered via free milling gravity methods. If gold mineralogy requires that heap leaching be employed, the site would be a money loser at $387/oz gold (table 2).

The most liberal estimate known for resources on the structure is 3 million st of auriferous, "low-grade" rock (Heylmun, 1989, p. 13). The higher tonnage is likely equivalent to inferred resources. Dimensions and grades are not addressed in that reference. At a modeled vein width of 2.6 ft and grade of 0.28 oz Au/st, a deposit of 3,000,000 st would be economical to mine over an 8-year mine life, with a NPV of over $24 million if free milling gravity recovery methods can be used and nearly $19 million if more expensive heap-leaching methods have to be employed.

This favorable economic estimate must be tempered with the following facts. Several assumptions were made due to the absence of USBM field observations and sampling. The grade may not be consistently 0.28 oz Au/st, a major factor in the estimated profitability of this property. Samples from the structure by Brinkerhoff (1934) from the Apache Girl prospect contain 0.06 oz Au/st. A prospect south of the Southern Belle Mine, apparently on the up-dip part of the same auriferous vein (location not known by USBM and not reported in Brinkerhoff, 1934) contains 0.02 oz Au/st (although a high-grade sample from the dump of the same working contains 0.24 oz Au/st). Brinkerhoff's (1934) mapping of the Southern Belle and Apache Girl properties (see fig. 10) clearly shows the sharp decrease of gold concentrations down dip beyond the extent of the areas that were mined. In fact, Brinkerhoff (1934) stated that the main stope area of the Southern Belle was mined out.

Future exploration.--It is notable that in 1990, Newmont Mining Company, Denver, CO, acquired options on 15 of the mineral patents in the area of the Southern Belle Mine and also staked 38 new mining claims on the National Forest, which were located as far east as the eastern slope of Apache Peak. The interest was in investigating deep gold targets with diamond drilling (Southwestern Pay Dirt, 1990, p. 2A). No other data are known about this activity and the current status of the claims is not known. It is probable that some geochemical indicators suggested that a deeper system contributed gold exploited from the Southern Belle and other nearby mines. These data, while they cannot be satisfactorily described or quantified, nevertheless suggest that future exploration for gold may occur in this area.

Other Oracle district workings, in and near the Mogul fault

Localities with base and precious metal mineralization, primarily in veins, are scattered in the Precambrian granite-diabase terrain to the north of the Mogul Fault and in the Precambrian and Paleozoic sediment-diabase terrain to the south of the Mogul Fault (see fig. 9). The few quartz veins in this remainder of the Oracle district that USBM was able to examine are generally less than 4 ft thick and contain only trace to minor amounts of sulfides (pyrite and galena to the north of the Mogul Fault; pyrite, galena, and sphalerite to the south of the Mogul Fault). Wall rock alteration, if present, is generally less than a few feet. The analytical results indicate that the base- and precious-metal values are generally lower to the north of the Mogul Fault than to the south of the fault.

Production of gold from these sites has been small. The Bear Cat claims (fig. 9) and the High Jinks Mine (SC90-99, fig. 9) each produced a few hundred ounces of gold (see appendix A, p. A5, A19). The Old Hat patent (SC129, fig. 9), from which the Oracle mining district took its original name, contains a small, auriferous quartz vein. A high-grade sample from the dump contains 0.70 oz Au/st and elevated, subeconomic levels of silver, copper, lead, and zinc, but the observed structure is too small to host a mineral resource (see appendix A, p. A27). A fault zone (unmapped) at unnamed prospect SC142-143 contains gold (0.04 oz Au/st) and elevated but subeconomic levels of silver, copper, lead, and zinc in thin (3-in.-wide) quartz veins exposed on the dump. There is no evidence of resource quantities of rock at the site (see appendix A. p. A48). Some gold occurs at the Old Maudina Mine (SC160-162, figs. 9, 11, 12), Maudina Mine (Pure Gold workings) (figs. 9, 13), and Morning Star Mine (figs. 9, 13). The few details known about gold mining at those sites are in appendix A, p. A25-A26, A28. Other properties that were examined by USBM in this area include:

Halloween and Spook Mine, SC87-88, fig. 15;
Carolina Moon group, SC100-111, fig. 9, appendix A, p. A12;
Santa Rosa patent, SC130-133, fig. 9, appendix A, p. A35;
Various unnamed workings, SC112-1128, SC134-141, SC155-157, SC163-172, fig. 9;
Oro Fino Mine, SC158-159, fig 9.

No resources are estimated at any of these sites.

Northwestern part of the Mogul fault zone, on the National Forest boundary

The northwestern extent of the Mogul fault, which is outside the National Forest (pl. 1) has been mined for copper, silica, and silver at three sites: the Little Hill or (Little Hills) Mine, Paradise Mine, and Azurite Mine (possibly a site formerly named the Copper Hill Mine). Gold Hill Mine (SC82-85, pl. 1) is on this same mineral trend and fault, and is inside the National Forest. It is of value as a source of silica flux, and is detailed later in this report under the "silica flux" section heading. The site does contain low amounts of silver. Only trace amounts of gold were detected in a few of the USBM samples from the workings (appendix C, D).

<u>Silver-lead-zinc veins</u>

A group of mines and prospects in the northeasternmost part of the Forest Unit (fig. 16; pl. 2, area A24) expose narrow, sulfidic and oxidized quartz veins, breccias, and replacement zones. These structures are metallized where they cut Precambrian- and Paleozoic-age sedimentary rock formations, mainly the Bolsa Quartzite, Horquilla Limestone, and Dripping Springs Quartzite. The overall area is a northwest-trending graben; metallized faults within that graben trend northeast to east-west (Durning and Dreier, 1976, p. 1). Budden (1975) provides additional geologic description. Copper occurs in recoverable quantities in the structures, in concentrations suggestive that the metal may represent a mining byproduct. Total production has been very small: about 4,500 st of ore between 1931 and 1967 (see appendix A, p. A10). Gold averaged about 0.07 oz Au/st, an amount that could elicit economic interest, though not when confined to structures as small as these.

The mines collectively have been referred to as the Burney claims, based on blanket staking of claims by a Mr. Burney to encompass the old mine sites; that claim group is currently (1992) held by Mr. Dave McGee of Little Hill Mines, Inc. (Heylmun, 1989, p. 11, 13). Literature citations began to refer to these workings collectively as the "Burney Mines" (Durning and Dreier, 1976), but apparently there is no one site ever named the "Burney Mine".

Assessment

Economic modeling was done for only the Birthday vein. Other workings are discussed below.

Birthday vein.--One USBM PREVAL mine and economic model was constructed for resources in the Birthday vein over a strike length that includes both the Birthday Mine and the Birthday Extension Mine (fig. 16). See table 2 and appendix A, p. A7. Average dimensions of the Birthday vein are 6-ft width[5], 375-ft down-dip extent, and 750 ft along strike (as suggested by Durning and Dreier, 1976, p. 16), leading to an inferred resource tonnage estimate of 140,000 st. Weighted average grades applied to this tonnage are 0.022 oz/st gold, 7.5 oz/st silver, 1.2% copper, and 10.3% lead. Indications are that the small deposit size and the low gold concentration are major factors that make this site uneconomical to mine. Shrinkage stoping is the most economical mining method, with a slight (10%) decrease in mining costs over open-pit mining. The most applicable beneficiation method to use is a matter of some conjecture at this point due to the absence of mill tests. The reported oxidized zone on the surface of the deposit is notably shallow, giving way to sulfide mineralization "a few tens of feet below the surface outcrops" (Durning and Dreier, 1976, p. 2). For this reason, the amenability of the rock to heap leaching is doubtful. If only the oxidized material were utilized, the deposit tonnage would drop to such a low amount that the site would not warrant further consideration. The gold grade is so low that a recovery method focused solely on gold would drop the overall revenue to extremely low levels. For these reasons, the USBM model is designed to recover all four commodities (gold, silver, copper, and lead) through standard flotation milling procedures.

The modeling results are that the property would have a NPV (15% ROR) of *negative* $8 million at mid-1994 commodity prices. A comparison of the NPV to the combined mine and mill capitalization ($5.7) suggests a small mining concern with most or all of the capitalization requirements in hand could conceivably operate close to the economic break-even point. A sharp increase in the price of gold could shift the model into estimated

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[5] This width was selected because, although the Birthday vein itself is 0.5-ft to 2-ft wide, Durning and Dreier (1976, p. 5) report that fractured quartzite up to 20-ft away from the fault also contains the same type of metallization.

profitability. It should be noted again, however, that tests on the amenability of the rock to the modeled beneficiation methods are essential to determining the true economic viability of this property. Drilling of the fault zone also is essential in order to better qualify tonnage estimates.

Other veins on the Burney claims.--There are 13 separate mines or prospect groups within the Burney claims for which no resources are estimated by USBM, based on USBM field data and assays and the assessments by Durning and Dreier (1976, p. 1-7). The complete list of sites for which no resources are estimated:

Gold Mine (Goodwill patent), SC18-23, fig. 16, appendix A, p. A17;
Lead Reef Mine, SC32-32, fig. 16, 20, appendix A, p. A24;
Lead Reef Extension Mine, SC35-38, fig. 16, 19, appendix A, p. A23;
Pretty Fair Mine, SC51-52, fig. 16, appendix A, p. A34;
San Manuel prospect, SC6-7, fig. 16;
Slim's Mine, SC47-48, fig. 16, 21, appendix A, p. A36;
Soldine Mine East, SC58-60, fig. 16, 22, appendix A, p. A38;
Soldine Mine West, SC53-57, fig. 16, 23, appendix A, p. A38;
Stove Lid Mine, S42-43, fig. 16, 24, appendix A, p. A43;
Unnamed workings, SC10, 13, 15, fig. 16, appendix A, p. A44;
Unnamed workings, SC25-26, fig. 16, appendix A, p. A45;
Unnamed workings, SC27-29, fig. 16, appendix A, p. A46;
Unnamed workings, SC71-79, fig. 16, appendix A, p. A47.

<u>Prospects on periphery of Cretaceous(?) intrusion, Oracle mining district</u>

Numerous prospects have been excavated on quartz veins and flat(?) siliceous zones or silicified flat faults that occur along the periphery of Cretaceous(?)-age granitic intrusive rocks (sample sites SC174-214, fig. 9). Many of the prospected sites are within rocks adjacent to the Cretaceous intrusion; they are composed mainly of metamorphic rock (phyllitic), fine-grained sedimentary or metamorphic rocks (shale, limestone, quartzite), and some diorite. There is minor sulfidization in these siliceous structures, indicated mainly by the presence of limonitic material, but also some pyrite and minor amounts of galena and sphalerite. Maximum vein widths are about 6 ft. The flat siliceous zones or silicified flat faults (SC182, 186) are also in the range of 6 ft thickness; some may exceed that dimension. Only one fracture zone of any appreciable strike length was observed (SC205-211), which is about 500-ft-long. It crosses the Yaqui Princess and Spirit-of-America mining claims. Some samples in that zone contain geochemically anomalous levels of zinc (1% to 2.5% Zn) and elevated levels of copper and lead, but none of those metals occur in concentrations that elicit economic interest. The maximum gold concentration encountered in any of these structures or workings is 1.7 ppm Au (equivalent to about 0.05 oz Au/st) in a select sample of a particularly sulfidic zone (sample SC176). There is no evidence of metallic mineral resources at any of these sites, based on USBM field data and assays. Further details on the sites are in appendix B, with the descriptions of the individual samples. Mary West prospect (fig. 26-27) and unnamed prospect SC201-202 (fig. 25) are the only workings among these prospects deemed large enough for detailed mapping by USBM.

Undocumented reports of platinum occurrences

During the course of this USBM field study, undocumented reports of finds of platinum in the northern Santa Catalina Mountains were brought to the attention of USBM field personnel by local prospectors. The CBS television affiliate (KOLD) in Tucson, AZ, aired a report on such a metal find in 1990 or 1991. Sites on Peppersauce Wash in the Santa Catalina Mountains were the most frequently mentioned. As a result of these reports, USBM checked 12 of the rock-chip samples collected from the vicinity for two of the platinum group metals (platinum and palladium). All project samples were screened for the platinum group metal called iridium, with a lower detection limit of 0.1 ppm Ir (appendix D).

Of the 12 select samples tested for platinum and palladium, four are from the main workings on the Geesaman fault at Catalina camp (SC216-219, fig. 5); five samples are from the fault and mineralization zone at the Yaqui Princess and Spirit-of-America claims (SC206, SC208-211, fig. 9); one is from a locality 1 mi west-northwest of the Yaqui Princess claim (SC200); two samples from the Burney claims (SC76, SC79, fig. 16) were selected because of unusually high minimum detection limits of iridium (3,000 and 620 ppb, respectively). Neither platinum nor palladium were detected in any of the 12 samples and no deposits of platinum group metals are suggested in the Forest Unit as a result of laboratory analyses.

Miscellaneous prospects in and near the Pusch Ridge Wilderness

Pusch Ridge Wilderness (pl. 1) contains numerous, small metal prospects, nearly all of which occur either along the Catalina detachment fault or the Pirate (normal) fault. It is apparent that these two structures, which are bounding structures of the Santa Catalina Mountain range, played a significant role in conducting metallizing solutions. The host rocks, mainly Tertiary-age granitic rocks, are essentially barren at all other localities in the Wilderness, away from the fault zones. The workings are essentially unsampled during this USBM Coronado National Forest study, that work having been adequately addressed in a previous USBM study, directed towards mineral resources within the Wilderness Area (Ryan, 1982a). Locations of the previously sampled workings with their sample numbers (NO SC PREFIX) are shown on pl. 1. The USBM reference for that work (Ryan, 1982a) can be consulted for additional data. No resources are suggested from the USBM work. The only operation of significance is the Pontatoc Mine, a former copper producer, 2,000 ft south of the Forest Unit and now within the Tucson residential area. Past production from that mine is 5,000 st of copper-silver ore. There is no basis for extending that mine's mineralization into the Forest Unit (see discussion in appendix A). Keith and others (1983a) assignation of Pusch Ridge Wilderness metallization as that associated with a copper-porphyry environment is significant. That topic is addressed in a section below under the "copper-porphyry" heading.

Gold

Quartz veins at the Soldier Canyon localities (pl. 1), which include sample sites 1-6 from Ryan (1982a) (see appendix A, p. A37) contain up to 0.22 oz Au/st and 5.8% Cu but have only limited strike length. The nearby Valerie May gold prospect shown on pl. 1 (Ryan, 1982a sample sites 8-11), was worked for auriferous quartz vein mineral specimen material (8 st). No structural or dimensional data on the quartz vein is available. Ryan (1982a) reported no appreciable gold concentration in the four USBM samples collected at the Valerie May site during the Pusch Ridge Wilderness study. Heylmun (1989, p. 15) reports visible free gold in the Valerie May vein and "good gold values", and also notes " a number of gold-bearing quartz lenses and pockets in igneous and metamorphic rocks on the rugged south and west flanks of the Catalinas, much of it being in areas withdrawn from mineral entry." The mineral withdrawal reference is to the Pusch Ridge Wilderness. USBM has no data to resolve the differences between Heylmun (1989) and Ryan (1982a) or to quantify the other reported gold occurrences of Heylmun.

Miscellaneous prospects in the Rincon Wilderness Study Area

Rincon Wilderness Study Area, which includes the Rincon Wilderness (pl. 1) contains numerous, small, metal prospects (primarily silver, copper, and zinc) associated with fault or shear zones, quartz veins, and intrusive contacts. A few of the sites occur along the Catalina detachment fault, a bounding structure of the Santa Catalina Mountain range that played a significant role in conducting metallizing solutions to the prospected area in the southernmost part of the Forest Unit (pl. 1). The host rocks, mainly Tertiary-age granitic rocks, are essentially barren at all other localities in the Wilderness Study Area, away from the fault zone. The workings were not sampled during this USBM Coronado National Forest study but were addressed in a previous mineral resource study (Thorman and others, 1981). Locations of the previously sampled workings with their sample numbers (NO SC PREFIX) are shown on pl. 1. The reference for that work (Thorman and others, 1981) can be consulted for additional data. No resources are suggested from the work.

All other prospects in the Rincon Wilderness Study Area are associated with Paleozoic-age strata (pl. 1). Prospects in the central part of the Rincon Wilderness (pl. 1) were not addressed in this USBM Coronado National Forest study [refer to Thorman and others (1981) for results of that work] but prospects in the northernmost part of the Rincon Wilderness

Study Area were investigated in this study. The most extensive known mineralization is at the Italian Trap allochthon, where samples of a gently dipping and partially silicified shear zone contain up to 2.9% copper (appendix A, p. A20). Details of some other sites are in appendix A:

Bear Creek area, no samples in current study, pl. 1, appendix A. p. A6;
Chiva Tank area, no samples in current study, pl. 1, appendix A. p. A14;
Posta Quemada Canyon area, no samples in current study, pl. 1, appendix A. p. A33;
Shaw Canyon area, no samples in current study, pl. 1.

No resources are suggested from available geologic evidence.

Possibilities for the existence of copper-porphyry deposits

An assessment by Keith and others (1983a) is that metallization in the majority of the mined areas in the Santa Catalina Mountains (pl. 1) was deposited in Laramide time via a copper-porphyry-type system or systems. These areas include the Oracle Ridge skarn deposit and adjacent metallized fractures such as the Hartman-Homestake mines; the Korn Kob skarn deposit; the Corregedor Mine; metallization on the Burney claims; metallization on the northeasternmost National Forest periphery at the Gold Hill Mine and other nearby sites outside of the National Forest, such as the Little Hill Mine, Paradise Mine and Azurite [Copper Hill(?)] Mine; and base-metal deposition in the southern part of the Pusch Ridge Wilderness and the nearby Pontatoc Mine (see pl. 1).

Other evidence supportive of the copper-porphyry hypothesis is from geologic relationships recognized and mapped by Creasey (1967). Rock temporally and lithologically equivalent to the Cretaceous-age, granitic and porphyritic rock units in the northern part of the Santa Catalina Mountains ("K" units on the generalized geologic map, pl. 1, this report) is the main ore host of the San Manuel copper-porphyry deposit (Creasey, 1967, p. 81), about 8 mi. north of the Forest Unit (see pl. 1). Creasey's (1967) quartz monzonite is temporally and lithologically the same as most Precambrian-age rock in the northern Santa Catalina Mountains, including Precambrian rocks inside the Forest Unit, both north of the Mogul fault and between the Mogul fault and Geesaman fault (pl. 1). This quartz monzonite of Creasey (1967, p. 81) is another important ore host at the San Manuel copper-porphyry deposit. To put the importance of the San Manuel ore-body in perspective, it has been estimated to contain 500 million st of average 0.8% Cu in both oxidized and sulfide forms. The ore body is 8,000-ft to 9,000-ft wide and 9,300-ft long. Chalcopyrite, pyrite and molybdenite are the primary sulfide minerals (Creasey, 1967, p. 81). San Manuel reserves estimated in 1991 were 74 million st of 0.7% Cu (sulfide) and 142 million st of 0.6% Cu (sulfide) in the underground operation. In addition, there were an estimated 205 million st of rock from which acid soluble, 0.2% Cu-grade copper could be mined by in-situ methods at an anticipated 50% recovery. The open-pit part of the San Manuel deposit contains other reserves: 31 million st of 0.5 % Cu (acid soluble), 4 million st ot 0.2% Cu (acid soluble, marginal), and 0.7 million st of 0.9% Cu (sulfide) (Phillips and Niemuth, 1993, p. 50). San Manuel is a deposit of major economic significance. The geologic similarities in the Santa Catalina Mountains should be remembered for future mineral exploration activities.

The San Manuel deposit is associated with the northwest-striking, southwest-dipping San Manuel fault that has at least two miles of right-lateral strike-slip displacement (Creasey, 1967; p. 76, 80, and 81; and plate 1.) The Mogul fault (pl. 1), in the Forest Unit, is closely analogous to the San Manuel fault, having a northwest strike, southwest dip, 5,000 ft of throw, and 10 mi of right-lateral strike-slip displacement (Creasey, 1967, p. 71). The Geesaman fault (pl. 1), also inside the Forest Unit, and 5 mi south of the Mogul Fault, also is closely analogous to the San Manuel Fault in terms of age, strike, dip, throw, and right-lateral strike-slip displacement (Dickinson, 1991). Creasey (1967, p. 80 and 87) adds that metal deposits in the northern part of the Santa Catalina Mountains most likely originated from some "relative" of the Laramide intrusions, with the Mogul and related faults (for up to 1,000 ft north and 1 mi south) serving to guide the mineralizing fluids to the carbonate host rocks.

Evidence of a buried intrusion and heat source for mineralization that is recognized along the numerous faults in the area has been reported in the vicinity of the Mogul fault. Such a buried intrusion would have provided the metallizing solutions which mineralized the faults in the area and would have facilitated movement of ore-bearing solutions (Bromfield, 1950, p. 9-11; and Ludden, 1950, plate 1). Presence of a buried intrusive metallizing source is an essential part of the copper-porphyry model.

Alteration is a very important geologic consideration when defining a possible copper-porphyry exploration target. USBM data on alteration in the Santa Catalina Mountains are limited to the Burney claims area: country rock is pyritized for at least 250 ft along the stream bank to the west of the Soldine Mine East adit (samples SC58-60, fig. 16), and there is iron-staining on the southwest-facing slope for a distance of 300 ft southeast from the Soldine Mine East adit. Broad areas of iron-staining and bleaching, each about 300 ft across, are in the vicinity of sample location SC69 (fig. 16) and the vicinity of the Soldine Mine West workings (samples SC53 to SC57, fig. 16). Hydrothermal alteration has been noted in the vicinity of the Mogul fault (Bromfield, 1950, p. 9-11; and Ludden, 1950, plate 1). If simply confined to the small fractures in the area, this alteration presence is not conclusive of any large-scale metallization. However, it should be noted that copper-porphyry systems are hydrothermal in nature.

The presence of skarn-type base- and precious-metal deposits, such as the Oracle Ridge deposit and the Korn Kob deposit in the Santa Catalina Mountains, can also be an important indicator of the presence of concealed copper-porphyry deposits. It is common in the region to find copper-porphyry deposits associated with base-metal skarn deposits. One example is the Twin Buttes deposit (sec. 5, T. 18 S., R. 13 E., Pima County, AZ), where five mines in carbonate rocks over the eventually discovered copper porphyry produced 479,000 st of copper ores (4% Cu to 7% Cu) with byproduct silver (1 oz Ag/st to 9 oz Ag/st). A small part of the tonnage also was lead and zinc ore (Titley, 1982, p. 403). At the San Xavier Mine, part of the Mission complex in the Pima mining district, south of Tucson, AZ (centered approximately at sec. 31, T. 16 S., R. 12 E., Pima County, AZ), 800,000 st of carbonate ores were mined (Titley, 1982, p. 403). The Mission deposit complex as a whole, which includes the San Xavier Mine, among others, is nearly all deposited in a carbonate-dominant sedimentary-rock sequence (Jansen, 1982, p. 467). As another example, the Esperanza deposit was mined for about 2,000 st of carbonate ores over a period of 40 years before the chalcocite blanket part of the copper-porphyry deposit was discovered (West and Aiken, 1982, p. 433). Skarn-hosted ore deposits are of additional significance as a favorable geologic indicators. Copper-porphyry deposits associated with carbonate ores have been shown to contain higher hypogene copper concentrations than copper-porphyry deposits that lack any associated carbonate rock (Einaudi, 1982, p. 139, 144; Barter and Kelly, 1982, p. 407-408).

The conclusion is that a copper-porphyry deposit or deposits could possibly be concealed under a large area of the northeastern Santa Catalina Mountains, i.e., that area underlain by Precambrian- to Mesozoic-age rocks and the Laramide-age intrusions (area A3, pl. 2). USBM search of the literature did not find evidence that these areas have been explored with regard to possible large-scale copper-porphyry metal deposition.

Tungsten deposits

Tungsten has been produced from three mine sites in the Oracle (Old Hat) mining district (fig. 9). In that area, scheelite and silicification are found in Escabrosa Formation limestone where it adjoins the 50-ft-wide Mogul fault zone, characterized by brecciation and the presence of mylonite. Age of the tungsten mineralization cannot be closely determined; it is younger than the Mogul fault and speculated to be younger than the Cretaceous-age granitic porphyry that is exposed to the south (pl. 1) (Creasey, 1967, p. 80, 85). Old Maudina Mine (fig. 11, 12) and the Maudina Mine, comprised of the Pure Gold workings (fig. 13) and Cody tunnel (fig. 14), were worked collectively for at least 15,000 stu of tungsten (WO_3) concentrates between 1908 and the late 1950's. The Morning Star Mine produced more than 6,000 stu of WO_3 concentrates during 1913, 1940-1943, and some in the 1950's. At both mines, nearly three-quarters of the production was during World War II. Mines were shut down after World War II as the demand for tungsten decreased (Creasey, 1967, p. 87). The area apparently has had little or no production since the late 1950's. USBM did not receive permission to examine either the Morning Star or the Happy Thot mineral patents, which prevented examination and sampling of the majority of the productive scheelite zones. Literature helped to close that data gap.

Maudina Mine has shoots of scheelite in a 40-ft-thick silicified limestone breccia, the formation of which is related to recurrent movement along the Mogul Fault (Creasey, 1967, p. 85). The Morning Star Mine has disseminations and veins of scheelite up to 2 ft thick in silicified limestone near a fault intersection. Geologic data (appendix A, p. A25-A26) suggest 97,000 st of inferred tungsten resources at Maudina Mine and another 9,300 st at Morning Star Mine. Reported grade of past production from the Maudina Mine's Pure Gold workings is 1.51% WO_3 (Sawyer and others, 1992, p. 263).

The Old Maudina tungsten mine is located 3,500 ft southeast of the Maudina Mine, on a fault paralleling the Mogul fault and about 1,000 ft south of it (figs. 15, 16; area A17, pl. 2). Mineralization, up to 15 ft thick, consists of veinlets and replacement masses of scheelite, either free of gangue in a limestone host, or in a quartz gangue; cerussite and wulfenite are reported in the upper 50 ft. Literature (appendix A, p. A28) suggests 25,000 st of tungsten resources. Probable grade is that of past ore production from the Maudina Mine: 1.51% WO_3.

<u>Economics</u>

USBM modeling of the tungsten mines was constructed as one, combined operation, in order to attain the maximum economies available. Nevertheless, results are not favorable. The three mines discussed above have combined resources of 131,300 st grading 1.51% WO_3. USBM PREVAL analysis, with a common mill for the three mines (table 2), suggests that the tungsten resources are not economically minable at the average 1992 price of \$2.63/lb WO_3 and would not be economically minable at three times that tungsten price (a price that was achieved in 1977).

<u>Future development</u>

Domestic tungsten production in the early 1990's is essentially nil, primarily due to insurmountable competition from foreign suppliers (details concerning market conditions in Chatman, 1994, p. 19-20). Should demand for tungsten increase dramatically in the future, there is a possibility that these tungsten deposits and the general area will receive renewed prospecting interest. Should that situation develop, the area in which prospecting is most likely to occur is that labelled A23 on pl. 2. The area was selected based on the proximity of the Mogul fault. Creasey (1967, p. 87) recommended that the area parallel to and up to 2,000-ft south of the Mogul fault be examined for additional, undiscovered tungsten deposits. However, the literature reveals that tungsten also occurs north of (on the footwall side of) the Mogul fault. Examples are the High Jinks Mine (SC90-94, fig. 9) and the Bear Cat claims (fig.

9), which collectively were mined for 210 lb of WO_3 concentrates. In this same area is the Carolina Moon claim group, on which scheelite has been found. The three tungsten claim groups/mines are all within about 1,500 ft of each other (fig. 9).

<u>Tungsten associated with the Geesaman fault</u>

Tungsten has been noted in the Geesaman fault zone at the Corregedor Mine and the Oracle Ridge Mine. USBM was unable to gain permission to examine either of those sites. Data available from other sources are sparse. No resource assessment can be made with this absence of data. The presence of tungsten demonstrates that the major faults in the area served as conduits for tungsten-bearing mineralizing solutions.

Gold placers

No placers were mapped or sampled by USBM in the course of this investigation. Data are nearly all from available literature. Apache defense of their homelands prevented U.S. prospectors from freely exploring the region until the late 1870's (Heylmun, 1989, p. 11), but previously, gold placering in Cañada del Oro ("gold gulch") was undertaken in the northern Santa Catalina Mountains by Spaniards as early as the mid-1700's. The cañada drainage flows northward from its headwaters in the central Santa Catalina Mountains through about 9 mi of the Forest Unit, then crosses the Unit boundary and turns south, flowing parallel to and mostly outside of the Forest Unit (pl. 1). Modern-era placering sites in Cañada del Oro (Heylmun, 1989, p. 11), shown on pl. 1, are all outside of and downstream from the Forest Unit; their reported production is as much as 1,000 oz gold, mined from 1904 to 1949 (Wilson, 1961, p. 61). It is likely that much of this gold originated from veins within the Burney claims. The segment of Cañada del Oro within the Burney claims (area C3, pl. 2) may also contain gold placers, but this has not been investigated.

Ewing (1945, p. 1 and 2) reports that gold was first discovered in Southern Belle, Bonito, and other nearby canyons in the late 1870's and early 1880's, and that most of the gold taken from Southern Belle Canyon was coarse, including a nugget weighing over 6 oz. Placer sites in Southern Belle Canyon are on fig. 9; specific sites in Bonito Canyon (fig. 9) are not known by USBM. Field evidence of placer workings is limited to the upper part of Southern Belle Canyon (workings less than 10 yd^3 each), but the lower parts of Southern Belle and Bonito Canyons (and intervening areas) have been mapped as Quaternary-age alluvium (Ludden, 1950, plate 1; Creasey, 1967, plate 1) and may contain placer gold (see area C1 on pl. 2). Possible sources of the gold are the 2-mi-long mineralized shear zone passing through the Southern Belle Mine (fig. 9), and other gold-bearing quartz veins in this part of the Oracle district.

A segment of Alder Canyon, adjoining the Forest Unit on the northeast side (pl. 1), has past production of 100 oz of placer gold (Wilson, 1961, p. 81; and Keith, 1974, p. 35). Sites of past placering are shown on pl. 1 (Heylmun, 1989, p. 11). USBM projects that placer gold may be present in a nearby 300 ft by 3,000 ft area of the Forest Unit (area C2, pl. 2). Possible gold sources are gold-bearing quartz veins in the Marble Peak area, 3 mi away, including Oracle Ridge Mine and adjoining metal mines and prospects.

A resource assessment cannot be made with the lack of data on these placers. The most recent work done was a test placer operated in 1982, by Dave McGee, Little Hill Mines, Inc., at one of the Cañada del Oro sites outside the Forest Unit (pl. 1). A reported 230 oz of gold was recovered in that test, which was on placer gravels allegedly near 200-year-old placer sites of the Spaniards (Heylmun, 1989, p. 11). These data suggest that some lucrative gold zones may be found in Canada del Oro with additional prospecting. Whether those sites will be inside the Forest Unit has not been determined. The clustering of the known sites outside the Forest Unit boundary is not favorable for a gold-resource-on-public-lands scenario. Should the price of gold increase, mapping and sampling of the placer gravels inside the Forest Unit may be warranted.

Silica flux

Gold Hill Mine (pl. 1; location C, pl. 2) of Little Hill Mines, Inc., Oracle, AZ, was inactive as of 1992, but has shipped a total 60,000 st of silica flux to the Hayden smelter; the last shipment, made in 1991, was reportedly 2,000 st of flux. The mine is reported to have a 5 million st reserve. The flux comes from Precambrian quartzite that is locally fractured, iron-stained, cut by rare quartz veins, and intruded by diabase. USBM economic analysis (appendix A, p. A16) suggests that the mine cannot currently compete with suppliers of flux closer to the Hayden smelter, which is 45 mi distant, due to transportation costs. Further, precious-metal content is a major consideration relative to the modern-day utility of flux. Gold Hill Mine flux is reported to contain 0.5 oz/st silver. Analyses of USBM samples revealed much lower silver content: 0.036 oz Ag/st, maximum (samples SC82 and SC83, appendix C). Minimum precious-metal content that is acceptable for use of a flux in the region's copper smelters (as of 1993) is 0.2 oz Au/st and 0.5 oz Ag/st (see Chatman, 1994, p. 16).

Sand, gravel, and fill material

Plate 2 depicts areas that may have resources of sand, gravel, and fill material, on the basis of geology and proximity to developments including Tucson, the road from Oracle to Summerhaven (Forest Route 38), the Mt. Lemmon Highway, the Redington Road (Forest

Route 371), and Interstate 10[6]. Table 3 summarizes geology of the areas and lists a brief appraisal.

Sand and gravel deposits adjacent to the Tucson metropolitan area are unlikely to be developed because of environmental and recreational concerns (Sabino and Pima Canyons; areas D1 and D2, pl. 2). Catalina State Park, now part of the Forest Unit, has large, but unquantified sand and gravel sources over its 8-mi^2 area that could be used if environmental concerns are adequately addressed (area D3, pl. 2). An area adjoining Catalina State Park to the north has sand and gravel sources that also are affected by environmental concerns (Sutherland Canyon; area D4, pl. 2). One small area that may contain sand and gravel deposits was identified along the road from Oracle to Summerhaven (Stratton Canyon, area D5, pl. 2). The indurated boulder and cobble fanglomerate (according to geologic mapping by Creasey, 1967) covering large parts of sec. 21, 28, and 34, T. 10 S., R. 16 E. may have local reworked sand and gravel deposits that could be used for road construction. Fill material near the Mt. Lemmon Highway and along the crest of the Santa Catalina Mountains (Bear Wallow Campground; area D6, pl. 2) is a valuable resource because of the lack of sand and gravel deposits in this area, but additional use of this material will be limited by environmental considerations. Significant sand and gravel deposits may exist within 3 mi. of the Redington Road but their composition is unknown (Government Tank, Race Track Tank, and Alambre Tank; areas D7, D8, and D9, pl. 2). Geologic mapping and USBM reconnaissance suggest the presence of sand and gravel deposits along the Happy Valley Road in the southeastern Rincon Mountains, 9 mi to 16 mi from Interstate 10 (area D10, pl. 2).

Limestone, dolomite, and marble

Some of the large areas underlain by Mississippian-age Escabrosa Formation in the northern Santa Catalina Mountains (area E, pl. 2), identified by geologic mapping of Creasey (1967, pl. 1) and Creasey and Theodore (1975), eventually may be explored and developed for carbonate rocks, which include limestone, dolomite, and marble. However, no detailed evaluation of the Escabrosa Formation for these commodities has been undertaken in the Forest Unit. A specific area that may warrant examination is Creasey's (1967, p. 37-39) 517-ft-thick section of Escabrosa Formation limestone in Nugget Canyon (sec. 33, T. 10 S., R. 16 E.; area E, pl. 2) that "appears to be free of primary impurities". Marble occurrences that are

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[6]Phillips (1992, p. 33) gives the average mine value of sand and gravel in Arizona (for 1990) as $3.30/st. Transportation costs are $0.14 per ton-mile (USBM data, June 1992; for tractor-trailer). Thus, it can be seen that distance is an important factor in the viability of sand and gravel deposits; a distance of 1 to 2 mi is optimum; distances of up to 20 mi (costing $2.80/st) will significantly reduce the viability of a deposit.

Table 3.--Appraisal of sand, gravel, and fill material sources in the Santa Catalina-Rincon Mountains Unit

The Bear Wallow Campground area (D6) has fill material. The remaining areas have sand and gravel.

AREA (PLATE 2)	GEOLOGIC DESCRIPTION	REFERENCE	APPRAISAL/PROBLEMS
Sabino Canyon (D1)	Quaternary older alluvium and alluvial fan deposits. Generally fine grained and unconsolidated to weakly consolidated.	Banks (1976)	At boundary between popular recreational area and the Tucson metropolitan area. Not likely to be used.
Pima Canyon (D2)	Quaternary older alluvium and alluvial fan deposits. Generally fine grained and unconsolidated to weakly consolidated.	Banks (1976)	At boundary between popular recreational area and the Tucson metropolitan area. Not likely to be used.
Catalina State Park (D3)	Quaternary gravel and alluvium. Mostly boulder conglomerate to pebble gravel. Minor sand and silt.	Banks (1976)	Popular recreational area but deposits could be used if environmental concerns are adequately addressed. Average of 6 mi from Tucson metropolitan area and surrounded by new residential and commercial developments.
Sutherland Canyon (D4)	Quaternary gravel and alluvium. Mostly boulder conglomerate to pebble gravel. Minor sand and silt.	Banks (1976)	Environmental concerns. 8 mi from Tucson metropolitan area and surrounded by new residential and commercial developments.
Stratton Canyon (D5)	Quaternary alluvium consisting of unconsolidated sand and gravel.	Creasey (1967, pl. 1)	Within 0.5 mi of Forest Route 38. Deposits likely to be localized in relatively steep canyon. No road developed in canyon.
Bear Wallow Camp-ground (D6)	Precambrian Apache Group. Interbedded soft shale and hard dense sandstone, broken up by intense tectonic activity and faulting.	Creasey and Theodore (1975) and the present study	40,000 yd^3 of fill material removed through 1991 (NW¼NW¼ sec. 5, T. 12 S., R. 16 E.). Environmentally sensitive area. Because of transportation costs, the use of this material will be limited to developments along the crest of the Santa Catalina Mountains.
Government Tank (D7)	Quaternary alluvium, colluvium, and stream terraces.	Creasey and Theodore (1975)	Within 3 mi of Forest Route 371. Composition unknown.
Race Track Tank (D8)	Quaternary alluvium, colluvium, and stream terraces.	Creasey and Theodore (1975)	Within 1 mi of Forest Route 371. Composition unknown.
Alambre Tank (D9)	Quaternary alluvium, colluvium, and stream terraces.	Creasey and Theodore (1975)	Adjacent to Forest Route 371. Composition unknown.
Happy Valley (D10)	Quaternary gravel. Locally derived and 2-ft to 10-ft-thick.	Drewes (1974)	Along Forest Route 35 and 9 mi to 16 mi from Interstate 10.

both within the Escabrosa Formation and in the vicinity of Marble Peak (see Braun, 1969), may also warrant examination.

If eventual mapping and testing of carbonate rocks in any of those areas reveal high purity and large tonnages, deposits of considerable economic value could eventually be delineated. Phillips (1992, p. 31 and 32) reports that crushed and/or milled limestone and marble for uses other than cement and lime in Arizona in 1989 had an average mine value of $13.85/st, and that high-brightness marble produced as a filler for paints and coatings from the Specialty Minerals Inc. Santa Rita Quarry near Tucson was priced at $70.00/st.

CONCLUSIONS

Mining of copper-silver skarn at the Oracle Ridge Mine will likely continue and mining of the cupriferous skarn at the Korn Kob deposit may begin. As those deposits are revealed through mine excavation, detailed geologic study of the sites should be considered. The study could better define the possibilities of the metallization as being related to a concealed copper-porphyry system or to some other source with a lower economic potential. Finding and mining of a concealed copper-porphyry deposit is the single largest potential economic effect related to minerals that the Forest Unit might experience in the future. Tungsten development in the foreseeable future is not considered likely. Placer gold development may ensue if a significant gold-price increase takes place, but the placer situation is so loosely defined, geologically, that a true resource assessment cannot be made. It is more likely that any operations which might be developed would be small rather than large. The weak and sporadic placering history and low overall production contributes to that conclusion. The use restrictions placed on aggregates within the Forest Unit prevents any market-driven scenarios to be developed. It will suffice to report that supplies are relatively plentiful for the permissible usage. Data on stone products are too sparse for any detailed resource assessment.

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EXPLANATION OF SYMBOLS FOR REPORT FIGURES AND PLATES, INCLUDING:
Inset maps at various scales and 1:126,720-scale plates.

APPROXIMATE BOUNDARY OF THE FOREST MANAGEMENT AREA

APPROXIMATE BOUNDARY OF WILDERNESS

NATIONAL MONUMENT BOUNDARY

6000 — TOPOGRAPHIC CONTOUR–Showing elevation in feet above sea level

STATE LINE

COUNTY LINE

PRIMARY SECONDARY ROADS

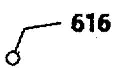
UNIMPROVED ROADS TRAILS

INTERMITTENT STREAMS

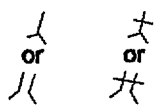
GRID TICK MARK

PATENTED MINING CLAIM

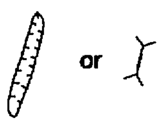
SURFACE OPENINGS–Showing sample number(s); symbols may represent more than one working. Also, VARIOUS REPRESENTATIONS OF SAMPLE SITES:



Rock sample locality–Showing sample number

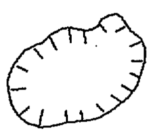


Adit open (left); Adit, inaccessible (right)



Trench

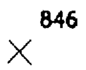
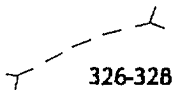
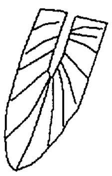
Opencut



Glory hole, open pit, or quarry

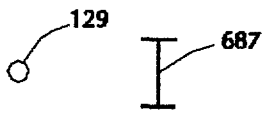
EXPLANATION OF SYMBOLS FOR REPORT FIGURES AND PLATES, INCLUDING:
Inset maps at various scales and 1:126,720-scale plates–Continued.

SURFACE OPENINGS–Showing sample number(s); symbols may represent more than one working. Also, VARIOUS REPRESENTATIONS OF SAMPLE SITES–Continued:

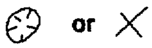
	Prospect (pit, opencut, or small trench)
	Tunnel
	Mine or quarry (active, left; inactive, right)
	Placer mine or gravel pit (active, left; inactive, right)
	Shaft, open to surface (left); Shaft, inclined (right)
	Shaft, water filled (left); Shaft, caved (right)
	Shaft, reclaimed
	Mine dump
	Drill hole collar
	Land or mineral monument

EXPLANATION OF SYMBOLS FOR REPORT FIGURES, INCLUDING:

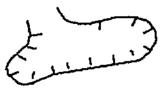
Features of detailed mine maps, both surface and underground, at various scales (larger than 1:24,000).



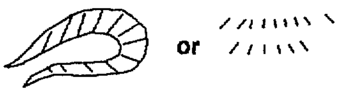
ROCK SAMPLE LOCALITY–Showing sample number



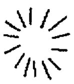
PITS



OPENCUT



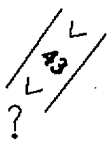
DUMPS



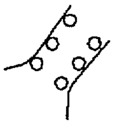
STOCKPILE

ADIT PORTAL (left);
ADIT PORTAL WITH TRENCH OR OPEN CUT (right)

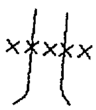
LEVEL WORKING–Dashed and/or queried where uncertain



INCLINED WORKING–Showing degree of inclination, chevrons pointing down; queried where uncertain or inaccessible



TIMBERED (Vertical timbers and/or lagging)



CAVED

RUBBLE (BACKFALL) FILLED, MUCK-FILLED, OR BACKFILLED WORKING–Queried where uncertain or inaccessible

EXPLANATION OF SYMBOLS FOR REPORT FIGURES, INCLUDING:
Features of detailed mine maps, both surface and underground,
at various scales (larger than 1:24,000)–Continued.

STEP DOWN IN SILL–Showing drop in feet; hachures on down side

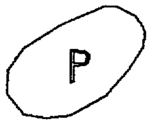
RAISE, head (left); RAISE, foot (right)

RAISE GOING UP AND WINZE GOING DOWN

WINZE–Noted if water filled

MANWAY (left); CHUTE (right)

SHAFT, open at surface (left); SHAFT, bottom (right)

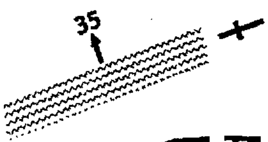


PILLAR

GEOLOGIC SYMBOLS

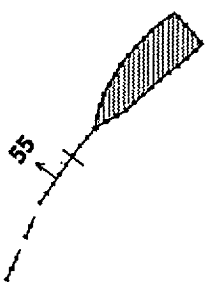
Strike and dip of bedding

Fault–Showing strike and dip (inclined or vertical, degrees); dashed where approximate



Fault zone or shear zone–Showing strike and dip (inclined or vertical, degrees); dashed where approximate

Thrust fault–Sawteeth on upthrown side



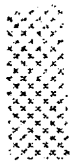
Vein–Showing strike and dip (inclined or vertical, degrees); dashed where approximate

EXPLANATION OF SYMBOLS FOR REPORT FIGURES, INCLUDING:
Features of detailed mine maps, both surface and underground,
at various scales (larger than 1:24,000)--Continued.

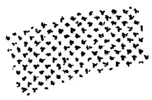
GEOLOGIC SYMBOLS--Continued

Contact--Showing strike and dip (inclined or vertical, degrees); dashed where approximate

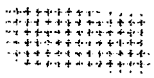
Dike--Showing strike and dip (inclined or vertical, degrees); dashed where approximate



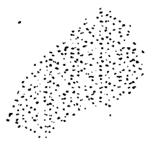
Shattered zones



Brecciated zones



Igneous rock zone or structure

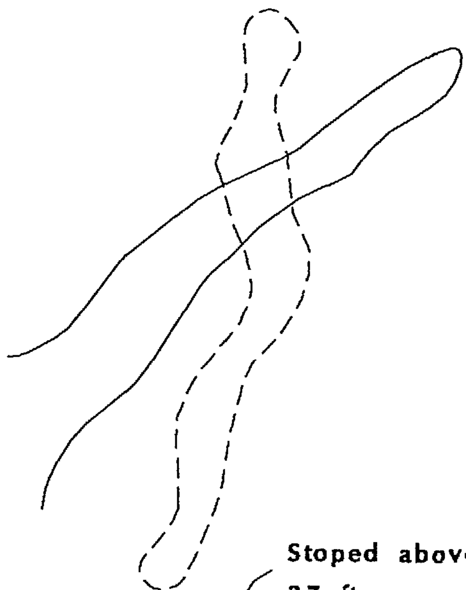


Mineralized zone, disseminated

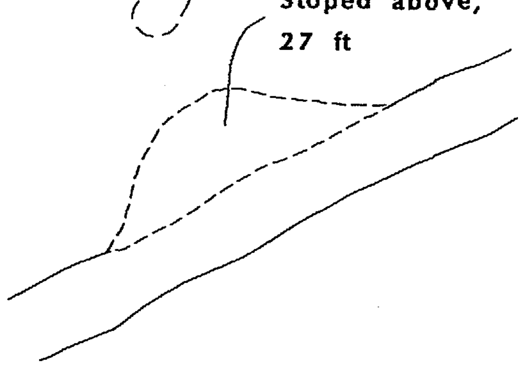
Mineralized zone, localized

Zone containing resources

EXPLANATION OF SYMBOLS FOR REPORT FIGURES, INCLUDING:
Features of detailed mine maps, both surface and underground, at various scales (larger than 1:24,000)--Continued.



Multiple level workings



Stope

Symbols for vertical cross-section maps

 Crosscut

 Drift into facing wall

 Drift into removed wall

 Drift into facing and removed wall

 Water-filled winze

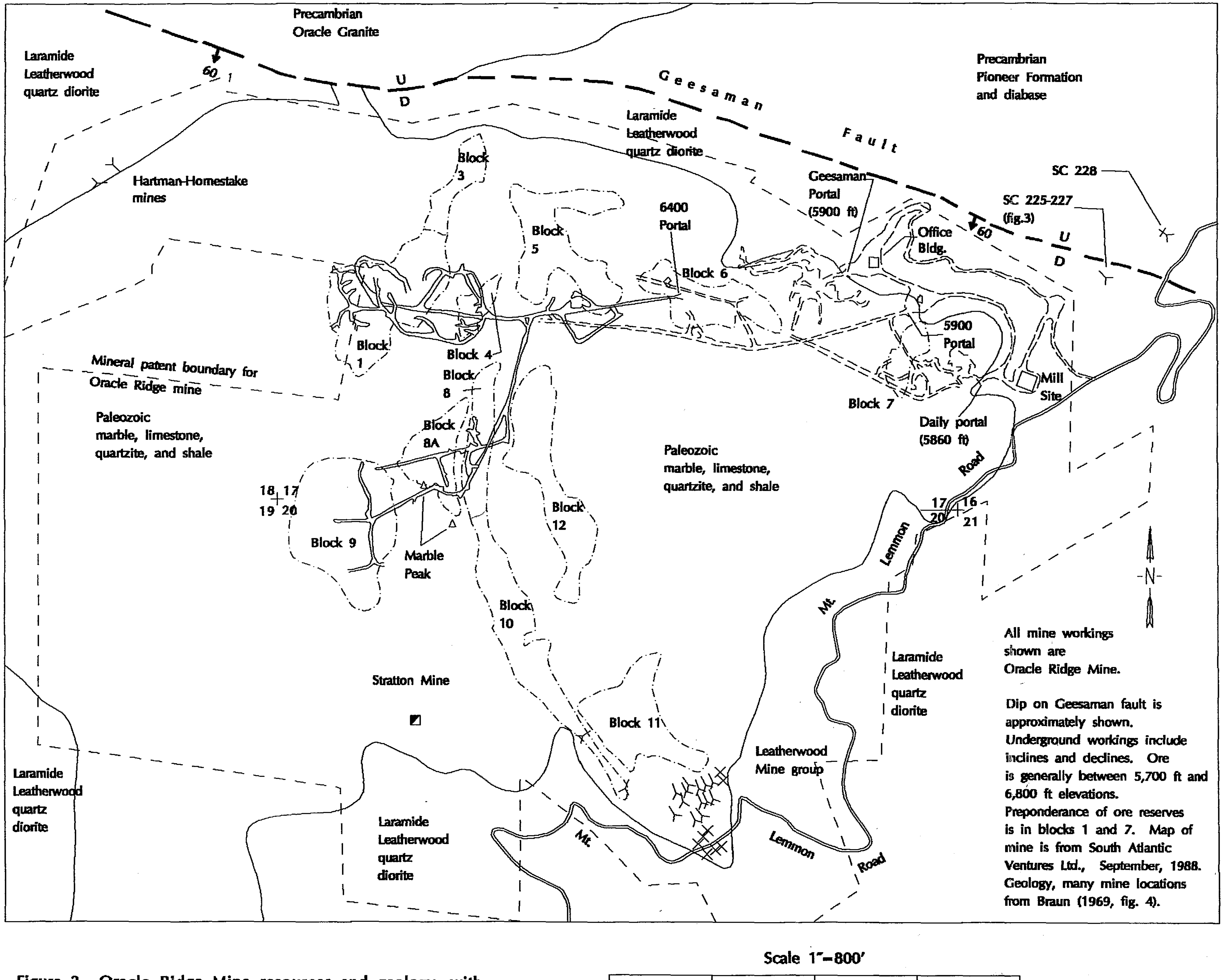


Figure 2.– Oracle Ridge Mine resources and geology, with locations of other nearby mines and sample localities SC225-228, Santa Catalina Mountains.

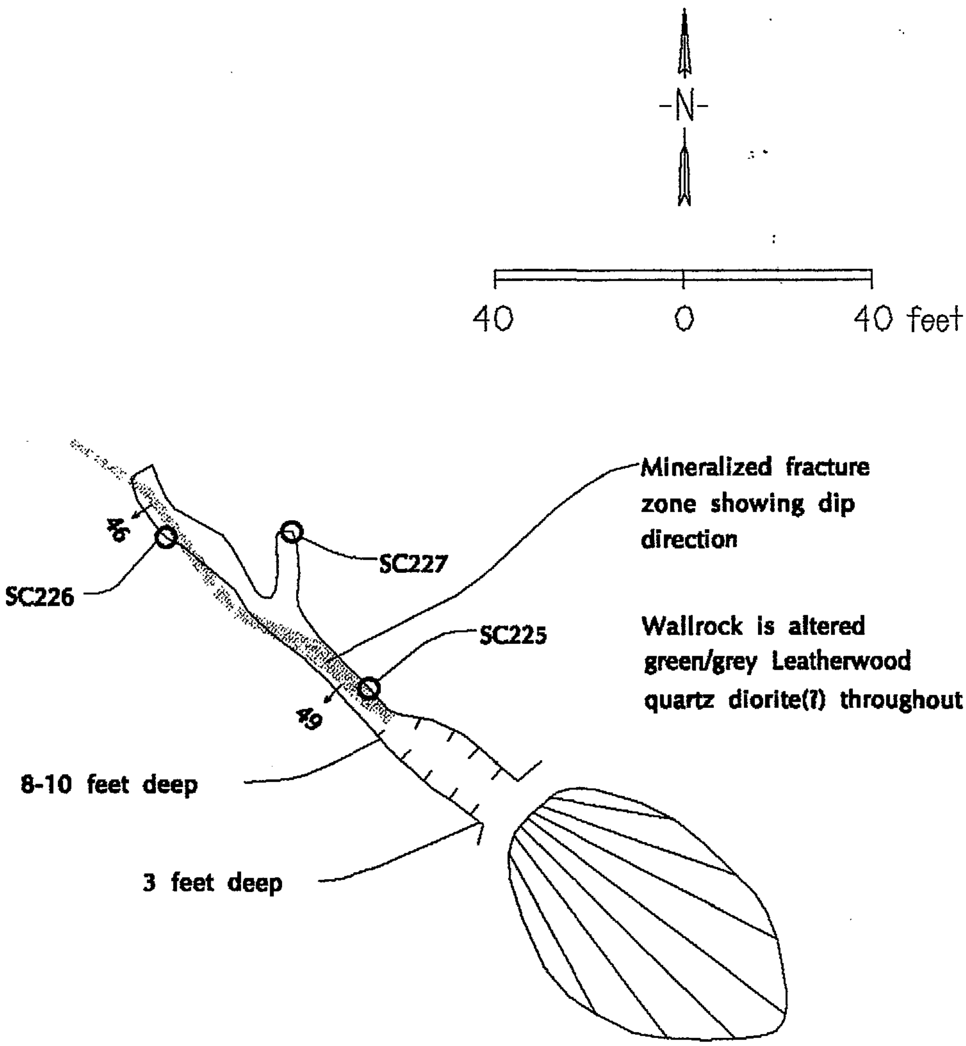


Figure 3.–Prospect near Oracle Ridge Mine, with sample localities SC225-227, Santa Catalina Mountains.

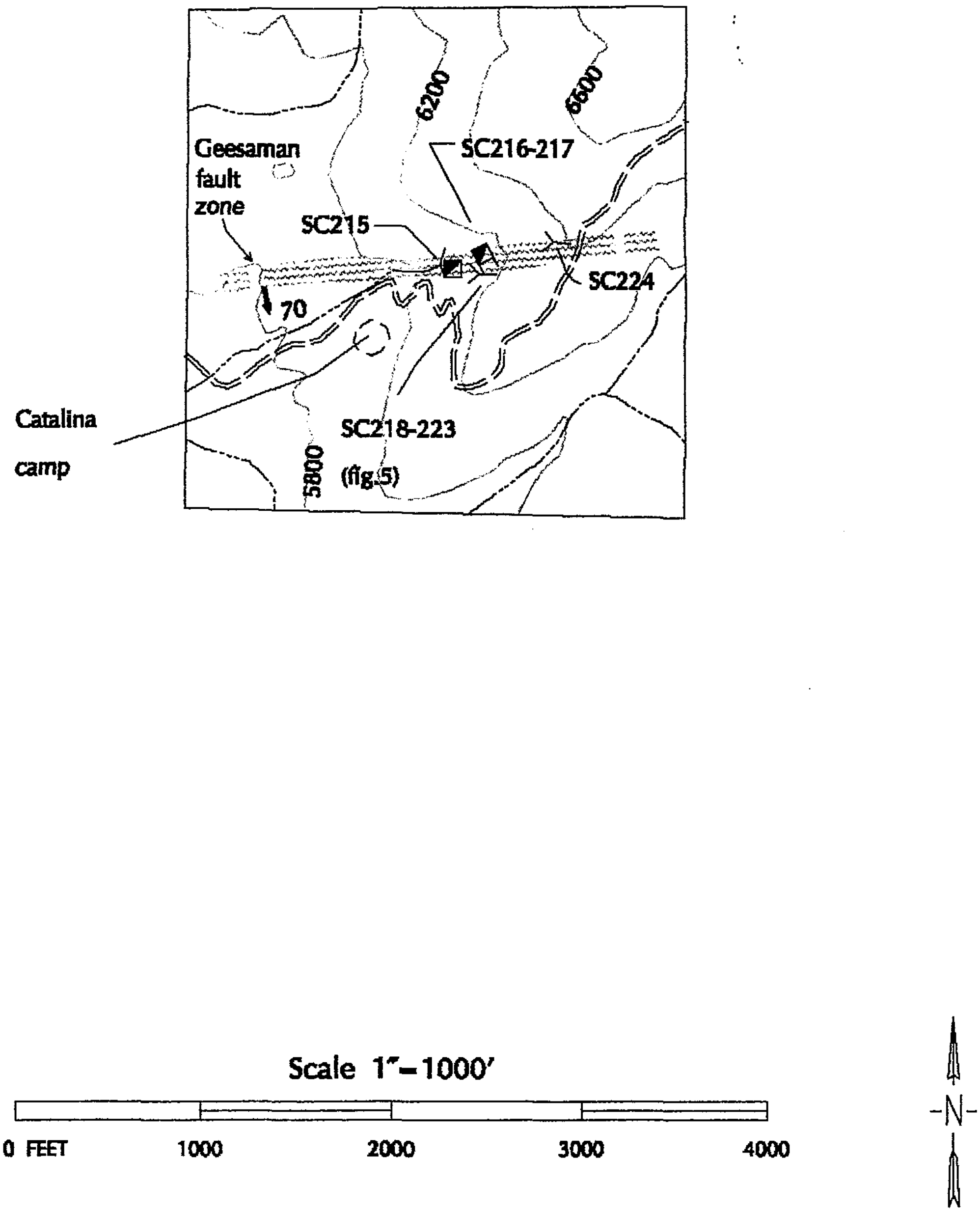


Figure 4.– Prospects at Catalina camp (Taylor X(?) Mine), with sample localities SC215-224, Santa Catalina Mountains.

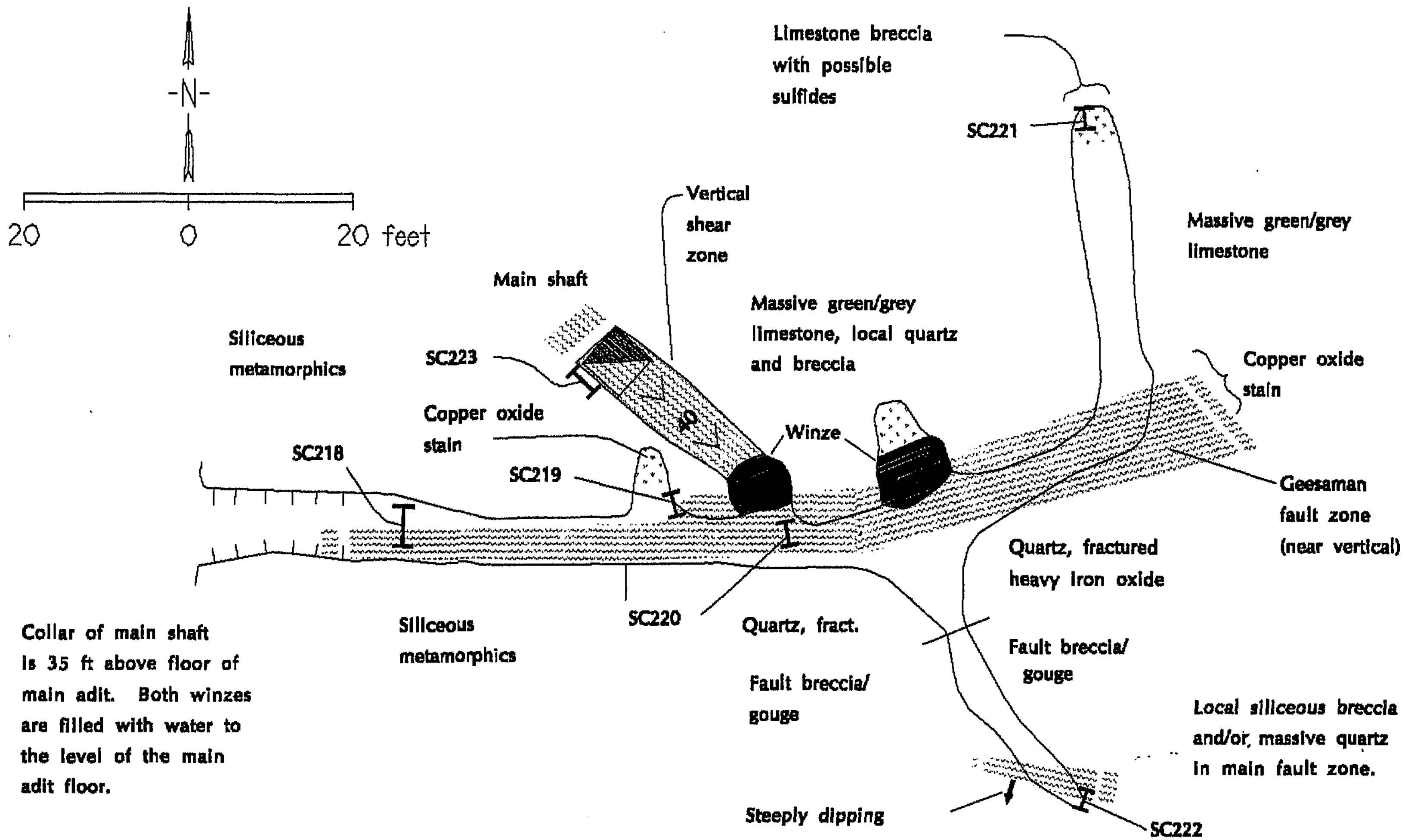


Figure 5.–Prospect on Geesaman fault, with sample localities SC218-223, Santa Catalina Mountains

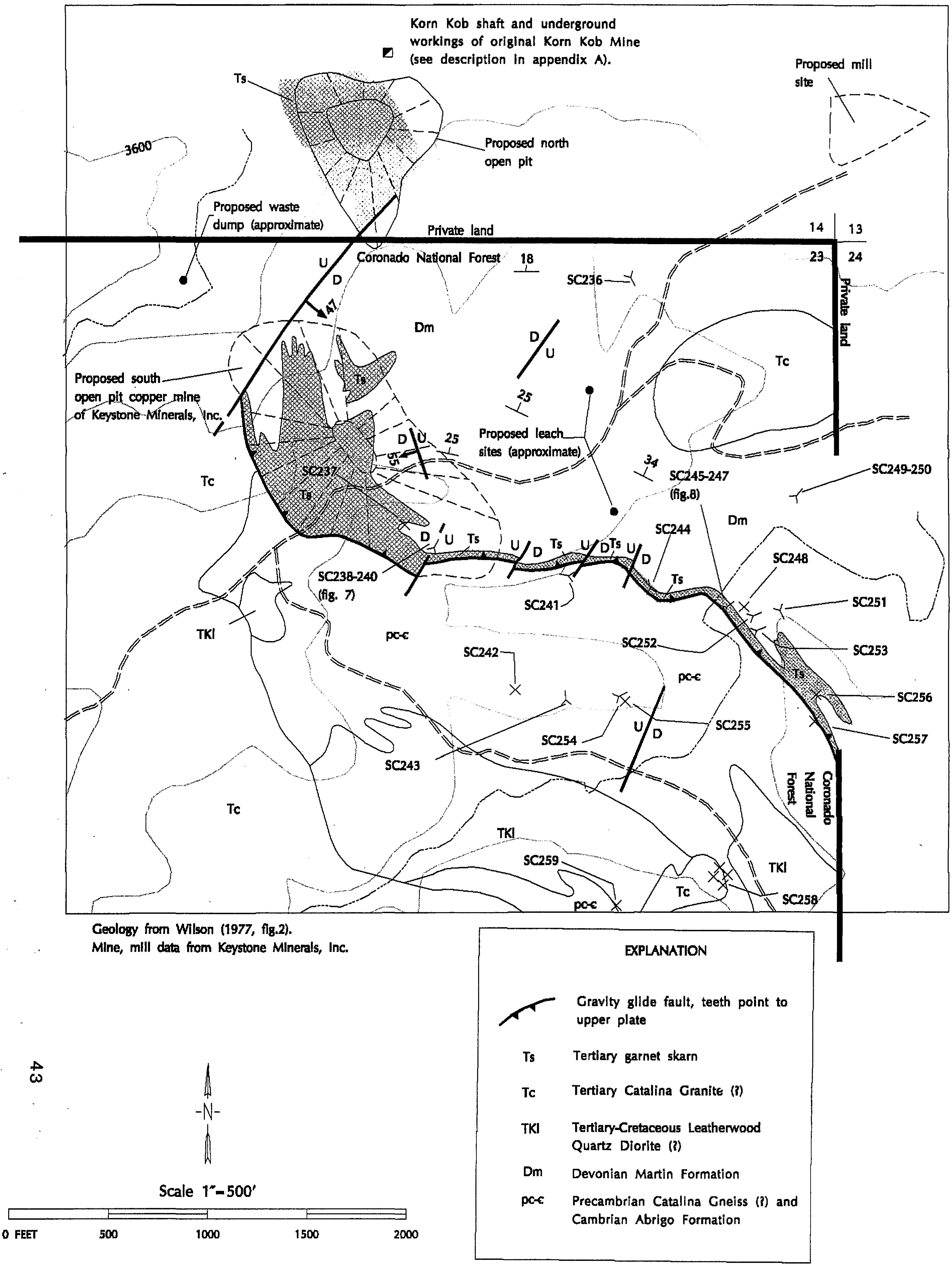


Figure 6.—Proposed open-pit mines, Korn Kob deposit, and adjoining skarn to the southeast, with sample localities SC236-259, Santa Catalina Mountains.

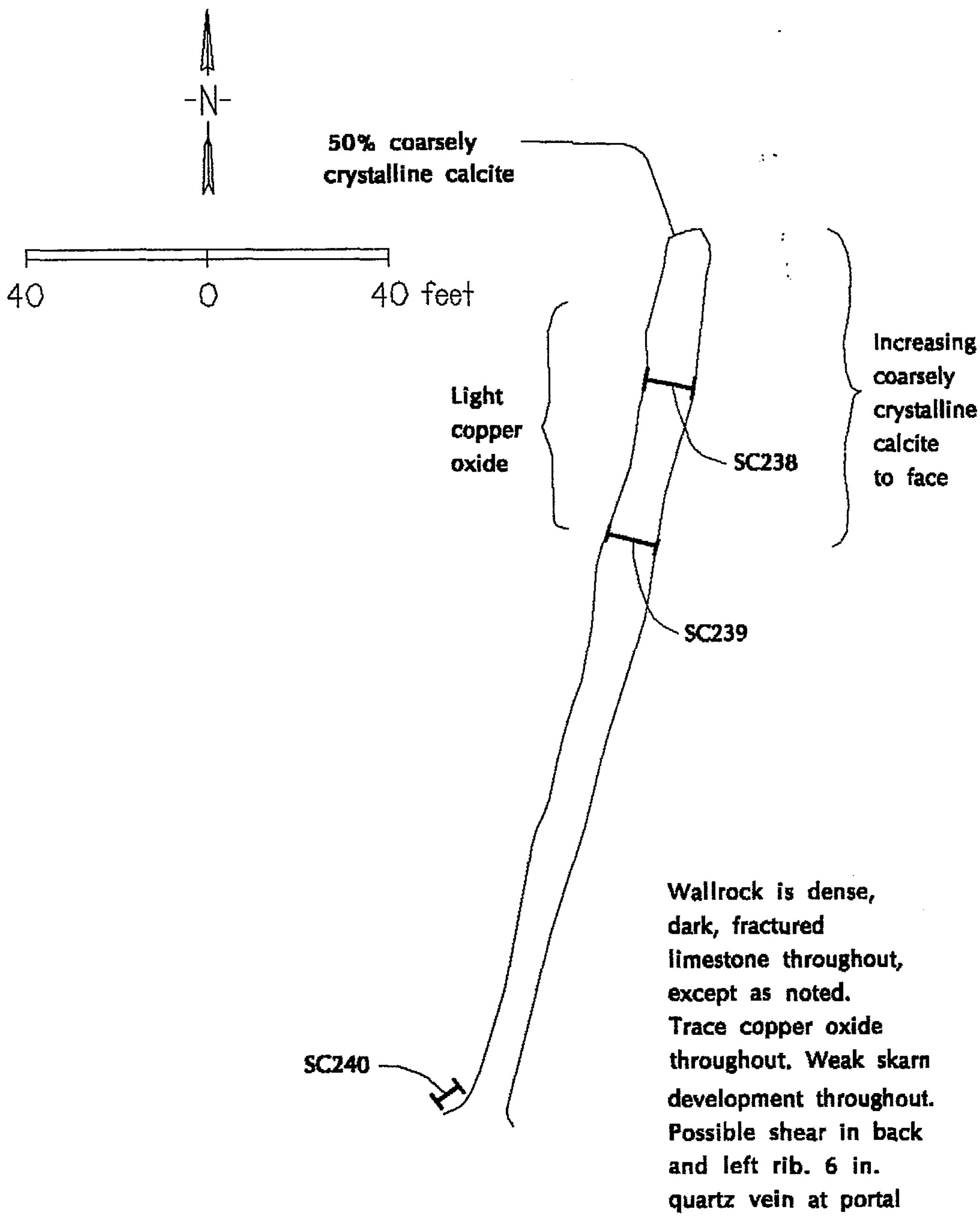
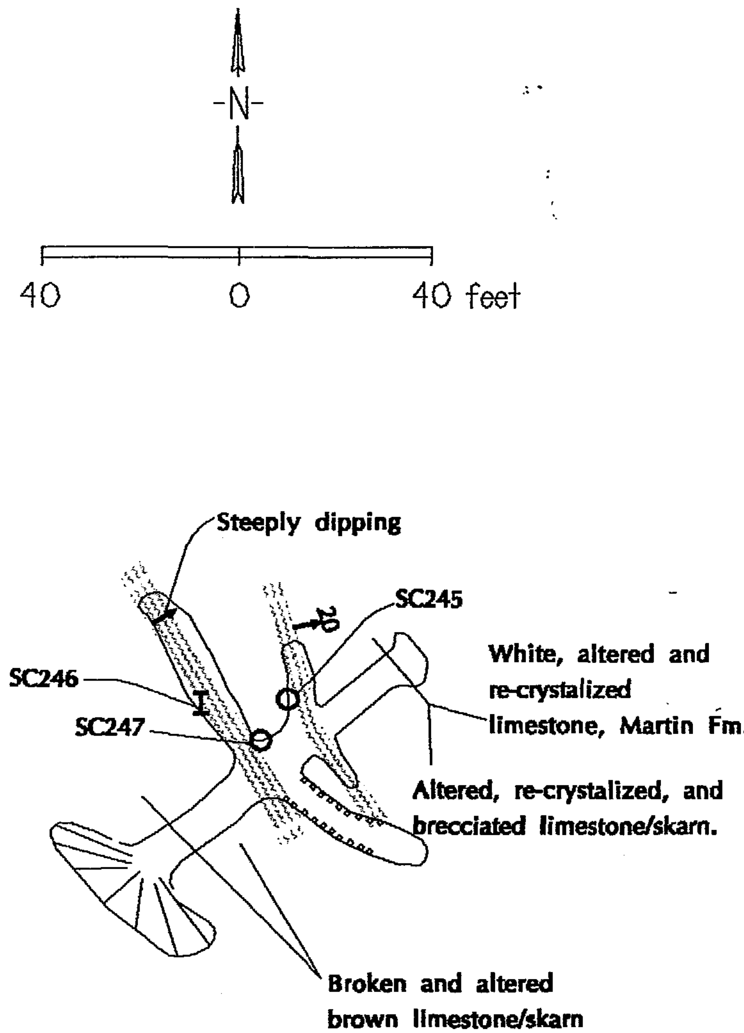
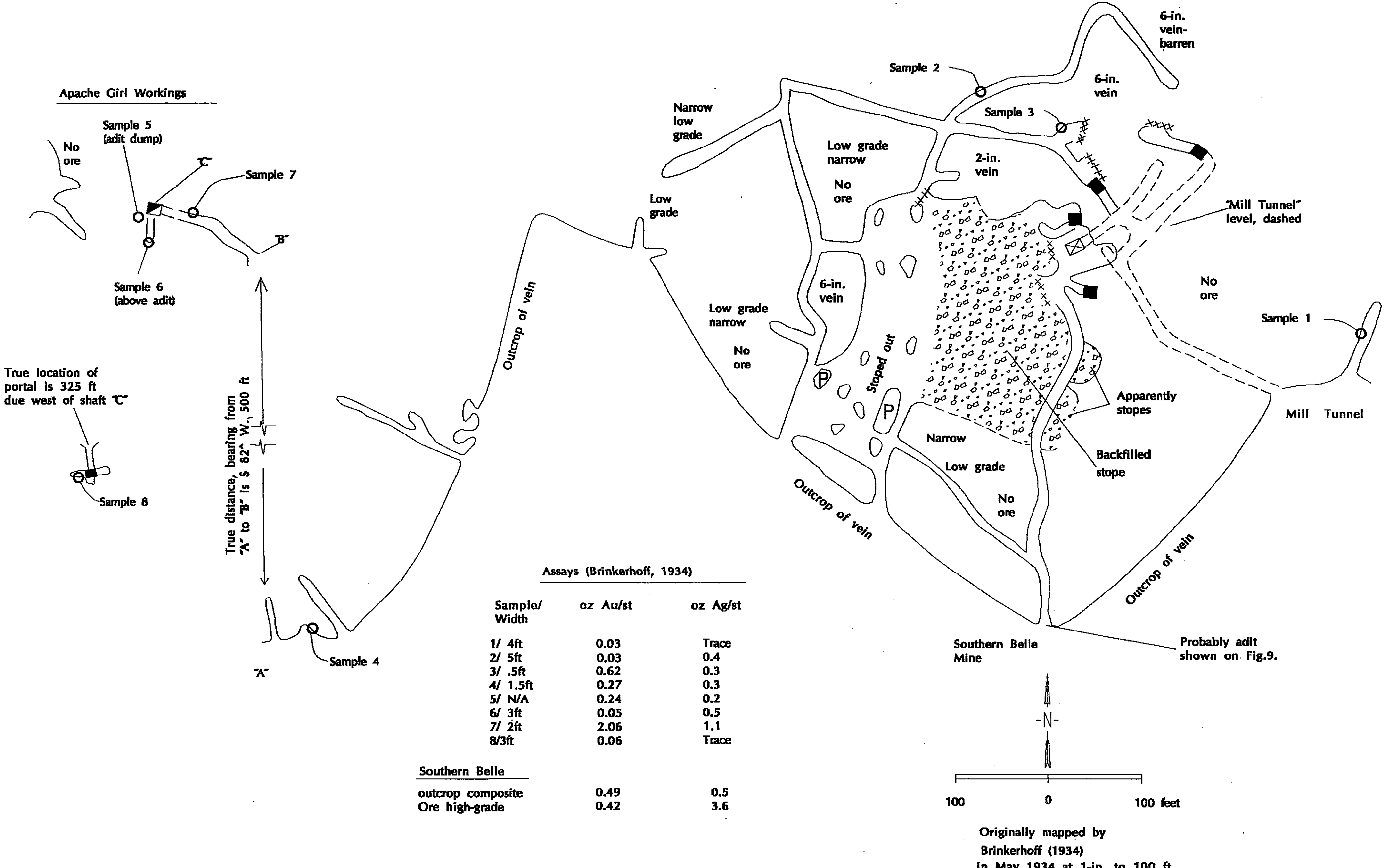


Figure 7.--Prospect in Korn Kob deposit, with sample localities SC238-240, Santa Catalina Mountains.



Local copper oxide, iron oxide throughout adit

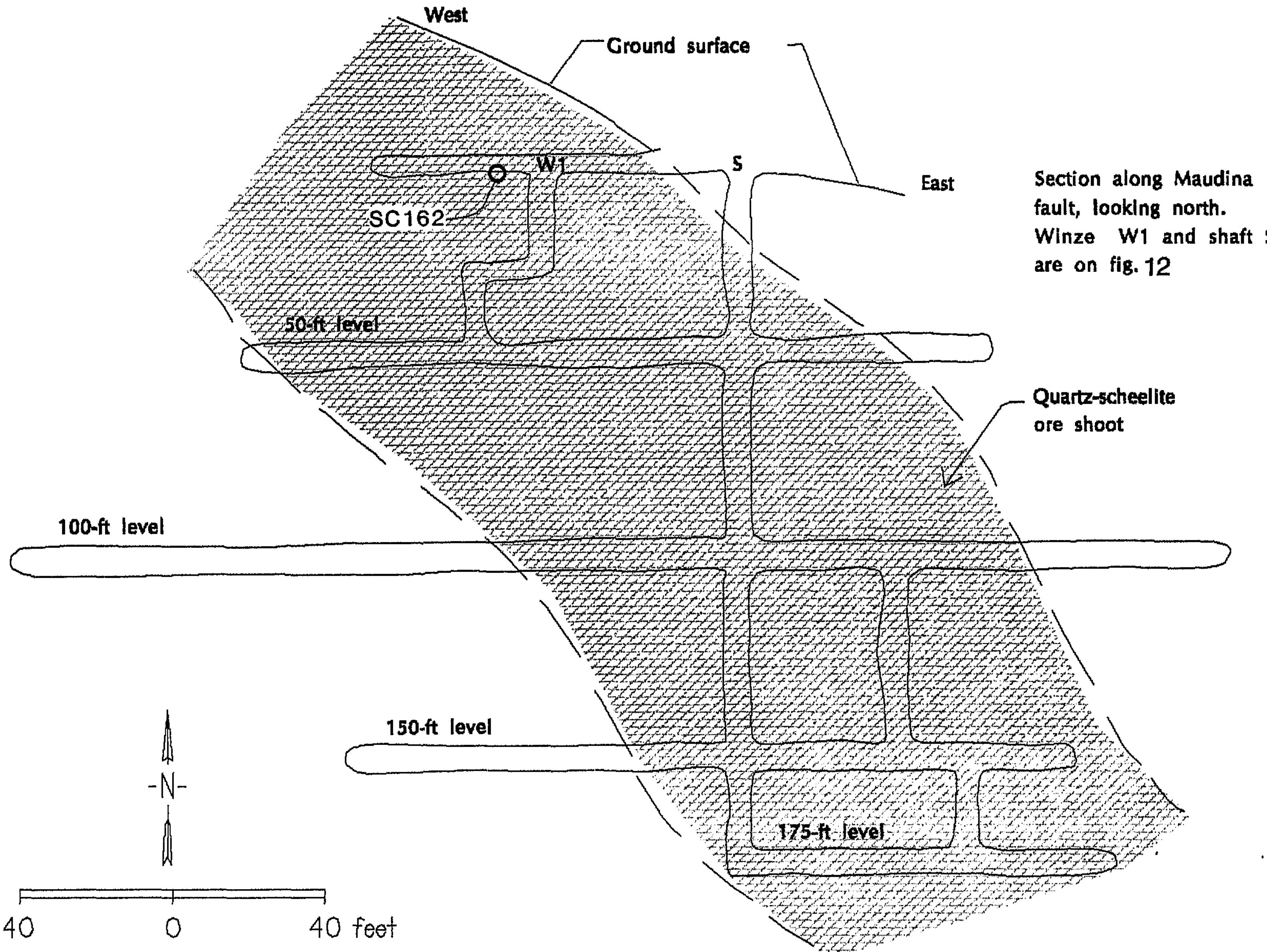
Figure 8.--Prospect in Skarn zone Southeast of Korn Kob deposit, with sample localities SC245-247, Santa Catalina Mountains.



Assays (Brinkerhoff, 1934)

Sample/ Width	oz Au/st	oz Ag/st
1/ 4ft	0.03	Trace
2/ 5ft	0.03	0.4
3/ .5ft	0.62	0.3
4/ 1.5ft	0.27	0.3
5/ N/A	0.24	0.2
6/ 3ft	0.05	0.5
7/ 2ft	2.06	1.1
8/3ft	0.06	Trace
Southern Belle		
outcrop composite	0.49	0.5
Ore high-grade	0.42	3.6

Figure 10.–Southern Belle Mine and part of Apache Girl prospect, Santa Catalina Mountains.



(From Bromfield, 1950, pl.10.)

Figure 11.–Old Maudina Mine, cross section, with sample locality SC162 Santa Catalina Mountains.

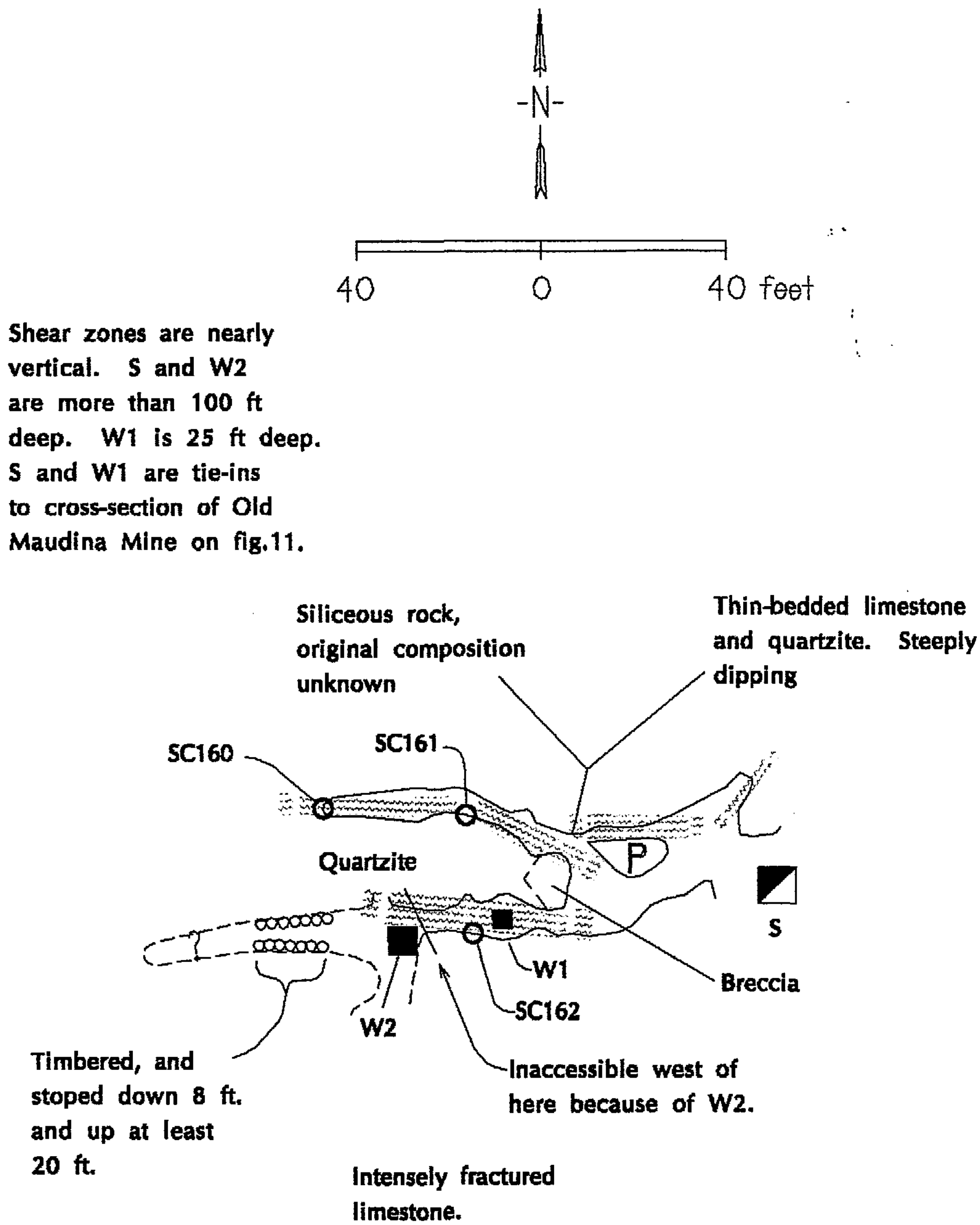
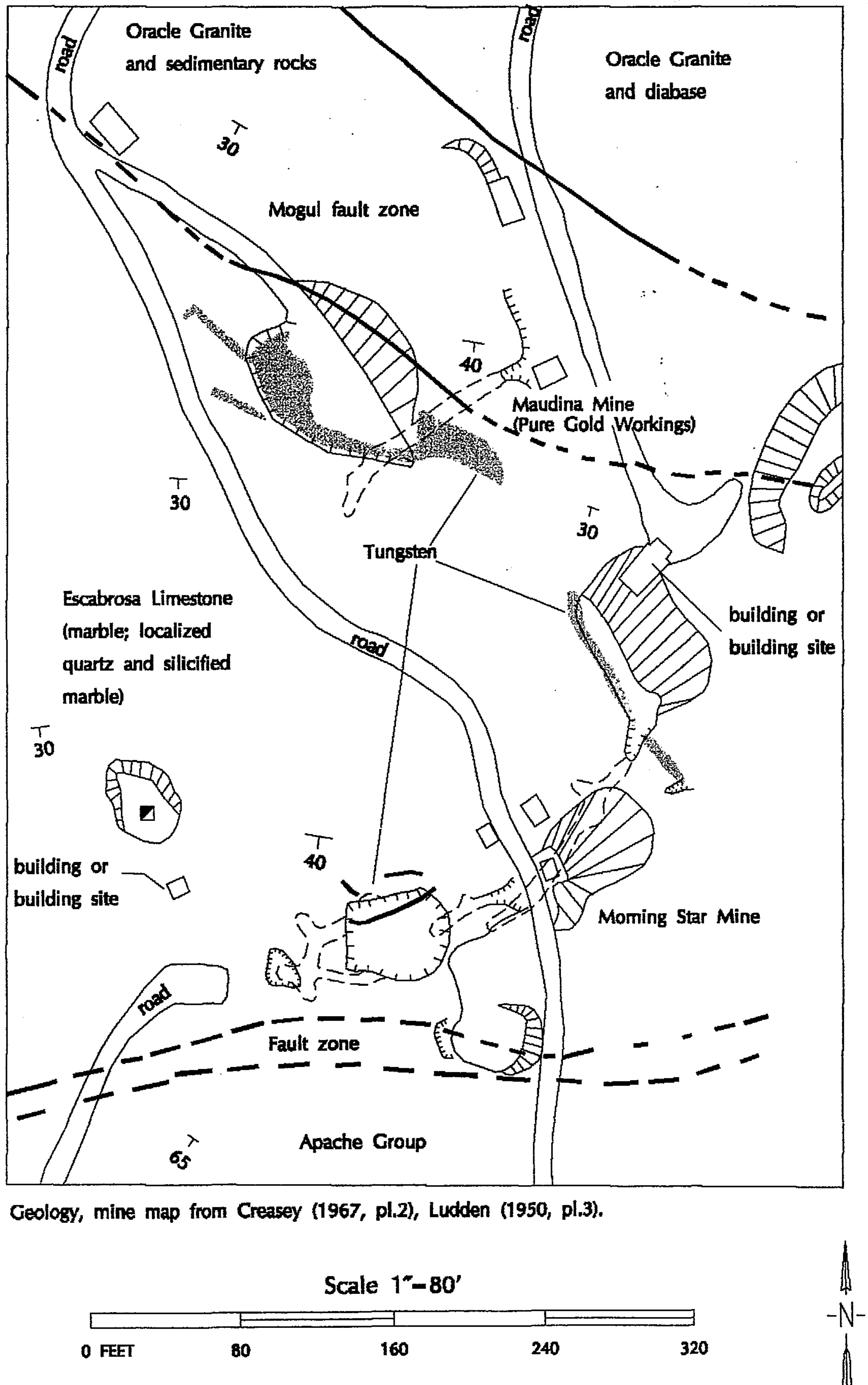


Figure 12.--Old Maudina Mine, with sample localities SC160-162, Santa Catalina Mountains.



Geology, mine map from Creasey (1967, pl.2), Ludden (1950, pl.3).

Figure 13.– Morning Star Mine and part of Maudina Mine (Pure Gold workings) Santa Catalina Mountains.

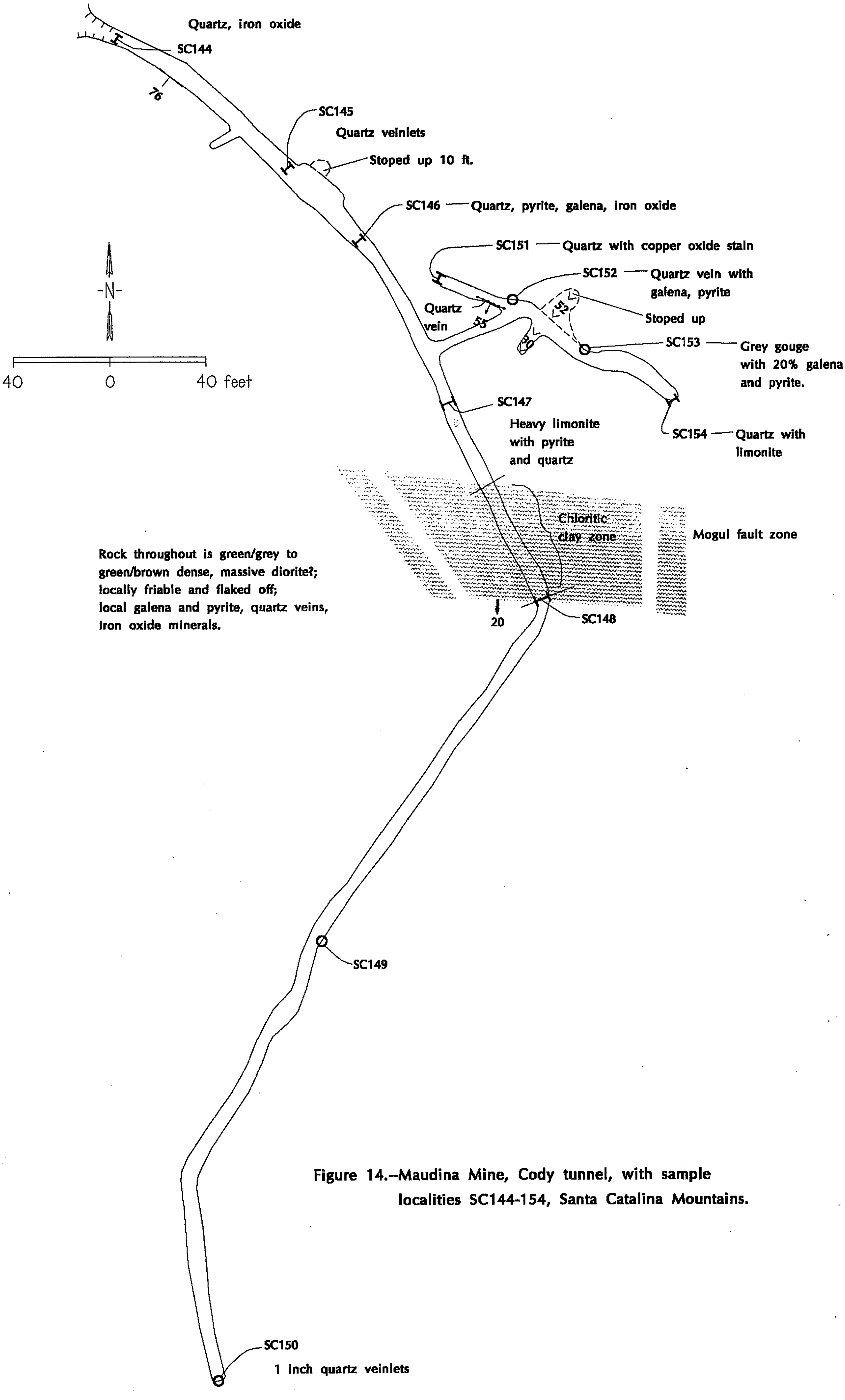


Figure 14.--Maudina Mine, Cody tunnel, with sample localities SC144-154, Santa Catalina Mountains.

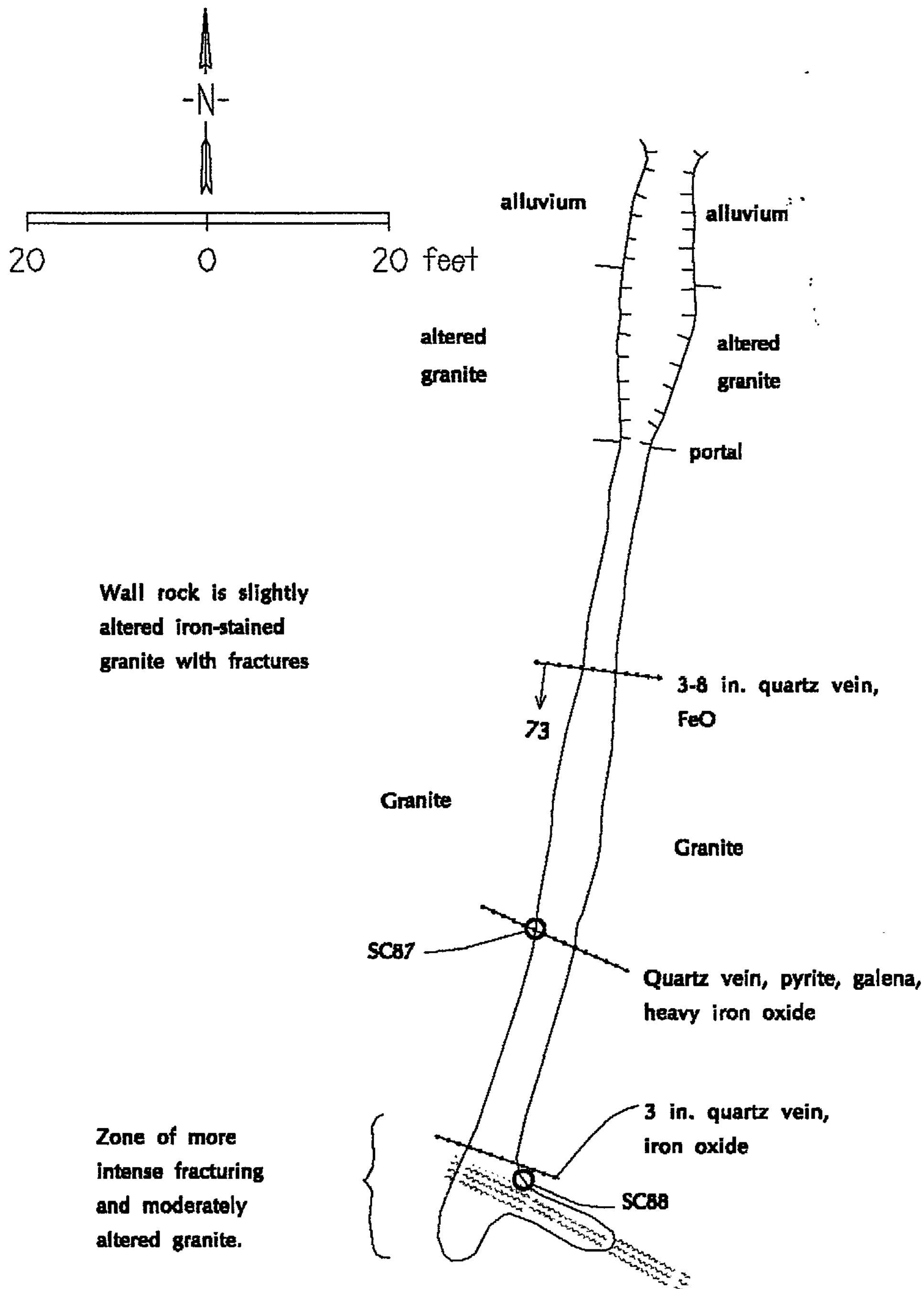


Figure 15.—Halloween and Spook Mine, with sample localities SC87-88, Santa Catalina Mountains.

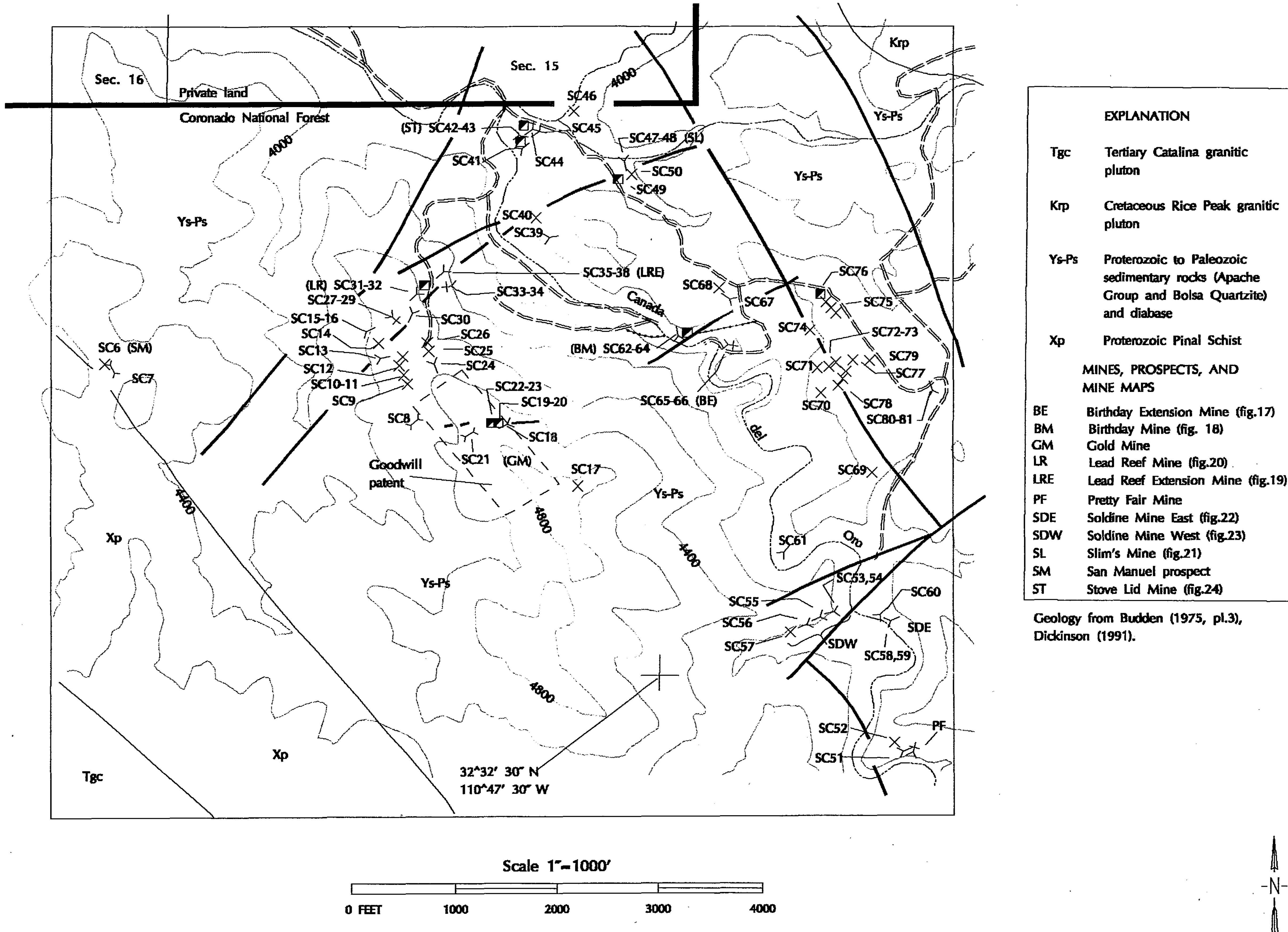


Figure 16.—Mines and prospects encompassed by the Burney Claim group, with sample localities SC6-81, Santa Catalina Mountains.

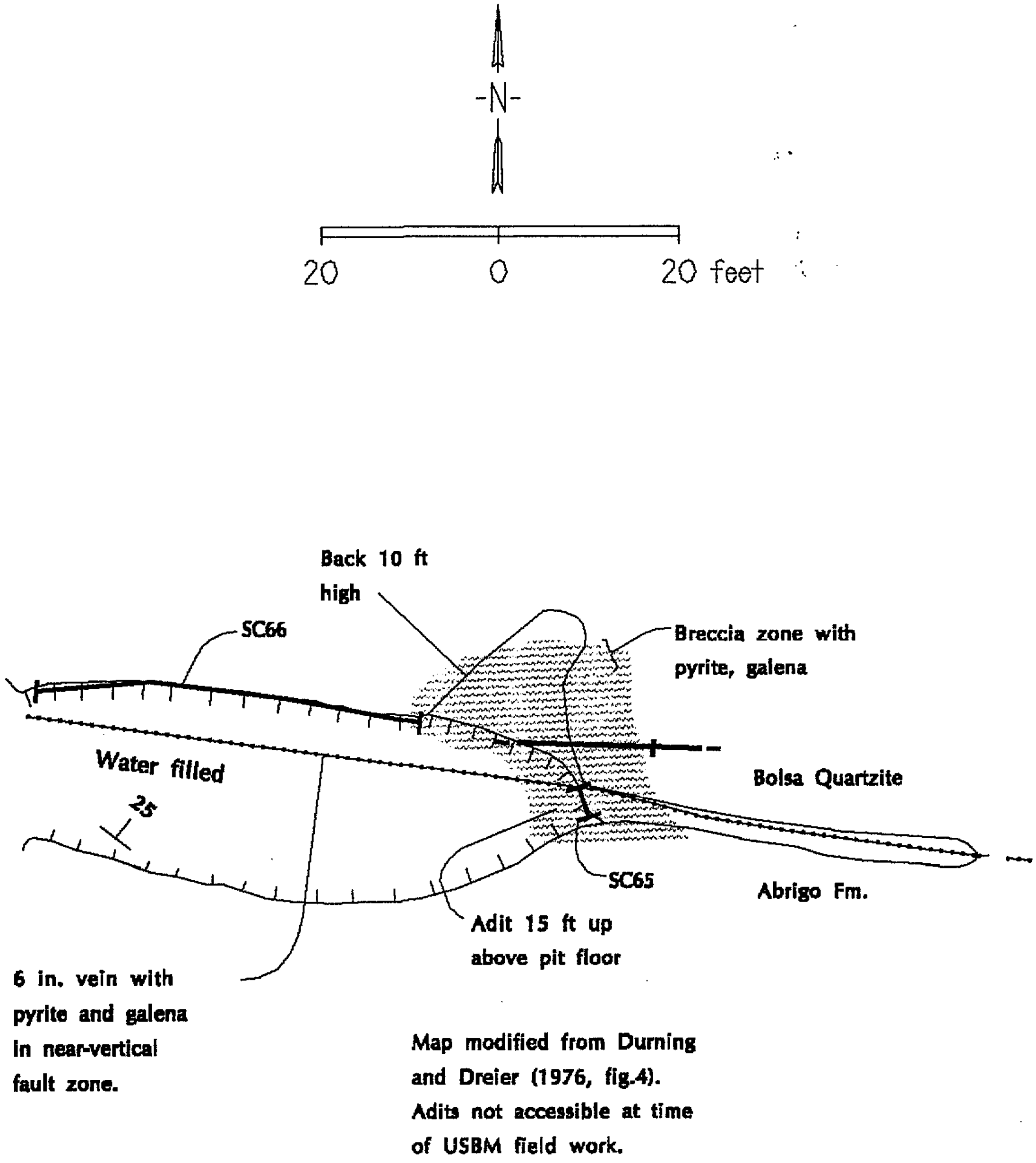


Figure 17.--Birthday Extension Mine, with sample localities SC65-66, Santa Catalina Mountains.

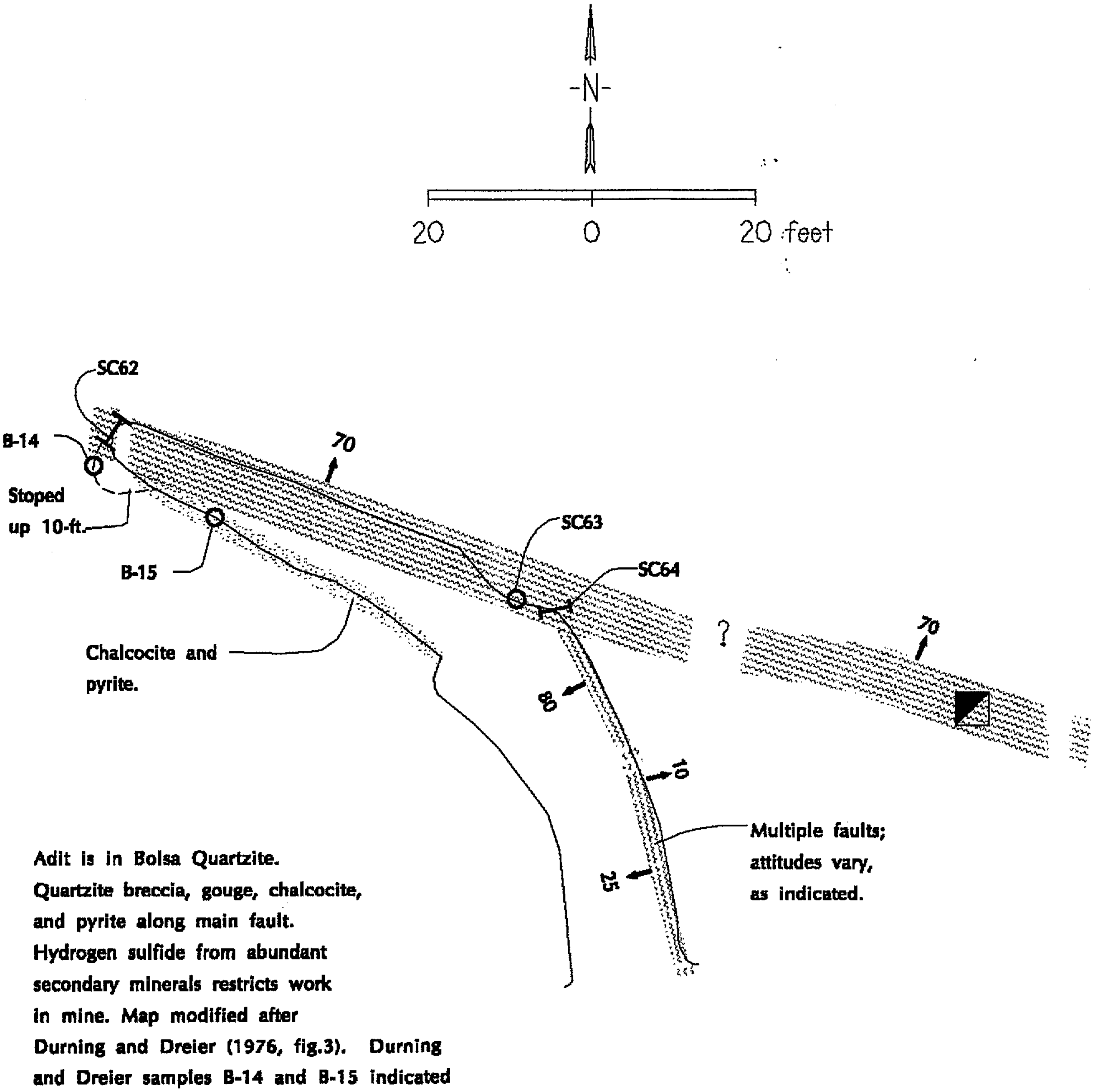
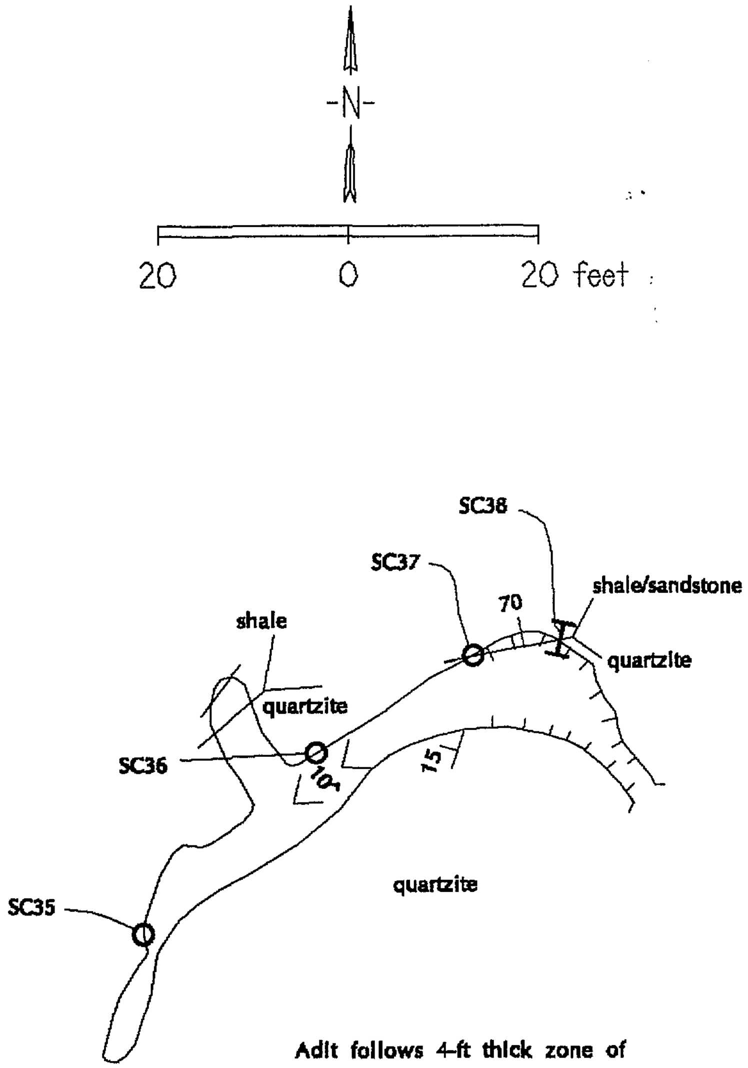
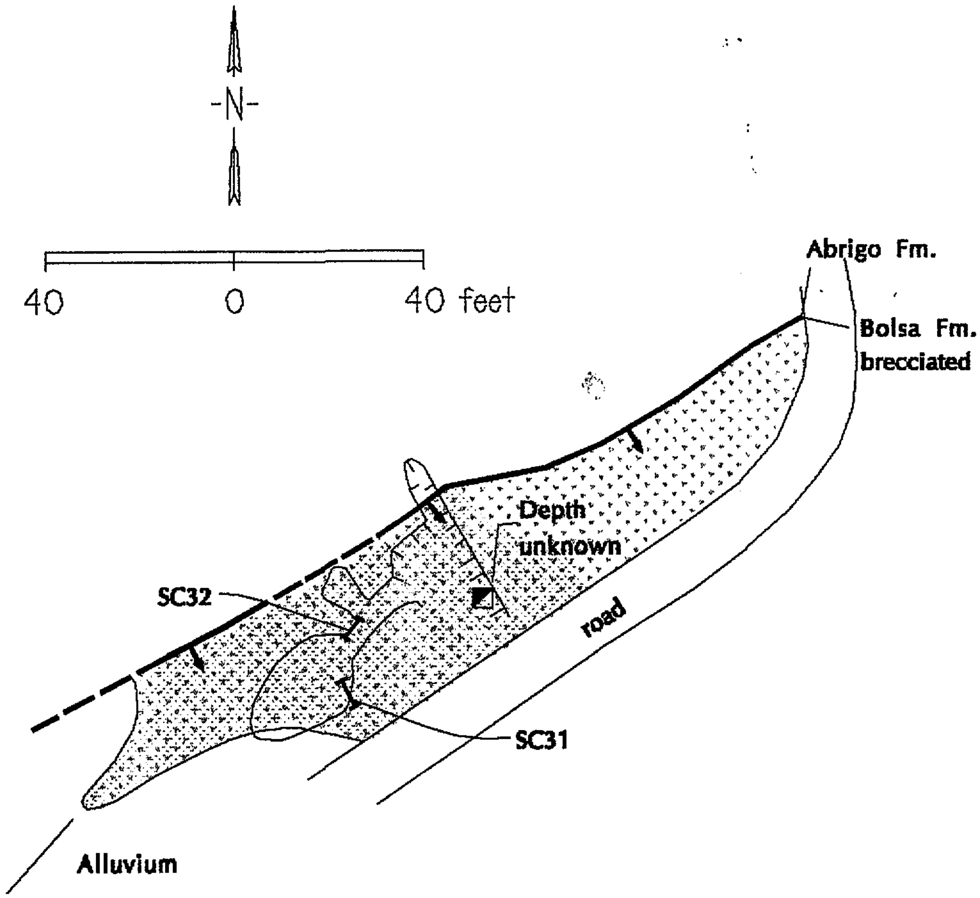


Figure 18.--Birthday Mine, with sample localities SC62-64, Santa Catalina Mountains.



Adit follows 4-ft thick zone of quartzite breccia and gouge in flat fault zone. Wall rock is altered for 1-2 ft from fault.
Mineralization is oxide, hematite, cerussite, wulfenite, and goethite.
Mine map after Durning and Dreier (1976, fig.6).

Figure 19.--Lead Reef Extension Mine, with sample localities SC35-38, Santa Catalina Mountains.



Workings are in altered and brecciated quartzite of the Bolsa Formation. Dip of poorly exposed fault not measured.
Mine map after Durning and Dreier (1976 fig.5).
Mineralization of limonite, cerussite and other oxides, carbonates and sulfates of Pb, Cu, Zn, and Ag. Mineralization localized at intersection of at least two faults.

Figure 20.–Lead Reef Mine, with sample localities SC31-32, Santa Catalina Mountains.

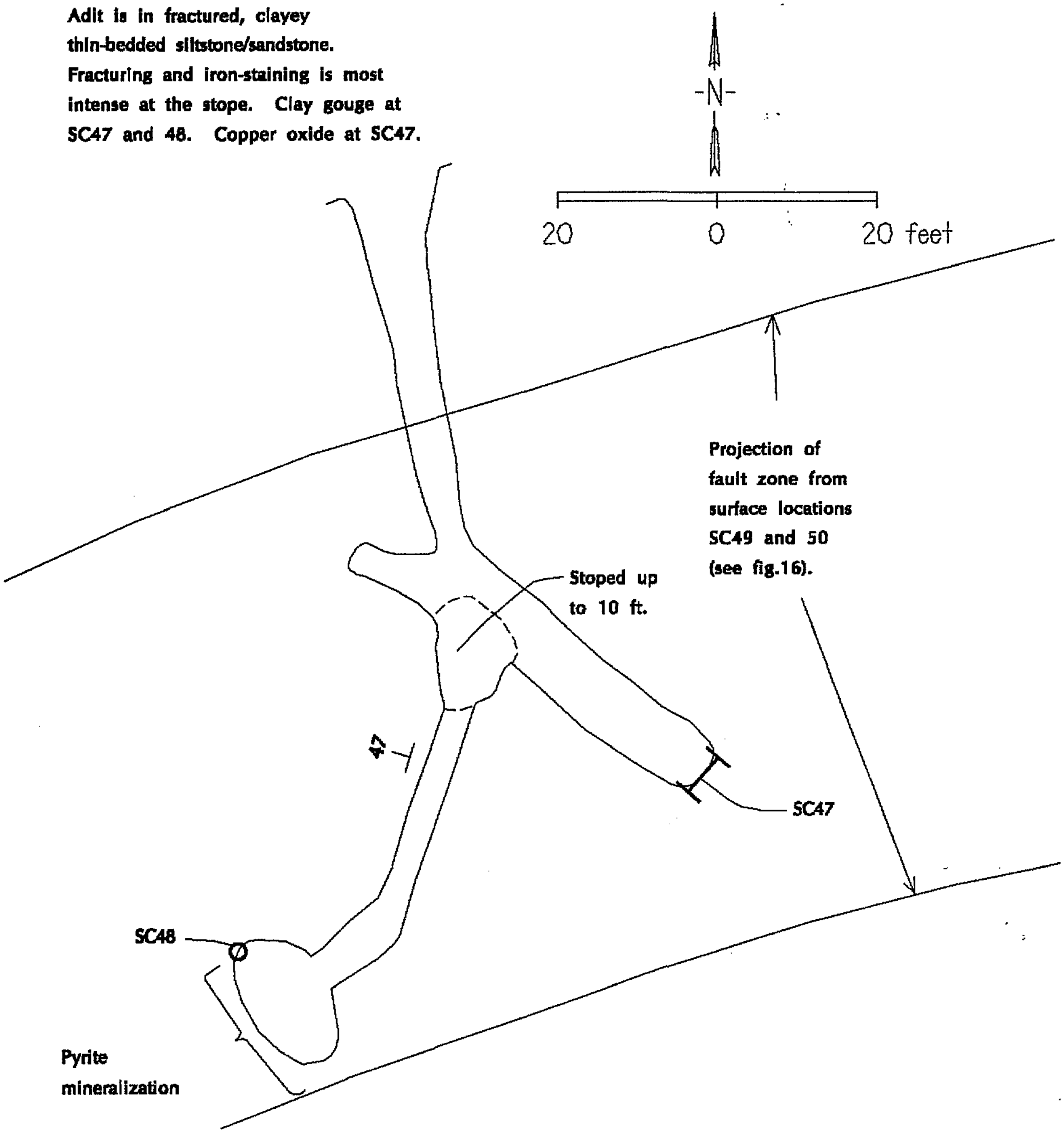
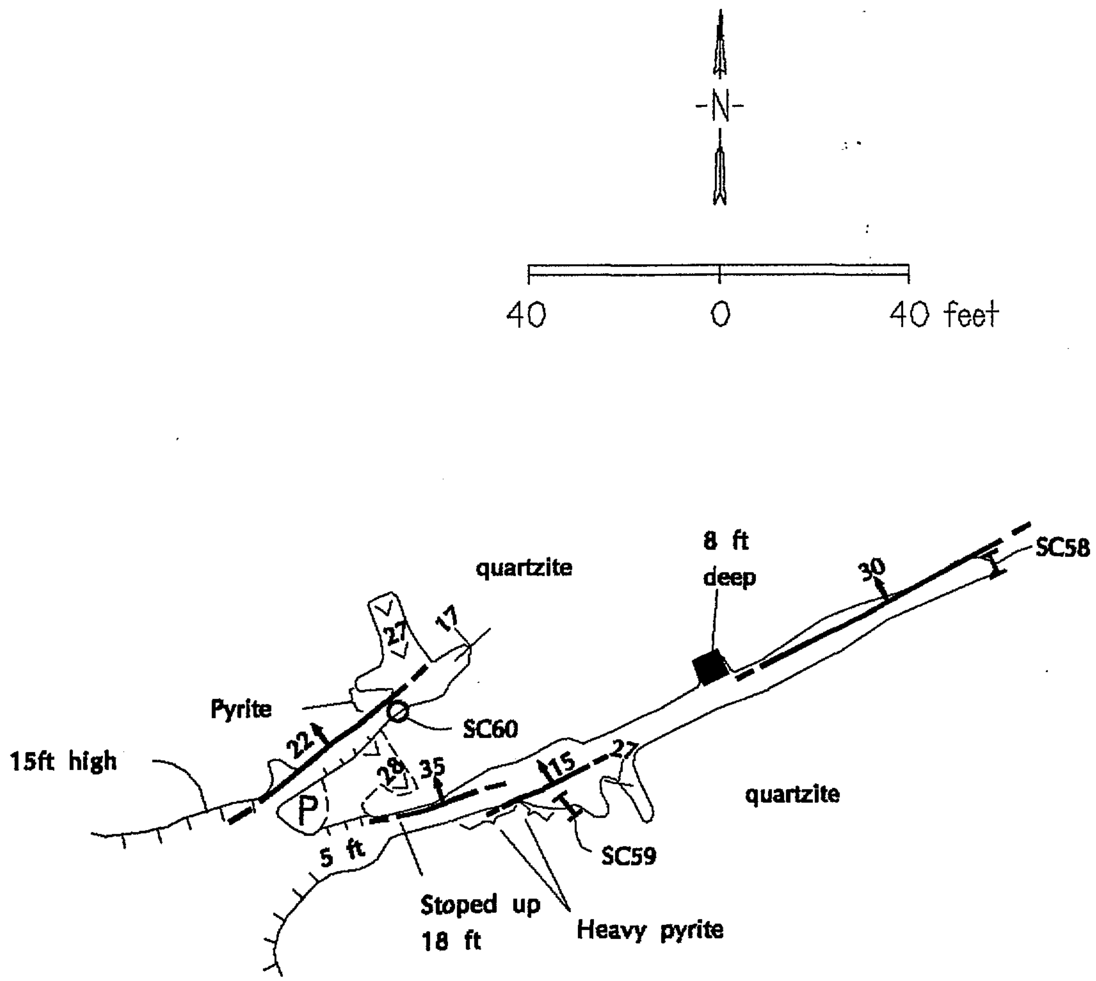


Figure 21.–Slim's Mine, with sample localites SC47-48, Santa Catalina Mountains.



Wall rock is quartzite. Local fracturing, alteration, fault gouge, chloritization, iron-staining, silicification, pyrite, and/or copper oxide.
Faults after Durning and Dreier (1976, fig.9).

Figure 22.–Soldine Mine East, with sample localities SC58-60, Santa Catalina Mountains.

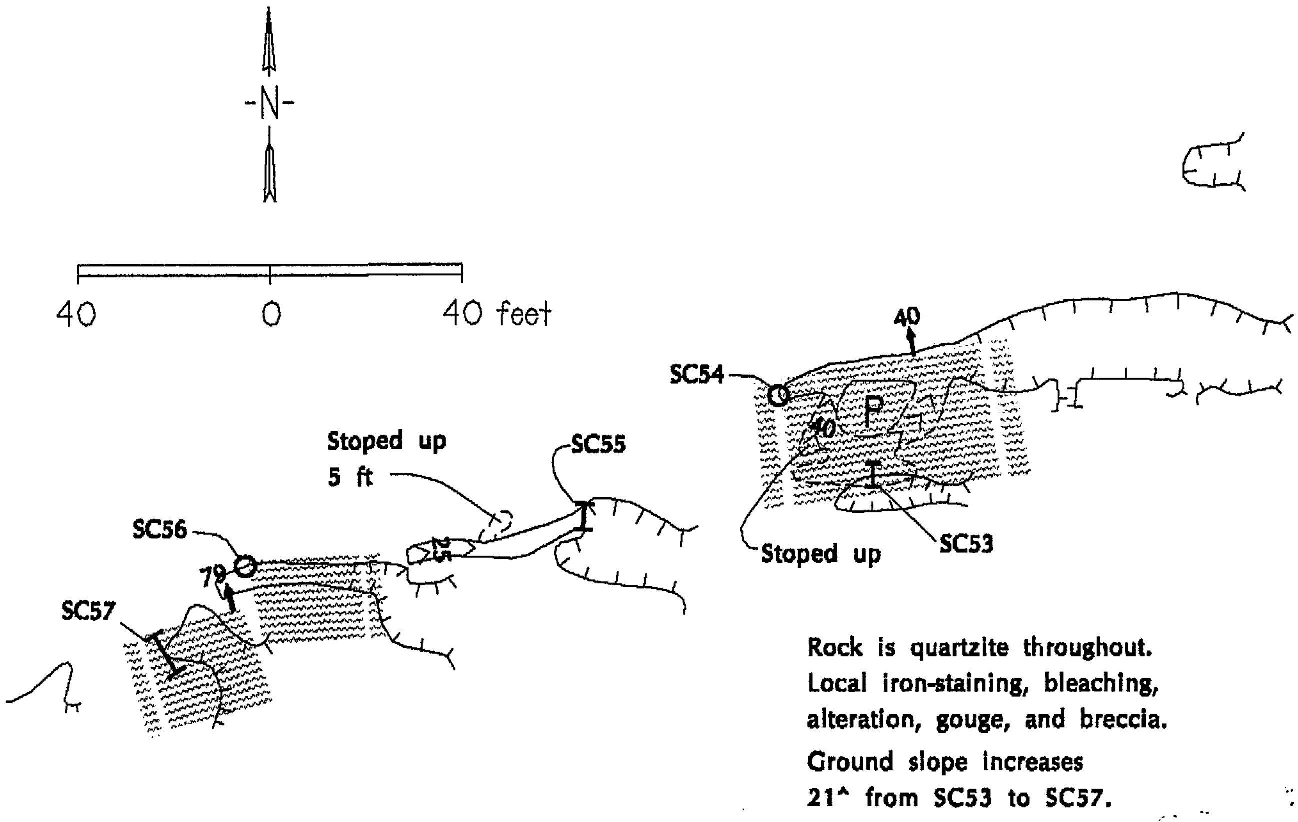


Figure 23.–Soldine Mine West, with sample localities SC53-57, Santa Catalina Mountains.

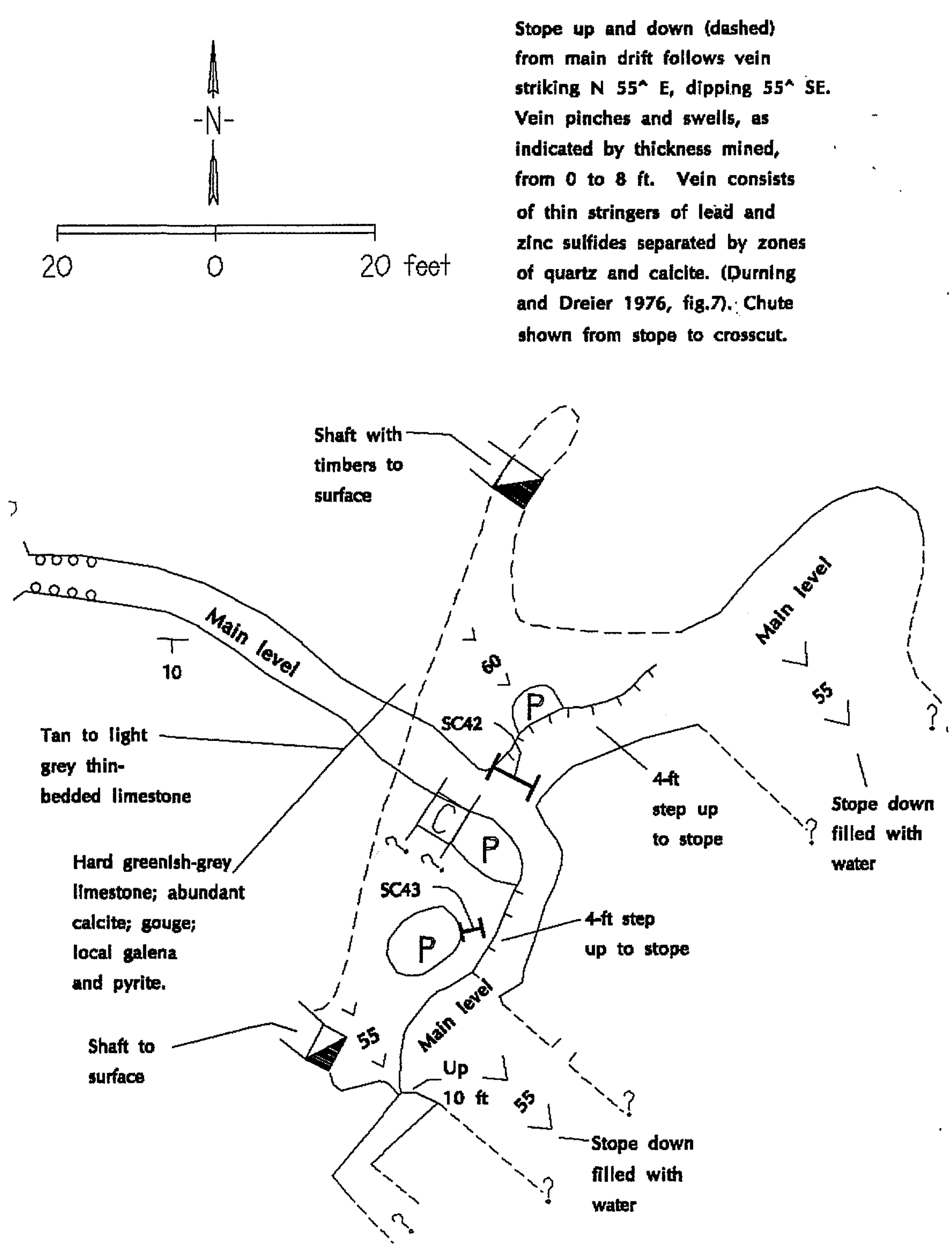


Figure 24.--Stove Lid Mine, with sample localities SC42-43, Santa Catalina Mountains.

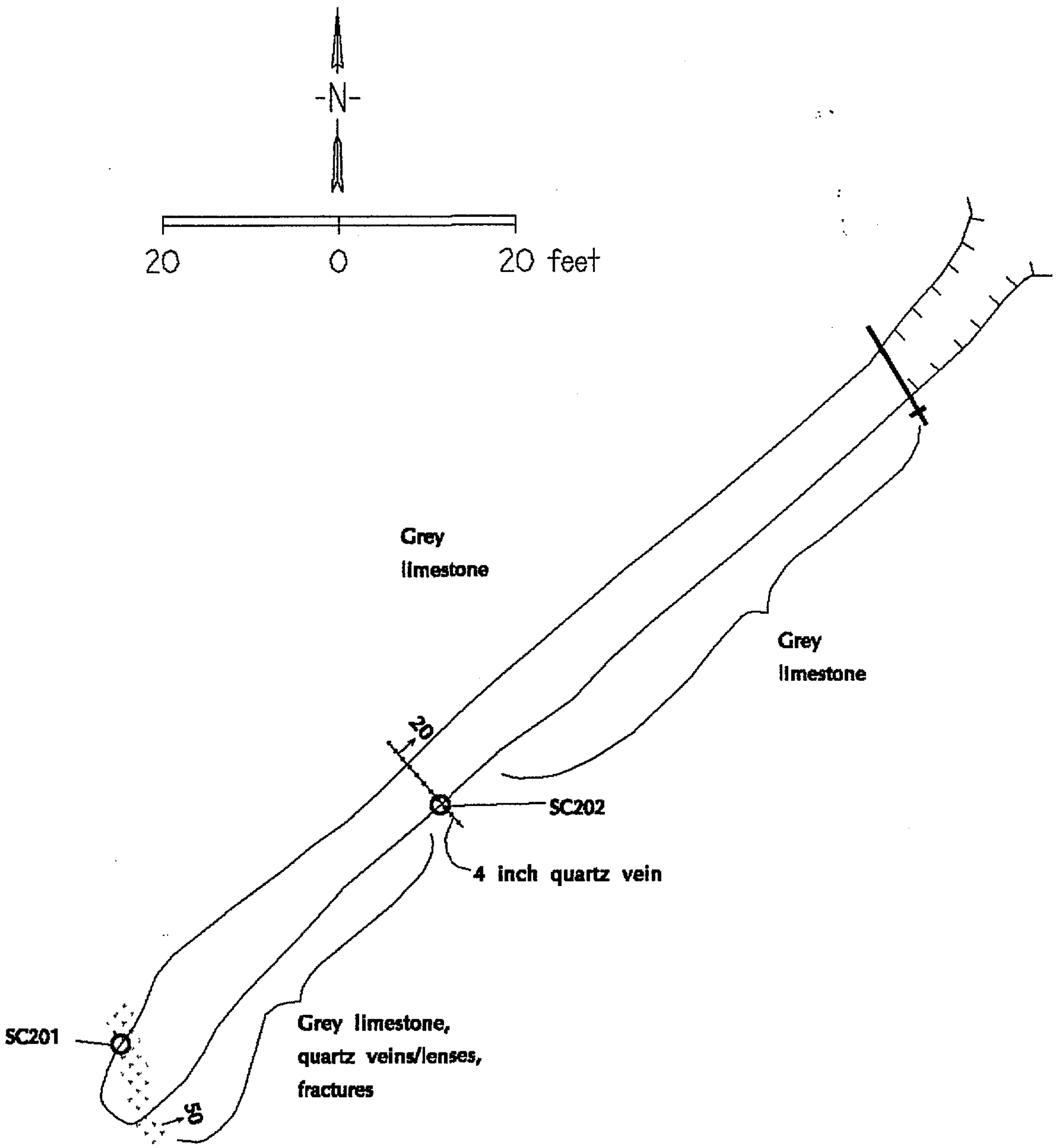


Figure 25.--Unnamed prospect, with sample localities SC201-202, Santa Catalina Mountains.

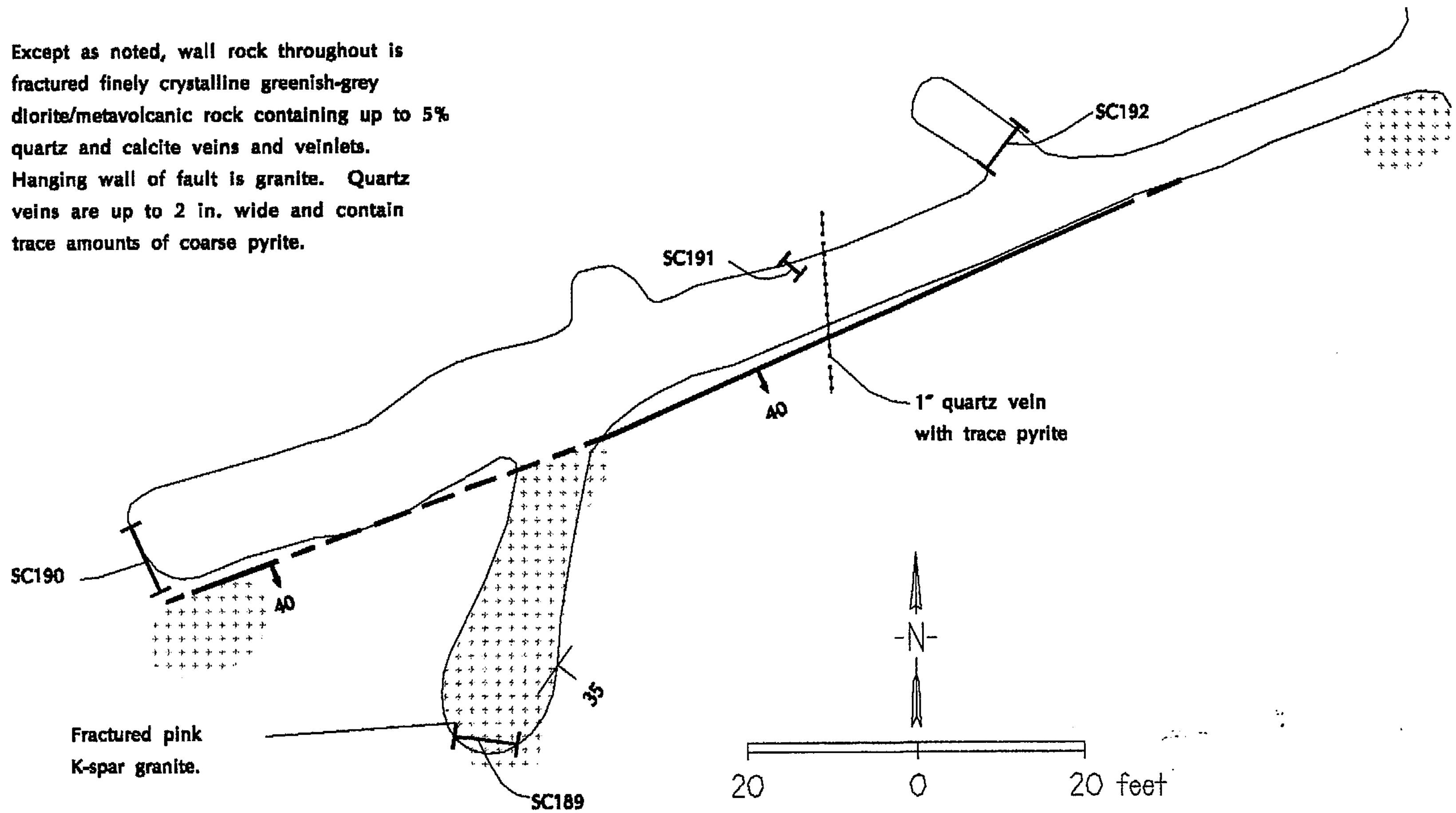


Figure 26.--Part of Mary West prospect, with sample localities SC189-192, Santa Catalina Mountains.

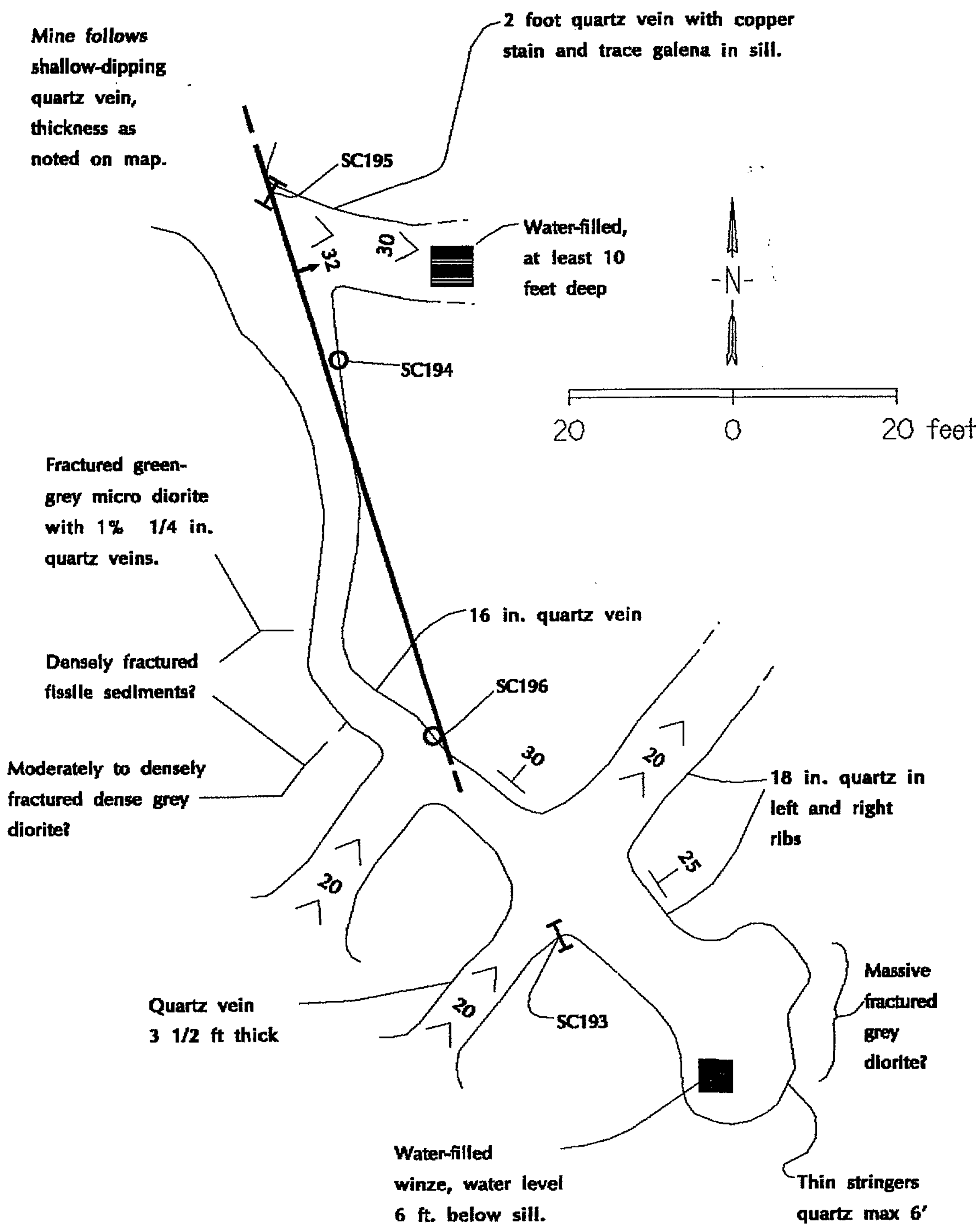


Figure 27.–Mary West prospect, with sample localities SC193-196, Santa Catalina Mountains.

APPENDIX A. MINE AND PROSPECT DESCRIPTIONS
Santa Catalina-Rincon Mountains Unit

The descriptions are organized by primary mineralized area and/or commodity (as discussed in the text; see table of contents at beginning of report) and (alphabetically) by mine or prospect name. USBM samples (if any were taken) and illustrations in this report are indicated after the name. Conclusions regarding resources are presented and relevant USBM sample results are discussed at the end of each Mine and Prospect Description, in the section "Resource estimate and basis." ADMMR = Arizona Department of Mines and Mineral Resources.

ALPHABETICAL LISTING		
Name	*Sample nos., (figure)*	*Page/location information*
Alder Canyon gold placers	no samples (pl. 1)	not addressed in this appendix
Apache Girl prospect	no samples (fig. 9, 10)	p. A4
Azurite Mine	no samples (pl. 1)	not addressed in this appendix
Bear Cat claims	no samples (fig. 9)	p. A5
Bear Creek area	no samples (pl. 1)	p. A6
Birthday Extension Mine	SC65-66 (fig. 16, 17)	p. A7
Birthday vein	SC62-66 (fig. 16)	p. A7
Birthday Mine	SC62-64 (fig. 16, 18)	p. A7
Blue Rock Mine	no samples (pl. 1)	not addressed in this appendix
Bluff Mine	no samples (pl. 1)	not addressed in this appendix
Bonanza Mine		see Lead Reef Mine or Gold Mine (Goodwill patent)
Burney claims	SC8-61 (fig. 16)	p. A10
"Burney Mines"		see Burney claims
Canada del Oro gold placers	no samples (pl. 1)	not addressed in this appendix
Carolina Moon group(?)	SC100-111 (fig. 9)	p. A12
Catalina camp	SC215-224 (fig. 4, 5)	p. A13
Chiva Tank area	no samples (pl. 1)	p. A14
Cochise Mine	no samples (pl. 1)	not addressed in this appendix
Cody tunnel		see Maudina Mine
Copper Hill Mine	no samples (pl. 1)	not addressed in this appendix
Corregedor Mine	no samples (pl. 1)	p. A15
Dailey Mine		see Oracle Ridge Mine
Geesaman Mine		see Oracle Ridge Mine
Geesman Mine		see Geesaman Mine
Gold Hill Mine	SC82-85 (pl. 1)	p. A16

ALPHABETICAL LISTING		
Name	Sample nos., (figure)	Page/location information
Soldine Mine West	SC53-57 (fig. 16, 23)	p. A38
Southeast extension, Korn Kob deposit	SC241, 244-248, 252, 253, 256-257 (fig. 6-8)	p. A39
Southern Belle	no samples (fig. 9, 10)	p. A40
Stove Lid Mine	SC41-45 (fig. 16, 24)	p. A43
Stratton Mine		see Oracle Ridge Mine
Taylor X Mine		see Catalina camp
Unnamed workings in Burney claim group (SC10, 13, 15)	SC10, 13, 15 (fig. 16)	p. A44
Unnamed workings in Burney claim group (SC25-26)	SC25-26 (fig. 16)	p. A45
Unnamed workings in Burney claim group (SC27-29)	SC27-29 (fig. 16)	p. A46
Unnamed workings in Burney claim group (SC71-79)	SC71-79 (fig. 16)	p. A47
Unnamed workings, Maudina Mine vicinity	SC142-143 (fig. 9)	p. A48
Unnamed prospect, Oracle mining district	SC201-202 (fig. 9, 25)	not addressed in this appendix
Valerie May prospect	no samples from this study (pl. 1)	p. A49

No samples fig. 9

Apache Girl prospect

Topographic quadrangle and location. Campo Bonito 7.5-minute quadrangle; NE¼ sec. 19, T. 10 S., R. 16 E.

Property holdings. Apache Girl patent, Southern Belle Group.

Production. Unknown.

Development. The workings are not extensive.

Geology and mineralization. The gangue is mostly quartz. Secondary copper minerals and galena are also reported.

Reference. Ludden (1950, p. 48)

Resource estimate and basis. Resource assessment pertains to gold. Apache Girl is contiguous with the western extent of the auriferous quartz vein deposit of the Southern Belle Mine. Details of the resource assessment are under the "Southern Belle" heading in this appendix. No attempt was made to separate resources specific to this prospect.

No samples fig. 9

Bear Cat claims

Topographic quadrangle and location. Campo Bonito 7.5-minute quadrangle. The Bear Cat shaft is probably located near the southwest corner of the SE¼ sec. 8, T. 10 S., R. 16 E., as indicated on Creasey (1967, plate 1). Location not known at time of USBM field investigations.

Property holdings. Unknown.

Production. 210 lb of tungsten concentrates.

Development. 20-ft inclined shaft; and a gravity mill capable of processing 150 lb of rock per hour.

Geology and mineralization. Granite intruded by a 60-ft-wide diorite-porphyry dike (N. 10° E., 45° E). Both the east and west dike contacts contain breccia, gouge, and scheelite-bearing veins.

The east vein ranges from a thin streak to about 1 ft in width. It consists of coarsely crystalline grayish-white quartz with disseminated scheelite, iron oxide, and local sparse wulfenite and vanadinite.

The west quartz vein had been opened by a 20-ft inclined shaft that revealed a vein width of 16 in. at the collar and increasing downward. The vein contains disseminated scheelite, iron oxide, and pyrite.

References. Wilson (1941, p. 34), except as noted above.

Resource estimate and basis. No resources present, based on the above information.

No samples in this Forest-wide study pl. 1

Bear Creek area, Rincon Wilderness Study Area

Topographic quadrangle and location. SW¼ sec. 25, T. 14 S., R. 18 E.

Property holdings. No data.

Production. No data.

Mining history and development. No data.

Geology and mineralization. Six chip samples collected in a previous USBM study (Thorman and others, 1981) from an area of 1,000 ft by 1,500 ft contain 0.03 to 2.1 oz Ag/st, 1.7 to 5.8% Cu, up to 3.5% Zn, and up to 0.96% Pb (sample length 12 to 21 in.; samples 16-19, 21, and 22). The samples are from small pits and trenches in the Rincon Valley Granodiorite and marbleized and epidotized Horquilla Limestone. Highest metal concentrations (2.1 oz Ag/st and 5.8% Cu) are from the contact between aplite(?) and altered schist(?). The remaining localities include: brecciated zone in limestone, siliceous breccia zone, contact zone of marble and aplite(?), siliceous vein, and a highly altered fault zone.

References. Thorman and others (1981).

Resource estimate and basis. No resources estimated by USBM.

Samples SC62-66 fig. 16-18

Birthday Mine (SC62-64), fig. 18
Birthday Extension Mine (SC65-66), fig. 17

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; NE 1/4 sec. 22 and NW 1/4 sec. 23, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, Arizona; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. Both mines intersect Birthday vein (fig. 16), though precise structural relationships at the Birthday Extension Mine are not known by USBM. Compare Durning and Dreier's (1976) mapping of the Birthday vein (fig. 16, this report) to the plot of the Birthday Extension Mine (fig. 16, this report). Metallized vein at these mines is 6-in. to 2-ft-wide. Average metal content is 1 oz Ag/st, 1% Pb, 0.5% to 1% Zn (Durning and Dreier, 1976, p. 2).

USBM data:
The Birthday vein is exposed in the Birthday Mine, Birthday Extension Mine, and a shaft near the portal of the Birthday Mine (see figs. 17 and 18). The vein is in the footwall of a N. 65° W.-striking, 70° NE.-dipping fault.

The Birthday vein is typically 6 ft wide and consists of the following: 1 ft of quartz containing pyrite; quartzite breccia containing pieces of vein quartz; fault gouge; decomposed Abrigo Formation (fine-grained sediments); and disseminated pyrite, galena, chalcocite, and sphalerite.

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. *ONE ESTIMATE FOR THE LENGTH OF THE VEIN AT BOTH THE BIRTHDAY MINE AND THE BIRTHDAY EXTENSION MINE.* The grade of the Birthday vein is best represented by Durning and Dreier's (1976, p. 16) samples B-14 and B-15 at the Birthday Mine and USBM sample SC65 at the Birthday Extension Mine. The surface distance between the pair of Durning and Dreier's samples and the USBM sample is 500 ft. Approximate weighted averages of the assays for Durning and Dreier's samples (assigning a thickness of 3 ft to each sample because they were not taken normal to the fault) are 0.023 oz Au/st, 7.4 oz Ag/st, 2.2% Cu, and 5.0% Pb. The analytical results for sample SC65 (6 ft normal to the structure) are 0.02 oz Au/st, 7.7 oz Ag/st, 0.27% Cu, and 15.7% Pb. The weighted averages of the above samples are 0.022 oz Au/st, 7.5 oz

Ag/st, 1.2% Cu, and 10.3% Pb. For comparison, the weighted averages of smelter shipments from the Birthday Mine are given by Durning and Dreier (1976, p. 15) as 0.06 oz Au/st, 21.5 oz Ag/st, 1.0% Cu, and 7.83% Pb.

USBM RESOURCE ESTIMATE FOR ENTIRE BIRTHDAY VEIN (BOTH BIRTHDAY EXTENSION MINE AND BIRTHDAY MINE):

Average dimensions of the Birthday vein are 6 ft width[1], 375 ft down dip, and 750 ft along strike (as suggested by Durning and Dreier, 1976, p. 16), leading to an inferred resource tonnage estimate of 140,000 st.

USBM PREVAL modeling of this deposit estimate, with the weighted average grades reported above (USBM and Durning and Dreier samples) indicates that the small deposit size and the low gold concentration are major factors that make this site uneconomical to mine. Shrinkage stoping is the most economical mining method, with a slight (10%) advantage, relative to mining costs, over open-pit mining. The most applicable beneficiation method to use is a matter of some conjecture at this point due to the absence of mill tests. The reported oxidized zone on the surface of the deposit is notably shallow, giving way to sulfide mineralization "a few tens of feet below the surface outcrops" (Durning and Dreier, 1976, p. 2). For this reason, the amenability of the rock to heap leaching is doubtful. If only the oxidized material were utilized, the deposit tonnage would drop to such a low amount that the site would not warrant further consideration. The gold grade is so low that a recovery method focused solely on gold would drop the overall revenue to extremely low levels. For these reasons, the USBM model is designed to recover all four commodities (gold, silver, copper, and lead) through standard flotation milling procedures. The model and resulting costs are as follows:

Deposit size: 140,000 st.
Grades: 0.02 oz Au/st, 7.5 oz Ag/st, 1.2% Cu, 10.3% Pb, all assumed to be in sulfide form, for modeling purposes.
Mine method: Shrinkage stoping, 130 st/d, 260 d/y.
Mine life: 3 preproduction years to develop the property and 4 production years.
Mine recovery: 90% with 10% dilution.
Commodity prices used: (mid-1994) gold: $387/oz; silver: $5.55/oz; lead: $0.35/lb; copper: $0.98/lb.
Milling method: flotation for copper and lead and assumed capture of silver and gold; rate of 100 st/day, 350 days/year.
Mill recoveries: 90% lead; 91% copper; 76% gold; 80% silver.
Mine operation costs: $35/st.
Mill operation costs: $48/st.
Mine capitalization costs: $3.7 million.
Mill capitalization costs: $2.0 million.
NPV at 15% ROR: -$8 million.

It should be noted that the capitalization costs are similar to the projected losses over the estimated 7-year life of the operation. A small mining concern with most or all of the capitalization requirements in hand could conceivably set up operation at this site close to

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[1] This width was selected because, although the Birthday vein itself is 0.5-ft to 2-ft wide, Durning and Dreier (1976, p. 5) report that fractured quartzite as much as 20 ft away from the fault also contains the same type of metallization.

the economic break-even point. A sharp increase in the price of gold could shift the model into estimated profitability. It should be noted again, however, that tests on the amenability of the rock to the modeled beneficiation methods are essential to determining the true economic viability of this property. Drilling of the fault zone also is essential.

Samples SC6-81 fig. 16

Burney claims
(aka "Burney Mines")

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; E½ sec. 22, W½ sec. 23, and NW 1/4 sec. 26, T. 10 S., R. 15 E.

Property holdings. 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, Arizona; current status unknown.

Production. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967.

1,227 st total "smelter liquidations" from three mines (Birthday, Lead Reef, and Stove Lid), with a weighted average of 0.76% Cu, 8.6% Pb, 2.0% Zn, 11 oz Ag/st, and 0.074 oz Au/st.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the area between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. Mineralization occurs in the hard, brittle units of the Bolsa Quartzite, Horquilla Limestone or Dripping Springs Quartzite. The mineralization frequently occurs where a northeast- to east-west-trending high-angle fault cuts one of the favorable units. Mineralization consists of sulfides and quartz deposited in the fault breccias or as replacements in selected favorable horizons for a few feet away from the fault. The mineralized fault zones average 1.5 to 4 ft wide but may open up to as wide as 20 ft at the Lead Reef Mine. Replacement zones generally 3 ft to 4 ft thick occur at the Birthday Mine up to 10 ft to 20 ft away from the fault.

Typical values over a 1- to 2-ft vein width in the oxidized zone are 20 oz to 50 oz Ag/st, 3% to 5% Pb and trace Zn. In the sulfide zone these same veins average 2 oz to 4 oz Ag/st, 3% to 5% Pb, and 2% to 3% Zn. Wall rocks on either side of the vein contain significantly lower metal values.

In addition to being small and low grade these veins are offset by numerous post-ore faults and are sheared and contorted by post-ore movement along the vein.

Many of the mines and prospects are at the contact between thick-bedded quartzite and subjacent or superjacent fine-grained sedimentary rocks. Diabase dikes or sills are present in many of the localities, porphyry is less common. The sediments are not appreciably metamorphosed (USBM field data, 1990-1992).

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area. Wallace (1951) provides some additional information on mineralization and paragenesis at the Stove Lid Mine.

Resource estimate and basis. This page is a summary of the entire claim group. Assessments of individual mines are in separate sections of this appendix, listed alphabetically:

LIST OF THE MINES AND PROSPECTS
Birthday Extension Mine
Birthday Mine
Bonanza Mine
Gold Mine
Goodwill patent
Lead Reef Mine
Lead Reef Extension Mine
Pretty Fair Mine
Slim's Mine
Soldine Mine, east and west
Stove Lid Mine

Samples SC100-111 fig. 9

Carolina Moon(?) group

Topographic quadrangle and location. Campo Bonito 7.5-minute quadrangle. The precise location of this claim group is unknown. The referenced report gives the location as sec. 18, T. 10 S., R. 16 E., but there are no known workings on this scale in section 18. Because the referenced report indicates that two of the unpatented mining claims are called "Hi Jinks #2 and #3," it was presumed that the location of the Carolina Moon group is probably near USBM sample locations SC100-111.

Property holdings. 6 unpatented lode mining claims, current status unknown.

Production. Unknown.

Development. 300-ft adit, 200-ft adit, 75-ft-deep shaft, 50-ft-deep shaft, number of shallow shafts and open cuts. 600 to 700 st tailings. An old gold mill (now entirely dismantled) once stood on one of the claims.

Geology and mineralization. Several quartz veins, as much as 4 in. wide, cross terrain that consists of Oracle Granite and diorite. The veins contain scheelite and powellite, and there has been some gold production from the property.

A considerable amount of scheelite, with probably some powellite, was found in the waste material. Scheelite was detected in the workings, but there was not enough to sample.

Reference. ADMMR unpublished Field Engineers Report, dated Nov. 3, 1961.

Resource estimate and basis. No resources present, based on the above information.

Samples SC215-224

fig. 4, 5
area A12 on plate 2

Catalina camp

Topographic quadrangle and location. Mt. Lemmon 7.5-minute quadrangle; center NW¼ sec. 18, T. 11 S., R. 16 E.

Property holdings. Unpatented lode mining claims.

Production. Unknown.

Development. 100-ft-long adit (fig. 5); shallow shaft; other adits.

Geology and mineralization. Cambrian Abrigo Formation, along Geesaman Fault. Local quartz, calcite, pyrite, chalcopyrite, copper stain.

References. Geology mapped by Suemnicht (1977b). Other data from USBM field study.

Resource estimate and basis. Five samples taken at Catalina camp represent mineralization along 225 ft of strike length of the Geesaman fault. The average length of the samples is 3.5 ft (samples SC216-220, fig. 4). The weighted average metal concentrations are 0.47% Cu, 0.55 oz Ag/st, and 0.53% Pb. Assuming the mineralization has a strike length of 450 ft and maximum depth of 900 ft, the tonnage is 172,000 st. This tonnage/grade combination is not economically minable.

No samples in this Forest-wide study pl. 1

Chiva Tank area, Rincon Wilderness Study Area

Topographic quadrangle and location. Sec. 29, T. 13 S., R. 17 E.

Property holdings. No data.

Production. No data.

Mining history and development. No data.

Geology and mineralization. Random grab outcrop sample 99 from a previous USBM study (Thorman and others, 1981) contains 0.2 oz/st silver and 2.2% copper. A 3-ft chip sample, number 100, contains 3.5% copper. The samples were taken 200 ft apart from a quartz vein in quartz monzonite.

References. Thorman and others (1981).

Resource estimate and basis. No resources estimated by USBM.

No samples pl. 1

Corregedor Mine

Topographic quadrangle and location. Mount Bigelow 7.5-minute quadrangle; ctr. sec. 15, T. 11 S., R. 16 E. Located 7,500 ft northeast of the Oracle Ridge Mine millsite along the Geesaman fault.

Property holdings. Patented property held by Oracle Ridge Partners.

Production. 100 st of tungsten ore containing 4% WO_3.

Development. Shallow shafts.

Geology and mineralization. Shallow, spotty scheelite in a metamorphosed quartzite lens near the contact with a Laramide quartz diorite intrusive.

Reference. Keith (1974, p. 130).

Resource estimate and basis. No resources present, based on the above information.

Samples SC82-83 pl. 1

Gold Hill Mine (silica flux)

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; NW¼ sec. 14, T. 10 S., R. 15 E.

Property holdings. Two north-trending unpatented lode mining claims owned by Little Hill Mines, Inc., of Oracle, AZ.

Production and reserves. Total past production is 60,000 st of silica flux containing 0.5 oz Ag/st. Shipped 2,000 st to the Hayden smelter in 1991. Reserves are 5 million st.

Development. The north pit measures 200 ft by 200 ft, and has an average depth of 15 ft. The south pit measures 420 ft by 145 ft, and has an average depth of 12 ft. The access road through the Little Hill Mines crushing and screening plant in sec. 5, T. 10 S., R. 15 E. was improved in 1991.

Geology. The mine occurs in a gently westward-dipping block of Precambrian Dripping Springs Quartzite, measuring 2,500 ft in a north-south direction by 800 ft in an east-west direction. The block of Dripping Springs Quartzite is underlain on the east by sedimentary rocks of the Pioneer Formation, overlain and/or intruded at the west end of the mine site by diabase, and cut off on the north and south by faults. The thickness of the Dripping Springs Quartzite in the Santa Catalina-Rincon Mountains Unit, based on information in Budden (1975), is around 300 ft.

References. Production and reserves are from Dave McGee (president of Little Hill Mines, Inc.; personal communications, 1990 to 1993). Geology (exclusive of dimensions and thickness estimates) are from Budden (1975). All other information from USBM field study.

Resource estimate and basis. The block described above under "Geology" has inferred resources of 50,000,000 st of silica flux. This is consistent with the reserve figure given above.

USBM information is that the price paid for silica flux at the Hayden smelter is $12/st. The added value of silver content reported for the Gold Hill flux ($2.00/st, if paid to the supplier) is not enough to compensate for the cost of shipping the flux to Hayden (estimated to be $6.30/st for a tractor-trailer). Thus, it appears that flux from the Gold Hill Mine could not compete with suppliers of flux closer to the Hayden smelter.

Samples SC18-23 fig. 16

Gold Mine
(includes Goodwill patent)

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; SE 1/4 sec. 22, T. 10 S., R. 15 E.

Property holdings. Within and near a group of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. Samples collected from 175 ft of strike length of a N. 70° E.-striking fault and vein contain as much as 0.13 oz Au/st, 4.6 oz Ag/st, and 15.7% Pb. The highest metal content (sample SC23) is for select siliceous vein material from a dump. The fault zone is typically 3 ft wide.

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. No resources estimated by USBM, primarily due to the small size of the occurrence.

No samples fig. 2

Hartman-Homestake mines

Topographic quadrangle and location. Mt. Lemmon 7.5-minute quadrangle; ctr. E½ sec. 18, T. 11 S., R. 16 E. Located 7,500 ft west of the Oracle Ridge Mine millsite, still within the central patented and unpatented mining claim holdings of the Oracle Ridge Partners.

Property holdings. Six patented mining claims.

Production and reserves. Past production is 600 st of ore averaging 5% Pb, 3% Zn, 3% Cu, and 30 oz Ag/st; produced in 1947-1948 (Keith, 1974, p. 130). Reserves are 18,000 st grading 6% Pb, 7.6% Zn, 3% Cu, and 2.5 oz Ag/st on the 100-ft level; and 40,000 to 50,000 st grading 3.5% Cu, 2 to 4 oz Ag/st, and 0.03 oz Au/st on the 200-ft level (ADMMR report, identified below).

Development. 2,500 ft of drifts, raises, and winzes (Braun, 1969, p. 44-50).

Geology and mineralization. The mines are in the Cambrian-age Abrigo Formation, 200 ft southeast of the Leatherwood quartz diorite contact and 1,500 ft south-southwest of the Geesaman fault. The most important workings and mineralization are in the Hartman-Homestake fault zone, striking from N. 50° E. to N. 80° E. and steeply dipping to the southeast or northwest. The fault zone is an average of 5 ft wide and consists of gouge and breccia (Braun, 1969, p. 44-50).

Mineralization consists of partly oxidized base metal sulfides and pyrite in skarn, gouge, and breccia along the fault zone and in the adjacent metamorphosed Cambrian-age Abrigo Formation (Keith, 1974, p. 130).

References. As noted above. Unpublished ADMMR report is as follows: "Production possibilities of the marginal copper mines in Arizona," August 1, 1941.

Resource estimate and basis. Information provided by Braun (1969, p. 45) is the basis for economic analysis. The arithmetic averages of 18 sample assays from 200 ft of strike length along the main mineralized fault zone are: 2.43 oz Ag/st, 2.80% Cu, 2.94% Pb, and 1.4% Zn. Assuming a 9-ft width for the ore, 400 ft of strike length, and 800 ft maximum depth, the total tonnage would be 240,000 st. No resources present, based on USBM PREVAL analysis.

Samples SC99 fig. 9

High Jinks Mine

Topographic quadrangle and location. Campo Bonito 7.5-minute quadrangle; NW¼NW¼ sec. 1, T. 10 S., R. 16 E.

Property holdings. Unpatented lode mining claims.

Production. A few hundred ounces of gold in the 1890's.

Development. Shaft is reclaimed.

Geology and mineralization. East-west quartz veins in a broad north-trending diorite.

Reference. Ewing (1945, p. 12-13).

Resource estimate and basis. No resources present, based on the above information and the following USBM sample result: sample SC99, from near the presumed location of the shaft, is from a 2.5-ft-thick quartz vein and contains 0.04 oz Au/st.

Samples SC261-262, 265-266 pl. 1
Other samples from previous USBM study

Italian Trap allochthon, Rincon Wilderness Study Area

Topographic quadrangle and location. T. 13 S., R. 17 E., sec. 22, 23, 26, 27.

Property holdings. No data.

Production. No data.

Mining history and development. No data.

Geology and mineralization. The Italian Trap allochthon is a 1-mi-diameter area of Pennsylvanian-age Naco Limestone that overlies the Precambrian-age Oracle granite and quartz monzonite of Tertiary or Cretaceous age. A number of faults cross the area and these strike N. 40° W. to N. 50° W. and dip an average of 50° NE. (Creasey and Theodore, 1975).

Two adits at the west margin of the allochthon follow an eastward-dipping shear zone that is 10 ft thick. The lower half of the shear zone is siliceous and has the highest metal concentrations (0.28 oz Ag/st, 2.28% Cu, and 0.11% Zn; sample SC265). The upper half of the shear zone consists of sheared and altered limestone, clay, and quartz veins/lenses as much as 1 ft thick. Other samples from these adits contain as much as 0.17 oz Ag/st, 0.23 to 0.96% Cu, and 0.14 to 0.28% Zn (samples SC261, SC262, and SC266). Samples collected from the same adits by Thorman and others (1981, p. 56-59, samples 87-90) contain up to 0.4 oz Ag/st, 1.3 to 2.9% Cu, and 0.05 to 0.3% Zn.

Two samples collected by Thorman and others (1981, p. 56 and 60) from prospect pits 600 ft south-southwest of the Italian Trap allochthon and on the possible continuation of the shear zone from the adits discussed have the following metal concentrations: 0.19% Cu and 9.9% Zn for 51-in. chip sample 97; and 0.2 oz Ag/st, 1.8% Cu, and 1.5% Zn for random sample 98.

References. Thorman and others (1981).

Resource estimate and basis. No resources estimated by USBM.

Samples SC237-240

fig. 6
A13 on plate 2

Korn Kob skarn deposit,
Korn Kob Mine

Topographic quadrangle and location. Buehman Canyon 7.5-minute quadrangle; secs. 13, 14, 15, 22, 23, and 24, T. 12 S., R. 17 E. (only secs. 15, 22, and 23 are in the Forest).

Property holdings. 300 unpatented lode mining claims.

Production and reserves. Total past production is 100 st of ore containing 12,000 lb of Cu and 150 oz Ag in the period 1913-1942 (Keith and others, 1983b).

Two main skarn bodies have been outlined by drilling. The combined minable reserves are reported to be 20 million st of 0.42% acid soluble copper at a 1.5:1 (waste-to-ore) development. Twelve to 14 million st of the minable reserves are reported to be in the Forest, and the larger of two planned open pits is in the Forest (Personal communications with Dirk Den-Baars, president of Keystone Minerals, Inc., 1993).

Mining history. Highlights of the mining history are as follows (Wilson, 1977, p. 4 and 5):

1. Probable recognition of mineralized skarns by prospectors in the late 1800's.

2. Completion of the 130-ft Korn Kob shaft (outside the Forest) and 3,900 ft of underground workings by approximately 1910.

3. An attempt to acid leach copper in the early 1960's.

4. Drilling by El Paso Natural Gas in 1970.

5. Completion of feasibility studies by Newmont Exploration before 1986.

Development and exploration. Developments, in addition to the Korn Kob shaft and underground workings described above, include numerous pits, shafts, and tunnels (Keith, 1974, p. 41, 42 and 141).

Significant workings on the Forest part of the property were mapped and sampled by USBM. One hundred and fifteen drill holes, aggregating 35,000 ft, have been completed (personal communications with Dirk Den-Baars, 1993).

Geology and mineralization. The following summary is from Wilson (1977, p. x):

> Rocks exposed within the area include the Catalina granite(?), the Dripping Springs(?) Quartzite, the Abrigo Formation, the Martin Formation, the Horquilla(?) Limestone, the Leatherwood(?) quartz diorite, and pegmatite, andesite porphyry, and lamprophyre dikes. The major structural features present within the area include gravity-glide faults, drag folds, tension fractures, and normal faults.

The Korn Kob Mine area has been extensively affected by regional and contact metamorphism and pyrometasomatic and non-pyrometasomatic hydrothermal alteration-mineralization. Regional metamorphism primarily affected the intrusive rocks and resulted in deformation and the development of widespread foliation. Contact metamorphism affected the Abrigo and Martin Formations and resulted in the formation of calc-silicate hornfelses and tremolite-bearing marbles. Pyrometasomatism primarily affected the Martin Formation and resulted in the formation of a massive garnet skarn. Non-pyrometasomatic alteration-mineralization resulted in widespread silicate mineral veining and weak sericitization.

Base metal mineralization consists primarily of copper and iron and is associated with veinlets, skarn silicate minerals, pegmatite dikes, and "bull" quartz veins. Mineralization generally postdates alteration. Both alteration and mineralization appear to be spatially and genetically related to Paleozoic sediment-Catalina(?) granite stock contacts.

References. As noted above.

Resource estimate and basis. USBM PREVAL analysis of the mine indicates a 3,500 st/d optimum mining rate and a 16-year mine-life. Summary of PREVAL model in table 2.

Samples SC35-38 fig. 16, 19

Lead Reef Extension Mine

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; center sec. 22, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. Samples of limonite-stained fault gouge and breccia, typically 4 ft thick, contain as much as 0.038 oz Au/st, 1.1% Cu, and 6.0% Pb. The samples were taken from 55 ft of strike length of a N. 55° E.-striking fault.

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. No resources estimated by USBM, largely due to the small size of the occurrence.

Samples SC31-32 fig. 16, 20

Lead Reef Mine

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; center sec. 22, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. An irregular body of brecciated quartzite (100-ft by 20-ft, unknown depth) contains average 1 oz Ag/st, 0.5% Cu, 6% to 7% Pb, 0.5% Zn. If faulted off, as predicted at 25-ft depth, only 3,000 st of metallized rock are present (Durning and Dreier, 1976, p. 3).

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. Assessment by Durning and Dreier (1976, p. 6) is that the site does not warrant further economic interest due to small size of deposit and the grade. Absence of mapping of the structures by USBM prevents any refinement in the conclusion by Durning and Dreier.

Samples SC144-154

fig. 9, 13, 14
A16 on pl. 2

Maudina Mine (includes Pure Gold workings and Cody tunnel)
Morning Star Mine

Note: For purposes of the present report, the name "Maudina Mine" refers to the northern workings (Pure Gold claim) of Creasey (1967).

Topographic quadrangle and location. Campo Bonito 7.5-minute quadrangle; SW¼ sec. 17 and NW¼ sec. 20, T. 10 S., R. 16 E.

Property holdings. Morning Star patent group.

Production. Total past production is 17,700 stu of tungsten trioxide in the period 1908-1944. This includes an unknown amount of production from the Old Maudina Mine, described separately in this appendix.

Mining history. Highlights of the mining history, from Ludden (1950, p. 45-47), include:

1. Mining and milling of an undisclosed amount of gold(?) ore between 1910 and 1912.

2. Production of 100 st of concentrates grading 61-67% tungsten trioxide in 1915 and 1916.

3. Production of as much as 82 st of 60% tungsten trioxide by Molson & Co. and Morning Star Mine Co. between 1943 and 1944.

Development. The Pure Gold workings consist of a 175-ft adit, an opencut (30 ft by 160 ft), a 35-ft-deep inclined shaft, an 88-ft-long adit, and two shallow shafts. No description of workings at the Morning Star Mine is available.

Geology and mineralization. The principal geologic feature of the area is the Mogul fault. In this area the fault dips 30° to 60° S. It comprises many planes of movement and consists of a zone of breccia and mylonite as much as 50 ft thick. All the mineralized zones are confined to a fault block of Escabrosa Formation limestone adjacent to the Mogul fault. The fault block is bounded on the west and northwest by the Abrigo Formation, on the south by quartzites of the Pioneer Formation, on the east by the Dripping Springs Quartzite, and on the north by Precambrian quartz monzonite (Oracle granite).

The scheelite is restricted to well-defined shoots in silicified Escabrosa Formation limestone. The silicification is an alteration and is restricted to zones in the limestone that seem to be controlled by faults or fractures related to the Mogul fault. The Escabrosa Formation limestone adjacent to the silicified zones has recrystallized to marble.

The ore body in the Pure Gold workings is localized in the silicified upper part of the breccia in the Mogul fault. The surface width of the zone ranges from 5 ft to 40 ft, and the exposed length in 1943 was about 200 ft. The mineralized zone appears to dip parallel to the fault, about 40° to 50° southward.

In 1944, the ore at the Morning Star Mine came from a glory hole and some small stopes west of the glory hole. The scheelite was in an irregular body of silicified limestone, elongated in a northwest-southeast direction. The scheelite was concentrated in large crystals along two faults at right angles to each other that cut through the silicified limestone. The northwest-trending fault, which has some postmineral movement, offset the southwest-trending fault about 10 ft. The ore along the faults, across the widths of 6 in. to 2 ft, appeared under ultraviolet light to contain several percent tungsten trioxide. Scheelite was sparsely disseminated throughout the rest of the silicified zone.

References. Except as noted above, information is from Creasey (1967, p. 85-87). Further information, not reported above, can be found in Ewing (1945).

Resource estimate and basis. Geologic considerations indicate that the Maudina Mine has potential for mineralization along 200 ft of strike, to a depth of 400 ft, and over an average width of 15 ft, or 97,000 st; and that the Morning Star Mine has potential for mineralization along 120 ft of strike, to a depth of 240 ft, and over an average width of 4 ft, or 9,300 st.

Sample SC129 fig. 9

Old Hat patent

Topographic quadrangle and location. Campo Bonito 7.5-minute quadrangle, E 1/2 sec. 16, T. 10 S., R. 16 E.

Property holdings. Unknown.

Production. No data.

Development. Shaft.

Geology and mineralization. Select sample of quartz containing pyrite and other sulfides from the dump at the main shaft contains 0.70 oz Au/st, 0.77 oz Ag/st, 0.71% Pb, 0.066% Cu, and 0.33% Zn. A 2-ft quartz vein is exposed below the shaft collar but is inaccessible. A nearby adit trending toward the vein at a lower elevation is also inaccessible.

References. No data.

Resource estimate and basis. No resources estimated.

Samples SC160-162 fig. 9, 11, 12
A17 on pl. 2

Old Maudina Mine

Topographic quadrangle and location. Campo Bonito 7.5-minute quadrangle; NE¼ sec. 20, T. 10 S., R. 16 E.

Property holdings. Unknown.

Production. Included with that of the Maudina Mine, discussed above.

Development. 175-ft vertical shaft with levels at 50, 100, 150, and 175 ft below the collar; total 1,000 ft of crosscuts and drifts. At one time an 18-in. gauge track ran 6,000 ft from the mine down to the mill at Campo Bonito (Bromfield, 1950, p.55-60).

Geology and mineralization. The geologic setting of the Old Maudina Mine is essentially the same as that of the Maudina Mine, discussed previously (USBM field data).

The ore shoot in the Old Maudina Mine is along a steep-dipping fault (striking N. 80° W.) that is nearly parallel to the Mogul fault. The ore shoot plunges 45° E., ranges in width from 4 to 15 ft, and is 50 ft or more in dip length. The ore consists of veinlets and replacement masses of scheelite, commonly free of gangue but locally in a quartz gangue. The best ore was reported to be below the 100-ft level in impure limestone beneath sandstone and quartzite. Lead carbonate and wulfenite are reported from the upper 50 ft of the ore shoot (Creasey, 1967, p. 86).

Wilson (1941, p. 33) describes a small separate ore shoot, 20 by 12 by 4 ft, on the 150-ft level of the main ore shoot and suggests further exploration along the fault.

References. References are noted above. Additional discussion can be found in Ludden (1950, p. 45-47).

Resource estimate and basis. Published and unpublished reports indicate that the mineralized zone has a strike length of 125 ft, an average width of 10 ft, and possible depth of 250 ft, equivalent to 25,000 st. The highest grade of mineralization was not sampled by USBM but a breccia zone on trend with the mined zone was sampled (SC160-162).

No samples

pl. 1, fig. 2
A11 on pl. 2

Oracle Ridge Mine

Topographic quadrangle and location. Mt. Bigelow and Mt. Lemmon 7.5-minute quadrangles; secs. 16-20, T. 11 S., R. 16 E.

Property holdings. Patented and unpatented property holdings of Oracle Ridge Partners.

Production and reserves. The total past production is 849,500 st containing 38.8 million lb Cu, 81,000 lb Pb, 37,000 lb Zn, 580,500 oz Ag, and 4,550 oz Au (includes a small amount of production from other mines at Marble Peak) through October, 1993. Current (1993) annual production is 285,000 st containing 13 million lb Cu, 191,000 oz Ag, and 1,700 oz Au. Current (1993) milling rate is 850 st/d. Proven and probable ore reserves are 4 million st with a cutoff grade of 1.5% Cu, and average grades of 2.33% Cu and 0.67 oz Ag/st. The gold content, back-calculated from production figures, is 0.011 oz/st (Carter, 1991; Dillard, 1992; and 1988 Annual Report of South Atlantic Ventures, Ltd., Vancouver, B.C.).

Mining history. These are highlights of the mining history (Braun, 1969; Carter, 1991; and Dillard, 1992):

1. Beginning of significant mining activity around 1881, when a 20-st/d smelter was constructed to process ore from several small mines.

2. Six thousand feet of mine development by Phelps Dodge between 1910 and 1913.

3. Development of the Daily Mine by the Daily Arizona Consolidated Copper Co. between 1910 and 1930.

4. Production of 112,500 st of 3.1% Cu ore from the Geesaman and Daily mines[2] by the Catalina Consolidated Copper Co. between 1937 and 1944.

5. Sporadic activity between 1944 and 1968.

6. Completion of more than 100,000 ft of diamond drilling and 2,600 ft of drifting by Continental Copper Inc. between 1968 and 1974, delineating 11 million tons of ore grading 2.25% Cu.

7. Development of the Union Mines-Continental Copper partnership in 1977.

8. Completion of office building, warehouse, and maintenance shop by 1979.

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[2] Apparently mine names derived from the names of original claims staked on the property; workings now encompassed in the Oracle Ridge Mine.

9. Stockpiling of 85,000 st of development ore and completion of another 125,607 ft of surface drilling, 28,000 ft of drifting, and 46,916 ft of underground drilling between 1980 and 1983.

10. Acquisition of outstanding shares of Union Mines by South Atlantic Ventures Ltd. of Vancouver, B.C., in 1988.

11. Start of construction of an 850-st/d concentrator in 1990.

12. Production of the first salable batch of concentrates from the new mining operation in 1991.

Mining and milling operation. These are highlights of the current mining and milling operation (Carter, 1991; and Dillard, 1992):

1. Ore body divided into 12 blocks based on surface and underground drilling results.

2. Random room-and-pillar methods used to develop 5900-ft and 6400-ft levels.

3. Diesel-powered rubber-tired equipment used for production drilling, mucking, and haulage.

4. Overall 4,000-kw diesel power plant.

5. Ball mill, 10½ by 12½ft, equipped with 800 hp drive.

6. Bulk sulfide flotation process that recovers copper and associated gold and silver in a single concentrate.

7. Two 5-ft-diameter by 35-ft-high flotation columns augmented by four 100-ft^3 mechanical flotation cells.

8. At full production, two 25-st truckloads of concentrate will be taken daily to a smelter at Hayden, Arizona.

9. The mine has a predicted life of 20 to 30 years with concentrate averaging 42% Cu.

10. The mill is currently processing 750 st/d and is being upgraded by 20% from present capability of 850 st/d.

Geology and mineralization. The following summary is from Braun (1969, p. x and xi).

> Marble Peak consists of a thick sequence of Paleozoic marbles which were intruded during Laramide(?) time by the Leatherwood quartz diorite. Lamprophyre dikes cut both the metasediments and the quartz diorite. Low-grade regional metamorphism has affected the rocks in the area.

Metal deposits which are present in the Marble Peak area near the quartz diorite contact were subdivided into three types.

1. Chalcopyrite-pyrite-scheelite mineralization associated with skarn and structural deformation at the contact between the Leatherwood quartz diorite and marble. The Daily and Geesaman mines typify this deposit type.

2. Bornite-chalcopyrite mineralization in skarn associated with lamprophyric dikes. This type of mineralization occurs at the Leatherwood mines.

3. Sulfide mineralization associated with faults in the Abrigo Formation. The Hartman-Homestake and Stratton mines are of this type.

"Igneous" [contact?] metamorphism altered carbonate sediments to skarn in the vicinity of the Leatherwood quartz diorite. Silica, alumina, iron, copper, lead, zinc, tungsten, and molybdenum were introduced into the altered sediments. Deposition of sulfide and gangue minerals appears to have occurred after the formation of skarn without an intervening hiatus.

References. As noted above. Additional geologic information is in Peterson and Creasey (1943).

Resource estimate and basis. USBM economic modeling of the deposit, using deposit data from Carter (1991) and Dillard (1992), suggests a net present value (NPV) of $5.1 million, mining cost in the amount of about $14/st of ore and milling costs of about $5/st (table 2). A 13-year optimum mine life was a result of the USBM modeling, whereas Dillard (1992, p. 8A) estimated a 20- to 30-year mine life.

No samples pl. 1

Pontatoc Mine

Topographic quadrangle and location. Tucson North 7.5-minute quadrangle; NE¼ sec. 3, T. 13 S., R. 14 E. Located 2,000 ft south of the Forest Unit in the Tucson metropolitan area.

Property holdings. Unknown.

Production and reserves. 5,000 st of hand-sorted ore produced from 1907 to 1918. Ore averaged 4% Cu, 0.5 oz Ag/st, and a trace of gold (Keith, 1974, p. 113).

Maximum grade 10.5% copper. In 1926, reported to have potential reserves of 75,000 st of copper ore (Medhi, 1964).

Development and exploration. Mine started in 1906. Shafts sunk to 105 ft and 125 ft. 1,000 ft of underground workings, including drifts, winzes, and several stopes. 19 diamond drill-holes and 3 churn-drill holes put in 1918 with depths up to 446 ft (Medhi, 1964).

Geology and mineralization. The mine is on the west-striking Catalina fault, which forms the southern boundary of the Santa Catalina-Rincon metamorphic core complex and the contact between gneissic rocks to the north and Cenozoic sedimentary rocks to the south. The mineralization is associated with the Catalina fault, there is no intrusion in the area, and neither the Catalina gneiss nor the Cenozoic sedimentary rocks are a significant host for mineralization. The wall rock alteration (silicification and propylitization) is restricted to what is called a "small zone." Northeast-striking cross faults do not carry important mineralization (Medhi, 1964).

Primary sulfides are pyrite, chalcopyrite, bornite, and traces of molybdenite(?). Secondary copper minerals include chalcocite and covellite. Gangue minerals are quartz, sericite, epidote, ankerite, hematite, and limonite (Medhi, 1964).

References. As noted above.

Resource estimate and basis. No resources present, based on the above information. No extension of the mineralization into the Forest Unit.

No samples from USBM Forest-wide study pl. 1

Posta Quemada Canyon area, Rincon Wilderness Study Area

Topographic quadrangle and location. E½ sec. 34, T. 15 S., R. 17 E.

Property holdings. No data.

Production. No data.

Mining history and development. No data.

Geology and mineralization. Grab sample 12 from a previous USBM study (Thorman and others, 1981) contains 2.4 oz Ag/st and 2.6% Cu. The sample was taken from the dump at a caved prospect pit in quartz monzonite. The geology is described as a silicified shear zone containing epidote, pyrite, and garnet.

References. Thorman and others (1981).

Resource estimate and basis. No resources estimated by USBM.

Samples SC51-52 fig. 16

Pretty Fair Mine

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; NW 1/4 sec. 26, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. Mineralization along a 1-ft to 2-ft-wide fissure vein (N. 45° E.). Galena, sphalerite, copper oxides in economic concentrations only in small pockets (Durning and Dreier, 1976, p. 4).

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. Assessment by Durning and Dreier (1976, p. 6) is that the site does not warrant further economic interest due to small size of deposit. USBM did not map the structure, preventing any refinement of the Durning and Dreier conclusion.

Samples SC130-133 fig. 9

Santa Rosa patent

Topographic quadrangle and location. Campo Bonito 7.5-minute quadrangle; W½ sec. 15, T. 10 S., R. 16 E.

Property holdings. Santa Rosa patent.

Production. None reported.

Development. Shaft, 4 ft by 5 ft and 20 ft deep.

Geology and mineralization. Northwest-striking quartz veins intrude the Oracle Granite. A 24 in. sample taken from near the bottom of the shaft contains 0.07 oz Au/st, 0.31% Pb, and a small amount of silver.

Reference. ADMMR unpublished Field Engineers Report, dated October 22, 1948

Resource estimate and basis. No resources present, based on the above information and the USBM sample results.

Samples SC47-50 fig. 16, 21

Slims Mine

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; NE 1/4 sec. 22, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. A "few in.-wide" to 2-ft-wide pair of veins, distorted by post-metallization faulting is reported at the mine; strike length of each is less than 100 ft. Metal content is reported as average 0.5 oz Ag/st and a maximum of 2% Pb (Durning and Dreier, 1976, p. 3). USBM data differ strikingly: Slim's Mine is believed to penetrate a 70-ft-wide, N. 75° E.-striking fault zone exposed at surface localities SC49 and SC50. A 3.5-ft vertical chip sample of fault gouge taken from inside the mine contains 0.06 oz Au/st, 59.7 oz Ag/st, and 5.5% Pb (sample SC48), but the location of this sample relative to bounding faults of the 70-ft-wide fault zone is unknown. Two samples of limonite-stained gouge taken from next to the southeast-bounding fault of the 70-ft-wide fault zone on the surface, and representing no more than 2 ft of thickness normal to the southeast-bounding fault, contain 0.024 oz Au/st and 0.004 oz Au/st, 13.7 oz Ag/st and 5.9 oz Ag/st, 1.0% and 0.82% Pb, respectively (samples SC49 and SC50).

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. Assessment by Durning and Dreier (1976, p. 6) is that the site does not warrant further economic interest due to small size of deposit and the grade. The high silver content in the USBM samples must be tempered with the report that supergene enrichment and oxidation in the area has dramatically increased the silver content in these rocks where they are above the sulfide horizon (Durning and Dreier, 1976, p. 2). Absence of mapping of the structures by USBM prevents resolution of the differences with the geologic report and the mineral resource assessment by Durning and Dreier.

No samples in this Forest-wide study pl. 1

Soldier Canyon area, Pusch Ridge Wilderness

Topographic quadrangle and location. NW¼ sec. 33, T. 12 S., R. 16 E.

Property holdings. No data.

Production. No data.

Mining history and development. No data.

Geology and mineralization. Two samples collected in previous USBM study (Ryan, 1982a) taken of quartz veins in granite-gneiss from two adits above the Mt. Lemmon Highway. Sample 1 (4-ft chip across the back of a 16-ft adit, with the vein pinching to 5 in. at the face) contains 0.22 oz Au/st, 1.8 oz Ag/st, and 5.80% Cu. Sample 4 (6-ft chip) contains 0.13 oz Au/st, 0.4 oz Ag/st, and 0.05% Cu.

References. Ryan (1982a).

Resource estimate and basis. No resources estimated by USBM.

Samples SC53-60 fig. 16, 22

Soldine Mine East (SC58-60)
Soldine Mine West (SC53-57)

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; SW 1/4 sec. 23 and NW 1/4 sec. 26, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. **Both mines:** thin, gently north-dipping veins contain as much as 1.5 oz Ag/st, 3.4% Pb, 3% Zn, and some copper (Durning and Dreier, 1976, p. 3).

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. Assessment by Durning and Dreier (1976, p. 6) is that the site does not warrant further economic interest due to small size of deposit and the grade. Mining widths would dilute the grades listed above to about 0.5 oz Ag/st, 0.5% Pb, 0.2% Zn. USBM data: a 6-ft sample taken in the broad N. 75° E.-striking shear zone contains 0.024 oz Au/st, 5.43 oz Ag/st, and 2.49% Pb. The sample includes limonite-stained gouge, altered quartzite breccia, and resilicified quartzite breccia. USBM did not map the structure, preventing any refinement of the Durning and Dreier conclusion.

Samples SC241, SC244-248, SC252, SC253, SC256, and SC257 fig. 6-8
A14 on plate 2

Southeast extension, Korn Kob deposit

Topographic quadrangle and location. Buehman Canyon 7.5-minute quadrangle; NE¼NE¼ sec. 23, T. 12 S., R. 17 E.

Property holdings. Unpatented lode mining claim holdings of Keystone Minerals, Inc.

Production. Unknown.

Development. Adits as much as 63 ft long; pits and cuts.

Geology and mineralization. Copper-bearing skarn extends 2,000 ft southeastward from the planned south open pit of Keystone Minerals, Inc. Skarn is an average of 20 ft thick and dips 30° to the northeast.

References. USBM field data. Geology mapped by Wilson (1977, fig. 2).

Resource estimate and basis. The weighted average of 10 chip samples (identified above) taken from the skarn unit, is 2.3% Cu, over an average sample length of 4 ft. The samples are from mines and prospects driven on shear zones, faults, alteration zones, and quartz veins, typically with some degree of copper mineralization. The highest copper content is 7.18% (sample SC248).

Inferred resources of 1.9 million st grading 2.3% Cu, assuming 20-ft skarn thickness, 2,000 ft strike length, down-dip extent of 600 ft, underground mining, and SX/EW processing.

No samples

fig. 9, 10
A15 on pl. 2

Southern Belle Mine

Topographic quadrangle and location. Campo Bonito 7.5-minute quadrangle; secs. 19 and 20, T. 10 S., R. 16 E.

Property holdings. Southern Belle patent group.

Production and reserves. Produced about 18,000 st of ore at an average grade of 0.5 oz Au/st, from 1885 to 1888. Mill was in the canyon below (Ewing, 1945, p. 2; ADMMR report, untitled and undated).

Reported 618,000 st of ore remaining but grade is unknown; auriferous silica was mined from the Southern Belle Group for copper smelter flux, but no tonnage figures are available. (ADMMR report)

Mining history. Highlights of the mining history are as follows (Ludden, 1950, p. 45-51):

1. Discovery of placer gold in Southern Belle Canyon in the late 1870's and early 1880's.

2. Opening of the Southern Belle Mine by a New York firm in 1885 and two to three years of subsequent gold production.

3. Acquisition of the Southern Belle Mine in 1910 by William "Buffalo Bill" Cody and company.

4. Leasing and development of the Southern Belle Mine by Molson and Co. between 1930 and 1932.

Development and exploration. Many prospect pits and short adits, several long inaccessible adits, and several shafts (Creasey, 1967, p. 82 and 83).

Strike length of the main stope is reported to be 500 ft and dip length, 160 ft (ADMMR report).

Staking and leasing of claims in the area by Newmont Exploration in 1990 (Southwestern Pay Dirt, December, 1990, p. 2A).

Geology and mineralization. The host for gold mineralization is variously reported as: flat vein or "blanket," dipping 20° to 30° to the northeast (ADMMR report); flat to steeply dipping quartz veins up to 2 ft thick (Creasey, 1967, p. 82); about 4 ft of quartz below and 2 ft above a parting layer of red shale (ADMMR report); and brecciated and intensely sheared Dripping Springs Quartzite (Creasey, 1967, p. 82).

The gold is generally fine and free, any pyrites which formerly existed having been fully oxidized. The quartz is reported to be richer in gold where there is no galena (ADMMR report).

References. As noted.

Resource estimate and basis (includes that part of the quartz vein on the Apache Girl prospect).

Data and assessment are based on literature, since permission to examine the mine was not granted to USBM. The mine is one of the few in the Santa Catalina Mountains which has produced any significant quantity of auriferous ore. From 1881 to 1906, 18,666 st of auriferous quartz vein were mined. The vein is hosted in Precambrian-age Dripping Springs Quartzite and is reportedly near-flat lying, 6-ft-thick, and continuous for 500-ft along strike where it was stoped (Heylmun, 1989, p. 13). Reported grades of the past production vary considerably, from 0.5 oz Au/st to 0.71 oz Au/st (Heylmun, 1989, p. 13; ADMMR report). A weighted average grade from the mined area (fig. 10), based on 1934-era assays reported in Brinkerhoff (1934), is 0.28 oz Au/st in an average 2.6-ft wide vein. Mapping of the vein and its shear zone host by Creasey (1967, p. 83) shows a strike length of 2,500-ft (which intrudes upon the Apache Girl prospect, fig. 9). The stoped area was worked for 160-ft down dip (fig. 10). Using these dimensions (2,500-ft by 160-ft and 2.6-ft-wide), there are an estimated 85,200 st of indicated resources of auriferous vein material along the full strike length.

Economics.--USBM PREVAL mine and economic modeling estimates suggest that this low tonnage (85,200 st) could be mined economically (table 2) if the reports of free gold are correct. If the gold particle size is too small or if there is too much oxide-form gold so that heap leaching must be employed, then the property is not economic (table 2). Estimates are based on the mid-1994 gold price of $387/oz. The value of silver, which averages less than 0.5 oz/st can help to improve the economics; it was not utilized in this modeling because of its low grade and the inherent problems of counting on recoverability of multiple commodities in a deposit for which there are no first-hand tests of the recoverability. Silver recovery should be investigated if or when future development work takes place on the property.

Earlier field work on the site (ADMMR report) utilized a more favorable average vein width (5-ft). Over the full strike length to the Apache Girl property, this earlier work estimates 618,800 st of auriferous vein material, but no grade is reported. That tonnage can be considered as inferred resources for this exercise. USBM PREVAL estimates suggest that a deposit of this size and grade (0.28 oz Au/st was used) could be mined at about the economic break-even point (table 2) if the gold could be recovered via free milling gravity methods. If gold mineralogy requires that heap leaching be employed, the site would be a money loser at $387/oz gold (table 2).

The most liberal estimate known for resources on the structure is 3 million st of auriferous, "low-grade" rock (Heylmun, 1989, p. 13). The higher tonnage is likely equivalent to inferred resources. Dimensions and grades are not addressed. At a modeled vein width of 2.6 ft and grade of 0.28 oz Au/st, a deposit of 3,000,000 st would be economical to mine over an 8-year mine life, with a NPV of over $24 million if free milling gravity recovery methods can be used and nearly $19 million if more expensive heap-leaching methods have to be employed.

This favorable economic estimate must be tempered with the following facts. Several assumptions were made due to the absence of USBM filed observations and sampling. The grade may not be consistently 0.28 oz Au/st, a major factor in the estimated profitability of this property. Samples from the structure by Brinkerhoff from the Apache Girl prospect contain 0.06 oz Au/st. A prospect south of the Southern Belle Mine, apparently on the up-dip part of the same auriferous vein (location not known by USBM and not reported in Brinkerhoff, 1934) contains 0.02 oz Au/st (though a high grade from the dump of the same working contains 0.24 oz Au/st). Brinkerhoff's (1934) mapping of the Southern Belle and Apache Girl properties (see fig. 10) clearly shows the sharp decrease of gold concentrations down dip beyond the extent of the areas that were mined. In fact, Brinkerhoff (1934) stated that the main stope area of the Southern Belle was mined out.

Future exploration.--It is notable that in 1990, Newmont Exploration Company acquired options on 15 of the mineral patents in the area of the Southern Belle Mine and also staked 38 new mining claims on the National Forest, which were locate as far east as the eastern slope of Apache Peak. The interest was in investigating deep gold targets with diamond drilling (Southwestern Pay Dirt, 1990, p. 2A). No other data are known about this activity and the current status of the claims is not known. It is probable that some geochemical indicators suggested a deeper system that contributed the gold exploited from the Southern Belle and other nearly mines. These data, while they cannot be satisfactorily described or quantified, nevertheless suggest that future exploration for gold will occur in this area.

Samples SC41-45 fig. 16, 24

Stove Lid Mine

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; NE 1/4 sec. 22, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. A 6-in. to 5-ft-wide vein was mined for about 80-ft to 90-ft along strike and for about 80-ft to 90-ft down dip, even though it is continuous along strike for 550-ft. Average metal content is 0.5 oz Ag/st, 0.002 oz Au/st, 2.25% Pb, 1.4% Zn (Durning and Dreier, 1976, p. 3).

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. Assessment by Durning and Dreier (1976, p. 6) is that the site does not warrant further economic interest due to small size of deposit and the grade. Absence of mapping of the structures by USBM prevents any refinement in the conclusion by Durning and Dreier.

Samples SC10, 13, 15 fig. 16

Unnamed workings in Burney claim group

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; center sec. 22, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. Samples collected from three separate fault zones over a northwest-southeast distance of 550 ft contain a maximum of 2.8% Cu and 1.3% Pb. The faults strike N. 70° E., N. 75° E., and N. 85° W.

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. No resources estimated by USBM, primarily due to the small size of the occurrence.

Samples SC25-26 fig. 16

Unnamed workings in Burney claim group

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; center sec. 22, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. These two localities are 100 ft apart in a northwest-southeast direction, are both located on faults striking N. 63° E., and the faults at these locations may be continuous with faults at localities SC12 and SC13. Sample SC25 contains 0.009 oz Au/st, 1.2 oz Ag/st, 22.4% Cu, and 0.65% Pb; and is a 14-in. chip sample which includes a 1-ft thick clay-rich fault zone containing copper minerals. Sample SC26 contains 1.6 oz Ag/st and 4.8% Cu; and it is a 4-ft sample of soft copper-stained fault breccia and gouge containing pieces of vein quartz.

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. No resources estimated by USBM, primarily due to the small size of the occurrence.

Samples SC27-29 fig. 16

Unnamed workings in Burney claim group

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; center sec. 22, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. A 4-ft chip sample across quartzite breccia with silica cementing in a N. 50° W.- striking fault zone at this location contains 0.11 oz Au/st (SC27). Select samples of copper-stained quartzite, aphanitic vein quartz, gossan, and silica-cemented breccia from the dump contain up to 0.024 oz Au/st, 4.0% Cu, and 5.1% Zn (SC28 and SC29).

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. No resources estimated by USBM, primarily due to the small size of the occurrence.

Samples SC71-79 fig. 16

Unnamed workings in Burney claim group

Topographic quadrangle and location. Oracle SE 7.5-minute quadrangle; NW 1/4 sec. 23, T. 10 S., R. 15 E.

Property holdings. On one of 29 unpatented lode mining claims owned by Little Hill Mines, Inc. of Oracle, AZ; current status unknown.

Production. No data specific to this mine. 4,500 st of copper-lead-zinc-silver ore in the period 1931 to 1967 from all of Burney claims group.

Mining history and development. Wallace (1951) quotes publications and newspaper accounts relative to exploration of the overall claims between 1869 and 1927, but there is no real indication of when the development work was started.

Geology and mineralization. Only select workings, all of them relatively small, in this 500 ft by 800 ft area on the southwest-facing slopes of the Canada del Oro were described and sampled. The host formation is quartzite, but at localities SC75 and SC77 the workings are at the contact between the quartzite and the overlying thin-bedded sandstone/siltstone. Faults are generally dipping less than 55° and at localities SC75 and SC77, the faults are parallel to the bedding. Gossan, iron-silicate, and hematite are present at most of the localities, and the high iron content is reflected in the analyses (listed in appendixes C and D) of samples from these localities. Quartz ranges from thin coatings on fractures to veins that are as much as 5 in. thick.

Select samples from dumps and stockpiles contain as much as 0.077 oz Au/st, 17.4 oz Ag/st, 17.7% Cu, 11.6% Pb, and smaller amounts of zinc (samples SC71, SC73, SC74, SC76, and SC79). Minerals include secondary copper minerals, limonite, hematite, pyrite, galena, sphalerite(?) and chalcocite(?).

The four outcrop samples are from 2-ft to 5-ft-wide fault zones composed of sheared and brecciated quartzite, gouge, minor amounts of quartz, limonite, iron-silicate cementing, and secondary copper minerals. These samples contain as much as 0.038 oz Au/st, 4.3 oz Ag/st, 1.20% Cu, 10.7% Pb, and smaller amounts of zinc (samples SC72, SC75, SC77, and SC78).

References. All above information from Durning and Dreier (1976), unless otherwise noted. Budden (1975) is the primary source of information on geology of the area.

Resource estimate and basis. No resources estimated by USBM, primarily due to the small size of the occurrence.

Samples SC142-143 fig. 9

Unnamed workings, Maudina Mine vicinity

Topographic quadrangle and location. Campo Bonito 7.5 minute quadrangle, SW 1/4, sec. 17, T. 10 S., R. 16 E.

Property holdings. No data.

Production. No data.

Mining history and development. No data.

Geology and mineralization. Select sample SC143 of quartz containing big clots of galena, chalcocite, and pyrite from the large waste dump at creek level below the Cody tunnel contains 0.04 oz Au/st, 0.98 oz Ag/st, 0.18% Cu, 3.24% Pb, and 0.39% Zn. An inaccessible adit at this location is estimated to be 350 ft long, sufficient to reach the Mogul fault at an elevation of about 80 ft below that of the Cody tunnel. A fault zone containing 3-in. quartz veins and sampled at the portal of the inaccessible adit has only low metal concentrations (sample SC142).

References. No data.

Resource estimate and basis. No resources estimated by USBM.

No samples in Forest-wide study pl. 1
Samples 1-8 from Pusch Ridge Wilderness study (Ryan, 1982a)

Valerie May prospect

Topographic quadrangle and location. Aqua Caliente Hill 7.5 minute quadrangle, SE 1/4, sec. 33, T. 12 S., R. 16 E.

Property holdings. Claim held by Edwin Goodyear, Tucson, AZ.

Production. 8 st hand-picked auriferous quartz vein material, packed out by claimant (Helymun, 1989, p. 15).

Mining history and development. Working in place in 1979 (Ryan, 1982a, pl. 1). Working is 40-ft-deep inclined shaft.

Geology and mineralization. A quartz vein with visible free gold contains "good gold values"; host rock is gneiss (Heylmun, 1989, p. 15).

References. See above.

Resource estimate and basis. No resources estimated by USBM. No significant gold or silver reported in USBM samples collected in 1979 at the site (Ryan, 1982a). The production is reportedly utilized as mineral specimen material. The "environmentally sensitive" classification of the site (Heylmun, 1989, p. 15) possibly limited production.

APPENDIX B. SAMPLE DESCRIPTIONS

Santa Catalina-Rincon Mountains Unit

Background data

Sampling methods. All samples collected and assayed during this study were composed of rock chips. The rock samples were most often collected from mineralized structures observed in the National Forest. Wherever possible, these samples were taken as continuous or semi-continuous chips *perpendicular* to the strike of the mineralized structure, thus representing a cross section through the structure. Samples represent reconnaissance-level sampling (i.e. low density of sample sites). Each rock-chip sample was 3 lb to 10 lb in weight. Sample type definitions are as follows. Chip samples are a regular series of rock chips taken in a continuous (or semi-continuous) line across a mineralized zone or other exposure, and usually across the entire width or thickness of that exposure. Grid and grab samples are from mine/prospect dumps. The grid type are taken systematically over an area to convey possible mineral value distributed in a dump. The grab type are taken unsystematically, usually as a background check, where no specific mineral zone is known or expected. In some cases, grab samples may be collected from an outcrop, for similar reasons. Select samples are often from a mine/prospect dump and are select chips of a specific rock type; select samples can also be collected from an in-place mineral structure to convey assays for the specific zone. Samples noted as "high-grade" are select samples collected from the most intensely mineralized (usually metallized) rock available in dumps, outcrops, or other exposed mineral zones.

Sample preparation procedures (for assay). The rock samples were prepared for assay as follows. The entire sample was crushed to -20 mesh in size, with no sieving, via a jaw crusher and cone crusher, and then the entire crushed output was homogenized in a riffle splitter. A 200 gram to 300 gram split was segregated and pulverized in a shatterbox pulverizer to -125 mesh or smaller, with no sieving. The pulverized pulp was divided equally into two kraft paper envelopes, producing two 100-gram to 150-gram pulp splits. One pulp spilt was stored as an archive. The other was sent to laboratories for assay procedures.

Abbreviations: v = vertical, nv = near vertical, h = horizontal, d = diagonal, sp = spacing, a = area, rand = random, w/ = with, and NA = not applicable.

NO.	TYPE	LENGTH	DESCRIPTION
SC1	Select	NA	Outcrops white quartz veins, 0.5 in. to 2 ft thick, in gneiss.
SC2	Select	NA	Float white quartz from 4-in.-thick veins.
SC3	Select	NA	Float iron-stained quartz.

NO.	TYPE	LENGTH	DESCRIPTION
SC4	Chip	4 ft h	Adit, 6 ft long, following 4-ft-thick quartz vein striking N. 30° W., dipping 60° NE. Whitish sandstone w/ light Cu stain and minor quartz in hanging wall of vein. Sample includes 3 ft quartz and 1 ft sandstone as described above.
SC5	Select	NA	See SC4. Select pieces gray quartz and one piece sandstone w/ Cu staining from dump.
SC6	Chip	14 in. h	Pit, 8 ft across. Exposes quartz vein, 14 in. thick, striking N. 10° W., dipping 70° SW. Wall rock is possible quartz-chlorite skarn, and consists of: finely crystalline greenish gray to brown gray altered diorite?, quartz crystals up to ½ in. across, and chlorite. Sample taken across quartz vein, and consists of: white quartz, FeO, MnO, chlorite, epidote, and galena. Another 4-in. quartz vein to SW. of here.
SC7	Chip	4 ft h	Trench, 15 ft long. Exposes 12-in. quartz vein parallel to that of SC6. Wall rock is soft altered mafic dike, and includes: small vugs w/ quartz crystals, sphalerite?, FeO, MnO, epidote, and chlorite. Sample taken across SE. end of trench, consists of: white quartz w/ FeO, MnO, green CuO, and galena (12 in.); and wall rock, as described above (36 in.).
SC8	Chip	5 ft d	Trench, 8 ft long. Country rock is light yellowish gray Precambrian? sandstone and siltstone in beds 1 to 12 in. thick, striking N. 60° W., dipping 48° NE. Sample taken normal to bedding, where they may have prospected on a few in. of light gray alteration, or on the FeO stain. Sample consists of country rock, alteration, and FeO staining, as described above.
SC9	Chip	3.5 ft v	Pit, 45 ft by 20 ft by 35 ft max deep; inaccessible adit, at least 15 ft long, at end of pit. Workings are in thin- to medium- bedded sandstone and siltstone, cut by north-striking (steeply east-dipping) fractures along which have developed pockets of alteration and Cu mineralization (1 ft by 4 ft in size). Sample taken at SE. entrance to cut; where the host sandstone and shale beds are striking N. 68° W., dipping 44° NE.; and where there is a possible north-striking 3- to 12-in.-wide fracture zone (sampled). Sample consists of: ground up shale and sandy siltstone; gouge?; limonite and MnO stain; no Cu minerals.

NO.	TYPE	LENGTH	DESCRIPTION
SC10	Chip	3 ft h	Cut, 37 ft by 33 ft by 15 ft deep; 12-ft adit at end of cut. The country rock is shale and siltstone overlying quartzite. The adit exposes a normal fault (6-ft displacement) striking N. 70° E., dipping 50° to SE. Breccia and Cu mineralization are developed in the fault zone in the adit (SC10) and along the shale-quartzite contact beneath a 15-ft overhang in the east part of the pit (SC11). Sample SC10 was taken across the fault zone in the back of the adit, and consists of pieces of shale and quartzite with green and blue copper oxides.
SC11	Chip	3 ft d	Sample taken normal to bedding and across bedding-plane breccia described under SC10. Sample consists of: blue and green Cu oxides on pieces of quartzite and shale; and minor vein quartz.
SC12	Chip	1.5 ft h	Two pits, 11 ft and 8 ft across. Country rock is bedded white quartzite and siltstone. The pits expose an 18-in. quartz vein, striking N. 25° E., dipping about 75° SE. Sample taken across quartz vein; consists of white quartz, pieces of red quartzite (in vein), and some CuO.
SC13	Chip	2 ft d	Adit, 23 ft long, declining 15° from portal. Country rock is mostly siltstone. Fault and quartz vein in NW. rib strike N. 75° E., dip 47° NW. Fault zone is 2 ft thick and includes lenses (15 ft long) of: Cu-stained breccia and gouge (sampled); and quartz-vein material. Footwall of fault is quartzite. Hanging wall is greenish gray thin-bedded siltstone. Sample taken across fault zone in NW. rib of adit. Sample consists of: mostly brecciated greenish gray sediments and quartzite; also fault gouge, limonite stain, abundant green CuO.

NO.	TYPE	LENGTH	DESCRIPTION
SC14	Chip	6 ft h	Cut, 25 ft long and 12 ft deep; possible collapsed adit. Country rock (to NW.) is massive white to yellowish gray quartzite. Cut is generally in: a breccia of quartzite and quartz; with chunks of green shale and sandstone locally; and gouge. Breccia on the NW. wall of the cut includes FeO, MnO, and some veins of white quartz. The breccia appears to be controlled by a probable N. 50° E. (dipping 80° SE.) fault in the NW. wall of the cut; and a flat-lying fracture zone w/ ½- to 1-in. quartz veins, also in the NW. wall. The sample was taken across the N. 50° E. end of the cut and consists of: breccia of quartzite and shale; gouge; red-brown clay; and quartz from a couple of 1- to 4-in. quartz veins.
SC15	Chip	3.5 ft h	Adit, 28 ft long. In Fe- and Mn-stained quartzite. Fault in SW. rib striking N. 85° W., dipping 45° NE. Footwall and hanging wall of fault consist of Fe-stained, fractured, and recemented quartzite. Local Fe-Si-cemented quartzite breccia up to 1 ft thick. Sample taken across face of adit; consists of light gray/white gouge; disseminated Cu throughout; some FeO stain.
SC16	Chip	5 ft v	See SC15. Sample taken at NE. side of portal, in hanging wall of fault. Sample consists of mostly Fe- and Mn-stained quartzite breccia, also few inches white quartz vein at top.
SC17	Chip	32 in. h	Pit, 6 ft across. In light yellowish gray to black, fissile to medium bedded fractured siltstone; beds striking N. 45° W., dipping 30° NE. Sample taken on N. wall of pit. Sample consists of: siltstone, as described above; gossan; black Fe-Si-cemented siltstone; and minor quartz. 1- to 3-in. quartz veins in vicinity.
SC18	Chip	3.5 ft h	Adit, backfilled at 38 ft from the portal, beyond which the adit continues for at least another 25 ft, turning to NW. Adit is in thin- to medium-bedded yellowish gray to greenish gray siltstone; beds dipping in an approximate direction of N. 65° E. Steeply dipping fault in SE. rib, striking generally N. 65° E. Sample taken across Fe-stained fault zone in SE. rib, 38 ft from portal. Sample consists of: gouge; and varicolored broken and altered siltstone.

NO.	TYPE	LENGTH	DESCRIPTION
SC19	Grid	6 ft sp	Shaft, 20 ft deep. Grid sample taken of waste material; mostly siltstone; some quartz, Fe and hematite stain.
SC20	Chip	2 ft h	See SC19. Wall rock is fractured siltstone w/ FeO stain. Shaft exposes steeply dipping, west-striking (3 ft wide) fault zone characterized by reddish brown to white/gray gouge w/some blocks of siliceous material. Sample taken across fault zone, as described above; at collar on west wall of shaft.
SC21	Chip	2.5 ft h	Trench, 14 ft long. Wall rock is dark brown to black siltstone, locally silicified. Sample taken at N. 75° E. end of trench. Sample consists of quartz vein and minor limonite gouge. Adjoining material (to NW.) covered.
SC22	Grid	10 ft	Shaft opening is 17 ft by 10 ft; shaft depth is more than 30 ft; and the shaft has a 25-ft adit bearing E. N. wall of shaft is siltstone, striking N. 75° W., dipping about 50° NE. Shaft exposes steeply dipping possible fault zone, about 4 ft wide, striking about W. Material adjacent to fault is bleached and reddish siltstone. Grid sample taken across dump; predominantly siltstone w/ minor quartz; includes abundant epidote, FeO, limonite, hematite, MnO, trace pyrite, limonite after pyrite, chlorite, chalcocite, chalcopyrite, and possible galena.
SC23	Select	NA	See SC22. Select sample of probable vein material from dump, mostly siliceous w/ FeO.
SC24	Chip	5 in. h	Adit, 48 ft long. Portal of adit is 9 ft above floor of SC25 cut. Adit is in quartzite and siltstone; beds are striking about N. 70° E., dipping about 40° NW.; and there is little alteration or coloration of the wall rock. A prominent fracture and two steeply dipping quartz veins (1 and 5 in. thick) strike with the adit, but their dips are unreported. Sample taken across thickness of 5-in. quartz vein, half way back in adit, on SW. rib. Sample mostly white quartz; also minor limonite gouge and small pieces of quartzite.

NO.	TYPE	LENGTH	DESCRIPTION
SC25	Chip	14 in. h	Cut, 26 ft long and 13 ft deep. Middle of cut exposes fault striking N. 63° E., dipping 65° SE. Thickness of fault zone exposed is ½ to 1 ft, and there is silicification and alteration of the wall rock for 2 ft beyond the fault. Footwall of fault is fine-grained greenish gray medium-bedded sandstone/siltstone, locally bleached and locally silicified. Hanging wall is massive white quartzite, fractured w/ local CuO and FeO. Sample taken from center NE. wall of cut, across broad portion of fault zone w/ CuO stain. Sample consists of clay, green and blue CuO, and possible azurite.
SC26	Chip	4 ft h	Cut, 50 ft by 20 ft by 15 ft deep; adit at NE. end is backfilled 23 ft from portal. The workings are in white quartzite and shale; the beds striking about N. 60° W., dipping 50° NE. The NW. rib of the adit is a fault, striking N. 63° E., dipping 79° SE. Sample taken across back of adit, against and in the hanging wall of the fault, 23 ft from the portal. Sample consists of Cu-stained fault breccia and minor gouge; includes pieces of shale, quartzite, vein quartz w/ Cu, some clay, FeO; all soft and heavily sheared. Note quartz veins, 1 to 10 in. thick, continue in shale-quartzite contact away from fault zone at portal of adit.
SC27	Chip	4 ft v	Inaccessible adit, at least 30 ft long. In massive light gray to yellowish gray fractured quartzite and greenish gray shale/siltstone; beds striking N. 14° E., dipping 32° SE. Adit appears to be in footwall of fault striking N. 50° W., dipping steeply to NE. Sample taken in footwall of massive quartzite and across possible fault zone, at NE. portal of adit. From top down, the sample consists of: quartzite breccia w/ some altered quartzite, FeO, and Fe-Si cementing (16 in.); light-gray to reddish-gray altered shale w/ heavy FeO and gossan (16 in.); and greenish-gray unaltered shale/siltstone w/ FeO coating (16 in.). The bottom of the sample interval is covered.
SC28	Select	NA	See SC27. Select Cu-stained quartzite and Cu-stained aphanitic vein quartz; both dump material and blocks in front of adit.
SC29	Select	NA	See SC27. Select dark gossan and Fe-Si- cemented breccia; from dump and float around adit.

NO.	TYPE	LENGTH	DESCRIPTION
SC30	Chip	3.5 ft h	Adit, 16 ft long. In Fe-stained quartzite. Fault in SE. rib striking N. 65° E., dipping 74° SE. Sample taken at portal; across back and fault zone. Sample consists of: solid mass of recemented quartzite fragments; some Fe-Si cementing; minor clay gouge; minor gossan at fault contact; Fe and Mn staining.
SC31	Chip	9 ft v	See fig. 20. Orange/red/brown altered (punky) quartzite, FeO, limonite, hematite, MnO, sphalerite?
SC32	Chip	14 ft h	See fig. 20. Orange/gray quartzite, some with clay (crumbly), MnO; interior of reef.
SC33	Chip	1 ft d	Collapsed adit. Lack of mineralization in dump suggests this was exploration or haulage adit for mineralization at SC31-32. Loose Fe-stained quartzite rubble above adit to SW.; same rubble and outcrops of porphyry above adit to NW. and NE. Sample taken of outcrop above collapsed portal. Sample consists of: altered porphyry; and possible silicified porphyry.
SC34	Chip	7 ft h	See SC33. Sample taken above portal. Sample consists of: altered porphyry and possible gouge; all loose material.
SC35	Chip	4.5 ft v	See fig. 19. 2 ft fault gouge, limonite-stained w/ small pieces quartzite; 2 ft fault gouge and breccia, white chalky material, limonite stain; 6 in. Abrigo Formation.
SC36	Chip	5 ft v	See fig. 19. Loose fault gouge, limonite-stained; from overlying contact to quartzite contact in floor; small pieces of quartzite in upper part.
SC37	Chip	6 ft v	See fig. 19. Breccia and gouge w/ limonite staining, mostly altered Abrigo Formation/siltstone, light green-gray, in contact w/ altered breccia.
SC38	Chip	3 ft v	See fig. 19. Begins in FeO-stained brown quartzite; continues into Cu-stained quartzite breccia, which is adjacent to steeply dipping fault zone.

NO.	TYPE	LENGTH	DESCRIPTION
SC39	Chip	5 ft d	Adit, 27 ft long. In brownish gray to white, fissile to medium bedded, partially silicified limestone. Ninety-degree fold (axis striking N. 80° E., plunging 23° NE.) is developed in the back of the adit; beds dipping away from the fold axis at 40° in both ribs. Sample taken across back of adit and SE. rib near portal. Sample consists of: siliceous breccia w/ local FeO (2 ft); varicolored gouge (2 ft); and altered and locally silicified limestone (1 ft). Some green CuO and limonite on dump.
SC40	Chip	4 ft h	Cut, 11 ft long. In alluvium, except for NE. corner (sampled). Sample taken across N. 45° E. end of cut. Sample consists of: Fe-stained, fractured and broken silicified limestone?; possible outcrop.
SC41	Chip	2 ft h	Adit, 38 ft long; 8-ft-high stope at face. Fault on SE. rib of adit, striking N. 54° E., dipping about 70° SE. Footwall of fault, at face, consists of calcium silicates w/ occasional sulfide. Sample taken in hanging wall of fault at face. Sample consists of: greenish-gray clay gouge; and minor consolidated calcium silicates.
SC42	Chip	6.5 ft	See fig. 24. Across back; green/gray calcium silicate w/ 6 in. gouge; calcite; minor pyrite, galena.
SC43	Chip	5.5 ft	See fig. 24. Steeply cut across pillar; green/gray calcareous gouge?; minor pyrite, galena.
SC44	Chip	3.5 ft h	Adit, 17 ft long. In yellowish gray to brownish gray fractured limestone. Fault in SE. rib striking N. 62° E., dipping 64° SE. Sample taken across back of adit, 10 ft from portal. Sample consists of: fractured limestone and 6 in. varicolored gouge (against NW. rib); light limonite and Fe stain.
SC45	Chip	5.5 ft h	Adit, 22 ft long; has 17-ft-deep winze just inside portal. Workings in brownish gray limestone. Possible faults on both ribs of adit, striking N. 60° E., dipping 69° SE. Sample taken across face of adit. Sample consists of: hard, recrystallized limestone?; few inches total quartz (from veinlets ¼ to ½ in. thick); and trace pyrite.

NO.	TYPE	LENGTH	DESCRIPTION
SC46	Chip	1.5 ft h	Location is on continuation of fault (N. 65° E.) from Stove Lid Mine, there being only limited gossan float and thin quartz veins in the limestone country rock between here and the easternmost workings of the Stove Lid Mine (SC45). This location has an 8-ft pit; the pit is across the full width of the fault zone (N. 70° E., 74° SE.) at this location; and the country rock is limestone. Sample taken across S. wall of pit. Sample consists of fractured limestone.
SC47	Chip	8.5 ft h	See fig. 21. Across face; all sheared country rock (gouge); gray and white clays w/ green CuO, limonite stain; gouge is calcareous; fibrous minerals.
SC48	Chip	3.5 ft v	See fig. 21. Gray and yellowish gray gouge, gently dipping and surrounded by siltstone.
SC49	Chip	1.5 ft h	Location is at SE. end of 70-ft-wide fault zone. The SE.-adjoining formation of the fault zone is a buff-colored limestone. The SE.-bounding fault of the fault zone strikes N. 75° E. and dips 52° NW. The fault zone consists of contorted and discontinuous portions of limestone, siltstone, and gouge. The NW. adjoining material of the fault zone is competent fractured siltstone/limestone. Sample SC49 was taken at the SE. end of a 10-ft-deep shaft, against and in the hanging wall of SE.-bounding fault. Sample consists of limonite stained fault gouge.
SC50	Chip	2 ft h	Location is probably over the workings at Slim's Mine (SC47-48). Sample taken from SE. end of 10-ft pit, near SE.-bounding fault described under SC49, but across a second shear zone (striking N. 34° E., dipping 50° NW.). Wall rock of pit is broken limestone/siltstone. Sample consists of: limonite-stained fault gouge; white, gray, and black clays; and decalcified? yellowish gray to dark gray limestone.

NO.	TYPE	LENGTH	DESCRIPTION
SC51	Chip	4 ft v	Adit, 12 ft long; portal is 15 ft from main (inaccessible) adit of Pretty Fair Mine (see Durning and Dreier, 1976). Wall rock is Bolsa Quartzite (striking N. 75° W., dipping 37° NE.), except that Durning and Dreier note calc silicates at the portal to the Pretty Fair Mine. A 4-ft-thick gently dipping shear and alteration zone (striking N. 53° W., dipping 10-30° NE.) is exposed 3 ft inside the adit at this location and was sampled at the face. Sample consists of: highly fractured, bleached, and Fe-stained quartzite; thin to very thin layers of black siliceous replacement? w/ pyrite; and strong to weak pyrite zones.
SC52	Chip	5 ft h	Cut, 17 ft by 15 ft, with 12-ft-long adit at end. Adit and cut expose breccia, Fe-stained, and altered quartzite. Adit follows 3-ft steeply dipping fault and alteration zone. Sample taken across portal of adit, through fault and alteration zone noted above. Sample consists of: heavily limonite-stained (soft clay) gouge; and yellowish to dark brown highly altered quartzite?.
SC53	Chip	4 ft h	See fig. 23. Across back in footwall of fault zone; altered very light gray-red/brown gouge.
SC54	Chip	3.5 h	See fig. 23. Hanging wall of fault zone of SC53; mostly competent quartzite; a couple of 4-in. beds of soft black material; also some thin beds of calcite, pyrite.
SC55	Chip	3 ft h	See fig. 23. Across back of portal; orange/gray-white altered quartzite representing steeply dipping shear and alteration zone.
SC56	Chip	2 ft h	See fig. 23. Across back, 21 ft from portal; brecciated quartzite and gouge, limonite-stained.
SC57	Chip	6 ft h	See fig. 23. Gouge, breccia, limonite stain.
SC58	Chip	3 ft h	See fig. 22. Fractured quartzite w/ limonite on surface; also greenish altered rock w/ Fe, Cu on all fractures.
SC59	Chip	4 ft v	See fig. 22. Across pyritized greenish-gray altered rock; part of 8- to 10-ft zone, largely removed; minor clay.
SC60	Chip	6 ft v	See fig. 22. Lower 2 ft is brownish-gray broken layered quartzite; remainder is white clay gouge and FeO-stained quartzite.

NO.	TYPE	LENGTH	DESCRIPTION
SC61	Chip	3 ft h	Adit, 27 ft long. In NE.-dipping shale/sandstone of the Abrigo Formation; locally fractured, Fe-stained, and bleached. Adit follows fault. Sample taken at face of adit, across fault noted above. Sample consists of light-gray sheared and brecciated shale/sandstone. Note local zones of heavy alteration and bleaching in ribs and back of adit, and 1- to 3-in. quartz veins at portal.
SC62	Chip	5 ft h	See fig. 18. Across face; quartzite breccia w/ some CuO; heavy yellow/green Cu sulfates on surface.
SC63	Chip	3 ft nv	See fig. 18. Quartz w/ pyrite; gouge w/ pyrite.
SC64	Chip	6 ft d	See fig. 18. Across fault zone; quartzite; some pyrite (less than in SC63); abundant limonite.
SC65	Chip	6 ft h	See fig. 17. Intensely fractured fault zone; gouge and decomposed? Abrigo Formation; some pyrite, galena.
SC66	Chip	5 ft h	See fig. 17. Part of sulfide-galena-quartzite breccia zone w/ pieces of vein quartz and sulfides; pyrite, galena locally abundant.
SC67	Chip	2 ft h	Adit, 16 ft long. Multiple fractures in brecciated limestone. Sample taken across 2-ft shear zone (striking N. 66° W., dipping 64° NE.) in NE. rib, 13 ft from portal. Sample consists of sheared and fractured limestone. Note the following in the portal area: 1-in. quartz vein, gouge w/ limonite, and clay. Note also pyrite and chalcopyrite on dump.
SC68	Chip	1 ft h	Pit, 8 ft deep. Partially exposed wall rock consists of: limestone breccia; and 1 ft whitish siliceous breccia (sampled; attitude and full thickness unknown). Sample material has: trace pyrite, coarse galena, green and blue CuO, limonite, hematite, and Mn.

NO.	TYPE	LENGTH	DESCRIPTION
SC69	Chip	2.5 ft v	Irregular cut, 28 ft long by ave. 8 ft wide. In yellowish to orangish gray breccia of quartzite and probably Abrigo Formation w/ 3-ft zones bleached and heavy Fe-stained (reddish brown to purple) material cutting through. Sample taken at N. 45° W. end of cut, perpendicular to bedding and across fault zone striking generally N. 65° E. Sample consists of: brecciated and bleached country rock; and gouge. Note very irregular alteration and shearing in and adjacent to fault zone; Fe-staining over 300-ft-diam. area at this locality; and abundant reddish quartzite breccia.
SC70	Chip	3.5 ft h	Cut, 30 ft long; was adit. In reddish brown fractured quartzite; some w/ heavy black FeO coating; no quartz veins or CuO. Cut follows steeply dipping fault. Sample taken at N. end of cut, through fault zone noted above. Sample consists of: gouge; brecciated country rock; heavy limonite stain.
SC71	Select	NA	Cut, 19 ft long. Cut is in quartzite and Abrigo Formation?; exposes fault striking about N. 80° E., dipping 43° NW. Footwall of fault is yellowish gray sheeted shale of Abrigo Formation? Fault zone has 1 to 2 ft light gray gouge. Hanging wall of fault is tan quartzite w/ remnants of white quartz veins, local Fe-Mn stain. Sample taken from stockpile next to cut. Sample consists of: quartzite w/ Fe-Mn staining (mostly massive quartzite); minor spongy gossan; blue and green CuO; some light yellow secondary mineral; fine quartz coating on fractures.

NO.	TYPE	LENGTH	DESCRIPTION
SC72	Chip	2.5 ft d	Cut, 25 ft long; has 15-ft adit at end. Workings are in whitish quartzite, commonly fractured and Fe-stained; less commonly brecciated. The several workings and dumps in the area have: minor amounts of quartz-filled quartzite breccia; trace amounts of quartz veinlets; localized areas of black Fe-Si cementing or coating (possible hematite); and trace amounts of Cu minerals. Adit exposes fault striking N. 57° E., dipping 28° NW. Sample taken across fault described above, near face of adit on SE. rib. Fault zone characterized by irregular fracture/fault surfaces; and irregular breccia and mineralization. Sample consists of brecciated quartzite, gouge, and Cu staining. A second N. 57° E.-striking fault (dipping 42° NW.) is exposed in the cut and adit (aggregating 20 ft long) to the NE. This second fault zone (not sampled) consists of: Fe-stained broken quartzite, gouge, Fe-Si cementing, and a trace of CuO.
SC73	Select	NA	See SC72. Sample taken from stockpile. Sample consists of: altered (spongy) gossan w/ heavy black (hematite?) coating, limonite, pyrite, CuO, chalcocite?; and a trace of vein quartz.
SC74	Select	NA	Cut, 15 ft long; has 8-ft adit at end. In fractured and locally heavily Fe-stained (yellowish to reddish brown) quartzite w/ 1- to 2-ft pockets of gossan remaining; beds strike N. 61° E., dip 30° NW. Sample taken of spongy gossan material from possible stockpile outside adit. Sample includes: galena, sphalerite?, pyrite, limonite, hematite, Mn, and $FeSiO_2$.

NO.	TYPE	LENGTH	DESCRIPTION
SC75	Chip	2 ft h	One of four separate workings in a 110 ft by 30 ft area. The workings are generally along the contact (striking N. 13° W., dipping 51° SW.) between the quartzite and overlying thin-bedded sediments (sandstone/shale). The quartzite is typically pinkish gray and thick bedded; but is locally Fe-stained to an orangish gray color, brecciated and/or sheared, cut by stringers of quartz (½ to 5 in. thick) perpendicular to the bedding, and coated with limonite, hematite, and MnO. The sandstone/shale is typically yellowish gray to greenish gray and thin bedded to fissile; is locally altered; and also has local heavy FeO and Mn staining. The sample was taken from the NW. rib of a 5-ft adit at the back of a 15-ft cut. The adit (sampled) exposes a 5-ft fault zone that is generally parallel to the bedding; and has large- to small-scale breccia of quartzite and gouge. The sample consists of gouge and small pieces of quartzite.
SC76	Select	NA	See SC75. Select sample taken from stockpile on dump. Sample consists primarily of a dark red to brownish black iron-silicate material; but also includes fine breccia of quartzite; and has some pervasive CuO on fractures of clear quartz.
SC77	Chip	2.5 ft v	One of four separate workings in a 100 ft by 20 ft area. The workings are generally along the contact (striking N. 35° E., dipping 25° NW.) between quartzite and the overlying thin-bedded sediments (sandstone/shale). The host formations are locally heavily Fe-stained and/or bleached; locally fractured and/or sheared w/ up to 2 ft gouge development (pockets and layers); have local development of quartzite-breccia veins w/ $FeSiO_2$ filling; have trace to minor amounts of quartz veins, ½ to 3 in. thick; and locally have trace amounts of limonite, hematite, Mn, CuO, chalcocite, chalcopyrite, and bornite. Quartzite, being the most brittle of formations at this locality, is the host for most of the features listed above. Sample taken from face of 10-ft adit in back of 30-ft cut. Sample taken across 2-ft-thick gently dipping fault zone approximately parallel to bedding. Sample consists of: mostly gouge; some sheared quartzite, some CuO; heavy limonite stain.

NO.	TYPE	LENGTH	DESCRIPTION
SC78	Chip	2 ft h	See SC77. Pit, 8 ft across. Pit is in reddish brown Fe-stained quartzite, irregularly fractured w/ 1- to 3-in. quartz veins (striking generally N. 65° W.); and has localized Cu- and Fe-stained gouge pockets up to 2 ft thick. Sample taken from NW. wall of pit, across 2-ft localized gouge zone w/ CuO and FeO staining.
SC79	Select	NA	Pit, 8 ft across. In orangish gray Fe-stained quartzite. Select sample Cu-stained material from dump; trace vein quartz.
SC80	Chip	3.5 ft h	Adit, 20-ft-long, at face of cut, 30 ft by 8 ft by 20 ft max deep. In gently folded, locally fractured and Fe-stained Abrigo Formation? (striking N. 25° E., dipping 45° NW.); and reddish brown to light gray brecciated quartzite. Adit is in central part of 15-ft-wide fault zone striking N. 25° W., dipping 60° SW. Sample taken across back of adit, at portal. Sample consists of: fractured and brecciated white to yellowish gray Abrigo Formation?
SC81	Chip	5 ft h	Sample taken adjacent to SC80, just to NE. of portal through continuation of fault zone. Sample consists of: limonite-stained gouge; reddish brown quartzite breccia; and altered light gray breccia.
SC82	Chip	5 ft v	Pit, 420 ft by 145 ft by ave. 12 ft deep (max 25 ft deep). In thick beds of gray quartzite; locally heavily Fe-stained and highly fractured; containing rare white quartz veins; and no sign of CuO. Quartzite locally rests on beds of white ash or altered sill? and altered diorite?. Sample taken from west wall of pit. Sample consists of quartzite w/ FeO stain. Total waste material around pits SC82 and SC83 estimated at 15,000 st.

NO.	TYPE	LENGTH	DESCRIPTION
SC83	Chip	5 ft v	Pit, 200 ft by 200 ft by ave. 15 ft deep (max 35 ft deep); SW. wall of this pit is separated from NW. wall of SC82 pit by 140 ft; and a 350 ft by 30-60 ft wide by 5-35 ft deep trench adjoins the W. end of the SC83 pit and the NW. end of the SC82 pit. Same general description of geology presented for SC82 applies to SC83 pit, except that: the outcrops in the SC83 pit have up to 1 ft diorite; there is generally much more fracturing in the SC83 pit; and there is Mn staining in addition to Fe staining. Sample taken from west wall of pit. Sample consists of: more than 4 ft quartzite; some altered diorite; FeO, some MnO stain.
SC84	Grid	2 ft sp	Location is on the northwest-striking Mogul fault which here is about 100 ft wide and consists of mostly gray gouge. Granite adjoins the fault zone to the NE. Sample taken of dump material next to 8-ft pit. Sample consists of: altered granite w/ Fe stain and trace CuO. Note outcrops of gray granite w/ possible alteration and weak quartz veining in pit.
SC85	Select	NA	See SC84. Select sample taken of dump material. Sample consists of: gray granite? w/ quartz; Fe-stained quartz; massive quartz w/ trace of pyrite. Note pieces of quartz are a maximum of 2 in. across.
SC86	Chip	6 ft h	One of four steeply dipping quartz veins (on the order of 10 ft thick; spaced 500 to 750 ft apart; and striking an average of N. 65° W. in the W½ sec. 11). This one is 12 ft thick; is partially massive white and partially brecciated; and has local heavy FeO coating. Wall rock to SW. is Oracle granite. Sample taken across quartz vein outcrop as described above.
SC87	Chip	1 ft h	See fig. 15. Across quartz vein w/ abundant pyrite; small amount galena.
SC88	Chip	5 ft h	See fig. 15. Across back; sheared and FeO-stained granite; limonite.
SC89	Chip	4 ft h	Across quartz vein; galena and pyrite. West wall of 15-ft pit; vein N. 80° W., vertical.

NO.	TYPE	LENGTH	DESCRIPTION
SC90	Chip	1 ft h	700 ft by 200 ft leveled area at top of hill. Main part of leveled area underlain by weathered brown loose granite cut by occasional 4- to 6-in. aplite/pegmatite. SE. quarter underlain by fresh green-gray diorite. Sample taken of 1-ft massive quartz vein outcrop in granite, attitude unknown; sample consists of white quartz w/ minor Fe stain.
SC91	Chip	4 ft h	Rusty 4-ft outcrop and near-outcrop resilicified and weakly chloritized granite cut by 5% quartz veins up to 2 in. thick. Quartz vein N. 65° W. Country rock fresh rounded granite and grus.
SC92	Chip	14 ft h	See SC90. Sample taken on SW. wall of leveled area, across extension of vein from SC91. Sample taken across heavily fractured, locally silicified and competent rock in vertical shear zone; true thickness 4 to 6 ft; shear zone surrounded by friable massive rusty brown Oracle granite; includes 3 to 4 in. quartz; overall strike N. 50°-60° W. Sample consists of: 5.6 ft weathered decomposed granite; 7 ft slightly to moderately silicified granite; remainder thin quartz veins.
SC93	Select	20 ft	See SC90. Sample along 20-ft distance diagonal to quartz vein described under SC94; true thickness 3 to 4 ft. Sample includes: rusty brown pyritic gossan (minor); silicified granite w/ pyrite; quartz; and iron-stained granite.
SC94	Select	3 ft a	See SC90. Sample includes: light green altered and Fe-stained Oracle granite; and quartz from 4- to 6-in. veins. Veins strike N. 65° W.
SC95	Select	NA	Waste dump of fresh dense finely crystalline diorite (300 st). Sample is select, from dump, of rare pieces of: quartz; and diorite cut by quartz veins.

NO.	TYPE	LENGTH	DESCRIPTION
SC96	Chip	3 ft h	Cut, 50 ft by 30 ft by 20 ft deep cut. Wall rock to west is granite containing local quartz veins, and there is a small house there. Wall rock to north and south is moderately fractured, massive drab olive gray brown porphyritic diorite. The granite-diorite contact strikes N. 20° W., and dips 30° NE. At the north end of the cut there is a steeply dipping fracture zone striking N. 80° E. Sample taken across this fracture zone; and consists of friable, loose, sheared diorite; and locally includes 1 in. dense red Fe-cemented material.
SC97	Select	NA	Location is at NW. corner of SC96 cut. House at this location is probably over backfilled High Jinks shaft. Granite outcrops contain quartz veins as noted above (SC96); quartz veins are 1 to 4 in. thick, and occupy <5% of the friable altered granite country rock. Select sample quartz from outcrops and stockpile at this location.
SC98	Grid	5 ft	Irregular pit, 20 ft by 25 ft by 10 ft deep. In rounded rusted drab-color diorite with loose brown soil between diorite pieces. Grid sample over 5-ft-diameter rusty hill of Fe-stained and altered diorite next to pit as described. Location on trend with quartz vein of SC99, but there is no quartz here. Six additional pits and cuts (10 to 20 ft across; in rusted and rounded diorite; no quartz) on strike of vein to NW. and SE. of here.
SC99	Chip	2.5 ft h	Outcrop of quartz vein and silicified Oracle granite.
SC100	Chip	3.5 ft h	Pit, 12 ft across. Wall rock is altered granite. Sample across heavily Fe-stained white quartz (24 in.) and silicified altered granite; striking N. 70° E., dipping 80° SE.
SC101	Chip	4 ft h	Two 10-ft-long cuts, spaced 15 ft apart; sample taken at eastern cut. Country rock is primarily diorite. Quartz vein exposed in cuts, striking N. 80° E., dipping about 85° to S. Sample includes: 18 in. quartz and silicified country rock; remainder is dense clay-altered drab olive green to red/brown diorite.
SC102	Chip	14 ft h	Pit, 12 ft across. In deeply weathered rusty diorite and diorite colluvium. Sample length of west wall; consists of 7 ft altered diorite; and 7 ft loose weathered diorite (grus).

NO.	TYPE	LENGTH	DESCRIPTION
SC103	Chip	2 ft h	Trench, 40 ft long. North wall of trench is fault, dipping 80° S. Footwall of fault (to north) consists of fractured and resistant Fe-stained granite; then 2-ft quartz vein and densely silicified granite. Footwall of the vein is weakly chloritically altered granite. Sample taken across quartz vein and silicified granite, described above. Quartz is mostly white w/ local red-brown stain.
SC104	Select	NA	See SC103. Select from stockpile on south side of trench. Sample consists of: limonite-coated and clay-filled massive quartz vein 6 in. thick; finely crystalline altered dark diorite cut by thin (0.25 to 0.5 in.) quartz veins w/ malachite and limonite; quartz-filled breccia of altered diorite; and trace Cu mineralization.
SC105	Chip	4.5 ft h	Pit, 12 ft across. Granite to north of vein; diorite to south. Sample across vein and part of country rock. Sample includes: 1.8 ft quartz; 1.3 ft granite; and 1.4 ft slivered and dense (chilled/altered) diorite. Quartz has intruded fracture zone between granite and diorite.
SC106	Select	NA	Same vein as SC103 and SC105. Shaft, 30 ft deep; exposes 4-ft fracture zone (N. 85° E., 85° S). Footwall is moderately fractured resistant Oracle granite cut by 6-in. white quartz veins out to 5 ft from the main vein. Hanging wall (to the S.) is moderately fractured gray unknown rock. Fracture zone includes one-third vein quartz; the remainder is densely to moderately fractured country rock cut by quartz veins. Main quartz vein 9 in. thick. Select sample quartz from ore pile, includes: trace pyrite and rare galena, limonite coating, rare covellite.
SC107	Chip	3 ft h	Cut, 18 ft across. North one-fourth of cut in dark brown fractured and finely crystalline diorite/diabase; remainder in friable weathered/altered granite. Sample taken across east-striking contact zone on NW. wall of cut, includes: 1 ft friable granite, 1 ft brownish gray fractured contact zone w/ heavy FeO; and 1 ft dense gray-brown aphanitic diorite.
SC108	Rand	NA	Tailings, 2,000 st; sample taken from SE. end. Old millsite was located 150 ft N. of here on north side of draw.
SC109	Rand	NA	See SC108; sample taken from NW. end of tailings.

NO.	TYPE	LENGTH	DESCRIPTION
SC110	Chip	2 ft h	Cut, 12 ft across. In fractured and slightly Fe-stained granite w/ sparse 1- to 3-in. quartz veins striking approximately N. 47° E. Sample taken at N. 47° E. end of cut, across granite (as described above) and includes 1-in. quartz vein.
SC111	Select	NA	Trench, 78 ft long by 12 ft wide (max) by 5 ft deep. West end has sparse outcrops of tan rhyolite/aplite w/ 3-in. quartz veins. Center has sparse outcrops granite w/ 1- to 4-in. quartz veins. East end has no exposures, but does have blocks of quartz up to 8 in. across piled alongside. Sample taken from dump next to center of trench; and consists of white quartz.
SC112	Chip	27 in. h	Trench, 18 ft long and 10 ft wide. Mostly chilled dark olive-gray to brownish-gray latite w/ outcrops of altered granite. Sample taken from east wall of trench, consists of altered granite. Located approximately on trend with quartz vein at SC113.
SC113	Chip	13 in. d	Cut, 73 ft long by 20 ft wide by 6 ft max deep. The cut is mostly in cover or decomposed granite. Granite w/ thin quartz veins is exposed in the NW. wall of the cut. A 13-in. quartz vein is exposed near the NE. end of the cut. The vein is striking N. 38° W.; and is sandwiched between 5-ft outcrops of olive gray chilled? rust to dark brown monzonite/latite. The monzonite/latite, in turn, is surrounded by Oracle granite. The sample was taken across the quartz vein, and it includes some limonite.
SC114	Chip	4 ft d	Pit, 6 ft across. Fault through pit, striking N. 10° W., dipping 50° NE. Footwall dark greenish gray diabase?; hanging wall decomposed granite. Thin quartz veins along bedding plane fractures. Sample taken across fault zone, includes altered and silicified footwall and hanging wall w/ breccia layers.
SC115	Chip	5 ft h	Adit, 32 ft long. Following fault N. 27° W., 50° SW. Footwall formation is fractured siltstone; but 2 ft nearest fault is orangish-gray fault gouge (SC116). Hanging wall formation is altered granite with quartz veins, but 5 ft nearest fault (SC115) is fault breccia of altered pinkish granite with quartz veins. Sample SC115 taken at face of adit, consists of granite pieces (3.5 ft) and quartz with limonite staining, Mn and fine pyrite (1.5 ft).

NO.	TYPE	LENGTH	DESCRIPTION
SC116	Chip	2 ft h	See SC115. Sample taken at face of adit, consists of orangish-gray fault gouge.
SC117	Chip	5.5 ft h	Cut, 55 ft by 15 ft by 6 ft max deep. In fractured and locally (loose) altered pinkish coarse granite w/ thin quartz stringers 1 to 3 in. thick. Localized fractures N. 60° W., 71° NE.; and N. 30° W., 83° NE. Attitudes of quartz stringers vary. Sample taken at SW. end of cut, not necessarily representative of entire cut. Sample consists of: sheared and altered granite w/ FeO; and a couple of 1- to 3-in. quartz veins; minor limonite stain.
SC118	Chip	4.5 ft h	Cut, 39 ft by 20 ft by 10 ft max deep. In sheared and altered coarse, friable granite; local dense pinkish granite; and local fractured siltstone. Sample taken at SW. end, across granite-siltstone contact w/ quartz veins, minor gouge, and FeO. Sample consists of: sheared granite (10 in.); fractured granite with quartz veins and minor gouge (26 in.); and fractured dark blocky siltstone (18 in.).
SC119	Chip	4 ft h	Cut, 22 ft long. In Fe-stained and fractured Oracle granite; local clay gouge and thin quartz veins. Sample taken at NW. end of cut, next to clay gouge. Sample consists of iron-stained granite and 1-in. quartz vein.
SC120	Chip	43 in. d	Cut, 17 ft long. Quartz vein in middle of cut, striking N. 84° W., dipping 35° NE. Vein surrounded by altered coarse granite. Whitish rhyolite porphyry at N. 60° E. end of cut. Sample taken across quartz vein, on SE. side of cut; consists of chloritically altered granite and white vein quartz.
SC121	Chip	21 in. v	Pit, 27 ft across. Pit exposes contact (dipping about 20° to E.) between chilled brown monzonite (footwall) and reddish-brown altered granite (hanging wall). Sample taken in NE. part of pit, of varicolored coarse altered granite above the monzonite contact.
SC122	Chip	16 in. d	Cut, 14 ft across. Cut exposes 16-in. quartz vein, striking N. 45° W., dipping 32° NE. Footwall of vein is granite, highly altered and Fe-stained near contact with the quartz vein. Hanging wall is light greenish gray monzonite, chilled to brick red at the quartz contact. Sample taken across quartz vein described above.

NO.	TYPE	LENGTH	DESCRIPTION
SC123	Grid	1 ft	Shaft, 13 ft deep. Grid sample over stockpile next to shaft. Sample consists of vein quartz w/ FeO-filled voids. Country rock, as indicated by material on dump, includes chilled phase of monzonite and varicolored altered granite.
SC124	Chip	5 ft v	Pit, 26 ft across. Middle of pit exposes fault zone with quartz veins striking N. 38° W., dipping 42° NE. Footwall of fault is gouge and friable breccia of Oracle granite. Hanging wall is gray to olive-gray monzonite/latite (all broken, fractured, and sheared), grading downward into Fe-stained fine blocky material like middle of fault zone. Sample taken across fault zone, includes: 2-in. and 3-in. quartz veins; tan to pinkish gray carbonate; and minor breccia w/ quartz pieces.
SC125	Chip	28 in. h	Pit, 15 ft across. In Oracle granite. 6-in. quartz vein at SE. end of pit striking N. 45° W. Sample taken adjacent to quartz vein; consists of altered, loose, and heavy Fe-stained granite.
SC126	Chip	31 in. v	See SC125. Sample taken on north wall of pit; consists of resilicified and altered granite w/ quartz and limonite.
SC127	Chip	3.5 ft d	Pit, 13 ft across. In Oracle granite; some of it weathered to grus; some sheared and altered with local heavy FeO; some dense silicified granite with 1- to 2-in. quartz veins. Sample taken at N. 50° W. end of pit; through 3.5-ft-wide zone of silicified granite, as described above.
SC128	Chip	3 ft h	Pit, 10 ft across. In granite and andesite. Sample taken at N. 25° W. end of pit; consists of pinkish silicified granite w/ thin quartz veins to 1 in.
SC129	Select	NA	Variety of quartz from dump: white quartz, heavily Fe-stained quartz, quartz w/ pyrite and trace chalcopyrite; flaky black sphalerite?/galena. Backfilled major shaft, 10 ft by 16 ft at collar; now 50 ft deep; 2-ft quartz vein in wall, N. 50° W., 50° NE.
SC130	Select	3 ft a	Select sample ½- to 1-in. quartz veins (10% of rock) intruding resistant brown Oracle granite over 3-ft-diameter area.

NO.	TYPE	LENGTH	DESCRIPTION
SC131	Select	NA	Three steeply sloping cuts in hillside, averaging 12 ft long and spaced 10 ft apart. Cuts expose 1-ft-wide Fe-stained shear zone in Oracle granite, and 4-in. quartz veins. Attitudes of shear zone and quartz veins were not determined because of poor exposures. All country rock Fe-stained Oracle granite. Sample taken of loose and near-outcrop material in middle cut, including: vein quartz (50%); and Fe-rich sheared granite (50%).
SC132	Chip	5 ft d	Inaccessible adit, 25 ft long. Country rock is fractured and Fe-stained Oracle granite. Adit follows 4-ft-wide fracture zone and quartz veins, dipping 40° SE. Sample taken across portal (true thickness 5 ft), and includes: fractured Oracle granite (1 ft); brown dense massive limestone (1.5 ft); and quartz veins w/ Fe stain, Mn, pyrite, limonite (2.5 ft).
SC133	Chip	3.5 ft h	Pit, 10 ft across. In Fe-stained and decomposed Oracle granite. Sample taken at S. 40° W. end. Sample consists of: resilicified and altered siliceous Oracle granite (3 ft); multiple thin quartz veins (aggregating 3 in.); and Fe-rich, soft fault gouge (3 in.).
SC134	Chip	1.5 ft v	Cut, 104 ft by 66 ft max wide by 8 ft max deep. Fractured purple to gray quartzite all around, some with slickensides; FeO on fractures; very small amount of quartz on fractures also; some bleaching along fractures; possible outcrops or landslide material. Sample blue-gray quartzite with Fe-staining at N. 85° W. end of pit.
SC135	Chip	15 in. v	Pit, 12 ft across. Sample outcrop of gray to purple-gray quartzite with FeO on fractures at W. end.
SC136	Chip	4 ft h	Adit, flooded 31 ft from portal; probably goes another 50 ft beyond this. Adit in iron-stained, clay-altered, and sheared granite. Sample taken 10 ft from portal, across back; consists of granite as described above; also clay and limonite. No structure apparent.
SC137	Grid	3 ft	See SC136. Dump material; varicolored chloritically altered granite and white quartz; a few deep rusty pieces; no sulfides. Arrastre nearby.

NO.	TYPE	LENGTH	DESCRIPTION
SC138	Chip	5 ft	Cut, 16 ft long by 10 ft wide and 20 ft deep; in front of 20-ft adit. All workings are in granite. Adit follows steeply dipping shear zone, approximately 4 ft wide, and containing 1- to 4-in. quartz veins. Granite in shear zone is weakly altered, friable, and lightly iron-stained. Sample taken across shear zone on west side of cut. Sample mostly weakly altered granite; also contains pieces of quartz from 4-in. quartz vein; some limonite staining.
SC139	Chip	6 ft h	Shaft, 11 ft to water; emanating sulfur smell. Wall rock to SW. is gray rock, unknown. Wall rock to NE. is fresh coarse granite containing black books of mica. Sample across steeply dipping quartz vein, striking N. 50° W., at edge of shaft. Sample mostly iron-stained quartz with trace 0.12-in. chunks of pyrite; some granite.
SC140	Select	NA	Select from 6-st dump: sulfur-stained clean quartz w/ trace fresh 0.04- to 0.08-in. pyrite and galena.
SC141	Chip	1 ft h	Pit, 10 ft across. In fractured and iron-stained granite. Sample across 1-ft iron-stained quartz vein in NE. side, striking N. 61° W., dipping 69° NE. Silicification extends beyond vein into country rock. Probable continuation of vein sampled at SC139.
SC142	Chip	3 ft	Adit, inaccessible 10 ft beyond portal; estimated to be 350 ft long. Adit in fractured Oracle granite. Steeply dipping shear zone follows back of accessible drift. Sample taken 10 ft from portal, across shear zone described above; includes fractured and altered granite (white clay matrix), clay gouge, and 2- to 3-in. quartz vein.
SC143	Select	NA	See SC142. Select sulfur-stained white quartz with big clots of sulfides; from stockpile and strewn on waste dump; galena, chalcocite, pyrite, and lots of limonite. Note sulfides in granite also (not sampled).
SC144	Chip	4 ft h	See fig. 14. Across back at portal; quartz; light FeO stain.
SC145	Chip	4 ft h	See fig. 14. Across back; altered country rock and quartz-vein material; FeO stain.
SC146	Chip	5 ft h	See fig. 14. Across back; gray granite and quartz; pyrite; galena; heavy FeO.

NO.	TYPE	LENGTH	DESCRIPTION
SC147	Chip	4.5 ft h	See fig. 14. Across back; Fe-stained zone; sulfur smell; gray clay, heavily limonite-stained, w/ pyrite and quartz.
SC148	Chip	3 ft h	See fig. 14. Across back; mostly clay w/ some dense rock in center.
SC149	Chip	4.5 ft v	See fig. 14. Possible gently dipping shear zone, all clay; light Fe stain.
SC150	Chip	4 ft v	See fig. 14. Across face; massive blocky brown-green; thin wisps of quartz (metamorphic?); locally sheared and white/gray clay-coated surfaces; couple 1-in quartz veins.
SC151	Chip	2.5 ft h	See fig. 14. Across face; mostly quartz and silicified material; Cu stain; sulfur smell.
SC152	Chip	5 ft d	See fig. 14. Quartz veins w/ galena, pyrite; heavy FeO; some gouge; shattered rock.
SC153	Chip	3 ft v	See fig. 14. Across siliceous zone w/ 0.6 ft sulfide-layered gray gouge; dark red/brown FeO.
SC154	Chip	4 ft h	See fig. 14. Across back; quartz w/ limonite.
SC155	Chip	4 ft v	Adit, 22 ft long. 12-ft broad drift to S. 20° W. from main adit, down at angle of 15°; and then stoped to surface opening of 4 ft diam. at elevation 14 ft above back. 20-ft drift to N. 40° E. from near face of main adit, goes up 42° to surface. Entire working is in siliceous breccia w/ pieces of greenish gray country rock included, pieces of vein quartz, and local heavy FeO. Possible shear in back of adit, near face, N. 73° W., 38° NE.; but entire working probably in broad shear zone. Sample taken near face on NE. rib; dense silicified area part of layer drifted on to NE.; includes sheared material and quartz, trace pyrite, and limonite staining.
SC156	Chip	2.5 ft v	Adit, inaccessible beyond 10 ft from portal; estimated total length 50 ft. NE. rib all whitish, friable, highly altered. Shear zone and quartz vein in SW. rib striking about N. 58° W., dipping about 45° SW. Sample taken across quartz vein noted above; 10 ft from portal; consists of quartz, trace pyrite, FeO.

NO.	TYPE	LENGTH	DESCRIPTION
SC157	Chip	5.5 ft h	Cut, 24 ft long. NE. 10 ft of cut and entrance is in silicified and slightly iron-stained granite? Sample taken from right side, at entrance, facing into cut; consists of silicified granite?; no minerals. No structural orientation apparent.
SC158	Chip	4.5 v	Cut, 15 ft by 15 ft; in front of 22-ft adit. In footwall of fault striking N. 65° E. and dipping about 30° SE. Hanging wall is purplish limestone containing ¼- to 1-in. quartz stringers and 3 ft massive white to purplish quartz near the portal. Footwall has 2.5 ft fault gouge and fault breccia with some quartz below this. Sample taken from near face on left rib; consists of 2 ft gray fault gouge and the remainder, below the gouge, fault breccia.
SC159	Chip	5 ft d	See SC158. Sample taken across back at portal; massive quartz with some gouge; trace galena, pyrite, FeO.
SC160	Chip	2 ft h	See fig. 12. Across face; fault gouge and breccia; no mineralization.
SC161	Chip	28 in. h	See fig. 12. Across back; reddish-brown fault gouge and breccia; no mineralization.
SC162	Chip	8 ft h	See fig. 12. Across back and through shear zone; tan, intensely fractured limestone.
SC163	Chip	28 in. h	Pit, 8 ft across. Following 18-in.-thick siliceous replacement of limestone, striking N. 65° W., dipping 75° SW. Thin quartz veins continue into limestone country rock. Sample across replacement zone (containing pyrite and galena) and into varicolored altered limestone.
SC164	Chip	4 ft h	Pit, 23 ft across. Area of multiple shears, iron-stained and silicified granite. Sample taken across zone of shearing, attitude not clear, on east wall of pit near dump. Sample interval consists of sheared and iron-stained granite; and 7-in. fractured quartz vein.
SC165	Chip	4 ft h	Trench, 13 ft long. Area of dense, resistant, quartz-veined and iron-stained granite. Sample taken along quartz vein, thickness unknown, striking generally with the trench. Quartz includes pyrite and galena.

NO.	TYPE	LENGTH	DESCRIPTION
SC166	Chip	6 ft h	Location on or near Rattlesnake silicified fault zone, as mapped by Ludden (1950, Pl. 1). Country rock (to SW.) mapped as Cambrian Southern Belle quartzite. 20-ft adit. Adit in quartzite cut by thin crisscrossing quartz veins. Sample taken across back at portal.
SC167	Rand	NA	Geologic setting same as SC166. 45-ft adit; center part open to sky; 10-ft side cuts/drifts from center part normal to main drift on each side. Main adit follows weak fractures striking N. 70° W. and dipping 65° SW. Limited accessibility because of wasps. Two samples (SC167 and SC168) collected over area of 45 ft by 25 ft. Each sample consists of stockwork-silicified quartzite; quartz veins are thin, on order of ½ in.; also local 2- to 3-in. open boxwork; local heavy FeO.
SC168	Rand	NA	See SC167.
SC169	Select	NA	From dump. Light brown gossan w/ thin quartz veins after limestone. Below probable collapsed adit estimated to be 280 ft long.
SC170	Chip	4 ft	Country rock is Oracle granite. Pit, 34 ft by 13 ft. Fracture zone and quartz vein exposed at NW. end of cut; striking N. 70° E., dipping 30° SE. 20-ft adit begins at quartz vein, bears approximately south; and goes into water-filled winze driven toward vein in the hanging wall. True thickness of fracture zone containing quartz is about 4 ft, and sample taken across this zone. Sample consists of: 1.4 ft heavily Fe-stained massive quartz vein; remainder is varicolored altered Oracle granite. Footwall of vein is intensely fractured, dense, silicified Oracle granite containing <1% quartz veins up to 1 in. thick and a trace of pyrite. Hanging wall is moderately fractured same but lacking pyrite. Approximately on the N. 60° W. fault mapped by Ludden (1950, pl. 1).
SC171	Select	NA	Locality is <u>not</u> on trend of vein described at SC170. Pit, 12 ft across. Adit, no longer than 10 ft, begins from north end of pit and goes down 30° to the east. Portal of adit in intensely fractured brown to very light gray altered but dense and competent Oracle granite. Sample taken from stockpile near waste dump; consists of quartz with possible pyrite. Approximately on the N. 60° W. fault mapped by Ludden (1950, pl. 1).

NO.	TYPE	LENGTH	DESCRIPTION
SC172	Select	NA	Cut, 35 ft long. Mostly in Quaternary alluvium. Sample taken from loose blocks of quartz, up to 18 in. across; probable vein quartz; fractured with limonite on fractures. No outcrops but certain quartz came from here. Country rock not exposed but area is mapped as American Flag Formation (sedimentary). Approximately on the N. 60° W. fault mapped by Ludden (1950, pl. 1).
SC173	Select	NA	Pit, 8 ft across. In brown colluvium with local outcrops of iron-rich silica-cemented breccia. Sample consists of: 1/3 iron-stained light gray siliceous rock; 1/3 quartz-rich material on dump; and 1/3 iron-rich outcrop material containing quartz. Country rock is not identifiable but is mapped as American Flag Formation (sedimentary). Structure not apparent but locality is near mapped Mogul fault.
SC174	Select	NA	Pit, 100 ft by 50 ft by 4 ft max deep. White quartz w/ trace galena interbedded with metamorphic rocks. Select quartz and quartz w/ trace pyrite and galena from 50-st stockpile.
SC175	Chip	4 ft h	Pit 125 ft (N.-S.) by 75 ft (E.-W.). East and west walls average 10 ft deep. North and south walls average 3 ft deep. West wall exposes 4-ft quartz vein and silicified metamorphic zone striking N., dipping 75° E. Samples SC175-177 are from this quartz vein and silicified zone. Floor of pit and hanging wall of vein is granite, weakly propylitically altered w/ up to 5% white quartz veins up to 1 in. thick (see SC178). Footwall of vein is loose weathered granite. Sample SC175 is across quartz vein at NW. end of pit, and its true thickness is 4 ft. Sample SC175 consists of: limonite-stained quartz w/ local heavy pyrite (2 ft); and greenish-gray metamorphic siliceous rock (2 ft).
SC176	Select	NA	Located on quartz vein described under SC175, 20 ft S. of SC175. Select, from outcrops, heavy limonite- and hematite-coated quartz containing coarse pyrite (up to 0.25 in.); these zones are a maximum of 6 in. thick.

NO.	TYPE	LENGTH	DESCRIPTION
SC177	Chip	4 ft h	Located on quartz vein described under SC175, near SW. corner of pit. Sample composite of white quartz veins over greater thickness of country rock; aggregate thickness of quartz, 4 ft.
SC178	Select	NA	See description of floor of pit under SC175. This sample select of quartz veins outcropping in that floor.
SC179	Chip	6 ft h	Cut 200 ft (E.-W.) by 75 ft (N.-S.); 35-ft highwall facing north. Sample across limonitic white quartz vein, 6 ft thick, striking N. 20° W., dipping 25° NE. Footwall is gray quartzite; hanging wall is phyllitic metamorphic rock containing multiple thin quartz veins and local pyrite. 20,000 st waste.
SC180	Select	NA	See SC179. Select sample quartz from waste material, some w/ trace pyrite to 0.4 in., some w/ open spaces and heavy limonite/hematite.
SC181	Chip	5.5 ft v	Outcrop, 4-ft white quartz vein, striking about N. 20° W., dipping about 30° NE. Sample across vein; some Fe staining; no sulfides.
SC182	Select	NA	Cut, 100 ft by 30 ft; 30-ft highwall, facing N. 20° W. Massive quartz veins and/or blankets intruding greenish-gray phyllitic metamorphic rock; quartz locally limonitic; outcrops also possibly diorite and/or monzonite. Outcrops of quartz veins up to 8 in. thick intruding metamorphic rocks, but predominant structure(s) and/or veins and blankets not exposed. Blocks of quartz up to 6 ft across suggest veins and/or blankets would be that thick at least. Select sample outcrop and float containing trace amounts of pyrite up to 0.4 in. across. 10,000 st waste.
SC183	Select	NA	See SC182. Select sample of the following from stockpile below the main dump: white quartz, some w/ limonite stain, some w/ pyrite cubes up to 0.4 in. across; include some greenish-gray phyllitic metamorphic w/ pyrite cubes and quartz veins.
SC184	Chip	16 in. h	Cut, 100 ft by 10 ft by max 3 ft deep. Exposing 16-in. flat-lying quartz vein intruding (trace) pyritized fine-grained metasediments. Metasediments are thinly bedded to fissile. Sample taken across thickness of quartz vein.

NO.	TYPE	LENGTH	DESCRIPTION
SC185	Select	NA	Pit, 6 ft across. Near contact between cliffs of pinkish quartzite and clay-altered mafic dike. Dike striking about N. 80° E., dipping about 75° NW. Select sample silica-cemented quartzite and clay-altered diorite.
SC186	Chip	4 ft d	Adit, 104 ft long. Adit begins in colluvium (0 to 20 ft); remainder in medium-bedded whitish to gray or brown fine-grained argillaceous sediments; possibly 1-ft ash beds. Beds strike N. 20° W., dip 25° NE. Bedding-plane and cross-cutting quartz veins begin 53 ft from portal and continue to face. Flat fault on back of adit at 50 ft. Sample taken on SE. rib, 92 ft from portal. Sample consists of: country rock (as described above; 3.8 ft); white quartz veins (as also described above; 0.2 ft), 1 to 3 in. thick w/ blebs of limonite, rare sulfides.
SC187	Chip	6 ft d	See SC186. Sample taken 53 ft from portal on NW. rib. Sample consists of: fine-grained country rock (as described under SC186; 3 ft) containing trace pyrite casts to 0.1 in.; bedding-plane (18 in. thick) and cross-cutting (1- to 3-in.) white quartz veins (as also described under SC186; total 3 ft), Fe-stained and fractured.
SC188	Chip	3.5 ft h	Outcrop. Quartz vein striking N. 37° W., 35° NE. (approximately bedding plane, as noted at SC186). Hanging wall of vein in vicinity is altered and loose drab gray-green diorite. Sample taken across 3.5-ft exposure of vein. Sample consists of: white quartz (18 in.); and Fe-stained quartz (24 in.) containing 2 to 3% pyrite to 0.12 in.
SC189	Chip	5 ft h	See fig. 26. Potassium feldspar porphyry (to 0.5 in.), fractured and Fe-stained.
SC190	Chip	8 ft d	See fig. 26. Across face; includes 4 in. brown gossan material; remainder is green/gray finely crystalline metavolcanic? or diorite, fractured w/ minor (<5%) calcite and quartz veinlets; some deep Fe stain.
SC191	Select	4.5 ft d	See fig. 26. Mostly finely crystalline green/gray rock; total 6 in. quartz and quartz w/ coarse pyrite; local FeO on fractures.
SC192	Select	5 ft h	See fig. 26. Quartz veining on back.
SC193	Chip	4 ft v	See fig. 27. White massive to densely fractured quartz w/ small amount Fe stain.

NO.	TYPE	LENGTH	DESCRIPTION
SC194	Chip	3 ft v	See fig. 27. 2.5 ft hanging wall; 0.5 ft footwall and vein; heavy Fe stain w/ 3 in. quartz; trace of large pyrite in host rock.
SC195	Chip	4 ft v	See fig. 27. Includes 2 ft massive white quartz; 2 ft thinly laminated metavolcanic/siltstone; green Cu stain on quartz; trace galena in quartz.
SC196	Chip	4 ft v	See fig. 27. 3 ft hanging wall, massive but fractured and Fe-stained green metadiorite?; 1 ft fractured quartz vein (16 in. thick).
SC197	Select	NA	Cut, 15 ft long; may have been 20-ft adit. In fissile gray limestone/shale (4 ft thick), interlayered with light gray to brownish gray massive quartzite. Beds striking N. 15° W., dipping 20° NE. Select from dump, includes: quartz (<1 to 2 in. thick) w/ trace sulfides; Fe-stained quartzite; trace bornite.
SC198	Select	NA	Inaccessible adit, possibly 250 ft long. Waste material indicates quartz vein (pieces up to 3 in. thick) intruding green-gray diorite?; not much wall rock alteration of greenish host; blocks of Cretaceous? conglomerate at portal of adit. Select sample pieces of quartz with limonite staining from waste dump.
SC199	Select	NA	Inaccessible adit, possibly 200 ft long. Waste material indicates quartz vein (no more than 1 ft thick) in greenish diorite intrusion. Select sample quartz as described above; some w/ limonite; some with massive pyrite and galena.
SC200	Select	NA	Pit, 8 ft across. No outcrops. The following, in and around the pit: blocks and near outcrop greenish diorite?; and pieces vein quartz not more than 3 in. across. Select sample vein quartz w/ pieces of greenish country rock attached at pit (30% of sample); and similar float from 50-ft radius outside of pit (remainder of sample).
SC201	Chip	3 ft v	See fig. 25. Limestone; quartz (3-in. pods); calcite veining.
SC202	Chip	10 in.	See fig. 25. Includes 5-in. quartz vein; 5 in. limestone wall rock.

NO.	TYPE	LENGTH	DESCRIPTION
SC203	Chip	5 ft d	Cut, 15 long. Wall rock is light gray limestone, some w/ pinkish cast; all w/ 0.04-in.-thick quartz veinlets. 2-ft-wide possible shear zone w/ soft clay material goes through S. 60° W. wall of cut. Sample taken at S. 32° W. end of cut; consists of limestone (as described above) and 3-in. clay layer in limestone.
SC204	Select	NA	Shaft, 20 ft deep. In massive pinkish-gray fractured and Fe-stained volcanic or diorite. 2-ft intensely fractured zone in shaft; striking N. 75° W., dipping 75° SW.; has associated 6-in. quartz zone; and is probable continuation of fault and vein at SC205-211. Select sample from dump, consists of: quartz; quartz breccia; and quartz w/ blobs/cavities of limonite.
SC205	Chip	5.5 ft h	Cut, 12 ft long. Cut crosses 4-ft massive (hard) quartz vein striking N. 70° W. Sample taken across quartz vein described above; true thickness, 4 ft. Location is 280 ft NW. from SC211 portal.
SC206	Chip	11 ft h	Pit, 10 ft across. Country rock unidentified. At pit, wall rock is variously faulted and heavily fractured. Sample taken of entire exposure on N. 70° W. wall of pit. Sample consists of: heavily brecciated country rock; and local, heavy Fe-Si impregnation (to SW. side; 1 ft thick). Location is 220 ft NW. from SC211 portal.
SC207	Chip	8 in. h	Cut, 20 ft long. Country rock (unidentified), is heavily fractured and limonite-coated. Sample taken of quartz vein w/ few percent sphalerite. Location is 142 ft NW. of SC211 portal.
SC208	Chip	12 ft h	Pit, 15 ft across. Sample taken on N. 70° W. wall of pit. Sample consists mostly of intensely fractured and moderately altered (unidentified) country rock; also local heavy FeO and limonite; aggregate 24 in. quartz and moderately silicified country rock. Location is 109 ft NW. of SC211 portal.

NO.	TYPE	LENGTH	DESCRIPTION
SC209	Chip	3.5 ft d	Pit, 20 ft across. SW. wall of pit is 28 ft high; forms hanging wall of fault (N. 70° W., 70° SW.); consists of brown dense blocky limestone/metasediments, fractured w/ FeO; and has small inaccessible decline going to adit (SC211) below. Sample taken in upper (NW.) part of pit, across fault zone noted above. Sample consists of brecciated wall rock w/limonite. Location is 40 ft NW. of SC211 portal.
SC210	Chip	3 ft h	Cut, 18 ft long. East half of cut is in soil and rubble. SW. quarter of pit is in fractured limestone/siltstone w/ limonite on fractures. NW. quarter of pit exposes a highly silicified shear zone (attitude not noted) w/ quartz, galena, Cu-staining, and limonite. Sample taken across shear zone as described above. Location is 90 ft NW. of SC211 portal.
SC211	Chip	7 ft h	Adit, backfilled 20 ft from portal; original length may have been 100 ft. Adit exposes fault N. 65° W., 70° SW. Hanging wall of fault Fe-stained and fractured finely crystalline rock, possibly siltstone or volcanic. Sample taken across fault zone and consists of: highly altered (hanging wall) rock; fault gouge and breccia; and 6-in. quartz vein containing a few percent sphalerite and heavy FeO.
SC212	Chip	10 ft h	Outcrop. Possible continuation of fault/vein at SC204 and SC205-211. 20 ft by 75 ft outcrop varicolored quartzite; striking N. 75° E., dipping steeply to SE.; containing <5% quartz veins, typically ¼ to 1 in. thick, but locally up to 12 in. thick; locally heavily sheared, but attitude of shearing was not noted; and similar to outcrops at SC214. Sample taken across central part of outcrop, in a SE.-NW. direction. Sample material generally as described above.
SC213	Chip	4 ft h	Pit, 6 ft across. Pit is adjacent (on its NE. side) to the 20-ft-wide N. 70° W-trending ridge of massive white to Fe-stained quartzite described under SC214. Pit exposes brown fine-grained and thinly laminated/fissile metasediments, striking N. 65° W., dipping about 50° SW. Sample taken across S. 65° E. end of pit, lithology as described above.

NO.	TYPE	LENGTH	DESCRIPTION
SC214	Chip	15 ft h	Outcrop. 20-ft-wide ridge of massive white to Fe-stained quartzite, striking N. 70° W., dipping about 70° SW. Road crosses "ridge" at this point, and the locality may have been prospected. Quartzite is cut by <5% whitish quartz veins up to ½ in. thick. Sample taken across trend, in a SW. to NE. direction. Sample material described above, except that the sample emphasizes quartzite containing quartz veins.
SC215	Chip	1.5 ft d	Geologic unit unknown. Location is in or near Geesaman fault. 17-ft adit in quartz. Sample across fault breccia in NE. rib striking N. 60° W., dipping 15° SW. Sample includes iron-enriched gouge, pieces of quartz, and pieces of altered country rock.
SC216	Chip	3 ft h	Geologic unit unknown. Location is in or near Geesaman fault. Shaft, 10 ft deep. Appears to be in steeply dipping fault striking north. Sample taken normal to fault on its east side; whitish probable fault gouge w/ green and blue CuO.
SC217	Chip	3 ft h	See SC216. Sample taken normal to fault on its west side; dense quartz w/ green and blue CuO.
SC218	Chip	4 ft h	See fig. 5. Abrigo Formation (?). Sample taken in nearly vertical Geesaman fault; across back of adit; CuO in 1-ft zone; remainder is sheared country rock, gouge, limonite.
SC219	Chip	3 ft h	See fig. 5. Abrigo Formation (?). Sample taken in nearly vertical Geesaman fault; 1.5 ft quartz; FeO; disseminated pyrite; chalcopyrite; calcite stringers; biotite and chlorite alteration; schistose zone.
SC220	Chip	6 ft h	See fig. 5. Abrigo Formation (?). Sample taken in nearly vertical Geesaman fault; across back; siliceous breccia and gouge; mostly quartz; moderately disseminated pyrite.
SC221	Chip	4 ft v	See fig. 5. Abrigo Formation (?). Sample taken at face of crosscut; limestone breccia; 1.2 ft clay/gouge - thin calcite stringers; moderately abundant disseminated pyrite; trace chalcopyrite.
SC222	Chip	2 ft h	See fig. 5. Abrigo Formation (?). Sample taken across steeply southward- dipping fault zone away from main Geesaman fault; sheared limestone; minor pyrite and FeO stain.

NO.	TYPE	LENGTH	DESCRIPTION
SC223	Chip	5 ft h	See fig. 5. Abrigo Formation (?). Sample taken on southwest wall at collar of shaft leading to adit 35 ft below. Shaft follows vertical shear zone striking N. 35° W. Shaft collar essentially all in massive white quartz with local Cu and Fe staining. Sample material consists of quartz, light CuO; and some epidote.
SC224	Chip	5 ft h	Abrigo Formation (?). Location is in or near Geesaman fault. Cut, 25 ft long; in front of 25-ft adit; on steeply dipping fault striking N. 78° W. Wall rock consists of fractured siliceous metamorphic rocks, locally brecciated and containing quartz veins. Sample consists of quartz and pyrite, some FeO stain.
SC225	Chip	2.5 ft v	See fig. 3. Tertiary Leatherwood quartz diorite. Location is in or near Geesaman fault. 4 in. gray/white gouge (altered country rock); 5-in. massive quartz vein w/ red hematite, MnO stain; remainder is gray/white clay gouge w/ quartz stringers; pyrite altered in quartz.
SC226	Chip	2.5 ft v	See fig. 3. Tertiary Leatherwood quartz diorite. Location is in or near Geesaman fault. Top 7 in. gray/white gouge (altered country rock) w/ FeO stain; 12-in. massive quartz vein w/ FeO and MnO stain, disseminated pyrite; bottom 10 in. altered country rock w/ FeO, MnO stain, muscovite, no visible sulfides.
SC227	Chip	3 ft v	See fig. 3. Tertiary Leatherwood quartz diorite. Location is in or near Geesaman fault. Sulfide zone in green/gray diorite? country rock; some Cu stain; some calcite filling in fractures.
SC228	Chip	5 ft h	Precambrian Apache Group. Location is in or near Geesaman fault. True thickness 3 ft. Sample across heavily fractured zone of diorite containing 1- to 3-in. layers of quartz, above road and to the east of portal to inaccessible adit. Minor gossan in structure. Structure strikes N. 80° E., dips 57° NW. Hanging wall green siliceous metasediment? Footwall gray diorite, locally bleached. Structures are short and discontinuous, and cannot be traced to nearby outcrops. Most of dump lost to roadway.

NO.	TYPE	LENGTH	DESCRIPTION
SC229	Chip	4 in.	Precambrian Apache Group. Location is in or near Geesaman fault. White vein quartz, possibly in place. In one of two 8-ft pits, spaced 30 ft apart. Host is light-colored phyllitic pre-gneiss.
SC230	Chip	4 ft d	Precambrian Apache Group. Location is in or near Geesaman fault. Thinly layered metasediments, striking N. 70° E, dipping 50° NW. White quartz veins up to 2 in. thick are localized in the bedding plane near vertical fractures striking N. 10° W. and N. 25° W., and in the fractures themselves. Sample taken from west wall of 15-ft pit, parallel to N. 10° W. fracture and about 2 ft from it. Sample includes 2.8 ft light green/gray metasediment and 1.2 ft white quartz.
SC231	Select	NA	Precambrian Apache Group. Location is in or near Geesaman fault. Outcrops of massive to phyllitic gray/green metasediment. Two shafts, each 6 ft deep, separated by 5 ft of rock. Select sample from dump: quartz-mica-garnet skarn? with some vuggy quartz in pieces.
SC232	Chip	2 ft h	Adit, 13 ft long, orientation not reported. In whitish limestone; 20-ft ledge light-gray quartzite on slope below; alteration and silicification over 20-ft-diameter area at portal; complex fracture zone in fine-grained sandy metamorphics w/ pegmatite; 2-ft greenish-gray flat-lying siliceous zone at lower face of adit. Sample taken at portal through gently dipping (to N.) hard siliceous Cu-bearing zone w/ epidote and sphalerite?
SC233	Chip	100 ft h	Across pegmatite, medium hard to hard; 75% potassium feldspar; 20% gray quartz; 5 to 10% mica. Outcrop.
SC234	Chip	35 ft h	Moderately altered, fractured, and Fe-stained pegmatite; 25% gray/white quartz w/ mica to 0.5 in. Outcrop.
SC235	Chip	20 ft h	Fractured and highly altered pegmatite; 2- to 4-in. blocks of unaltered white-gray quartz; 1 to 2% muscovite. Outcrop.

NO.	TYPE	LENGTH	DESCRIPTION
SC236	Chip	4 ft v	Mapped as contact between Martin Formation and Tertiary andesite porphyry. Adit, 27 ft long. Wall rock is dense tan siliceous rock, bedded and fractured with CuO on fractures; some quartz blebs and streamers. Sample taken across gently dipping shear zone (striking N. 50° W.) on southeast rib near face. Sample consists of quartz rock w/ CuO and 3-in. clay layer.
SC237	Chip	4 ft d	Martin Formation, in or near garnet skarn of Wilson (1977). Cut, 18 ft long. Beds dipping about 15° to N. Sample taken across replacement zone with Cu and Fe stain; sphalerite. Thin quartz veins above cut not sampled.
SC238	Chip	3 ft h	See fig. 7. Martin Formation, in or near garnet skarn of Wilson (1977). Possible shear follows back and NW. rib. Portal in dense red-brown replacement rock with 6-in. quartz vein. Sample taken across back; more CuO, quartz than SC239; some slickensides.
SC239	Chip	3 ft h	See SC238 and fig. 7. Across back; through shear zone; mostly loose, altered, red-brown rock; CuO, FeO, quartz.
SC240	Chip	3 ft h	See SC238 and fig. 7. 1.5 ft white quartz w/ beryl? pegmatite?; remainder altered rock.
SC241	Chip	6.5 ft d	Martin Formation, in or near garnet skarn of Wilson (1977). Adit, 25 ft long. Adit in contorted, fractured, altered limestone and quartz w/ showings of CuO throughout; partly brick-red due to addition of Fe. Adit in shear zone N. 86° E., 52° NW. Sample across back at portal through sheared and altered material; upper 3 ft is red/brown rock w/ stringers of quartz and CuO; lower 3 ft is sheared micaceous rock w/ 1- to 3-in. pieces Fe-stained quartz.
SC242	Chip	4 ft h	Mapped as Precambrian gneiss. Cut, 41 ft by 10 ft by 9 ft max deep. First 10 ft of cut (SW. end) is in light-green layered gneiss with 3-in. Cu-stained quartz vein; remainder is in varicolored quartz with epidote, Fe-Mn stain, and fractures. Cut follows 4-ft-wide shear zone with abundant parallel and normal fractures and shears. Sample taken through fracture zone at NE. end of cut; consists of brown quartz, epidote, brown fault gouge, thin siliceous portion w/ CuO throughout.

NO.	TYPE	LENGTH	DESCRIPTION
SC243	Chip	4.5 ft v	Mapped as Precambrian gneiss. Adit, 27 ft long. Lower 2.5 ft of ribs massive quartz. Upper 2.5 ft and back (flat-lying unit, dipping about 10° to N.) is banded gray and white siliceous unit with local Fe-staining; within 10 ft of portal this unit is oxidized, white and brown banded. Sample taken near face on NE. rib; upper unit as described above; consists of quartz and mica. Banded unit at portal overlain by 3-ft quartz with epidote and FeO.
SC244	Chip	3.5 ft v	Martin Formation, in or near garnet skarn of Wilson (1977). Adit, 24 ft long. Adit in dense, brecciated, brown to banded limestone; minor calcite veins. 2-ft alteration zone with FeO and CuO at 12 ft from portal; on NE. rib;, striking N. 80° E., dipping 30° to NW. Sample taken across brown altered limestone at SW. side at portal; CuO and FeO.
SC245	Chip	4 ft d	See fig. 8. Martin Formation, in or near garnet skarn of Wilson (1977). 10 ft of adit nearest face is in whitish, altered and recrystallized limestone. Remainder of adit is in the following: altered, recrystallized, and brecciated limestone; gently to steeply dipping shear zone, 4 to 5 ft wide (as mapped); local FeO; wisps, patches, and lenses of CuO; irregular, discontinuous patches of CuO and/or Cu staining on walls. Sample taken through altered and shear zone; Cu and Fe stain.
SC246	Chip	5 ft h	See SC245 and fig. 8. Martin Formation, in or near garnet skarn of Wilson (1977). Across back and shear zone; brown altered limestone; FeO and CuO stain.
SC247	Chip	2.5 ft h	See SC245 and fig. 8. Martin Formation, in or near garnet skarn of Wilson (1977). Sample across wall rock with heavy CuO at entrance to drift; adjacent to shear which follows drift; dense altered limestone; also FeO.

NO.	TYPE	LENGTH	DESCRIPTION
SC248	Chip	8 ft d	Martin Formation, in or near garnet skarn of Wilson (1977). Pit 19 ft by 16 ft. Highwall (N. 60° E. end) is a maximum of 27 ft high and is in broken white limestone. Remainder of pit, averaging 8 ft deep, is in skarn adjacent to sheared-to-brecciated brownish altered and slightly silicified limestone containing local veins and lenses of quartz, and scattered patches and layers of secondary CuO. Limestone-skarn contact generally strikes N. 30° W. and dips steeply to the SW. Sample taken diagonally across SE. wall of pit is interpreted to be true thickness of skarn with the top covered.
SC249	Chip	3 ft h	Shear zone in Martin Formation and Tertiary andesite porphyry, 500 ft NE. of skarn contact. Adit, 88 ft long. Adit in limestone except first 20 ft in andesite porphyry and andesite porphyry also overlies limestone. Vertical shear zone, 4 ft wide, follows back of adit. Shear zone filled with calcite and intensely sheared limestone. Sample taken across face of adit and shear zone; consists of calcite, intensely sheared limestone, thin quartz veins, and has FeO staining.
SC250	Chip	3.5 ft v	See SC249. Sample taken across back, through shear zone, 50 ft from portal. Intensely sheared limestone, slight FeO staining.
SC251	Chip	4.5 ft v	Martin Formation, 150 ft NE. of mapped skarn contact. Adit, 33 ft long. Adit is in limestone; also altered blocks of limestone; and cross-cutting iron-stained and brecciated zones. Gently dipping shear zone above waist level in adit. Sample taken across shear zone at face of adit; consists of sheared and brecciated limestone; FeO staining; white and brown clays.
SC252	Chip	3.5 ft v	Martin Formation, in garnet skarn of Wilson (1977). Adit, 22 ft long. Wall rock as follows: dense, altered to recrystallized and slightly silicified limestone, badly broken with thin copper-bearing seams on fractures. At portal: Cu-bearing seams, 0 to 8 in. thick, steep to gently dipping; quartz and calcite veins in wall rock. Sample taken across skarn and gently dipping (strike approximately N. 60° W.) Cu seam 10 ft to left of portal; variety of unidentified Cu oxides.

NO.	TYPE	LENGTH	DESCRIPTION
SC253	Chip	2 ft h	Martin Formation, in or near garnet skarn of Wilson (1977). Adit, 63 ft long. Portal is in chloritized limestone containing epidote and FeO. Remainder of adit is in dense micaceous limestone which is typically badly broken; has local calcite veins; has multiple cross-cutting vertical fractures zones (striking N. 20° W. to N. 30° E; some with CuO staining); and has multiple quartz veins, the thickest of which was sampled. Sample taken across 2-ft quartz vein, 50 ft from portal, on NW rib; striking about N. 10° W., dipping 59° SW. Sample consists of quartz, minor Cu on fractures, mica, and limonite.
SC254	Chip	1.5 ft h	Mapped as Precambrian gneiss. Adit, 14 ft long. Adit in steeply dipping metamorphic rocks; approximately following shear zone N. 57° E., 65° SE. Sample taken across portal, through shear zone; includes 6-in. quartz vein w/ epidote and 1-ft shear zone w/ black FeO. Quartz with epidote to left of portal 3 ft thick; more quartz with epidote to right of portal; another shear 3 ft to SE. of portal.
SC255	Chip	1 ft h	Mapped as Precambrian gneiss. Pit, 9 ft across. Highwall in massive quartz cut by N. 60° E. quartz-Fe-Cu veins (sampled), 1 to 3 in. thick. Breccia of quartz 3 ft thick in NW wall of pit. Epidote staining and black Fe-Mn throughout exposures in pit. Sample taken across vein (noted above); consists of 0.75 ft unidentified wall rock; remainder quartz-Fe-Cu vein.
SC256	Chip	2 ft h	Mapped as Abrigo Formation, 100 ft SW. of skarn contact of Wilson (1977). Cut, 10 ft long. Cut in gray limestone and irregular masses of brown siliceous Cu-bearing replacement/skarn. Sample taken from middle of south wall is of such a replacement, containing CuO, epidote, quartz, feldspar, limonite, and Mn.
SC257	Chip	3 ft h	Abrigo Formation (?), on skarn contact of Wilson (1977). Cut, 13 ft long. Cut in epidotized and quartz-veined metasediments? Quartz veins (coarsely crystalline, 1 to 3 in. thick) throughout striking approximately N. and dipping steeply to E.; may have platy sphalerite/bornite. Sample taken at SE. end of cut; consists of quartz, feldspar, epidote, FeO, chlorite, and mica.

NO.	TYPE	LENGTH	DESCRIPTION
SC258	Chip	1 ft h	Southernmost of 4 pits cut into gray micaceous schist. This one is 6 ft across. Sample taken across 12-in. white quartz vein striking N 10° W, dipping 72° NE.
SC259	Chip	3.5 ft h	Cut, 20 ft long. Both ends of cut in schist; middle (10 ft approx.) in massive quartz with epidote coating, having local Fe-rich veins/pods. Sample taken at NW. end of cut, through contact zone; includes 1.7 ft quartz and 1.8 ft chilled and altered (heavy Fe-coated) schist.
SC260	Chip	4.5 ft h	Cut, 47 ft by 20 ft by 6 ft deep. In whitish coarsely crystalline mica-quartz-feldspar gneiss and clay-altered aplite. Several near-vertical faults/shear zones in cut, striking N. 45° E. Sample taken in center of NW. side of cut, normal to and across shears containing Fe- and Cu-staining.
SC261	Chip	3 ft v	Adit, 35 ft long. First 10 ft of adit inclined 50°; remainder inclined 27°. 9-ft-diameter pit in front of adit has 5-ft-wide shear zone going through it, striking N. 18° E, dipping 69° NE. Ribs are whitish sheared limestone w/ 1- to 3-in. quartz lenses containing CuO. Back of adit is dense recrystallized limestone. Sample taken near face; consists of sheared limestone w/ clay, trace CuO, FeO, trace quartz.
SC262	Chip	5.5 ft h	Across SC261 shear. Sample includes sheared limestone, quartz, minor CuO, FeO, chlorite alteration.
SC263	Chip	4.5 ft h	Pit, 8 ft across. Sample taken of white irregular quartz-replacement of limestone; Cu-staining and limonite; some clay. Pyrite in dump material (not sampled); breccia.
SC264	Chip	5 ft v	Adit, 92 ft long, sloping down 25°. In fractured white to gray-white banded limestone. At 50 to 60 ft from portal, Cu in irregular fractures spaced 1 in. apart. Sample taken 60 ft from portal, on SW. rib. Sample consists of fractured limestone, trace CuO, MnO dendrites. Beds strike N. 57° E., dip 42° SE.

NO.	TYPE	LENGTH	DESCRIPTION
SC265	Chip	4 ft d	53-ft adit, sloping down 35°. Shear strikes N., dips 55° E. Ribs are in footwall of shear and consist of 5-ft-thick siliceous replacement of limestone w/ local FeO and CuO. Back of adit exposes hanging wall of shear and this includes 5 ft greenish altered shaly limestone? w/ 1-ft-thick quartz veins. Outcrops of whitish limestone to SE. of portal. Sample taken 10 ft from portal, on NW. rib. Sample consists of dense siliceous replacement of limestone, as described above, w/ CuO and limonite.
SC266	Chip	4 ft d	See SC265. Sample taken 33 ft from portal, on NW. rib. Sample consists of silicified and sheared limestone w/ CuO and limonite. Not accessible beyond this point.
SC267	Chip	5 ft h	Cut, 22 ft long; has shaft with small headframe in center; shaft probably less than 20 ft deep. Sample taken across outcrop of pegmatite and sheared pegmatite on SW. wall of cut. Sample consists of quartz-feldspar-mica pegmatite and clay.
SC268	Chip	4.5 ft h	Cut, 26 ft by 10 ft by 19 ft max deep. Conveyor at NW. end of cut. Cut follows shear zone with black dike? rock in the middle, striking N. 17° W., dipping 35° NE. Footwall of shear zone and dike is fractured chalky-white altered pegmatite w/ light clay in fractures and light FeO stain. Hanging wall of dike and shear zone is coarsely crystalline fractured pegmatite. Sample taken at SE. end of cut, across shear zone and possible dike rock described above. Sample consists of fractured and sheared black dike? rock w/ bright red iron staining along fractures.

APPENDIX C. Analyses of rock-chip samples by Chemex Labs, Inc., using inductively coupled plasma-atomic emission spectroscopy method, Santa Catalina-Rincon Mountains Unit, Coronado National Forest, Arizona.

Element	Detection limit [lower/upper (if applicable)]
Ag (silver)	0.2 ppm/200 ppm
Al (aluminum)	0.01%/15.00%
As (arsenic)	2 ppm/10,000 ppm
Ba (barium)	10 ppm/10,000 ppm
Be (beryllium)	0.5 ppm/100.0 ppm
Bi (bismuth)	2 ppm/10,000 ppm
Ca (calcium)	0.01%/15.00%
Cd (cadmium)	0.5 ppm/100 ppm
Co (cobalt)	1 ppm/10,000 ppm
Cr (chromium)	1 ppm/10,000 ppm
Cu (copper)	1 ppm/10,000 ppm
Fe (iron)	0.01%/15.00%
Ga (gallium)	10 ppm/10,000 ppm
Hg (mercury)	1 ppm/10,000 ppm
K (potassium)	0.01%/10.00%
La (lanthanum)	10 ppm/10,000 ppm
Mg (magnesium)	0.01%/15.00%
Mn (manganese)	5 ppm/10,000 ppm
Mo (molybdenum)	1 ppm/10,000 ppm
Na (sodium)	0.01%/5.00%
Ni (nickel)	1 ppm/10,000 ppm
P (phosphorus)	10 ppm/10,000 ppm
Pb (lead)	2 ppm/10,000 ppm
Sb (antimony)	2 ppm/10,000 ppm
Sc (scandium)	1 ppm/10,000 ppm
Sr (strontium)	1 ppm/10,000 ppm
Ti (titanium)	0.01%/5.00%
Tl (thallium)	10 ppm/10,000 ppm
U (uranium)	10 ppm/10,000 ppm
V (vanadium)	1 ppm/10,000 ppm
W (tungsten)	10 ppm/10,000 ppm
Zn (zinc)	2 ppm/10,000 ppm

APPENDIX C. INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROSCOPY ANALYSES OF SAMPLES BY CHEMEX LABS, INC.--Continued

[*, less than; <, less than (lower detection limit elevated by interference from other elements); >, greater than; 1, overlimit results reported in oz/st (analytical method is fire assay); 2, overlimit results reported in % (atomic absorption analytical method used with aqua-regia digestion)]

Sample No.	Ag (Ppm)	Al (Pct)	As (Ppm)	Ba (Ppm)	Be (Ppm)	Bi (Ppm)	Ca (Pct)	Cd (Ppm)	Co (Ppm)	Cr (Ppm)	Cu (Ppm)	Fe (Pct)	Ga (Ppm)	Hg (Ppm)	K (Pct)	La (Ppm)	Mg (Pct)	Mn (Ppm)	Mo (Ppm)	Na (Pct)	Ni (Ppm)	P (Ppm)	Pb (Ppm)	Sb (Ppm)	Sc (Ppm)	Sr (Ppm)	Ti (Pct)	Tl (Ppm)	U (Ppm)	V (Ppm)	W (Ppm)	Zn (Ppm)
SC001	1.0	0.33	* 2	100	* 0.5	* 2	0.05	0.5	1	118	65	0.33	10	2	0.25	* 10	0.03	45	1	0.07	5	70	8	* 2	* 1	17	*0.01	* 10	* 10	4	* 10	6
SC002	0.8	0.26	* 2	20	* 0.5	* 2	0.02	* 0.5	1	241	38	0.38	* 10	* 1	0.15	* 10	0.01	65	5	0.05	5	40	2	* 2	* 1	4	*0.01	* 10	10	1	* 10	4
SC003	0.8	0.68	* 2	20	* 0.5	4	0.03	* 0.5	6	265	11	1.29	10	* 1	0.31	* 10	0.31	300	3	0.03	16	30	2	* 2	3	2	0.04	* 10	* 10	9	* 10	34
SC004	5.4	0.58	* 2	50	* 0.5	26	0.06	* 0.5	3	260	1737	0.79	* 10	1	0.13	* 10	0.08	180	190	0.05	7	70	4	* 2	* 1	8	0.01	* 10	10	8	* 10	28
SC005	39.2	0.19	* 2	50	0.5	140	0.03	* 0.5	2	242	> 10000	0.77	* 10	* 1	0.03	* 10	0.01	35	106	0.02	7	150	* 2	2	* 1	4	*0.01	* 10	40	6	< 50	50
SC006	8.8	1.92	25	50	* 0.5	* 2	0.95	* 0.5	39	232	451	11.23	* 10	* 1	0.03	10	1.23	1995	10	0.04	44	1480	134	5	7	53	0.31	* 10	* 10	76	* 10	336
SC007	3.2	2.78	30	50	* 0.5	* 2	2.46	* 0.5	43	80	599	7.20	* 10	* 1	0.09	20	1.49	2730	3	0.05	12	4830	262	5	13	119	0.88	* 10	* 10	116	* 10	702
SC008	2.4	1.99	20	50	1.0	2	0.09	* 0.5	11	113	120	3.87	* 10	2	0.63	30	0.30	130	12	0.03	8	320	848	5	3	13	0.01	* 10	* 10	15	* 10	244
SC009	18.8	4.86	5	110	* 0.5	56	0.15	2.0	62	48	7839	>15.00	* 10	* 1	0.36	30	0.96	3640	252	0.02	28	920	2450	5	11	115	0.04	* 10	* 10	132	< 50	2080
SC010	60.8	3.11	* 5	50	* 0.5	160	0.10	3.0	43	62	2 2.00	12.02	* 10	* 1	0.33	30	1.34	2480	52	0.03	18	400	2376	5	7	17	0.03	* 10	* 10	128	* 10	1940
SC011	20.0	0.99	* 5	150	* 0.5	200	0.05	3.0	66	327	2 1.71	4.22	* 10	* 1	0.07	10	0.34	4365	26	0.02	14	< 200	830	5	3	20	0.01	* 10	* 10	30	* 10	518
SC012	5.0	1.55	45	20	0.5	40	0.29	3.0	25	175	2421	10.15	* 10	* 1	0.12	10	0.86	1545	31	0.02	14	1630	5776	5	4	12	0.03	* 10	* 10	158	* 10	2714
SC013	44.4	2.14	105	20	* 0.5	400	0.32	3.0	65	163	2 2.80	9.34	* 10	5	0.30	20	0.52	3020	59	0.02	12	400	7762	5	8	20	0.21	* 10	* 10	482	* 10	3532
SC014	8.8	1.86	580	20	2.0	* 2	0.16	4.5	35	123	444	9.76	* 10	* 1	0.09	10	0.53	5150	17	0.05	10	370	9926	5	5	24	0.02	* 10	* 10	50	* 10	2858
SC015	10.2	2.83	10	50	2.5	< 20	1.35	22.5	25	25	2 1.86	3.13	10	* 1	0.25	20	5.75	9275	10	0.57	9	< 200	2 1.30	5	4	101	0.03	* 10	* 10	35	* 10	8910
SC016	7.0	0.43	135	20	0.5	6	0.05	3.0	17	275	398	4.70	* 10	* 1	0.03	10	0.09	1810	26	0.04	8	370	3816	5	1	51	0.01	* 10	* 10	22	* 10	1640
SC017	7.6	0.84	30	10	0.5	12	0.05	3.0	12	104	354	5.21	* 10	8	0.02	10	1.39	505	8	0.02	4	160	1150	5	5	5	0.01	* 10	* 10	29	* 10	1172
SC018	17.8	5.30	640	550	1.0	6	0.62	10.5	94	50	509	13.63	10	* 1	1.00	30	1.74	2 3.46	8	0.19	48	410	> 10000	15	19	98	0.20	* 10	* 10	123	* 10	5626
SC019	15.6	2.79	1780	220	* 0.5	10	0.15	3.5	44	75	221	9.13	10	* 1	0.57	30	0.82	2 1.75	27	0.03	33	770	> 10000	20	15	48	0.11	* 10	* 10	96	* 10	3906
SC020	7.8	2.18	2295	190	* 0.5	* 2	0.16	17.0	25	48	451	>15.00	* 10	* 1	0.49	20	0.27	6505	14	0.03	8	640	> 10000	30	13	34	0.15	* 10	* 10	105	< 50	3448
SC021	61.6	1.43	4165	40	* 0.5	* 2	0.10	17.5	17	106	255	>15.00	* 10	* 1	0.27	10	0.18	1505	9	0.02	14	750	2 1.14	40	9	54	0.06	* 10	* 10	88	< 50	3936
SC022	11.4	4.83	215	140	* 0.5	28	2.10	17.0	64	63	404	11.84	* 10	* 1	0.71	30	2.27	6200	4	0.03	61	2970	4592	5	20	73	0.58	* 10	* 10	190	* 10	2818
SC023	154.2	0.57	1545	70	* 0.5	12	0.06	2.5	23	184	282	6.03	* 10	* 1	0.08	10	0.06	1455	9	0.02	12	160	2 15.70	90	2	27	0.01	* 10	* 10	18	* 10	600
SC024	36.2	0.66	45	40	* 0.5	10	0.16	4.5	13	318	4781	2.18	* 10	* 1	0.07	10	0.34	3160	7	0.02	6	160	1456	5	1	24	*0.01	* 10	* 10	8	* 10	1126
SC025	1 39.60	2.87	110	* 10	* 0.5	540	0.04	* 0.5	21	30	2 22.40	8.25	* 10	* 1	0.06	10	0.03	135	26	0.02	* 1	< 200	6504	5	10	47	0.01	* 10	* 10	71	* 10	1984
SC026	52.8	4.00	35	80	* 0.5	2000	0.09	2.0	31	69	2 4.83	8.32	20	4	0.18	100	0.38	520	39	0.02	10	1400	1614	5	16	349	0.03	* 10	* 10	135	* 10	672
SC027	21.4	1.52	1185	20	* 0.5	* 2	0.07	* 0.5	11	82	552	13.98	* 10	2	0.16	10	0.10	1725	912	0.03	3	1480	2 2.32	60	3	11	0.03	* 10	* 10	53	* 10	1674
SC028	7.0	1.56	55	20	0.5	14	0.16	>100.0	9	96	6585	1.24	* 10	3	0.43	60	1.51	2140	22	0.02	13	270	2 1.10	5	* 1	15	*0.01	* 10	* 10	* 1	60	2 5.11
SC029	33.8	1.47	1165	10	* 0.5	* 2	0.10	0.5	18	62	1025	>15.00	* 10	* 1	0.15	10	0.16	2885	120	0.06	* 1	1520	2 4.00	90	4	11	0.01	* 10	* 10	53	< 50	4306
SC030	21.6	0.98	100	20	1.5	2	0.19	* 0.5	45	278	209	5.03	* 10	1	0.23	20	0.22	4140	31	0.02	26	2350	2 2.70	10	2	38	0.02	* 10	* 10	60	* 10	1960
SC031	11.0	0.78	85	10	* 0.5	100	0.07	* 0.5	10	164	1307	11.75	* 10	4	0.15	10	0.03	960	44	0.02	3	650	7770	15	2	21	0.02	10	* 10	104	* 10	986
SC032	21.2	2.32	200	20	* 0.5	136	0.10	* 0.5	17	204	2334	>15.00	10	* 1	0.37	50	0.11	1755	83	0.05	7	1880	2 1.67	35	5	62	0.04	* 10	* 10	279	< 50	1280
SC033	1.6	1.39	* 5	70	0.5	10	0.51	4.0	13	39	50	1.13	10	* 1	0.49	30	0.49	2975	4	0.02	3	450	468	5	2	40	0.07	* 10	* 10	5	* 10	1462
SC034	2.0	2.23	* 5	30	* 0.5	2	0.71	2.5	15	42	143	2.20	10	* 1	0.46	30	0.94	1955	4	0.03	13	940	466	5	3	39	0.06	* 10	* 10	23	* 10	4344
SC035	7.8	4.56	305	50	1.5	48	0.10	* 0.5	38	101	2445	9.37	* 10	* 1	0.73	70	1.06	2265	49	0.09	19	2250	2 1.71	5	9	96	0.03	* 10	* 10	162	* 10	6008
SC036	5.6	6.74	1370	20	1.0	140	0.10	* 0.5	19	20	2 1.17	>15.00	* 10	1	2.31	120	0.16	200	79	0.84	10	2400	2 6.04	75	8	36	0.02	* 10	* 10	296	< 50	3396
SC037	4.6	6.06	60	80	* 0.5	8	0.09	* 0.5	17	62	2516	11.90	* 10	* 1	1.63	50	0.33	800	42	0.13	* 1	2020	2 3.12	15	8	131	0.01	* 10	* 10	188	* 10	4508
SC038	19.2	1.25	1060	10	* 0.5	24	0.05	5.0	14	269	1788	11.89	* 10	3	0.30	10	0.01	140	247	0.06	9	430	2 1.80	10	2	16	*0.01	* 10	* 10	22	* 10	898
SC039	20.8	0.72	45	10	* 0.5	8	8.60	64.0	17	159	379	3.09	* 10	1	0.02	* 10	1.70	2 1.98	5	0.04	9	140	5076	5	3	81	*0.01	* 10	* 10	13	* 10	6122
SC040	12.2	3.60	30	50	* 0.5	* 2	4.46	6.0	18	174	492	6.40	10	* 1	0.21	30	0.45	2125	9	0.03	6	690	2098	5	4	58	0.07	* 10	* 10	39	* 10	2252
SC041	8.0	1.70	60	* 10	* 0.5	* 2	>15.00	>100.0	28	22	193	6.18	* 10	* 1	0.04	* 10	5.01	2 5.14	25	0.04	10	810	934	10	3	227	0.03	* 10	* 10	24	* 10	2 1.54
SC042	12.2	1.52	170	10	* 0.5	* 2	>15.00	15.0	22	11	42	6.28	* 10	* 1	0.25	* 10	5.00	2 2.80	16	0.04	7	480	5586	15	3	238	0.02	* 10	* 10	17	* 10	2486
SC043	12.2	0.52	40	* 10	* 0.5	* 2	>15.00	33.0	21	6	75	4.86	* 10	* 1	0.04	* 10	5.43	2 4.90	6	0.05	* 1	120	8162	10	2	259	0.01	* 10	* 10	2	* 10	5918
SC044	7.0	0.62	10	* 10	* 0.5	* 2	>15.00	16.0	18	8	46	3.98	* 10	* 1	0.03	* 10	6.23	2 2.85	2	0.03	4	150	3768	5	1	221	*0.01	* 10	* 10	11	* 10	2422
SC045	2.4	0.13	* 5	* 10	* 0.5	* [illegible]	>15.00	1.5	15	16	25	1.95	* 10	* 1	0.04	* 10	10.40	9865	14	0.04	* 1	70	1630	15	1	85	*0.01	10	* 10	6	* 10	278
SC046	5.8	0.29	130	190	* 0.5	* 2	>15.00	53.5	18	73	42	2.06	* 10	* 1	0.03	* 10	5.89	7940	4	0.04	* 1	150	2172	5	1	158	*0.01	* 10	* 10	15	* 10	3100
SC047	48.0	1.61	15	120	* 0.5	92	3.92	11.5	25	104	2912	4.22	* 10	1	0.45	20	1.07	4405	7	0.03	40	370	2780	35	4	53	*0.01	* 10	* 10	20	* 10	1522
SC048	1 59.70	1.28	* 5	30	* 0.5	3218	8.00	9.0	15	121	634	7.39	* 10	1	0.39	* 10	1.50	2320	4	0.03	20	3280	2 5.50	90	3	71	*0.01	* 10	* 10	35	80	1046
SC049	1 13.70	1.15	60	110	* 0.5	804	7.43	29.0	26	41	1733	>15.00	90	* 1	0.44	10	1.42	4550	11	0.06	19	2350	2 1.08	85	4	108	*0.01	* 10	* 10	73	< 50	4018
SC050	199.6	1.16	25	650	* 0.5	162	10.80	80.5	21	83	1670	6.61	* 10	* 1	0.65	* 10	1.48	2 1.60	10	0.05	11	520	8280	20	10	149	0.07	* 10	* 10	46	10	8388
SC051	7.8	2.56	105	30	* 0.5	12	1.92	3.5	44	133	902	10.84	10	* 1	0.28	30	1.49	1680	10	0.07	10	8610	1156	5	5	54	0.04	* 10	* 10	106	* 10	752
SC052	109.4	1.41	885	60	* 0.5	682	0.10	* 0.5	9	42	1594	>15.00	10	* 1	0.15	20	0.22	190	42	0.20	10	6180	4862	15	4	118	0.06	* 10	* 10	268	< 50	344
SC053	147.2	1.64	580	400	* 0.5	238	0.24	5.0	24	33	553	>15.00	* 10	* 1	1.04	20	0.76	490	9	0.12	12	3930	2 2.26	5	10	104	0.19	* 10	* 10	173	< 50	854

APPENDIX C--Santa Catalina-Rincon Mountains Unit--contin..

Sample No.	Ag (Ppm)	Al (Pct)	As (Ppm)	Ba (Ppm)	Be (Ppm)	Bi (Ppm)	Ca (Pct)	Cd (Ppm)	Co (Ppm)	Cr (Ppm)	Cu (Ppm)	Fe (Pct)	Ga (Ppm)	Hg (Ppm)	K (Pct)	La (Ppm)	Mg (Pct)	Mn (Pct)	Mo (Ppm)	Na (Pct)	Ni (Ppm)	P (Ppm)	Pb (Ppm)	Sb (Ppm)	Sc (Ppm)	Sr (Ppm)	Ti (Pct)	Tl (Ppm)	U (Ppm)	V (Ppm)	W (Ppm)	Zn (Ppm)
SC054	3.6	1.98	60	* 10	* 0.5	2	>15.00	57.5	29	2	83	1.50	* 10	* 1	0.08	* 10	3.78	5515	* 1	0.04	17	180	880	5	3	333	0.02	* 10	* 10	14	10	4880
SC055	50.8	3.00	255	110	* 0.5	86	0.18	* 0.5	13	147	201	>15.00	* 10	5	0.56	20	0.18	135	7	0.05	13	1820	2 1.10	5	13	30	0.71	* 10	* 10	556	< 50	638
SC056	72.4	4.03	270	20	* 0.5	132	0.15	* 0.5	17	132	219	7.23	* 10	* 1	0.37	10	0.68	815	7	0.07	20	1370	2 2.21	5	6	23	0.05	* 10	* 10	38	* 10	540
SC057	1 5.43	2.06	615	100	* 0.5	342	0.08	* 0.5	13	84	553	>15.00	* 10	* 1	0.86	20	0.24	165	6	0.11	8	2750	2 2.49	5	9	52	0.31	* 10	* 10	243	< 50	610
SC058	6.8	3.53	50	40	* 0.5	32	0.04	* 0.5	29	90	1034	6.60	10	1	0.10	10	3.15	1600	635	0.02	32	250	2968	5	5	15	0.02	* 10	* 10	41	* 10	7608
SC059	7.0	4.76	70	140	0.5	12	0.05	41.5	40	47	207	12.08	* 10	* 1	1.41	30	1.86	1630	25	0.04	37	2020	6750	5	20	102	0.10	* 10	* 10	210	* 10	2354
SC060	6.6	4.98	10	50	0.5	* 2	0.02	2.0	20	52	321	4.76	10	6	0.24	30	2.85	1545	93	0.04	24	380	4032	5	9	30	0.02	* 10	* 10	51	* 10	4068
SC061	0.6	2.87	5	20	0.5	4	3.26	1.5	17	63	114	2.66	10	* 1	0.31	30	4.15	1715	* 1	0.04	4	160	184	5	4	91	0.02	* 10	* 10	31	* 10	902
SC062	61.4	0.98	45	20	* 0.5	< 20	0.05	>100.0	29	367	2 1.58	3.56	10	* 1	0.21	10	0.06	360	14	0.03	48	400	2 1.32	35	1	7	*0.01	* 10	20	14	* 10	1586
SC063	124.2	1.21	60	50	* 0.5	20	0.09	56.5	30	335	512	3.96	10	* 1	0.53	10	0.33	215	15	0.03	29	860	4004	5	2	6	0.01	* 10	* 10	28	* 10	2154
SC064	61.4	1.76	45	190	0.5	8	0.30	62.5	22	379	528	3.24	10	1	0.83	30	0.37	340	20	0.04	30	1280	3354	5	3	10	0.01	* 10	* 10	32	* 10	2160
SC065	1 7.73	0.77	135	120	* 0.5	24	0.33	65.5	11	203	2784	8.40	* 10	1	0.54	30	0.10	170	13	0.04	16	2090	2 15.70	100	2	41	0.05	* 10	* 10	19	* 10	6204
SC066	37.2	0.39	75	20	* 0.5	4	0.12	53.0	21	304	493	5.60	10	* 1	0.12	10	0.03	80	17	0.04	19	440	2 1.80	10	1	17	0.02	* 10	* 10	18	* 10	3862
SC067	7.0	3.39	25	* 10	1.0	* 2	>15.00	21.0	21	32	101	3.06	* 10	* 1	0.09	* 10	6.34	6020	* 1	0.07	3	2330	1814	10	6	335	0.07	* 10	* 10	31	* 10	1994
SC068	109.6	1.95	* 5	10	0.5	14	0.77	74.0	12	142	1970	1.60	10	5	0.26	20	2.49	3655	5	0.03	5	1300	2 2.45	5	3	14	0.11	* 10	* 10	33	30	2 2.70
SC069	2.6	2.47	185	80	* 0.5	4	0.10	9.0	7	76	387	7.92	10	* 1	0.50	40	0.13	70	5	0.04	2	770	2288	5	5	216	0.01	* 10	* 10	53	* 10	362
SC070	6.6	2.15	190	130	* 0.5	16	0.07	* 0.5	10	173	1265	13.65	10	1	0.40	30	0.08	120	20	0.03	9	1360	5542	20	4	274	0.04	* 10	* 10	311	* 10	252
SC071	1 10.60	0.31	85	20	* 0.5	< 20	0.11	1.5	15	298	2 3.29	6.85	* 10	* 1	0.05	* 10	0.04	155	55	0.03	2	200	5370	45	1	9	*0.01	* 10	* 10	17	* 10	1768
SC072	144.4	1.35	760	50	* 0.5	72	0.30	5.5	25	95	5881	>15.00	* 10	* 1	0.21	20	0.06	65	4003	0.04	1	5540	2 10.70	290	2	87	*0.01	* 10	40	181	< 50	1770
SC073	1 17.40	0.49	540	60	* 0.5	160	0.06	1.0	21	71	2 2.79	>15.00	* 10	8	0.03	* 10	0.04	50	379	0.03	2	600	2 11.60	315	2	32	*0.01	* 10	40	179	< 50	902
SC074	144.6	0.64	430	20	* 0.5	78	0.23	9.5	12	120	1492	>15.00	* 10	* 1	0.08	10	0.11	130	1337	0.03	* 1	2050	2 9.52	135	2	34	*0.01	* 10	50	538	< 50	1630
SC075	20.2	1.47	40	50	1.5	2	0.22	1.5	14	249	912	4.01	10	1	0.57	40	0.15	255	104	0.03	17	2380	8394	15	3	308	0.02	* 10	* 10	33	* 10	1258
SC076	178.8	0.96	810	7900	* 0.5	40	0.11	37.0	13	180	2 3.60	11.08	* 10	14	0.13	10	0.03	50	26	0.03	12	200	5800	5830	2	232	*0.01	* 10	* 10	25	* 10	866
SC077	37.2	1.88	180	70	* 0.5	< 20	0.09	2.5	148	124	2 1.20	>15.00	* 10	* 1	0.38	30	0.13	3755	948	0.03	40	2200	2 2.53	175	5	32	0.04	* 10	* 10	62	< 50	4118
SC078	42.2	0.70	240	90	* 0.5	40	0.06	* 0.5	12	465	6166	7.80	* 10	* 1	0.17	20	0.03	175	83	0.03	15	880	7058	90	1	56	0.02	* 10	* 10	249	* 10	230
SC079	141.8	0.28	535	130	* 0.5	< 20	0.05	3.5	22	153	2 17.70	6.91	* 10	2	0.03	* 10	0.02	170	20	0.03	6	< 200	1384	1765	4	18	0.01	* 10	* 10	10	* 10	1766
SC080	3.8	2.54	20	70	1.0	4	0.27	1.5	12	46	1018	2.50	10	* 1	0.96	40	0.68	365	5	0.03	12	550	478	5	5	54	0.02	* 10	* 10	26	* 10	718
SC081	6.0	2.36	100	60	0.5	240	0.10	1.5	35	147	2 1.04	14.44	* 10	* 1	0.17	20	0.43	1310	139	0.03	11	800	1064	10	5	181	0.02	* 10	* 10	44	* 10	932
SC082	0.8	0.11	* 5	* 10	* 0.5	6	0.08	* 0.5	* 1	254	7	0.61	* 10	* 1	0.05	* 10	0.02	65	6	0.02	8	100	50	5	* 1	14	*0.01	* 10	* 10	* 1	* 10	14
SC083	1.2	0.11	10	* 10	* 0.5	* 2	0.05	* 0.5	* 1	347	1	0.71	* 10	* 1	0.04	* 10	* 0.01	65	10	0.02	13	70	172	5	* 1	5	*0.01	* 10	* 10	7	* 10	44
SC084	7.6	0.58	15	80	0.5	6	0.36	13.0	1	46	923	1.13	* 10	1	0.34	10	0.19	360	5	0.03	2	470	3676	5	1	24	*0.01	* 10	20	5	* 10	1688
SC085	1.2	0.77	* 5	140	1.0	8	5.67	2.0	8	40	17	3.05	* 10	2	0.45	50	2.65	1615	1	0.02	5	2570	78	5	6	52	*0.01	* 10	* 10	16	* 10	194
SC086	3.0	0.07	* 5	160	* 0.5	58	0.03	0.5	3	184	80	1.55	* 10	2	0.02	* 10	* 0.01	175	45	0.02	7	80	70	5	* 1	6	*0.01	10	* 10	9	* 10	104
SC087	8.0	0.38	5	30	* 0.5	6	0.08	* 0.5	3	206	89	2.31	* 10	* 1	0.25	10	0.05	190	17	0.04	5	240	188	5	1	15	*0.01	* 10	* 10	5	* 10	18
SC088	5.6	1.62	* 5	60	* 0.5	* 2	0.44	1.0	15	106	765	3.55	* 10	* 1	0.48	40	0.44	1325	4	0.09	4	1270	284	5	6	15	0.07	* 10	* 10	40	* 10	278
SC089	30.4	0.38	* 5	30	* 0.5	8	0.05	* 0.5	3	211	296	2.45	* 10	* 1	0.24	10	0.03	180	31	0.03	2	370	1100	5	* 1	9	*0.01	* 10	* 10	4	* 10	74
SC090	1.0	0.06	* 5	* 10	* 0.5	4	0.02	0.5	* 1	113	5	0.37	* 10	2	0.01	* 10	0.01	30	* 1	0.03	* 1	* 10	24	5	* 1	1	*0.01	10	10	1	* 10	14
SC091	2.4	0.82	5	140	0.5	4	0.19	* 0.5	6	187	10	2.06	10	* 1	0.58	60	0.07	890	4	0.02	12	840	10	5	3	21	*0.01	* 10	* 10	11	* 10	38
SC092	1.4	0.91	5	70	0.5	26	0.33	1.0	7	47	79	2.03	10	* 1	0.40	40	0.14	595	1	0.04	4	860	434	5	3	23	*0.01	* 10	20	15	* 10	386
SC093	3.8	0.53	* 5	50	* 0.5	* 2	0.16	0.5	4	55	93	2.57	* 10	3	0.38	10	0.07	670	6	0.02	1	590	484	5	1	13	*0.01	10	* 10	10	* 10	254
SC094	10.4	0.46	10	40	* 0.5	2	0.13	1.0	4	211	31	1.65	* 10	* 1	0.32	10	0.04	230	15	0.02	4	460	126	5	1	5	*0.01	* 10	* 10	8	* 10	54
SC095	0.8	0.85	35	70	* 0.5	* 2	2.96	* 0.5	7	175	17	2.23	* 10	* 1	0.15	10	0.53	920	2	0.05	10	350	46	5	3	59	0.01	* 10	* 10	28	* 10	44
SC096	0.4	4.54	15	70	1.0	8	1.22	0.5	43	45	51	10.42	20	* 1	0.24	10	2.49	1225	3	0.12	59	2230	88	5	17	64	0.04	* 10	* 10	175	* 10	236
SC097	2.0	0.54	10	70	* 0.5	2	0.15	* 0.5	8	220	31	1.78	10	* 1	0.24	20	0.14	440	1	0.03	10	460	164	5	2	7	*0.01	* 10	* 10	11	* 10	32
SC098	0.2	4.56	10	60	1.0	* 2	1.22	0.5	49	48	63	9.93	20	* 1	0.23	10	2.42	1010	2	0.08	74	2160	26	5	17	63	0.29	* 10	* 10	179	* 10	78
SC099	3.8	0.49	15	40	* 0.5	* 2	0.11	* 0.5	4	226	45	2.05	* 10	2	0.36	10	0.07	85	5	0.02	11	430	154	5	1	16	*0.01	* 10	* 10	10	* 10	12
SC100	8.6	0.64	15	80	* 0.5	54	0.07	* 0.5	4	62	98	4.89	* 10	2	0.44	20	0.09	80	16	0.05	6	460	220	5	2	69	0.01	10	* 10	18	* 10	20
SC101	4.2	2.14	* 5	150	* 0.5	28	0.22	* 0.5	42	120	601	6.08	* 10	8	0.84	10	0.46	515	11	0.02	15	960	86	* 5	5	25	0.02	* 10	* 10	45	* 10	94
SC102	* 0.2	6.07	* 5	180	* 0.5	22	1.55	0.5	57	62	103	11.44	* 10	2	0.18	10	2.69	1320	5	0.09	75	2420	2	5	22	56	1.26	20	* 10	226	* 10	94
SC103	1.8	1.01	* 5	60	* 0.5	* 2	0.17	1.5	3	266	146	1.72	* 10	3	0.55	30	0.14	265	3	*0.01	4	470	216	5	3	6	0.01	* 10	10	19	* 10	134
SC104	12.0	1.61	* 5	90	* 0.5	28	0.24	0.5	15	57	1359	3.75	* 10	* 1	0.79	10	0.36	465	3	0.02	* 1	1210	40	15	3	24	0.01	* 10	* 10	21	* 10	92
SC105	2.4	0.95	15	100	* 0.5	10	0.16	* 0.5	10	177	198	2.54	* 10	* 1	0.60	30	0.08	510	7	*0.01	* 1	730	102	* 5	2	18	*0.01	* 10	* 10	14	* 10	54
SC106	45.0	1.14	30	80	* 0.5	36	0.19	8.0	13	117	2725	3.67	* 10	* 1	0.71	10	0.13	130	22	*0.01	* 1	670	634	* 5	2	9	0.01	* 10	40	16	* 10	204
SC107	* 0.2	1.93	* 5	280	* 0.5	4	0.27	1.0	23	51	108	4.79	* 10	6	0.84	40	0.19	1555	19	*0.01	10	840	158	10	8	17	0.01	* 10	10	42	* 10	118
SC108	1.0	0.04	* 5	50	* 0.5	* 2	>15.00	21.0	3	102	8	0.76	* 10	* 1	0.02	20	2.74	1100	* 1	0.03	2	130	188	5	1	70	*0.01	* 10	* 10	7	1990	464
SC109	* 0.2	0.08	* 5	40	* 0.5	2	1.38	9.0	5	69	6	0.74	* 10	* 1	0.04	* 10	0.31	540	2	0.02	2	320	186	5	2	9	*0.01	* 10	10	4	3330	200
SC110	< 0.8	0.60	* 5	90	0.5	* 2	0.19	0.5	7	86	93	1.91	* 10	1	0.42	40	0.04	775	2	0.02	4	870	28	5	2	6	*0.01	* 10	* 10	11	* 10	28

APPENDIX C--Santa Catalina-Rincon Mountains Unit--contin.

Sample No.	Ag (Ppm)	Al (Pct)	As (Ppm)	Ba (Ppm)	Be (Ppm)	Bi (Ppm)	Ca (Pct)	Cd (Ppm)	Co (Ppm)	Cr (Ppm)	Cu (Ppm)	Fe (Pct)	Ga (Ppm)	Hg (Ppm)	K (Pct)	La (Ppm)	Mg (Pct)	Mn (Pct)	Mo (Ppm)	Na (Pct)	Ni (Ppm)	P (Ppm)	Pb (Ppm)	Sb (Ppm)	Sc (Ppm)	Sr (Ppm)	Ti (Pct)	Tl (Ppm)	U (Ppm)	V (Ppm)	W (Ppm)	Zn (Ppm)
SC111	10.4	0.20	*5	20	*0.5	24	0.02	*0.5	3	194	38	1.64	*10	*1	0.18	*10	0.01	55	26	0.03	5	180	550	5	*1	8	*0.01	*10	*10	3	*10	4
SC112	0.8	1.01	*5	60	0.5	*2	0.30	2.0	11	140	77	1.86	*10	*1	0.87	60	0.09	740	5	0.03	9	1240	154	5	4	7	*0.01	*10	*10	11	10	88
SC113	1.6	0.17	*5	80	*0.5	4	0.04	2.0	6	242	38	1.46	*10	3	0.11	*10	0.01	255	7	0.02	12	100	390	5	1	4	*0.01	*10	*10	7	500	238
SC114	1.6	0.91	10	80	0.5	4	0.19	1.5	30	135	92	4.70	*10	*1	0.48	10	0.11	1415	11	0.02	61	370	160	10	7	30	*0.01	10	*10	23	*10	150
SC115	0.8	0.51	*5	120	*0.5	*2	0.18	1.5	13	137	66	2.60	*10	*1	0.50	20	0.07	1135	6	0.05	20	640	284	10	4	17	*0.01	*10	*10	11	30	204
SC116	1.6	1.41	20	570	1.0	*2	0.40	2.0	45	81	148	5.22	*10	*1	0.81	10	0.34	3570	8	0.04	83	520	420	25	11	27	*0.01	*10	*10	44	130	230
SC117	< 0.8	0.95	10	80	0.5	*2	0.28	*0.5	5	116	34	2.77	*10	3	0.60	40	0.08	390	3	0.03	6	1000	52	5	4	12	*0.01	*10	*10	14	100	46
SC118	< 0.8	1.83	10	180	1.0	8	0.34	1.5	27	113	65	5.21	*10	3	0.74	40	0.54	1625	8	0.02	68	1060	76	5	12	32	*0.01	30	*10	44	270	152
SC119	< 0.8	1.00	*5	100	0.5	*2	0.24	1.0	7	125	44	2.24	*10	*1	0.71	50	0.09	770	6	0.02	6	1030	232	5	3	6	*0.01	*10	*10	12	*10	154
SC120	24.0	0.54	30	90	0.5	28	0.11	2.0	6	226	701	1.54	*10	2	0.43	20	0.03	500	11	0.02	6	560	4214	55	1	17	*0.01	*10	*10	7	*10	224
SC121	4.8	1.01	20	70	1.0	*2	0.32	5.5	8	128	192	2.23	*10	8	0.58	50	0.13	535	3	0.04	8	1010	426	50	4	9	*0.01	*10	*10	21	*10	576
SC122	5.6	0.40	5	20	*0.5	4	0.10	0.5	11	215	75	1.75	*10	1	0.23	*10	0.04	670	7	0.02	40	60	564	10	2	6	*0.01	*10	*10	22	*10	52
SC123	32.8	0.42	15	30	0.5	*2	3.27	96.0	11	202	344	2.48	*10	11	0.30	10	0.13	1055	17	0.02	32	300	2348	150	4	16	*0.01	*10	*10	50	1150	1476
SC124	0.8	0.96	10	130	0.5	*2	3.49	4.5	28	132	29	4.13	*10	2	0.52	20	0.44	2200	12	0.03	68	520	326	15	8	72	*0.01	10	*10	47	*10	280
SC125	< 0.8	1.58	15	80	0.5	*2	0.31	1.5	11	158	46	3.08	*10	3	0.60	60	0.18	640	5	0.04	7	970	308	10	5	12	0.01	10	*10	38	*10	274
SC126	0.8	0.89	10	90	0.5	*2	0.21	*0.5	10	111	69	2.86	*10	*1	0.66	50	0.07	805	3	0.03	2	790	526	5	4	7	*0.01	*10	*10	27	*10	70
SC127	1.6	0.66	15	60	*0.5	*2	0.19	4.0	12	206	70	5.53	*10	1	0.34	20	0.06	1310	408	0.02	9	600	4286	10	3	27	*0.01	*10	*10	37	*10	2314
SC128	< 0.8	0.84	*5	60	0.5	4	0.22	1.0	6	121	23	2.30	*10	3	0.57	70	0.06	560	11	0.03	8	800	490	10	4	10	*0.01	*10	*10	18	*10	354
SC129	25.6	0.27	40	40	*0.5	*2	0.75	>100.0	4	378	661	2.21	*10	*1	0.20	10	0.02	550	4	0.02	13	230	7116	65	1	16	*0.01	*10	10	5	*10	3310
SC130	1.2	0.38	15	70	*0.5	6	0.11	0.5	5	73	13	2.39	*10	*1	0.34	20	0.02	445	5	0.02	*1	420	134	5	3	5	*0.01	10	*10	11	*10	140
SC131	2.0	0.84	10	70	*0.5	4	0.18	*0.5	7	71	21	1.63	10	*1	0.27	40	0.12	230	*1	0.03	*1	350	24	5	3	8	0.01	10	*10	21	*10	30
SC132	1.2	0.90	20	180	0.5	2	0.54	0.5	14	247	14	3.55	10	*1	0.62	30	0.11	1795	11	0.02	13	940	56	5	4	24	*0.01	10	10	41	*10	56
SC133	1.4	1.24	*5	80	0.5	6	0.31	2.5	7	56	67	2.25	20	1	0.61	50	0.12	425	*1	0.02	7	1140	1472	5	4	10	0.01	*10	*10	21	*10	634
SC134	< 0.8	0.71	30	40	0.5	*2	0.07	0.5	2	64	8	0.74	10	2	0.49	30	0.04	30	2	0.02	*1	370	96	5	1	6	*0.01	*10	*10	6	*10	8
SC135	< 0.8	0.64	*5	120	0.5	*2	0.09	0.5	2	63	6	0.90	10	2	0.40	30	0.05	65	1	0.02	2	350	46	5	1	5	0.01	*10	*10	10	*10	8
SC136	< 0.8	1.02	*5	120	1.5	4	0.44	0.5	4	127	22	1.27	10	*1	0.59	40	0.11	745	1	0.03	4	830	114	5	3	11	*0.01	*10	*10	6	*10	46
SC137	< 0.8	0.72	*5	50	0.5	*2	0.44	0.5	2	161	17	0.86	10	*1	0.39	30	0.15	280	2	0.02	4	910	86	5	1	13	*0.01	*10	*10	6	*10	22
SC138	0.8	0.88	*5	50	1.0	4	0.05	2.0	3	154	25	1.58	10	1	0.49	30	0.07	35	3	0.09	1	390	298	5	1	21	*0.01	*10	*10	7	*10	42
SC139	20.8	0.18	*5	20	*0.5	160	0.05	*0.5	1	280	489	4.20	*10	1	0.10	*10	0.01	90	22	0.02	2	620	1616	10	*1	4	*0.01	*10	*10	15	*10	6
SC140	113.6	0.26	*5	20	*0.5	240	0.11	18.5	5	287	2407	1.91	*10	*1	0.20	10	0.03	105	8	0.04	7	310	7618	5	1	4	*0.01	*10	*10	3	10	342
SC141	9.6	0.15	*5	10	*0.5	74	0.04	0.5	2	287	107	0.93	*10	*1	0.13	*10	0.02	75	6	0.03	4	130	172	5	*1	2	*0.01	*10	*10	4	20	*2
SC142	0.8	1.18	*5	50	0.5	10	0.36	2.0	9	104	12	2.60	10	1	0.39	40	0.36	635	5	0.05	6	1030	150	5	4	13	*0.01	*10	*10	22	*10	114
SC143	32.8	0.07	*5	20	*0.5	4	0.01	>100.0	14	203	1794	4.60	*10	*1	0.03	*10	0.01	50	40	0.02	10	70	2 3.24	5	*1	18	*0.01	*10	*10	*1	*10	3976
SC144	1.6	1.70	*5	190	1.0	*2	0.09	1.5	30	140	55	4.14	*10	*1	0.45	10	0.83	1105	9	0.02	62	460	626	5	5	9	*0.01	*10	*10	39	110	672
SC145	2.4	0.70	*5	70	*0.5	*2	0.02	2.5	5	182	296	1.92	*10	*1	0.39	20	0.05	50	39	0.02	6	670	3100	5	1	7	*0.01	*10	*10	6	10	214
SC146	3.2	0.69	*5	80	*0.5	*2	0.02	6.5	7	180	90	2.84	*10	1	0.41	20	0.06	65	50	0.02	9	1480	654	5	1	3	*0.01	*10	*10	7	*10	170
SC147	0.8	1.60	45	20	0.5	*2	1.64	10.5	19	98	109	2.90	*10	1	0.69	30	0.63	865	50	0.01	29	750	942	5	5	39	*0.01	*10	*10	26	*10	1198
SC148	0.8	1.58	*5	180	0.5	8	3.91	*0.5	22	93	11	4.31	*10	*1	0.62	30	1.68	965	*1	0.02	20	770	6	5	11	53	*0.01	*10	*10	50	*10	88
SC149	0.8	1.13	*5	150	1.0	*2	2.91	*0.5	11	15	64	2.46	*10	*1	0.61	40	1.08	1115	*1	0.02	4	1500	*2	5	5	68	0.01	*10	*10	32	*10	44
SC150	< 0.8	0.88	*5	1200	0.5	*2	3.28	*0.5	12	31	55	1.63	*10	1	0.53	30	1.03	830	2	0.02	2	1350	28	5	3	46	*0.01	*10	*10	21	*10	38
SC151	1.6	0.57	*5	100	*0.5	*2	0.15	5.0	4	92	72	1.67	*10	*1	0.29	10	0.09	60	44	0.03	4	390	1534	5	1	6	*0.01	*10	*10	8	*10	294
SC152	5.6	0.56	5	180	*0.5	*2	0.06	>100.0	7	174	219	4.61	*10	2	0.29	10	0.05	45	186	0.02	11	370	6662	5	1	5	*0.01	*10	*10	6	*10	1400
SC153	8.8	0.37	*5	50	*0.5	*2	0.03	>100.0	3	211	285	3.33	*10	*1	0.15	*10	0.03	50	364	0.02	4	240	2 1.08	5	*1	8	*0.01	*10	*10	15	*10	1164
SC154	9.6	0.36	15	220	*0.5	12	0.10	>100.0	3	191	64	2.81	*10	*1	0.17	10	0.06	70	215	0.02	6	250	3944	5	*1	6	*0.01	*10	*10	5	*10	1382
SC155	4.8	1.07	10	250	1.0	10	0.05	3.5	13	123	122	3.19	*10	*1	0.23	10	0.06	620	57	0.02	15	1180	6044	5	1	33	*0.01	*10	*10	11	80	502
SC156	16.8	0.28	*5	90	*0.5	10	0.05	8.0	4	252	203	3.21	*10	1	0.07	*10	0.03	45	544	0.03	7	1300	8110	5	1	5	*0.01	*10	*10	5	330	400
SC157	< 0.8	0.61	*5	20	*0.5	*2	0.16	2.0	5	117	26	1.76	10	2	0.40	20	0.10	135	12	0.02	6	510	580	5	1	5	*0.01	*10	*10	8	*10	386
SC158	3.2	0.85	*5	40	2.0	2	3.94	96.0	14	84	210	3.03	10	*1	0.51	30	0.35	1015	1	0.06	6	820	1520	15	3	17	*0.01	*10	*10	22	*10	1986
SC159	4.8	0.71	15	10	*0.5	*2	0.05	2.0	3	220	111	2.55	*10	*1	0.24	*10	0.02	85	5	0.02	5	130	1132	55	*1	13	*0.01	*10	*10	5	*10	244
SC160	< 0.8	0.96	*5	130	2.0	8	0.85	7.5	7	69	19	2.35	10	1	0.54	50	0.12	1645	2	0.05	7	2420	380	5	3	19	0.01	*10	*10	15	10	86
SC161	0.8	0.45	*5	30	0.5	6	2.64	2.0	2	159	32	0.81	10	*1	0.30	30	0.09	575	2	0.02	3	2930	282	5	1	21	*0.01	*10	*10	11	30	48
SC162	< 0.8	1.17	5	170	2.0	2	4.43	3.5	13	38	19	4.46	10	1	0.70	50	0.29	4090	*1	0.22	14	1540	1082	5	7	60	0.01	*10	*10	18	280	92
SC163	8.0	0.45	25	20	0.5	4	2.14	92.0	5	148	215	1.99	*10	4	0.24	20	0.63	380	29	0.01	6	650	4162	140	2	31	*0.01	*10	*10	25	70	1048
SC164	19.2	0.93	5	50	*0.5	24	0.17	0.5	8	160	209	6.42	*10	1	0.48	30	0.08	315	21	0.03	7	960	2 2.20	5	2	7	*0.01	*10	*10	32	*10	18
SC165	3.2	0.26	*5	30	*0.5	14	0.02	0.5	4	229	30	3.32	*10	6	0.32	10	0.02	45	10	0.03	3	300	2016	10	*1	5	*0.01	*10	*10	14	*10	16
SC166	13.0	0.25	35	5000	*0.5	*2	0.08	*0.5	4	90	46	0.68	10	3	0.07	*10	0.03	175	1	0.02	5	270	2134	70	*1	58	*0.01	30	*10	25	*10	294
SC167	52.8	0.22	50	1020	*0.5	*2	0.79	30.5	7	72	108	0.94	*10	7	0.09	*10	0.41	395	93	0.02	2	440	2 1.17	125	1	19	*0.01	10	10	13	*10	1092

APPENDIX C--Santa Catalina-Rincon Mountains Unit--contin.

Sample No.	Ag (Ppm)	Al (Pct)	As (Ppm)	Ba (Ppm)	Be (Ppm)	Bi (Ppm)	Ca (Pct)	Cd (Ppm)	Co (Ppm)	Cr (Ppm)	Cu (Ppm)	Fe (Pct)	Ga (Ppm)	Hg (Ppm)	K (Pct)	La (Ppm)	Mg (Pct)	Mn (Pct)	Mo (Ppm)	Na (Pct)	Ni (Ppm)	P (Ppm)	Pb (Ppm)	Sb (Ppm)	Sc (Ppm)	Sr (Ppm)	Ti (Pct)	Tl (Ppm)	U (Ppm)	V (Ppm)	W (Ppm)	Zn (Ppm)
SC168	57.0	0.35	85	2520	* 0.5	2	0.19	9.0	4	257	173	1.38	* 10	6	0.11	* 10	0.07	270	47	0.02	10	430	8100	260	1	28	*0.01	10	10	28	* 10	1220
SC169	11.4	0.46	80	190	1.0	* 2	1.28	>100.0	44	258	361	2.24	10	5	0.11	10	0.73	1920	19	0.02	18	360	7766	15	4	7	*0.01	10	* 10	240	* 10	1540
SC170	5.6	0.92	25	110	1.0	* 2	0.09	1.0	3	32	265	2.18	* 10	* 1	0.56	20	0.03	165	2	0.02	2	460	1184	70	2	192	*0.01	10	* 10	12	40	398
SC171	2.2	0.28	10	90	* 0.5	* 2	0.93	10.0	2	300	214	1.35	* 10	* 1	0.16	10	0.02	195	2	0.02	9	60	728	355	* 1	14	*0.01	10	* 10	26	* 10	160
SC172	3.0	0.10	20	20	* 0.5	8	0.02	0.5	1	159	158	1.45	* 10	1	0.05	* 10	0.01	65	2	0.02	3	* 10	328	80	* 1	2	*0.01	10	* 10	15	* 10	250
SC173	3.0	0.64	25	200	1.0	* 2	1.37	1.0	6	92	82	2.74	* 10	* 1	0.34	10	0.04	825	2	0.02	* 1	160	212	45	2	70	*0.01	* 10	10	16	* 10	134
SC174	* 0.2	0.04	* 2	* 10	* 0.5	* 2	* 0.01	* 0.5	2	300	10	0.63	* 10	* 1	0.01	* 10	* 0.01	35	4	0.01	9	20	* 2	* 2	* 1	1	*0.01	* 10	* 10	1	* 10	* 2
SC175	8.8	0.20	4	20	* 0.5	10	0.01	* 0.5	2	291	33	1.24	* 10	* 1	0.12	* 10	0.01	50	14	0.01	9	290	1120	* 2	* 1	11	*0.01	20	* 10	3	* 10	4
SC176	41.2	0.07	4	20	* 0.5	30	* 0.01	* 0.5	10	320	252	2.26	* 10	* 1	0.02	* 10	* 0.01	50	10	0.01	9	120	1870	* 2	* 1	6	*0.01	* 10	* 10	3	* 10	6
SC177	13.0	0.25	* 2	20	* 0.5	18	0.02	* 0.5	9	220	73	2.30	* 10	* 1	0.14	* 10	0.01	45	13	0.01	9	330	784	* 2	* 1	2	*0.01	* 10	* 10	4	20	46
SC178	3.6	0.56	2	30	* 0.5	2	0.07	* 0.5	1	212	49	0.72	* 10	* 1	0.34	20	0.04	65	9	0.02	5	440	212	* 2	* 1	8	*0.01	* 10	* 10	3	* 10	14
SC179	* 0.2	0.08	2	* 10	* 0.5	* 2	* 0.01	* 0.5	1	230	4	0.75	* 10	* 1	0.03	* 10	* 0.01	45	4	0.01	7	20	4	* 2	* 1	5	*0.01	* 10	* 10	1	* 10	2
SC180	* 0.2	1.00	12	60	* 0.5	* 2	0.01	* 0.5	8	268	6	2.91	* 10	* 1	0.36	* 10	0.20	90	13	0.02	9	210	14	2	* 1	51	*0.01	* 10	* 10	12	10	36
SC181	0.8	0.23	15	20	* 0.5	* 2	0.01	* 0.5	1	97	7	1.59	* 10	2	0.14	10	0.01	20	4	0.02	2	50	4	5	* 1	36	*0.01	* 10	* 10	5	* 10	4
SC182	0.2	0.20	* 2	20	* 0.5	* 2	0.02	* 0.5	1	261	8	0.81	* 10	* 1	0.14	* 10	0.01	70	10	0.01	6	150	46	* 2	* 1	45	*0.01	* 10	* 10	3	* 10	4
SC183	0.6	0.47	* 2	60	* 0.5	* 2	0.01	* 0.5	12	213	9	3.19	* 10	* 1	0.33	* 10	0.03	40	64	0.02	7	350	96	* 2	* 1	108	*0.01	* 10	* 10	6	50	8
SC184	1.4	0.35	* 5	30	* 0.5	2	0.01	0.5	2	276	7	0.90	* 10	* 1	0.25	* 10	0.02	45	8	0.02	9	* 10	6	5	* 1	1	*0.01	20	* 10	5	* 10	6
SC185	0.2	4.84	20	300	1.0	* 2	0.91	* 0.5	51	11	35	11.05	* 10	* 1	0.37	20	3.27	2155	7	0.05	48	3260	18	10	16	39	0.02	* 10	* 10	184	* 10	210
SC186	1.0	0.73	10	90	1.0	16	0.40	* 0.5	* 1	48	5	0.99	* 10	1	0.43	40	0.07	195	2	0.02	* 1	360	* 2	5	1	7	0.01	20	* 10	6	* 10	6
SC187	1.0	1.10	15	80	1.0	2	0.10	* 0.5	4	257	22	1.62	* 10	* 1	0.49	10	0.10	50	6	0.04	10	320	58	5	1	7	0.01	* 10	* 10	8	* 10	14
SC188	6.6	0.10	5	40	* 0.5	* 2	0.01	* 0.5	2	123	4	1.61	* 10	1	0.06	* 10	0.01	30	3	0.03	* 1	* 10	60	5	* 1	1	*0.01	10	* 10	3	* 10	4
SC189	1.0	0.66	* 5	160	1.0	* 2	0.23	1.0	1	44	7	1.35	* 10	* 1	0.42	40	0.06	105	2	0.05	1	720	26	5	1	9	0.01	10	* 10	11	* 10	14
SC190	1.6	3.25	35	100	3.5	* 2	1.22	* 0.5	48	43	160	10.56	* 10	* 1	0.35	20	1.88	1425	8	0.06	37	1200	178	5	17	36	0.05	10	* 10	218	* 10	322
SC191	3.4	1.27	5	90	2.5	16	0.43	0.5	47	49	155	7.81	* 10	* 1	0.55	10	0.40	325	12	0.04	25	810	216	5	7	15	0.02	* 10	* 10	56	* 10	172
SC192	2.0	1.27	* 5	270	4.0	* 2	0.20	1.0	36	67	658	10.11	* 10	* 1	0.86	20	0.14	845	12	0.02	21	1040	128	5	12	9	0.03	20	* 10	59	* 10	284
SC193	2.0	0.15	10	>10000	0.5	* 2	0.10	* 0.5	* 1	299	170	0.90	* 10	* 1	0.09	* 10	0.04	340	4	0.03	5	30	224	5	* 1	189	*0.01	30	* 10	4	* 10	10
SC194	1.8	0.83	5	520	10.0	8	0.25	0.5	43	35	1499	7.10	* 10	* 1	0.44	20	0.19	2365	13	0.11	11	1050	4184	5	4	16	0.01	* 10	* 10	21	320	182
SC195	39.4	0.65	20	290	3.5	58	0.18	* 0.5	5	244	2291	2.71	* 10	1	0.41	10	0.05	180	12	0.02	8	680	2 1.62	5	1	14	0.01	* 10	* 10	8	50	240
SC196	2.0	1.20	10	260	2.5	8	0.30	* 0.5	25	51	766	3.86	* 10	* 1	0.41	10	0.28	1145	6	0.03	15	580	1114	5	5	17	0.01	* 10	* 10	44	* 10	100
SC197	1.4	0.37	15	50	0.5	18	0.08	* 0.5	2	225	6	1.21	* 10	* 1	0.21	30	0.06	125	4	0.02	9	260	18	5	* 1	3	0.01	30	* 10	5	* 10	14
SC198	0.6	0.91	10	10	* 0.5	* 2	8.82	5.5	16	57	20	4.48	* 10	7	0.15	20	2.27	1440	7	0.04	16	700	232	5	3	215	*0.01	* 10	* 10	33	* 10	282
SC199	25.4	0.34	15	30	* 0.5	* 2	2.55	6.0	24	198	23	7.49	* 10	1	0.20	10	0.39	1010	22	0.02	17	740	2 5.95	15	8	59	*0.01	* 10	* 10	17	* 10	626
SC200	0.6	0.77	* 5	20	* 0.5	4	0.09	0.5	3	204	17	1.55	* 10	* 1	0.02	* 10	0.56	265	6	0.03	5	100	172	5	* 1	18	0.01	* 10	* 10	10	* 10	150
SC201	< 0.8	0.09	* 5	* 10	* 0.5	* 2	>15.00	0.5	5	98	6	0.36	* 10	* 1	0.08	* 10	8.43	130	1	0.04	4	70	50	10	* 1	30	*0.01	* 10	* 10	8	10	8
SC202	< 0.8	0.08	* 5	10	* 0.5	6	>15.00	1.0	4	66	6	0.27	* 10	2	0.08	* 10	5.53	240	1	0.03	6	120	16	5	* 1	36	*0.01	* 10	* 10	6	* 10	4
SC203	< 0.8	0.34	* 5	20	* 0.5	2	14.41	1.0	6	19	6	0.98	* 10	* 1	0.22	* 10	7.93	380	1	0.03	4	120	20	10	2	34	*0.01	* 10	* 10	8	* 10	* 2
SC204	1.4	0.24	10	920	* 0.5	16	0.80	1.0	8	65	50	1.66	* 10	* 1	0.16	* 10	0.03	450	2	0.02	3	300	1170	5	* 1	154	*0.01	10	10	17	* 10	960
SC205	1.2	0.35	5	120	0.5	14	0.12	1.5	3	43	26	0.75	* 10	4	0.29	* 10	0.04	310	2	0.02	* 1	290	220	5	* 1	12	*0.01	20	* 10	5	* 10	266
SC206	0.6	1.56	15	180	0.5	* 2	0.37	8.5	29	37	982	2.34	* 10	* 1	0.53	10	0.27	1350	1	0.04	2	1360	8200	5	2	64	*0.01	* 10	* 10	45	20	2 2.86
SC207	3.4	0.48	* 5	30	0.5	4	0.16	2.5	1	43	526	0.95	* 10	* 1	0.33	10	0.05	145	1	0.04	* 1	530	6066	5	* 1	63	*0.01	10	10	6	* 10	1356
SC208	0.4	1.57	* 5	90	0.5	* 2	0.34	4.0	9	42	313	2.44	* 10	3	0.60	10	0.34	570	4	0.07	2	1060	1364	5	2	32	0.01	* 10	* 10	17	* 10	9008
SC209	0.8	1.10	* 5	160	0.5	2	0.96	4.0	8	52	474	2.20	* 10	1	0.43	20	0.33	540	1	0.06	1	880	1518	5	2	233	*0.01	* 10	* 10	25	* 10	3968
SC210	13.6	1.14	5	100	0.5	12	0.28	8.5	10	111	1498	1.79	10	23	0.44	10	0.19	355	2	0.03	3	990	2 2.92	5	1	413	*0.01	* 10	* 10	17	10	2 1.34
SC211	6.6	0.92	* 5	260	0.5	14	0.27	7.5	23	97	1034	1.77	* 10	3	0.29	10	0.17	725	6	0.05	4	530	2 3.45	5	1	681	*0.01	10	* 10	343	20	2 1.79
SC212	1.4	0.18	15	30	* 0.5	8	0.02	* 0.5	3	264	21	1.16	* 10	1	0.05	* 10	0.03	75	6	0.02	12	50	22	5	* 1	9	*0.01	10	* 10	6	* 10	56
SC213	9.0	0.54	15	330	1.0	12	0.54	36.0	1	43	722	1.30	* 10	1	0.41	10	0.13	335	3	0.02	1	430	2196	5	1	26	*0.01	10	* 10	5	* 10	4730
SC214	1.6	0.10	10	20	* 0.5	18	0.11	* 0.5	4	222	13	1.17	* 10	4	0.01	* 10	0.05	240	6	0.01	9	230	4	5	* 1	6	*0.01	30	* 10	7	* 10	48
SC215	< 0.8	2.66	* 5	50	16.5	64	1.42	* 0.5	25	95	684	4.08	* 10	* 1	0.71	20	1.79	4430	28	0.03	3	1810	712	5	4	38	0.25	* 10	* 10	47	20	238
SC216	< 0.8	3.14	15	10	12.0	120	11.12	0.5	103	64	2 1.79	6.42	* 10	* 1	0.26	* 10	0.97	4520	2	0.03	18	400	482	10	6	13	0.06	* 10	* 10	111	< 50	1284
SC217	29.6	1.21	5	* 10	2.5	120	4.67	2.5	31	169	2 1.35	5.66	* 10	* 1	0.05	10	0.67	1845	58	0.02	12	200	250	10	3	6	0.02	* 10	* 10	35	100	1554
SC218	53.2	2.19	* 5	70	4.0	160	2.71	19.5	24	222	2 0.98	3.80	20	* 1	1.10	20	1.99	1355	68	0.05	16	800	7870	5	3	87	0.17	* 10	* 10	23	< 50	486
SC219	6.4	1.96	* 5	50	5.5	36	2.79	10.0	13	103	2848	2.39	30	* 1	1.00	20	2.18	1250	27	0.06	9	1430	422	5	2	73	0.21	* 10	* 10	14	* 10	330
SC220	1.6	1.15	* 5	70	3.5	16	0.68	0.5	16	269	431	2.17	20	* 1	0.46	10	0.41	440	136	0.04	11	520	430	5	2	22	0.05	* 10	* 10	17	340	50
SC221	< 0.8	1.61	* 5	30	4.0	14	0.72	0.5	13	210	78	2.04	30	* 1	0.60	10	0.82	590	9	0.06	10	620	110	5	3	22	0.15	* 10	* 10	36	550	80
SC222	< 0.8	2.27	5	40	2.5	4	1.81	* 0.5	15	53	136	3.16	* 10	* 1	0.62	10	1.53	1150	4	0.07	13	870	14	5	6	55	0.22	10	* 10	76	* 10	110
SC223	4.0	0.29	* 5	20	* 0.5	50	0.41	0.5	2	282	190	0.60	10	* 1	0.06	* 10	0.09	275	63	0.04	8	150	294	5	1	10	0.01	* 10	* 10	6	950	28
SC224	8.0	0.55	* 5	60	1.0	62	0.29	0.5	6	354	715	1.89	10	* 1	0.22	10	0.11	365	99	0.03	10	120	968	5	1	5	0.01	* 10	* 10	7	1610	84

APPENDIX C—Santa Catalina-Rincon Mountains Unit—contin.

Sample No.	Ag (Ppm)	Al (Pct)	As (Ppm)	Ba (Ppm)	Be (Ppm)	Bi (Ppm)	Ca (Pct)	Cd (Ppm)	Co (Ppm)	Cr (Ppm)	Cu (Ppm)	Fe (Pct)	Ga (Ppm)	Hg (Ppm)	K (Pct)	La (Ppm)	Mg (Pct)	Mn (Pct)	Mo (Ppm)	Na (Pct)	Ni (Ppm)	P (Ppm)	Pb (Ppm)	Sb (Ppm)	Sc (Ppm)	Sr (Ppm)	Ti (Pct)	Tl (Ppm)	U (Ppm)	V (Ppm)	W (Ppm)	Zn (Ppm)
SC225	1.6	1.97	10	60	0.5	28	0.75	* 0.5	27	258	221	3.35	* 10	4	0.48	10	0.78	760	33	0.06	20	590	54	5	3	60	0.16	* 10	* 10	32	210	66
SC226	4.0	1.54	20	40	3.5	32	0.35	* 0.5	20	120	293	7.85	* 10	* 1	0.61	10	0.47	675	140	0.09	7	660	42	5	3	23	0.05	* 10	* 10	39	430	58
SC227	1.6	2.63	15	80	* 0.5	14	1.97	* 0.5	26	80	305	3.05	* 10	* 1	1.41	20	1.56	675	6	0.08	18	990	40	5	4	114	0.31	* 10	* 10	52	50	104
SC228	3.8	2.95	10	70	21.0	6	2.02	3.0	14	62	2053	5.72	* 10	* 1	0.90	10	2.53	2255	2	0.03	23	590	76	15	3	93	0.12	10	* 10	57	120	440
SC229	1.0	0.98	* 5	20	0.5	18	0.83	1.0	3	183	42	0.83	* 10	1	0.12	10	0.21	600	34	0.02	10	90	392	5	1	44	0.15	* 10	* 10	22	50	198
SC230	* 0.2	1.22	* 5	50	3.5	* 2	2.01	1.0	10	61	28	1.13	* 10	* 1	0.16	10	0.70	1395	9	0.03	4	830	* 2	5	3	68	0.15	* 10	10	23	3910	496
SC231	3.2	2.44	10	70	3.0	30	3.22	0.5	12	144	25	2.33	* 10	* 1	1.38	10	2.18	1925	9	0.03	16	700	288	10	3	81	0.18	20	* 10	33	2010	348
SC232	8.0	2.22	10	40	23.0	68	2.80	1.0	13	99	4222	2.18	20	* 1	0.80	30	1.12	1020	2	0.02	19	450	12	5	3	57	0.20	* 10	* 10	40	* 10	144
SC233	0.6	0.46	5	* 10	* 0.5	4	0.03	* 0.5	* 1	47	24	0.21	* 10	1	0.14	* 10	0.01	105	2	0.07	* 1	80	8	5	* 1	1	*0.01	* 10	10	2	* 10	8
SC234	0.4	0.93	15	20	0.5	* 2	0.03	* 0.5	5	142	81	0.71	* 10	1	0.22	* 10	0.05	455	7	0.10	2	* 10	86	5	* 1	3	0.01	* 10	10	4	* 10	22
SC235	1.0	0.79	5	* 10	* 0.5	* 2	0.04	* 0.5	* 1	53	35	0.33	* 10	* 1	0.10	* 10	0.04	485	1	0.11	* 1	* 10	154	5	* 1	6	*0.01	10	10	3	* 10	10
SC236	< 0.8	3.04	* 5	10	7.0	88	>15.00	3.0	7	117	2523	1.37	30	* 1	* 0.01	* 10	0.41	790	16	0.04	10	1200	16	5	6	57	0.18	* 10	* 10	36	* 10	612
SC237	< 0.8	1.69	* 5	30	11.0	< 20	8.31	5.5	28	82	> 10000	>15.00	90	* 1	0.04	10	0.23	2 1.95	6	0.03	2	1200	* 2	15	4	22	0.01	* 10	* 10	74	< 50	966
SC238	< 0.8	2.88	25	10	22.5	* 2	>15.00	2.0	32	75	8954	11.50	60	* 1	0.03	* 10	0.25	2 4.32	11	0.04	10	6540	60	5	4	14	0.02	* 10	* 10	30	* 10	926
SC239	< 0.8	3.13	10	* 10	17.0	* 2	>15.00	1.0	21	117	6333	14.74	70	* 1	0.03	* 10	0.18	2 3.68	88	0.03	9	1950	2	5	4	* 1	0.04	* 10	* 10	29	* 10	480
SC240	< 0.8	2.26	10	60	11.5	* 2	4.95	0.5	21	47	2010	10.91	50	* 1	0.83	20	0.43	6880	11	0.25	11	6160	14	5	2	33	0.03	* 10	* 10	29	* 10	496
SC241	< 0.8	1.96	5	80	3.0	< 20	5.48	1.5	39	182	2 2.27	6.58	40	* 1	0.80	20	1.91	1800	29	0.06	13	1800	* 2	5	4	192	0.10	* 10	* 10	46	< 50	646
SC242	< 0.8	1.80	* 5	40	2.5	* 2	4.91	1.0	19	230	1751	4.14	40	* 1	0.03	20	0.10	4795	10	0.03	10	1790	6	5	4	48	0.10	* 10	* 10	30	* 10	146
SC243	< 0.8	2.36	* 5	120	0.5	2	4.94	1.5	11	152	594	2.68	30	* 1	0.40	20	0.54	1665	7	0.05	13	790	2	5	5	40	0.29	* 10	* 10	43	* 10	118
SC244	< 0.8	2.73	35	140	12.0	* 2	>15.00	4.0	32	72	4736	7.12	30	* 1	0.54	* 10	1.98	2 1.96	33	0.03	18	1110	* 2	10	5	68	0.08	* 10	* 10	45	* 10	1230
SC245	1.6	3.39	200	70	13.5	* 2	14.20	8.0	14	48	7829	>15.00	80	* 1	0.08	* 10	0.72	2 2.72	108	0.03	6	720	8	10	3	382	0.01	* 10	* 10	55	< 50	1788
SC246	< 0.8	2.85	70	10	3.5	* 2	>15.00	4.0	17	66	8626	14.06	80	* 1	0.05	* 10	0.56	>10000	37	0.01	1	440	* 2	5	3	19	0.01	* 10	* 10	36	* 10	1696
SC247	< 0.8	2.92	90	10	6.5	< 20	>15.00	4.0	23	64	2 1.47	13.07	90	* 1	* 0.01	* 10	0.38	2 2.85	81	0.01	9	600	* 2	5	3	67	0.02	* 10	* 10	45	< 50	1296
SC248	4.0	2.10	85	50	48.0	< 20	5.35	10.0	52	41	2 7.18	>15.00	70	* 1	0.12	30	0.72	2 1.90	244	0.04	9	400	* 2	10	4	82	*0.01	* 10	* 10	60	< 50	4096
SC249	< 0.8	0.20	5	30	1.5	14	>15.00	* 0.5	2	41	44	0.30	* 10	* 1	0.04	* 10	0.35	1940	4	0.02	9	310	* 2	5	2	287	0.01	* 10	* 10	7	* 10	56
SC250	< 0.8	1.88	25	40	4.0	6	2.46	* 0.5	11	206	1048	1.66	20	* 1	0.33	20	1.23	385	7	0.04	31	740	* 2	5	7	55	0.15	* 10	* 10	48	* 10	326
SC251	< 0.8	2.11	* 5	60	34.5	26	>15.00	0.5	4	70	57	0.69	* 10	* 1	0.11	* 10	1.22	825	* 1	0.03	18	720	4	5	3	98	0.10	* 10	* 10	19	* 10	510
SC252	1.6	2.81	70	10	10.0	< 20	>15.00	5.0	20	85	2 1.32	13.76	70	* 1	0.03	* 10	0.39	2 3.45	66	0.01	13	600	8	5	3	23	0.02	* 10	* 10	42	< 50	1396
SC253	< 0.8	3.76	30	80	7.0	4	5.96	0.5	12	69	1111	3.03	30	* 1	1.98	30	0.81	2 1.89	95	0.41	13	430	24	5	4	141	0.09	* 10	* 10	16	* 10	722
SC254	< 0.8	1.99	* 5	70	5.5	* 2	1.90	0.5	40	188	5652	6.89	20	* 1	0.11	20	0.47	3480	199	0.03	11	1560	10	5	4	20	0.13	* 10	* 10	53	* 10	394
SC255	< 0.8	0.71	* 5	10	5.5	< 20	1.23	3.0	64	240	2 2.45	7.62	10	* 1	0.04	10	0.09	545	157	0.02	11	800	10	5	2	9	0.05	* 10	* 10	48	< 50	642
SC256	< 0.8	4.18	5	* 10	18.0	* 2	>15.00	2.0	10	111	1681	8.50	60	* 1	0.02	* 10	0.26	2 3.66	16	0.04	13	470	20	5	5	58	0.08	* 10	* 10	52	* 10	630
SC257	< 0.8	3.22	* 5	10	12.5	* 2	10.35	1.5	9	178	767	3.13	50	* 1	0.26	10	0.49	8710	13	0.10	17	350	* 2	5	5	37	0.19	* 10	* 10	45	* 10	458
SC258	< 0.8	0.20	* 5	10	* 0.5	4	0.22	* 0.5	4	457	111	0.74	* 10	* 1	0.03	* 10	0.02	215	6	0.03	8	200	12	5	* 1	13	*0.01	* 10	* 10	6	* 10	16
SC259	< 0.8	1.84	* 5	130	13.5	4	0.90	1.0	21	187	433	9.28	20	* 1	0.78	20	0.26	1230	194	0.03	10	1260	20	5	4	229	0.06	* 10	* 10	81	270	120
SC260	< 0.8	0.48	20	70	* 0.5	* 2	0.13	* 0.5	3	131	360	0.78	* 10	* 1	0.19	* 10	0.08	275	3	0.08	7	120	12	5	* 1	16	*0.01	* 10	* 10	3	* 10	36
SC261	< 0.8	1.49	5	10	1.0	26	>15.00	5.5	8	21	6546	1.83	10	* 1	0.16	* 10	3.48	3690	173	0.02	2	420	4	5	4	88	0.04	* 10	* 10	21	* 10	1684
SC262	5.6	2.32	20	30	0.5	6	8.81	6.5	21	172	9619	3.90	20	* 1	0.18	10	2.80	3195	183	0.01	56	860	18	5	6	46	0.13	* 10	* 10	62	* 10	1414
SC263	0.8	1.64	5	* 10	1.0	* 2	7.40	8.0	6	224	2401	3.23	30	* 1	* 0.01	10	0.20	5455	16	*0.01	12	750	* 2	5	2	27	0.05	* 10	* 10	34	* 10	2022
SC264	< 0.8	0.24	* 5	10	0.5	140	>15.00	2.0	6	22	91	0.24	* 10	* 1	0.10	* 10	4.86	805	114	0.01	3	140	88	5	2	121	*0.01	* 10	10	6	* 10	206
SC265	9.4	0.78	* 5	20	* 0.5	< 20	3.01	7.5	16	197	2 2.28	3.92	20	* 1	0.10	20	0.66	1325	727	*0.01	12	200	14	10	2	19	0.03	* 10	* 10	8	< 50	1144
SC266	< 0.8	2.66	* 5	30	1.5	* 2	>15.00	5.5	12	69	2232	5.23	40	* 1	0.04	* 10	1.59	>10000	54	0.03	12	790	* 2	5	3	58	0.06	* 10	* 10	55	* 10	2844
SC267	< 0.8	0.52	* 5	20	* 0.5	* 2	0.31	* 0.5	1	86	192	0.38	* 10	1	0.16	10	0.10	135	3	0.05	2	130	8	5	* 1	7	*0.01	* 10	* 10	3	* 10	42
SC268	< 0.8	6.16	60	110	1.5	* 2	1.68	* 0.5	47	373	118	8.84	30	* 1	3.50	30	4.26	3910	2	0.05	125	780	14	5	23	46	0.26	* 10	* 10	178	* 10	424

APPENDIX D. Analyses of rock-chip samples by Bondar-Clegg and Co., Ltd., using neutron activation analysis method, Santa Catalina-Rincon Mountains Unit, Coronado National Forest, Arizona.

Element	Detection limit [lower/upper (if applicable)]
Ag (silver)	5 ppm/ -
As (arsenic)	1 ppm/ -
Au (gold)	5 ppb/ -
Ba (barium)	100 ppm/ -
Br (bromine)	1 ppm/ -
Cd (cadmium)	10 ppm/ -
Ce (cerium)	10 ppm/ -
Co (cobalt)	10 ppm/ -
Cr (chromium)	50 ppm/ -
Cs (cesium)	1 ppm/ -
Eu (europium)	2 ppm/ -
Fe (iron)	0.5%/ -
Hf (hafnium)	2 ppm/ -
Ir (iridium)	100 ppb/ -
La (lanthanum)	5 ppm/ -
Lu (lutetium)	0.5 ppm/ -
Mo (molybdenum)	2 ppm/ -
Na (sodium)	0.05%/ -
Ni (nickel)	20 ppm/ -
Rb (rubidium)	10 ppm/ -
Sb (antimony)	0.2 ppm/ -
Sc (scandium)	0.5 ppm/ -
Se (selenium)	10 ppm/ -
Sm (samarium)	0.2 ppm/ -
Sn (tin)	200 ppm/ -
Ta (tantalum)	1 ppm/ -
Tb (terbium)	1 ppm/ -
Te (tellurium)	20 ppm/ -
Th (thorium)	0.5 ppm/ -
U (uranium)	0.5 ppm/ -
W (tungsten)	2 ppm/ -
Yb (ytterbium)	5 ppm/ -
Zn (zinc)	200 ppm/30,000 ppm
Zr (zirconium)	500 ppm

APPENDIX D. NEUTRON ACTIVATION ANALYSES OF SAMPLES BY BONDAR-CLEGG AND CO., LTD. INC.--Continued

[*, less than; <, less than, for lower detection limits elevated by interference from other elements; >, greater than; #, no result; 1, overlimit result by fire assay in oz/st]

Sample No.	Ag (Ppm)	As (Ppm)	Au (Ppb)	Ba (Ppm)	Br (Ppm)	Cd (Ppm)	Ce (Ppm)	Co (Ppm)	Cr (Ppm)	Cs (Ppm)	Eu (Ppm)	Fe (Pct)	Hf (Ppm)	Ir (Ppb)	La (Ppm)	Lu (Ppm)	Mo (Ppm)	Na (Pct)	Ni (Ppm)	Rb (Ppm)	Sb (Ppm)	Sc (Ppm)	Se (Ppm)	Sm (Ppm)	Sn (Ppm)	Ta (Ppm)	Tb (Ppm)	Te (Ppm)	Th (Ppm)	U (Ppm)	W (Ppm)	Yb (Ppm)	Zn (Ppm)	Zr (Ppm)
SC001	*5	*1	*5	2700	*1	*10	*10	*10	190	2	*2	*0.5	*2	*100	*5	*0.5	*2	2.20	*20	220	*0.2	*0.5	*10	0.3	*200	*1	*1	*20	1.5	0.6	*2	*5	*200	*500
SC002	*5	*1	*5	340	*1	*10	*10	*10	390	2	*2	*0.5	*2	*100	*5	*0.5	5	1.30	*20	210	*0.2	0.9	*10	0.8	*200	*1	*1	*20	1.6	0.8	2	*5	*200	*500
SC003	*5	*1	*.5	130	*1	*10	14	*10	440	2	*2	1.4	*2	*100	6	*0.5	3	0.71	28	79	*0.2	4.6	*10	1.5	*200	*1	*1	*20	2.5	1.0	*2	*5	*200	*500
SC004	*5	2	160	240	*1	*10	19	*10	410	4	*2	0.8	*2	*100	9	*0.5	160	1.50	*20	65	*0.2	1.2	*10	1.2	*200	2	*1	*20	0.5	4.9	*2	*5	*200	*500
SC005	46	2	628	*100	*1	*10	*10	*10	470	3	*2	0.8	*2	*100	*5	*0.5	100	0.48	*20	14	*0.2	*0.5	*10	<0.5	*200	*1	*1	*20	*0.5	18.0	5	*5	*200	*500
SC006	*5	5	9	120	*1	*10	13	43	330	2	*2	10.0	*2	*100	7	*0.5	10	0.30	*50	26	3.4	10.0	*10	3.2	*200	*1	*1	*20	0.8	*0.5	14	*5	230	*500
SC007	*5	12	*.5	130	3	*10	49	46	140	3	2	9.1	5	*100	26	0.8	5	0.78	*50	14	13.0	29.0	*10	11.0	*200	1	2	*20	1.8	0.7	11	5	710	*500
SC008	*5	35	9	500	*1	*10	82	*10	170	6	*2	3.4	11	*100	40	0.9	10	0.28	*50	92	1.9	9.3	*10	8.6	*200	1	2	*20	11.0	3.6	*2	6	*200	*500
SC009	21	43	81	510	*1	*10	53	67	84	12	*2	>10.0	9	*100	34	0.8	284	0.10	*50	150	6.2	20.0	*10	4.8	*200	*1	1	*20	7.4	3.6	9	6	1600	*500
SC010	>50	26	23	540	*1	*10	68	51	130	4	*2	>10.0	8	*100	39	0.8	57	0.08	*50	90	3.3	16.0	*10	8.5	*200	*1	1	*20	6.2	4.3	12	5	1600	560
SC011	20	8	35	300	*1	*10	10	66	470	*1	*2	3.7	4	*100	7	*0.5	33	*0.05	*50	30	1.2	3.5	*10	1.5	*200	*1	*1	*20	2.0	1.5	9	*5	320	*500
SC012	*5	48	25	340	*1	*10	25	25	300	2	*2	9.2	6	*100	18	*0.5	36	0.07	*50	56	7.1	6.4	*10	5.7	*200	*1	1	*20	3.7	3.6	9	*5	2300	*500
SC013	47	122	95	120	*1	*10	10	67	210	3	*2	8.2	7	*100	19	0.9	62	*0.05	*50	49	9.0	13.0	*10	5.5	*200	*1	*1	*20	3.8	3.7	13	*5	2800	*500
SC014	11	587	1070	*100	3	*10	10	26	140	*1	*2	8.9	*2	*100	12	*0.5	17	0.06	*50	*10	8.6	4.8	*10	3.9	*200	*1	1	*20	1.8	2.0	6	6	2300	*500
SC015	10	32	38	*100	86	15	10	14	50	*1	*2	3.7	*2	*100	16	0.5	11	0.57	*50	*10	5.2	3.9	*10	4.5	*200	*1	*1	*20	2.0	1.7	4	*5	7300	*500
SC016	*5	135	400	*100	*1	*10	18	10	360	*1	*2	3.8	4	*100	11	*0.5	31	*0.05	*50	*10	9.5	3.0	*10	3.1	*200	*1	*1	*20	2.3	1.8	31	*5	1200	*500
SC017	9	26	40	*100	1	*10	18	*10	110	*1	*2	4.8	*2	*100	11	*0.5	9	0.07	*50	*10	13.0	5.9	*10	3.1	*200	*1	*1	*20	0.6	2.8	*2	*5	970	*500
SC018	17	659	120	560	20	15	80	100	120	27	2	>10.0	4	*100	28	1.5	14	0.24	75	120	22.5	22.0	*10	17.0	*200	*1	3	*20	5.2	7.3	9	9	4800	*500
SC019	*5	1690	628	500	5	*10	72	47	*50	6	2	8.3	*2	*100	32	1.3	33	0.14	*50	140	45.5	21.0	*10	10.0	*200	*1	*1	<46	5.2	4.6	6	12	3200	*500
SC020	*5	2270	1940	420	6	13	29	27	150	5	*2	>10.0	*2	*100	23	*0.5	12	0.08	*50	95	30.4	18.0	*10	6.4	*200	*1	*1	<52	4.9	3.4	6	*5	3000	*500
SC021	>50	4100	4500	*100	13	16	41	*10	190	2	*2	>10.0	*2	*100	13	*0.5	13	*0.05	*50	*10	51.6	10.0	*10	3.4	*200	*1	*1	<77	3.3	2.1	*2	15	3300	*500
SC022	19	221	170	530	2	12	55	68	110	13	3	>10.0	4	*100	26	1.1	4	0.58	78	97	17.0	34.0	*10	9.2	*200	1	2	*20	3.5	2.7	10	6	2200	*500
SC023	>50	1490	1050	*100	7	*10	29	18	380	*1	2	5.2	*2	*100	11	0.6	12	*0.05	*50	18	132.0	2.5	*10	0.9	*200	*1	*1	<55	1.1	0.7	*2	*5	460	*500
SC024	36	76	100	180	3	*10	10	*10	430	*1	*2	1.7	*2	*100	8	*0.5	9	*0.05	*50	20	3.5	1.5	*10	1.7	*200	*1	*1	*20	0.8	0.8	5	*5	790	*500
SC025	>50	132	310	*100	120	*10	49	*10	100	*1	*2	6.4	*2	*100	19	0.7	35	*0.05	*50	*10	18.0	5.4	*10	1.8	*200	*1	*1	70	3.7	10.0	15	*5	780	*500
SC026	>50	47	120	170	*1	*10	250	32	120	4	5	7.7	15	*100	120	1.8	47	0.09	*50	37	6.7	27.0	*10	30.9	*200	2	5	*20	12.0	7.2	17	12	360	*500
SC027	36	1150	3670	180	7	*10	23	*10	93	1	3	>10.0	*2	*100	19	*0.5	885	*0.05	*50	14	87.9	4.1	*10	2.7	*200	*1	*1	*20	1.4	2.9	7	*5	1300	*500
SC028	13	22	28	230	*1	300	43	*10	170	4	*2	1.0	*2	*100	55	0.7	20	0.08	*50	87	2.8	0.8	*10	15.0	*200	*1	3	*20	1.8	1.2	*2	5	>20000	*500
SC029	48	1170	821	*100	7	13	29	16	140	*1	*2	>10.0	*2	*100	15	*0.5	120	0.05	*50	*10	156.0	4.2	*10	2.2	*200	*1	*1	<55	3.3	4.6	9	8	3200	*500
SC030	25	74	530	*100	2	*10	45	52	440	3	*2	4.3	10	*100	22	0.5	33	*0.05	*50	30	18.0	4.1	*10	4.2	*200	1	*1	*20	6.4	5.7	8	*5	1600	600
SC031	19	61	110	*100	*1	*10	10	*10	290	1	*2	>10.0	13	*100	13	0.5	51	*0.05	*50	14	26.7	4.0	*10	2.4	*200	1	*1	*20	12.0	5.6	27	*5	830	530
SC032	29	181	100	*100	2	*10	82	10	330	2	*2	>10.0	25	*100	60	1.6	92	0.07	*50	*10	54.7	9.2	*10	7.3	*200	3	1	*20	17.0	8.7	71	11	1000	1100
SC033	*5	4	6	1400	*1	*10	87	10	83	6	*2	1.7	6	*100	45	*0.5	6	0.29	*50	210	2.7	5.2	*10	5.7	*200	2	*1	*20	21.0	5.0	3	*5	1200	*500
SC034	*5	5	6	1200	*1	*10	76	12	91	6	*2	2.8	6	*100	44	*0.5	3	0.32	*50	240	3.1	7.4	*10	5.7	*200	2	*1	*20	18.0	4.6	3	*5	3800	*500
SC035	13	269	110	790	2	*10	87	34	120	4	*2	8.5	12	*100	85	0.9	56	0.17	*50	89	18.0	14.0	*10	6.1	*200	2	1	85	13.0	6.9	11	*5	5200	500
SC036	*5	1260	1250	*100	6	*10	86	*10	68	1	4	>10.0	36	*100	140	0.8	85	0.90	*50	43	144.0	11.0	27	5.9	*200	3	*1	530	19.0	10.0	55	8	2800	1500
SC037	9	102	370	160	*1	*10	71	11	130	*1	*2	>10.0	12	*100	71	0.9	44	0.23	*50	32	27.3	18.0	*10	4.5	*200	2	*1	31	17.0	4.6	15	5	5200	600
SC038	16	969	210	*100	3	*10	21	*10	410	*1	*2	10.0	8	*100	11	*0.5	241	0.06	*50	*10	30.7	2.3	*10	1.4	*200	*1	*1	*20	4.6	2.2	43	*5	600	*500
SC039	18	13	34	*100	1	49	17	11	190	*1	*2	3.1	*2	*100	11	*0.5	6	0.07	*50	*10	6.0	2.6	*10	2.5	*200	*1	*1	*20	0.8	2.9	2	*5	5300	*500
SC040	13	53	63	*100	2	*10	32	16	200	3	*2	6.4	21	*100	24	0.5	11	*0.05	*50	26	4.0	6.5	*10	2.5	*200	2	*1	*20	10.0	9.2	19	5	1900	1100
SC041	6	64	95	*100	*1	96	10	11	*50	*1	*2	6.0	*2	*100	10	*0.5	31	0.08	*50	*10	3.0	2.7	*10	2.6	*200	*1	*1	*20	3.0	2.9	3	*5	14000	*500
SC042	14	139	170	*100	*1	14	26	*10	*50	4	*2	6.6	3	*100	11	*0.5	19	0.08	*50	20	8.4	3.4	*10	2.5	*200	*1	*1	*20	3.7	3.9	4	*5	2200	*500
SC043	12	57	70	*100	*1	29	16	*10	*50	*1	*2	5.6	*2	*100	8	*0.5	8	0.10	*50	*10	10.0	1.3	*10	2.4	*200	*1	*1	*20	1.5	1.4	4	*5	5700	*500
SC044	10	27	43	*100	*1	15	11	*10	*50	2	*2	4.4	*2	*100	*5	*0.5	4	0.08	*50	*10	4.6	1.0	*10	1.4	*200	*1	*1	*20	1.0	1.0	3	*5	2200	*500
SC045	5	15	17	*100	2	*10	10	*10	*50	*1	*2	1.9	*2	*100	*5	*0.5	16	0.12	*50	*10	4.7	*0.5	*10	0.7	*200	*1	*1	*20	0.5	1.1	*2	*5	*200	*500
SC046	6	105	37	180	*1	45	10	*10	89	*1	*2	2.1	*2	*100	*5	*0.5	5	0.08	*50	*10	6.3	0.6	*10	1.1	*200	*1	*1	*20	*0.5	1.5	*2	*5	2800	*500
SC047	46	24	110	790	3	*10	60	22	130	10	*2	3.6	*2	*100	24	*0.5	7	0.07	*50	68	93.8	7.8	*10	6.7	*200	*1	1	*20	14.0	8.2	26	*5	1200	*500
SC048	>50	28	2090	170	3	*10	100	15	130	2	5	6.4	*2	*100	39	0.9	10	0.06	66	47	164.0	1.8	*10	16.0	*200	1	*1	*20	20.0	11.0	36	13	830	*500
SC049	>50	35	829	*100	6	22	62	20	84	3	6	>10.0	*2	*100	28	1.0	7	0.09	*50	17	196.0	4.1	*10	21.7	*200	*1	4	*20	31.0	12.0	15	13	3500	*500
SC050	>50	49	150	1500	11	64	18	13	110	3	*2	6.1	3	*100	9	*0.5	12	0.08	*50	28	41.0	16.0	*10	2.9	*200	*1	*1	*20	5.7	8.1	7	*5	7200	*500
SC051	*5	118	32	*100	*1	*10	34	65	180	2	*2	10.0	3	*100	18	0.5	7	0.06	*50	29	3.0	5.6	*10	5.6	*200	*1	*1	*20	3.9	2.8	5	*5	550	*500
SC052	>50	821	44	*100	4	*10	31	*10	*50	*1	*2	>10.0	*2	*100	21	*0.5	30	0.17	*50	*10	1.7	4.0	74	5.4	*200	*1	*1	52	6.3	2.3	7	*5	*200	*500
SC053	>50	535	200	920	7	*10	66	16	*50	3	*2	>10.0	5	*100	26	0.7	10	0.19	*50	94	21.0	11.0	18	5.9	*200	*1	*1	76	5.0	5.0	*2	*5	680	*500
SC054	*5	12	6	*100	*1	49	22	21	*50	*1	*2	1.9	*2	*100	8	0.7	2	0.09	*50	*10	1.5	3.3	*10	5.7	*200	*1	1	*20	0.7	1.3	*2	*5	4200	*500

APPENDIX D. NEUTRON ACTIVATION ANALYSES OF SAMPLES BY BONDAR-CLEGG AND CO., LTD.--Continued

Sample No.	Ag (Ppm)	As (Ppm)	Au (Ppb)	Ba (Ppm)	Br (Ppm)	Cd (Ppm)	Ce (Ppm)	Co (Ppm)	Cr (Ppm)	Cs (Ppm)	Eu (Ppm)	Fe (Pct)	Hf (Ppm)	Ir (Ppb)	La (Ppm)	Lu (Ppm)	Mo (Ppm)	Na (Pct)	Ni (Ppm)	Rb (Ppm)	Sb (Ppm)	Sc (Ppm)	Se (Ppm)	Sm (Ppm)	Sn (Ppm)	Ta (Ppm)	Tb (Ppm)	Te (Ppm)	Th (Ppm)	U (Ppm)	W (Ppm)	Yb (Ppm)	Zn (Ppm)	Zr (Ppm)
SC055	46	365	250	110	8	<10	48	<10	210	4	<2	>10.0	8	<100	23	0.6	10	0.06	<50	45	14.0	23.0	11	4.3	<200	2	<1	<20	6.1	7.3	22	<5	480	740
SC056	>50	237	360	<100	3	<10	34	22	130	3	<2	7.2	<2	<100	16	<0.5	8	0.13	<50	14	7.0	6.5	69	3.2	<200	<1	<1	<20	3.5	3.9	<2	<5	400	<500
SC057	>50	567	806	<100	4	<10	36	<10	110	2	<2	>10.0	4	<100	26	<0.5	5	0.10	<50	15	7.6	11.0	19	5.0	<200	<1	<1	180	3.2	2.2	6	<5	490	<500
SC058	<5	20	22	310	<1	<10	32	22	120	2	<2	6.2	5	<100	22	<0.5	642	0.09	<50	59	1.6	6.2	<10	1.8	<200	<1	<1	<20	2.8	2.7	11	<5	6400	<500
SC059	<5	50	21	320	<1	38	80	33	110	21	6	>10.0	6	<100	33	1.9	30	0.08	55	150	4.7	38.0	<10	18.0	<200	1	5	32	5.9	7.9	27	14	2000	<500
SC060	8	16	8	120	<1	<10	100	13	75	2	<2	4.6	2	<100	53	0.6	100	0.09	<50	23	3.9	9.2	<10	5.4	<200	<1	1	<20	2.2	2.2	4	6	3200	<500
SC061	<5	4	<5	780	<1	<10	38	12	62	6	<2	2.6	4	<100	20	<0.5	3	0.11	<50	79	1.6	5.8	<10	4.9	<200	<1	<1	<20	2.0	2.1	<2	<5	760	<500
SC062	>50	56	220	<100	2	120	28	30	430	3	<2	3.5	8	<100	13	<0.5	16	<0.05	<50	29	39.2	2.8	<10	0.8	<200	<1	<1	<20	7.6	37.0	6	<5	1200	<500
SC063	>50	47	430	110	<1	40	38	33	380	3	<2	3.6	18	<100	16	0.5	17	<0.05	<50	58	8.1	7.5	<10	2.9	<200	2	<1	84	7.6	11.0	9	<5	1700	<500
SC064	>50	37	230	310	<1	43	51	17	490	6	<2	3.0	19	<100	28	0.7	22	<0.05	<50	87	10.0	10.0	<10	5.1	<200	2	1	<20	10.0	14.0	7	5	1600	840
SC065	>50	114	748	360	5	54	65	<10	290	3	<2	7.8	16	<100	30	0.5	14	<0.05	<50	60	129.0	5.0	380	2.0	<200	2	<1	150	8.0	6.2	7	<5	4900	<500
SC066	40	56	160	100	<1	38	28	15	380	<1	<2	5.0	7	<100	14	<0.5	18	<0.05	<50	29	12.0	2.1	19	2.4	<200	<1	<1	<20	4.7	5.9	5	<5	3100	<500
SC067	10	24	60	<100	<1	18	72	<10	50	1	<2	3.4	7	<100	36	0.9	2	0.11	<50	10	3.5	7.4	<10	7.4	<200	1	2	<20	8.2	4.2	4	<5	1800	<500
SC068	>50	8	200	370	2	64	38	<10	170	2	<2	1.3	<2	<100	18	<0.5	5	0.09	<50	42	27.9	3.0	<10	2.7	<200	<1	<1	41	3.4	1.1	4	<5	>20000	<500
SC069	<5	196	14	120	<1	<10	100	<10	100	4	6	7.5	3	<100	49	1.2	6	0.05	<50	37	3.2	6.5	<10	36.3	<200	<1	4	<20	3.7	2.5	<2	7	350	<500
SC070	6	155	210	110	3	<10	62	<10	220	2	<2	>10.0	32	<100	36	0.9	20	<0.05	<50	13	30.4	8.6	<10	8.9	<200	2	<1	58	17.0	12.0	12	5	<200	1000
SC071	>50	77	1370	<100	7	<10	10	<10	350	<1	<2	6.2	13	<100	7	<0.5	53	<0.05	<50	11	70.2	1.7	<10	0.8	<200	<1	<1	95	5.0	10.0	12	<5	1300	<500
SC072	>50	661	1080	<100	12	<10	22	17	130	<1	3	>10.0	13	<100	14	<0.5	3070	<0.05	<50	<10	341.0	2.4	41	<1.3	<200	<1	1	<20	5.4	58.8	31	10	1400	1200
SC073	>50	564	2560	<100	52	<10	10	<10	93	<1	<2	>10.0	<2	<100	7	0.6	341	<0.05	<50	<10	424.0	<0.5	120	<1.4	<200	1	<1	<20	2.9	72.4	11	<5	450	<500
SC074	>50	441	1390	<100	5	<10	36	11	140	<1	<2	>10.0	8	<100	9	<0.5	1200	<0.05	<50	<10	160.0	2.7	<10	<1.7	<200	<1	<1	86	5.4	73.7	19	7	1400	<500
SC075	25	45	110	110	2	<10	83	15	290	5	<2	3.6	15	<100	41	0.7	120	<0.05	<50	82	19.0	8.6	<10	10.0	<200	2	2	<20	12.0	8.0	25	7	1000	<500
SC076	>50	1890	<490	10300	372	<440	850	<100	<2900	<19	<66	10.0	<77	<3000	28	<16.0	<94	<3.10	<590	<410	>5000.0	<8.1	<510	3.4	<16000	<12	<8	<1700	<36.0	<23.0	<65	410	<3400	# 0
SC077	48	215	1270	<100	16	<10	39	170	130	2	<2	>10.0	6	<100	26	1.4	958	<0.05	<50	33	292.0	7.9	<10	2.0	<450	<1	2	150	9.0	10.0	9	16	3200	1000
SC078	>50	216	220	<100	6	<10	23	<10	490	<1	<2	7.0	8	<100	20	0.8	88	<0.05	<50	<10	192.0	2.5	<10	1.1	<200	<1	1	320	4.6	5.3	6	8	<200	<500
SC079	>50	731	<100	<910	100	<91	170	<22	<590	<4	<14	5.0	<16	<620	6	4.3	27	0.66	<130	<91	4050.0	3.8	<100	2.8	<3300	<3	<1	<340	<7.1	<4.8	<31	88	250	<3200
SC080	<5	15	12	370	<1	<10	66	<10	85	9	<2	2.6	6	<100	40	0.9	4	0.08	<50	150	2.8	13.0	<10	8.0	<200	1	1	<20	12.0	4.3	4	6	460	<500
SC081	11	56	55	250	<1	<10	27	41	140	3	<2	>10.0	5	<100	20	<0.5	140	<0.05	<50	45	6.0	9.4	<10	4.0	<200	<1	1	<20	7.0	5.2	8	<5	690	<500
SC082	<5	8	<5	<100	<1	<10	19	<10	450	<1	<2	0.6	12	<100	8	<0.5	9	<0.05	<50	10	0.8	2.1	<10	1.7	<200	<1	<1	<20	8.1	2.9	17	<5	<200	<500
SC083	<5	7	7	<100	<1	<10	15	<10	580	<1	<2	0.7	7	<100	7	<0.5	12	<0.05	<50	<10	1.0	1.6	<10	1.5	<200	<1	<1	<20	4.6	2.3	8	<5	<200	<500
SC084	<5	2	15	300	<1	<10	72	<10	110	8	<2	1.8	4	<100	26	<0.5	5	0.76	<20	240	2.5	7.4	<10	4.7	<200	2	1	<20	8.2	31.0	22	<5	2200	<500
SC085	<5	9	<5	660	1	<10	160	<10	110	9	3	4.0	14	<100	58	1.1	<2	0.13	63	280	1.6	11.0	<10	13.0	<200	3	2	<20	17.0	6.7	3	10	350	<500
SC086	<5	3	15	180	<1	<10	10	<10	570	<1	<2	2.2	<2	<100	<5	<0.5	46	<0.05	<20	28	5.1	0.8	<10	<0.2	<200	<1	<1	<20	<0.5	0.9	6	<5	<200	<500
SC087	11	1	440	120	2	<10	26	<10	520	2	<2	2.3	2	<100	12	<0.5	19	0.10	<50	78	0.4	3.1	<10	2.3	<200	<1	<1	<20	3.3	2.6	19	<5	<200	<500
SC088	<5	4	130	760	5	<10	94	13	250	5	<2	3.8	8	<100	44	1.1	3	1.30	<50	250	0.5	13.0	<10	11.0	<200	2	2	<20	15.0	6.0	8	7	300	670
SC089	35	2	2320	180	<1	<10	30	<10	520	1	<2	2.5	2	<100	15	<0.5	35	0.05	<50	100	0.6	3.4	<10	3.4	<200	<1	<1	70	4.6	5.2	20	<5	<200	<500
SC090	<5	<1	22	<100	2	<10	10	<10	240	1	<2	<0.5	<2	<100	<5	<0.5	3	0.33	<20	27	0.7	1.2	<10	0.5	<200	<1	<1	<20	0.7	0.8	2	<5	<200	<500
SC091	<5	2	94	580	<1	<10	230	<10	390	7	3	3.7	9	<100	82	0.9	5	0.22	<20	470	2.2	16.0	<10	16.0	<200	2	2	<20	16.0	5.4	41	9	<200	<500
SC092	<5	1	270	740	<1	<10	160	<10	120	11	<2	3.8	8	<100	65	1.2	<2	0.59	<20	520	1.0	16.0	<10	14.0	<200	2	2	<20	22.0	6.2	26	9	770	680
SC093	<5	<1	390	440	<1	<10	98	<10	120	5	<2	3.7	7	<100	33	<0.5	9	0.08	<20	350	0.6	9.4	<10	7.2	<200	<1	1	<20	13.0	6.7	39	6	420	<500
SC094	13	<1	370	290	<1	<10	61	<10	470	3	<2	2.5	5	<100	25	0.6	17	0.13	30	240	0.9	7.1	<10	6.1	<200	<1	1	<20	8.9	1.9	18	5	<200	<500
SC095	<5	2	26	340	2	<10	40	11	470	3	<2	3.1	2	<100	18	<0.5	5	1.00	28	150	0.8	6.9	<10	4.3	<200	<1	<1	<20	10.0	1.7	9	<5	<200	<500
SC096	<5	4	88	320	<1	<10	36	71	76	12	<2	>10.0	5	<100	19	0.6	<2	2.00	62	120	3.2	32.0	<10	7.9	<200	<1	1	<20	1.9	2.9	8	7	480	<500
SC097	5	1	250	430	<1	<10	96	13	560	4	<2	2.6	5	<100	37	<0.5	5	0.65	<20	230	0.8	8.5	<10	7.3	<200	<1	<1	<20	14.0	1.8	10	<5	<200	<500
SC098	<5	2	28	270	<1	<10	46	81	67	13	4	>10.0	7	<100	21	0.7	<2	2.40	110	70	1.1	34.0	<10	8.3	<200	1	2	<20	1.3	2.5	7	7	270	670
SC099	<5	3	1410	330	<1	<10	55	<10	510	4	<2	2.9	4	<100	24	<0.5	7	0.10	<20	280	0.6	7.4	<10	5.0	<200	<1	<1	<20	11.0	5.2	33	<5	<200	<500
SC100	8	4	240	450	<1	<10	77	<10	140	5	<2	6.0	6	<100	34	<0.5	16	0.44	<20	260	0.9	9.4	<10	5.7	<200	1	1	<20	12.0	5.5	15	<5	<200	<500
SC101	7	5	170	350	<1	<10	40	60	230	5	<2	8.4	5	<100	18	<0.5	10	0.12	55	270	2.1	16.0	<10	3.5	<200	<1	<1	<20	2.6	10.0	23	6	200	<500
SC102	<5	4	23	510	<1	<10	60	85	120	5	5	>10.0	5	<100	24	1.0	<2	2.70	110	60	1.0	41.0	<10	8.6	<200	1	1	<20	1.4	1.8	<2	9	330	<500
SC103	<5	3	584	360	<1	<10	100	<10	540	6	2	3.0	6	<100	38	0.9	4	0.11	<20	280	2.0	8.6	<10	6.2	<200	<1	<1	<20	11.0	2.1	14	<5	340	<500
SC104	9	<1	340	350	<1	<10	64	24	150	6	<2	5.8	6	<100	27	<0.5	3	0.61	<20	400	0.9	12.0	<10	4.6	<200	<1	<1	<20	4.0	3.2	16	<5	<200	<500
SC105	<5	2	260	350	<1	<10	110	16	430	7	<2	4.2	6	<100	42	<0.5	7	0.59	<20	360	1.8	12.0	<10	6.5	<200	1	<1	<20	7.6	3.0	20	<5	<200	<500
SC106	50	35	1510	220	<1	11	48	25	290	5	<2	5.3	<2	<100	25	<0.5	15	0.07	<20	290	4.3	9.1	<10	4.3	<200	<1	<1	<20	4.6	11.0	14	<5	340	<500
SC107	10	3	73	870	<1	<10	100	50	98	11	3	7.0	8	<100	51	<0.5	17	0.70	<20	620	1.4	24.0	<10	9.3	<200	<1	2	<20	20.0	8.9	25	8	<200	<500
SC108	<5	<1	<15	<230	6	27	31	<10	270	<1	<2	0.8	56	<100	<5	0.9	11	<0.05	<20	15	0.6	<0.5	<10	1.3	<200	<1	<1	<20	<1.1	<0.5	>2000	<5	600	<500
SC109	<5	<1	<5	<100	4	18	21	<10	220	<1	<2	0.8	33	<100	<5	1.0	10	<0.05	<20	24	1.1	0.8	<10	1.1	<200	<1	<1	<20	<0.5	<0.5	>2000	<5	270	<500
SC110	<5	2	20	720	<1	<10	120	12	280	11	<2	3.1	7	<100	49	0.8	3	0.62	<50	360	0.9	12.0	<10	11.0	<200	2	2	<20	17.0	4.3	24	6	<200	<500

Sample No.	Ag (Ppm)	As (Ppm)	Au (Ppb)	Ba (Ppm)	Br (Ppm)	Cd (Ppm)	Ce (Ppm)	Co (Ppm)	Cr (Ppm)	Cs (Ppm)	Eu (Ppm)	Fe (Pct)	Hf (Ppm)	Ir (Ppb)	La (Ppm)	Lu (Ppm)	Mo (Ppm)	Na (Pct)	Ni (Ppm)	Rb (Ppm)	Sb (Ppm)	Sc (Ppm)	Se (Ppm)	Sm (Ppm)	Sn (Ppm)	Ta (Ppm)	Tb (Ppm)	Te (Ppm)	Th (Ppm)	U (Ppm)	W (Ppm)	Yb (Ppm)	Zn (Ppm)	Zr (Ppm)
SC111	10	2	190	* 100	* 1	* 10	20	* 10	530	1	* 2	1.8	* 2	* 100	8	* 0.5	35	* 0.05	* 50	61	1.2	2.0	* 10	1.5	* 200	* 1	* 1	* 20	4.0	1.6	7	* 5	* 200	* 500
SC112	* 5	2	30	430	* 1	* 10	130	13	300	9	* 2	3.3	8	* 100	56	1.2	* 2	0.10	* 50	470	1.5	14.0	* 10	14.0	* 200	2	2	* 20	20.0	4.8	57	8	260	* 500
SC113	* 5	3	1640	180	* 1	* 10	18	* 10	590	2	* 2	1.4	* 2	* 100	* 5	* 0.5	9	* 0.05	* 50	28	2.5	1.3	* 10	0.8	* 200	* 1	* 1	* 20	0.7	3.0	356	* 5	360	* 500
SC114	* 5	6	506	220	2	* 10	15	32	390	10	* 2	5.0	* 2	* 100	8	* 0.5	10	* 0.05	87	270	8.7	16.0	* 10	2.8	* 200	* 1	* 1	* 20	1.7	3.7	38	* 5	300	* 500
SC115	* 5	7	150	430	2	* 10	50	17	350	5	* 2	2.5	4	* 100	21	0.7	8	0.08	* 50	190	22.0	8.0	* 10	5.4	* 200	1	* 1	* 20	7.5	2.8	73	* 5	270	* 500
SC116	6	14	89	670	3	* 10	10	50	320	37	* 2	5.8	* 2	* 100	11	0.6	8	0.09	110	340	31.6	21.0	* 10	4.0	* 200	* 1	1	* 20	1.0	4.1	150	* 5	230	* 500
SC117	* 5	3	30	770	* 1	* 10	90	* 10	250	7	* 2	3.5	9	* 100	40	1.1	* 2	0.45	* 50	360	2.2	12.0	* 10	11.0	* 200	3	2	* 20	14.0	5.6	120	11	* 200	* 500
SC118	* 5	5	25	550	2	* 10	84	24	260	10	* 2	5.4	5	* 100	40	0.8	6	0.08	61	350	3.7	21.0	* 10	10.0	* 200	2	2	* 20	12.0	6.0	211	6	340	* 500
SC119	* 5	2	79	400	* 1	* 10	120	* 10	270	13	* 2	3.0	8	* 100	49	0.6	4	0.08	* 50	380	3.4	11.0	* 10	11.0	* 200	2	2	* 20	19.0	8.6	16	6	320	* 500
SC120	28	43	450	300	9	* 10	51	* 10	360	5	* 2	1.7	4	* 100	23	* 0.5	10	0.06	* 50	240	76.8	5.2	* 10	6.7	* 200	1	1	* 20	11.0	7.5	27	* 5	340	* 500
SC121	12	15	18	360	5	* 10	130	* 10	190	7	* 2	2.4	7	* 100	51	0.9	2	0.61	* 50	320	54.2	11.0	* 10	11.0	* 200	1	2	* 20	22.0	4.8	14	* 5	780	* 500
SC122	10	8	160	* 100	* 1	* 10	10	* 10	490	3	* 2	1.6	* 2	* 100	* 5	* 0.5	8	* 0.05	* 50	68	23.9	4.5	* 10	1.0	* 200	* 1	* 1	* 20	0.9	0.9	18	* 5	* 200	* 500
SC123	44	26	808	* 100	10	86	11	* 10	490	3	* 2	2.6	* 2	* 100	6	0.5	20	* 0.05	* 50	65	172.0	5.5	* 10	2.2	* 200	* 1	* 1	* 20	2.0	* 0.5	716	* 5	1500	* 500
SC124	* 5	10	63	340	2	* 10	25	28	340	31	* 2	4.1	* 2	* 100	16	0.5	11	0.06	90	250	7.1	14.0	* 10	4.9	* 200	* 1	* 1	* 20	5.9	3.6	42	* 5	420	* 500
SC125	* 5	3	75	930	4	* 10	140	10	240	10	* 2	3.4	7	* 100	59	1.2	2	0.67	* 50	370	1.1	11.0	* 10	15.0	* 200	2	2	* 20	24.0	4.9	14	7	560	590
SC126	* 5	3	370	720	* 1	* 10	110	10	240	8	2	3.2	8	* 100	46	0.9	* 2	0.32	* 50	380	1.3	11.0	* 10	12.0	* 200	2	2	* 20	20.0	6.8	14	6	* 200	* 500
SC127	* 5	4	480	160	* 1	* 10	46	12	390	4	* 2	5.3	3	* 100	24	* 0.5	442	0.08	* 50	170	4.9	4.9	* 10	6.2	* 200	* 1	1	* 20	8.9	16.0	27	* 5	2800	* 500
SC128	* 5	2	300	530	* 1	* 10	160	* 10	250	9	* 2	2.6	7	* 100	66	0.9	8	0.33	* 50	360	2.0	10.0	* 10	12.0	* 200	2	2	* 20	37.0	5.8	11	* 5	490	* 500
SC129	26	44	1 0.707	* 100	7	110	10	* 10	670	1	* 2	2.6	* 2	* 100	11	* 0.5	6	* 0.05	* 20	100	90.8	3.2	* 10	2.3	* 200	* 1	* 1	* 20	2.7	4.8	6	* 5	3600	* 500
SC130	* 5	1	130	330	* 1	* 10	55	* 10	130	3	* 2	3.0	4	* 100	22	* 0.5	4	0.08	* 20	250	2.2	6.4	* 10	4.9	* 200	* 1	1	* 20	8.6	7.8	7	6	* 200	* 500
SC131	* 5	6	21	230	3	* 10	140	* 10	130	9	2	2.0	5	* 100	52	0.6	3	0.78	* 20	210	11.0	7.1	* 10	9.3	* 200	1	1	* 20	22.0	4.9	6	5	* 200	* 500
SC132	* 5	4	87	390	1	* 10	100	14	480	7	* 2	5.0	6	* 100	39	* 0.5	11	0.08	* 20	330	2.4	11.0	* 10	7.5	* 200	1	1	* 20	12.0	9.2	18	* 5	210	* 500
SC133	* 5	5	761	590	2	* 10	160	11	150	9	3	3.9	11	* 100	68	1.3	* 2	0.14	* 20	490	3.5	15.0	* 10	14.0	* 200	2	2	* 20	22.0	4.8	25	10	980	520
SC134	* 5	35	6	470	* 1	* 10	74	* 10	190	6	* 2	1.3	8	* 100	31	1.1	* 2	0.14	* 50	160	3.5	7.8	* 10	7.4	* 200	* 1	1	* 20	9.5	1.6	6	6	* 200	* 500
SC135	* 5	2	* 5	1400	* 1	* 10	72	* 10	180	4	* 2	1.9	9	* 100	32	0.8	* 2	0.13	* 50	150	3.9	7.6	* 10	6.2	* 200	* 1	1	* 20	11.0	1.7	5	5	* 200	700
SC136	* 5	2	16	380	1	* 10	100	* 10	320	23	* 2	2.1	6	* 100	40	1.4	* 2	0.11	* 50	340	4.5	10.0	* 10	10.0	* 200	3	2	* 20	19.0	4.6	9	7	* 200	* 500
SC137	* 5	2	120	440	* 1	* 10	83	* 10	380	9	* 2	1.5	4	* 100	29	0.5	4	0.22	* 50	230	2.0	6.2	* 10	7.3	* 200	1	1	* 20	13.0	3.2	12	* 5	* 200	* 500
SC138	* 5	2	2210	350	3	* 10	79	* 10	330	14	* 2	2.4	4	* 100	30	0.8	3	0.13	* 50	330	2.2	9.0	* 10	7.7	* 200	2	1	* 20	14.0	2.3	17	* 5	* 200	* 500
SC139	26	8	230	* 100	1	* 10	10	* 10	650	* 1	* 2	4.1	* 2	* 100	6	* 0.5	24	0.07	* 50	33	15.0	1.5	* 10	1.2	* 200	* 1	* 1	* 20	1.5	2.0	12	* 5	* 200	* 500
SC140	> 50	2	894	210	* 1	* 10	31	* 10	680	1	* 2	2.0	* 2	* 100	14	* 0.5	11	0.35	* 50	69	2.2	2.9	* 10	3.2	* 200	* 1	* 1	* 20	4.5	0.9	16	* 5	480	* 500
SC141	10	* 1	31	* 100	* 1	* 10	10	* 10	660	* 1	* 2	1.1	* 2	* 100	5	* 0.5	6	0.12	* 50	29	0.4	1.6	* 10	1.0	* 200	* 1	* 1	* 20	2.2	* 0.5	5	* 5	* 200	* 500
SC142	* 5	2	57	750	* 1	* 10	120	* 10	240	15	2	3.0	7	* 100	45	0.9	7	0.67	* 50	290	1.2	11.0	* 10	11.0	* 200	2	2	* 20	17.0	2.9	23	8	* 200	* 500
SC143	42	4	1420	* 100	* 1	200	10	14	570	* 1	* 2	4.1	* 2	* 100	* 5	* 0.5	42	* 0.05	* 50	* 10	5.4	* 0.5	* 10	* 0.2	* 200	* 1	* 1	* 20	* 0.5	2.0	9	* 5	4900	* 500
SC144	* 5	4	51	350	* 1	* 10	31	30	320	5	* 2	4.5	* 2	* 100	9	* 0.5	10	0.06	71	160	1.2	13.0	* 10	2.7	* 200	* 1	* 1	* 20	2.9	3.0	110	* 5	920	* 500
SC145	* 5	2	240	210	* 1	* 10	73	* 10	480	5	* 2	2.3	4	* 100	26	0.5	47	* 0.05	* 50	160	1.7	5.6	* 10	5.9	* 200	* 1	* 1	* 20	19.0	2.0	20	* 5	360	* 500
SC146	* 5	3	320	340	* 1	* 10	53	* 10	460	7	* 2	3.2	4	* 100	23	0.7	56	* 0.05	* 50	210	0.9	6.1	* 10	6.3	* 200	* 1	1	* 20	13.0	3.8	22	* 5	240	* 500
SC147	* 5	48	190	130	* 1	17	72	21	280	12	* 2	3.2	2	* 100	29	0.6	57	* 0.05	* 50	260	4.5	12.0	* 10	6.5	* 200	* 1	1	* 20	8.6	3.3	57	* 5	1400	* 500
SC148	* 5	5	25	420	* 1	* 10	40	27	310	25	* 2	4.9	* 2	* 100	20	0.6	* 2	0.06	* 50	240	16.0	19.0	* 10	5.8	* 200	* 1	* 1	* 20	5.2	2.0	39	* 5	* 200	* 500
SC149	* 5	8	566	630	2	* 10	58	15	89	32	* 2	3.1	* 2	* 100	28	* 0.5	* 2	0.08	* 50	380	29.7	9.2	* 10	5.9	* 200	2	* 1	* 20	17.0	4.0	42	* 5	* 200	* 500
SC150	* 5	8	50	2200	2	* 10	50	13	* 50	23	* 2	2.4	3	* 100	29	* 0.5	* 2	0.09	* 50	270	26.9	6.4	* 10	4.9	* 200	1	* 1	* 20	15.0	6.1	7	* 5	* 200	* 500
SC151	* 5	7	170	270	* 1	* 10	37	* 10	280	7	* 2	1.8	* 2	* 100	14	* 0.5	57	* 0.05	* 50	160	2.6	4.7	* 10	4.1	* 200	* 1	* 1	* 20	6.2	3.6	27	* 5	420	* 500
SC152	9	10	380	130	* 1	590	20	* 10	390	5	* 2	4.7	* 2	* 100	10	* 0.5	225	* 0.05	* 50	110	4.8	4.1	* 10	2.8	* 200	* 1	* 1	* 20	5.0	2.8	34	* 5	1800	* 500
SC153	12	9	759	* 100	* 1	540	10	* 10	420	4	* 2	3.1	* 2	* 100	6	* 0.5	407	* 0.05	* 50	67	3.8	1.9	* 10	1.4	* 200	* 1	* 1	* 20	2.9	3.8	19	* 5	1500	* 500
SC154	12	9	1000	250	* 1	260	26	* 10	410	4	* 2	2.7	* 2	* 100	9	* 0.5	245	* 0.05	* 50	78	3.3	2.4	* 10	2.1	* 200	* 1	* 1	* 20	3.4	4.5	13	* 5	1700	* 500
SC155	9	22	617	400	* 1	* 10	30	16	290	5	* 2	3.4	* 2	* 100	10	* 0.5	67	* 0.05	* 50	110	3.7	3.5	* 10	3.3	* 200	* 1	* 1	* 20	4.6	11.0	92	* 5	620	* 500
SC156	22	6	1040	120	7	* 10	10	* 10	520	* 1	* 2	3.0	* 2	* 100	* 5	* 0.5	619	* 0.05	* 50	12	4.3	0.9	* 10	0.8	* 200	* 1	* 1	* 20	4.1	5.2	284	* 5	550	* 500
SC157	* 5	5	51	250	* 1	* 10	44	* 10	280	6	* 2	2.2	3	* 100	19	0.6	14	* 0.05	* 50	230	3.0	6.9	* 10	5.2	* 200	1	1	* 20	7.8	1.9	38	* 5	540	* 500
SC158	7	10	260	240	4	110	51	17	250	28	* 2	3.6	* 2	100	20	0.7	4	* 0.10	* 50	220	38.1	9.3	* 10	5.2	* 200	* 1	* 1	* 20	6.1	1.5	29	* 5	2500	* 500
SC159	7	36	970	* 100	7	* 10	10	* 10	460	2	* 2	2.4	* 2	* 100	6	* 0.5	9	* 0.05	* 50	64	83.5	2.0	* 10	1.4	* 200	* 1	* 1	* 20	1.2	* 0.5	18	* 5	340	* 500
SC160	* 5	7	94	360	2	* 10	160	10	210	26	* 2	3.2	19	* 100	47	1.3	* 2	0.08	* 50	210	22.4	7.8	* 10	11.0	* 200	3	2	* 20	18.0	5.7	43	9	* 200	750
SC161	* 5	3	29	* 100	1	* 10	87	* 10	400	6	* 2	1.1	7	* 100	22	* 0.5	* 2	* 0.05	* 50	53	6.7	2.6	* 10	6.6	* 200	1	1	* 20	6.0	3.2	29	* 5	* 200	* 500
SC162	* 5	14	210	610	3	* 10	110	14	130	21	* 2	4.6	5	* 100	42	0.8	* 2	0.20	* 50	220	5.9	10.0	* 10	10.0	* 200	2	2	* 20	14.0	4.1	241	* 5	* 200	720
SC163	12	59	4950	* 100	15	110	63	10	370	2	* 2	2.1	* 2	* 100	15	* 0.5	37	* 0.05	* 50	84	175.0	3.6	* 10	3.5	* 200	* 1	* 1	* 20	5.4	1.4	89	* 5	1400	* 500
SC164	25	2	1600	540	3	* 10	120	* 10	380	7	* 2	6.2	5	* 100	44	0.8	22	0.12	* 50	270	2.9	8.2	* 10	10.0	* 200	2	2	* 20	16.0	8.6	20	6	* 200	* 500
SC165	7	2	220	150	* 1	* 10	29	* 10	570	2	* 2	3.3	* 2	* 100	10	* 0.5	13	* 0.05	* 50	94	1.1	2.3	* 10	2.2	* 200	* 1	* 1	* 20	3.7	2.1	9	* 5	* 200	* 500
SC166	12	53	< 12	4900	21	18	26	* 10	220	1	* 2	0.6	* 2	* 100	8	* 0.5	6	* 0.05	* 20	20	262.0	0.8	* 10	1.4	* 200	* 1	* 1	* 20	< 1.1	0.7	7	8	410	* 500

APPENDIX D. NEUTRON ACTIVATION ANALYSES OF SAMPLES BY BONDAR-CLEGG AND CO., LTD.--Continued

Sample No.	Ag (Ppm)	As (Ppm)	Au (Ppb)	Ba (Ppm)	Br (Ppm)	Cd (Ppm)	Ce (Ppm)	Co (Ppm)	Cr (Ppm)	Cs (Ppm)	Eu (Ppm)	Fe (Pct)	Hf (Ppm)	Ir (Ppb)	La (Ppm)	Lu (Ppm)	Mo (Ppm)	Na (Pct)	Ni (Ppm)	Rb (Ppm)	Sb (Ppm)	Sc (Ppm)	Se (Ppm)	Sm (Ppm)	Sn (Ppm)	Ta (Ppm)	Tb (Ppm)	Te (Ppm)	Th (Ppm)	U (Ppm)	W (Ppm)	Yb (Ppm)	Zn (Ppm)	Zr (Ppm)
SC167	50	86	<14	1500	28	*10	27	*10	110	2	*2	1.0	*2	*100	9	0.6	76	*0.05	*20	<22	374.0	1.8	*10	1.7	*200	*1	*1	*20	2.9	*0.5	7	11	1200	*500
SC168	61	131	<18	2500	39	<22	37	*10	440	2	4	1.2	*2	*100	7	0.9	35	*0.05	*20	61	547.0	1.7	*10	1.0	*200	*1	*1	<48	<1.4	1.4	6	12	1400	*500
SC169	14	99	*5	380	13	140	26	65	430	3	*2	3.1	*2	*100	11	*0.5	20	*0.05	*20	58	129.0	4.8	*10	2.7	*200	*1	*1	*20	2.1	1.8	12	7	2600	*500
SC170	10	38	701	590	11	*10	68	*10	59	14	*2	3.0	*2	*100	29	*0.5	*2	0.08	*20	300	130.0	7.5	*10	5.6	*200	*1	*1	*20	10.0	2.1	24	6	490	*500
SC171	9	94	4540	260	35	<20	34	*10	450	2	*2	1.7	*2	*100	8	1.1	6	*0.05	*20	86	474.0	1.9	*10	1.6	*200	*1	*1	<42	2.9	1.2	10	9	*200	*500
SC172	7	30	2520	*100	10	*10	10	*10	260	*1	*2	1.6	*2	*100	*5	*0.5	*2	*0.05	*20	27	108.0	0.8	*10	0.4	*200	*1	*1	*20	0.7	*0.5	6	*5	260	*500
SC173	8	19	1120	370	5	*10	30	*10	170	5	*2	3.2	3	*100	14	*0.5	*2	*0.05	*20	110	64.4	3.6	*10	2.7	*200	*1	*1	*20	4.6	1.1	19	*5	200	*500
SC174	*5	*1	*5	*100	*1	*10	*10	*10	460	*1	*2	0.6	*2	*100	*5	*0.5	4	*0.05	*20	*10	0.3	*0.5	*10	0.2	*200	*1	*1	*20	*0.5	*0.5	*2	*5	*200	*500
SC175	9	1	230	*100	*1	*10	*10	*10	470	1	*2	1.3	*2	*100	*5	*0.5	14	*0.05	*20	44	0.7	0.8	*10	0.8	*200	*1	*1	*20	2.2	2.8	3	*5	*200	*500
SC176	40	2	1670	*100	*1	*10	*10	10	520	*1	*2	2.2	*2	*100	*5	*0.5	12	*0.05	*20	11	0.7	*0.5	*10	0.5	*200	*1	*1	*20	0.5	1.3	5	*5	*200	*500
SC177	12	3	150	*100	1	*10	25	11	390	3	*2	2.7	*2	*100	11	*0.5	11	*0.05	*20	65	1.2	2.0	*10	2.2	*200	*1	*1	*20	6.1	4.4	31	*5	*200	*500
SC178	6	*1	96	240	*1	*10	54	*10	370	7	*2	1.4	*2	*100	24	0.6	8	0.38	*20	220	0.7	5.7	*10	4.7	*200	1	*1	*20	10.0	3.1	10	*5	*200	*500
SC179	*5	1	13	*100	*1	*10	*10	*10	390	*1	*2	0.7	*2	*100	*5	*0.5	5	*0.05	*20	*10	0.5	*0.5	*10	*0.2	*200	*1	*1	*20	0.5	*0.5	2	*5	*200	*500
SC180	*5	2	8	290	*1	*10	14	*10	380	5	*2	3.5	*2	*100	6	*0.5	12	*0.05	*20	120	0.7	2.7	*10	0.9	*200	*1	*1	*20	1.4	*0.5	29	*5	*200	*500
SC181	*5	3	*5	110	*1	*10	26	*10	190	2	*2	2.1	*2	*100	13	*0.5	3	*0.05	*20	75	1.1	1.8	*10	2.5	*200	*1	*1	*20	2.0	1.6	6	*5	*200	*500
SC182	*5	*1	42	120	*1	*10	*10	*10	420	1	*2	0.9	*2	*100	*5	*0.5	9	*0.05	*20	42	0.4	1.0	*10	0.8	*200	*1	*1	*20	0.5	*0.5	14	*5	*200	*500
SC183	*5	2	65	420	*1	*10	17	16	340	5	*2	3.8	*2	*100	10	*0.5	59	*0.05	*20	150	0.6	3.2	*10	1.5	*200	*1	*1	*20	1.4	1.3	57	*5	*200	*500
SC184	*5	2	6	170	*1	*10	20	*10	580	4	*2	1.7	2	*100	9	*0.5	7	*0.05	*20	93	1.4	3.1	*10	1.7	*200	*1	*1	*20	2.6	3.3	3	*5	*200	*500
SC185	*5	7	*5	960	1	*10	85	67	*50	4	3	>10.0	11	*100	32	0.8	*2	3.30	38	71	2.5	26.0	*10	12.0	*200	2	2	*20	1.4	1.0	64	7	340	*500
SC186	*5	2	8	670	*1	*10	150	*10	98	12	*2	2.4	8	*100	54	1.6	*2	0.22	*20	360	1.2	9.0	*10	14.0	*200	2	2	*20	17.0	2.3	5	13	*200	*500
SC187	*5	2	51	390	*1	*10	48	*10	500	12	*2	3.0	5	*100	23	*0.5	4	0.31	*20	260	1.2	6.9	*10	5.1	*200	*1	*1	*20	4.9	2.0	14	*5	*200	*500
SC188	7	2	430	*100	*1	*10	10	*10	190	*1	*2	1.8	*2	*100	*5	*0.5	*2	*0.05	*20	24	0.5	*0.5	*10	*0.2	*200	*1	*1	*20	*0.5	*0.5	2	*5	*200	*500
SC189	*5	1	*5	590	*1	*10	110	*10	100	20	2	2.5	6	*100	48	1.4	*2	2.20	*20	470	1.8	12.0	*10	11.0	*200	3	2	*20	19.0	3.2	8	9	*200	*500
SC190	*5	5	*5	490	*1	*10	62	72	81	7	3	>10.0	6	*100	30	0.7	*2	1.90	81	190	2.0	41.0	*10	8.5	*200	1	1	*20	7.8	5.0	21	8	570	*500
SC191	*5	5	110	570	*1	*10	53	67	90	11	*2	10.0	6	*100	25	0.7	6	0.47	*20	420	2.4	31.0	*10	6.8	*200	*1	*1	*20	5.7	3.3	29	6	390	*500
SC192	*5	7	23	1000	*1	*10	48	56	120	15	3	>10.0	6	*100	25	*0.5	6	0.09	*20	670	3.3	43.0	*10	7.4	*200	*1	1	*20	6.9	4.9	28	7	550	*500
SC193	*5	3	16	14000	1	*10	13	*10	650	2	*2	1.2	*2	*100	*5	*0.5	6	*0.05	*20	35	2.7	1.1	*10	0.7	*200	*1	*1	*20	1.0	0.6	21	*5	*200	*500
SC194	*5	23	320	1500	5	*10	95	57	90	17	9	>10.0	16	*100	39	1.3	8	0.24	*20	560	3.5	23.0	*10	12.0	*200	*1	1	*20	7.6	6.9	389	10	350	*500
SC195	39	13	518	580	*1	*10	44	12	450	7	*2	4.1	5	*100	18	*0.5	8	0.08	*20	270	4.4	6.1	*10	4.3	*200	*1	*1	*20	5.1	4.3	94	*5	390	*500
SC196	*5	7	110	610	1	*10	49	31	100	8	*2	5.4	5	*100	20	*0.5	2	0.11	*20	290	2.4	21.0	*10	5.9	*200	*1	*1	*20	4.8	2.8	58	5	*200	*500
SC197	*5	2	*5	280	*1	*10	94	*10	530	3	2	2.0	4	*100	40	*0.5	3	0.06	*20	140	1.1	3.8	*10	7.6	*200	*1	*1	*20	4.2	1.0	8	*5	*200	*500
SC198	*5	4	*5	170	*1	*10	10	21	110	2	2	5.4	*2	*100	6	*0.5	5	0.30	*20	62	1.8	5.6	*10	2.3	*200	*1	*1	*20	*0.5	*0.5	5	*5	390	*500
SC199	34	6	765	*100	2	*10	10	40	350	1	4	8.8	*2	*100	8	*0.5	19	0.11	*20	84	12.0	11.0	*10	2.7	*200	*1	*1	*20	0.5	*0.5	16	*5	740	*500
SC200	*5	1	*5	*100	*1	*10	10	11	490	*1	*2	1.7	*2	*100	*5	*0.5	6	0.28	*20	*10	0.5	0.9	*10	0.5	*200	*1	*1	*20	*0.5	*0.5	*2	*5	250	*500
SC201	*5	2	24	*100	2	*10	10	*10	210	1	*2	*0.5	*2	*100	*5	*0.5	2	0.10	*50	*10	1.7	0.7	*10	0.9	*200	*1	*1	*20	*0.5	0.6	*2	*5	*200	*500
SC202	*5	2	6	*100	1	*10	10	*10	180	*1	*2	*0.5	*2	*100	*5	*0.5	3	0.06	*50	*10	1.1	0.6	*10	1.0	*200	*1	*1	*20	*0.5	*0.5	*2	*5	*200	*500
SC203	*5	11	*5	150	2	*10	29	*10	*50	3	*2	1.1	4	*100	13	*0.5	*2	0.11	*50	62	2.7	3.5	*10	2.7	*200	*1	*1	*20	5.6	1.6	*2	*5	*200	*500
SC204	*5	2	*5	1600	*1	*10	16	*10	160	5	*2	2.3	*2	*100	7	*0.5	3	0.08	*20	82	3.2	2.2	*10	1.2	*200	*1	*1	*20	1.0	*0.5	4	*5	1300	*500
SC205	*5	4	5	330	*1	*10	21	*10	130	7	*2	1.3	*2	*100	9	*0.5	2	0.39	*20	170	4.0	2.5	*10	1.7	*200	*1	*1	*20	1.1	*0.5	11	*5	510	*500
SC206	*5	5	7	530	*1	*10	43	43	78	22	*2	3.5	4	*100	24	*0.5	*2	1.30	<47	350	5.7	8.4	*10	5.4	*200	*1	*1	*20	3.4	0.6	15	*5	>20000	*500
SC207	7	4	7	*100	*1	*10	32	*10	130	5	*2	1.5	2	*100	12	*0.5	2	1.40	*20	140	9.3	3.5	*10	2.0	*200	*1	*1	*20	1.7	*0.5	15	*5	1900	*500
SC208	*5	4	6	240	*1	10	56	14	86	11	*2	3.6	4	*100	22	*0.5	*2	2.70	*20	320	2.9	7.9	*10	4.1	*200	*1	*1	*20	3.5	0.9	13	*5	12000	*500
SC209	5	4	11	670	*1	*10	48	11	150	14	*2	2.9	2	*100	19	*0.5	*2	2.10	*50	190	7.4	6.4	*10	3.8	*200	*1	*1	*20	3.3	1.0	17	*5	5900	*500
SC210	21	5	26	180	1	10	19	14	230	4	*2	1.9	*2	*100	11	*0.5	*2	0.71	*50	130	4.7	3.2	*10	2.1	*200	*1	*1	*20	1.7	0.8	13	*5	19000	*500
SC211	*5	8	17	630	1	11	15	37	210	12	*2	1.8	*2	*100	11	*0.5	5	0.34	*20	160	17.0	3.6	*10	2.0	*200	*1	*1	*20	2.0	*0.5	9	*5	>20000	*500
SC212	*5	3	*5	150	*1	*10	27	*10	630	2	*2	1.4	6	*100	9	*0.5	6	*0.05	39	35	1.2	2.6	*10	1.9	*200	*1	*1	*20	4.1	1.2	5	*5	*200	*500
SC213	7	1	20	620	*1	40	66	12	140	9	*2	2.6	4	*100	26	0.6	*2	*0.05	*20	290	2.4	7.7	*10	5.7	*200	1	1	*20	7.8	2.7	19	*5	5900	*500
SC214	*5	2	*5	*100	*1	*10	13	*10	460	*1	*2	1.4	3	*100	*5	*0.5	5	*0.05	*20	*10	2.4	0.7	*10	1.0	*200	*1	*1	*20	1.5	1.1	6	*5	*200	*500
SC215	*5	5	*5	170	1	*10	97	22	250	17	*2	4.6	10	*100	36	0.7	31	0.16	*50	310	0.9	6.3	*10	8.4	*200	2	2	*20	13.0	7.5	55	*5	270	*500
SC216	*5	26	*5	*100	*1	*10	16	110	140	3	*2	7.1	*2	*100	7	1.3	4	0.06	*50	39	11.0	5.3	*10	4.3	*200	*1	2	*20	2.6	22.0	55	13	1400	*500
SC217	33	20	13	*100	*1	*10	10	30	330	*1	*2	5.6	*2	*100	*5	*0.5	68	*0.05	*50	19	5.9	2.6	*10	1.8	*200	*1	*1	*20	0.8	18.0	150	6	1900	*500
SC218	>50	*1	61	360	*1	*10	41	18	240	19	*2	3.4	3	*100	19	*0.5	82	0.09	*50	250	0.8	2.9	*10	4.8	*200	*1	*1	*20	7.5	17.0	190	*5	610	*500
SC219	7	2	8	*100	*1	*10	75	11	140	19	*2	4.7	6	*100	32	*0.5	32	0.17	*50	210	0.7	5.3	*10	7.6	*200	1	1	*20	11.0	14.0	18	*5	540	*500
SC220	*5	*1	9	660	1	*10	21	11	380	6	*2	2.2	*2	*100	14	*0.5	150	0.13	*50	180	0.3	3.7	*10	3.3	*200	*1	*1	*20	5.7	3.1	300	*5	*200	*500
SC221	*5	*1	*5	640	3	*10	31	*10	300	14	*2	2.1	*2	*100	14	*0.5	9	0.80	*50	190	*0.2	4.1	*10	2.9	*200	*1	*1	*20	5.7	1.9	525	*5	*200	*500
SC222	*5	2	*5	1400	*1	*10	51	12	86	10	*2	3.0	4	*100	25	*0.5	4	1.30	*50	390	0.5	8.7	*10	4.9	*200	1	*1	*20	8.8	3.2	9	*5	*200	*500

Sample No.	Ag (Ppm)	As (Ppm)	Au (Ppb)	Ba (Ppm)	Br (Ppm)	Cd (Ppm)	Ce (Ppm)	Co (Ppm)	Cr (Ppm)	Cs (Ppm)	Eu (Ppm)	Fe (Pct)	Hf (Ppm)	Ir (Ppb)	La (Ppm)	Lu (Ppm)	Mo (Ppm)	Na (Pct)	Ni (Ppm)	Rb (Ppm)	Sb (Ppm)	Sc (Ppm)	Se (Ppm)	Sm (Ppm)	Sn (Ppm)	Ta (Ppm)	Tb (Ppm)	Te (Ppm)	Th (Ppm)	U (Ppm)	W (Ppm)	Yb (Ppm)	Zn (Ppm)	Zr (Ppm)
SC223	*5	*1	*5	320	3	*10	10	*10	490	*1	*2	0.7	*2	*100	*5	*0.5	67	0.13	*50	32	*0.2	0.6	*10	0.6	*200	*1	*1	*20	1.1	0.6	662	*5	*200	*500
SC224	10	*1	*5	770	5	*10	21	*10	600	2	*2	1.8	*2	*100	10	*0.5	110	0.10	*50	94	*0.2	2.5	*10	2.5	*200	*1	*1	*20	3.1	6.9	1450	*5	*200	*500
SC225	*5	1	10	420	*1	*10	37	19	360	14	*2	3.5	*2	*100	19	*0.5	41	0.32	*50	81	0.9	6.6	*10	3.2	*200	*1	*1	*20	4.7	2.2	200	*5	*200	*500
SC226	6	2	95	440	2	*10	27	22	210	14	*2	7.6	*2	*100	14	*0.5	150	0.34	*50	150	1.0	6.7	*10	3.3	*200	*1	*1	*20	4.2	3.7	379	*5	*200	*500
SC227	*5	1	*5	840	*1	*10	68	22	160	38	*2	4.2	*2	*100	32	*0.5	6	1.80	*50	210	1.6	12.0	*10	6.0	*200	*1	*1	*20	7.7	2.1	71	*5	*200	*500
SC228	*5	4	12	*100	4	*10	57	29	130	13	2	10.0	11	*100	29	*0.5	3	0.13	*20	220	5.9	6.0	*10	4.3	*200	*1	*1	*20	10.0	8.4	344	*5	870	*500
SC229	*5	1	*5	220	*1	*10	89	*10	330	3	*2	1.8	4	*100	33	*0.5	30	0.08	*20	76	1.0	5.4	*10	5.6	*200	*1	*1	*20	6.3	2.1	75	*5	250	*500
SC230	*5	*1	<15	270	8	<23	35	16	200	*1	*2	3.9	60	*100	20	1.0	12	0.12	*20	26	*0.2	5.7	*10	3.8	*200	1	*1	<48	4.1	3.0	>2000	*5	920	1200
SC231	*5	*1	13	*100	2	*10	42	13	290	13	*2	4.3	33	*100	23	0.8	12	0.16	*20	320	*0.2	6.8	*10	4.4	*200	*1	*1	*20	5.5	1.8	>2000	*5	600	*500
SC232	7	9	36	420	*1	*10	130	17	200	13	*2	5.0	5	*100	68	*0.5	*2	0.20	*50	230	2.3	10.0	*10	11.0	*200	4	2	*20	17.0	9.0	*2	*5	250	*500
SC233	*5	*1	*5	*100	*1	*10	10	*10	98	1	*2	*0.5	*2	*100	*5	*0.5	3	3.30	*20	520	*0.2	0.8	*10	0.6	*200	5	*1	*20	2.7	4.7	*2	*5	*200	*500
SC234	*5	*1	6	*100	*1	*10	21	*10	270	*1	*2	1.2	3	*100	6	*0.5	7	3.90	*20	390	0.2	1.6	*10	0.9	*200	5	*1	*20	2.1	6.5	*2	*5	*200	*500
SC235	*5	*1	*5	*100	*1	*10	18	*10	98	*1	*2	*0.5	*2	*100	7	*0.5	2	4.90	*20	160	*0.2	1.1	*10	2.8	*200	8	*1	*20	4.3	13.0	3	*5	*200	*500
SC236	*5	4	7	*100	*1	*10	51	*10	190	*1	*2	2.2	3	*100	26	*0.5	17	0.06	*50	*10	1.5	7.7	*10	5.2	*200	*1	*1	*20	7.7	5.8	*2	*5	1600	*500
SC237	*5	48	*5	*100	1	*10	10	23	120	*1	*2	>10.0	*2	*100	13	*0.5	17	*0.05	*50	17	24.0	1.6	*10	2.1	*200	*1	*1	*20	1.2	13.0	*2	*5	1400	640
SC238	7	44	*5	*100	*1	*10	10	21	120	*1	*2	>10.0	*2	*100	9	*0.5	17	0.05	*50	13	16.0	2.6	*10	2.3	*200	5	*1	*20	1.1	15.0	*2	*5	1100	*500
SC239	*5	14	*5	*100	2	*10	10	12	190	*1	*2	>10.0	*2	*100	*5	*0.5	150	*0.05	*50	*10	1.5	2.1	*10	1.7	*200	1	*1	*20	0.8	23.0	2	*5	460	*500
SC240	*5	6	*5	630	*1	*10	16	15	72	8	*2	10.0	*2	*100	8	*0.5	15	1.80	*50	320	0.7	0.9	*10	2.7	*200	1	*1	*20	1.5	6.0	*2	*5	420	*500
SC241	*5	21	*5	140	3	*10	21	31	270	8	*2	6.5	*2	*100	8	*0.5	39	0.10	*50	150	2.0	3.0	*10	2.8	*200	*1	*1	*20	2.6	5.3	3	*5	730	*500
SC242	*5	2	*5	*100	*1	*10	30	15	370	*1	*2	4.9	4	*100	14	*0.5	11	0.07	*50	*10	0.3	4.9	*10	4.6	*200	*1	1	*20	3.3	5.3	3	*5	*200	*500
SC243	*5	5	*5	560	1	*10	44	*10	250	5	*2	4.0	6	*100	24	0.7	7	0.57	*50	97	1.2	10.0	*10	6.7	*200	*1	1	*20	7.4	2.5	5	*5	*200	*500
SC244	*5	48	10	*100	*1	*10	23	25	120	47	*2	8.3	*2	*100	10	*0.5	37	0.07	*50	170	2.3	3.5	*10	2.9	*200	*1	*1	*20	2.6	8.6	18	*5	1500	690
SC245	*5	218	*5	*100	3	*10	13	*10	96	1	*2	>10.0	*2	*100	11	*0.5	120	0.06	*50	*10	6.2	1.2	*10	1.7	*200	*1	*1	*20	1.9	17.0	3	*5	2200	*500
SC246	*5	111	7	*100	*1	*10	10	*10	150	*1	*2	>10.0	*2	*100	7	*0.5	52	*0.05	*50	*10	3.5	1.0	*10	1.3	*200	*1	*1	*20	1.3	22.0	12	*5	2000	*500
SC247	10	118	6	*100	2	*10	13	12	*50	*1	*2	>10.0	*2	*100	7	*0.5	120	*0.05	*50	*10	4.2	1.5	*10	2.4	*200	*1	*1	*20	1.4	22.0	6	*5	1300	*500
SC248	10	104	15	*100	3	*10	18	43	*50	2	*2	>10.0	*2	*100	13	*0.5	268	0.07	*50	20	15.0	1.1	*10	1.3	*200	*1	*1	*20	2.2	44.0	24	*5	4600	*500
SC249	*5	6	*5	*100	2	*10	13	*10	84	2	*2	*0.5	*2	*100	6	*0.5	5	*0.05	*50	20	8.9	0.7	*10	1.2	*200	*1	*1	*20	0.7	1.5	*2	*5	*200	*500
SC250	*5	16	10	410	3	*10	61	*10	370	9	*2	1.6	3	*100	26	*0.5	10	0.62	*50	200	12.0	9.1	*10	5.3	*200	*1	*1	*20	8.4	3.4	12	*5	440	*500
SC251	*5	4	*5	*100	*1	*10	18	*10	120	3	*2	0.9	3	*100	19	*0.5	*2	0.28	*50	27	2.6	3.0	*10	2.8	*200	*1	*1	*20	3.6	6.6	*2	*5	710	*500
SC252	8	59	8	*100	*1	*10	10	12	120	*1	*2	>10.0	*2	*100	*5	*0.5	91	*0.05	*50	*10	2.3	1.0	*10	1.3	*200	*1	*1	*20	1.3	23.0	12	*5	1700	*500
SC253	*5	28	*5	200	2	*10	24	*10	100	14	*2	3.2	*2	*100	16	*0.5	110	1.30	*50	510	3.1	3.3	*10	2.5	*200	2	*1	*20	4.5	16.0	*2	*5	800	*500
SC254	*5	7	*5	*100	*1	*10	16	35	320	2	*2	7.5	3	*100	9	*0.5	233	0.12	*50	37	1.7	4.9	*10	3.4	*200	*1	*1	*20	3.0	4.8	4	*5	430	*500
SC255	*5	9	17	*100	*1	*10	10	54	370	*1	*2	7.4	*2	*100	6	*0.5	180	*0.05	*50	*10	0.9	1.6	*10	1.7	*200	*1	*1	*20	1.1	8.6	6	*5	600	*500
SC256	*5	5	*5	*100	*1	*10	10	*10	160	2	*2	10.0	*2	*100	*5	*0.5	18	0.22	*50	*10	1.3	3.3	*10	1.9	*200	*1	*1	*20	2.8	17.0	3	*5	880	*500
SC257	*5	4	*5	*100	*1	*10	29	*10	330	4	*2	3.8	4	*100	14	*0.5	15	0.57	*50	110	2.5	4.9	*10	3.3	*200	*1	*1	*20	5.4	8.8	3	*5	570	*500
SC258	*5	3	*5	*100	*1	*10	10	*10	690	*1	*2	0.8	*2	*100	*5	*0.5	7	0.13	*50	16	0.3	0.7	*10	0.3	*200	*1	*1	*20	*0.5	*0.5	2	*5	*200	*500
SC259	*5	13	9	390	1	*10	47	20	270	6	*2	9.5	5	*100	29	*0.5	211	0.08	*50	370	0.5	8.7	*10	6.1	*200	1	*1	*20	6.6	6.5	243	*5	220	*500
SC260	*5	11	*5	1700	*1	*10	29	*10	260	2	*2	0.7	*2	*100	12	*0.5	5	2.40	*50	160	0.6	1.7	*10	2.8	*200	*1	*1	*20	5.6	1.2	*2	*5	*200	*500
SC261	*5	2	9	*100	3	*10	25	*10	*50	2	*2	2.5	*2	*100	15	*0.5	208	0.13	*50	20	*0.2	2.8	*10	2.1	*200	*1	*1	*20	3.2	8.8	3	*5	2200	*500
SC262	5	3	14	100	*1	*10	24	16	320	2	*2	3.9	2	*100	15	*0.5	212	0.38	*50	42	0.3	6.3	*10	3.0	*200	*1	*1	*20	2.8	11.0	5	*5	1600	*500
SC263	*5	5	25	*100	*1	*10	33	*10	430	*1	*2	3.8	*2	*100	14	*0.5	19	*0.05	*50	*10	0.3	1.9	*10	2.2	*200	*1	*1	*20	2.1	5.5	10	*5	2500	*500
SC264	*5	4	*5	*100	*1	*10	10	*10	*50	*1	*2	*0.5	*2	*100	*5	*0.5	150	0.09	*50	14	0.3	*0.5	*10	0.4	*200	*1	*1	*20	0.5	0.8	*2	*5	280	*500
SC265	19	4	19	160	*1	*10	17	12	360	1	*2	4.1	3	*100	9	*0.5	798	0.14	*50	33	0.3	1.3	*10	1.4	*200	*1	*1	*20	2.0	6.6	4	*5	1200	*500
SC266	*5	5	*5	*100	3	*10	27	*10	140	1	*2	6.6	*2	*100	16	*0.5	59	0.11	*50	*10	0.3	3.4	*10	2.8	*200	*1	*1	*20	2.6	4.5	4	*5	3500	*500
SC267	*5	3	*5	390	*1	*10	28	*10	180	3	*2	0.6	*2	*100	9	*0.5	4	2.50	*50	200	0.2	2.6	*10	2.7	*200	3	*1	*20	5.0	2.6	*2	*5	*200	*500
SC268	*5	9	*5	130	*1	*10	37	41	530	32	*2	8.7	*2	100	18	0.5	*2	0.58	94	760	0.4	23.0	*10	5.1	*200	2	*1	*20	2.2	3.9	*2	*5	540	*500

U.S. DEPARTMENT OF THE INTERIOR
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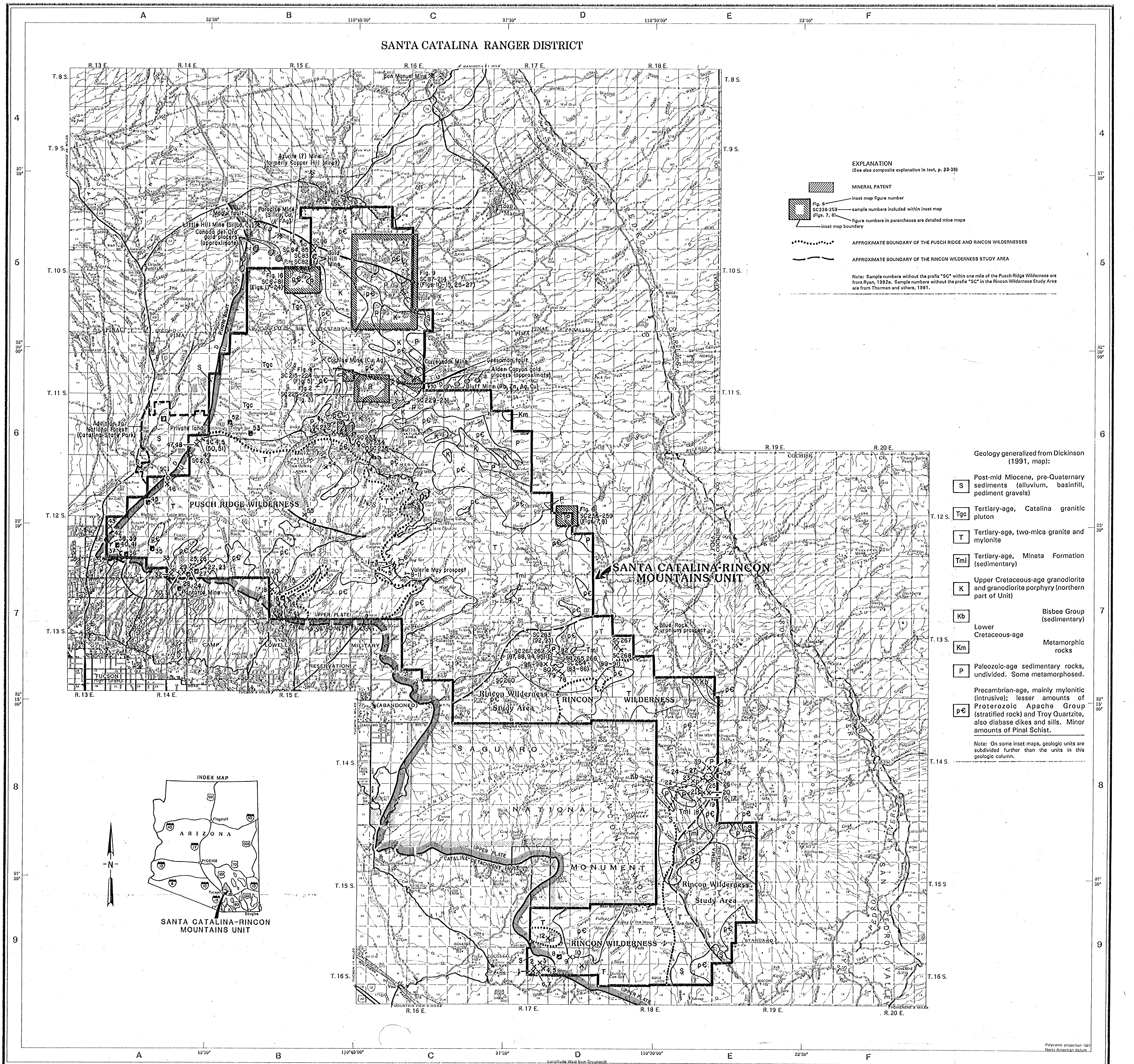
PLATE 1



Base map compiled and drafted at Regional Office, Albuquerque, New Mexico, from U.S. Forest Service Planimetric maps. Revised 1976.

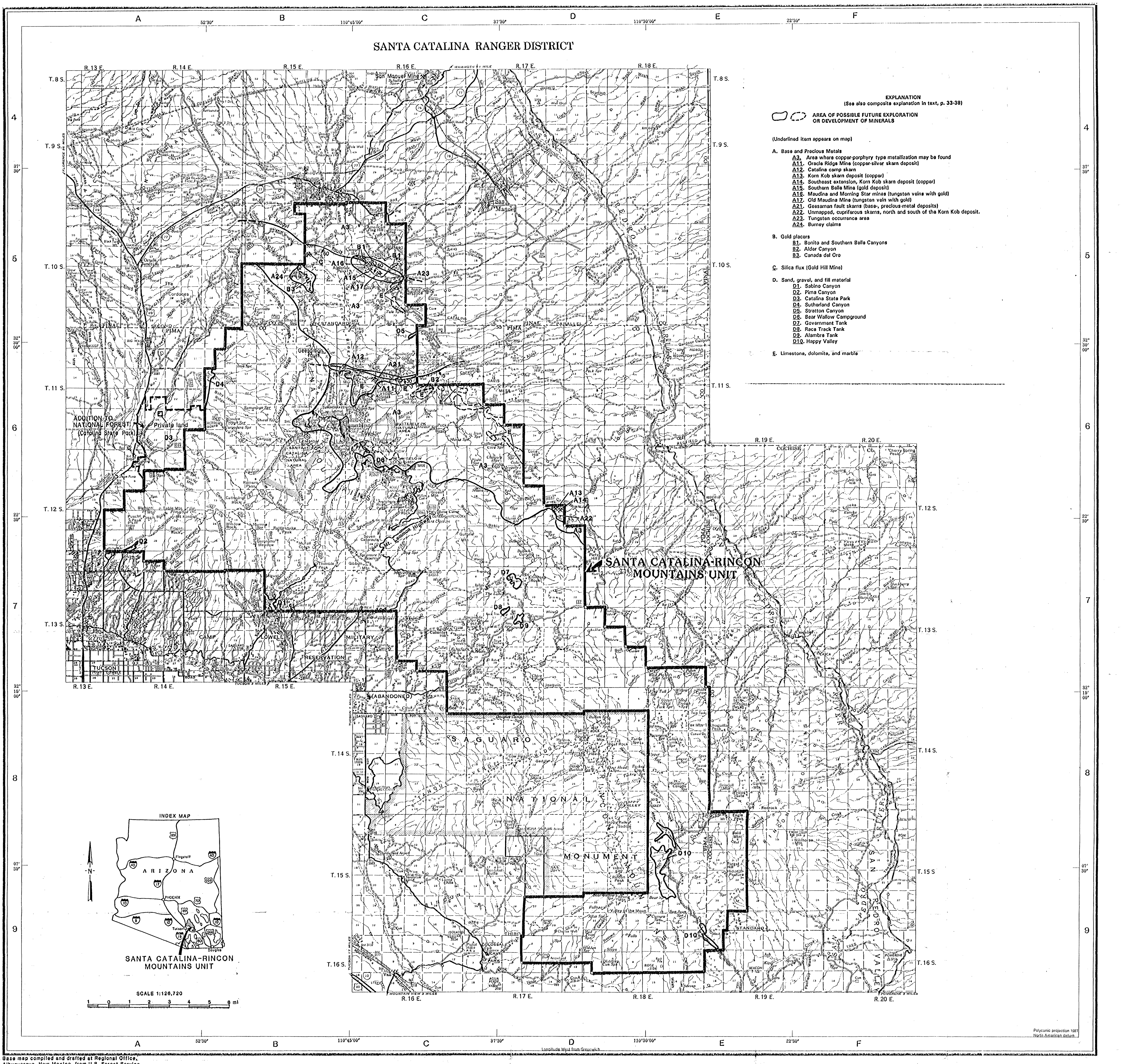
Field work completed in 1992 by Darwin K. Marjaniemi; assisted by Robert Armstrong, Roy Harris, Robert Smith, Roger Villalobos, and Jeanne Zelten.

SAMPLE LOCALITY AND GEOLOGIC MAP OF THE SANTA CATALINA-RINCON MOUNTAINS UNIT, CORONADO NATIONAL FOREST, COCHISE, PIMA, AND PINAL COUNTIES, ARIZONA

BY

STAFF, U.S. BUREAU OF MINES

1994



Base map compiled and drafted at Regional Office, Albuquerque, New Mexico, from U.S. Forest Service Planimetric maps. Revised 1976, Geesaman and Mogul Faults taken from Dickinson, 1991; other geologic sources referenced in text.

AREAS OF POSSIBLE FUTURE EXPLORATION OR DEVELOPMENT OF MINERALS, SANTA CATALINA-RINCON MOUNTAINS UNIT, CORONADO NATIONAL FOREST, COCHISE, PIMA, AND PINAL COUNTIES, ARIZONA

BY

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FIG. 9

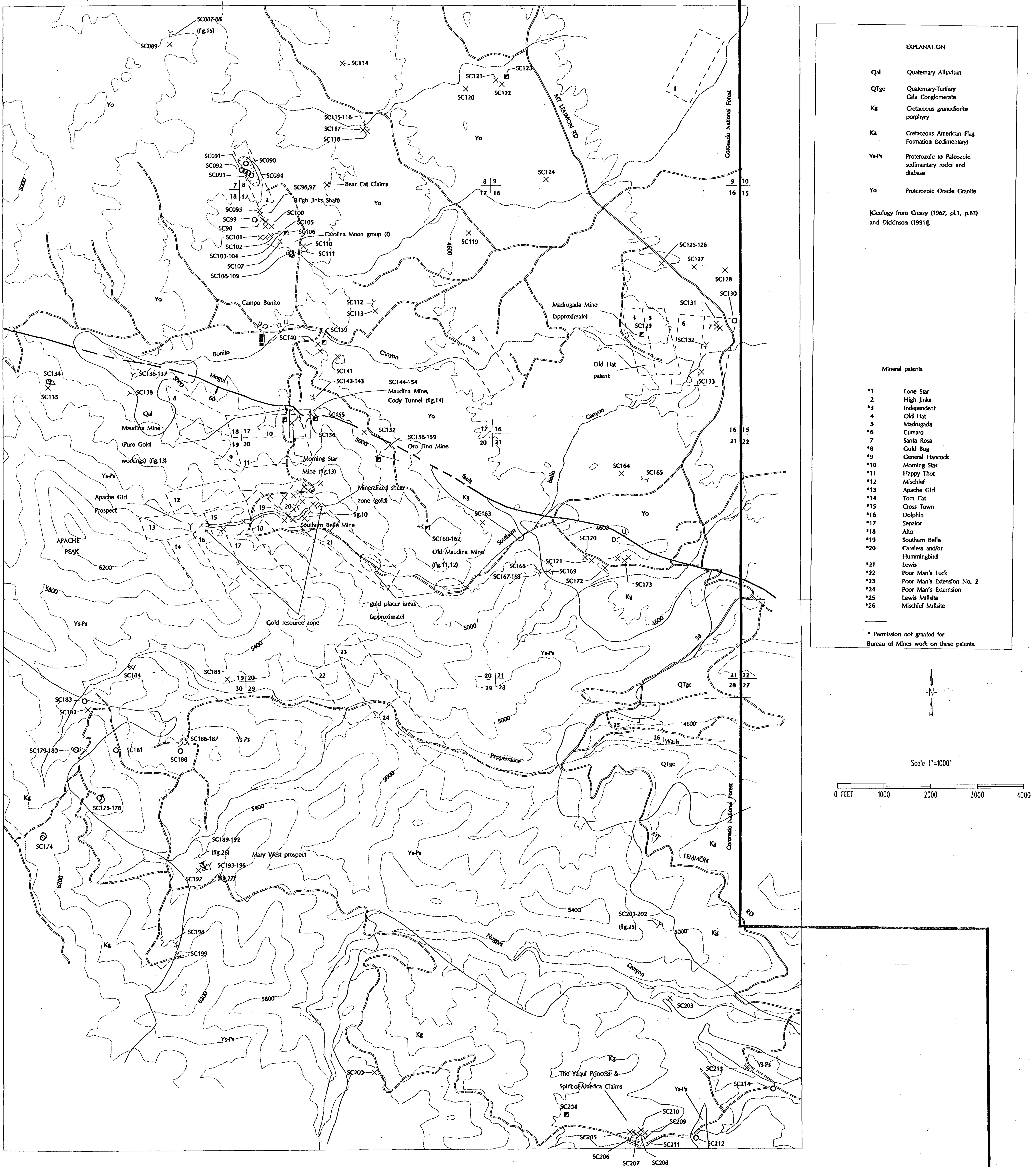

Figure 9.--: Oracle district, with sample localities SC87-214, Santa Catalina Mountains.