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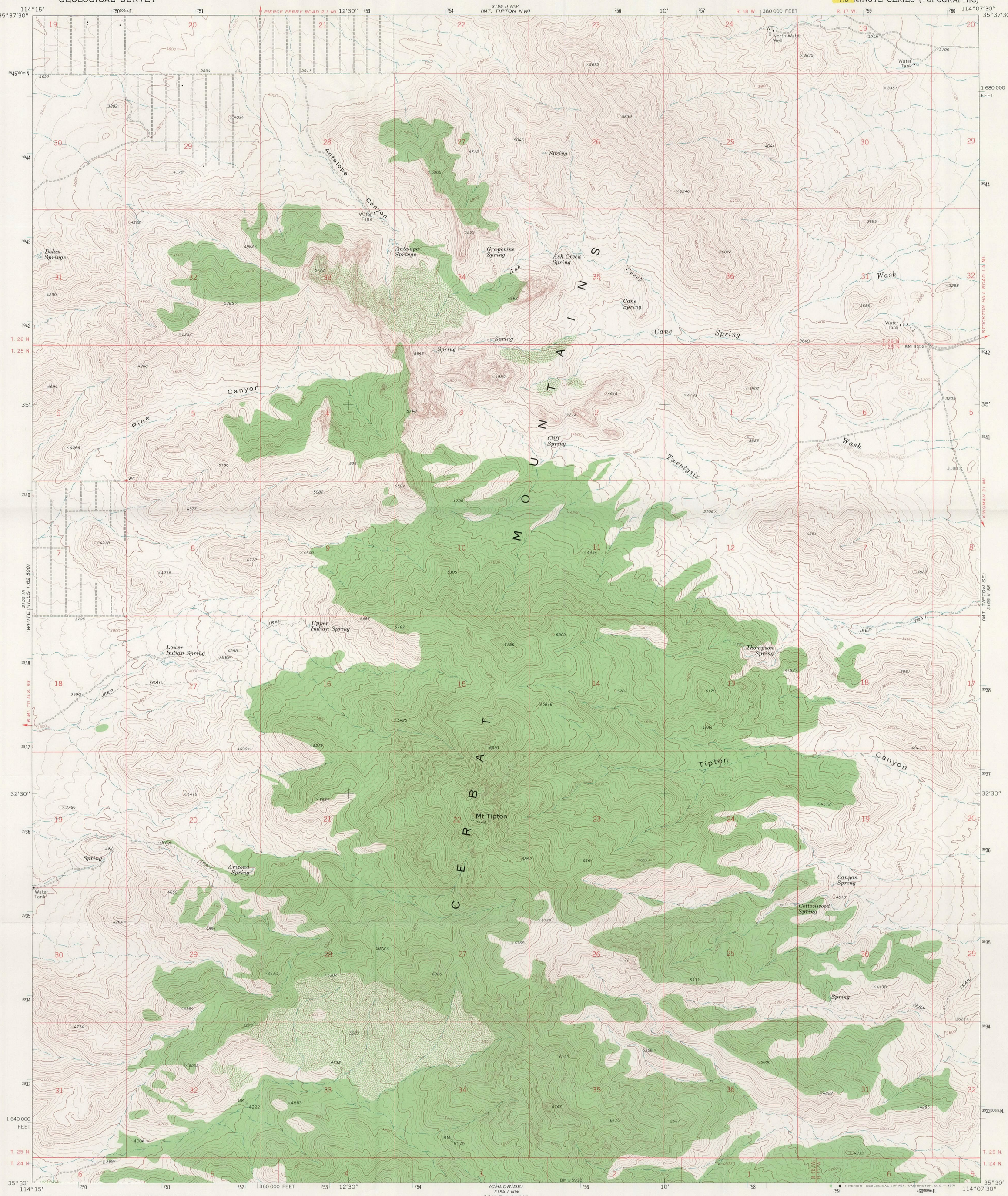
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SW

MT. TIPTON QUADRANGLE
ARIZONA—MOHAVE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



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Topography by photogrammetric methods from aerial photographs taken 1967. Field checked 1968

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 11, shown in blue

Fine red dashed lines indicate selected fence lines

UTM GRID AND 1968 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Light-duty ..... Unimproved dirt - - - - - -

ARIZONA
QUADRANGLE LOCATION

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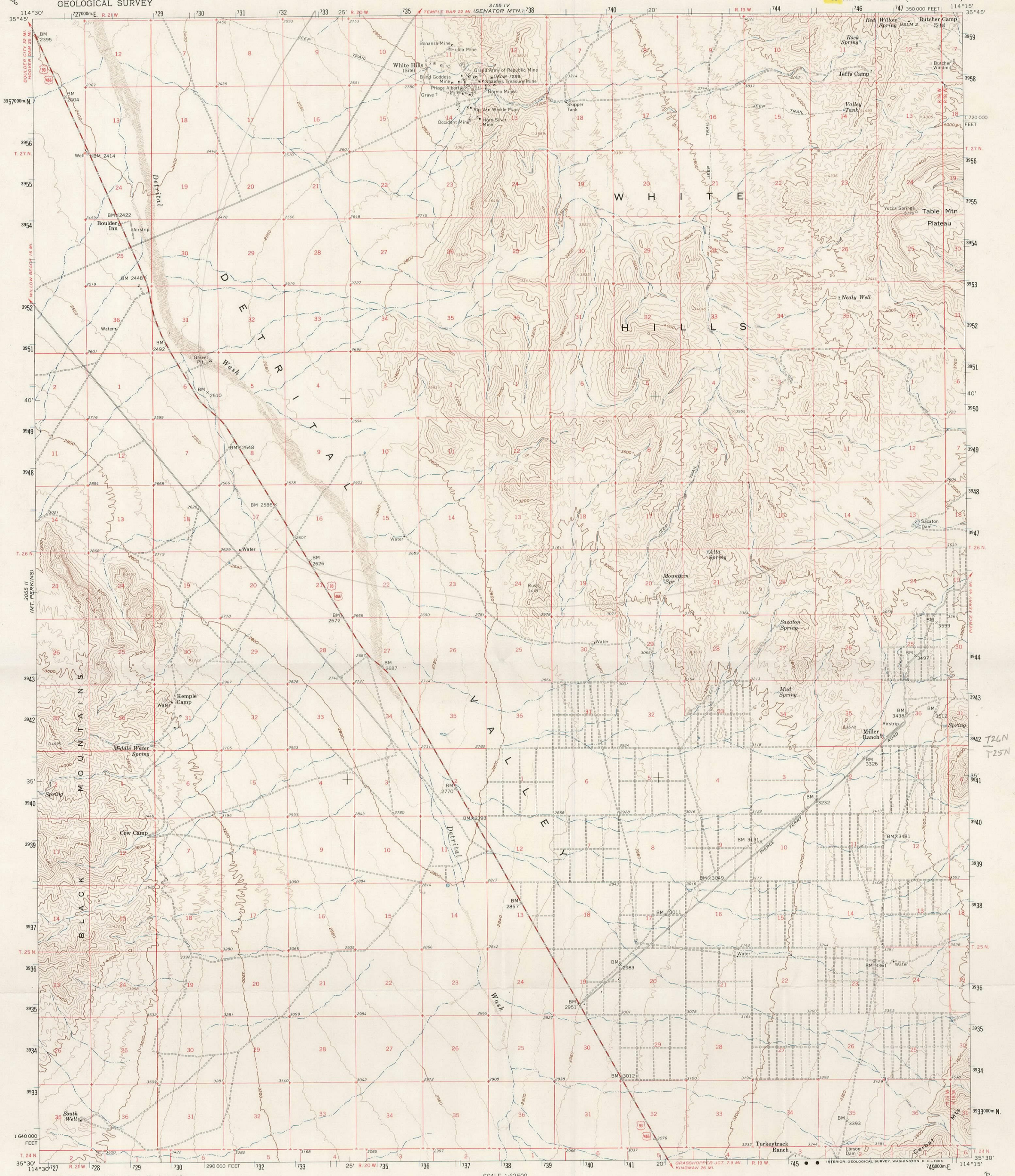
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1971

Kurz 2/87

SW MT. TIPTON, ARIZ.
N3530—W11407.5/7.5
1968
AMS 3155 II SW—SERIES V898

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WHITE HILLS QUADRANGLE
ARIZONA–MOHAVE CO.
15 MINUTE SERIES (TOPOGRAPHIC)



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Aerial photographs taken 1958. Field check 1960

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks,
zone 11, shown in blue

Landlines unsurveyed in part of T. 27 N.–R. 21 W.

UTM GRID AND 1960 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:62 500

CONTOUR INTERVAL 80 FEET
DOTTED LINES REPRESENT 40-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION
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WHITE HILLS, ARIZ.
N3530—W11415/15
1960
AMS 3155 III—SERIES V798

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MT. TIPTON NW QUADRANGLE
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7.5 MINUTE SERIES (TOPOGRAPHIC)

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Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 11, shown in blue

To place on the predicted North American Datum 1983 move the projection lines 3 meters north and 72 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence lines

GN MN
1°38′ 29 MILS
15° 267 MILS
UTM GRID AND 1968 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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ARIZONA
QUADRANGLE LOCATION

Map photoinspected 1980
No major culture or drainage changes observed

ROAD CLASSIFICATION
Light-duty ——— Unimproved dirt - - - - -

MT. TIPTON NW, ARIZ.
35114-F2-TF-024
PHOTOINSPECTED 1980
1968

DMA 3155 II NW—SERIES V898

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
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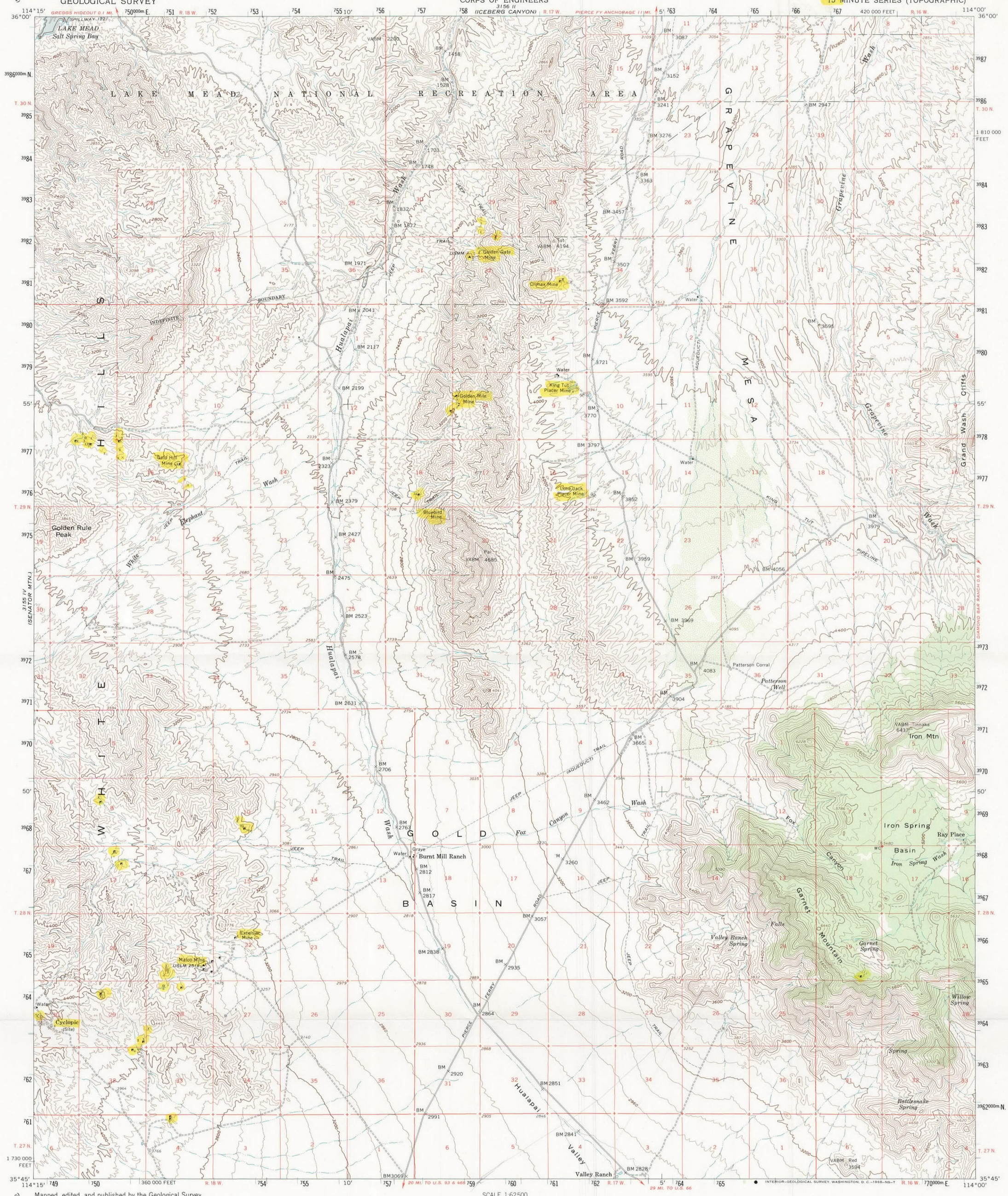
CORPS OF ENGINEERS

GARNET MOUNTAIN QUADRANGLE
ARIZONA—MOHAVE CO.
15 MINUTE SERIES (TOPOGRAPHIC)



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Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1958. Field check 1960

Underwater contours compiled from USDA maps
and later sedimentation studies

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks,
zone 11, shown in blue

Land lines unsurveyed in parts of T. 29 N.–R. 18 W.,
and T. 30 N.–Rs. 17 and 18 W.

UTM GRID AND 1960 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCALE 1:62500

CONTOUR INTERVAL 80 FEET
DOTTED LINES REPRESENT 40-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION
Light-duty — Unimproved dirt

ARIZONA
QUADRANGLE LOCATION

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GARNET MTN., ARIZ.
N3545—W11400/15

1960

AMS 3155 I—SERIES V798

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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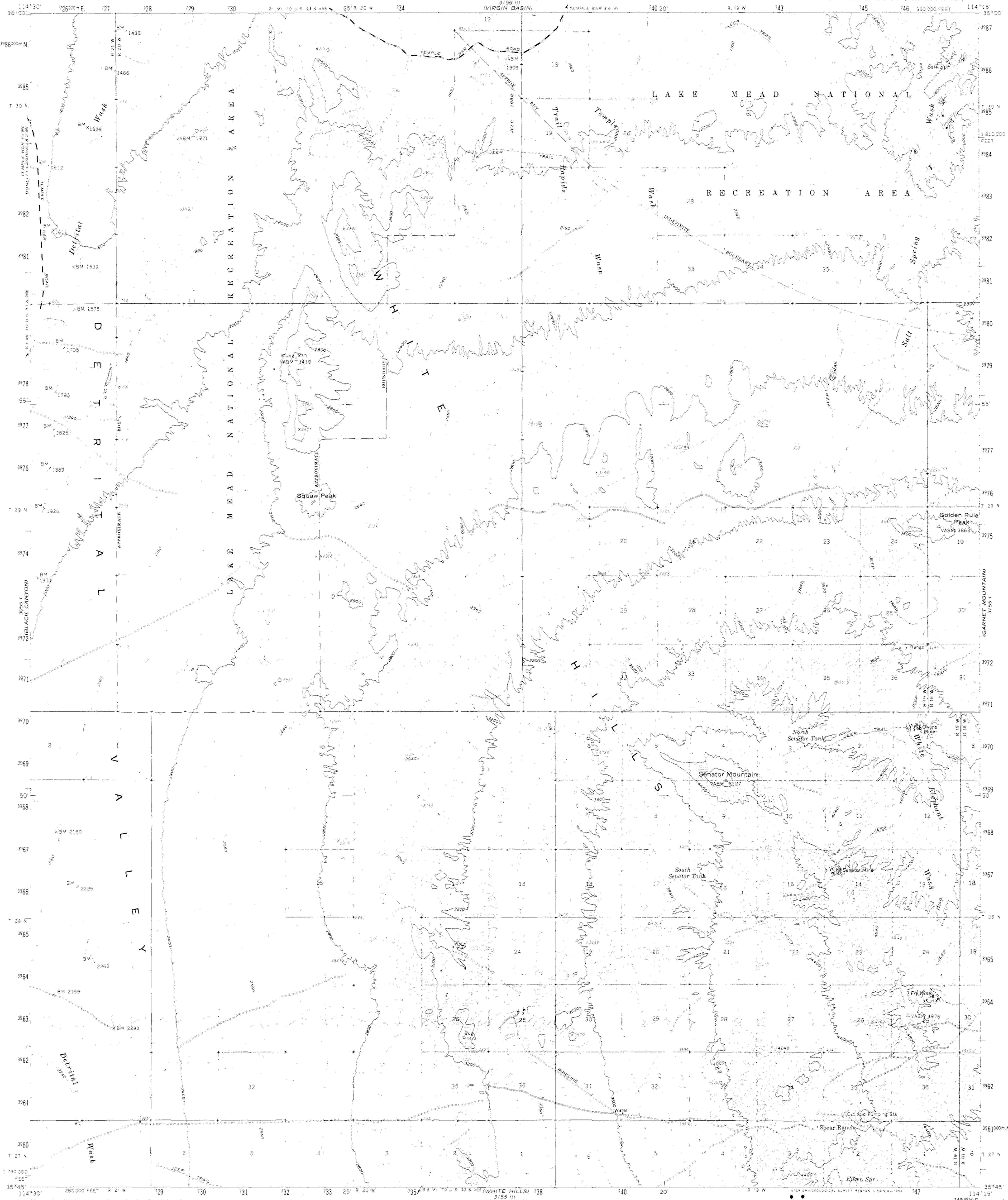
SENATOR MOUNTAIN QUADRANGLE
ARIZONA–MOHAVE CO.
15 MINUTE SERIES (TOPOGRAPHIC)



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Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1958. Field check 1960

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks,
zone 11, shown in blue

To place on the predicted North American Datum 1983
move the projection lines 4 meters north and
72 meters east

Land lines unsurveyed in parts of T. 27 N., R. 21 W.,
T. 28 N., Rs. 20, and 21 W., and Ts. 29 and 30 N., Rs. 18,
19, 20, and 21 W.

There may be private inholdings within the boundaries of
the National or State reservations shown on this map

UTM GRID AND 1960 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCALE 1:62500

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION
Medium-duty — Light-duty
Unimproved dirt

ARIZONA
QUADRANGLE LOCATION

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SENATOR MOUNTAIN, ARIZ.
N3545—W11415/15

1960

DMA 3155 IV—SERIES V798

TUCSON'S
MAP
& FLAG CENTER
2560 N. 1st Ave.
Tucson, AZ 85719
(602) 623 1104

Gold Basin Study.
Observations / Sampling.

1. Style of Area, Structures, strike/dip, thickness

2. Wallrock type, ~~and~~ relationships, & contacts.

3. Type of mineralization, associate gange, thickness, attitude.

4. Sample interval, position.

5. Sketch map.

Things To do: Gold Basin

~~1. Order 15' Topo Senator Mtn Garnet Mtn) done 12/14 5 copies w/ Dave~~

~~2. Order 7½ topo from above 15' by cutting & enlarging 12/14 Dave to have done.~~

3. Order Orthophoto of above Quads (7½')

4. Order other preliminary data available (7½')

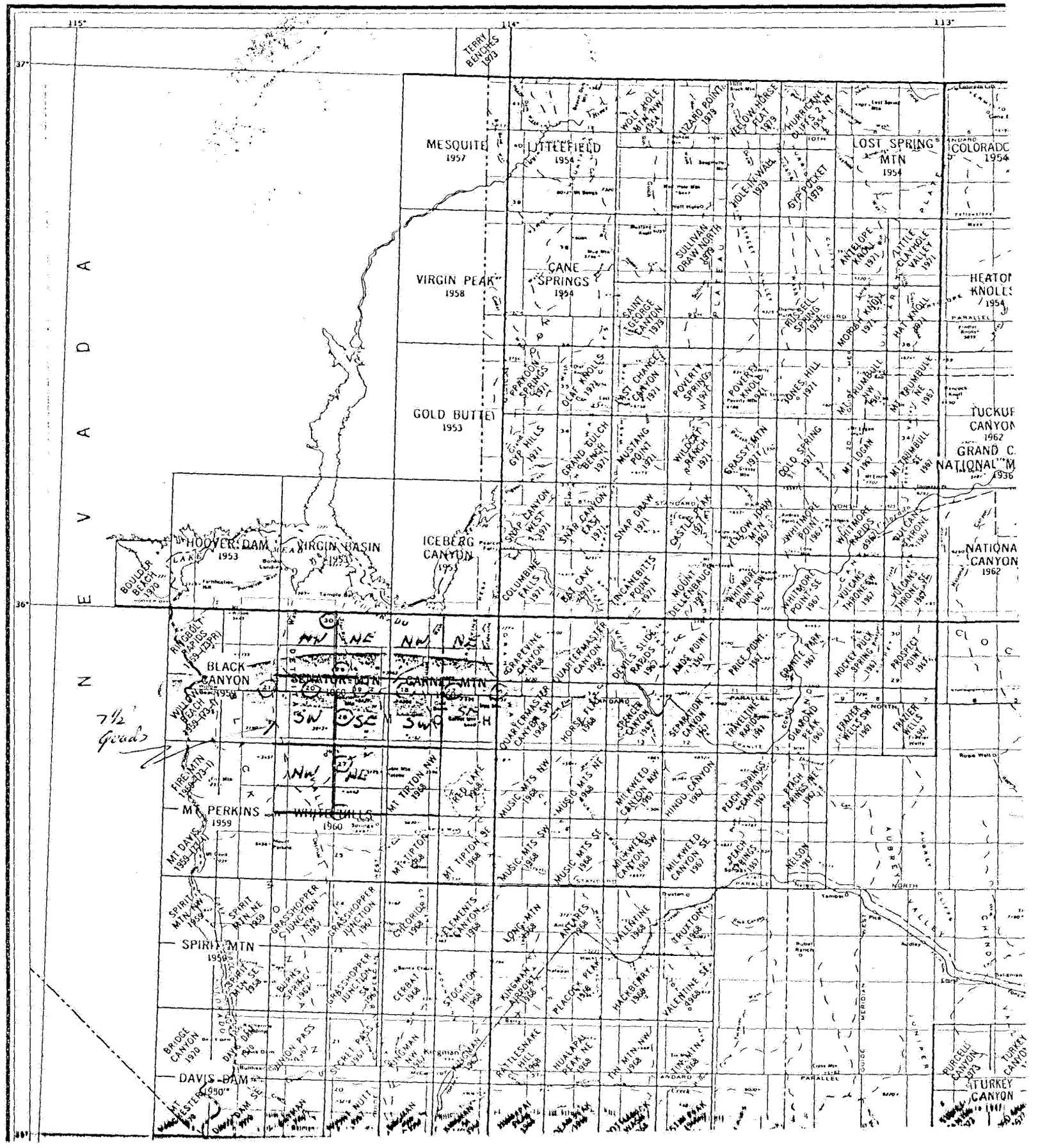
5. Order USGS PP 1361 requested Med 12/14

6. Order Publication: list to Mark 12/14

~~7. Enlarge Photo 1 from 1:40,000 to 1:24,000. req 12/14 w/ Dave~~

~~8. Enlarge top ½ of White Hills (15') to 7½ minute as in 2 above. done 12/14 Dave Fletcher~~

~~9. Enlarge top ½ of Order 7½' NW Mt Tipton. done 12/14 Dave Fletcher~~


115°
114°
113°
37°
36°
NEVADA
MESQUITE 1957
LITTLEFIELD 1954
LOST SPRING MTN 1954
COLORADO 1954
VIRGIN PEAK 1958
CANE SPRINGS 1954
HEATON KNOLLS 1954
GOLD BUTTE 1953
TUCKUP CANYON 1962
GRAND C. NATIONAL M 1936
HOOVER DAM 1953
VIRGIN BASIN 1953
ICEBERG CANYON 1953
NATIONAL CANYON 1962
BOULDER BEACH 1970
BLACK CANYON
SENATOR MTN
CARNEY MTN
WILLOW BEACH 1959
7½' Grids
FIRE MTN
MT PERKINS 1959
WHITE HILLS 1960
MT DAVIS 1959
SPIRIT MTN 1959
DAVIS DAM 1950
BRIDGE CANYON 1970
TURKEY CANYON 1973
PURCELL CANYON 1973

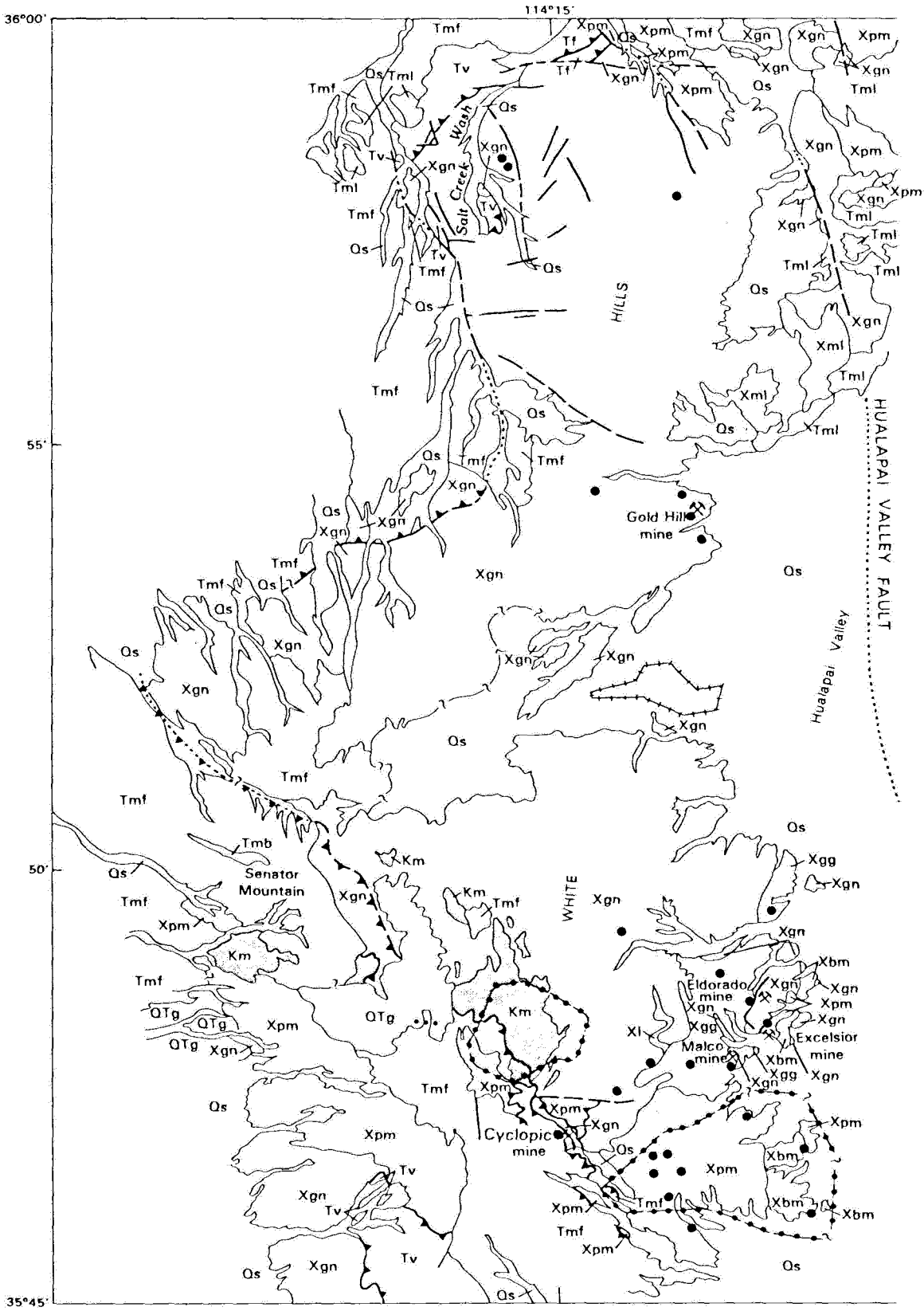


FIGURE 2.—Sketch map of area of Gold Basin-Lost Basin mining districts showing geology, major mines credited with production of metal(s), known occurrences of gold, and major placer workings. Geology modified from Blacet (1975), P.M. Blacet (unpub. data, 1967–72), Deaderick (1980), and K.A. Johnson (unpub. data, 1983). Field checked by T.G. Theodore and W.N. Blair, 1977–79.

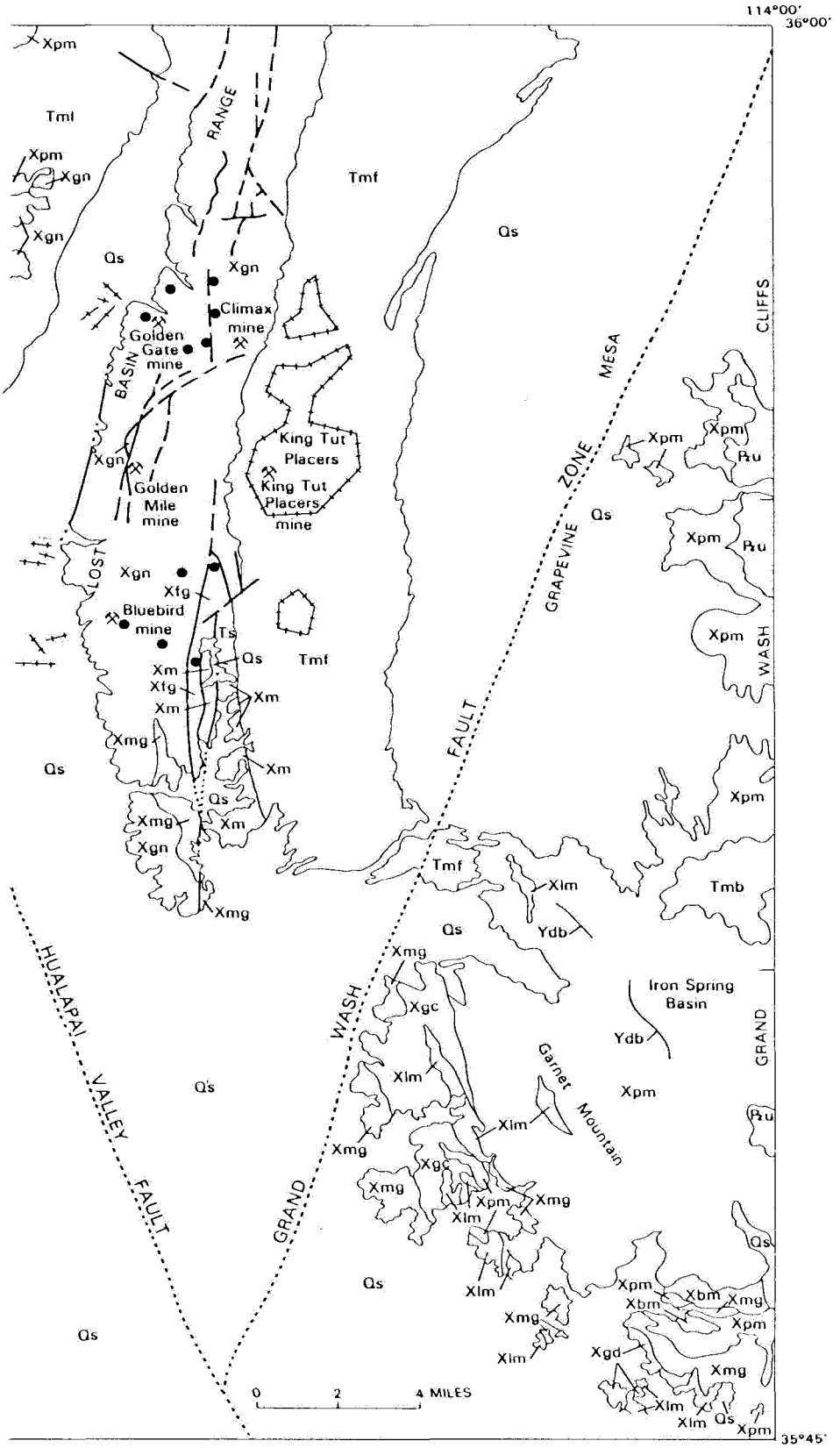


FIGURE 2.—Continued.

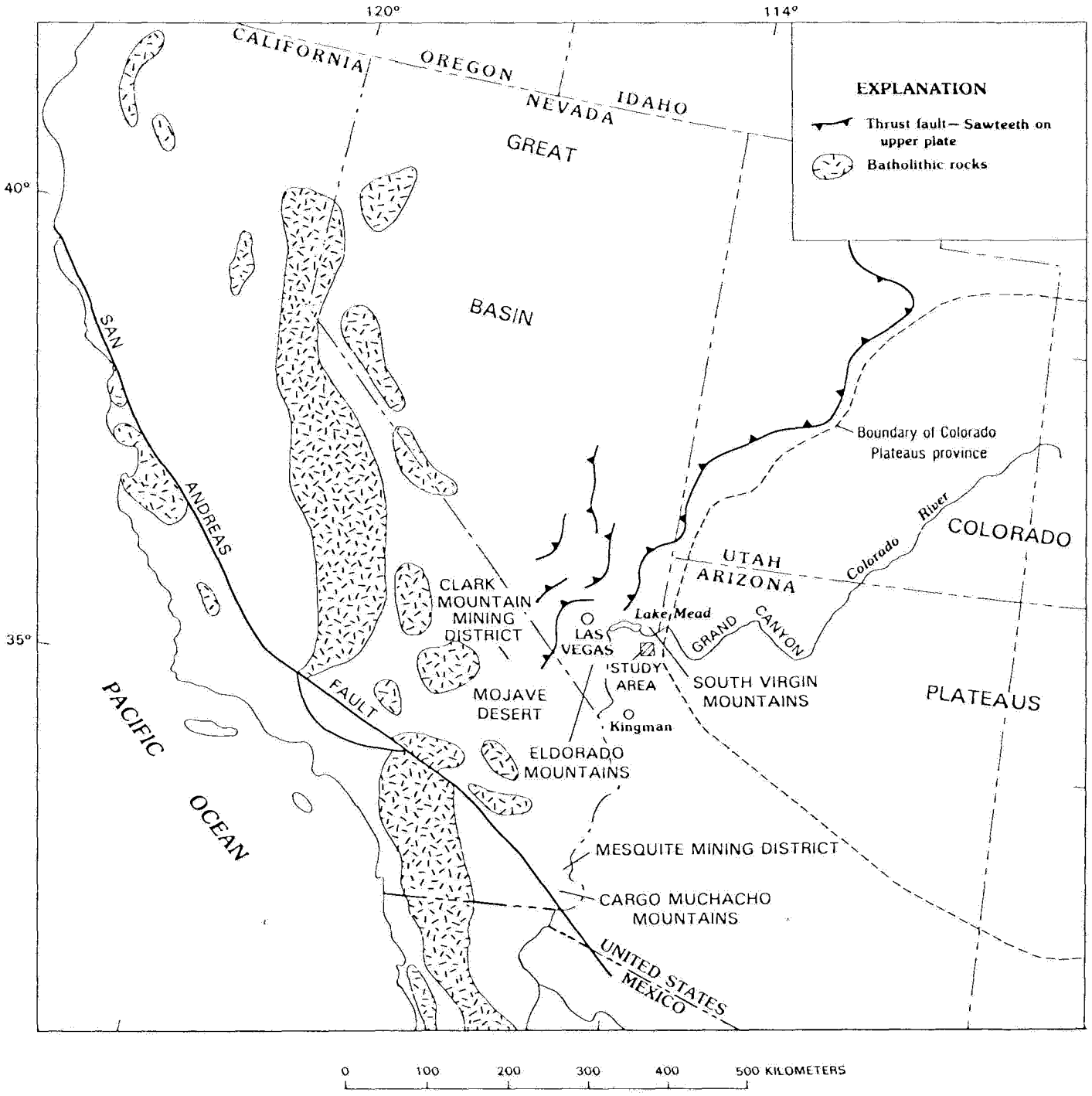
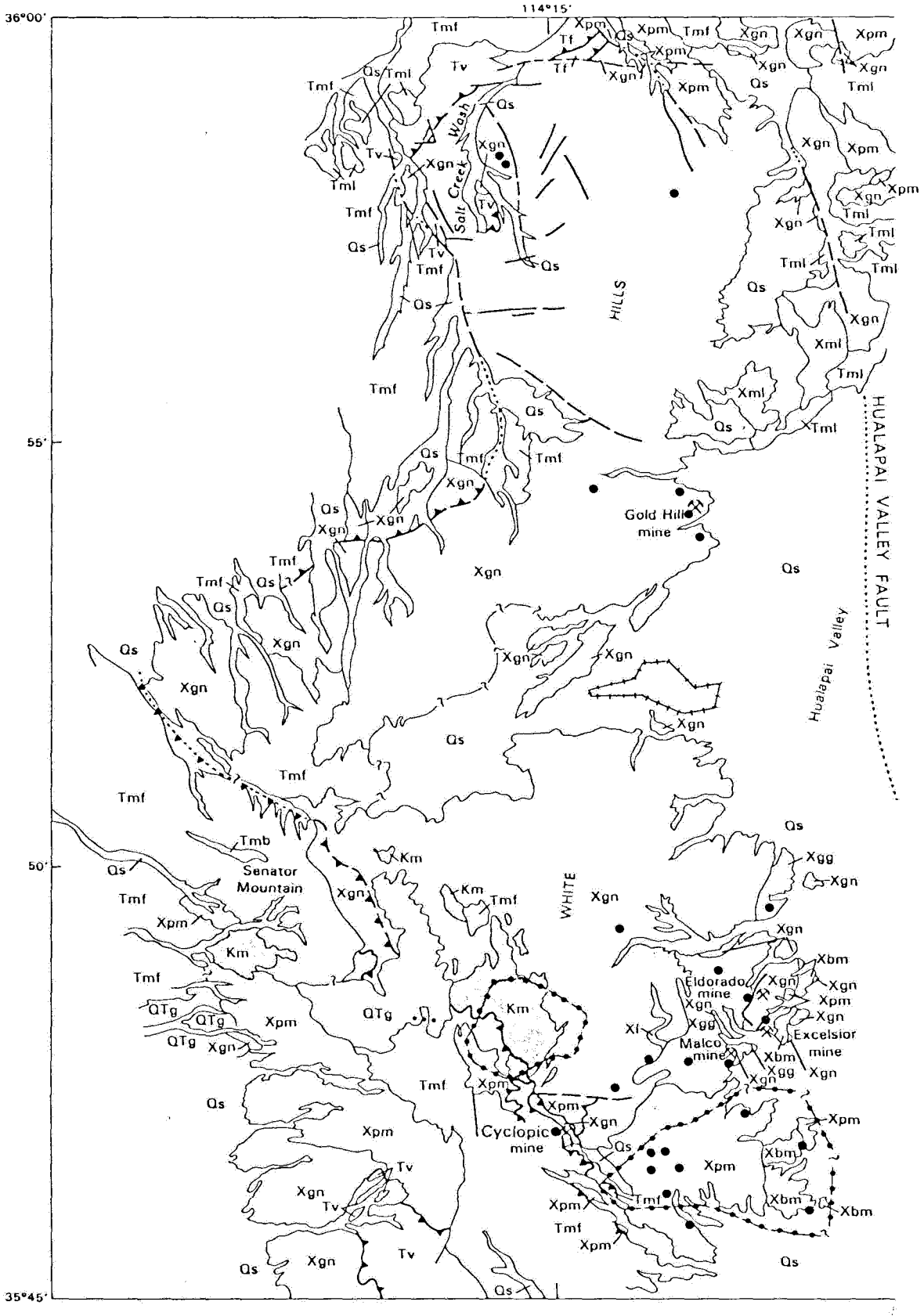


FIGURE 1.—Index map showing location of study area containing Gold Basin-Lost Basin mining districts. Modified from Haxel and others (1984).



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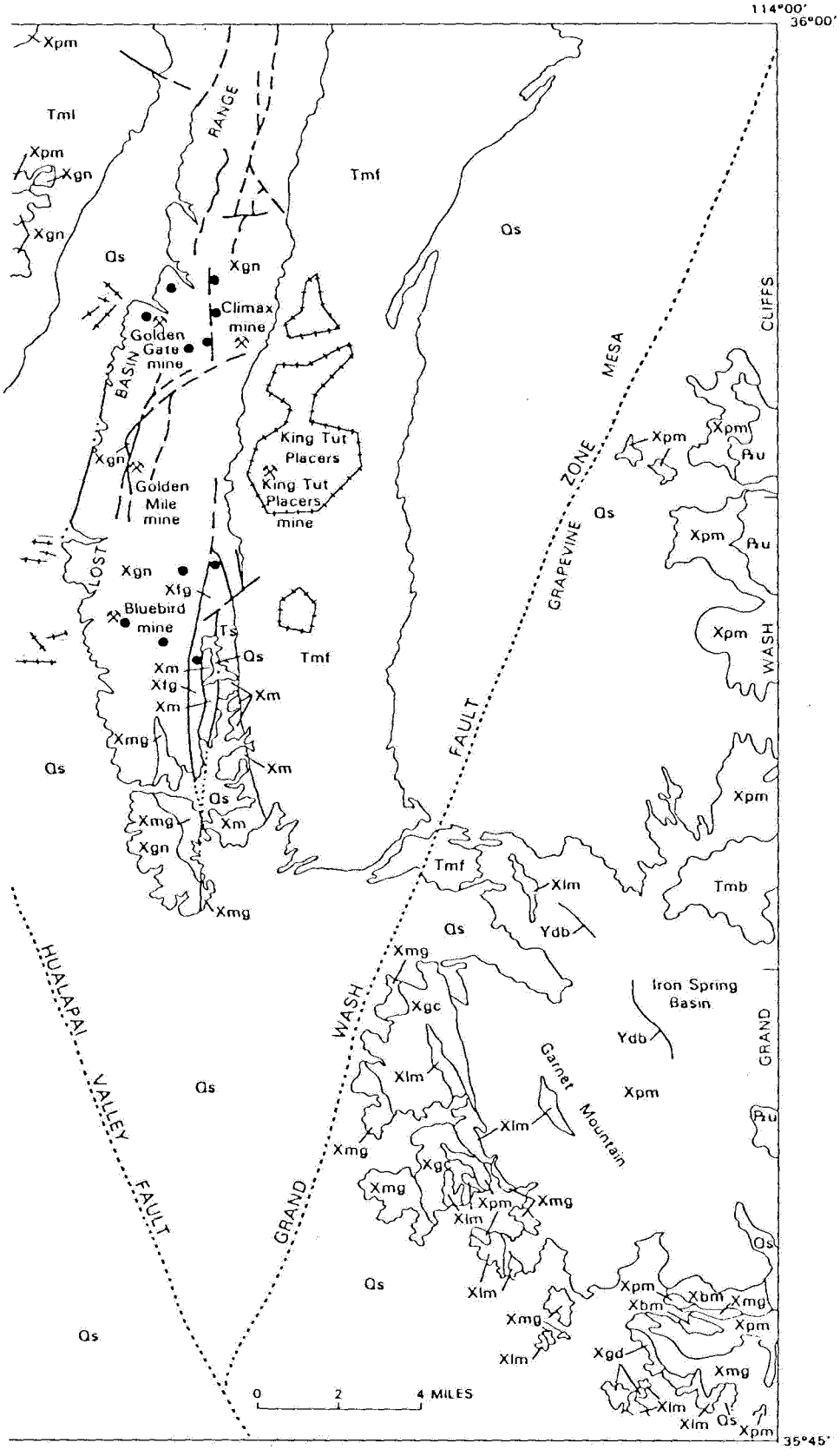

FIGURE 2.—Continued.

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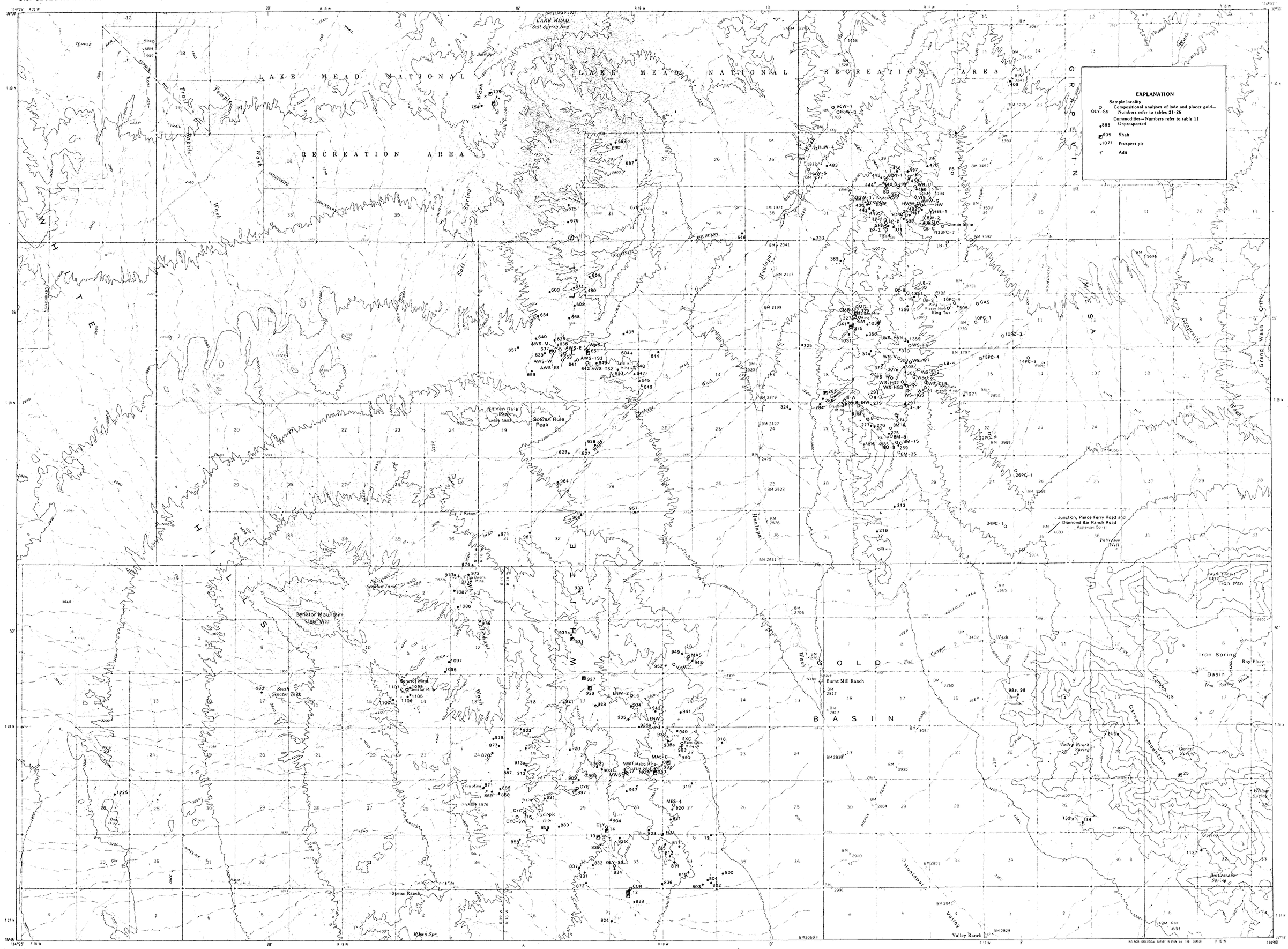

LOCALITIES FOR COMMODITIES AND COMPOSITIONAL ANALYSES OF LODE AND PLACER GOLD IN THE GOLD BASIN-LOST BASIN MINING DISTRICTS, MOHAVE COUNTY, ARIZONA

Localities
Lode & Placer Gold
Gold Basin - Lost Basin
Mining Districts
Mohave County
Arizona

USGS PP 1361
Plate 1.

Geology and Gold Mineralization of the Gold Basin-Lost Basin Mining Districts, Mohave County, Arizona

U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER 1361

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Geology and Gold Mineralization of the Gold Basin-Lost Basin Mining Districts, Mohave County, Arizona

By TED G. THEODORE, WILL N. BLAIR, *and* J. THOMAS NASH

With a section on K-AR CHRONOLOGY OF MINERALIZATION AND IGNEOUS ACTIVITY

By EDWIN H. McKEE

and a section on IMPLICATIONS OF THE COMPOSITIONS OF LODE AND PLACER GOLD

By J.C. ANTWEILER *and* W.L. CAMPBELL

U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER 1361

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1987

CONTENTS

	Page
Abstract	1
Introduction	1
Acknowledgments	2
History of mining activity	3
General geology of the districts	9
K-Ar chronology of mineralization and igneous activity, by Edwin H. McKee	14
Cretaceous plutonic rocks	15
Cretaceous veins	15
Proterozoic(?) vein	16
Tertiary volcanic rocks	17
Petrochemistry of crystalline rocks and their relation to mineralization	18
Pelitic metamorphic rocks	20
Muscovite-biotite schist	21
Tourmaline schist and gneiss	23
Almandine-biotite ± staurolite schist and gneiss	25
Kyanite-bearing gneiss	27
Sillimanite- and cordierite-bearing gneiss and schist	29
Petrogenetic implications of mineral relations	32
Quartzofeldspathic gneiss	33
Amphibolite	35
Metachert, banded iron formation, and metarhyolite	43
Marble, calc-silicate marble, and skarn	44
Proterozoic igneous and metaigneous rocks	46
Leucogranite	47
Gneissic granodiorite	48
Feldspathic gneiss	49
Biotite monzogranite	49
Leucocratic monzogranite	50
Porphyritic monzogranite of Garnet Mountain	51
Granodiorite	60
Diabase	61
Cretaceous crystalline rocks	61
Two-mica monzogranite	61
Episyenite	69
Gold deposits and occurrences	70
Proterozoic veins	71
Late Cretaceous and (or) early Tertiary veins	74
Disseminated gold in episyenite	82
Petrography	84
Paragenetic relations of gold	87
Chemistry	88
Discussion	91
Veins along the Miocene detachment fault	93
Placer gold deposits	93
Implications of the compositions of lode and placer gold, by J.C. Antweiler and W.L. Campbell	100
Introduction	100
Variations in gold composition	101
Comparison of composition of placer gold in Lost Basin with that of possible lode sources	103
Composition of lode gold from the Lost Basin district	105
Composition of gold from mines in Gold Basin	105
Similarity of signatures of gold samples from some localities in the districts to that of gold samples from some porphyry copper deposits	105
Fluid-inclusion studies	108
Types of fluid inclusions	109
Homogenization temperatures and salinities	111
Fluid inclusions in the episyenitic alteration pipes containing disseminated gold	115
Fluid inclusions in a quartz-fluorite-white mica vein that cuts the Late Cretaceous two-mica monzogranite	117
Comparison of fluids in a quartz-fluorite-white mica vein and in gold-bearing episyenitic pipes	120
Estimates of the pressure-temperature environment of mineralization	120
Discussion	122
Suggestions for exploratory programs	125
References	126

ILLUSTRATIONS

		Page
FRONTISPIECE.	Placer gold nugget about 1 cm wide showing gold molded partly against rounded fragment of clear vein quartz.	
PLATE 1.	Localities for commodities and compositional analyses in the Gold Basin-Lost Basin mining districts	In pocket
FIGURE 1.	Index map showing area of study	2
2.	Sketch map of area of Gold Basin-Lost Basin mining districts showing geology, major mines credited with production of metal(s), known occurrences of gold, and major placer workings	4
3.	Schematic east-west cross sections showing inferred geologic relations	8
4.	Scanning electron micrograph and X-ray spectra of an unknown mineral	17
5.	Photographs showing typical exposures of paragenetic sequences	19
6.	Photograph showing coarse-grained quartz-feldspar leucogranite crosscutting schistosity in amphibolite and filling fracture opened between blocks of amphibolite	20
7.	Chart of inferred mineral changes and corresponding metamorphic facies in pelitic rocks from the Early Proterozoic gneiss terrane	21
8.	Photograph of laminated muscovite-biotite-quartz schist showing fabric composed of three distinct *s* surfaces reflecting three superposed deformations	21

Page

FIGURES 9–14. Photomicrographs showing:
9. Schist containing relatively abundant concentrations of muscovite and (or) biotite ---------- 22
10. Structural and textural relations of tourmaline in metamorphic rocks---------- 25
11. Textural relations among minerals in garnet-bearing gneiss ---------- 26
12. Textural relations of kyanite ---------- 28
13. Textural relations of sillimanite---------- 30
14. Textural relations of cordierite ---------- 32
15. Thompson (1957) AFM diagrams for medium-pressure progressive metamorphism---------- 33
16. Equilibrium curves generated from thermodynamic data---------- 34
17. Graph showing plot of SiO_2 versus CaO in four samples of quartzofeldspathic gneiss ---------- 35
18. Photomicrographs of structure and textures in amphibolite ---------- 36
19–21. Graphs showing:
19. Niggli 100 *mg*, *c*, and *al-alk* values for amphibolite, diabase, and pyroxene-banded gneiss ---------- 41
20. Niggli *c* versus *mg* values for amphibolite, diabase, and pyroxene-banded gneiss ---------- 42
21. Niggli *c* versus *al-alk* values for amphibolite, diabase, and pyroxene-banded gneiss ---------- 42
22. Photomicrograph of oxide facies, banded iron formation---------- 44
23. Schematic diagram of sequence of mineral assemblages developed in zones near the contact between medium-grained schist and fine-grained calc-silicate rock ---------- 46
24. Ternary diagram showing modes of Proterozoic igneous and metaigneous rocks---------- 47
25. Photographs of porphyritic monzogranite of Garnet Mountain ---------- 53
26. Photomicrographs showing textural relations in gneiss immediately adjacent to porphyritic monzogranite and in porphyritic monzogranite itself---------- 54
27. Graph showing fluorine and cerium contents versus differentiation index of analyzed samples of Early Proterozoic porphyritic monzogranite of Garnet Mountain and Early Proterozoic biotite monzogranite --- 57
28. Graph showing total alkalis and CaO plotted against weight percent SiO_2 for analyzed samples of Early Proterozoic porphyritic monzogranite and Early Proterozoic biotite monzogranite---------- 58
29. Ternary chemical and normative diagrams of analyzed Early Proterozoic porphyritic monzogranite and biotite monzogranite---------- 59
30. Photomicrographs showing textural relations in Early Proterozoic granodiorite border phase of the porphyritic monzogranite of Garnet Mountain ---------- 60
31. Map showing occurrences of Phanerozoic muscovite-bearing plutonic rocks in Western United States------ 62
32. Photograph of Tertiary(?) composite, partly chloritized, porphyritic biotite dacite dike containing septum of Cretaceous two-mica monzogranite---------- 63
33. Ternary diagram showing modes of Cretaceous two-mica monzogranite ---------- 64
34. Photomicrographs showing textural relations in Cretaceous two-mica monzogranite---------- 65
35–37. Graphs showing:
35. Ratio of Al_2O_3: (K_2O+Na_2O+CaO) versus SiO_2 from a Cretaceous two-mica monzogranite------- 68
36. Na_2O plus K_2O versus Al_2O_3 from a Cretaceous two-mica monzogranite ---------- 68
37. Normative corundum versus SiO_2 from a Cretaceous two-mica monzogranite---------- 69
38. Ternary diagram showing normative proportion of albite, orthoclase, and quartz in Cretaceous two-mica monzogranite---------- 69
39. Map showing areas reported to contain gold mineralization in the general area of the Black Mountains volcanic province of Liggett and Childs (1977) ---------- 71
40. Photographs showing microscopic and megascopic relations in apparently Proterozoic veins---------- 72
41. Scanning electron micrographs showing relations of gold in apparently Proterozoic veins at locality 735 in the Senator Mountain 15-minute quadrangle ---------- 73
42. Photographs of selected mine workings, quartz veins, and quartz-cored pegmatite---------- 74
43. Equal-area projection showing orientation of poles to veins ---------- 75
44. Photographs showing typical veins---------- 76
45. Photomicrographs showing relations between quartz-ferroan calcite veins and sericitically altered Proterozoic granitic gneiss ---------- 77
46. Scanning electron micrographs of lode gold collected from Golden Gate mine ---------- 78
47. Diagrammatic summary of alteration surrounding typical feldspar-stage vein including albite-quartz-calcite-barite-pyrite-gold composite assemblage ---------- 80
48. AKFC diagram showing mineral assemblages in altered wall rock adjacent to typical feldspar-bearing vein --- 80
49. Schematic stability relations among minerals as function of $(Mg^{2+})/(2H^+)$ and $(K^+)/(H^+)$ cation activity ratios in coexisting fluid---------- 81
50. Geologic sketch map of immediate vicinity of occurrence of visible disseminated gold ---------- 83
51. Photographs of gold-bearing episyenitic rock---------- 84
52. Graph showing variation in volume percent of potassium feldspar and quartz along section line *A-A′* of figure 50---------- 84
53. Photomicrographs and scanning electron micrograph of mineralogic relations in episyenitic rock -------- 86
54. Scanning electron micrographs showing gold disseminated in episyenitic rock---------- 88
55. Photomicrographs of coarse-grained episyenite containing visible gold---------- 89

Page

FIGURE 56. Photomicrograph showing morphology of intergrown fluorite and gold ---------- 89
57. Plot showing normative potassium feldspar, normative albite, and normative quartz in analyzed samples of Late Cretaceous and (or) early Tertiary episyenite, contact zone of the episyenite, and sample of Early Proterozoic biotite monzogranite ---------- 91
58–60. Photographs showing:
58. Relations along Miocene detachment fault in general area of Cyclopic mine ---------- 94
59. Placer gold from Lost Basin mining district ---------- 95
60. Small, hand-operated dry washer ---------- 95
61. Scanning electron micrographs of placer gold nuggets ---------- 96
62. Photograph of relatively large placer gold nugget from Lost Basin mining district ---------- 97
63. Scanning electron micrographs of silver-gold relations in placer gold nugget obtained from northern part of Lost Basin mining district ---------- 97
64. Graphs of weight percent silver versus number of gold occurrences ---------- 104
65. Graphs of mean fineness versus number of gold occurrences in lode and placer gold ---------- 104
66. Photomicrograph and scanning electron micrographs showing relations among liquid carbon dioxide-bearing fluid inclusions ---------- 112
67. Photomicrographs showing relations among liquid carbon dioxide-bearing fluid inclusions ---------- 113
68. Graph of fluid-inclusion homogenization temperature and salinity data for various precious- and base-metal districts and deposits ---------- 115
69. Photomicrographs of fluid inclusions in samples from gold-bearing episyenitic rock ---------- 116
70–72. Histograms showing:
70. Salinities of primary and pseudosecondary and secondary fluid inclusions in fluorite from gold-bearing episyenitic rocks ---------- 118
71. Filling temperatures in fluorite from gold-bearing episyenitic rocks ---------- 118
72. Salinity and filling-temperature data obtained from selected quartz-fluorite-white mica vein ---------- 119
73. Schematic cross sections showing inferred relations among Early Proterozoic mafic and ultramafic rocks, Late Cretaceous two-mica monzogranite, fluids evolved from monzogranite, and episyenite ---------- 123

TABLES

Page

TABLE 1. Descriptions of gold-quartz mills in the Gold Basin-Lost Basin mining districts ---------- 10
2. Production of gold, silver, copper, and lead from lode deposits in the Gold Basin and Lost Basin mining districts, 1901–42 ---------- 11
3. K-Ar analytical data and ages ---------- 15
4. Chemical analyses of selected schist and gneiss from the Gold Basin-Lost Basin mining districts compared with analyses of slate, argillite, shale, graywacke, and arkose ---------- 24
5. Composite assemblages in sillimanite- and cordierite-bearing gneiss and schist in the Early Proterozoic metamorphic rocks in the general area of the Gold Basin-Lost Basin mining districts ---------- 29
6. Composite mineral assemblages in amphibolite and altered amphibolite from the Gold Basin-Lost Basin mining districts ---------- 38
7. Analyses of mafic rocks from the Early Proterozoic terrane in the Gold Basin-Lost Basin mining districts ---------- 39
8. Analyses for minor metals in selected samples of amphibolite and associated soil from the general area of the Bluebird mine in the Lost Basin mining district ---------- 40
9. Average major-element compositions of Gold Basin-Lost Basin amphibolite and various groups of igneous rocks and other amphibolites ---------- 41
10. Analyses of metachert, banded iron formation, metarhyolite, and calc-silicate marble in various Early Proterozoic metamorphic units from the Gold Basin-Lost Basin mining districts ---------- 43
11. Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts ---------- 135
12. Modal data for Proterozoic igneous and metaigneous rocks from the Gold Basin-Lost Basin mining districts ---------- 48
13. Analytical data of Early Proterozoic biotite monzogranite ---------- 50
14. Analytical data from the Early Proterozoic porphyritic monzogranite of Garnet Mountain ---------- 56
15. Analytical data from the Cretaceous two-mica monzogranite ---------- 66
16. Occurrences of episyenitic and syenitic rocks known in the Gold Basin-Lost Basin mining districts ---------- 70
17. Modal analyses of thin sections from rocks in the general area of the occurrence of visible, disseminated gold cropping out in the southeastern part of the Gold Basin mining districts ---------- 85
18. Analytical data of Late Cretaceous and (or) early Tertiary episyenite, of the contact zone of the episyenite, and of the adjoining host Early Proterozoic biotite monzogranite ---------- 90
19. Chemical analysis of average episyenite from Gold Basin and chemical analyses of other syenitic and episyenitic rocks from elsewhere ---------- 92

Page

TABLE 20. Semiquantitative spectrographic analyses for minor metals in heavy-mineral concentrates from a selected lode occurrence and previously worked placer deposits and occurrences in the Gold Basin-Lost Basin mining districts ---------- 99
21. Compilation of signatures of placer gold samples, Lost Basin mining district ---------- 102
22. Variation of silver and copper content of lode gold samples from Lost Basin and Gold Basin mining districts as shown by replicate emission-spectrographic analyses ---------- 103
23. Comparison of signatures of placer gold and possible lode gold sources ---------- 104
24. Compilation of signatures of lode gold, Lost Basin mining district ---------- 106
25. Compilation of lode gold signatures, Gold Basin mining district ---------- 108
26. Signatures of gold from Lost Basin and Gold Basin mining districts that are somewhat similar to those of gold from porphyry copper deposits in other areas ---------- 110
27. Homogenization temperatures and salinity data from fluid-inclusion studies in the Gold Basin-Lost Basin mining districts ---------- 114

CONVERSION FACTORS

1 micrometer (μm) = 1×10^{-6} meter (m)
1 meter (m) = 3.281 feet (ft)
1 kilometer (km) = 0.6214 mile (mi)
1 gram (g) = 0.0022 pound, avoirdupois (lb avdp)
1 gram (g) = 0.035 ounce, avoirdupois (oz avdp)
1 kilogram (kg) = 2.205 pounds, avoirdupois (lb avdp)
1 tonne (t) = 1.102 tons, short (2,000 lb)
1 tonne (t) = 0.9842 ton, long (2,240 lb)
1 kilogram per square centimeter (kg/cm^2) = 0.98 bar (0.9869 atm)
1x10^6 pascals (MPa) = 10 bars
degree Celsius (°C) = 1.8 (temp °C)+32 degrees Fahrenheit (°F)

GEOLOGY AND GOLD MINERALIZATION OF THE GOLD BASIN-LOST BASIN MINING DISTRICTS, MOHAVE COUNTY, ARIZONA

By Ted G. Theodore, Will N. Blair, and J. Thomas Nash

ABSTRACT

The Gold Basin and adjacent Lost Basin mining districts are in northwestern Arizona, south of Lake Mead and just west of the Grand Wash Cliffs. Gold in quartz veins was apparently first discovered in the area in the 1870's. Recorded production from the districts between 1901 and 1942 includes 13,508 oz gold and 6,857 oz silver and has a value of about $359,000, of which 98 percent is credited to gold. Most recorded production from lode deposits was from mines in the Gold Basin district, which is in the southern White Hills, whereas the bulk of placer production was along the east flank of the Lost Basin Range, about 16 km to the northeast across Hualapai Valley. The districts have been idle since about 1942, except for very small scale placer mining.

Most known occurrences of lode gold in the districts are associated with widespread quartz-cored pegmatite vein systems that were probably emplaced episodically during Early Proterozoic, Middle Proterozoic, and Late Cretaceous time into Early Proterozoic metamorphic and igneous rocks. Most of the veins apparently were emplaced during the Late Cretaceous, and they were localized along both high- and low-angle structures in the Early Proterozoic rocks. These veins are associated spatially and possibly genetically with two-mica magmatism of presumed Late Cretaceous age. A Late Cretaceous two-mica monzogranite, which includes some episyenite, crops out in an area of 4 to 5 km^2 in the southern part of the Gold Basin district. Some gold is found also in small episyenitic alteration pipes and in veins along a regionally extensive, low-angle detachment surface that has been traced for at least 30 km along the western flank of the White Hills and crops out conspicuously in their southern part.

Hydrothermal micas from selected veins in the districts give K-Ar ages of 822, 712, 69, 68, and 65 Ma, and those from pipes give ages of 130 and 127 Ma. The oldest ages (822 and 712 Ma) may reflect resetting of veins emplaced penecontemporaneously with the 1,400-m.y.-old granite of Gold Butte, which crops out just to the north of Lake Mead. The ages from pipes (130 and 127 Ma) must reflect either the presence of excess radiogenic argon in the hydrothermal environment of the evolving pipes or contamination of the dated mineral separates by Proterozoic mica and (or) feldspar. Primary white mica from the two-mica monzogranite gives a K-Ar age of 72 Ma.

Most occurrences of gold in the veins and pipes probably reflect either remobilization of gold from gold-bearing, near-surface Proterozoic metabasite or anatectic incorporation of gold into Late Cretaceous, two-mica magmas from very deep gold-bearing Proterozoic sources. Deposition of gold occurred in a mesothermal environment during the galena-, chalcopyrite-, and ferroan-carbonate-bearing stages of the veins. Homogenization studies of fluid inclusions prominent in the veins and pipes yield temperatures mostly in the range 150 to 280 °C. Early-stage trapping temperatures in the pipes were probably about 330 °C, and pressures in the range 50 to 70 MPa can be inferred. Fluids were moderately saline, mostly 4 to 16 weight percent NaCl equivalent, nonboiling, and contained appreciable amounts of carbon dioxide and, in places, fluorine. Such fluids associated with the deposition of gold in these districts largely bridge the fluid-composition interval between fluids associated with other epithermal precious-metal and porphyry copper deposits.

Approximately 350 compositional analyses of samples of native gold from 20 mines in the Gold Basin district and from 48 veins in the Lost Basin district show silver contents from 6 to approximately 50 weight percent, and copper contents from 0.01 to 0.5 weight percent. Metal zonation and a possible relation to a porphyry copper system at depth can be inferred from some of these chemical data. Differences between the composition of placer gold from 24 occurrences in the Lost Basin district and that of gold in nearby lode sources suggest that other sources contributed gold to the placers or that locally derived grains were enriched by oxidation and weathering of the lodes.

INTRODUCTION

The Gold Basin-Lost Basin mining districts of northwestern Arizona are in Mohave County, 120 km southeast of Las Vegas, Nev., and about 95 km north of Kingman, Ariz. (fig. 1). These districts comprise primarily gold-bearing vein deposits containing minor byproduct lead, silver, and copper, and placer gold deposits. Gold was first discovered there in the 1870's. The districts lie adjacent to each other south of Lake Mead and west of the Grand Wash Cliffs, which mark the boundary of the Colorado Plateau. The Gold Basin district is mostly in the southern White Hills, and the Lost Basin district is to the east, across Hualapai Wash; they are mostly in the Garnet Mountain 15-minute quadrangle (fig. 2). In this report, we follow a broadly defined, strictly geographic assembly of mineral deposits and occurrences into mining districts. Our Gold Basin mining district includes the Gold Basin, Cyclopic, and Gold Hill mineral districts of Welty and others (1985), and our Lost Basin mining district includes the Lost Basin and Garnet Mountain mineral districts of Welty and others (1985). In their classification, Welty and others (1985) grouped known metallic mineral occurrences and deposits according to metallogenic criteria. This report summarizes field and laboratory investigations in which a remarkable suite of gold-bearing samples were collected from wide-ranging localities in these districts. Included are discussions of the environment(s) and age

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*

[Modified from P.M. Blacet, unpub. data, 1967-72; ?, presence of commodity inferred]

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
11	Golden Gate mine	NW1/4 sec. 32, T. 30 N., R. 17 W.	Au, Cu	Free gold occurs in yellowish- to red-stained quartz characterized by empty pyrite molds and cellular hematite vugs. Gold usually is in very intricate sheaves that are so fragile that they wave in the wind. Some rather solid gold pieces as much as 1 mm in diameter are present also. Veins as much as 1 m thick, but many of the veins consist of massive quartz containing little sulfide. Relatively abundant free gold on the dump so early miners must really have high-graded the deposit. First workings probably date before 1900. Chalcopyrite, cuprite, malachite, and pyrite noted.
12	L.P.M. mine	NW1/4 sec. 4, T. 27 N., R. 18 W.	Cu, Au	Two shafts to approximately 15 m deep in pediment. Country rocks are very coarse grained, porphyritic monzogranite, including potassium feldspar phenocrysts as much as 5 cm. Altered schist crops out in pit 60 m northwest of old headframe. Sparse secondary copper found. Low sulfide content and absence of coarse vein material suggests general alteration zone with many small quartzose seams. A zone of steeply north dipping to vertical quartz veins and veinlets have an average strike of N. 50° E. The veins are not persistent and the majority are stringers less than 2.5 cm, while a few are 20 to 30 cm long. No chalcopyrite, galena, fluorite, or carbonate was observed. A trace of gold was found in fine- to medium-grained quartz. Ore probably was hosted by silicified granite and schistose metamorphic rocks.
13	Red Norse mine	NE1/4 sec. 32, T. 28 N.,R. 18 W.	Au, Cu, Pb, Mo	Vein 20 cm wide at the collar of 60° inclined shaft. Vein strikes N. 15° E., dips 60° E. Country rock is Early Proterozoic porphyritic monzogranite. Free gold coarse and abundant in cellular vuggy quartz containing limonitic and hematitic cavity fills. Some secondary copper minerals and wulfenite.
14	Junction mine	SE1/4 sec. 29, T. 28 N., R. 18 W.	Au, Cu, Pb Mo	Quartz, galena, chalcopyrite (minor), pyrite (trace), and relatively abundant wulfenite in vein exposed in shallow opencut trending N. 30° E. Vein strikes approximately N. 30°-35° E. and dips 85° southeast. Some masses of partially oxidized pyrite show irregularly shaped blebs of free gold

				approximately 1 to 2 mm across. Exposed segment of the vein is approximately 1 m and includes some septa of granitic rock from the surrounding Early Proterozoic porphyritic monzogranite. Opencut is about 30 m southwest of two shallow shafts, each 15 to 30 m deep.
16	Cyclopic mine	SW1/4 sec. 30, T. 28 N., R. 18 W.	Au, Pb, Mo,	Series of northwest opencuts and pits along Miocene detachment fault breccia which is exposed in place at several localities. Free gold in at least one hand sample picked up in southern half of series of cuts. Abundant angular fragments contain milky-white quartz with dark-reddish-gray matrix. Considerable cellular gossan, with wulfenite common. Old underground workings intersected in some of the opencuts; none accessible. Numerous prospects, pits, and trenches in the lower(?) gouge zone. Vein quartz is brecciated and widely scattered in the gouge as blocks 0.6 m long and approximately 0.3 m thick. Veins contain galena, pyrite, ferrocalcite, malachite (alteration of chalcopyrite(?)), wulfenite, gold, cerussite. Brilliant crimson mineral may be cuprite. Red, brown, and black Fe and Mn(?) oxides.
17	Eldorado mine	SW1/4 sec. 21, T. 28 N., R. 18 W.	Cu, Pb, Mo, Au	The mineralized vein seems to average 1 m thick and dips 25°-30° E.-SE. on west side of workings and shallowing to nearly horizontal at the tunnel portals on the east side of the ridge. The workings generally dip 20° E.-SE. parallel to the vein. The country rock is intensely sheared, cataclastic medium-grained Early Proterozoic gneissic granodiorite. The mineralized vein(s) is occupying an intensely sheared zone that is of probable Late Cretaceous and (or) early Tertiary age. Although the vein quartz is fractured (locally intensely), it is not brecciated. Some veins crosscut highly foliated gneissic granodiorite, but generally they approximately parallel the schistosity. No red or other clay gouge and no indication of notable Tertiary movement. The main vein parallels also the pegmatite, and, in part, the 2-m thickness of quartz probably reflects the quartz-core stage of the pegmatite. The quartz vein lies between a crumpled and kinkbanded schistose granodiorite and an overlying sill of leucogranite pegmatite. Abundant chrysocolla; moderate galena; but no chalcopyrite seen. Some wulfenite and cerrusite present also. In the irregular surface cut 10 m northwest of the opening at the northwest end of the underground stopes, altered biotite lamprophyre has consistent chilled margins against the mineralized vein quartz. This indicates the mafic dikes and sills are postmineralization. Intensely sericitized leucogranitic sills occur below the vein here,

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
17	Eldorado mine—Continued			indicating a somewhat crosscutting relationship. Numerous veins 2 cm to 1 m thick are concentrated in an intensely sheared zone, which dips very gently but is undulating overall.
19	Unnamed prospect	SE1/4 sec. 27, T. 28 N., R. 18 W.	Au, F	Fluorite-gold-pyrite-bearing episyenitic rocks, which cut fine- to medium-grained biotite monzogranite. Gold occurs in leached cavities in these episyenitic rocks (see text). In outcrop, the episyenitic rock occurs in four small pipelike masses, the largest of which measures about 8 m across (see fig. 50). Two shallow prospect pits have been dug on the pipes most likely because of the color anomaly resulting from the oxidation of pyrite.
24	Ford mine	SW1/4 sec. 33, T. 30 N., R. 17 W.	Au, Cu, Pb	Portal initially trends N. 10° W., then bends to N. 15° E. and extends 100 to 150 m intersecting raise and winze. Winze continues 10 m below level of main drift. Workings follow shear zone. Quartz vein as much as 1.5 m thick, exposed in back, contains thin seams of chalcopyrite oxidizing to chalcocite, cuprite, malachite, and azurite; and a trace of galena. Some fine gold seen in yellow-brown lacy quartzose gossan. Vein ends by interfingering with altered and sheared amphibolite.
25	Unnamed prospect	SE1/4 sec. 19, T. 28 N., R. 16 W.	W	Vertical shaft 30 ft deep in opencut made in garnet-epidote-quartz skarn composing a small roof pendant or septum in Early Proterozoic porphyritic monzogranite. Pendant is approximately 50 m long and trends N. 45°-55° W.
26	Blue Bird mine	NE1/4 sec. 19, T. 29 N., R. 17 W.	Au	Horizontal adit 800 m along northwest-striking shear zone dipping 65° SW. Damp clay gouge is contorted and locally contains some quartz veinlets which mushroom into quartz stringers making as much as 0.5 m of the adit width.
138	Unnamed prospect	SE1/4 sec. 26, T. 28 N., R. 17 W.	Mica	Two pegmatite dikes, both apparently claimed but unmined. The dikes are muscovite bearing with books as much as 15 cm in diameter and 5 to 8 cm thick. One dike trends approximately N. 10° W. and is about 3 m wide. Small prospect pit at second dike.
139	M. P. Mica mine	SE1/4 sec. 26, T. 28 N., R. 17 W.	Mica	A series of north-northwest-striking pegmatite lenses 3 to 5 m thick with well-defined bull quartz cores. Coarse muscovite is common, transparent in thin cleavage sheets, but inclusions of other minerals

				are common. The books are less than 10 to 15 cm across. This series of pegmatites possibly is continuous with a series of several muscovite-bearing pegmatites to the northwest. Early Proterozoic leucocratic monzogranite makes up the country rock. The main mine workings are opencut.
205	Unnamed prospect	NE1/4 sec. 28, T. 30 N., R. 17 W.	Au?	Prospect pit just west of contact between Muddy Creek Formation and Early Proterozoic gneiss. The pit exposes an alternating sequence of amphibolite and biotitic quartzite and (or) quartzofeldspathic gneiss. The rocks here also show abundant iron oxide-stained cubic molds after pyrite. No gold or secondary copper minerals observed. Locally, coarse-grained granitic dikes or sills are abundant in some of the schistose sequences.
213	Unnamed locality	SE1/4 sec. 29, T. 29 N., R. 17 W.	Cr	Metaclinopyroxenite contains very sparse concentrations of chromite.
216	Valley View	NW1/4 sec. 32, T. 29 N., R. 17 W.	Fe	Banded jasper-magnetite beds associated with laminated or foliated quartzite. Foliation strikes N. 30° W. and dips 65°-70° SW. Quartzite includes vitreous white and micaceous pink types.
217	Malco mine	SE1/4 sec. 21, T. 28 N., R. 18 W.	Au	Inclined shaft plunging 45°-55° (30° below third main level) parallel to a conspicuous shear zone which strikes N. 45° E. Mineralized quartz veins are parallel to the shear zone. There are three major levels, about evenly spaced, from which irregular raises follow ore shoots. Overall workings are close to a contact between Early Proterozoic gneissic granodiorite and gneiss.
259	Unnamed prospect	SE1/4 sec. 20, T. 29 N., R. 17 W.	Au?	Prospect pit exposing complexly intermixed quartz-pyrite rock and apparently genetically related and intermixed quartz-calcite-pyrite and feldspar-calcite-quartz-pyrite rock very similar to the episyenitic rocks containing visible gold in the East White Hills (loc. 19, above). Although oxidized, pyrite-rich rocks were examined carefully, no free gold was seen.
274	Unnamed prospects	NE1/4 sec. 20, T. 29 N., R. 17 W.	Au?	In one of the prospect pits, a pyrite-bearing aplitic dike strikes east-northeast and dips 40°-45° S. A large amount of weathered pyrite is associated with the dike. In addition, nearby there is a couarse-grained magnetite-rich pegmatite which may have a genetic connection with the pyrite-bearing dike. The dike is about 0.5 m wide and has rather sharp contacts with altered and silicified feldspathic gneiss.
275	Unnamed prospect	SE1/4 sec. 20, T. 29 N., R. 17 W.	Au	Prospect contained a very altered feldspar-quartz-pyrite vein several centimeters thick, judging from rock samples on the upper "ore" pile. Generally similar to rocks at location 274. The aplitic feldspar rock usually bounds the quartz vein on the north side, and the quartz-rich portions contain most of the sulfide. Gold was seen in the boxwork. No indications of copper were seen.

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
276	Unnamed adit and prospect pit	NW1/4 sec. 20, T. 29 N., R. 17 W.	Au?	Small adit driven straight in for about 9 m along a fault zone varying about 0.6 to 1.2 m wide. Slickensides are well developed with the wall rock altered to an ochre-orange color. The slickensides plunge westward at about 50° in the fault zone, which strikes N. 50° W., and dips about 60° W. An irregular vein zone of crushed- and carbonate-cemented (ankeritic) white milky quartz, ranging from 0 to 23 cm thick can be seen locally at the back of the adit. A small prospect also is located along the fault about 60 m to the southeast. No copper staining, sulfides, or pyrite-type boxworks present. A newspaper found inside suggests work was before or during the 1920's.
277	Unnamed adit	NW1/4 sec. 20, T. 29 N., R. 17 W.	Au?	This adit is similar to location 276. The adit is driven at about N. 50° W. along the same fault as in location 276 for about 10 to 12 m. The fault dips about 60°-65° SW., and it contains oblique mullions and slickensides plunging about 55° W. The fault zone, which is about 0.3 m to 0.9 m wide, is composed of highly sheared gouge and brecciated lenses of white milky quartz. The quartz vein observed at location 276 is not continuous through this adit. An orange-ochre color from weathering ankeritic calcite was also observed at this locality. This adit also intersects a raise to the surface about 9 m from the portal. No sulfides or copper staining were observed.
279	Unnamed prospect	NW1/4 sec. 20, T. 29 N., R. 17 W.	F, Au?	The prospect pits are along feldspathic veins which contain quartz, potassium feldspar, carbonate, and pyrite. The veins are about 0.6 m thick and strike irregularly N. 55° W. roughly paralleling the vertical layering in the surrounding banded gneiss. On the dump there are samples of fluorite and topaz. Gold was not observed but may be present in the vuggy (pyrite molds) quartz at the pits. There is also abundant ankeritic carbonate commonly containing large pyrite cubes about 1.3 cm. The pyrite is generally altered. No copper staining or galena was observed.
284	Unnamed drywasher site	NW1/4 sec. 19, T. 29 N., R. 17 W.	Au	The sample was taken from above the caliche-cemented fanglomerate just west of mine road leading to the adit and shaft at locality 285. A few fine-sand-size frosted colors were found. From their

				condition, they are probably some distance from their source.
285	No name opencut and adit	SW1/4 sec. 18, T. 29 N., R. 17 W.	Au?	The first 6 m along the adit consists of Quarternary fanglomerate which has been faulted against amphibolitic, banded gneis. The fault strikes north-south and dips 60° W. The brecciated amphibolite and banded gneiss generally have their layering striking N. 15° E. and dipping 50° W. Well-developed striations trend N. 85° W. and plunge 43° W. The fanglomerate, gravel, and breccia generally are poorly cemented except in certain spots where they have been case-hardened by caliche. About 50 m from the portal, the adit apparently was filled subsequently with waste rock from a shaft. No vein material seen in place, but the dump contains vein material similar to that of the Bluebird vein.
286	Unnamed drywasher site	SW1/4 sec. 18, T. 29 N., R. 17 W.	Au	Drywasher concentrate from irregular surface consisting of amphibolite bed rock about 6 m upstream from highest Quarternary fanglomerate and fault. One small color was observed with abundant garnet.
291	Unnamed prospects	SW1/4 sec. 17, T. 29 N., R. 17 W.	Cu, Au?	This locality consists of two prospect pits approximately 3 m apart along a shear zone striking N. 30° E. and dipping 65° E. and about 1 to 1.5 m wide. Although the fault may be relatively important, and somewhat like the one at the Bluebird mine, it could not be traced because of talus- and debris-covered slopes. In the pits, the veins consist of pyrite and chalcopyrite together with milky quartz and ferruginous carbonate. Generally the veins are thin stringers, less than 3 cm wide, although one pod reached as much as 25 cm across and had a well-developed sericitic envelope.
297	Unnamed prospect	NE1/4 sec. 20, T. 29 N., R. 17 W.	Cu	An approximately 8-m-thick syenitic micropegmatite contains abundant quartz associated with red-brown, presumably iron-rich carbonate and pyrite. This locality is approximately 30 m N. 35° E. of the two prospects known as the Jumbo (loc. 913, this table). The feldspar in the micropegmatite is microcline, and only traces of secondary copper minerals were noted to stain the rocks.
300	Unnamed adit	SE1/4 sec. 17, T. 29 N., R. 17 W.	Au?	An approximately 35-m-long adit initially driven N. 40° E. on a black quartz-rich lens. Exposed in the workings are a series of three northeast-striking quartz veins or stringers that are as much abundant yellow or reddish-brown carbonate and sparse amounts of weathered pyrite. Country rock consists of strongly lineated feldspathic gneiss.
303	Unnamed shaft	NE1/4 sec. 17, T. 29 N., R. 17 W.	Fe	A N. 30° W.-striking oxide facies, banded iron formation. An approximately 20-m deep vertical shaft has been sunk on the iron formation; the as 13 cm wide. Associated with these veins are shaft probably follows a minor fault zone. Another shaft, approximately 100 m N. 70° W. of this

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
303	Unnamed shaft—Continued			locality, has been put down on dark, manganiferous gossanlike stringers in brecciated and highly altered granitoid pegmatite. See figure 22 (this report) for a photomicrograph of quartz-iron oxide relations in the banded iron formation.
305	Unnamed shaft	NE1/4 sec. 17, T. 29 N., R. 17 W.	Pb, Cu, Au	Shaft along a N. 35° W.-striking, 55° NE.-dipping approximately 0.6-m-wide quartz-carbonate vein. Downward the vein feathers into a series of veinlets measuring from 2 to 8 cm wide. Yellow-brown carbonate fills the center of the veins, but much of the carbonate is intergrown with quartz. The primary minerals observed in the veins include galena, chalcopyrite, pyrite, and free gold. Secondary minerals include chrysocolla and malachite.
307	Ideas Lode 30	NE1/4 sec. 17, T. 29 N., R. 17 W.	Au?	Workings along nearly flat lying shear zone which includes irregularly distributed quartz-yellow-brown-carbonate veins nearly parallel to the shallow-dipping foliation. Some evidence for the flooding of nearby rock by yellow-brown carbonate.
308	Unnamed prospect	NE1/4 sec. 17, T. 29 N., R. 17 W.	Au?	Episyenitic aplite exposed in the prospect pit. Disseminated pyrite, but relatively little carbonate and no fluorite were seen. The episyenitic aplite crops out in an approximately 9-m^2 area. The upper parts of the gulch in this general area include many small, irregular dikes of similar episyenitic aplite.
310	Vanadinite mine (Van-Wulf)	NE1/4 sec 17, T. 29 N., R. 17 W.	V, Pb, Mo, Cu	The adit is about 15 m long, driven along a fault zone striking S. 15° E. and dipping about 70° NE. Slickensides have a variable orientation but generally they plunge moderately (50°-60°) to the north. Vanadinite and wulfenite are especially abundant in brecciated vein material and in adjacent wall rock just inside the portal. Rocks across the opencut show at least 3 m of offset. At east end of opencut is an 8-cm-thick quartz-carbonate vein, containing sporadically distributed interstitial chlorite. Minerals observed in the vein include galena, chrysocolla, wulfenite, vanadinite, red-brown carbonate, quartz, mottramite(?), chlorite, minor greenish clear calcite, and sericite. Little or no altered pyrite, no gold seen. Minor seams of episyenitic aplite were observed also.

311	Unnamed adit	SE1/4 sec. 32, T. 30 N., R. 17 W.	Pb, Au, Cu	A lower adit follows a well-defined fault zone 15 cm thick striking N. 80° E. and dipping 45°-50° S. Galena is rather abundant in quartz-carbonate gangue. Upper workings consist mostly of dump material derived by stripping overburden from vein lying along a N. 75° E., 45°-50° S.-dipping fault. Vein material ranges from 0 to 30 cm thick. No vein material seen in lower workings, which follows the fault, and the quartz+minor carbonate vein occupied a steeply plunging mullionlike opening along the fault which had no lateral extent. Some gold, but minor chrysocolla, a little unoxidized pyrite, and galena. Quartz is the major gangue together with yellow-brown carbonate. Wall rock alteration appears to be mostly introduction of carbonate. One speck of gold found in the samples.
316	Unnamed drywasher site	NW1/4 sec. 23, T. 28 N., R. 18 W.	Au	From approximately 12 hoppers processed through the drywasher, only a few colors were obtained
319	Unnamed drywasher site	NW1/4 sec. 27, T. 28 N., R. 18 W.	Au	Only one color obtained from gravelly, reddish soil which overlies hard caliche-cemented false bed rock in the Quaternary fanglomerate.
324	Unnamed drywasher site	NE1/4 sec. 24, T. 29 N., R. 18 W.	Au	Moderate amount of fine gold.
325	Unnamed drywasher site	SW1/4 sec. 7, T. 29 N., R. 17 W.	Au	Moderate amount of gold.
327	Golden Mile mine	NW1/4 sec. 8, T. 29 N., R. 17 W.	Pb, Cu, Au?	1-2-m-thick prominent quartz vein exposed in face west of road approximately 20 m northwest of small shack; vein strikes N. 70° W. and dips 20°-25° SW. It is offset in a reverse sense approximately 1 m by an intensely clay-altered shear zone striking east-west and dipping 40° N. Fe-bearing calcite occurs in coarsely crystalline irregular masses which are markedly tabular and form lenses striking N. 20° W. and dipping 30° SW. These lenticular and irregularly shaped calcite pods definitely are oriented obliquely to the plane of the vein and may represent replacement of earlier quartz along opened gash fractures. The bulk of this carbonate occurs along the central zone of the vein, but it is sporadically distributed throughout the length of the examined vein. A poorly developed alteration zone in the vein's walls seems to include albite and pyrite+galena and a little chalcopyrite. A second oblique slip fault offsets the vein 1 m west of the incline. Slickensides plunge N. 65° E. at 25°. Crystals of feldspar (albite?), quartz, and calcite commonly reach 10 to 15 cm across in optically continuous, irregular, intergrown masses. Galena can be seen to vein or crosscut calcite, feldspar, and quartz--probably the

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
327	Golden Mile mine—Continued			galena, pyrite, and trace of chalcopyrite are somewhat later than the coarse crystalline material although all are probably related to transition pegmatite-vein processes. The vein exposed 15 m south of the portal is about 1 m thick and rather clearly the extension of the vein exposed in the small inclined shaft. Numerous east-northeast or easterly faults offset the vein, which strikes N. 70° W., 25° SW. No stopes in the adit. A trace of weathered pyrite was observed along the footwall in the adit.
329	Unnamed prospect	NW1/4 sec. 8, T. 29 N., R. 17 W.	Au?	The prospect exposes approximately 2-m-thick pegmatite containing well-defined crudely tabular masses of fine-grained green sericite in potassium feldspar in its 15-cm-wide alteration wall zones. A specimen found on the dump of the small cut shows a remnant of a white mica book, with cleavage faces 1 cm across. Pegmatite strikes N. 40° E. and dips 80°-85° SE. No sulfides except rare pyrite pseudomorphs near the walls.
330	Unnamed drywasher site	SW1/4 sec. 31, T. 30 N., R. 17 W. (location uncertain)	Au	Gold as much as matchhead size especially in upper reaches of small gulch.
341	Unnamed prospect	SE1/4 sec. 7, T. 29 N., R. 17 W.	Au?	A prospect cut poorly exposing a small quartz-carbonate-feldspar-sulfide vein of the Golden Mile type. Vein strikes north-south and is vertical. Maximum width about 0.6 m.
356	Glow in the Dark 8	SW1/4 sec. 8, T. 29 N., R. 17 W.	Pb, Cu, Au?	Prospects along wash about 0.8 km southeast of Golden Mile cabins. Opencut on side exposese for about 8 m 15- to 25-cm-wide quartz vein striking N. 15°-20° W. and dipping 50° NE. in a shear zone of approximately the same attitude. Maximum depth of vein exposed in cut is about 5 m. The shear zone separates vertically dipping interlayered quartzofeldspathic gneiss from amphibolite to the east. The vein pinches and swells averaging 25 to 30 cm in thickness. Galena and chalcopyrite appear disseminated in knots throughout quartz; sparse carbonate. No gold seen, but a trace has been reported. Another nearby prospect is on coarse magnetite-bearing highly fractured pegmatite containing galena and chalcopyrite (some altered to malachite). The sulfides in this pegmatite are scattered widely in white quartz as vug fillings. Somewhat anomalous radioactivity, approximately three times background.

372	Miss Texas 2	NE1/4 sec 17, T. 29 N., R. 17 W.	Au?	Pyritized zone now limonitic striking N. 60° W. and parallel to foliation in the surrounding gneiss. Several quartz veins cut this 10- to 15-m-wide altered zone which can be followed toward the southeast for at least 0.3 km. Location of zone about 100 m S. 25° E. from stone monument of the Miss Texas 2.
374	Bluebird 17-16	NW1/4 sec 17, T. 29 N., R. 17 W.	Pb	Two veinlets generally 2 to 8 cm thick but locally as much as 15 cm thick, striking nearly east and dipping steeply south. Abundant galena, but sparse pyrite noted. Veins cut amphibolite and gneiss. Broad open fold in amphibolite, plunging approximately 35° NW. just north of prospect. Some pyrite and altered feldspar in border alteration zone, which measures about 2 to 8 cm in thickness.
375	Unnamed prospect	SE1/4 sec. 7, T. 29 N., R. 17 W.	Au?	A 10-m shaft along the road 300 m south-southwest of Golden Mile cabins. Barren-looking veins, little carbonate, pyrite, and feldspar. No galena or copper minerals noted. The vein is about 0.6 m thick.
389	Unnamed prospects	NE1/4 sec. 6, T. 29 N., R. 17 W.	Au?	A group of prospects near the west base of Lost Basin Range, approximately 1.5 km north-northwest of the Golden Mile mine. Intensely altered mylonitic coarse-grained granite or alaskite dike striking N. 20° E. and dipping 55°-60° W. parallels the adjacent well-layered quartzofeldspathic gneiss which contains abundant thin well-defined amphibolite layers. Abundant hematite with some limonite. Pyrite molds are abundant in hematitic masses along shear zone. An inclined shaft south of the wash is 10 m deep. A gneissoid very coarse grained biotite granite dike forms the footwall. There is parallel layering in quartzofeldspathic gneiss which forms the hanging wall.
405	Twin yucca gulch	SE1/4 sec. 9, T. 29 N., R. 18 W.	Au	North of Salt Springs Wash road. This general area shows evidence of old placering possibly in the 1930's and much more recent scraping using a small bulldozer. Possibly part of the early Summit Mining Company work. Good placer gold as much as 2 mm obtained using a drywasher. The gold is not well concentrated on bed rock but instead is distributed throughout 20 to 35 cm of dirt above earliest Proterozoic outcrop. Proterozoic rocks are quartz-mica schist and gneiss.
409	Unnamed drywasher site	NW1/4 sec. 22, T. 30 N., R. 17 W.	Au	Some fine placer gold in heavily dug gulch. High percentage of granitoid clasts in the general area of this locality is distinctly out of proportion with the amount of granitoid rocks exposed in the Lost Basin Range.
436	Unnamed prospect	NW1/4 sec. 32, T. 30 N., R. 17 W.	Cu, Au	Prospect adit about 150 m southwest of lower dump of the Golden Gate mine. The adit essentially follows a well-developed, vertical, N. 50° E.-striking fault. Conspicuous cross faults include an east-west fault dipping 5° S. A little copper staining

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
436	Unnamed prospect—Continued			occurs on brecciated blocks of quartz-carbonate-minor chalcopyrite blocks. Considerable sericitization and carbonatization of the country rock. No vein material observed. A short adit directly up the ridge to the south exposes a prominent fault striking north-south to N. 10° E. This fault occurs between the brecciated footwall of an east-dipping quartz-carbonate vein which is as much as 0.6 m thick. The faulting postdates the quartz-carbonate vein whose footwall it follows. There is abundant sericitization and carbonate flooding of the quartzofeldspathic gneiss within a few meters of the vein. The brecciated vein material locally looks like that at the Cyclopic mine. A shaft at the top of the ridge is vertical and includes abundant broken-up vein quartz. Some free gold noted.
442	Unnamed prospect	NW1/4 sec. 32, T. 30 N., R. 17 W.	Pb	Small veinlets, approximately 5 to 20 cm wide, cut medium-grained quartzofeldspathic gneiss and minor amphibolite. Veins include minor galena, pyrite, carbonate, and chlorite. In addition, these veins locally develop a comb structure.
443	Unnamed prospect	NW1/4 sec. 32, T. 30 N., R. 17 W.	Cu, Au?	A small prospect pit on ridge crest at bend in ridge. A trace of copper stain occurs on an approximately 10-cm-thick vein including quartz, carbonate, some chlorite, pyrite, and possibly some gold.
444	Unnamed prospect	SW1/4 sec. 29, T. 30 N., R. 17 W.	Au?	A small prospect pit along major 10-m-wide range-front fault between iron oxide-stained quartzofeldspathic gneiss and interlayered amphibolite and caliche-cemented fanglomerate or talus. Clearly quartz-carbonate vein material is broken up in the zone, suggesting the fault zone may have followed locally an already emplaced vein system. The fault zone also shows evidence of having originally contained a lot of highly sericitized, chloritized, and carbonate-altered gneissic fragments. No sulfides or gold seen; little weathered pyrite noted.
445	Clipper	SE1/4 sec. 29, T. 30 N., R. 17 W.	Au?	Joins north endline of claims at Troy prospect and lies approximately 1 km southwest from the Scanlon mine. The quartz mass at this locality is bounded by two shear zones 15 cm thick dipping east approximately 75°. The shearing has been localized along the steep east-dipping northeast limb of a

				northwest-plunging fold. Gneissic-rock inclusions are sericitized and altered by carbonate. Little indication of sulfide mineralization.
446	Troy	SE1/4 sec. 29, T. 30 N., R. 17 W.	Cu, Au	Lower adit contains a splendid example of a quartz-carbonate vein disrupted and sheared out by later faulting. Lower adit driven almost due south beneath quartz vein outcrop; adit length is about 30 m, and the vein is sheared off 15 m from portal. Footwall bounded by fault, as is hanging wall. This occurrence is a brecciated quartz vein sliver in a low-angle oblique slip fault, similar to that in the vein just west of the Golden Gate. Total vein exposed in the lower adit is about 10 m long, and it has a maximum thickness of about 1 m. No sulfides seen in lower adit. In main adit or Troy vein, small amount of Cu staining (malachite) and some coarse anhedral pyrite oxidizing to cellular drusy boxworks. A few small flecks of gold seen in cellular drusy "high grade." The upper prospect pit shows four vein slivers in a nearly vertical shear zone. Overall strike of the vein is N. 5°-10° E. and dips 65°-85° E. A little orange-brown carbonate occurs in the mostly quartz vein.
453	Scanlon mine	SW1/4 sec. 28, T. 30 N., R. 17 W.	Au, Pb, Cu, Mo	Very little stoping. Probably no production. Prospect probably was worked in the 1930's. Veins show sheared margins containing gouge and contain milky-white quartz that is brecciated. Country rock consists of complexly and tightly folded quartz-feldspar gneiss. Wulfenite and anglesite noted.
456	Unnamed prospects	SE1/4 sec. 29, T. 30 N., R. 17 W.	Au?, Cu, Pb	Vein cutting amphibolite consists of milky quartz with irregularly distributed orange-brown carbonate with some granular chlorite in distinct irregular masses. Approximately 30 to 50 m west, other prospects show flat-lying similar veins approximately 0.3 m wide, containing traces of galena and secondary copper minerals.
457	Eagle Nest	SW1/4 sec. 28, T. 30 N., R. 17 W.	Au, Cu, Pb, Mo	Workings along the same vein system as exposed at the Scanlon mine (loc. 453). At adit number 1, complexly layered folded quartzofeldspathic gneiss is exposed directly north of portal. In adit, quartz-cored pegmatite containing microcline crystals as much as 30 cm across in its outer zones crops out. No sulfides seen in rocks on the dump, but malachite occurs as minute crystals in some boxworks showing cellular structures. No stopes in adit. Adit number 2 is short and straight and strikes N. 15° E. Fine gold seen at several points along vein outcrop. Here, the vein apparently cuts the pegmatite as does the fault zone. Average strike of Scanlon fault-vein in the workings is north-south to N. 3° E. dipping 85° E. Some malachite, galena, and wulfenite noted in samples on dump.

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
464	Unnamed adit	NE1/4 sec. 32, T. 30 N., R. 17 W.	Au, Cu	Approximately 15-m-long adit driven due south. A little highly cellular boxworks on dump is presumed to be ore from this vein system. Gold seen in several samples. Some specular hematite may reflect an alteration of carbonate or pyrite. Another nearby short adit driven along a steep west-dipping shear zone shows sparse amounts of chalcopyrite associated with iron-bearing calcite.
466	Warren Lode 5 (Cumberland)	NW1/4 sec. 33, T. 30 N., R. 17 W.	Pb, Cu	Abundant galena, wulfenite, malachite in N. 15° W.-striking vein.
470	Warren Lode 10	SW1/4 sec. 28, T. 30 N., R. 17 W.	Pb	Poorly exposed 1-m-thick feldspar-rich dikes (albitite?) containing sparse amounts of quartz, iron-bearing carbonate, and pyrite. Quartzofeldspathic gneiss makes up the wall rock of this dike and within about 5 to 15 m of it the wall rock shows veining by quartz and some evidence of propylitic alteration. Numerous quartz veinlets are the range 2.5 to 10 cm wide and locally they show abundant amounts of galena, especially concentrated in the central portions.
480	"BaBa" prospect ("Tungstake" on one 1955 claim notice)	SW1/4 sec. 4, T. 29 N., R. 18 W.	W?	Small 1-m-deep pit on ridge and main 6-m-across open trench to the northeast. The prospect is in layered amphibolite and biotite schist. No scheelite noted. Some tourmaline seen in quartz-feldspar-biotite pegmatitic-gneiss stringer. Some quartz-carbonate-pyrite-albite(?) veinlets as much as 8 cm thick. Euhedral tablets of albite(?) at extreme margins of vein. Main prospect is on southeast side of ridge 30 m northeast of small pit. The main prospect consists of an opencut 6 m long. Skarnlike amphibolite associated with quartz pods or stringers as much as 18 cm thick is exposed here. Pegmatoid gneiss also occurs in crosscutting dike as much as 8 cm thick which strikes N. 30° W. and dips 25° SW. Prospect across gulch to east-southeast contains more skarnlike calc-silicate rock apparently owing to the silicification of limy amphibolite or limy quartzofeldspathic gneiss. Well-layered amphibolitic gneiss strikes north-northwest dipping 30°-35° SW.
482	Unnamed prospect	NW1/4 sec. 33, T. 30 N., R. 17 W.	Au, Cu, Pb, Mo	An exposed feldspathic vein here is 45 to 60 cm thick and shows a well-developed quartz core. The vein strikes N. 55° W. and has an almost vertical dip.

				Quartz-carbonate-pyrite-chalcopyrite stringers cut the south end of the vein. They are as much as 5 cm thick and strike north-south, dipping 70°-75° E. The northeast wall of the vein is a 5-cm-thick crumbly fault gouge; whereas the southwest wall of the vein is healed to country rock. A second quartz-carbonate vein strikes N. 10°-15° E. approximately one-half of the way to the top of the hill from this locality and approximately 60 m S. 10° E. of the termination of the first vein described above. The second vein is 10 to 20 cm thick, locally brecciated, and shows no apparent copper staining or sulfides. No prospects on this second vein. Rock fragments included in the second vein are intensely sericitized. There are several pegmatites of the quartz-cored and related types which strike N. 50°-60° W. and are also cut by quartz-carbonate veins. A partial list of minerals identified in the veins includes: galena, wulfenite, malachite, chalcoyrite, gold (fine, fernlike in quartz and oxidized chalcopyrite), ferruginous carbonate, tenorite-cuprite(?), chrysocolla, opal, specular hematite, goethite.
483	Unnamed drywasher site	SE1/4 sec. 30, T. 30 N., R. 17 W.	Au	One moderate-sized color obtained from approximately 10 to 12 hoppers of gravel taken from two localities about 8 m apart.
498	Climax mine	SE1/4 sec. 33, T. 30 N., R. 17 W.	Pb	Vein strikes N. 18° E., dips 80° W.-NW. and swells to at least 2 m thick about 15 m south of the headframe. Massive milky quartz is present with some brecciated and recemented zones. A little carbonate, galena, pyrite molds, and honeycombed quartz showing cubic molds and elongate molds were noted. The host rocks are a sequence of granitoid gneiss within the mapped paragneiss unit.
505	Unnamed drywasher site	NE1/4 sec. 9, T. 29 N., R. 17 W.	Au	Sample of relatively small volume, approximately three hoppers, of red soil. Sample was not obtained from a good caliche horizon. One pinhead-sized color obtained.
509	Unnamed prospect	SE1/4 sec. 32, T. 30 N., R. 17 W.	Au, Cu	Prospect pit 3 m deep on lenticular, discontinuous quartz-carbonate-chalcopyrite-pyrite-gold vein. Lenticular masses of chalcopyrite and pyrite are largely altered to limonitic boxwork. No galena was noted. Gneissic inclusions are sericitized. Gold occurs along boundaries of chalcopyrite boxwork and quartz.
513	Unnamed prospect	SE1/4 sec. 32, T. 30 N., R. 17 W.	Au	Prospect in 3-cm-thick vein, showing mullionlike striae plunging 20° N.-NE. along footwall. Gold seen as fine dendritic foil in quartz. Webbed boxwork similar to that at the Golden Gate. Massive granular chlorite and sericitized quartzo-feldspathic gneiss inclusions occur in the vein. Some are lined by quartz crystals and calcite. Pyrite is rather abundant but no chalcopyrite,

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
513	Unnamed prospect--Continued			galena, or copper stain observed. A second nearby prospect contains a 45- to 60-cm-thick vein including intense sericitization of the wall rock. Small crosscut adit. Massive anhedral pyrite is the only sulfide observed. There was no galena, chalcopyrite, or malachite seen at any of these largely echelon quartz veins. Numerous small quartz-carbonate stringers cut quartzofeldspathic host.
546	Unnamed prospect	SE1/4 sec. 35, T. 30 N., R. 18 W.	Cu	Small prospect pit in chalcopyrite-quartz bodies in coarse-grained granite pegmatite. The chalcopyrite occurs locally in the feldspathic portion of the pegmatite, and mineralization is probably cogenetic with the late hydrothermal stages of the pegmatite.
552	Unnamed prospect	(In Iceberg Canyon quadrangle) UTM: 752,500 m E., 3,987,670 m N.	Mn	Breccia cemented with manganese oxide and calcite. Maximum amount of vein exposed is 20 cm. The vein cuts Proterozoic gneiss. Prospect is approximately 3 m long.
604	Gold Barr	NE1/4 sec. 16, T. 29 N., R. 18 W.	Au, Pb, Cu	Gold-bearing quartz stringers about 15 cm thick, poorly exposed in prospect pit, where they are seen to occupy a shear zone in biotite gneiss. Quartz, galena, iron-bearing calcite, albite, chlorite, pyrite pseudomorphs; trace copper stain. Free gold associated with pyrite and red chalcopyrite boxwork observed in three samples.
608	Unnamed drywasher site	UTM: 749,800 m E., 3,978,540 m N.	Au	Sample collected from alluvial gravels along a present arroyo bottom. Collected to a depth of about 20 cm, and approximately 1 ft^3 of material put through drywasher. Few colors were obtained.
609	Unnamed site	UTM: 749,800 m E., 3,978,540 m N.	Pb, Cu, Au?	Thin east-west-striking quartz vein containing fine-grained albite along its walls, orange-brown-weathering iron-bearing calcite in knots, a moderate amount of pyrite, and some galena and secondary copper minerals. Not prospected.
611	Mead Tungsten	UTM: 749,770 m E., 3,979,070 m N.	W	Abundant scheelite in crystalline masses as much as about 3 cm across. Scheelite occurs in narrow west-dipping skarn zones, developed as small pods less than 0.3 m thick adjacent to a 10-cm-thick granitic pegmatite stringer.
623	Marihauna	NE1/4 sec. 16, T. 29 N., R. 18 W.	Au, Cu, Pb	Trace of gold associated with oxidized blebs of chalcopyrite in quartz stringers. Stringers cut a fine-grained porphyritic granite dike exposed at southeast end of small opencut. Microcline(?)-bearing alteration assemblages are

				apparently similar to that noted previously at locality 19 (this table), but no fluorite was found here. Ferrocalcite and galena in quartz occur in surficial rubble. Over the hill from the highest cut, galena found in place as sparsely scattered blebs and irregular grains as much as 0.6 cm in diameter together with minor chalcopyrite. An open trench exposes vein apparently striking N. 10° W. that cuts gently east dipping gneiss. Approximately 9 m west of north end of northern prospect cut, a quartz vein is at least 12 to 15 cm thick and contains abundant galena and chalcopyrite. Narrow alteration zones and quartz seams cut a granite dike here striking most likely N. 10° W. and dipping 55° E.
626	Unnamed drywasher site	SW1/4 sec. 21, T. 29 N., R. 18 W.	Au	There is a moderate amount of surface scraping by bulldozer in this general area. Bed rock in this placer area consists of weathered and caliche-encrusted gently dipping gneiss. The gold and some rounded pebbles of magnetite appear to be coming off the low ridge to the northwest. Swept bed rock at head of the gulch at this site yielded not one single color, suggesting that the placer gold that was found is not local.
627	Unnamed drywasher site	SW1/4 sec. 21, T. 29 N., R. 18 W.	Au	Rather fair showing of placer gold in concentrates from drywasher. Some gold is approximately 1 mm across in longest dimension.
629	Unnamed drywasher site	SW1/4 sec. 20, T. 29 N., R. 18 W.	Au	Gold concentrated in coarse quartz gravel at scoured and winnowed head of delta in previously worked placer gravels.
635	Unnamed drywasher site	UTM: 749,230 m E., 3,977,500 m N.	Au	Only a trace of gold, one color, obtained in concentrate from gravels excavated from deep cracks in outcrops along main gulch. Concentrate included abundant lavender zircon and some fresh garnet.
636	Unnamed prospects	UTM: 750,310 m E., 3,977,500 m N.	Pb, Cu	Two veins, approximately 6 m apart, follow shear zones developed along the schistosity in the surrounding gneiss. Quartz is the predominant mineral in the veins and only trace amounts of secondary copper minerals and galena were noted in one of the veins. In an incline, one of the veins pinches and swells along the shear zone. Adjacent to the veins where they cut amphibolite, there is a marked development of chlorite and carbonate for about 1 m.
637	Red Rattler or Richman	UTM: 749,150 m E., 3,977,170 m N.	Au	Vein is approximately 0 to 0.6 m thick, and it has been explored by a shaft approximately 15 m deep. Gold occurs in fine honeycomb and pyrite(?) boxwork. Minerals in the vein also include quartz, ferrocalcite, and chlorite. Chlorite most likely reflects altered fragments of country rock picked up by the vein.
639	Unnamed adit	UTM: 748,950 m E., 3,977,060 m N.	Cu	Abundant staining by secondary copper minerals occurs at this adit driven approximately N. 20° E. Another prospect approximately 20 m

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
639	Unnamed adit—Continued			north-northeast of this locality shows gneissic biotite granite cut by a 0.6-m-wide vein which is in turn cut off by a N. 10° E.- striking fault.
640	Unnamed prospect	UTM: 748,670 m E., 3,977,530 m N.	Cu	Prospect in gently north-dipping granite gneiss. Honeycomb quartz; trace of copper stain in quartz-pyrite-chalcopyrite(?) vein. No gold observed.
641	Songbird	UTM: 749,850 m E., 3,976,890 m N.	Au, Cu, Pb	Late irregular patches of chalcopyrite, galena, pyrite pseudomorphs in irregular quartz vein; thickness approximately 0.3 to 0.6 m. Very minute gold specks associated with chrysocolla in late fractures.
642	Summit	NE1/4 sec. 16, T. 29 N., R. 18 W.	Cu	Mullion structure on footwall. Quartz vein approximately 30 to 45 cm thick, traced laterally about 1 m using float. Trace of malachite, chrysocolla, and dark-red cuprite(?). Generally poor in sulfides.
643	Pick 'N' Pan Originally named: Intention to Gold	NW1/4 sec. 16, T. 29 N., R. 18 W.	Au, Cu	Two parallel veins dip approximately 45° to 50° E., parallel to layering in surrounding gneiss. Lower vein explored by an incline sunk along the vein which is 0.3 to 0.45 m thick. Trace of gold occurs as minute inclusions in oxidized chalcopyrite. A sheared alteration zone above and below lower vein consists of orange carbonate. A third vein is poorly exposed in upper portion of the prospect and includes very minor amounts of chalcopyrite.
644	Unnamed drywasher site	NW1/4 sec. 15, T. 29 N., R. 18 W.	Au	Very fine gold, some quite flakey, collected at this locality.
645	Unnamed prospect pit	SW1/4 sec. 15, T. 29 N., R. 18 W.	Cu	Prospect pit on 20- to 50-cm-thick quartz vein, containing minor pyrite, chalcopyrite, and carbonate. Considerable chlorite and carbonate alteration of the gneissic diorite country rock.
646	Merrieta	SW1/4 sec. 15, T. 29 N., R. 18 W.	Au, Cu	Sparsely scattered patches of altered chalcopyrite and pyrite are included in milky-quartz vein. Trace amounts of gold occur as minute platelike inclusions in pyrite and possibly in chalcopyrite. Open stope along vein and inclined shaft suggest that gold was once much more plentiful than may be inferred from samples now available. Very few sulfides overall, however.
647	Unnamed prospect (part of Gold Hill workings)	NE1/4 sec. 16, T. 29 N., R. 18 W.	Cu, Au?	Swarm of veins and associated altered country rock exposed in prospect cut. Overall shear zone strikes about N. 35° W. dips approximately 40° NE. Irregular main vein contains pyrite and patches of chalcopyrite generally less than 2 cm across almost completely altered to dark-red

				mineral and chrysocolla. No gold observed. Country rock is altered diorite gneiss. In uppermost portion of prospect, a vein approximately 10 to 15 cm thick cuts a gently dipping leucogranite pegmatite dike. Minor amounts of carbonate pyrite and oxidized chalcopyrite are included within this vein.
648	Gold Hill mine	NE1/4 sec. 16, T. 29 N., R. 18 W.	Au	Intermittent production of gold from 1930 to 1942 (see text, this report).
651	Smokey (or Highline)	NW1/4 sec. 16, T. 29 N., R. 18 W.	Cu, Au, Pb	Irregular and brecciated vein approximately 10 to 15 cm thick, dips gently to the northeast. Six adits are driven to intersect the vein, in total, they aggregate approximately 90 m of workings. Minor oxidized chalcopyrite occurs as late fracture fillings and irregular patches. Minor galena, mostly altered to cerussite, occurs as blebs filling quartz-lined vugs. Gold occurs as minute grains in oxidized pyrite and quartz.
653	Unnamed prospects	UTM: 749,440 m E., 3,977,060 m N.	Au, P, Cu, Ba	A series of pods and stringers of quartz veins emplaced along what appears to be a N. 80° W.-striking and 35°-50° N.-dipping shear zone. An early quartz-carbonate-pyrite-galena-chalcopyrite-gold assemblage in the veins has been brecciated and cut by subsequent seams of white calcite, limonite, and barite. Bladed groups of thin barite crystals fill vugs from which the early carbonate has been leached. Considerable free gold found along pyritic seams in large quartz blocks on the easternmost dump along these workings. Galena and chalcopyrite are also abundant. Country rock consists of an altered granitic gneiss sequence within the gneiss unit.
654	Unnamed adit	UTM: 748,710 m E., 3,978,170 m N.	Au?	An approximately 1.5-m-long adit underlies a 40-cm-thick milky-quartz vein. The close association of an altered pegmatite beneath the vein may indicate that the vein itself may be the quartz-core portion of a small pegmatite-vein system here. No sulfides or secondary copper minerals were observed. A quartz pod approximately 1.2 m thick is exposed 30.5 m northest of the prospect; it also may be related to the pegmatite.
657	Gold Bond	UTM: 748,650 m E., 3,977,450 m N.	Au, Pb, Cu	Massive milky-quartz veins are cut by many low-angle faults. Along the Gold Bond incline, several quartz veins approximately 1.7 m thick do not show significant alteration of the adjoining country. rock. However, seams of pyrite voids and boxworks honeycombed by quartz are distributed throughout the vein parallel to its surface. Unaltered pyrite, chalcopyrite, and galena found in trace amounts. No gold was observed in place within the workings, although chalcopyrite and associated gold were found in an ore sample at the miners' camp. Mine predominantly worked during 1910-20. A second period of occupation of the workings occurred during the following depression.

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
659	Solomon	UTM: 748,590 m E., 3,976,540 m N.	Au?	A simple, massive, milky-quartz vein about 0.6 m thick. An approximately 3-m-deep prospect shaft penetrates the vein at approximately 1.5 m below the surface. Cubic pyrite boxwork, partially filled by jarosite(?), is present in outcrop. No sulfides were observed.
664	Unnamed site	SW1/4 sec. 4, T. 29 N., R. 18 W.	Fe	An approximately 20-cm-thick sequence of highly magnetic iron-formation crops out at this locality. The iron-formation is conformable with the surrounding amphibolite and mafic schist. In this general area, there are also some centimeter-sized tourmaline-bearing pegmatitic dikes which crosscut sharply the layering in the amphibolite and quartzofeldspathic gneiss.
668	Unnamed prospect	UTM: 749,660 m E., 3,978,160 m N.	Cu	A 20-cm-wide quartz-ankerite-pyrite vein contains trace amounts of secondary copper, and honeycomb partings. No gold was observed.
675	Unnamed site	UTM: 749,650 m E., 3,981,510 m N.	W	Calc-silicate rock and stringers of marble occur in a zone as much as 0.6 m thick, largely adjacent to 2- to 15-cm-thick sills and pods of quartz-rich leucogranitic pegmatite. Generally, the overall zone of calc-silicate rock and marble is enclosed within laminated amphibolite. The presence of scheelite in the calc-silicate rocks was verified using a black light. In addition, approximately 30 m north of the locality there is a post-regional-metamorphic granite dike striking approximately N. 10° W.
676	Unnamed site	UTM: 749,560 m E., 3,981,030 m N.	Cu	A 20-cm-wide quartz-ankerite (or siderite)-chalcopyrite vein crops out here. No gold or galena found.
678	Unnamed prospects	NW1/4 sec. 34, T. 30 N., R. 18 W.	Cu, Au?	Prospects at top of peak show quartz-ankerite-sericite-pyrite veins. Trace secondary copper present, and some gold was observed. The remoteness and amount of past work done at the site suggest that some gold must have been found here previously.
687	Unnamed site	SE1/4 sec. 28, T. 30 N., R. 18 W.	Ba	Group of approximately N. 10° W.-striking veins which dip 30°-35° NE. crop out here. Irregular stringers and elongate masses of coarsely crystalline barite are somewhat abundant in this general area as late fillings of echelon gashes. Ankerite is associated with the barite, and an albite-pyrite-ankerite assemblage is common along the walls of individual veins.

689	Unnamed site	NE1/4 sec. 28, T. 30 N., R. 18 W.	Ba	Veins showing an assemblage of quartz, carbonate, barite, albite, and pyrite crop out here. There is considerable albite along the wall zone of the veins. The main vein here measures about 20 cm thick, but several others are about 2 to 5 cm thick.
690	Unnamed site	NE1/4 sec. 29, T. 30 N., R. 18 W.	Ba, Cu	A 0.6-m-thick vein here includes chalcopyrite in its quartz-carbonate-barite-albite-pyrite assemblage.
735	Unnamed prospects	UTM: 747,180 m E., 3,984,640 m N.	Au	Gold was observed at five different prospects in this general area. A deep vertical shaft approximately 30 m deep had the largest amount of secondary(?) gold (see fig. 41). The veins generally pinch and swell irregularly and are composed essentially of quartz, carbonate, pyrite, and gold. They may be Proterozoic in age (see text).
754	Unnamed prospect	UTM: 746,850 m E., 3,984,420 m N.	Hg?	An adit approximately 9 m long intersects a gently south-dipping shear zone. Apparently, the prospect was for mercury, as the remains of an old hearth and a stockpile of hematitic schist suggests that the early prospectors mistook this for cinnabar.
800	Unnamed site	SW1/4 sec. 35, T. 28 N., R. 18 W.	Au?	Leucosyenitic pipe, elongate in a northeasterly direction crops out at this locality. Its overall dimensions at the surface are about 20 by 60 m. The pipe contains a quartz-free central zone which also shows fairly abundant concentrations of fluffy orange iron oxide(s) replacing iron carbonate. The outer portion of the pipe shows increasing concentrations of quartz in irregularly distributed stringers and veinlets. Although this locality shows no fluorite or obvious pyrite, the pipe here is nonetheless similar to that at locality 19 which contains visible disseminated gold.
802	Unnamed site	SE1/4 sec. 34, T. 28 N., R. 18 W.	F	Quartz-fluorite vein crops out here and shows an average thickness of about 20 cm. The quartz is intergrown with the variably colored fluorite, which ranges from colorless to deep purple.
803	Unnamed site	SE1/4 sec. 34, T. 28 N., R. 18 W.	F, Au?	An approximately 2-cm-wide quartz-fluorite-specularite-pyrite vein crops out here. One possible speck of free gold observed in limonitic boxworks after pyrite. Bleaching and the possible introduction of feldspar extends into the country rock for about 2 cm adjacent to the vein.
804	Unnamed site	SE1/4 sec. 34, T. 28 N., R. 18 W.	F	Fluorite occurs as coarsely crystalline knots in a quartz-fluorite-chlorite-iron carbonate-hematite-pyrite vein. The vein has a maximum observed thickness of about 20 cm.
810	Unnamed site	SW1/4 sec. 34, T. 28 N., R. 18 W.	F, Pb	A quartz-carbonate-fluorite-chlorite-galena vein system cuts a mixed zone of Early Proterozoic biotite monzogranite and porphyritic monzogranite. Most of the veinlets in the system measure about 0.6 cm thick, and they contain colorless fluorite.
811	Unnamed site	SW1/4 sec. 34, T. 28 N., R. 18 W.	F	A quartz-purple fluorite veinlet parallels the local northwest-striking joint set in the porphyritic monzogranite.

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
812	Unnamed site	NW1/4 sec. 34, T. 28 N., R. 18 W.	F	Quartz-fluorite-iron carbonate-pyrite-chlorite veinlets fill northeast-striking joints.
815	Unnamed site	NW1/4 sec. 34, T. 28 N., R. 18 W.	F	Quartz-fluorite-pyrite and quartz-pyrite veinlets as much as 15 cm thick fill northeast-striking steeply dipping joints.
817	Unnamed site	NW1/4 sec. 34, T. 28 N., R. 18 W.	Cu	An approximately N. 15° E.-striking and 75° NW.-dipping vein includes quartz, pyrite, chlorite, and secondary copper mineral(s).
820	Lady Mary	SW1/4 sec. 27, T. 28 N., R. 18 W.	F, Pb, Cu, Au	Numerous parallel veins and veinlets, less than or equal to 15 cm thick parallel the jointing in coarse-grained porphyritic monzogranite. Pale-lavender fluorite is in association with brown carbonate in quartz-lined cavities. There are abundant indications of galena and alteration products of chalcopyrite; numerous zones of small (less than 2 mm) pyrite molds and pseudomorphs; and minor unaltered pyrite. These veins were explored by three small inclines, but apparently the veins pinch out with depth as they are exposed only in the opencuts.
821	Unnamed prospect	SW1/4 sec. 27, T. 28 N., R. 18 W.	F	Vein cuts coarse-grained porhyritic monzogranite. Purple fluorite occurs with pyrite along late hypogene fractures and in masses about 1.0 cm across in milky quartz. No galena, gold, or copper stain was observed. The vein probably was emplaced along a northeast-striking fault as suggested by an intensely altered and friable zone at least 0.6 m thick along the footwall of the vein.
823	Unnamed site	SE1/4 sec. 28, T. 28 N., R. 18 W.	F	A quartz-fluorite-pyrite-chlorite-bearing vein strikes approximately N. 50° E., and dips 35°-40° NW. The vein is as much as 0.3 m thick and can be traced at the surface for a distance of about 30 m along strike. The fluorite in the vein consists of coarsely crystalline masses as much as 6 cm across.
824	Unnamed drywasher site	SW1/4 sec. 4, T. 27 N., R. 18 W.	Au	Fine particles of detrital gold are moderately abundant in gravel on a somewhat consolidated, reddish-brown clay soil. This soil fills irregularities developed in the true bed rock here. However, the reddish-brown soil does not itself contain placer gold particles.
828	Unnamed prospect	NW1/4 sec. 4, T. 27 N., R. 18 W.	Cu	Relatively abundant iron oxides replacing chalcopyrite in wispy quartz stringers following a N. 70° E.-striking and north-dipping shear zone. Considerable silicification along the zone.

831	Unnamed site	SE1/4 sec. 32, T. 28 N., R. 18 W.	F	An approximately 3-cm-thick quartz-pyrite-fluorite-carbonate vein cuts porphyritic monzogranite at this locality. The vein strikes N. 65° E. and dips 70° SE.
832	Unnamed site	SE1/4 sec. 32, T. 28 N., R. 18 W.	F	At this locality, two veins crop out about 1 m apart. The mineralogy of the veins includes quartz, pyrite, pale-lavender fluorite, carbonate, white mica, and possibly potassium feldspar.
834	Unnamed shaft	SW1/4 sec. 33, T. 28 N., R. 18 W.	Pb, Cu, Au	Quartz veins, as much as 20 cm wide, appear to parallel a strongly developed foliation in a N. 35° E.-striking shear zone in cataclastically deformed porphyritic monzogranite. The porhyritic monzogranite contains some scattered patches of galena and secondary copper minerals. One small grain of gold was noted.
835	Unnamed site	NW1/4 sec. 33, T. 28 N., R. 18 W.	Cu, Pb, Au	Several quartz-pyrite-carbonate±chalcopyrite±galena± gold (trace) veins cut coarse-grained porphyritic monzogranite. Gold occurs as minute grains in iron oxide-stained cavities possibly reflecting the former presence of chalcopyrite. In addition, a hornblende porphyry dike crops out at this locality and strikes northeasterly.
836	Unnamed prospect	SE1/4 sec. 33, T. 28N., R. 18 W.	F, Pb	A quartz-fluorite-pyrite-galena (trace) vein strikes N. 25° E. and dips 80° NW. Fluorite in the vein is as much as 4-cm-across and varies from colorless to dark purple.
837	Unnamed site	SW1/4 sec. 32, T. 28 N., R. 18 W.	F	Two quartz-fluorite-white mica veins crop out here approximately 3 m apart. The veins strike approximately N. 65° E. Greisen occur in the surrounding coarse-grained porphyritic monzogranite and includes some pyrite and feldspar. A potassium-argon age determination of white mica from these veins yielded an age of 65.4 Ma (see table 3).
838	Unnamed site	NE1/4 sec. 32, T. 29 N., R. 18 W.	F	Quartz-pyrite-fluorite veinlets in porphyritic monzogranite strike N. 20°-25° E. and dip 70° NW. In addition, several mafic dikes at this locality parallel the trend of the veins, but no veins were observed to cut the mafic dikes.
856	Unnamed prospect	SE1/4 sec. 30, T. 28 N., R. 18 W.	Au?	Prospect sunk on a 15- to 20-cm-thick, brecciated quartz-carbonate-pyrite vein. Further, a nearly flat lying shear zone is exposed throughout the prospect pit. The shear zone includes abundant sericitized and broken-up schist.
858	Red Cloud	NW1/4 sec. 31, T. 28 N., R. 18 W.	Cu	Approximately 30-m-long adit and 5-m raise to surface along quartz-pyrite-carbonate-chalcopyrite (trace) veins cutting porphyritic monzogranite. Numerous minor faults in the workings show shallow dips.
868	Cyclopic 6 prospects	NE1/4 sec. 25, T. 28 N., R. 19 W.	Au?	Major splay of detachment-fault zone containing red-brown gouge and comminuted monzogranite cuts through the prospects. A minor fault strikes N. 10°-15° E., and dips approximately 40° W.; it is possibly parallel to the main fault system. Quartz-carbonate-pyrite veins and recemented quartz breccia of the Cyclopic type occur in the gouge zone.

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
868	Cyclopic 6 prospects-Continued		Pb, Cu, Au, Mo	Approximately 150 to 300 m southeast of this locality, there are numerous prospects, pits, and trenches in the lower gouge zone. Vein quartz is brecciated and widely scattered in the gouge as blocks 0.6 m long and approximately 0.3 m thick. Veins contain galena, pyrite, iron carbonate, malachite (alteration of chalcopyrite(?)), wulfenite, gold, and cerussite. Brilliant crimson mineral may be cuprite. Red, brown, and black iron and manganese(?) oxides are relatively abundant.
869	Unnamed prospect	NE1/4 sec. 25, T. 28 N., R. 19 W.	Au?	Two prospect pits expose approximately 2 m of friable, coarse-grained, porphyritic monzogranite. The entire ridge to the east has similar lithology. Several thin seams of gouge dip gently to the southwest.
871	Fry mine	NE1/4 sec. 25, T. 28 N., R. 19 W.	Au?	A shaft is sunk on a late Tertiary fault zone and sheared Proterozoic rocks and Miocene and (or) Pliocene fanglomerate.
872	Beppo	SE1/4 sec. 32, T. 28 N., R. 18 W.	Au?	Fine-grained granular quartz veins containing numerous thin seams of pyrite in cubes. Several minor shear zones are present, yet there is no brecciation of the veins themselves. Country rock is foliated and sericitized, coarse-grained porphyritic monzogranite.
876	Unnamed site	NE1/4 sec. 24, T. 28 N., R. 19 W.	F	Quartz-carbonate (minor)-pyrite-fluorite-white mica veins cut the Late Cretaceous two-mica monzogranite.
877	Unnamed site	NE1/4 sec. 24, T. 28 N., R. 19 W.	F	Abundant quartz-white mica-fluorite veins and veinlets cut the Late Cretaceous two-mica monzogranite. The fluorite in these veins is colorless and as much as 8 cm thick.
878	Unnamed site	NE1/4 sec. 24, T. 28 N., R. 19 W.	F	A local swarm of nearly vertical, quartz-pyrite-white mica veinlets shows white mica-fluorite-quartz-potassium feldspar alteration assemblages in the adjacent two-mica monzogranite. In addition, small cubes of pyrite are oxidizing to red and yellow iron oxide(s) in some of the fluorite-bearing assemblages.
885	Unnamed adit	NE1/4 sec. 25, T. 28 N., R. 19 W.	Pb	Prospect adit driven into a major splay of the detachment-fault zone which crops out at the Cyclopic mine area. In the adit, friable and cemented Cyclopic-type quartz is exposed. The quartz vein is oxidized and contains abundant cerussite.
887	Unnamed prospect	SW1/4 sec. 19, T. 28 N., R. 18 W.	Cu	Quartz-pyrite-chalcopyrite-white mica-potassium feldspar-specular hematite vein, approximately 5 to

				45 cm thick. Immediate country rock consists of a septum of metamorphic rocks that have been engulfed by the two-mica monzogranite.
889	Unnamed shaft	SW1/4 sec. 29, T. 28 N., R. 18 W.	Au?	Shallow, 8-m-deep shaft is sunk in gneiss intruded by numerous biotite minette(?) and fine-grained andesite dikes. No obvious signs of mineralization present.
891	Unnamed prospects	NE1/4 sec. 30, T. 28 N., R. 18 W.	Pb	Series of prospects along generally east-west-striking structures crop out in the vicinity of this locality. One quartz vein (probably 15 to 30 cm thick) lies along a N. 85° E.-striking fault. Movement along the fault probably is premineralization.Abundant cerussite, minor galena, and some pyrite molds were noted locally. Numerous quartz veins and pods occur along a sericitized and deformed contact zone between medium-grained gneissic biotite granodiorite and leucocratic granite-bearing metamorphic complex. The easternmost prospect pits were sunk on two quartz-pyrite-galena-cerussite veins 15 to 30 cm thick.
897	Golden Rule mine (Gold Day mine)	NW1/4 sec. 29, T. 28 N., R. 18 W	Au, Pb	At top of hill, a shaft 6 m deep is sunk on a quartz vein 0.9 to 1.2 m thick, striking N. 20° E. and dipping 45° SE. Pyrite and other sulfides are concentrated along late hypogene fractures parallel to the overall strike of the vein. Only a small percentage of the vein is mineralized.
			Zn?, Cu, Au, Pb	Downhill to the east, the vein strikes N. 35° E., dips 20° SE. and is from 0.15 to 1.2 m thick. Here, the vein pinches and swells, cutting strongly sheared gneiss or medium-grained granodiorite, and it includes a quartz-iron carbonate-chlorite-pyrite-galena-sphalerite(?)-chalcopyrite(?) assemblage. Chrysocolla is abundant; no chalcopyrite was observed, although it may be present. Mineralogy of the north-northeast-striking, gently to moderately southeast dipping vein includes quartz, pyrite, galena, and cerussite. Trace amounts of secondary copper minerals were noted. Gold was found in the dump of the main shaft, approximately 30 m north-northeast of the hilltop. Veinlets locally cut hydrothermally altered alaskite.
900	Mountain View 2	SE1/4 sec. 20, T. 28 N., R. 18 W.	Cu, Pb	A fine-grained granular quartz-galena vein includes a trace of copper stain.
902	Unnamed shaft	SE1/4 sec. 20, T. 28 N., R. 18 W.	Cu, Pb	Incline workings have a maximum depth of about 12 m, and include a short, approximately 7-m-long drift along a minor fault. Traces of galena and secondary copper minerals were noted.
903	Ridgetop prospect (Never-get-left)	SE1/4 sec. 20, T. 28 N., R. 18 W.	Cu, Pb	Uppermost working is a 9-m-long, 0.6- to 3.1-m-deep opencut; along a N. 50° E. striking, 75° SE.-dipping fault vein. The vein contains minor chalcopyrite, galena, and pyrite.
904	Unnamed prospect	SW1/4 sec. 28, T. 28 N., R. 18 W.	Zn?, Pb, Cu, Mo	The prospect pit is approximately 1.5 m deep and cuts an irregular quartz-galena-sphalerite(?)-chalcopyrite-pyrite vein. Wulfenite is abundant; chalcopyrite and pyrite are rare. No free gold was found after an extensive search.

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
909	Unnamed prospect	SW1/4 sec. 20, T. 28 N., R. 18 W.	Cu, Pb	A 0.6-m-thick quartz-galena-chalcopyrite vein here dips about 45° S. and strikes N. 85° E.
911	Unnamed adit	Location uncertain	Pb, Cu, Au, Mo	Irregular sulfide-bearing quartz pods and stringers, parallel to foliation in sheared mafic gneiss. The veins have been deformed by the regional metamorphic events (see text). Sulfides include galena, chalcopyrite, pyrite, minor secondary cerussite, wulfenite, and green-blue copper stains.
913	Jumbo prospect	SW1/4 sec. 19, T. 28 N., R. 18W.	Au?	Main vein is 2.4 to 3 m thick, strikes N. 10° W., and has a vertical dip. The vein crops out continuously for approximately 140 m and appears to branch out into several veins at its north end. In the main prospect pit, which is about 3 m deep, the vein is 3.1 m thick and dips 80° E., cutting the gently northeast dipping gneiss. A second vein, 2 to 3 m thick, lies 30 m to the west and crops out for 30 m. The strike is N. 10° W., dip vertical. Veins consist of quartz, minor pyrite, trace sericite, and trace ferrocarbonate. No copper, lead ore, fluorite, or gold was observed, however.
913a	Unnamed prospect	SW1/4 sec. 19, T. 28 N., R. 18 W.	F	Massive quartz vein appears to dip 30° SE. and is intimately associated with two-mica monzogranite and pegmatite. Feldspar, muscovite, fluorite, and minor pyrite occur as thin seams less than 2.5 cm thick. The veins cut and are mutually cut by the monzogranite, suggesting a genetic relation.
917	Unnamed site	NW1/4 sec. 19, T. 28 N., R. 18 W.	F	Quartz-pyrite-white mica-fluorite veinlets as much as 5 cm thick cut a fine-grained facies of the two-mica monzogranite.
920	Patsy (Neglected)	NW1/4 sec. 20, T. 28 N., R. 18 W.	Pb, Cu	Several prospect pits on a gently southwest dipping quartz-pyrite-galena-chalcopyrite vein, 0.9 to 1.2 m thick. Also present are cerussite, chrysocolla, pyrite voids, and boxworks.
921	Unnamed prospect	SW1/4 sec. 17, T. 28 N., R. 18 W.	Pb, Ag	Considerable galena and cerussite exposed in a small pit. Country rock consists of quartzofeldspathic gneiss, amphibolite, and biotite sequences of the paragneiss unit.
923	Unnamed site	NW1/4 sec. 19, T. 28 N., R. 18 W.	F	An approximately east-west-striking vertical vein cuts the two-mica monzogranite and the adjoining gneiss. The vein includes quartz, pyrite, white mica, and fluorite. Some of the fluorite cubes are 5 cm on a side. A potassium-argon age determination on white mica from this vein yielded an age of 68.8 Ma (see text and table 3, this report).

927	Shelby mine (Harmonica)	NW1/4 sec. 17, T. 28 N., R. 18 W.	Au, Pb, Cu, V, Mo	Hilltop prospect pit exposes a pod of quartz-chalcopyrite-galena that is approximately 1.8 m thick. Examination of mineralogy on samples from dump revealed abundant gold approximately 1 mm in diameter; galena, minor altered chalcopyrite, pyrite, wulfenite, vanadinite, chrysocolla, copper stain.
928	Unnamed adit	SE1/4 sec. 17, T. 28 N., R. 18 W.	Au, Pb, Cu	Lower adit is approximately 14 to 15 m long. Workings are along a quartz-galena-cerussite-gold-altered chalcopyrite (malachite) vein, approximately 0.9 m thick.
929	Gold Street (also titled Climax group)	NE1/4 sec. 17, T. 28 N., R. 18 W.	Pb, Cu, V, Mo	Main shaft inaccessible but was approximately 9 m deep. A quartz-pyrite-iron carbonate-galena-chalcopyrite-chlorite vein is poorly exposed. It appears to strike N. 25°-30° W. Some vanadinite, wulfenite, and copper stain were observed also.
931	Big Lease	NW1/4 sec. 8, T. 28 N., R. 18 W.	Trace Cu	Prospect pit is approximately 3 m deep on a zone of quartz-pyrite-chlorite-sparse chalcopyrite veins, 1.5 m thick. The veins are fractured, brecciated, and recemented somewhat similar to ore at the Cyclopic mine workings.
931a	Unnamed prospect	NW1/4 sec. 8, T. 28 N., R. 18 W.	Au	A small opencut, about 3 m deep and 12 m long, lies in a zone of brecciated quartz lenses in a northwest-striking shear zone. Float suggests that this system of veining is the continuation of the zone of quartz veins extending through the Shelby mine (loc. 927). Vein includes quartz, pyrite, carbonate, chlorite, and gold.
933	Unnamed prospect	NW1/4 sec. 5, T. 28 N., R. 18 W.	Trace Cu	Pit on quartz-pyrite-carbonate-chlorite vein, approximately 2.4 m thick. A trace of copper stain was observed on float. The vein strikes approximately east-west and dips 35° N.
934	Star Extension 2	SW1/4 sec. 16, T. 28 N., R. 18 W.	Cu, Pb, Mo, Au?	Upper pit is on a quartz-pyrite-chalcopyrite-galena vein that ranges from 2.5 to 25 cm(?) thick. Minor chrysocolla and wulfenite present. No gold was observed. The vein strikes N. 25° E. and dips 75° SW. A mafic dike approximately 3 m thick is in the hanging wall of the vein and has a chilled margin against the vein.
935	Morning Star	SW1/4 sec. 16, T. 28 N., R. 18 W.	Au?	Morning Star is a shaft with a short connecting adit.
935a	Saint Charles	SE1/4 sec. 16, T. 28 N., R. 18 W.	Pb, trace Cu, Au?	Quartz-pyrite-galena-trace copper-bearing vein, 7 to 25 cm thick, strikes N. 10° E., and dips 35° E.
938	Round Top	NW1/4 sec. 22, T. 28 N., R. 18 W.	Pb, Cu, Au?	Quartz-pyrite-galena-chrysocolla vein occurs in a lens less than 0.9 m thick. Also present are cerussite and malachite. Vein and veinlets are concentrated in a shear zone. Country rock includes gneissic granodiorite below shear zone and paragneiss above the shear zone.
938a	Unnamed adit	NW1/4 sec. 22, T. 28 N., R. 18 W.	Au, Pb, Cu	At this locality, a prospect pit in lower plate of gneissic granodiorite has been dug on rocks cut by numerous small quartz veinlets. This pit lies approximately 15.2 m below a N. 65° E.; 25° SE.-dipping fault zone. The main quartz-pyrite-galena-chalcopyrite (cerussite-malachite)-gold vein near

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
938a	Unnamed adit—Continued			here, however, is less than 7.6 cm thick and lies within the fault zone. Adit is 1.2 m in length.
940	Claude (Eastside)	NW1/4 sec. 22, T. 28 N., R. 18 W.	Au, Cu, Pb	Quartz-iron carbonate-pyrite-galena-chalcopyrite (minor)-gold vein is hosted by gneiss. Vein strikes N. 75° E. and dips 50° NW.
941	Lester 1 and 2	SW1/4 sec. 15, T. 28 N., R. 18 W.	Pb, Au	An approximately 8-m-long adit is driven along a southeast-dipping fault zone in gneiss. The quartz vein is fragmented and recemented, and overall is not notably mineralized except at the north end where galena, cerussite, pyrite, and trace gold were observed.
942	Ridge Lode (For Years)	SE1/4 sec. 16, T. 28 N., R. 18 W.	Pb, Cu, Au	A quartz-pyrite-galena-carbonate-chalcopyrite-gold-bearing vein is 0.3 m thick here; it strikes approximately N. 45° E. and dips 40° SE.
947	Unnamed prospect	NW1/4 sec. 28, T. 28 N., R. 18 W.	Pb, Cu	Galena and copper stain noted in a small prospect pit dug on the ridgeline, approximately 30 m south of the contact between gneissic granodiorite and porphyritic monzogranite.
948	Grand View	SE1/4 sec. 10, T. 28 N., R. 18 W.	Au, Cu, Pb	Prospects and opencuts lie on group of echelon veins striking N. 55°-75° W. and dipping 55°-70° NE. Lower adit is approximately 7 m long and includes a 7-m opencut driven on a N. 45° W.-striking, 65° W.-dipping fracture zone containing irregular quartz, iron carbonate, and pyrite veinlets. The fracture zone is 5 cm wide in the gneissic granodiorite. A second adit uphill is about 13 m long and was driven along a quartz vein system varying from 1 to 60 cm in thickness; it occupies a N. 55° W.-striking, 55° NE.-dipping fault in the gneissic granodiorite. The system consists mostly of a zone 8 cm to 0.6 m wide that is made up of branching quartz veinlets. A third prospect here explores a fracture-vein system which strikes N. 75° W. and includes individual quartz veinlets as much as 8 cm wide. Sericitization of the gneissic granodiorite extends about 3 m out from the fracture-vein system. Free gold was noted in oxidized vein material on the dump. Individual veins may include variable amounts of galena, chalcopyrite, quartz, carbonate, pyrite, cerussite, and limonite.
949	Valley View 2	SW1/4 sec. 10, T. 28 N., R. 18 W.	Cu, Pb, Au?	Two prospect shafts approximately 5 to 6 m deep explore a 75-cm-wide vein of white quartz containing less than 1 percent overall pyrite, chalcopyrite, iron carbonate, and gold(?).

952	Valley View	SW1/4 sec. 10, T. 28 N., R. 18 W.	Au?	There are two shafts near this locality. Southern shaft exposes 3-m-wide contorted gouge zone containing blocks of vein quartz as much as 1 m long. The mineralogy of the veins includes quartz, carbonate, and pyrite.
957	Unnamed placer workings	SE1/4 sec. 28, T. 29 N., R. 18 W.	Au?	Gulches in this general area have been placered very heavily during several intervals of what appears to have been prolonged occupations.
964	Unnamed placer workings	NW1/4 sec. 29, T. 29 N., R. 18 W.	Au?	Gulches on both sides of the road in this general area were worked extensively for their placer gold content. Apparently the placer gold was concentrated on fractured but coherent gneissic basement rocks.
967	Unnamed prospects	NE1/4 sec. 31, T. 29 N., R. 18 W.	Cu, Pb, Au?	Four shallow prospect pits, the deepest of which is about 4 m, explore a series of northeast-striking southeast-dipping milky quartz veins. The veins contain local concentrations of chalcopyrite, galena, and carbonate. The veins are lenticular and branch approximately parallel to foliation in the paragneiss country rock.
968	Unnamed drywasher site	NE1/4 sec. 32, T. 29 N., R. 18 W.	Au	Placer gold occurs in particles approximately 1 mm across. The gold is hosted widely by the slopewash debris and is associated with relatively sparse concentrations of magnetite.
971	Unnamed drywasher site	NW1/4 sec. 31, T. 29 N., R. 18 W.	Au	Several small colors and one cerussite-encrusted pebble of galena were obtained from material collected from a small gulley cut in Tertiary and (or) Quaternary gravel. False bed rock is not well-cemented by caliche but instead consists of gravel cemented by a red clay-rich matrix.
972	Unnamed drywasher site	NW1/4 sec. 1, T. 29 N., R. 19 W.	Au	Some relatively coarse placer gold, with particles measuring more than 1 mm across, was obtained from a heavily worked gulch approximately 200 m northeast of the cabin at Owens mine.
973	Owens mine	NW1/4 sec. 1, T. 28 N., R. 19 W.	Cu, Fe	Underground workings at the mine probably measured at least 100 m. Headframes and ladders have been removed. Considerable chrysocolla and malachite occur as staining along a narrow fault zone which parallels the gneissic layering in its hanging wall. There is a slight discordance of the fault plane with the attitude of the layering in the footwall gneiss. Amphibolite and biotite gneiss are the main rock types in the mine area, but at least one 0.6-m-thick bed of laminated iron formation crops out at several points southwest and west of the main shaft. Calc-silicate rock is cut locally by quartzose veins or pegmatitic alaskite. The veins include fine-grained granular quartz, iron carbonate, specularite, pyrite, and secondary copper minerals. Sericitization is intense and widespread.
973a	Hope	NW1/4 sec. 1, T. 28 N., R. 19 W.	Cu	A shallow 3-m pit shows altered and copper-stained schistose cataclastic gneiss. Malachite, cuprite(?), and chalcopyrite occur in veinlets as

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
973a	Hope--Continued			much as 2.5 cm wide. They parallel foliation and layering. Brecciated zones in the gneiss are cemented by iron and copper oxide minerals.
974	Unnamed drywasher site	SE1/4 sec. 36, T. 29 N., R. 19 W.	Au	Relatively abundant and moderately coarse fragments of detrital gold obtained entirely from Tertiary and (or) Quaternary gravel. The bulk of the gold at this locality is concentrated on caliche-cemented false bed rock.
976	Unnamed drywasher site	NE1/4 sec. 12, T. 28 N., R. 19 W.	Au	Very few colors were obtained from this site. One fragment of gold measured 0.5 mm across. In addition, the overall abundance of magnetite in the sand at this site is relatively low.
980	Unnamed drywasher site	NW1/4 sec. 17, T. 28 N., R. 19 W.	Au	Relatively abundant concentrations of magnetite occur in the Tertiary and (or) Quaternary gravel, but only one color was found.
988	Excelsior mine	NW1/4 sec. 22, T. 28 N., R. 18 W.	Pb, Au?	Thin quartz-carbonate veinlets parallel foliation in a highly foliated zone that strikes N. 35°-40° E. The highly foliated shear zone shows silicification, sericitization, and flooding by carbonate; the zone occurs between gneiss and porphyritic monzogranite. The bulk of the alteration and quartz veinlets are concentrated in a zone approximately 7 m wide. The veins include quartz-carbonate-chlorite-pyrite-galena (trace)-gold(?) assemblages.
990	O.D. 1	SW1/4 sec. 22, T. 28 N., R. 18 W.	Pb, Cu, Au?	As much as 0.6 m of well-mineralized quartz occupies a west-northwest-dipping fault zone--possibly the extension of the Excelsior vein system. Abundant cerussite after galena, local concentrations of malachite and chrysocolla staining, and iron oxide pseudomorphs after pyrite.
992	Unnamed prospect	SW1/4 sec. 22, T. 28 N., R. 18 W.	Pb	Shaft 15 m deep shows stoping to that depth along a 0.3- to 1.0-m-thick vertical quartz vein occupying a N. 10° E.-striking sericitized shear zone. Two biotite lamprophyre dikes are visible in main shaft. One dike 15 cm thick crosscuts the vein, and the other, which is 40 cm thick, lies 0.6 m east of the vein. Galena and weathered pyrite occur in the vein quartz.
1031	Unnamed drywasher site	SE1/4 sec. 7, T. 29 N., R. 17 W.	Au	Considerable coarse-grained and fine-grained fragments of gold are associated with a moderate amount of magnetite, some barite, and a considerable amount of cerussite-encrusted galena. The coarse fragments of gold are moderately rounded, whereas the fine fragments are angular.

1036	Unnamed prospects	SW1/4 sec. 8, T. 29 N., R. 17 W.	U?, W?	Radioactivity is as much as seven times background locally in some hot spots. At this prospect a magnetite-bearing leucogranite pegmatite contains cataclastic margins characterized by fine-grained magnetite. The margins of the pegmatite have the highest counts in areas along the hanging wall. A block of skarn occurs in the wash at the prospect. Some calcite, quartz, garnet, pyrite, amphibole, and scheelite(?) were noted in the skarn.
1043	Unnamed prospect	UTM: 756,030 m E., 3,988,780 m N.	Cu	Prospect is east of Burro Springs in the Iceberg Canyon quadrangle. A 1-m-wide quartz vein contains some knots of brown-weathering carbonate, rather abundant pyrite, and a trace of secondary copper staining. The vein occupies a narrow augen gneiss cataclastic zone in an otherwise fresh porphyritic coarse-grained monzogranite.
1071	Lone Jack placer	SW1/4 sec. 15, T. 29 N., R. 17 W.	Au	Yellow-gray distinctly foliated to laminated quartzofeldspathic gneiss (medium grained) is the dominant clast type. Subangular to subrounded boulders as much as 0.6 m in diameter are common. Pyritic vein quartz is present but uncommon, and some pyritic and feldspathic altered wall rock of quartzofeldspathic gneiss is present. Gold and limonite pseudomorphs after pyrite were found northward. Heavily worked in the late 1950's; reportedly fragments of gold greater than 1 mm were very common.
1086	Unnamed prospect	SW1/4 sec. 1, T. 28 N., R. 19 W.	Pb, Cu, Ba?, Fe	A 0.3-m-thick quartz vein containing some iron carbonate, albite, and some minor seams of barite(?) crops out here. Considerable late galena and oxidation products of chalcopyrite also occur in the vein. The vein occupies a minor normal(?) fault in predominantly amphibolite paragneiss, which includes a lens of well-laminated iron formation, approximately 100 m north-northwest of the 2-m-deep pit at this site.
1087	Unnamed prospects	NW1/4 sec. 1, T. 28 N., R. 19 W.	Cu, Pb?	These workings include approximately 10 m of vertical and inclined shafts. There is considerable chrysocolla, but very little galena, if any. Iron oxides after pyrite are rather abundant.
1095	Senator mine	NW1/4 sec. 14, T. 28 N., R. 19 W.	Cu, Au?	An approximately 100-m-long adit has been driven to crosscut an approximately 0.6-m-thick breccia zone along a shallow-dipping fault zone. The fault zone dips 5°-10° E.- NE. and has a hanging wall of brecciated gneiss and a footwall of two-mica monzogranite. Only traces of secondary copper minerals were noted to occur in the fault zone, approximately 20 m from the portal. The fault zone in the adit also includes some vein quartz.
1096	Buena Vista	SE1/4 sec. 11, T. 28 N., R. 19 W.	Au?	Two quartz lenses as much as 2 m thick and 25 m along strike appear to lie on either side of a shear zone poorly exposed in a small prospect pit at the north end of the lenses. Indications of mineralization are very sparse. Faulting along the shear zone may

TABLE 11.—*Notable occurrences of commodities in the Gold Basin-Lost Basin mining districts*—Continued

Locality (pl. 1)	Name	Approximate location (UTM 10,000-m grid, zone 11)	Commodities present	Comments
1096	Buena Vista-Continued			have repeated a single lens. There are a few barren-appearing quartz veins in this general area, but no other prospects were noted.
1097	Unnamed site	SE1/4 sec. 11, T. 28 N., R. 19 W.	Cu	Altered amphibolite here shows silicification and flooding by carbonate. In addition, a quartz-carbonate-hematite-pyrite vein crops out here and includes some secondary copper mineral(s).
1100	Unnamed site	NE1/4 sec. 15, T. 28 N., R. 19 W.	Pb, Cu	Quartz-white mica-pyrite veins cutting two-mica monzogranite locally include relatively abundant concentrations of galena and trace amounts of secondary copper minerals(?).
1105	Unnamed prospect	NW1/4 sec. 14, T. 28 N., R. 19 W.	Au?	Prospect exposing fanglomerate of the Muddy Creek Formation in fault contact with paragneiss. The deep-brick-red and red-brown gouge of the fault zone, however, is not well exposed. The rocks in the lower plate here sporadically include tectonic blocks of crushed and recemented vein quartz similar to the Cyclopic-type ore.
1106	Unnamed prospect	NW1/4 sec. 14, T. 28 N., R. 19 W.	Au?	A lens of crushed quartz as much as 15 cm thick crops out in a prospect here. The prospect exposes these veins as gently east-dipping crosscutting bodies enclosed in crushed, brecciated, and intricately faulted Proterozoic gneiss. The brecciated ore is restricted entirely to a tectonic sliver of gneiss between two-mica monzogranite and fanglomerate.
1107	Unnamed adit	NW1/4 sec. 14, T. 28 N., R. 19 W.	Au?	Horizontal adit penetrates a low-angle fault, which is in turn offset about 1 m by a high-angle normal fault. An upper prospect nearby is an opencut 15 m long, entirely in mangled gneiss, containing commonly isolated blocks and lenses of crushed quartz. A trace of pyrite was found on one vein fragment.
1127	Unnamed site	NW1/4 sec. 32, T. 28 N., R. 16 W.	F	A 10-cm-thick vein of quartz, epidote, calcite, and fluorite crops out in a sheared and brecciated zone within the granodioritic border facies of the porphyritic monzogranite. Fluorite varies from colorless to purple and occurs together with white coarsely crystalline calcite in veinlets which cut the quartz- and epidote-bearing vein.
1225	Unnamed prospect	NE1/4 sec. 26, T. 28 N., R. 20 W.	Au	Gold-bearing quartz+pyrite+carbonate vein material occurring in a coarse, angular landslide breccia. Trace of gold visible.
1356	Unnamed prospect	NW1/4 sec. 9, T. 29 N., R. 17 W.	Cu	Two prospects occur at this locality. In the first prospect, hematitic gossan is apparently associated here with a 30-cm-wide quartz vein

				originally carrying abundant sulfides, including chalcopyrite. The vein dips moderately and parallels the dip of layering in the enclosing gneiss and leucogranite complex. In the second prospect, a trace of chrysocolla was noted associated with a 1-m-wide quartz vein occupying a minor fault in nearly flat lying amphibolite gneiss.
1357	Copper Glance 2 (Copper Blowout)	NW1/4 sec. 9,. T. 29 W., R. 17 W.	Cu	Gentle inclined adit exposes a 2- to 25-cm-thick zone of massive goethite-hematite lying parallel to the rounding, undulating foliation. Some malachite and chrysocolla on dump. Another shaft is vertical and about 10 m deep; it passes through a flat-lying hematite+goethite+malachite+ chrysocolla gossan exposed at the surface by cuts. The country rock is gently dipping amphibole-quartzofeldspathic gneiss and alaskite. This area seems to be dominated by a series of gently dipping quartz+ sulfide lenses parallel to layering in interlayered amphibole-quartzofeldspathic gneiss. Mineralization in this general area is referred to as Copper Blowout ridge in Deaderick (1980) and Krish (1974). Geochemical studies of minor elements in rocks in this area suggested to Krish that if there is a porphyry copper system buried here, the exposed rocks are above the outermost propylitic fringes of the system.
1359	White Beauty (High Voltage)	SW1/4 sec. 9, T. 29 N., R. 17 W.	Pb, Cu	A vein as much as 25 cm thick contains abundant cerussite, malachite, chrysocolla, and bornite(?).

203 workings

Copy 2
Gold Basin Area

WESTERN ARIZONA PROJECT

A regional geologic-metallogenic-target delineation study for precious metals in the Ajo, Phoenix and parts of Lukeville, Salton Sea, El Centro, Prescott, Needles, Kingman and Williams 1° X 2° Sheets

Prepared by

William A. Rehrig and Robert T. Wilson

APPLIED GEOLOGIC STUDIES INC.

with

Section on Tectono-Stratigraphic Units

by

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February, 1985

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GOLD BASIN (GOLD HILL) DISTRICT

Location:

The Gold Basin mining district is located in northern Mohave County, south of Lake Mead and about 95 km north of Kingman. The Gold Basin district is adjacent to, and often described with, the nearby Lost Basin district (cf. Theodore and others, 1982). The two districts are separated by Hualapai Valley.

Geology and History:

The Gold Basin district exhibits a complex geologic history, aspects of which have been recently studied by a number of workers (i.e. Blacet, 1968, 1975; Theodore and others, 1982; and Myers and Smith, 1984). Theodore and others (1982) describe field relationships of the geology and mineralization as well as laboratory results of metallogenic studies in great detail. This brief synopsis is largely abstracted from their study.

The Gold Basin district is located in the Basin and Range physiographic province just west of its boundary with the Colorado Plateaus. The district (as well as the Lost Basin district to the east) occurs in an uplifted platform and includes a north-south trending range (White Hills) that consists mostly of Proterozoic basement rocks from which the Paleozoic section has been removed by erosion.

Basement in the district consists of Proterozoic X metamorphic and igneous rocks. The gneiss is the most widespread unit in the range and is the major host to the known gold-quartz vein deposits. The unit includes both paragneiss and orthogneiss which are believed to be in the 1,750 m.y. age range. These rocks consist of an assemblage of metasedimentary rocks, composed mainly of quartzofeldspathic gneiss, but interlayered with biotite-garnet-sillimanite schist, cordierite gneiss and amphibolite. Locally the amphibolite sequence is predominant and consists of metagabbro, metadiabase, metaclinopyroxenite and metawehrlite. The amphibolite normally crops out as variably sized lensoid masses. In addition, metamorphic rocks in the district also include meta-quartzite, thin lenses of marble, calc-silicate gneiss, banded iron formation and metachert. Theodore and others (1982) note that pelitic metamorphic rocks are widespread throughout the gneiss terrane in the Gold Basin - Lost Basin districts. This assemblage includes; biotite-muscovite schist, tourmaline schist, almandine-biotite ± staurolite schist and gneiss, kyanite gneiss and schist and sillimanite - and cordierite-bearing gneiss and schist.

The gneiss complex is intruded by Proterozoic X igneous and metaigneous rocks, the most widespread of which include gneissic granodiorite, and a complex of porphyritic monzogranite and leucocratic monzogranite referred to as the Garnet Mountain complex. The porphyritic monzogranite of Garnet Mountain was most likely emplaced about 1,600 m.y. ago (Theodore and others, 1982). Proterozoic Y(?) diabase occurs locally as NW-trending dikes. An elongate, N25°E trending body of gneissic granodiorite crops out over about 10 km² area in the Gold Basin district. Theodore and others (1982) note that the eastern contact of

this body with the surrounding gneiss appears to have acted as an important conduit for the circulation of fluids associated with the gold mineralization. Prospects and productive mines are especially concentrated along an approximately 2 km strike length of this contact.

A late Cretaceous, (72.0 ± 2.1 m.y.; McKee in Theodore and others, 1982) peraluminous, two-mica, monzogranite crops out in a 4-5 km^2 area in the southern part of the Gold Basin district. This pluton is undeformed and includes some facies of episyenite, minor aplite and pegmatite.

The oldest Tertiary rocks in the general area are Miocene volcanic rocks believed to be Mount Davis or Patsey Mine equivalents (cf. Anderson, 1971), consisting of rhyolitic tuffaceous sedimentary rocks and fanglomerates. The volcanic rocks consist mainly of andesite. The base of the volcanic pile is poorly exposed in the Gold Basin - Lost Basin area, but rather is marked by a low-angle detachment surface. The overall tectonic history of the detachment fault is still poorly understood. Theodore and others (1982) suggest that it is not similar to dislocation surfaces spatially associated with Cordilleran metamorphic core complexes, but rather may be associated with near-surface distension associated with the emplacement of plutons penecontemporaneous with the Mount Davis volcanics (cf. Anderson, 1971; Anderson and others, 1972). This detachment fault borders the White Hills along its entire western margin.

Miocene-Pliocene sediments of the Muddy Creek Formation are younger than the volcanic rocks. The early depositional history appears to have been largely an environment of small basins and topographic lows associated with interior drainage. The Hualapai limestone member, however, was probably deposited in a marine environment at the northern end of an extended embayment of the Gulf of California beginning more than 8.9 m.y. ago (Blair and others, 1977).

Blacet (1969, 1975) and Theodore and others (1982) describe four types of lode gold deposits known in the Gold Basin - Lost Basin districts:

1. The most common lode gold deposits occur associated with widespread quartz-cored pegmatite-vein system, presumably emplaced in late Cretaceous time and genetically associated with the two-mica magmatism. These veins were deposited along both high- and low-angle, pre-existent structures in the Proterozoic X terrane.

2. Some gold-bearing quartz veins are believed to be Proterozoic in age and probably related to emplacement by the nearby 1,400 m.y. granite of Gold Butte, which crops out to the north of Lake Mead.

3. Disseminated gold occurs in small alteration pipes of fluorite-bearing episyenite, whose emplacement is presumably genetically related to the intrusion of the two-mica granite.

4. Gold-quartz mineralization occurs in the low-angle Miocene detachment fault. Theodore and others (1982) attribute this mineralization as Cretaceous vein deposits that were tectonically caught up and drug along the Miocene low-angle fault. The Cyclopic mine is the type example of this mineralization.

These workers suggest that most of the gold in vein and pipe deposits probably reflect either remobilization of gold from gold-bearing, near-surface Proterozoic source areas, or anatectic incorporation of gold into Late Cretaceous, peraluminous, two-mica magmas from very deep gold-bearing Proterozoic sources. Gold deposition occurred in a mesothermal environment during the galena-, chalcopyrite-, ferroan-carbonate-bearing stages of the veins. Laboratory studies indicate fluids were moderately saline (4-16 wt % NaCl equiv.), nonboiling, and also contained considerable CO_2 and locally fluorine. These workers suggest these salinities bridge the composition interval between epithermal precious metal and porphyry copper deposits.

Myers and Smith (1984a, 1984b) also recognize a Tertiary mineralizing event at the Cyclopic mine. This episode of gold mineralization was directly controlled by the detachment fault and is localized in the hanging wall of the detachment fault and in the footwalls of high-angle structures antithetic to the detachment surface. This mineralization is apparently low grade, relatively minor in importance, and is characterized by pervasive argillic and localized ferric alteration.

Most of the lode mines in the Gold Basin district occur in the southern portion of the district. Gold ore was discovered in the district in the early 1870's with most of the production prior to 1932 coming from the El Dorado, Excelsior, Golden Rule, Jim Blaine, Never-Get-Left, O.K. and Cyclopic properties (Theodore and others, 1982; Schrader, 1909). By 1881 ores were being worked in two stamp mills. By 1882 the El Dorado mine included 26,000 tons of developed ore (Burchard, 1883). The Cyclopic mine which was discovered in the 1880's became the main population center of the district during the early 1900's. This mine was intermittently in production between 1904 and 1934, and overall has been one of the largest producers in the district. In 1936 the property was acquired by new owners and produced nearly steadily through 1940. In addition to the Cyclopic, the O.K. and Excelsior mines were relatively steady producers over the years. Theodore and others (1982) state that the following mines also had intermittent production during the depression era mining revival between 1930 and 1942: Harmonica, El Dorado, Fry, Gold Hill, Golden Link, Golden Rule, M.O., Morning Star, and San Juan group. In 1980, Santa Fe Mining Company staked some 246 mining claims covering most of the southern part of the district. Whether or not they still hold this position is not known. Keith and others (1983a) credit the district with some 20,000 tons of production from which were produced 9,400 oz Au; 2,900 oz Ag; 34,000 lbs Pb; and 400 lbs Cu. This estimate would appear to be somewhat low.

Theodore and others (1982) suggest several avenues in which to channel addition exploration in the Gold Basin (and Lost Basin) districts. These include:

1. Prospecting for sequences of rock that might form favorable replacement zones adjacent to, or nearby any of the gold bearing veins. Suggested units include Proterozoic X carbonate, amphibolite, etc. Tectonically shattered zones would also fit into this category.

2. If the episyenite alteration pipes containing the disseminated gold formed as hypothesized, then such an environment must reflect a mineralized level geologically deeper than the bulk of the veins cropping out in the district. Thus, all quartz-fluorite-bearing veins should be evaluated as to whether or not they reflect the upper quartz depositing portions of a system which at depth includes early quartz-dissolving and late gold-depositing paragenesis. In addition, the two-mica monzogranite may contain disseminated gold-bearing episyenitic facies at depth.

3. The entire trace of the low-angle detachment surface should be evaluated for the occurrence of Cyclopic-type, "mechanically entrained" gold-quartz deposits. These writers indicate that this fault is poorly exposed in many areas, but that in places increased abundances of tectonically polished or striated vein quartz in float may indicate areas of similar tectonically caught up mineralization.

   We would also add to this consideration the Tertiary mineralization aspects controlled by this structure as identified by Myers and Smith (1984a, b). This might make this feature a much more attractive target similar to environments that are being heavily prospected at present in the nearby Black Range and other parts of the southwest. We would hasten to point out the number of Hg and As NURE anomalies that occur near the trace of this structure (see NURE overlay), particularly in the northern part (sometimes referred to as Gold Hill) of the district. We recommend that these anomalies be given additional field checking and sampling.

4. The Proterozoic X metamorphic rocks may be potential hosts for syngenetic, stratiform deposits. Theodore and others (1982) indicate that there are suggestions that boron-enriched fluids were important in the paragenesis of tourmaline-bearing schists. Such conditions may reflect exhalative horizons emanating from centers in the protolith of the metamorphic rocks.

   We would add that these workers also describe thin beds of carbonate-rich units (now marble, calc-silicate marble and skarn) that are spatially, closely associated with amphibolite (mafic to ultramafic protoliths). These could well be carbonate-rich exhalites. Some of the calc-silicate marbles contain such minerals as garnet, zoisite and clinozoisite, and possibly chloritoid. Minerals such as chloritoid and garnet are often found in the footwall or lateral facies of Archean syngenetic metal deposits. Metarhyolite and metachert horizons are also described within the gneissic terrane. Nearly all of the recognized gold-bearing iron formations in the Proterozoic of Arizona consist of small cherty horizons associated with rhyolite domes (Ed DeWitt, personal commun., 1985; also compare Swan and others, 1981).

5. Minor-element signatures in the native gold from several localities in the Gold Basin and Lost Basin districts indicate a possible relationship to a buried porphyry-type system. This relationship needs further evaluation.

The Gold Basin district contains numerous prospects and mines. The major early mines are described by Schrader (1909), and Wilson and others (1967). Theodore and others (1982) published Blacet's field descriptions of nearly every prospect in the Gold Basin - Lost Basin districts. We have reproduced a few of the most interesting ones below in the Mines of Interest Section. Any reader interested in the district should seek the complete list found in Theodore and others (1982).

Mines of Interest:

El Dorado Mine: (T28N, R18W, Sec. 21 SW¼) The mineralized vein seems to average 3 ft thick and dips ESE 25°-30° at west side of workings shallowing to nearly horizontal at the tunnel portals on the east side of the ridge. The workings generally dip 20°ESE parallel to the vein. The country rock is intensely sheared, cataclastic, medium-grained Proterozoic X gneissic granodiorite. The mineralized vein(s) are occupying an intensely sheared zone that is of probable late Cretaceous-early Tertiary age. Although the vein quartz is fractured (locally intensely), it is not brecciated.

Some veins crosscut highly foliated gneissic granodiorite, but generally they approximately parallel the schistosity. No red or clay gouge nor indication of notable Tertiary movement is present. The main vein also parallels a pegmatite, and in part, the 2 m thickness of quartz probably reflects the quartz-core stage of the pegmatite. The quartz vein lies between a crumpled and kink-banded, schistose granodiorite and an overlying sill of leucogranite pegmatite. There is abundant chrysocolla, moderate galena, but no chalcopyrite seen. Some wulfenite and cerrusite are also present.

In the irregular surface cut 30 ft northwest of the opening at the northwest end of the underground stopes, altered biotite lamprophyre has consistent chilled margins against the mineralized vein quartz. This indicates the mafic dikes and sills are post-mineralization. Intensely sericitized leucogranitic sills occur below the vein here, indicating a somewhat crosscutting relationship. Numerous veins 1 in to 3 ft thick are concentrated in an intensely sheared, gently dipping but undulating zone.

Unnamed Site: (T30N, R18W, Sec. 28 SE¼) Group of approximately N10°W striking veins which dip 30°-35° NE crop out here. Irregular stringers and elongate masses of coarsely crystalline barite are somewhat abundant in this general area as late fillings of en echelon gashes. Ankerite is associated with the barite, and an albite-pyrite-ankerite assemblage is common along the walls of individual veins.

Excelsior Mine: (T28N, R18W, Sec. 22 NW¼) Thin quartz-carbonate veinlets parallel the foliation in a highly foliated zone that strike N35°-40°E. The

highly foliated shear zone shows silicification, sericitization, and flooding by carbonate, and the zone occurs between gneiss and porphyritic monzogranite. The bulk of the alteration and quartz veinlets are concentrated in a zone approximately 22 ft wide. The veins include quartz-carbonate-chlorite-pyrite-galena (trace)-gold(?) assemblages.

Senator Mine Area: (T28N, R19W, Sec. 14, NW¼) A horizontal adit penetrates a low-angle fault, which is in turn offset about 3 ft a high-angle normal fault. An upper prospect nearby is an open cut 50 ft long, entirely in deformed gneiss, containing commonly isolated, blocks, and lenses of crushed quartz. A trace of pyrite was found on one vein fragment.

Cyclopic Mine: (T28N, R18W, Sec. 30, SW¼) Series of northwest open cuts and pits along a Miocene detachment fault breccia which is exposed in place at several localities. Free gold occurs in at least one hand sample picked up in southern half of series of cuts. Abundant angular fragments are found containing milky-white quartz with dark-reddish-gray matrix. Considerable cellular gossan, with wulfenite is common. Old underground workings were intersected in some of the open cuts, but none were accessible. Numerous prospects, pits and trenches occur in the lower (?) gouge zone. Vein quartz is brecciated and widely scattered in the gouge as blocks 2 ft long and approximately 1 ft thick. Veins contain galena, pyrite, ferrocalcite, malachite (alteration of chalcopyrite(?)), wulfenite, gold and cerrusite. Brilliant crimson mineral may be cuprite. Red, brown, and black Fe and Mn(?) oxides are present. Tertiary mineralization is characterized by pervasive argillic and ferric alteration. Samples of this mineralization reportedly run 0.002-0.065 opt Au.

Cyclopic No. 6 Prospects: (T28N, R19W, Sec. 25, NE¼) A major splay of the detachment fault zone containing red-brown gouge and comminuted monzogranite cuts through the prospects. A minor fault strikes N10°-15°E, dips approximately 40°W, and is possibly parallel to the main fault system. Quartz-carbonate-pyrite veins and recemented quartz breccia of the Cyclopic type occur in the gouge zone.

Approximately 500 to 1000 ft southeast of this locality, there are numerous prospects, pits and trenches in the lower gouge zone. Vein quartz is brecciated and widely scattered in the gouge as blocks 2 ft long and approximately 1 ft thick. Veins contain galena, pyrite, iron carbonate, malachite (alteration of chalcopyrite(?)), wulfenite, gold and cerrusite. Brilliant crimson mineral may be cuprite. Red, brown and black iron and manganese (?) oxides are relatively abundant.

Unnamed Prospect: (T28N, R20W, Sec. 26, NE¼) Gold-bearing quartz + pyrite + carbonate vein material occurs in a coarse, angular landslide breccia. Trace of gold is visible, and may indicate covered mineralized area of Cyclopic type.

Owens Mine: (T28N, R19W, Sec. 1, NW¼) Underground workings at the mine probably measured at least 300 ft. Head frames and ladders have been removed. Considerable chrysocolla and malachite occur as staining along a narrow fault zone which parallels the gneissic layering in the hanging wall. There is a slight discordance of the fault plane with the attitude of the layering in the

footwall gneisses. Amphibolite and biotite gneiss are the main rock types in the mine area, but at least one 2 ft thick bed of laminated iron formation crops out at several points southwest and west of the main shaft. Calc-silicate rock is cut locally by quartzose veins or pegmatitic alaskite. The veins include fine-grained granular quartz, iron carbonate, specularite, pyrite and secondary copper minerals. Sericitization is intense and widespread.

Unnamed Site: (T28N, R19W, Sec. 11, SE¼) Altered amphibolite here shows silicification and flooding by carbonate. In addition, a quartz-carbonate-hematite-pyrite vein crops out and contains some secondary copper minerals.

Unnamed Site: (T28N, R18W, Sec. 35, SW¼) Leucosyenitic pipe, elongated in a northeasterly direction crops out at this locality. Its overall dimensions at the surface are about 60 by 200 ft. The pipe contains a quartz-free central zone which also shows fairly abundant concentrations of fluffy orange iron oxide(s) replacing iron carbonate. The outer portion of the pipe shows increasing concentrations of quartz in irregularly distributed stringers and veinlets. Although this locality shows no fluorite or obvious pyrite, the pipe here is nonetheless similar to that exposed in Sec. 27 (see below) which contains visible disseminated gold.

Unnamed Prospect: (T28N, R18W, Sec. 27, SE¼) Fluorite-gold-pyrite-bearing episyenitic rocks cut fine- to medium-grained biotite monzogranite. Gold occurs in leached cavities in these episyenitic rocks. In outcrop, the episyenitic rock occurs in four small pipe-like masses, the largest of which measures about 25 ft across. Two shallow prospect pits have been dug on the pipes, most likely because of the color anomaly resulting from the oxidation of pyrite.

Unnamed Prospects: (T30N, R18W, Sec. 19, NE¼-protracted) Gold was observed at five different prospects in this general area. A vertical shaft approximately 100 ft deep had the largest amount of secondary (?) gold. The veins generally pinch and swell irregularly, and are composed essentially of quartz, carbonate, pyrite and gold. They may be Proterozoic in age.

Unnamed Prospects: (T29N, R18W, Sec. 17, NW¼NE¼-protracted) A series of pods and stringers of quartz veins are emplaced along what appears to be a N80°W striking and 35°-50° N dipping shear zone. An early quartz-carbonate-pyrite-galena-chalcopyrite-gold assemblage in the veins has been brecciated and cut by subsequent seams of white calcite, limonite and barite. Bladed groups of thin barite crystals fill vugs from which the early carbonate has been leached. Considerable free gold is found along pyritic seams in large quartz blocks on the easternmost dump along these workings. Galena and chalcopyrite are also abundant. Country rock consists of an altered granitic gneiss sequence within the gneiss unit.

References:

Anderson, 1971; Anderson and others, 1972; Blacet, 1968, 1969, 1975; Blair and others, 1977; Burchard, 1883; Keith and others, 1983a; Myers and Smith, 1984a, 1984b; Schrader, 1909; Swan and others, 1981; Theodore and others, 1981; Wilson and others, 1967.

LOST BASIN DISTRICT

Location:

The Lost Basin district is located to the east of the Gold Basin district and south of Lake Mead in northern Mohave County. The two districts are separated by Hualapai Valley.

Geology and History:

The Lost Basin district is located just to the west of the Colorado Plateau in the Basin and Range physiographic province. The district is geologically contiguous with the Gold Basin mining district to the west and the two are often discussed together (cf. Theodore and others, 1982; Blacet, 1968, 1975). A more thorough discussion of Proterozoic rock types found in the Loast Basin area can be found under the Gold Basin district discussion. Basement in the district consists of Proterozoic (X) metamorphic and granitic rocks that are nonconformably overlain on the eastern part of the district by alluvial fanglomeratic deposits of the Muddy Creek Formation which locally includes lenses and beds of rhyolitic tuff (Theodore and others, 1982). Amphibolite comprises a significant proportion of exposed Proterozoic gneissic units in the southern parts of the Lost Basin range. Theodore and others (1982) suggest this sequence consists of metagabbro, metadiabase, metaclinopyroxenite and metawehrlite.

The Lost Basin range is bounded on the east by the Grand Wash fault zone. Regional eastward to northeastward tilting of the Lost Basin block along this fault has resulted in the present relationship of widespread Precambrian exposures on the western flank being covered by fanglomeratic deposits as one approaches the eastern flank. East of the Lost Basin district, extensive Paleozoic rocks are exposed in the Grand Wash Cliffs.

Theodore and others (1982) discuss the geologic, structural and geomorphic history of the Lost Basin - Gold Basin in great detail. Our synopsis greatly oversimplifies the complex geologic history of the region. Interested readers are referred to these workers' lengthy discussion of the area.

Lode gold mineralization in the district consists of narrow (4-6 ft average width), iron- and copper-stained quartz veins that occur in the Proterozoic granite and gneissic rocks. These veins usually display north-trending strikes and steep dips. Similar to the Gold Basin area, Theodore and others (1982) believed the gold in the Lost Basin veins probably reflect either remobilization of gold from gold-bearing, near-surface Proterozoic source areas or anatectic incorporation of gold into Laramide, peraluminous two-mica magmas from very deep gold-bearing sources. The gold was then deposits by hydrothermal systems associated with emplacement of the 72.0 m.y. old two-mica monzogranite in the southern White Hills. These workers believed that deposition of gold occurred in a mesothermal environment during galena-, chalcopyrite-, ferroan-carbonate-bearing stages of vein development. Fluid inclusion studies indicate that salinities associated with gold deposition in the Lost Basin - Gold Basin districts largely bridge the fluid composition interval between epithermal and porphyry copper mineralization.

The principal gold veins in the district were discovered about 1886 and considerable ore was reported to have been periodically mined and milled or treated in arrastres (Schrader, 1909). Schrader (1909) noted that production prior to 1909 was reported to be many thousand dollars, chiefly in gold. Hewett and others (1936) noted recorded production between 1904-1932 was valued at less than $45,000 (in Au, Ag, Cu). The King Tut placers were discovered in 1931 and between 1934-1942, a gold production valued at $23,510 was credited to the placer area (Wilson, 1961). Most activity in the district since the 1930's relates to the placer deposits.

While finding new ore shoots within the known veins of the district would seem to offer little hope of finding targets suitable for most mining companies, Theodore and others have offered a number of suggestions for directing future exploration efforts in the Lost Basin - Gold Basin region. These are described under the Gold Basin district description and all will not be repeated here. The two which seem most appropriate for the Lost Basin district are as follows:

(1) Prospecting for sequences of rock that might form favorable replacement zones adjacent to, or nearby any of the gold-bearing veins that crop out. Suggested units include Proterozoic carbonate, amphibolite, etc. Tectonically shattered zones would also fit into this category.

(2) Possible syngenetic or stratiform gold mineralization in the Proterozoic metamorphic rocks. Theodore and others (1982) suggest that boron-enriched fluids were probably important in the paragenesis of the tourmaline-bearing schists locally exposed in the Precambrian terrane. These workers felt such conditions may have been reflective of exhalative horizons emanating from centers in the protoliths of the metamorphic rocks. Possibly even more appropriate for the Lost Basin area is that these workers also noted thin beds of carbonate-rich units (now marble, calc-silicate marble and skarn) that are spatially associated with amphibolite (which in the southern Lost Basin area is believed to have been derived from mafic to ultramafic protoliths). We would wonder if the carbonates could be carbonate-rich exhalites. Some of the calc-silicate marbles contain minerals such as garnet, zoisite, clinozoisite and possibly chloritoid. Some of these minerals are used as footwall indicators of mineralization associated with stratiform mineralization in the Archean. Also mentioned are horizons of metachert and metarhyolite within the gneissic terrane. Gold-bearing exhalative chert horizons associated with Proterozoic rhyolite domes occur in the Bradshaw Mountain (cf. Swan and others, 1981).

Schrader (1909) and Wilson and others (1967) describe the early lode mines of the district. Theodore and others (1982) have reported Blacet's field notes of the various prospects that he looked at in the Lost Basin and Gold Basin area. We have reproduced several of Blacet's more interesting descriptions below in the Mines of Interest section.

Mines of Interest:

<u>Miss Texas no. 2</u> (T29N, R17W, Sec. 17, NE¼) A 30 to 50 ft wide pyritized zone striking N60°W parallel to foliation in the surrounding gneiss is cut by several

quartz veins which can be followed toward the southeast for at least 0.3 km. Location of the zone is about 300 ft S25°E from the stone monument of the Miss Texas no. 2 claim.

Ideas Lode no. 30: (T29N, R17W, Sec. 17, NE¼) Workings occur along a nearly flat-lying shear zone which contains irregularly distributed, quartz-yellow-brown carbonate veins more or less parallel to the shallow-dipping foliation. Some evidence exists to indicate the rock was flooded by yellow-brown carbonate.

Unnamed prospect: (T30N, R17W, Sec. 29, SW¼) A small prospect pit occurs along a major 30 ft wide range-front fault between iron-oxide stained quartzo-feldspathic gneiss and interlayered amphibolite and caliche-cemented fanglomerate or talus. Clearly, quartz-carbonate vein material is broken up in the zone suggesting the fault zone may have followed locally an already emplaced vein. The fault zone also shows evidence of having originally contained much highly sericitized, chloritized and carbonate-altered gneissic fragments. No sulfides or gold were observed; a little weathered pyrite was noted.

Unnamed prospect: (T30N, R17W, Sec. 32, NW¼) Prospect adit is located about 500 ft southwest of lower dump of the Golden Gate mine. The adit essentially follows a well-developed, vertical, N50°E striking fault. Prominent cross faults include an east-west fault dipping 5°S. A little copper staining occurs on brecciated blocks of quartz-carbonate-minor chalcopyrite. Considerable sericitization and carbonatization of the country rock was noted, but no vein material observed. A short adit directly up the ridge to the south exposes a prominent fault striking north-south to N10°E. This fault occurs between the brecciated footwall of an east-dipping quartz-carbonate vein which is up to 2 ft thick. The faulting postdates the quartz-carbonate vein whose footwall it follows. There is abundant sericitization and carbonate flooding of the quartzofeldspathic gneiss within several feet of the vein. The brecciated vein material locally looks like that at the Cyclopic mine. A shaft at the top of the ridge is vertical and includes abundant broken-up vein quartz. Some free gold was noted.

References:

Blacet, 1968, 1975; Hewett and others, 1936; Schrader, 1909; Swan and others, 1981; Theodore and others, 1982; Wilson, 1961; Wilson and others, 1967.

WHITE HILLS (INDIAN SECRET) DISTRICT

Location:

The White Hills mining district covers the eastern half of T27N, R20W in northwestern Mohave County. The district lies about 40 miles northwest of Kingman.

Geology and History:

The district has been described by Schrader (1908) and more recently by Huskinson (1984). The following general discussion is largely taken from Huskinson (1984). Basement in the district consists of migmatitic gneisses and granites that locally contain amphibolite pods. Foliation and schistosity trends generally N35°E with a gentle dip to the NW. Schrader (1908) mentions that the gneisses contains garnet which locally occur in 2.5 ft wide bands or zones that traverse the gneisses. Andesites to latites of the Patsey mine sequence (?) overlie the Precambrian rocks to the east, and are in turn capped by relatively flat lying olivine basalt flows. The Patsey mine volcanics are rotated and tilted (40°-50°) along a series of listric and low-angle normal faults (Wilkins, 1984) that are common this part of Arizona. The younger basalts covering the tilted sequence are relatively flat-lying. Numerous veins that strike WNW and dip to the north at 25° to 75° dips fill shear zones in the Precambrian rocks. These veins are typically 1-3 ft in average width and consist of FeOx- and MnOx-stained clay gouge. Cerargyrite is the main ore mineral and occurs as vug fillings in the quartz and as fracture filling in the shear zones. The average grade of the ore was reportedly less than 25 opt Ag, although small extremely high-grade pockets were evidently found. The dumps were reworked in the 1904 era and reportedly averaged 6-7 opt Ag.

Two mineralized vein sets occur in the area. The oldest(?) is a low-angle (20°-30°) set that appears to have been truncated by a higher angle (60°-70°) set. Both types have been productive, although the low-angle structures seem to have carried richer ore. Huskinson (1984) also mentions that low-angle bedding plane faults are numerous in the area.

Huskinson (1984) who studied the district as part of a small Canadian company's attempt to evaluate the mineral potential of the district, believed the following points were significant:

1. Oxidation and enrichment occur throughout the veins in the district. The ore is always cerargyrite (AgCl), and no sulfides (except for very minor pyrite in the Review area) have been found. The Occident and Norma mines have been developed in excess of 500 ft deep, always in oxide ore.

2. Many of the veins appear to be listric structures: (i.e., they flatten with depth). A particularly good example of this can be seen at the Africa shaft.

3. Many of the veins are shear zones with minor listric type structures displayed within the shears.

4. The White Hills do not appear to be bounded on the west by a normal basin and range fault. Depth to the basement in the center of the valley over a mile west of the camp is probably 800 ft or less.

5. There are reports that a deep hole 3 to 4 miles west of the White Hills passed through three or more parallel horizontal structures.

6. There are no intrusive rocks nearby to credit as a source of mineralization, although Gulf is said to have drilled a small porphyry copper deposit 7 or 8 miles west of the area.

Given that the above points indicate that mineralization occurs in a extensional structural setting, Huskinson (1984) believes that the mineralization at White Hills may be explained as follows:

1. Upper-plate movement over the lower plate boundary at White Hills resulted in the formation of high-angle fractures in the lower-plate sub-detachment zone.

2. These structures flattened with continued movement of the upper plate and were cut by subsequent high-angle fractures.

3. Silver, carried as a chloride complex by meteoric water circulating through the upper plate (and derived from an admittedly nebulons source), was deposited in both vein sets.

4. Because the low-angle sets are older they have been subjected to greater enrichment.

5. The upper plate is eroded and the volcanic rocks are extruded.

The district was foremost a silver district, although locally gold was present. Huskinson (1984) notes that the EMMA veins are auriferous as is the Hulda/Review area (assays of 0.68 opt Au across narrow intervals). He estimates that total production from the district is probably 6-8 million oz Ag and 5,000 oz (or less) Au.

The district was discovered in 1892 when a Hualapai Indian showed a local miner some rich silver ore from the area. As a result of some of the ore running to $1,000/ton, a rush to the camp ensued and by 1894 it boasted a population of 1,200. The camp was soon controlled by a single mining company whose principals were from Denver. They sold the property in 1895 to an English concern who brought in a new mill. The English concern failed and the mine was bought back by the original owners at a sheriff's sale. The district produced steadily for a 10-12 year period. During this time, work was mainly performed by lease miners who "chlorided" the rich ore shoots until they pinched out or were faulted off (as at the Occident/Horn Silver area).

Huskinson claims the district has never been systematically explored. Presumably the Corval Resources Ltd. who control an undetermined amount of the district, is attempting to evaluate the area.

Schrader (1908) briefly describes some of the mines in the district. Apparently by the time of his visit many of the main producers had already been closed. We only mention two such mines here, although due to our ignorance of the district, others may be of equal or greater interest.

Mines of Interest:

Grand Army of the Republic (GAR) Mine: (Sec. 11, T27N, R20W) Located about 3/4 mile north of main street (see Figure 22), the GAR vein system is one of the largest in the district. It was said to have been extensively developed to a depth of 700 ft by inclines, drifts, stopes and shafts distributed on five levels. Water level was reached at the 60 ft level. Country rock consists of highly altered and iron stained gneissic granite and schist. The deposits are contained in two nearly parallel veins about 30 ft apart. The lowermost vein is the principal producer. The veins strike N62°W and dip about 23° NE approximately conformable to foliation in the country rock. The veins increase in dip to 75° about 150 yards SE of the mine. Ore was free milling and reportedly very rich, some going as much as 6,000-7,000 opt Ag. According to Schrader (1908) the mine produced much rich ore from all of its five levels. It was the major producer during the early days and as many as 100 men would be stoping at one time. Since the early miners mainly high graded the richest parts of the veins, one must wonder what the average grade might run across the 30 ft between the two veins. Since these structures display a low dip for a considerable distance some open pit tonnage could possibly still exist.

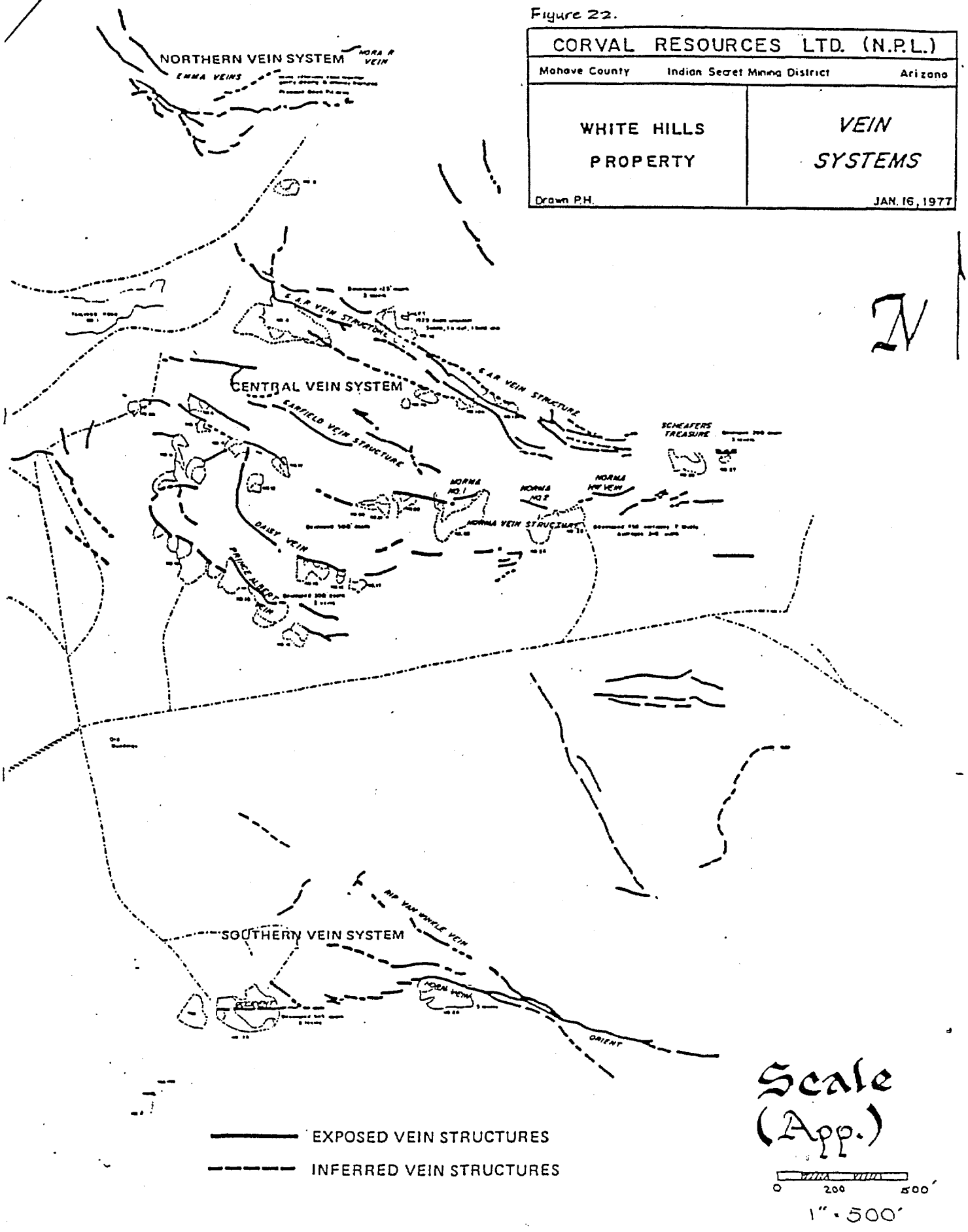
Occident and Horn Silver Mines: (Sec. 14, T27N, R20W) Located about 1/4 mile south of town, both mines are believed to be on opposite ends of same vein which has been faulted in the middle (see Figure 23). The vein is from 2-4 ft wide and consists of reddish-brown, FeOx-stained, crushed and brecciated quartz. The vein strikes about east-west and dips 60°N. Ore was said to be principally horn silver. Both mines were believed to have been quite productive. The Occident mine is thought to be 800 ft deep with considerable lateral workings. The vein flattens with depth in the Horn Silver. Huskinson (1984) indicates that the two mines are separated from one another by post-mineral faults and that the area in between has never been adequately tested for continuations of the ore shoots. This untested zone has about 600 ft of strike length and might present a nice target for a small to medium size mining company.

References:

Huskinson, 1984; Schrader, 1909; Wilkins, 1984.

Figure 22.

CORVAL RESOURCES LTD. (N.P.L.)		
Mohave County	Indian Secret Mining District	Arizona
WHITE HILLS PROPERTY	VEIN SYSTEMS	
Drawn P.H.		JAN. 16, 1977



(From Huskinson, 1984)

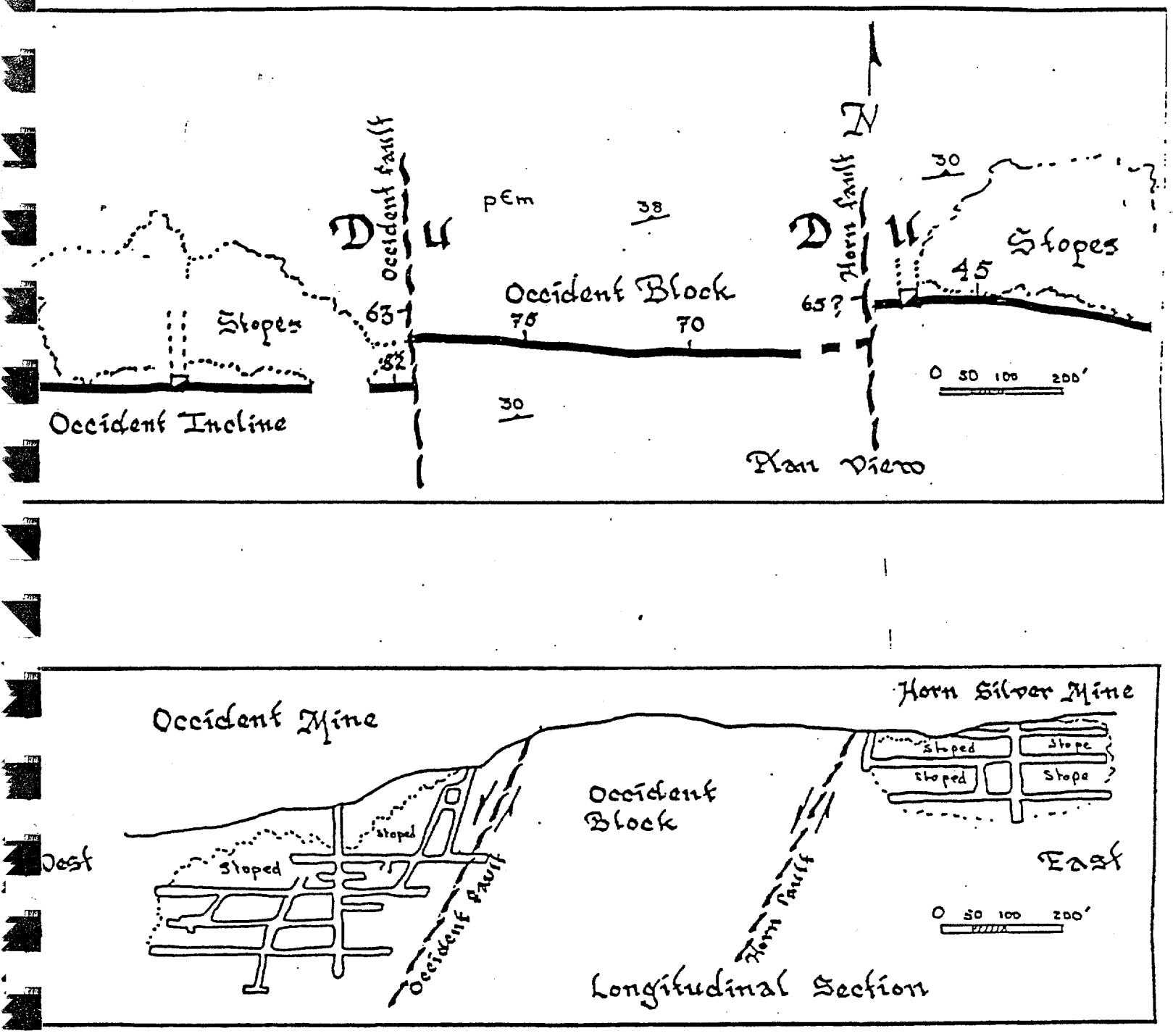


Figure 23.
Occident Mine & Horn Silver Mine area. The block of ground between these producers has not been adequately tested.

After Schrader, 1908, p.135
(From Huskinson, 1984)

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MINERALIUM DEPOSITA

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GOLD MINERALIZATION IN THE GOLD BASIN - LOST BASIN MINING DISTRICTS MOHAVE COUNTY, ARIZONA

Gold Mineralization in the Gold Basin - Lost Basin Mining Districts

The Gold Basin - Lost Basin districts exhibit several different types, styles and ages of gold mineralization. The following excerpts from various published and unpublished reports describe characteristics of the different types of mineralization and are intended as an aid to a field review of the area. Previous exploration efforts and geologic studies of the detachment-related mineralization have suffered from inaccurate and incomplete geologic observations and sample data and an observation/sampling checklist is included as an aid to field evaluations. Types of gold mineralization that are known in the districts or have been suggested to be present, include:

1. Detachment related (Tertiary)

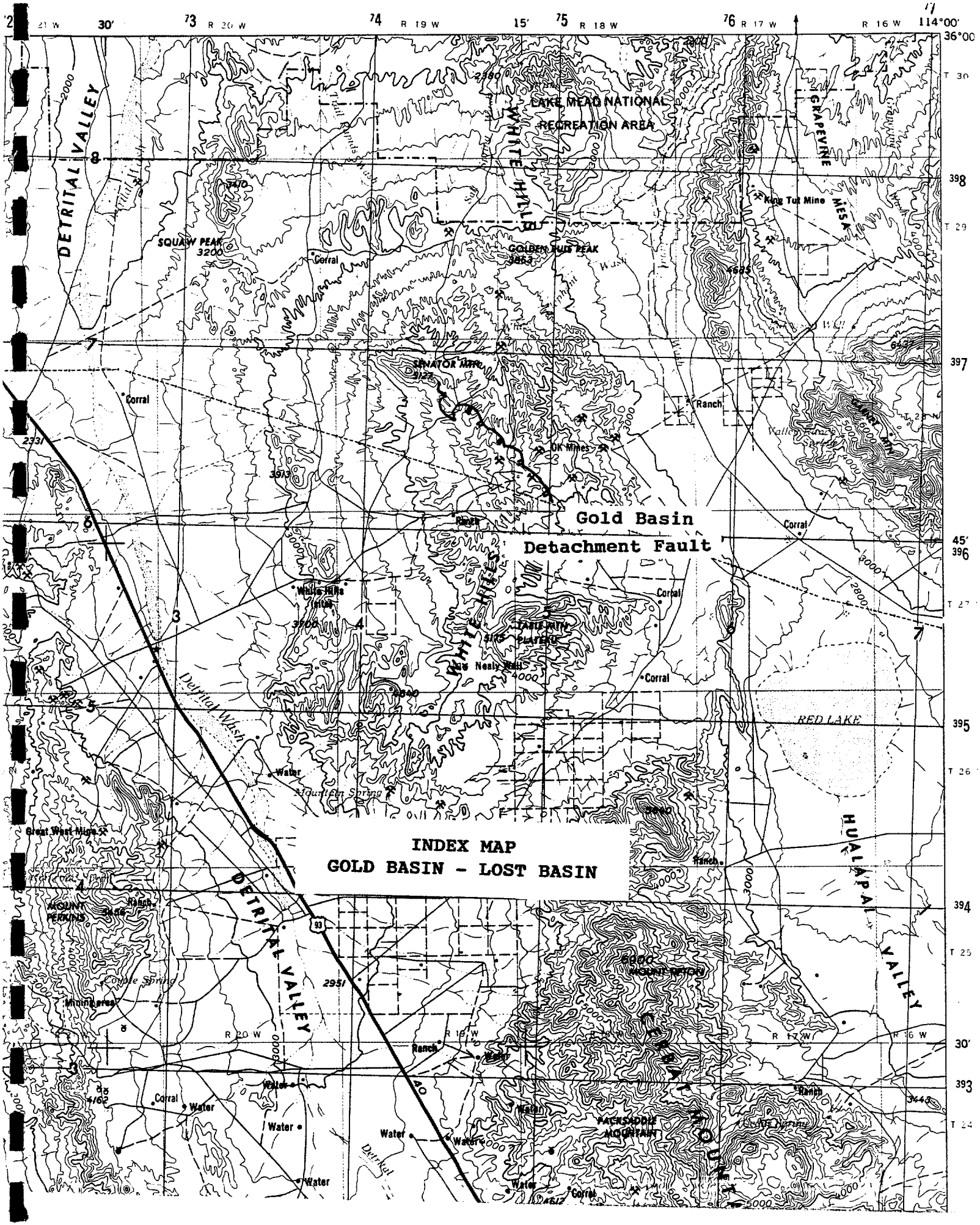
2. Veins - (Precambrian) (Cretaceous) (Tertiary)

3. Episyenite (Cretaceous)

4. Placers (Tertiary - Quaternary)

5. Volcanogenic - exhalative (Precambrian)

6. Porphyry copper related (Cretaceous - Tertiary)


Gold Basin
Detachment Fault
INDEX MAP
GOLD BASIN - LOST BASIN
LAKE MEAD NATIONAL
RECREATION AREA
DETRITAL VALLEY
HUALAPAI VALLEY
GRAPEVINE MESA
WHITE HILLS
SQUAW PEAK
3200
GOLDEN RULE PEAK
SENATOR MTN
OK Mines
King Tut Mine
TABLE MTN PLATEAU
Neally Wells
RED LAKE
Detrital Wash
Mountain Spring
Great West Mine
MOUNT PERKINS
Coyote Spring
Mountain Area
PACKSADDLE MOUNTAIN
Corral
Ranch
Water
93
40
R 21 W
R 20 W
R 19 W
R 18 W
R 17 W
R 16 W
T 30
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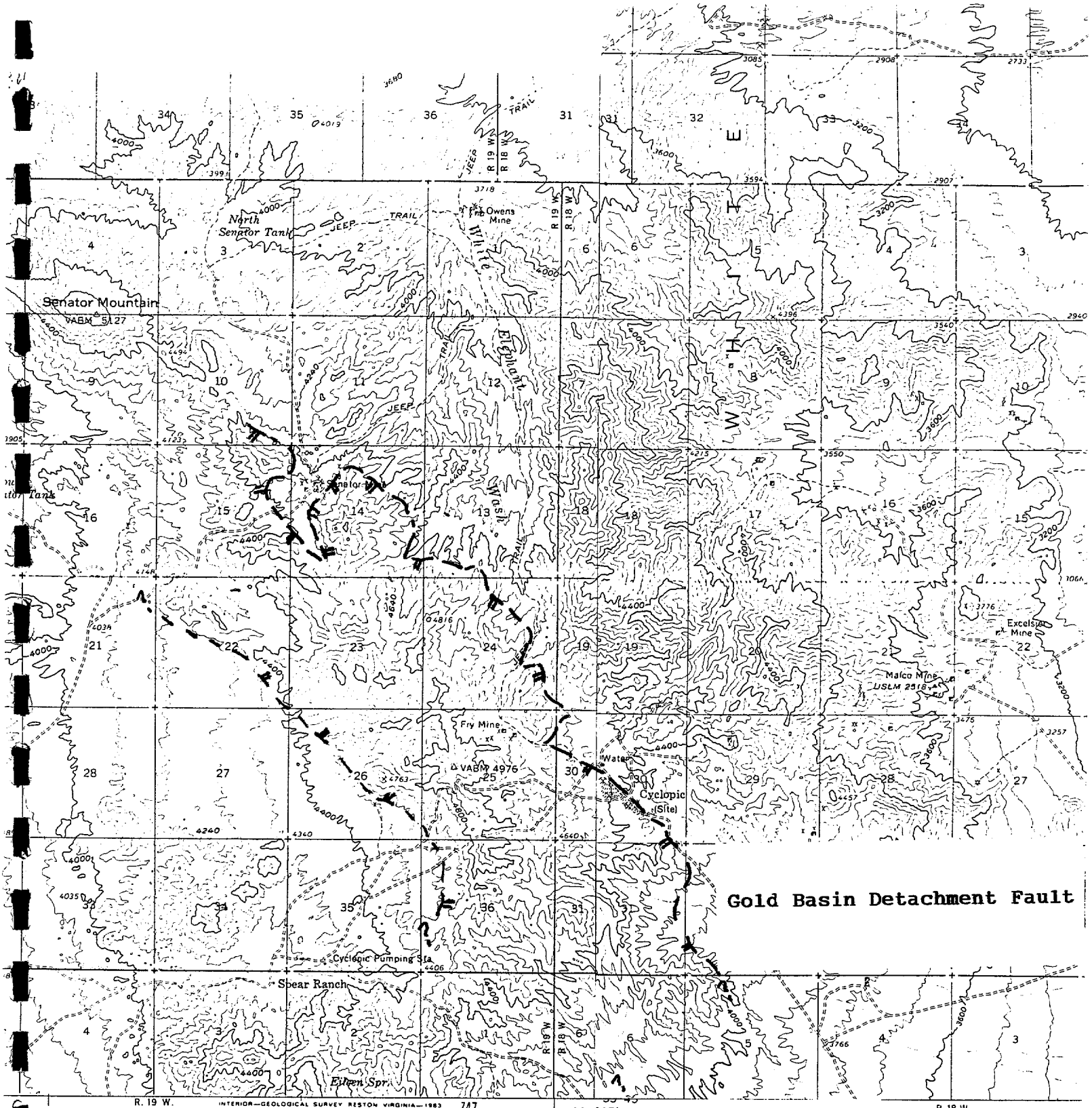
114°00'
36°00'
30'
45'
15'



ROAD CLASSIFICATION

Medium-duty — Light-duty

Unimproved dirt

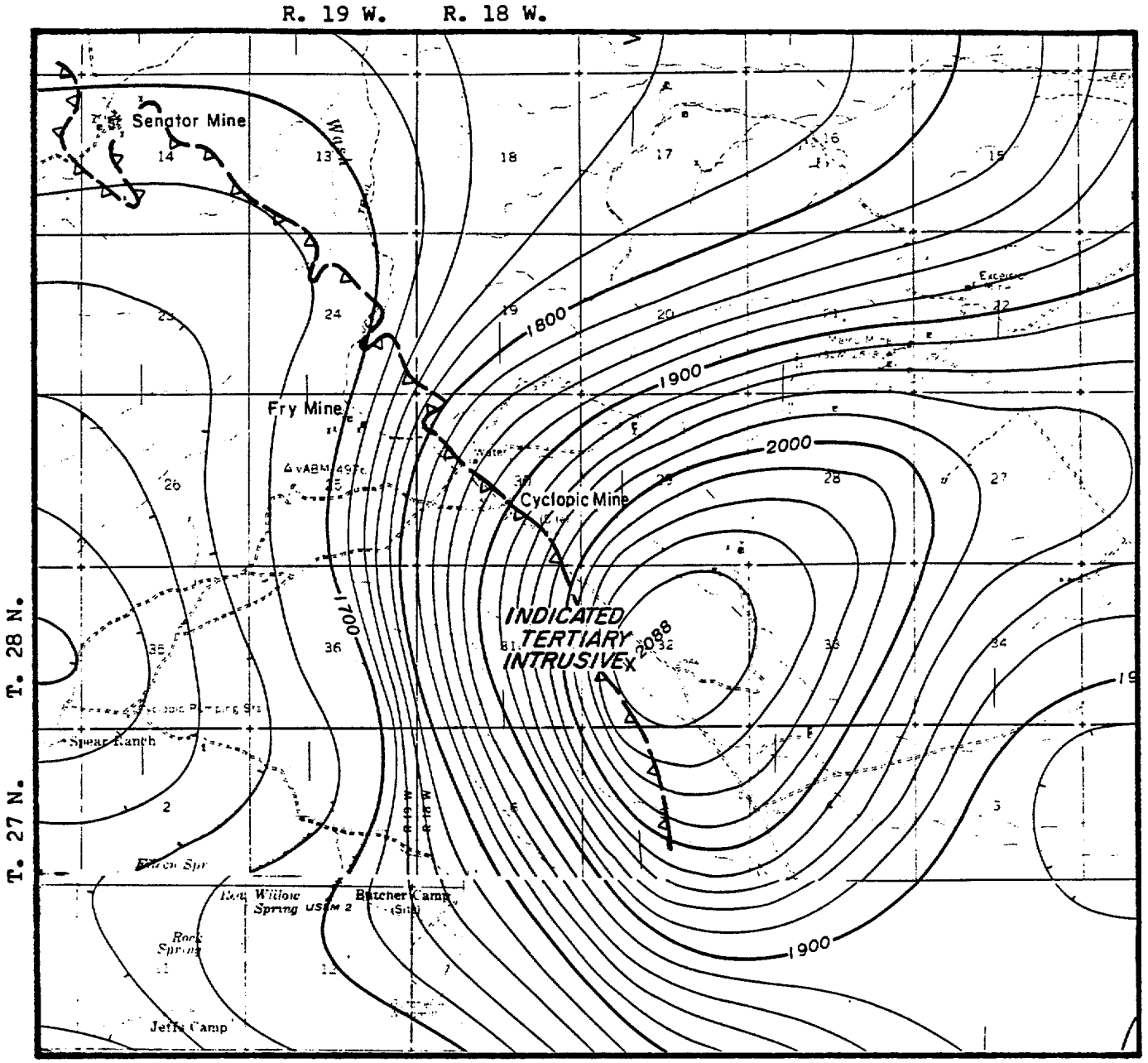
QUADRANGLE LOCATION

SENATOR MOUNTAIN, ARIZ.

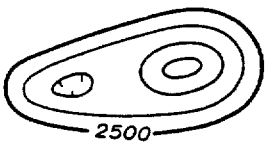
N3545—W11415/15

1960

DMA 3155 IV—SERIES V798



EXPLANATION



Magnetic contours

Showing total intensity magnetic field of the earth in gammas relative to arbitrary datum. Hachured to indicate closed areas of lower magnetic intensity. Contour intervals 20 and 100 gammas

x2863

Location of measured maximum or minimum intensity within closed high or closed low

Flight path

Showing location and spacing of data

Figure 2

AEROMAGNETIC MAP OF GOLD BASIN AREA

Mohave County, Arizona

1 : 62,500

From:
USGS Aeromagnetic Map of the Gold Butte - Chloride Quadrangle, GP-757

Approximate location of the eastern edge of the Gold Basin Crushed Zone

GOLD BASIN - LOST BASIN STUDY

Observations/Sampling Checklist

1. Structural Style of Area
   - Structural features - strike/dip - thickness

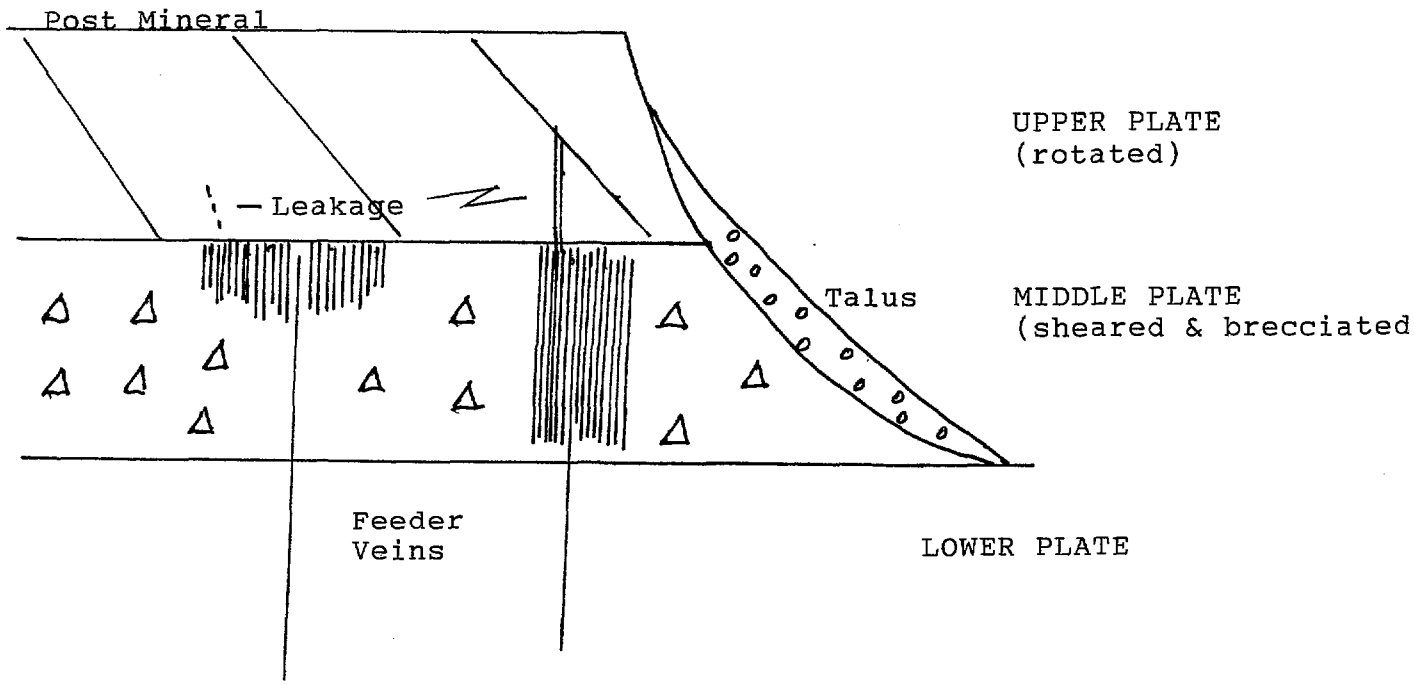
2. Position with respect to:
   - Major erosion surface
   - First post-mineral surface

3. Rock Type
   - Relationship to rock type and/or contacts
   - Reactive rock types

4. Type of Mineralization
   - Associated metals and gangue minerals
   - Attitude
   - Thickness
   - Possible size

5. Sample Description
   - Select or representative
   - Sample interval
   - Position of sample with respect to structure, contacts, cover etc.

6. Sketch Map



Diagrammatic Sketch Illustrating
Epithermal Mineralization
Hosted by a Detachment Fault Zone

Arizona Geological Society Digest Volume XVI, 1986

MINERALIZATION RELATED TO DETACHMENT FAULTS: A MODEL

Joe Wilkins Jr.,[1] Richard E. Beane,[2] and T. L. Heidrick[3]

NOTES

EXCERPTS FROM GOLD BASIN REPORT

CORN & AHERN, 1983

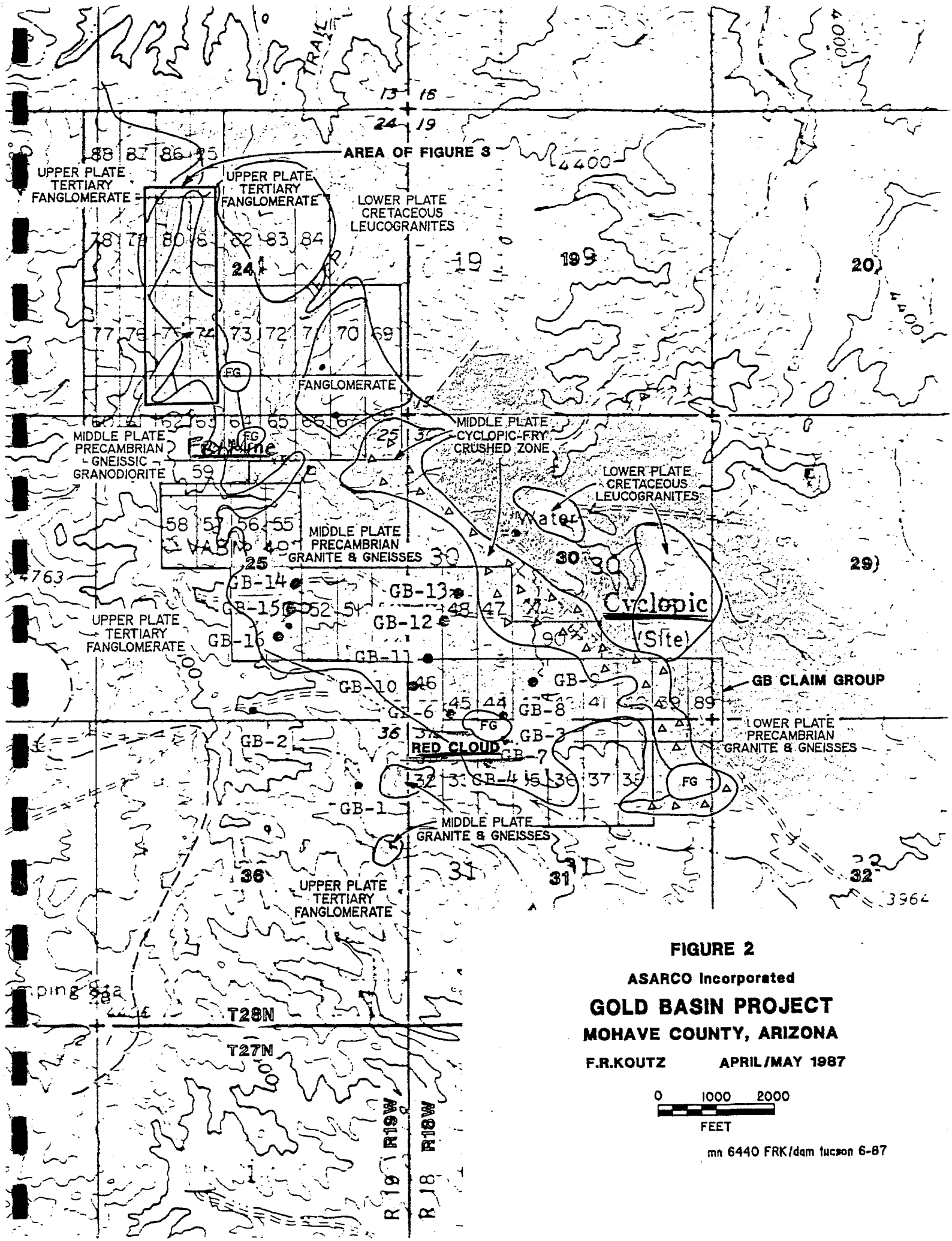


FIGURE 2

ASARCO Incorporated

GOLD BASIN PROJECT

MOHAVE COUNTY, ARIZONA

F.R.KOUTZ APRIL/MAY 1987

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sections. Detailed geologic and geochemical data, including the analytical results for geochemical samples and screen test data are tabulated in the appendix.

The geologic mapping and sampling was carried out between November, 1982, and April, 1983, and the work was concentrated on and near PCMI's GB claim group. PCMI's 89 GB claims were staked in 1981 on open public domain adjacent to the Cyclopic mine and are interspersed between sections held by the Santa Fe Railroad. The current land situation and the position of PCMI's claims and other unpatented claims are illustrated on the accompanying land map, Plate IV.

LAND

Mineral ownership in the Gold Basin District is shown on Plate IV and consists of alternate sections of public domain and Santa Fe Railroad land. Major claim blocks in the area include the 32 claim Cyclopic group owned by Wyman and King, PCMI's adjacent GB claim group of 89 claims, Fortress Mining Company's Suzie group of 34 claims, and placer claims held by Santa Fe Mining.

No drilling or substantive physical exploration has been conducted in the area during the past two years. The 1982 assessment work on the Cyclopic claim group consisted of geochemical sampling and road maintenance. The work was performed by Elden Lee, Denver, Colorado, who currently operates as the Cerbat Claims Acquisition Company, but there are no records indicating that he has optioned or leased the Cyclopic property. Fortress Mining Company from Battle Mountain, Nevada staked the Suzie claims in February, 1983.

GEOLOGY

The complex sequence of Precambrian metamorphic and intrusive rocks, Laramide intrusive rocks and Tertiary intrusive, volcanic, and sedimentary rocks known at Gold Basin is summarized in Table 1. Middle Tertiary orogenic activity in the area culminated in the emplacement of shallow stocks and batholiths, intense listric and low-angle faulting and epithermal precious metal mineralization.

The geologic relationships and exploration potential at Gold Basin are more apparent if the various rock units are considered as parts of a structurally layered sequence consisting of the following three "lithotectonic" units, separated on the basis of their structural and alteration characteristics and their structural-stratigraphic position:

1. an Upper Plate or layer of laterally transported, faulted, tilted, cohesive slices of dominantly Tertiary rocks;

2. a Middle Plate or layer of sheared and shattered rocks. The lower part of this layer is the "crushed zone," where rocks were completely converted to gouge and ground rock.

3. a Lower Plate or basement of competent rocks below the zone of concentrated low-angle shearing.

These relationships are shown in more detail on Table 2 and illustrated on Plate I, a generalized lithotectonic map of the Gold Basin District.

UPPER PLATE

Rock units in the Upper Plate include thin coherent slivers of Precambrian granite and layered gneiss, Tertiary andesite, sandstone, non-welded rhyolitic tuff, and a fanglomerate composed of mixed fragments and boulders of all earlier rocks. The fanglomerate and rhyolitic tuff are the dominant Upper Plate units in the area mapped and were uniformly rotated so that they dip 20 to 40 degrees to the northeast. The Upper Plate rocks are not shattered, altered or mineralized, and were transposed to their present position on underlying low-angle shears.

The fanglomerate readily disaggregates and forms a lag deposit mantling non-resistant underlying material. Consequently, some of the area mapped as fanglomerate is only a thin cover of eroded fanglomerate debris. A later conglomerate also derived from the eroded fanglomerate was not differentiated from fanglomerate during the mapping.

MIDDLE PLATE AND "CRUSHED ZONE"

The Middle Plate is a complex structural layer up to several hundred feet thick that is composed of numerous coalescing listric faults and thin fault slivers of thoroughly shattered and sheared rocks. Tertiary igneous units are the dominant rocks in the Middle Plate except in the area of the Cyclopic Mine where Precambrian granitic and metamorphic rocks predominate. The Middle Plate was overridden and truncated by the rotated fault blocks of the Upper Plate and its present configuration is that of a prism or lens that is relatively thick west of the Cyclopic Mine. It separates overlying tilted fault blocks of Tertiary fanglomerate and volcanic rocks from the underlying competent granite and metamorphic rocks in the Lower Plate. In this report the Middle Plate unit is defined as the layer of sheared and shattered rocks that differ substantially and are not the same rock type as those in the adjacent Lower Plate. It does not include sheared Lower Plate rocks where they are directly overlain by Upper Plate fanglomerate.

TABLE 1

Quaternary	Alluvium
Pliocene (?)	Basalt and conglomerate
Listric faulting----------	
Late Miocene (?)	Sandstone
	Rhyolitic tuff
	Fanglomerate
Gold Mineralization	
Listric faulting----------	GOLD BASIN CRUSHED ZONE----------
Miocene (USGS dates on similar Middle Tertiary volcanics and intrusives are 10-20 my)	Quartz latite welded tuff
	Andesite
	Lamprophyre
	Porphyritic granite
Cretaceous	Granite, alaskite
Precambrian	Granite, gneissic granite and granodiorite, granite gneiss, amphibolite, gneiss.

Table 2

Generalized Sequence of Rock Units at Gold Basin

Lithotectonic Unit	Structural Features	Rock Units Affected
Upper Plate	structurally rotated cohesive fault blocks and slivers.	Fanglomerate Ryolitic tuff Sandstone Andesite Porphyritic biotite granite Layered gneiss
----------Sub-horizontal zone of Shearing----------		
Middle Plate	thoroughly shattered and sheared rocks.	Lamprophyre White Hills granite Fine-grained quartz-biotite granite Porphyritic biotite granite Granite gneiss Layered gneiss Gneissic granodiorite Gneissic granite
Crushed Zone	crushed rock material and gouge	
----------Major Sub-horizontal Zone of Shearing and Coalesced Faults----------		
Lower Plate	competent unsheared rocks.	Lamprophyre and Latite porphyry White Hills granite Alaskite Leucogranite Porphyritic biotite granite Layered gneiss Gneissic granite

The base of the Middle Plate is characterized by 50 to 100 feet of gouge, crushed rock, and quartz breccia. It is this "Crushed Zone" which hosts the exposed mineralization at the Cyclopic, Fry and Senator Mines and which, together with overlying altered and mineralized portions of the Middle Plate, forms the target for the proposed exploration program. Other zones of shearing similar to the "Crushed Zone" occur locally within and at the top of the Middle Plate rocks.

As shown on Plates II and III, exposures of the mineralized crushed zone are near the northeast "wedge" edge of the prism of Middle Plate rocks, and they have been revealed only by relatively recent erosion. Mapping indicates that although the Middle Plate and mineralized crushed zone have been truncated by the Upper Plate both northwest and southeast of the Cyclopic Mine, these favorable units should be present over a larger area in the subsurface to the west.

LOWER PLATE

Lower Plate rocks include the same Precambrian granites, gneissic granites and granite gneiss prominent in the Middle Plate as well as leucogranite, alaskitic altered leucogranite, and layered gneiss. Numerous dikes, sills and irregular bodies of lamprophyre intrude the Lower Plate rocks near the zone of low-angle shearing but are virtually absent elsewhere. Some of the lamprophyre dikes show fragmental and porphyritic characteristics indicating that they are near-surface Tertiary intrusives. Latite porphyry, believed related to the lamprophyre occurs as thin dikes in the northwest quarter of Section 30, north of the Cyclopic Mine. These Tertiary intrusives are spatially related to the general area of gold mineralization and locally occur in the Middle Plate.

A 1972 USGS aeromagnetic map of the area shows a prominent magnetic high centered on Section 32 southeast of the Cyclopic Mine that is indicative of a subsurface Tertiary intrusive. Direct evidence for this postulated subsurface intrusive was not observed during detailed mapping.

MINERALIZATION AND ALTERATION

At Gold Basin gold occurs both in pre-Tertiary, near-vertical white quartz veins within the competent Precambrian rocks of the Lower Plate and as a diffuse mineralization of Middle Tertiary age within the laterally extensive, tabular zones of altered gouge and breccia in the Middle Plate. The extensive tabular zones of mineralization are a type of deposit that could contain major bulk-tonnage gold reserves that would be amenable to modern mechanized mining.

Detailed investigations at Gold Basin have indicated that:

1. Large amounts of gold were introduced into the entire layer of sheared and shattered Middle Plate rocks.

2. Gold occurs as diffuse and disseminated mineralization in gouge and brecciated rock and is concentrated in the laterally extensive, sub-horizontal crushed zone at the base of the Middle Plate.

3. Higher-grade gold values (10 ppm Au) occur in limonite-stained gouge and breccia in the upper part of the crushed zone and are enveloped in larger volumes of lower-grade mineralization.

4. Gold mineralization is tabular and laterally extensive. In the vicinity of the Cyclopic and Fry Mines, mineralization of potential interest is known through an interval 20 to 50 feet thick and over an area 500 to 2,000 feet wide and 7,000 feet long.

5. Gold is spatially associated with fluorite occurrences and pyritic alteration. Their distribution indicates a center of more intense mineralization south and west of the Cyclopic Mine.

6. Little or no gold mineralization is evident where the Middle Plate is missing and Upper Plate rocks rest directly on the Lower Plate. Detailed mapping indicates that the wedge of Middle Plate rocks and the mineralized "Crushed Zone" expand both in thickness and areal extent south and west of the Cyclopic Mine.

GEOCHEMICAL INVESTIGATIONS

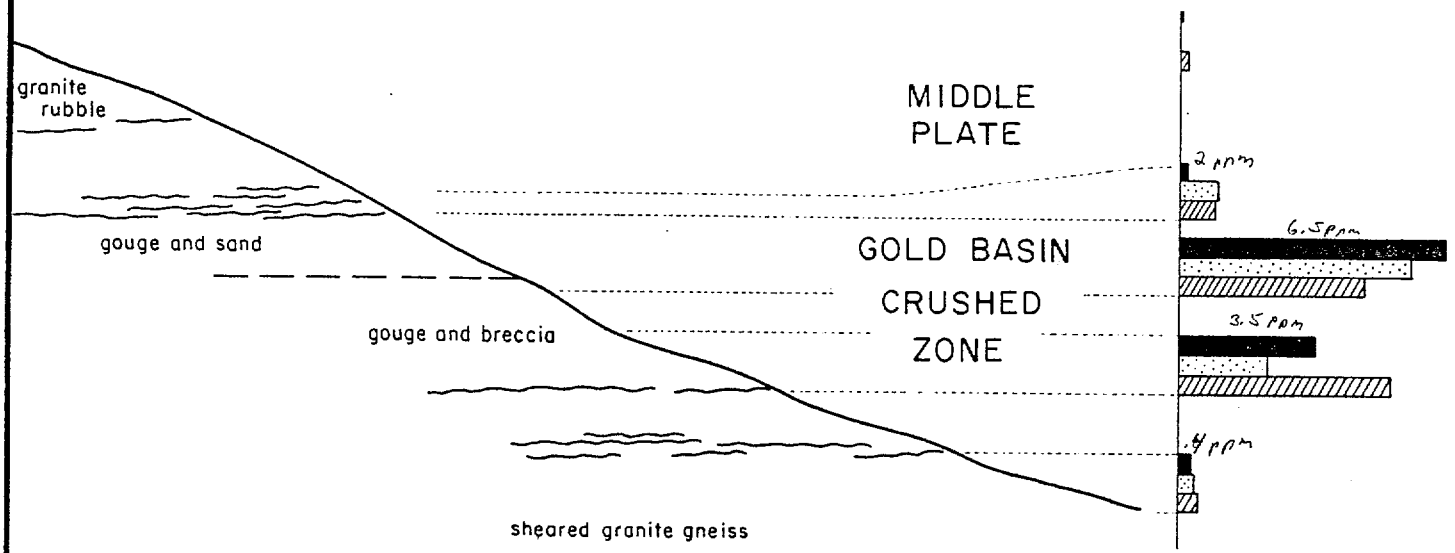
Four to five pound rock-chip samples were assayed for gold and associated trace elements. The samples were taken specifically from exposures of altered and mineralized sheared rocks and gouge, and as non-specific samples of rock and rock debris taken at claim corners. The sample data, including the results of earlier sampling, is tabulated in sample logs in the appendix and is shown on the accompanying geochemical maps. The geochemical results show that:

1. Gold is associated with introduced mercury, lead, tungsten, and fluorine.

2. Metal zoning is indicated by a pronounced separation of introduced mercury and lead with the coincident gold-mercury anomaly associated with pyritic alteration.

3. Gold and the other metals were concentrated in zones of more intense shearing, brecciation and gouge within the Middle Plate rocks and the "Crushed Zone."

Two major zones of gold concentration are evident from the sample data and are shown on the accompanying maps. These are (1) the exposed area of the "Crushed



EXPLANATION

BAR GRAPH OF RELATIVE ASSAYS

VALUES ARE AN AVERAGE OF 2 or 3 SAMPLES TAKEN AT SIMILAR STRATIFORM POSITIONS

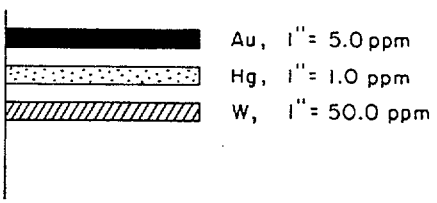


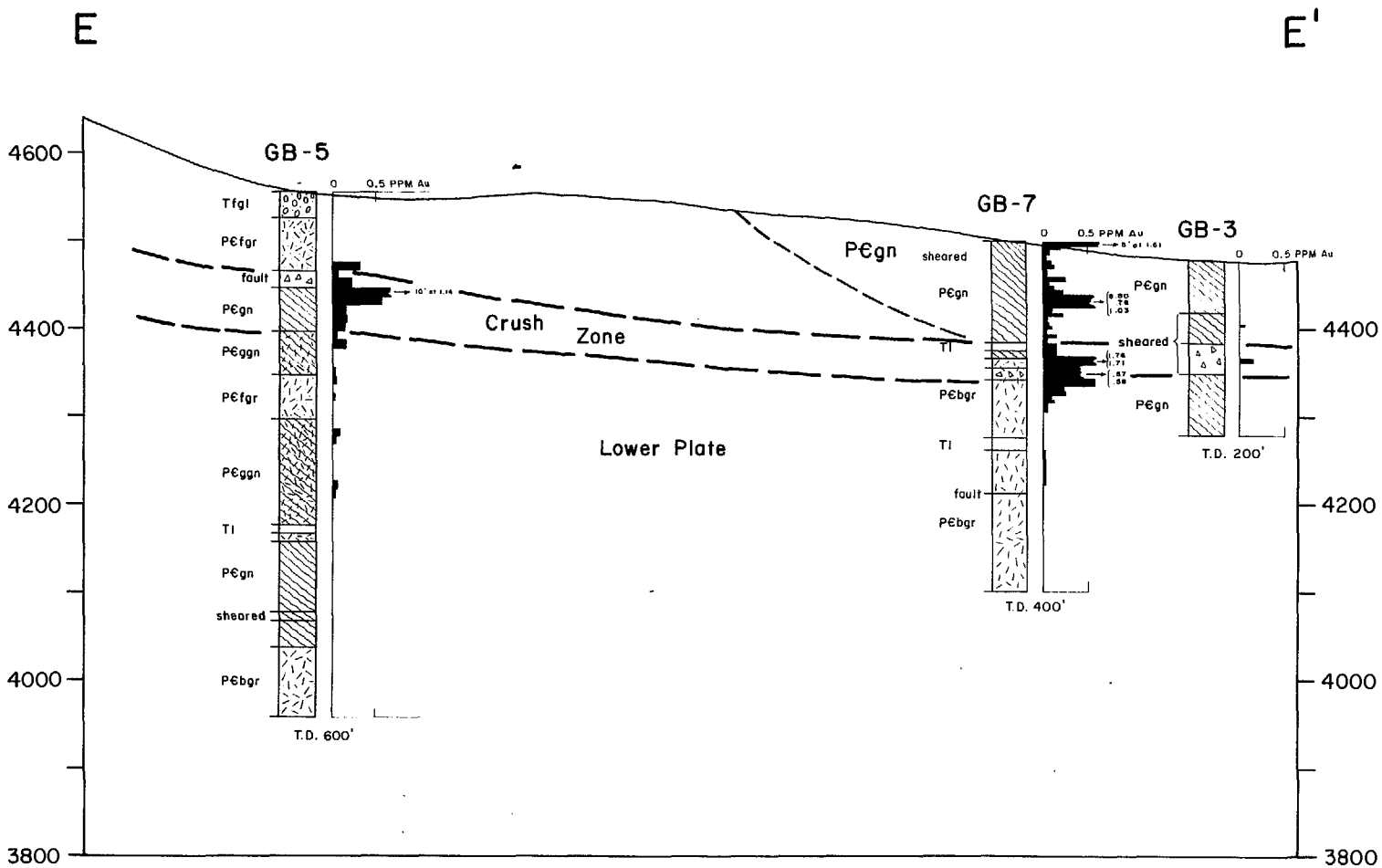
FIGURE 2

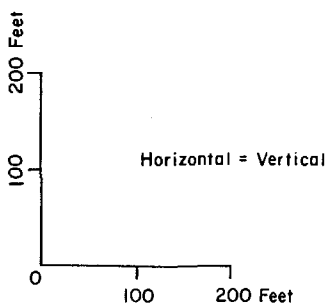
DIAGRAMMATIC SECTION
ILLUSTRATING THE DISTRIBUTION OF GOLD
IN THE GOLD BASIN CRUSHED ZONE
MOHAVE COUNTY, ARIZONA

DIAGRAM IS BASED ON GENERALIZED GEOLOGIC AND SAMPLE DATA FROM THE NE ¼ OF SECTION 25, T. 28 N., R. 19 W.

SCALE: 1" = ~50'

Conn & Ahern





CROSS SECTION E-E'
(LOOKING NORTH)
GOLD BASIN PROJECT

MOHAVE COUNTY, ARIZONA

R. AHERN MAY 1984

APPENDIX B.

SCREEN TEST
GOLD BASIN PROJECT
MOHAVE COUNTY, ARIZONA

A bulk sample weighing over twenty-five pounds was collected from an exposure of the "Crushed Zone" prospect pit in the NE NW of Section 25, T. 28 N., R. 19 W. Several previous samples of the crush and gouge zone from this prospect ran 3.5 ppm to 7 ppm gold.

The bulk sample was crushed and ground in a pulping mill and screened into three size fractions, coarse (+20 mesh), middle (<20:+60 mesh) and fine (<60 mesh). Assay results for gold, silver and several pathfinder elements on these fractions are shown on the following table. Detailed examinations of each size fraction did not disclose any gold particles, but gold was observed during microscopic examination of the panned heavies from the fine fraction. The gold observed consisted of a delicate crystalline particle in a soft white clay matrix. The panned heavy concentrate from 6 pounds of fines consisted of a few grams of hematite and goethite after fine-grained pyrite, too little to assay.

The analytical data show that gold and silver are slightly concentrated in the more siliceous coarse (+20 mesh) screen fraction with 60-percent of the total gold in this fraction. The data indicates that gold permeates the gouge and crushed material, probably occurring as free gold and/or auriferous pyrite and the mineralization has resulted from pervasive soaking of the crushed zone by epigenetic hydrothermal fluids.

Screen Test, Bulk Sample From Crushed Zone*

Sample Number	Screen Mesh	% Fraction	% Total Au in Fraction	Au ppm	Ag ppm	W ppm	As ppm	Sb ppm	Hg ppm
2799	-	-		2.13	1.1	79	20	2	2.03
2799A	+20	49.7	61%	3.02	3.5	43	18	2	1.66
2799G	<20 +60	32.4	26%	1.95	1.4	54	23	2	1.04
2799C	<60	17.9	13%	1.78	0.7	61	23	2	1.65

*Testing results from USBRC, Anaheim, California

PROSPECT GOLD BASIN

COUNTY MOHAVE STATE ARIZONA

SAMPLE LOG

SAMPLE NUMBER	LOCATION		DESCRIPTION	RADIOACTIVE ELEMENTS			PATHFINDER ELEMENTS							BASE METALS				SULFO-SALTS		PRECIOUS METALS	
	LEGAL	GEOGRAPHIC	LITHOLOGY AND MINERALIZATION	U_3O_8	eU	eTh			W[3]	Acid Sol Ba[2]	Total Ba %[2]	F[2]	Hg[2]	Cu[3]	Mo[3]	Pb[3]	Zn[3]	As[3]	Sb[3]	Au[3]	Ag[3]
3144	SE NW 31, 28N., 18W.	SE Cor GB 34.	Upper Plate; fanglomerate.						4				.09	12	5	29	43	3	< 2	<.02	.9
3145	"	SE Cor GB 35.	"						< 1				<.05	19	<5	27	46	< 2	< 2	<.02	1.0
3146	SW NE 31, 28N., 18W.	SE Cor GB 36.	"						1				.09	21	5	37	65	2	< 2	<.02	1.3
3147	"	SE Cor GB 37.	Fanglomerate debris.						6				.09	14	<5	37	78	2	< 2	<.02	1.6
3148	SE NE 31, 28N., 18W.	SE Cor GB 38.	Debris in vicinity of crush.						1				.20	23	<5	55	72	3	< 2	<.02	1.5
3149	NW NW 36, 28N., 19W.	NW Cor GB 8.	Upper Plate; andesite.						1				.09	23	<5	31	41	3	< 2	<.02	1.8
3150	"	NW Cor GB 9.	"						< 1				.05	94	<5	26	86	7	< 2	<.02	1.8
3152	SE SE 24, 28N., 19W.	NE Cor GB 68.	Lower Plate; leucogranite.						< 1				.09	149	<5	28	93	2	< 2	<.02	2.0
3153	"	SW Cor GB 69.	Fanglomerate debris near crush.						< 1				.05	28	<5	33	69	3	< 2	<.02	1.8
3154	"	SW Cor GB 70.	Upper Plate; fanglomerate.						< 1				.05	23	<5	33	57	2	< 2	<.02	2.1
3155	SW SE 24, 28N., 19W.	SW Cor GB 71.	Upper Plate; fanglomerate.						< 1				.05	13	<5	25	53	2	< 2	<.02	1.7
3156	"	SW Cor GB 72.	Middle Plate; poorly exposed sheared layered gneiss.						< 1				.07	29	6	33	38	4	< 2	<.02	2.4
3157	SE SW 24, 28N., 19W.	SW Cor GB 73.	Upper Plate; fanglomerate.						< 1				.05	25	<5	29	57	3	< 2	<.02	2.3
3158	"	SW Cor GB 74.	"						1				.09	21	<5	31	58	3	< 2	<.02	1.9
3159	SW SW 24, 28N., 19W.	SW Cor GB 75.	"						< 1				.05	20	<5	33	58	2	< 2	<.02	2.3
3160	"	SW Cor GB 76.	"						< 1				.07	16	<5	37	62	4	< 2	<.02	2.2

1 VALUES IN PPM EXCEPT "TOTAL BARIUM" WHICH IS IN %
2 COPPER STATE ANALYTICAL, TUCSON
3 U.S. BORAX RESEARCH CENTER, ANAHEIM

CORN & AHERN
CONSULTING GEOLOGISTS
TUCSON, ARIZONA

SAMPLE LOG

PROSPECT: GOLD BASIN

COUNTY: MOHAVE STATE: ARIZONA

SAMPLE NUMBER	LOCATION: LEGAL	LOCATION: GEOGRAPHIC	DESCRIPTION: LITHOLOGY AND MINERALIZATION	RADIOACTIVE ELEMENTS: U_3O_8	RADIOACTIVE ELEMENTS: eU	RADIOACTIVE ELEMENTS: eTh	PATHFINDER ELEMENTS:		W[3]	Acid Sol Ba[2]	Total Ba %[2]	F[2]	Hg[2]	BASE METALS: Cu[3]	Mo[3]	Pb[3]	Zn[3]	SULFO-SALTS: As[3]	Sb[3]	PRECIOUS METALS: Au[3]	Ag[3]
3168	SW NW 30, 28N., 18W.	Northwest of Cyclopic Mine.	Altered fine-grained granite (Middle Plate) near fluorite prospect.						37				.09	42	9	437	232	3	<2	.02	2.4
3169	"	Prospect pit, northwest of Cyclopic Mine	Middle Plate. Brecciated quartz with fluorite on dump.						32				5.86	36	301	2220	362	5	2	.19	5.6
3170	"	"	4-6" vein of fluorite-cerusite-no quartz with hematitic limonite. Middle Plate.						116				238	283	565	2%	590	ND	5	3.53	214
3171	SW NE 25, 28N., 19W.	1500' south of Fry Mine.	Middle Plate. Altered coarse-grained leucocratic granite.						41				.84	5	9	636	26	<2	<2	.10	2.0
3172	SE NW 25, 28N., 19W.	Pit on ridge.	Middle Plate. Altered gneiss.						48				.31	<5	5	76	33	2	4	.03	1.3
3173	SW SW 30, 28N., 18W.	Validation pit.	Middle Plate. Shattered fine-grained granite.						5				.27	<5	5	69	22	2	3	<.02	1.6
3174	NE SW 30, 28N., 18W.	Near Cyclopic.	Middle Plate, above crush. Silicified and sheared gneiss.						25				2.45	5	6	110	75	<2	<2	.04	1.5
3183	SW SE 25, 28N., 19W.	1000' southeast of fluorite prospect.	Middle Plate. Crushed and sheared altered gneiss.						27				.98	24	14	28	19	10	<2	.43	1.7
3184	NW NW 31, 28N., 18W.	Dump of adit.	Middle Plate. Tan to gray silicified fault breccia.						25				11.02	184	14	299	144	35	<2	25.3	11.0
3185	"	Prospect pit.	Middle Plate. Pyritized and silicified gneiss and granite.						9				1.16	13	9	21	7	2	2	2.68	1.4
3186	"	Road cut and drill site.	Middle Plate. Sample across 100' of pyritized gneiss and granite.						13				.83	13	10	23	7	2	2	2.09	1.2
3187	NE NE 36, 28N., 19W.	Prospect pit near head of gulch.	Middle Plate. Silicified and pyritized gneiss on wall of pit.						19				.55	13	10	31	9	2	2	.54	1.2
3188	"	Head of gulch.	Middle Plate. Crushed material and fault below fanglomerate.						6				.18	6	8	89	49	<2	<2	<.02	1.0
3189	"	"	Middle Plate. Extensive exposure crushed rock.						9				.16	9	9	49	48	<2	<2	.19	0.9
3191	NW SE 26, 28N., 19W.	Fluorite prospect.	Middle Plate. Sample of 6' of granite with fluorite veinlets.						5				.13	11	8	61	13	2	<2	.06	1.3
3192	"	"	Middle Plate. Gouge and crushed granite on east side of pit.						5				.13	7	7	36	18	3	<2	.09	1.0
3193	"	"	Middle Plate. Dense unmineralized granite.						4				.07	5	6	38	23	<2	<2	<.02	0.7
3194	SE SE 24, 28N., 19W.	Shaft dump.	Lower Plate. Alaskitic altered granite.						2				.17	6	<5	15	35	<2	<2	<.02	0.6
3195	"	Top of hill.	Lower Plate. Episyenite altered with sulfides in granite.						4				.24	577	19	17	29	<2	<2	<.02	0.9
3196	SE NW 24, 28N., 19W.	Prospect pit.	Middle Plate. Shattered biotite granodiorite.						6				.22	27	5	18	49	3	<2	<.02	1.0
3197	SE NE 1, 27N., 19W.	North of road.	Middle Plate. Quartz vein zone in granite.						4				.15	12	<5	20	22	2	<2	<.02	0.7

CORN & AHERN
CONSULTING GEOLOGISTS
TUCSON, ARIZONA

1 VALUES IN PPM EXCEPT "TOTAL BARIUM" WHICH IS IN %
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APPENDIX A

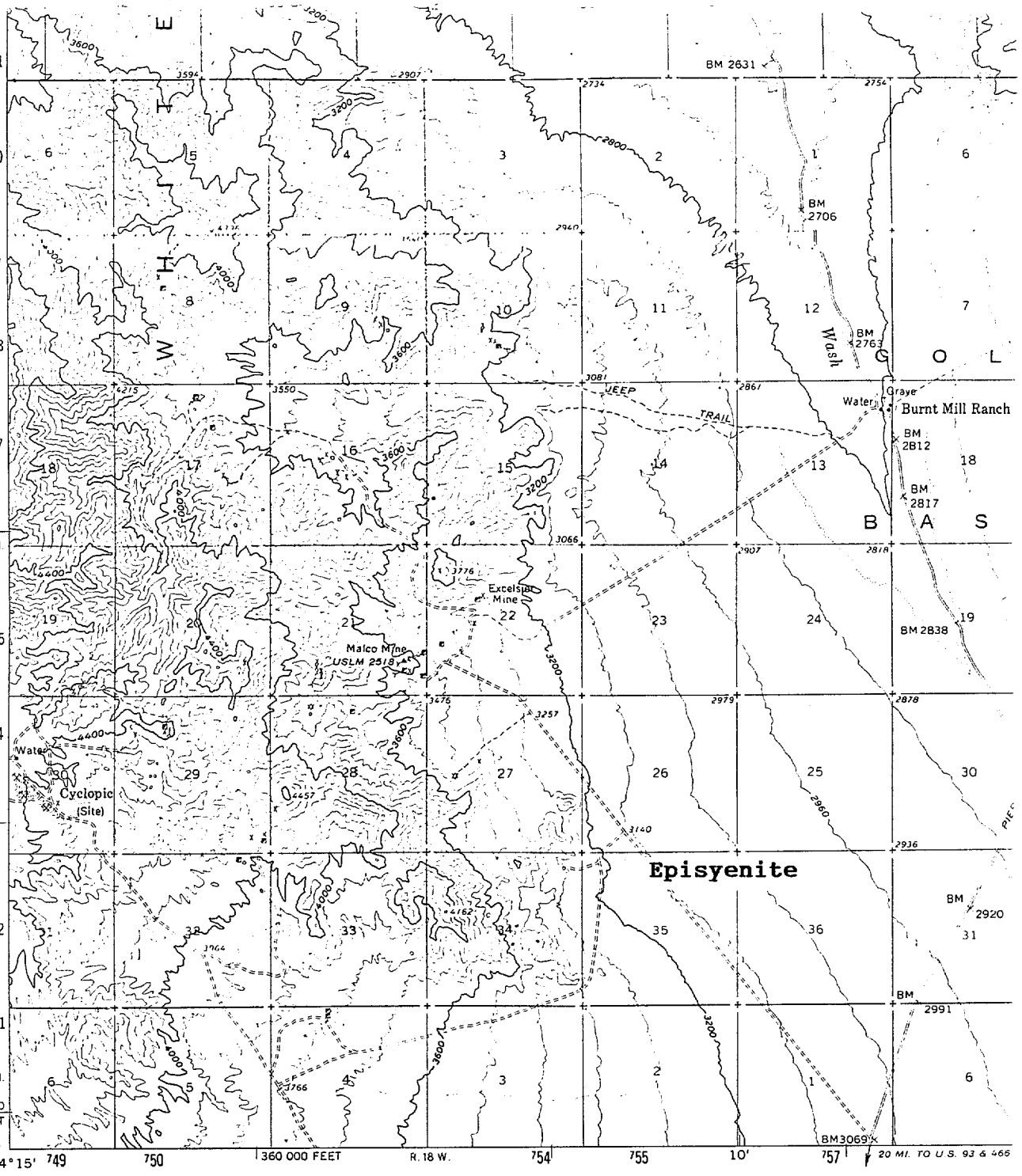
ROCK UNITS
GOLD BASIN DISTRICT
MOHAVE COUNTY, ARIZONA

Quaternary	Alluvium (Qal)	
Tertiary	Fanglomerate and conglomerate (Tfg)	Unsorted bouldery fanglomerate made up dominantly of cobbles and boulders of gneiss and granite set in a coarse sandy matrix. The unit includes a similar conglomerate that was derived from eroded and disintegrated fanglomerate.
	Rhyolitic tuff (Tr)	White, unwelded, fine-to-medium-grained rhyolitic ash flow tuff intimately associated with the fanglomerate.
	Andesite (Ta)	Medium-grained, dark grey hornblende andesite.
	Sandstone (Ts)	Fine-grained, light grey bedded arkosic sandstones.
	Lamprophyre (Tl)	Fine-to medium-grained, dark brown or greenish brown, intrusive dikes and sills characterized by phenocrysts and fragments of hornblende and plagioclase in a fine-grained matrix with a roughly equivalent content of amphibole and plagioclase. The rock is commonly fragmental or brecciated, exhibiting outlines of milled fragments or angular fragments of amphibole, and is generally altered to chlorite and siderite.
	Latite porphyry (Tl)	Light gray intrusive porphyry exhibiting small phenocrysts of feldspar (20%) in a dense gray aphanitic groundmass.
	White Hills granite (Twgr)	Light-gray to white coarse-grained leucocratic biotite granite (5% biotite) characterized by prominent one to two inch long feldspar crystals. This granite is <u>not</u> foliated, cut by pegmatites, or lamprophyre and is common south and west of the Cyclopic Mine.

Cretaceous	Leucogranite (Kg)	Medium to coarse-grained, light gray or white, biotite and biotite-muscovite granite that contains numerous pegmatite and aplite dikes over a large area adjacent to the low-angle shear zone at Gold Basin. The granite is altered to an alaskite (Kagr) which exhibits numerous quartz veinlets and muscovite as the only mica.
Precambrian	Quartz-Biotite granite (P€-fgr)	Fine-grained, dark gray-green, quartz-rich holocrystalline biotite granite. Quartz (30%) and biotite (10%) are prominent constituents.
	Biotite granite (P€-bgr)	Coarse-grained, equigranular biotite granite containing 10 to 15% biotite. The granite has been weakly metamorphosed and varies from non-foliated to severely foliated.
	Gneissic granodiorite (P€-gd)	Medium to coarse-grained, dark-colored gneissic granodiorite with 30% or more former ferro-magnesian minerals.
	Gneiss (P€-gn)	Layered gneissic metasedimentary and meta-volcanic rocks that exhibit epidote-amphibolite to amphibolite rank metamorphism. Included in the mapped unit are fine-grained quartz-biotite-feldspar gneiss, coarse-grained garnet-feldspar-amphibole gneiss and medium to coarse-grained granitic gneiss.
	Gneissic biotite granite (P€-gngr)	Coarse-grained, gneissic, intensely foliated tan to pink granite characterized by prominent K-feldspar, biotite and quartz.

EXCERPTS FROM DESCRIPTIONS OF MINERALIZED EPISYENITES

Episyenite is a term used to designate a syenitic rock formed by metasomatic process. Episyenites commonly reflect desilication of the replaced rock, exhibit an increase in potassium or sodium feldspars, and contain carbonates, fluorite, pyrite, specularite and introduced metals.



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1958. Field check 1960

Underwater contours compiled from USDA maps
and later sedimentation studies

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks,
zone 11, shown in blue

Land lines unsurveyed in parts of T. 29 N.–R. 18 W.,
and T. 30 N.–Rs. 17 and 18 W.

(WHITE HILLS)
3155 III

GN
MN
1°41'
30 MILS
15½°
276 MILS

UTM GRID AND 1960 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

CO
DOTTED

THIS MAP COMPLIE
FOR SALE BY U. S. GEOLOGICAL SU
A FOLDER DESCRIBING TOPO

Notes for Files

Russell M. Corn

December 13, 1984

NICOR Submittal
Gold-Bearing Episyenite
McConnico District
Mohave County, Arizona

GENERAL

NICOR Mineral Ventures submitted their gold-bearing episyenite prospect in the McConnico District, Mohave County, Arizona for joint venture consideration. The prospect is located in the NE¼ Section 29, T20N, R17W. Access is difficult, either through locked gates at the Railroad on the north edge of Section 29 or by way of a wash and a poor jeep road in Section 20.

NICOR holds 104 claims in the NE¼ of Section 29 and adjacent Sections 20, 21 and 28. They surround but do not hold one patented claim owned by Roger L. Faylor, Kingman (753-3150). Workings on the patented claim include a shaft and a 270 foot decline from which .50 oz Au ore was reportedly produced in the 1920's. Financal considerations and the type of deal desired by NICOR were not discussed.

MINERALIZATION

The gold-bearing episyenite is composed of coarse recrystallized feldspar, siderite or ankerite, some quartz, 10 to 15 percent pyrite and minor purple fluorite. Feldspars are commonly discolored to a brick-red color, which together with the purple fluorite suggests the presence of uranium-thorium minerals. Quartz flooding and quartz-pyrite stringer zones are prominent in the episyenite near the old workings on the patented claim and reportedly furnished the higher-grade ore. NICOR describes the mineralized episyenite as a replacement zone approximately 50 feet thick localized along a gently dipping structure in Precambrian gneiss, foliated granite and a specularite-rich granite. Similar, but much smaller north-east trending dike-like zones occur in the adjacent sections. Gold is associated with sulfides and varies from 1 to several ppm. Mineralization is similar to and related to the episyenites at and near the Bi Metal mine to the north but the prospect does not exhibit the prominent brecciation that characterizes the Bi Metal mine. The general area contains abnormal amounts of thorium and rare earths but NICOR had not assayed the episyenite for either radioactive or pathfinder elements or base metals.

EXPLORATION

NICOR carried out limited trenching in the vicinity of the old shaft and decline but has not conducted any drilling. The available sample data from the area of limited trenching suggests a 50 foot thick zone that dips 25° to 30° to the southeast and averages .077 oz Au. The zone is exposed over a length of 800 feet and is projected 2000 feet beneath alluvium to exposures on the east edge of the section. Samples from the eastern exposures reportedly average .025 oz/ton Au.

At the Gunnar deposit, a pipelike zone within the host granite has been altered to a rock type locally referred to as "syenite" through the removal of quartz and the apparent introduction of albite and calcite. Albite now comprises about 60 percent of the "syenite", and the balance is comprised of equal amounts of quartz, carbonate, and chlorite. Portions of the "syenite" are now a porous, altered rock, possibly formed by the removal of calcite, that persists to a depth of at least 500 m. Similarities have been suggested between the "syenite" and the "episyenites" associated with uranium deposits in the Massif Central and Vendee in France. The ore at Gunnar occurs within a zone of mylonitized "syenite".

Mineralization. Two types of uranium mineralization occur in the Fay-Ace-Verna area. The first type of mineralization is not economic but may represent, at least in part, the source for the later economic deposits. It consists of uranium in the form of uraninite, uranothorite, monazite, zircon, and other complex minerals, in various pegmatitic rocks, metasediments, and granites (Robinson, 1955a; Tremblay, 1978c). Koeppel (1968) established two principal ages for this type of uranium mineralization, the oldest at a minimum age of 2200 m.y. and the younger at 1930 m.y. These periods can be related to the emplacement of the "old" and "young" granites of Beck (1969, 1970). Beck also considers the possibility that the pegmatitic rocks represent stages of the transformation or granitization of country rock to granite. This may well be true for the younger (1930 m.y.) pegmatitic generation.

The second type of uranium mineralization includes the economic deposits and can be subdivided into simple, essentially monometallic and polymetallic deposits. Over 90 percent of the deposits are monometallic, including all major orebodies such as the Fay, Ace, Verna, Bolger, and Gunnar deposits. The principal ore mineral is pitchblende which contains negligible amounts of thorium and rare earth elements. It is accompanied by hematite, pyrite, and minor amounts of chalcopyrite, bornite, and galena. Calcite is the dominant gangue mineral, but dolomite, quartz, and chlorite, generally penninite, are also present. Locally brannerite (Fay Mine) and thucholite have been reported. Pitchblende is described as predominantly colloform and massive in habit, but euhedral shapes have also been reported. Several generations of ore and gangue are present (Fig. 7), and at least five generations of carbonate were distinguished by stable isotope and mineralogic studies (Sassano et al, 1972b).

Polymetallic occurrences of mineralization were discovered in a narrow belt within the Beaverlodge area. They form only small deposits, such as the Consolidated Nicholson Mine with original reserves of about 60 t U_3O_8, and consist of pitchblende accompanied by Co-Ni arsenides and sulfides, Co-Ni-Pb-selenides, and native platinum, gold, silver, and copper.

The lithologic and structural controls of both types of deposits appear to be similar. The ore minerals are described as occurring in subsidiary structures on both sides of major faults in the form of massive veins or veinlets, as well as disseminated in breccia zones within the crystalline basement. For example, the Ace-Fay deposits are found in the footwall and within 100 m of the St. Louis Fault that strikes north 70° east and dips 50° southeast. The Verna orebody, located about 1 km to the northeast and along strike from the Ace-Fay deposits, occurs 150 m or more into the hanging wall of the St. Louis Fault (Figs. 8, 9, 10).

At the Gunnar deposit, uranium mineralization consists of pitchblende and minor uranophane with chalcopyrite, pyrite, galena, quartz, kaolinite, and chlorite. Hematite is present with and without associated uranium. Uranophane persists to the deepest levels of the mine. The grade of the ore (0.175 percent U_3O_8) was fairly consistent throughout the mine. The deposit occurs within an altered granite (Fig. 11) close to its contact with the underlying gneiss and near the junction of the northeast-striking Zeemel and east-striking Iso (Fraser) Fault, a short distance north of the west-northwest-striking St. Mary's Channel Fault. The mineralization occupied fine fractures of a mylonite zone within the pipelike bodies of albitized, quartz-deficient, gneissic granite, locally referred to as "syenite".

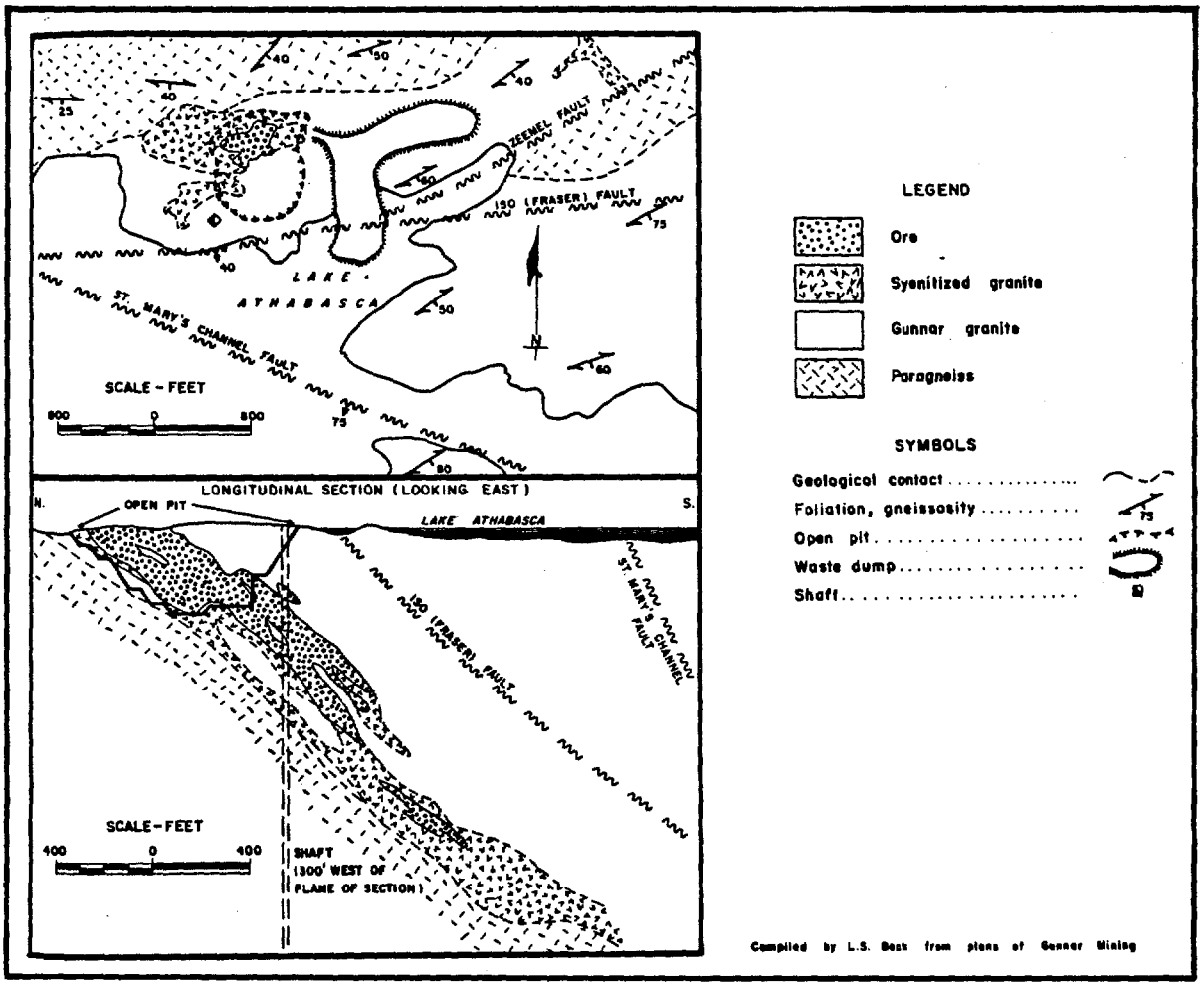


Figure 11. Geologic sketch map and cross section for the Gunnar Mine area, Canada (from Beck, 1969).

Gold mineralization at the Salave gold prospect, northwest Spain

M. Harris M.Sc., Ph.D.
Department of Geology, Royal School of Mines, Imperial College of Science and Technology, London

553.1:543.062:553.411(461)

Synopsis
Disseminated, high-purity gold occurs alone and intergrown with other minerals in very altered portions of a granodioritic intrusion and in its contact aureole. The gold is located in the core zone of a concentric sequence of hydrothermal alteration corresponding to increased carbonatization, desilicification, sericitization, albitization, sulphidization and texture-destruction inward from the unaltered granodiorite to the areas of disseminated gold. Quantitative correlations derived from a statistical study of analytical data are presented to support this zonation.

Salave is in the northwest corner of the Province of Oviedo, Spain, some 3 km east of the town of Tapia de Casariego (Fig. 1). The property was mined for gold by the Romans and possibly by the Celts; some minor molybdenum mining was carried out during the second world war, and since 1970 three mining companies have drilled at Salave to investigate its open-pit gold potential.

In summary, the geology consists of a Hercynian granodioritic pluton intruded into a heterogeneous gabbroic body and the Cambrian–Ordovician metasediments of the Los Cabos Formation. All three units are auriferous in places and were affected by the hydrothermal alteration associated with the gold mineralization. The Los Oscos thrust, a major structural feature of the region, crosses the deposit.

Hydrothermal alteration at Salave is a zonal sequence of concentric shells grading inward from the unaltered granodiorite through (1) chlorite–sericite alteration; (2) propylitic to advanced propylitic alterations; (3) albitites; and (4) an auriferous (> 1 ppm Au) alteration facies termed hongorock (HR), which is a sericite–carbonates–albite–(±) quartz–sulphide alteration facies with a cataclastic texture.

Analytical methods

Carbon dioxide was determined by wet chemical methods described by Bush;[1] SiO_2 by atomic absorption spectrophotometry (AAS) with closed vessel HF digestion, modified from Langmyhr and Paus;[2] arsenic antimony and molybdenum by colorimetry as detailed in Stanton;[3] sodium, aluminium, magnesium, calcium, iron, manganese and titanium by inductively coupled plasma spectrophotometry with a HF, HNO_3–$HClO_4$ digestion; and gold by AAS with an aqua regia attack.

Gold mineralization

Gold concentrations exceeding 1 ppm Au were only found analytically and microscopically in the alteration facies described as hongorock (Fig. 2(*a*)). Hongorock alteration exists not only in the granodiorite and its related dykes but also extends into the metasediments and the gabbro. The sulphide assemblage in hongorock typically consists of pyrite, arsenopyrite, stibnite, molybdenite and occasionally sphalerite. Gold was observed as discrete grains and intergrown with hematite and at times in all of the sulphides mentioned except stibnite. Some typical examples of gold occurrences are shown in Fig. 2(*b*)–(*b*). The average size of the 38 grains of free gold recorded was 25 μm within a range of 2–200 μm.

It was impossible to macroscopically predict the quantity of gold in hongorock other than that it would exceed 1 ppm, but several observations, made during drill-core logging, did bear some relationship to the amount of gold found in the laboratory analyses and these factors are summarized in Table 1.

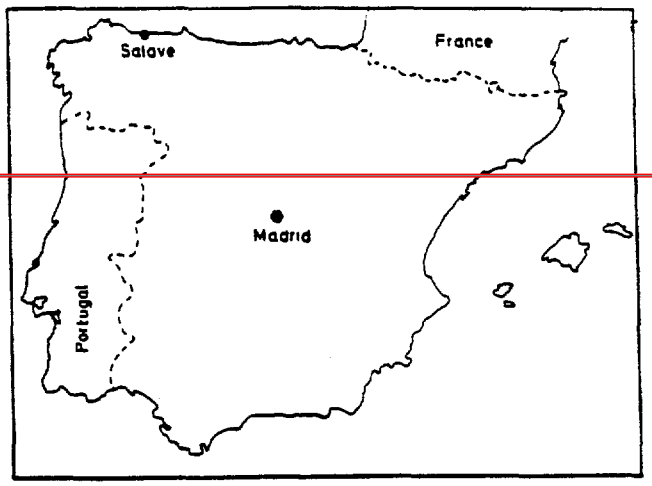


Fig. 1 Map of Iberian Peninsula showing location of Salave deposit

Major-element correlations with gold

One of the most distinctive features of the alteration at Salave is the coincident desilicification and carbonatization of the granodiorite with increased alteration (Fig. 3). The introduction of CO_2 as carbonate and the loss of SiO_2 from the silicate-destructive alteration are obvious petrographically and by chemical analysis.

Two distinct analytical populations were found when the CO_2 values determined for samples of hongorock were plotted against gold content. The lower group of samples in Fig. 4 display a strongly positive correlation between the two variables. The upper enclosed group, representing high CO_2–low gold relationships, contain excessive amounts of carbonates (carbonate flooding). When the two populations were statistically analysed, they were found to have a linear correlation coefficient (r) of 0.40 (broken line). This was improved to $r = 0.76$ (solid line) by excluding the six enclosed samples. The close association of gold with CO_2 has also been reported at other gold deposits (for example, by Roedder,[4] Boyle and co-workers,[5] Machairas[6] and Boyle[7]).

The lack of statistical correlation between gold and SiO_2 (Fig. 5) corroborates the petrographic observations on the erratic occurrence of silicates in hongorock, the proportions of which can vary drastically over a range of a few centimetres. The silica, lost from the altered zones, was redeposited as quartz veins and as areas of massive silicification near the granodiorite–metasediment contact.

The strongly negative correlation between gold and Na_2O (Fig. 6) suggests that intense albitization is not compatible with significant gold concentrations. This may

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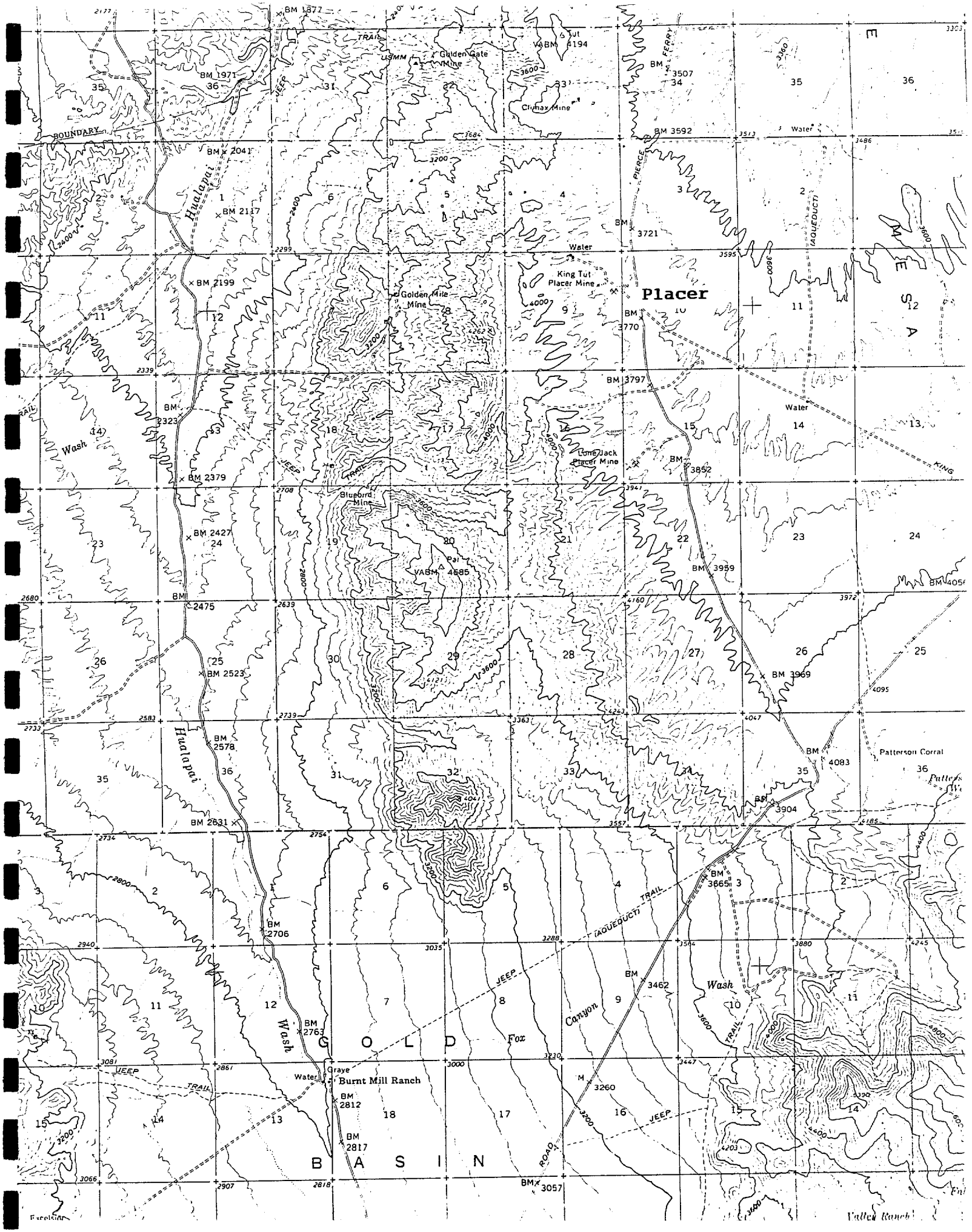
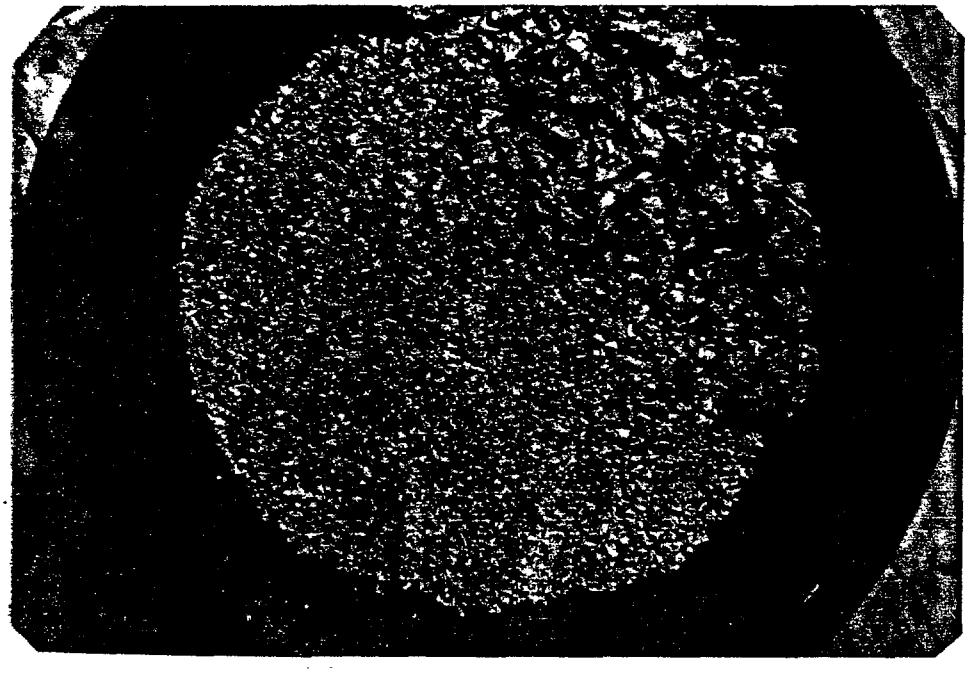
VEINS AND PLACER DEPOSITS


BM 1877
TRAIL
USMM
Golden Gate Mine
VABM 4194
BM 1971
JEEP
Climax Mine
BM 3507
FERRY
BOUNDARY
BM 3592
Water
BM 2041
Hualapai
BM 2117
PIERCE
BM 3721
(AQUEDUCT)
Water
King Tut Placer Mine
Placer
BM 2199
Golden Mile Mine
BM 3770
BM 3797
Water
BM 2323
Wash
Lone Jack Placer Mine
BM 3852
KING
BM 2379
Blueberry Mine
BM 2427
Pal
VABM 4585
BM 3939
BM 2475
BM 2523
BM 3969
Hualapai
BM 2578
Patterson Corral
BM 4083
BM 2631
BM 3904
BM 3665
TRAIL
(AQUEDUCT)
BM 2706
JEEP
BM 3462
Wash
Canyon
BM 2763
G O L D
Fox
Graye
Water
Burnt Mill Ranch
BM 2812
BM 2817
B A S I N
ROAD
BM 3260
BM 3057
Excelsior
Valley Ranch

Apache Oro Report May 1985

Lost Basin Mineral Potential

Gold Placer Deposits: The USGS in 1968 and 1969 published estimates that the potential placer gold resources "may exceed 500 million cubic yards of gravel averaging 0.01 - 0.02 oz. gold per cubic yard," (U.S. Geological Survey, Heavy Metals Program, Progress Report, Circular 560 and Professional Paper 650-A). Based on a price of $300 per ounce, this would add up to $1.5 billion to $3 billion. Many surface arroyos over a mile long have averaged 0.03 - 0.05 oz. gold per cubic yard and ancient channels (as yet, undeveloped) should average several times these surface values. Since 1968, the USGS (Denver) has been conducting an expanded research program of spectro-chemical analysis of the trace elements present in placer gold samples collected from many points in the area in an effort to determine the origin. (U.S. Geological Survey, Preliminary Report of the Geology and Gold Mineralization of the Gold Basin and Lost Basin Mining Districts, Mohave County, Arizona, 82-1052 Open File, 1982). The gold occurs both as nuggets ranging in size from a pinhead to over one ounce, and as widely disseminated flour gold from microscopic to visible particles. The majority of the nuggets are about 1/16 inch to 1/8 inch diamemter and have sharp, ragged surfaces and are not rounded and smoothed with wear, indicating limited travel. Secondary values of platinum, silver, tungsten and other heavy minerals have been found in the gold placer deposits.

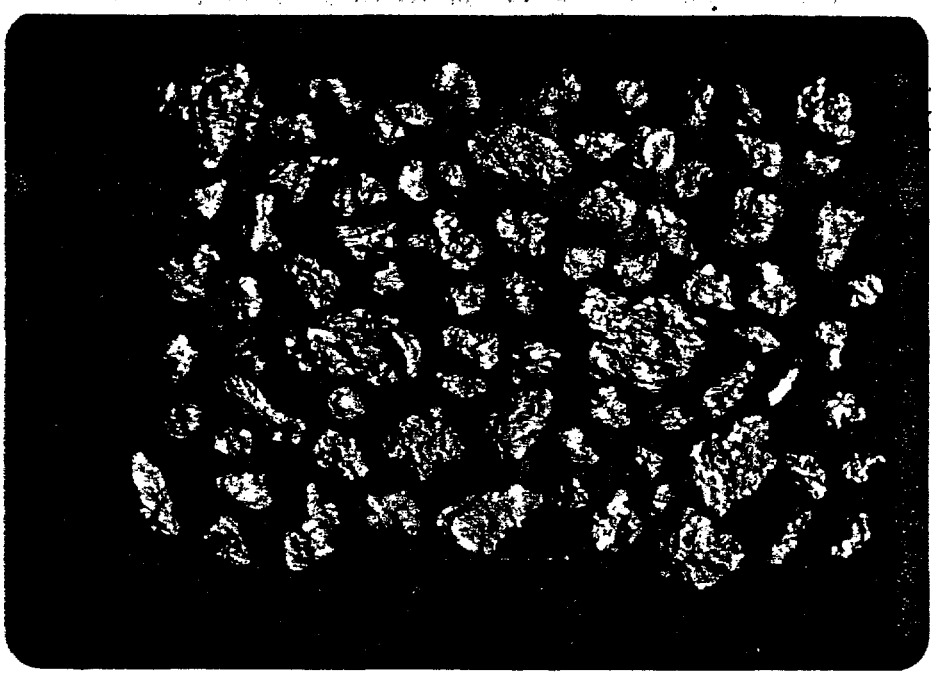


Note ratio of coarse to average size nuggets and the sharp, ragged surfaces. (Photo about 50% actual size).

Gold Placer Sources: The placer gold nuggets are believed to have been formed from both hydrothermal solutions in the Laramide vein systems, breccia zones, and metasomatic alteration bodies, and from precipitation out of cold water mineralized solutions by bacteria and fungi which are suspected to form the larger nuggets around river-worn and metamorphosed sand, magnetite, and other alluvial particles often found inside the nuggets. Age dating and geological data indicate several different geologic periods and environments of gold mineralization.

Gold Placer Sources (continued):

In the Summer of 1983, Apache Oro Company commissioned Lawrence E. Smith, Consulting Geologist with over 40 years of professional experience, to study the area and to review and evaluate the numerous geological, geophysical, and geochemical reports; the drill hole and channel sampling data; and the color stereo and satellite imagery photos which are listed in APPLICABLE REFERENCES at the end of this summary. Mr. Smith's resulting report, "Review and Evaluation, Geology and Mineralization of the Lost Basin Range, Mohave County, Arizona, October 23, 1984," is considered by most professionals personally acquainted with the area, to be the first comprehensive analysis which ties together all of the findings of the USGS and the several independent geologists who have studied the area, and which defines the source of the present surfacial alluvial gold concentrations. This source is composed of buried gold deposits which are the targets for future gold production.



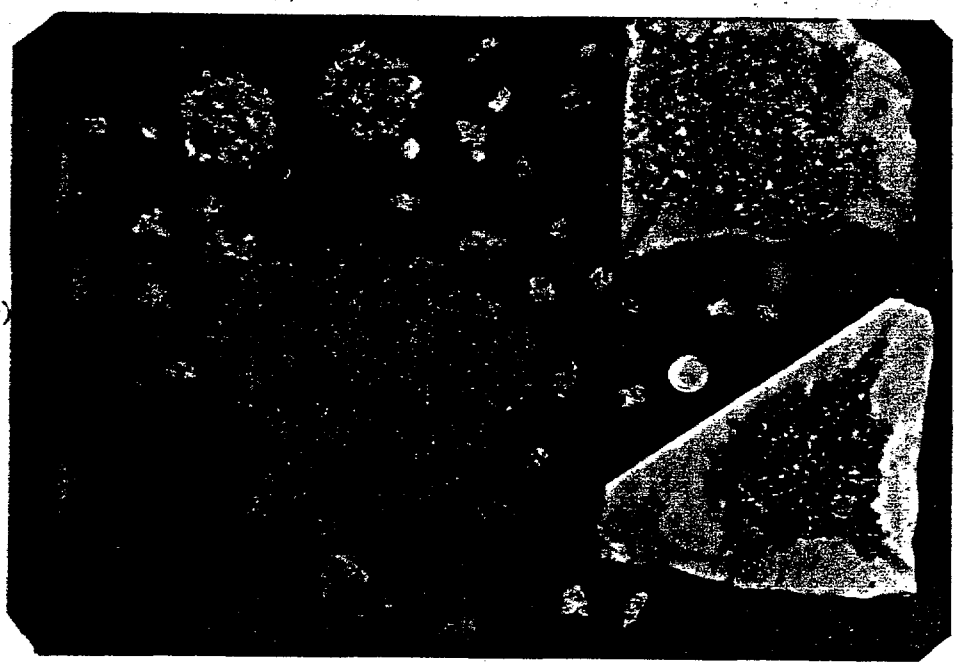
Note sharp, ragged surfaces on most nuggets. (Photo about 75% actual size).

Production History of Gold Placer Deposits: Due to the unusual topographic position of the placer deposits (the most productive of which occur in alluvium only slightly below and to the east of the gold bearing metamorphic source rocks) and due to the lack of water, the gold placer deposits were not discovered until 1931) - - - not by prospectors, but by a rancher's wife who picked up a golf ball size gold nugget! From 1935 to 1937 the King Tut placer operation reported a recovery of 1,175 ounces of free gold from several short gulches averaging 0.035 oz./cu. yd. Several other small operations have been attempted to mine the placer gold since that time, but because of the inefficiency of small volume handling, lack of water, and the low price of gold for so many years ($35 per oz.), none of these operations have been successful.

During 1974 and 1975 spot sampling of the surfacial placer gravels in nine sections was made by Vanguard Partners, a limited partnership, and Western Contracting, an earth moving corporation. However, due to the random pattern of the richer concentrations of the surficial placer gold and the depression of gold prices (from $190 to around $120/oz.), sampling was discontinued.

Production History of Gold Placer Deposits (continued):

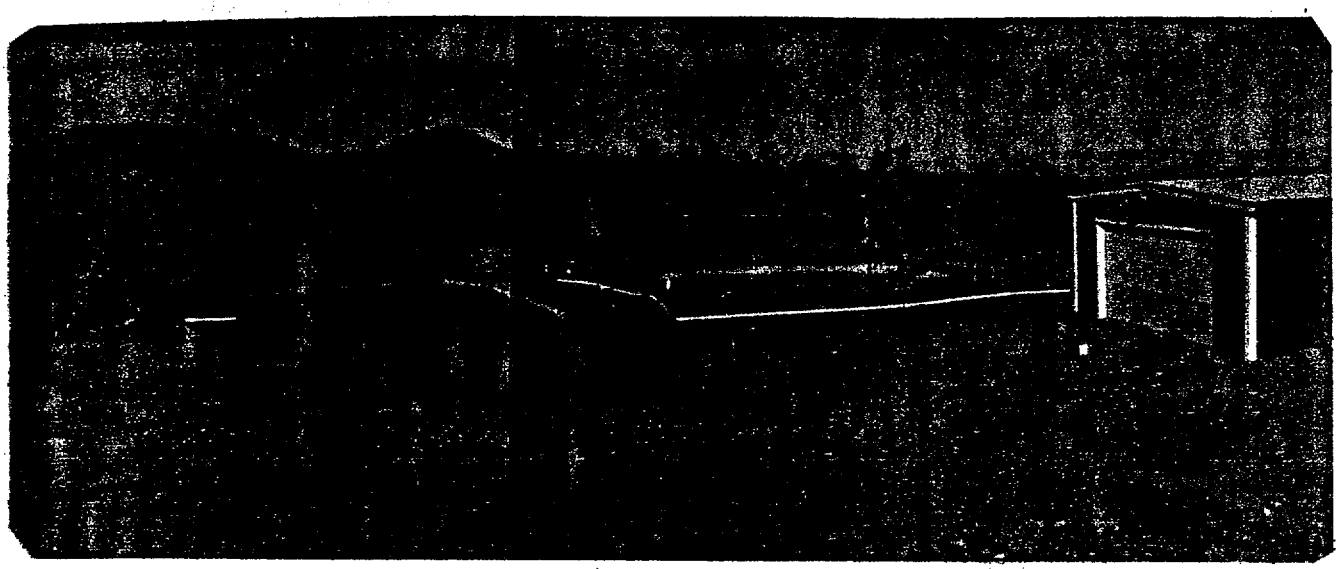
In 1976, Apache Oro leased its properties to Resources International Partners (RIP), a limited partnership, who (in 1978) set up a wet placer system using water from a 1,340 foot well. Placer gravels from two narrow gulches to an average depth of 10 feet along the center line were dug by a front-end loader and then dumped onto a conveyor feeding a wet classifier from which (-)3/4" material was sluiced. Later, jigs were added at the output of the sluice for black sand recovery. After about five months of placering, RIP recovered 113 troy ounces of free gold, plus abundant black sands. However, RIP ceased operations due to exorbitant operating costs of $10.68/cu. yd. (about double the normal).



113 troy ounces of placer gold recovered by RIP. (Note quarter)

Gold Placer Leaching: RIP drilled 551 holes 50 feet deep at random in the alluvial gravels which were reported to average 0.0174 oz. gold per cubic yard. Subsequently, RIP set up a cyanide heap leaching operation in an attempt to leach the gold from the vugs and fractures of the alluvial gravels, as well as from free gold particles. Many problems were encountered in obtaining uniform and consistent wetting of the excessively large leach pile and overcoming the detrimental effects of carbon and manganese from the gravels and a cyanide polymer which was formed. Also, several problems were encountered in obtaining satisfactory separation of the gold and other metals from the pregnant solution. An ion exchange process and a zinc separation method were attempted with little success. Subsequently, leaching operations were stopped until satisfactory solutions to the problems could be found. RIP now reports after several years of research that they have found the solutions to the problems they encountered.

Gold Placer Leaching (continued):



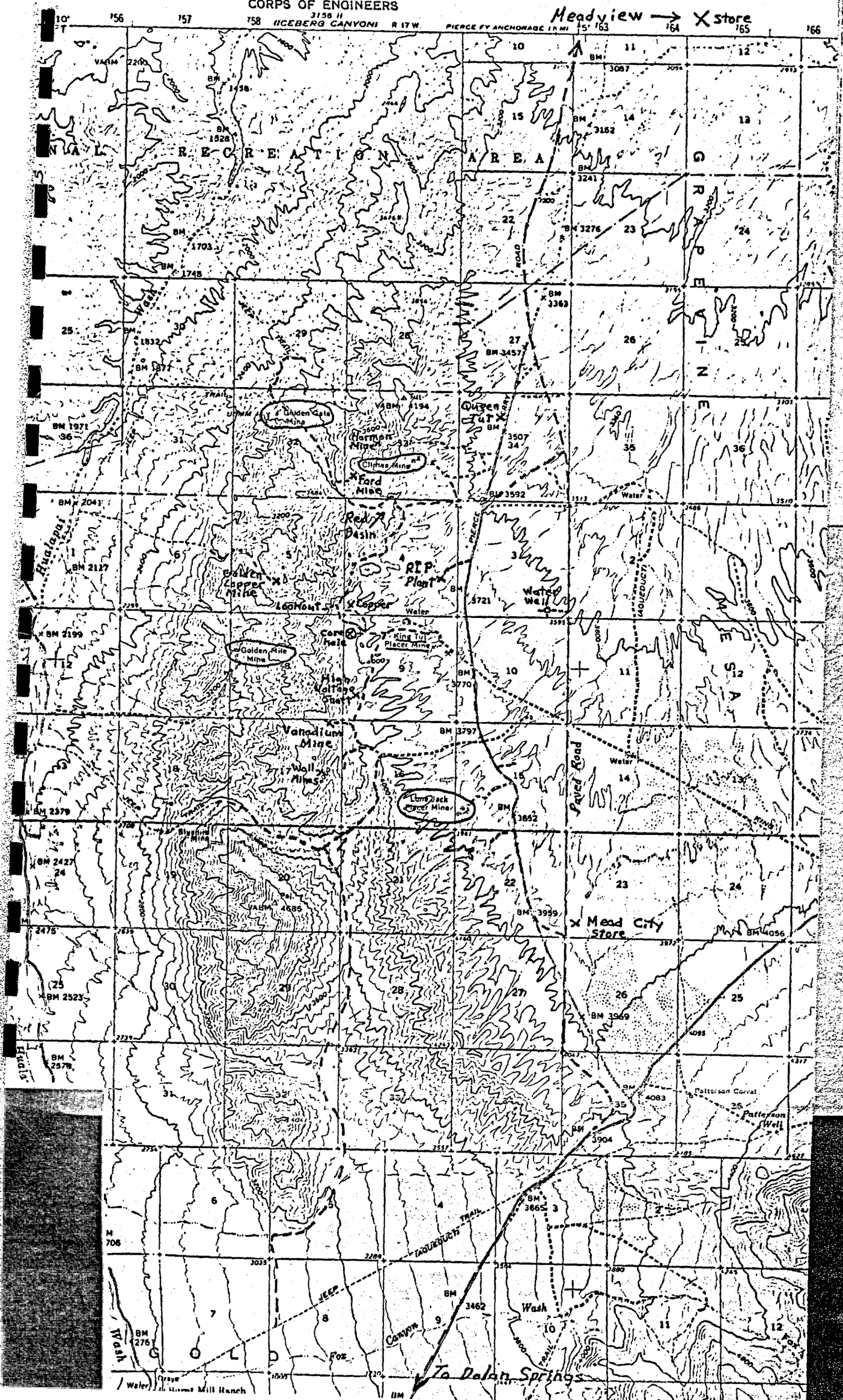
Pregnant cyanide pond (left), and building (right) of RIP's metals separation system

Gold Mineralized Breccia Zones: These are evident at the contact of the eastern alluvial gravel deposits and the adjacent bedrock to the west. Recently, one mineralized breccia zone over two miles long and up to ¼ mile in width has been surficially explored (50 foot drill holes) indicating the potential for a large open-pit low-grade gold operation. Also, a 240 foot core hole was drilled in this breccia zone and the drill sludge assayed 0.08 oz. gold/ton.

Gold Porphyry: An iron-stained circular depressed area, called "Red Basin", in bedrock about ½ mile in diameter is believed to cover, or be adjacent to a suspected gold porphyry. An 86 foot deep percussion drill hole near the center of this red area averaged 0.05 oz. gold/ton over the entire 86 feet. To the north of "Red Basin" is a 27 ft. wide gold bearing north-south ankerite zone about ¼ mile long.

Gold Bearing Quartz Veins: Apache Oro has found 52 different quartz veins exposed in the exposed bedrock that contain visible native gold. Also, several hundred other veins contain silver, copper and lead. Over 6,000 rocks with visible gold in vugs and fractures have been collected from exposed outcrops. The visible vein gold consists of thin flakes, just barely visible to the naked eye, with occasional flakes as large as 1/16 inch diameter, usually found in red or brown hematite after chalcopyrite and pyrite in spongy boxworks of vuggy and brecciated quartz. Assays show gold values from a few dollars up to several hundred dollars per ton of ore shoots in quartz veins a few inches to over seven feet in width.

UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS



Review and Evaluation

Geology and Mineralization of the Lost Basin Range

Mohave County, Arizona

for
Apache Oro Company

by

Lawrence E. Smith
Consulting Geologist

October 23, 1984

The Heinrichs induced polarization survey in 1968 (Apache Oro) consisted of five survey lines, two crossing the north-south fault zone in the northern part of the area, and three in various orientations in Migmatite Valley. Line #2 through Copper Basin revealed a small anomaly at the northwest corner of section 4, T29N, suggesting sulfide mineralization in a narrow zone possibly continuous with the Ford Mine vein system. The spacing and scope of this survey does not dispose of the porphyry mineralization potential.

Exploration and Development

Lode gold and copper were first discovered in the Lost Basin Range well back in the last century but development was hindered by the extreme remoteness of the area and the scarcity of water. Nevertheless, occasional reports of large gold nuggets in the arroyos on the western side of the Range, and an evolving legend of disappearing miners and lost mines in "Lost Basin" encouraged prospectors to return, and a modest record of production of gold, silver, copper and lead from veins began to accumulate after the turn of the century. Unfortunately, the production records of the Lost Basin and Gold Basin mining districts were combined. The evidence in mine and mill sites and from verbal history makes clear the origin of most of the precious metals production to be in the Gold Basin mining district in the White Hills.

However, the Lost Basin Mining District participated in each of the several revivals in production and ten or more prospects were developed into mines with shafts, adits and a few small stopes. Counted geographically from north to south the list of probable producers includes the Scanlon Mine which supplied a floatation mill from adits in the southwest corner of section 28, T30N, the Golden Gate Mine in the east central part of the northwest quarter of section 32, the Blood and Halfway prospects between the two above mentioned mines, the Harmon development on multiple veins in a saddle in the divide in the middle of section 33, the Ford adit westward near the center of the west line of section 33, and the Climax Mine southeast of the center of section 33 near the fanglomerate overlap. (Figure 4).

Southward in T29N the prospects are numerous but unnamed through the copper-bearing system of faults and veins in Copper Basin, Copper Ridge and the Copper Blowout along the west edge of sections 4 and 9. A mile to the west the Golden Copper veins were prospected near the center of the west half of section 5, and the Golden Mile Mine adits produced silver and uranium in section 8 north of the center of the west line.

Southward farther along the principal fault zone and the western margin of section 9 into the Wall Street area of section 16, many prospect pits were dug on quartz-carbonate veins containing sulfides of copper and lead with gold. One prospect discovered vanadinite in a small shear zone. At the southern limit of major development is the Bluebird Mine in which copper and gold were found in a long adit near the center of the north edge of the northeast quarter of section 19.

Recorded lode mine production from the combined Gold Basin and Lost Basin mining districts (U. S. Geological Survey, 1982) during the period from 1901 to 1942 was 69,189 tons of ore yielding 13,508 troy ounces of gold, 6,857 troy ounces of silver, 5,918 pounds of copper and 43,652 pounds of lead. This production does not include gold from placer operations.

In the alluvial gravels east and west of the Lost Basin Range, stream bottoms were prospected mostly by dry washers after discovery of placer gold in 1931. The more accessible east alluvial area attracted the more serious investigations leading to three placer operations. Dry washing was attempted at the Lone Jack Mine in section 16, T29N, and at the Queen Tut Mine in section 34, T30N.

Following the increase in the price of gold in 1933, the King Tut placer operation was launched in sections 4 and 9, T29N. Systematic sampling of arroyo and gulch bottoms preceeding mining, blocked out 90,000 tons of placer material with an average value of 69¢ per cubic yard (Arizona Mining Journal, Pg. 10, July 30, 1933), calculated at the old $20.00 per troy ounce price. A pipeline was installed to bring water from Grapevine Canyon, 10½ miles to the southeast. The mining depth was limited by hard caliche to a maximum depth of 6 feet. Production by a small power shovel and trucks was sluiced until 1937 with a reported yield of almost 1,200 troy ounces of gold. None of the gold was mined from uneroded Muddy Creek fanglomerate.

The geographically most continuous producing drainage system was that of a branch arroyo draining northeastward about 1,200 feet southeast of the King Tut wash plant and heading near the center of section 9. As shown in Figure 7, the head of the arroyo and each succeeding gulch feeding the arroyo from the west was found to be rich in gold for a total distance southwest to northeast of nearly one mile. The eleven short segments of mineable gravel, arrayed in-echelon on an approximate bearing of N 50 degrees east, all head at an elevation slightly below that of the incised plane. The principal arroyo into which the gulches and branch arroyo drain was nowhere productive.

As shown in Figure 7, another series of short branch gulches to the north of the King Tut placer plant were trench mined, but the principal arroyo drainage was undisturbed by mining. Additional trench mining of gulch bottoms can be witnessed within the King Tut Mine area a few miles to the north and south. At least one additional short alignment of successive mined gulches occurs within a mile to the north straddling the old Pierce Ferry Road in Section 3, repeating the trend of pay gravels around the King Tut plant.

Following consolidation of the available placer properties by the Apache Oro Company, in 1967, two serious investigations of the placer potential were arranged by agreements first with Western Nuclear in 1969, and later with Vanguard Partners/ Western Contracting in 1974 and 1975. Western Nuclear sampled the Muddy Creek fanglomerate to depths of 100 feet in ten widely scattered locations chosen by Apache Oro and two shallower holes at sites chosen by Western Nuclear, testing depth to Proterozoic bedrock. Vanguard Partners/Western Contracting sampled over 100 sites from backhoe trenches mostly dug in the recent alluvium of drainage bottoms but also including some sampling from trenches dug in regolith and unconsolidated Muddy Creek sediment on inter-arroyo high ground. Both groups made gold valu determinations from physically extracted gold, using a Denver gold-saver.

Western Nuclear used a cable-tool drill to drive their holes and a bailer to collec samples. The samples represented five foot intervals which produced 200 to 1200 pounds of sand and gravel. Out of a total of 225 samples, 63 appeared in panning to be barren of any visible particulate gold in the concentrate from the gold saver Only 4 samples yielded more than six visible gold particles. The free gold in thes concentrates was amalgamated and weighed leading to a calculation of less than 5¢ in gold per cubic yard. One sample from which four gold "colors" were panned was amalgamated and weighed yielding a gold value of 1¢ per cubic yard. All values were calculated when gold was priced at $35.00 per troy ounce.

In the Western Nuclear sampling there is an apparent stratification of the gold values indicated in the distribution of the "colors" in six of the 100 foot holes.

Drill Hole Section	No.	Distance from Bedrock Outcrop	Percent of Total Gold	Interval of Hole
N 24	1	2 miles	83	Upper 40 feet
N 26	1	1 "	80	Upper 65 feet
2	2	2½ "	87	Upper 60 feet
4	1	.6 "	56	Upper 35 feet
10	2	1¼ "	71	Upper 30 feet
4	2	.3 "	82	Lower 50 feet

During the Western Nuclear cable-tool drill exploration, a simultaneous hammer-drill exploration was conducted in Proterozoic bedrock outcrop areas to the west in sections 33, 4 and 9 by Apache Oro. Western Nuclear split and composited all the samples from each of nine holes, each 80 feet deep. Hazen Research assayed the composites, reporting 0.01 troy ounce per ton in the single holes in sections 33 and 9 and in five of the holes in section 4. The other two hole composites in section 4 assayed 0.02 and 0.05 troy ounces of gold per ton.

Later in 1974, a 243 foot vertical diamond core drill hole was completed in bedrock in the northwest corner of section 9 by Vanguard Partners. No record exists of the assays or the core, but a sample collected by the U. S. Geological Survey from the sludge pile was reported to have a gold content of 0.083 troy ounces of gold per ton. The hole was located in an area of highly ferruginous, sheared and brecciated schist with broken quartz veining and silicification. The area is known as Copper Blowout Basin. In the vicinity of the drill hole, considerable stripping and trenching exposes bedrock.

Vanguard Partners/Western Contracting conducted a rapid but well-planned sampling of most of the placer area by backhoe, truck and Denver gold-saver. The sampling spanned the Lone Jack and King Tut Mine area along 3½ miles of alluvium between the old Pierce Ferry Road and the bedrock area. Most of the sampling tested sediment in drainage bottoms, but some areas of surface detritus and weathered Muddy Creek fanglomerate in the slopes between arroyos also were trench sampled. The gold recoveries in these tests appear to have been closely comparable in four widely spaced areas to those sought in the King Tut operations.

Three sample sites were spaced along 1,000 feet of an inter-arroyo slope in the east-central part of section 16, north of the Lone Jack Mine. Thirteen individual bulk samples at these sites returned values averaging $2.70 per cubic yard and ranging from $0.13 to $10.16, calculated at a gold value of $350.00 per troy ounce. Another site in an arroyo southeast of the Lone Jack in the northwest quarter of section 22 produced five samples averaging $7.12 per cubic yard. Two other sites in adjoining narrow drainages in the northwest corner of section 3, produced individual samples with values averaging $7.00 per yard. Another site farther northwest in section 4 yielded a sample with a gold content of $8.22 per cubic yard. A site about ½ mile west of the King Tut plant produced an arroyo sample containing $7.75 in gold per yard. The average gold value calculated at $350.00 per troy ounce for nearly 1½ million cubic yards represented by the 102 samples is $0.42 per cubic yard. 37 of the 102 samples were barren.

The Vanguard Partners/Western Contracting sample site locations, value distribution and observations of the sampling supervisor strongly indicate the immediate origin of the recent placer concentrations to be the Muddy Creek fanglomerate.

In 1976 Resources International Partners obtained a ten-year lease from American Heavy Minerals, a subsidiary of Apache Oro Company. Resources International promptly tested the bedrock and alluvium in sections 4 and 9, T29N, with several hundred percussion drill holes. Placer assays were not provided from this drilling. In 1977, they attempted to recover gold by heap leaching the recent alluvium from modern stream channels in section 4, north of the King Tut operations. Leaching was abandoned with no information about the methods of gold precipitation employed and no report of any gold recovery. In 1978, Resources International set u a wet placer operation using water from their new well in section 3 to recover gol by gravity. In five months they recovered 113 troy ounces of free gold, but then closed down the operation without formal explanation.

For the subsequent two years Resources International sought a buyer for the lease. Early in 1980, Amax contracted for 16 holes by Becker Drilling and sampled placer ground in bulk in two locations, all in areas previously sampled by Resources International. Assays from selected samples from twelve drill holes in sections 4 and 9 were reported. No assays exceeded 0.01 troy ounces of gold per ton, and Ama withdrew.

In 1981, Resources International sold their lease to Charter Gold Corporation. Charter contracted a sampling program by Becker Drilling Company and set up a grav ity test plant using Reichert spirals. Neither Charter nor International subsequently submitted a report of the locations of sampling, sample assays or test results. By the autumn of 1981, all exploration and testing ceased and none has resumed to this date.

Sampling of mineralized Proterozoic lode zones by Resources International (Apache Oro, 1979) has appeared to confirm the presence of high grade gold ore in narrow quartz veins within short ore shoots and of low grade gold ore in ferruginous breccia and gouge zones and in ferruginous carbonate veins up to twenty five feet wide.

Geologic History:

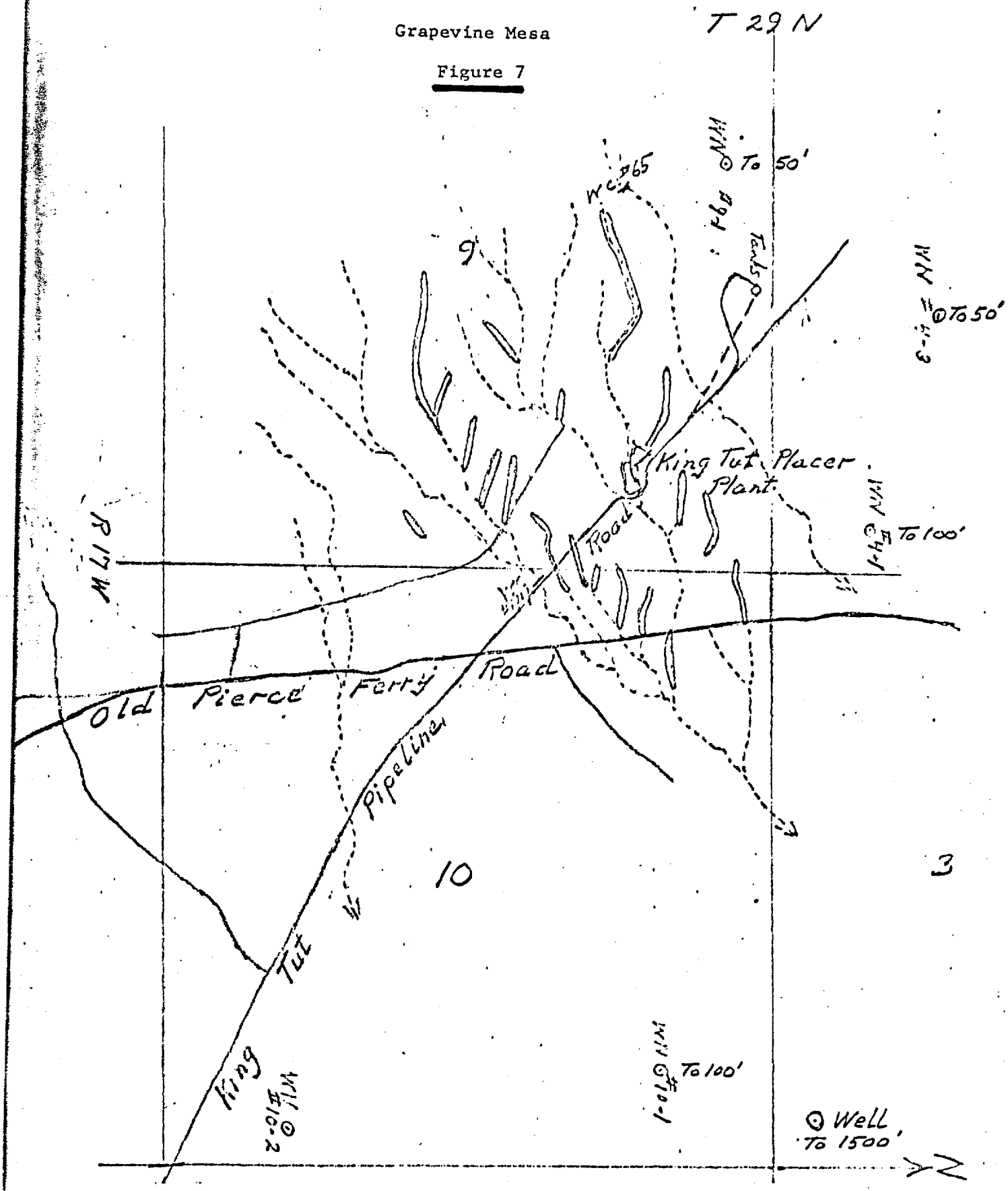
In western Arizona the oldest exposed rocks were deposited as mostly fine-grained sediments alternating with volcanic flows and ash-falls and chemical precipitates. After deposition of an unknown thickness of overburden and intrusion of basic igneous dikes and sills, crustal pressure built up from east and west. This event called The Mazatzal Revolution deformed the stratified rocks and built mountain highlands subject to rapid erosion. The deep strata responded to intense pressure and heat with recrystallization of the sedimentary minerals into a new assemblage more stable in the orogenic environment. The argillaceous layers, rich in clays, tended to become micaceous schists while the silica rich sands, silts and acid vol canics tended to become granular gneisses. The basic intrusives and extrusive vol canics tended to become hornblendites. Molten magma rising in the belt of deforma tion emplaced plutons of crystalline igneous rock from which rose volatile emanations carrying in solution a variety of highly reactive elements including the alk lis and silicon which interacted with the country rock along fissures and zones of fracturing, emplacing veins and pegmatites of quartz and feldspar with a little go An age of 710 to 830 million years has been established for the veins by analyzing the ratios of potassium and argon isotopes in muscovite mica from such veins. The local metamorphic rocks of this and older age are described as Proterozoic X.

Erosion which had accompanied the mountain building continue thereafter through an exceptionally long period in geologic time of crustal quiescence known as the Lipalian Interval. During this time the mountain-forming Proterozoic rocks were

King Tut Placer

Grapevine Mesa

Figure 7



Planimetry from Apache Oro colored aerial photograph

M line, No.6700

Notes for Files

From: R.M. Corn
September 26, 1985

Re: Apache Oro Properties &
Placer gold potential
Lost Basin District
Mohave County, Arizona

GENERAL

The Lost Basin properties of Apache Oro Company, located in T28, 29, and 30N, R17 & 18W, south of the southeast end of Lake Mead in northern Mohave County, Arizona were submitted to U.S. Borax in early June 1985 by Warren Mallory. Apache Oro has held this property for more than 25 years. Reportedly more than several million dollars have been spent on the property during this period resulting in no appreciable gold production and very little worthwhile data on mineral potential.

The Apache Oro properties are in the Lost Basin structurally rotated block of Precambrian and Tertiary volcanic and sedimentary rocks just west of the Grand Wash Cliffs. USGS Open-File Report 82-1052 on the Gold Basin-Lost Basin Area is the best geologic reference available, and describes mineralization as well as geology.

LAND

Apache Oro holds 92 unpatented placer claims and 174 unpatented lode claims on sections that alternate with Santa Fe Railroad land. The property is located along the crest of the Lost Basin Range and over the adjacent Tertiary conglomerates and alluvial gravels to the east.

EXPLORATION HISTORY AND DATA

Vein and placer gold occurrences in the area have been known since the late 1800's and have been intermittently worked on a relatively small scale since that time. The only substantial production has been from placer deposits that occur where Quaternary gravels and the old pre-Quaternary erosion surface lap on to rotated Tertiary conglomerates and mineralized Precambrian rocks. The generalized reports furnished by Mr. Mallory indicate that the area has been explored by several groups since the late 1960's.

1969 Western Nuclear - Churn Drilling of placer ground.
Five foot intervals from drill holes were processed and panned to concentrate recoverable gold. Four of the 225 samples processed contained recoverable values of .0014 oz. gold (50¢/yd at 350/oz Au) while the others had either smaller amounts or no recoverable gold.

1969 Apache Oro - Nine 80 foot deep Hammer holes were drilled in Secs. 33, 4 and 9. Composite assays of the entire 80 foot interval drilled in each hole were:

8 holes - .01 oz Au/ton or less
1 hole - .02 oz Au/ton
1 hole - .05 oz Au/ton

(Reliability of the assays is not known.)

1974-1975 Vanguard Partners/Western Contracting -- Backhoe Trenches of Placer gravel. Reported values were extremely variable. Reserves reported were 1½ million yards averaging .0012 oz recoverable gold (40¢/yd at 350/oz Au).

One 243 foot DDH in NW cor. Sec. 9. No data on core assays. (Rumored sludge assay of .083 oz AU?)

1976 Resources International Partners - Sampled placer gravels with several hundred percussion drill holes (results are not known -- data not available).

1977 Resources International Partners attempted to cyanide heap leach placer gravels and recovered a minor amount of gold in a wet placer operation.

1979 Resources International sampled veins and mineralized breccias in exposed Precambrian rocks. No data available on this sampling.

1980 AMAX sampled placer gravels with 16 drill holes. Recoverable values were all less than .01 oz gold/yd.

1981 Charter Gold Corp. sampled placer gravels by drilling. Results were not reported.

Additional work by Apache Oro at Lost Basin includes:

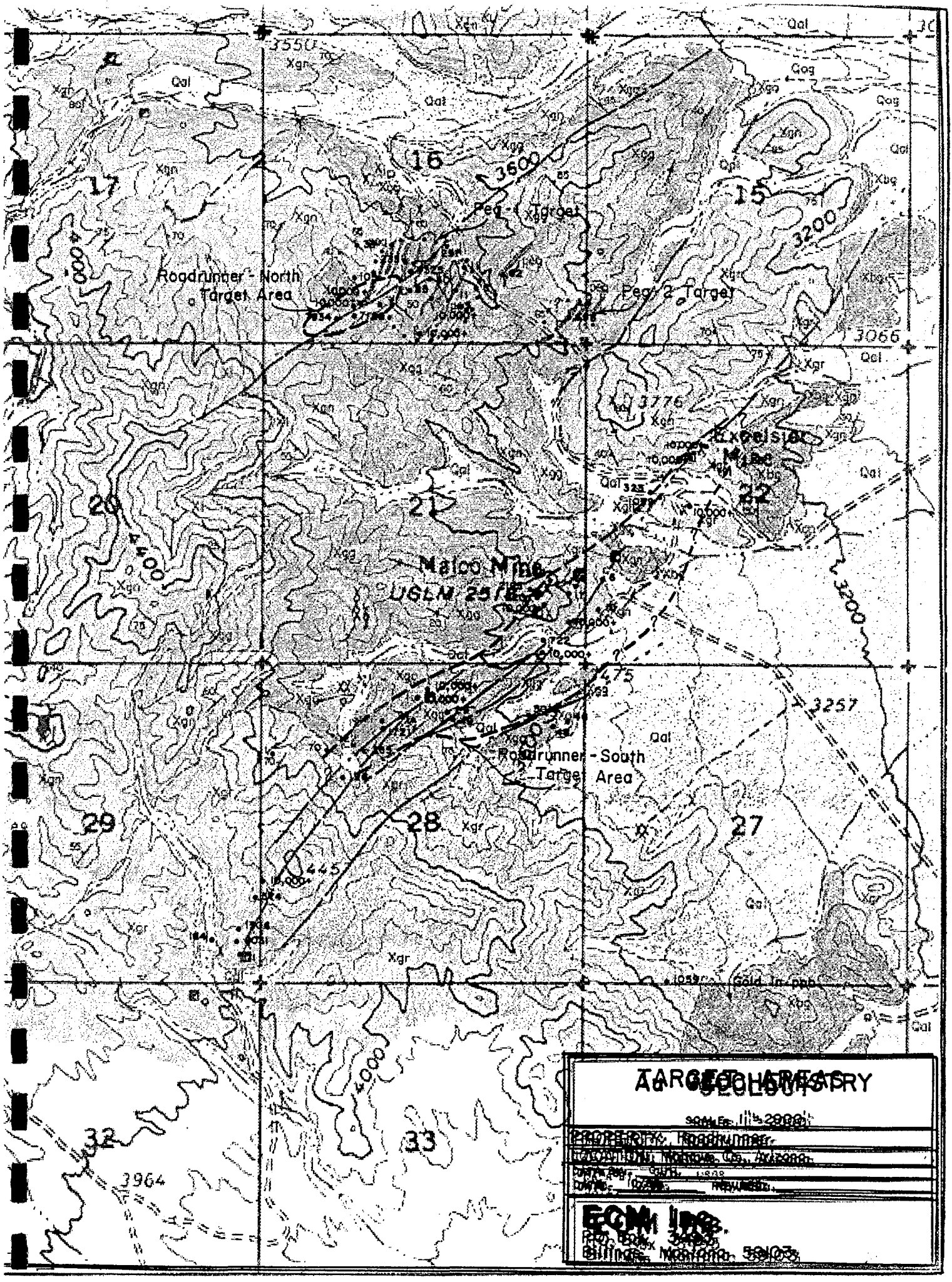
Airborne Magnetometer Survey
Gravity Survey over a limited area
IP Surveys
Generalized geologic studies

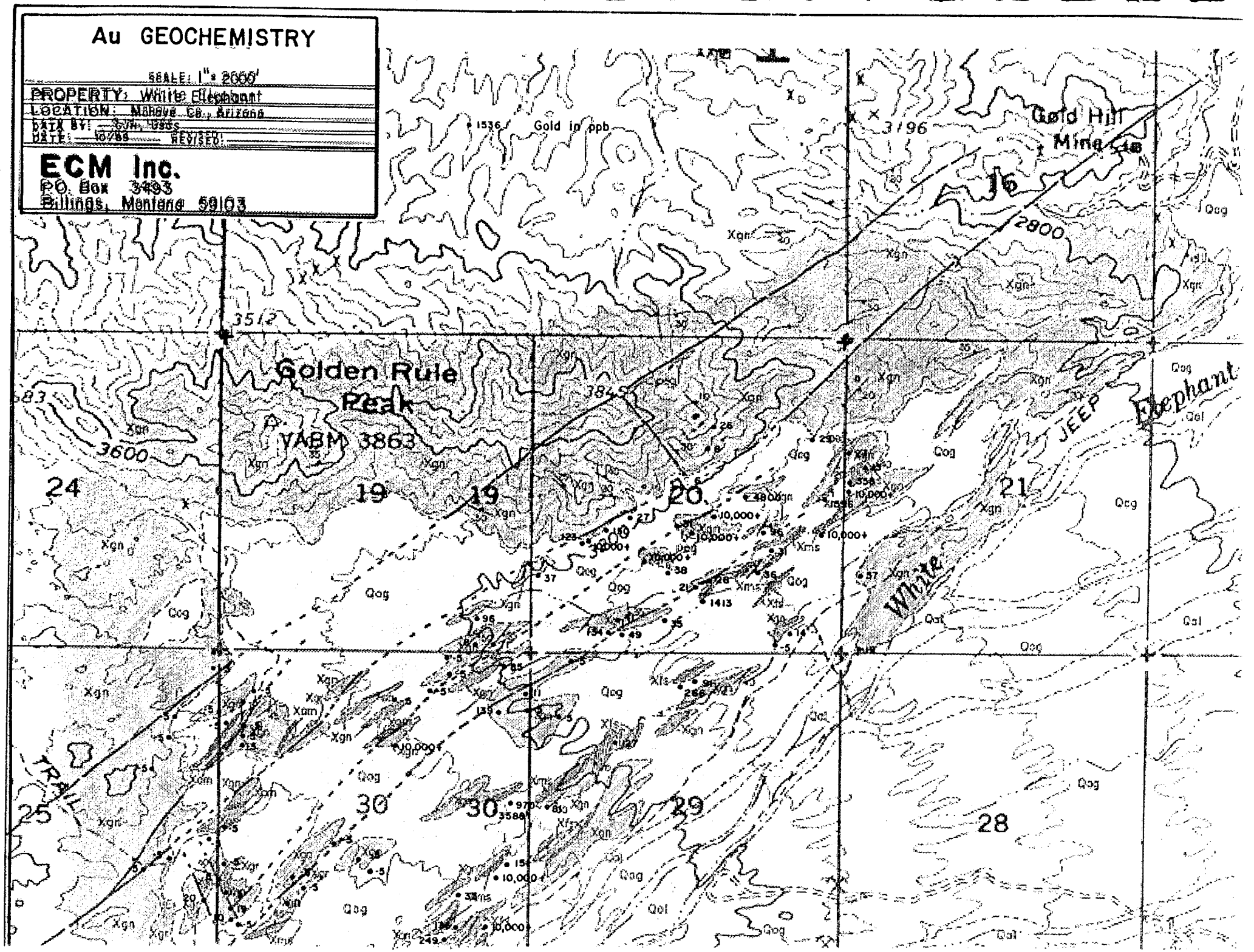
Although there are references to reports, Mr. Mallory did not provide any detailed data, sample, geochem, etc., on the vein and mineralized breccia zones in the Precambrian rocks, and no data was presented from any holes that have been drilled in breccia zones or altered areas in the Precambrian. Consequently, it is doubtful if any mineralization of significance was encountered in this previous drilling. The porphyry copper-molybdenum target discussed by Mr. Mallory is "wishful thinking" and has no basis in geologic fact.

MINERALIZATION AND EXPLORATION POTENTIAL

Types of gold mineralization known at Lost Basin and their exploration potential include:

1. Placer gold in Quaternary channel gravels:
   Available data indicates that these placers may have values of .01 to .03 oz Au/yd in small and very restricted alluvial channels.
2. Placer gold in tertiary conglomerates: Data indicates that recoverable gold values in any substatial volume of material is less than .0015 oz Au/yd and that these placers are not economically significant.


Roadrunner - North Target Area
Peg 1 Target
Peg 2 Target
Excelsior Mine
Malco Mine
UGLM 25 RE
Roadrunner - South Target Area
Gold In ppb
TARGET AREA GEOLOGY
SCALE: 1" = 2000'
PROPERTY: Roadrunner
LOCATION: Mohave Co., Arizona
ECM INC.
Box 3495
Billings, Montana 59103


Au GEOCHEMISTRY
SCALE: 1" = 2000'
PROPERTY: White Elephant
LOCATION: Mohave Co., Arizona
DATA BY: GJH, USGS
DATE: 10/88 REVISED:
ECM Inc.
P.O. Box 3493
Billings, Montana 59103
Gold in ppb
Gold Hill Mine Site
Golden Rule Peak
YABM 3863
White Elephant
JEEP TRAIL
2800
3600
3512
3196
1536
24
19
20
21
25
30
29
28
16
Qog
Qal
Xgn
Xms
10,000+

MINERALIZATION and TARGET AREAS

SCALE: 1" = 2000'

PROPERTY: White Elephant

LOCATION: Mohave Co., Arizona

DATA BY: GJH, USGS

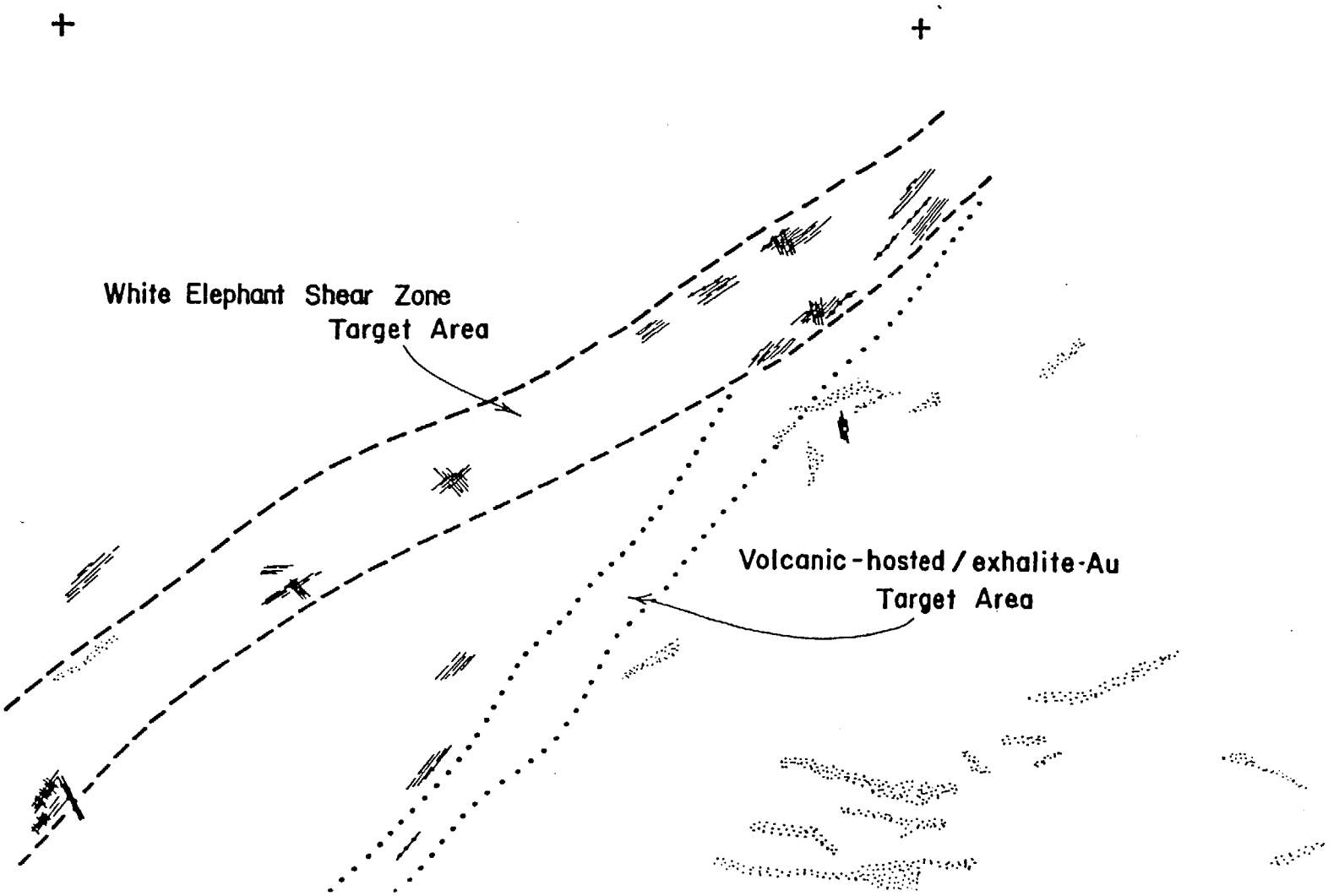
DATE: 10/89 REVISED:

ECM Inc.
P.O. Box 3493
Billings, Montana 59103

Quartz - CO_3 ± limonite(sulfide) veinlets and limonite(sulfide)-bearing fractures

Quartz - Kfeldspar - CO_3 ± sulfide veins and pegmatites

Area of placer mining



Schrader - 1909 - USGS Bull 397

rite.[a] It is said to be less rich in the sulphide zone in the lower part of the mine than in the oxide zone near the surface. Its run of mine, roughly computed from a record of the output from October 10, 1885, to March 6, 1901, is about as follows: Silver 160 ounces and gold 2 ounces to the ton; lead, 12 to 20 per cent.

Production.—The production is reported to be $1,300,000, that of silver alone amounting to about $1,000,000; and several thousand dollars' worth of medium-grade ore are said to now lie on the dump. The output was mostly made between the autumns of 1885 and 1892. During this period 3,687 tons of ore are reported, according to smelter return sheets, to have contained about 402,000 ounces of silver, 1,180 ounces of gold, and 515,760 pounds of lead. Later, about 1900 to 1902, about 17,550 ounces of silver, 180 ounces of gold, and 114,360 pounds of lead are said to have been obtained from 330 tons of concentrates.

MINES OF CANYON STATION WASH.

In Canyon Station Wash, about a mile north of C. O. D. Wash, there are reported to be several small mines, of which the most important seem to be the Baden-Baden, King, and Queen mines, said to be owned by Lewis Davidson, of Kingman.

MINES IN "TOP OF STOCKTON HILL" AREA.

The "top of Stockton Hill" is situated in the northwestern part of the district, at the crest of the range, between the northern part of the Cerbat district on the west and the heads of I. X. L. and C. O. D. washes on the east. The mines include the Cincinnati, Miner's Hope, Blue Bell, Fountain Head, Brown, and others, the most important of which seems to be the Cincinnati. It is situated near the crest of the range about midway between Lane Springs and I. X. L. basins. It has not been worked for many years, but is regarded as a good property.

GOLD BASIN DISTRICT.

GENERAL FEATURES.

The Gold Basin mining district, of which Basin is the post-office, is situated in the eastern part of the White Hills (fig. 18). It extends over a hilly area about 6 miles in diameter, sloping to Hualpai Wash on the east, and ranges from 2,900 to 5,000 feet in elevation. The northeastern portion, where most of the mines are situated, is rugged, being marked by longitudinal fault scarps and scored by

[a] The mine is said to contain no copper above the 200-foot level, but in an opening about half a mile west of the mine and about 500 feet above it, on what is thought to be the same C. O. D. vein, the ore, which here occurs in a milk-white quartz gangue, contains chiefly bornite and chalcopyrite, with some zinc blende, and about $20 in gold to the ton.

several deep transverse washes, of which the principal ones are Banker, O. K., and Cyclopic, situated about 2 miles apart. The nearest railway station is Hackberry, 40 miles to the south, with which connection is made by stage line. Colorado River lies 16 miles to the north. Mineral was first discovered here early in the seventies, but remoteness from the base of supplies, together with scarcity of fuel and water, renders operations expensive and has materially retarded developments. Nevertheless, considerable progress has been made and much ore has been produced and worked in arrastres and mills.

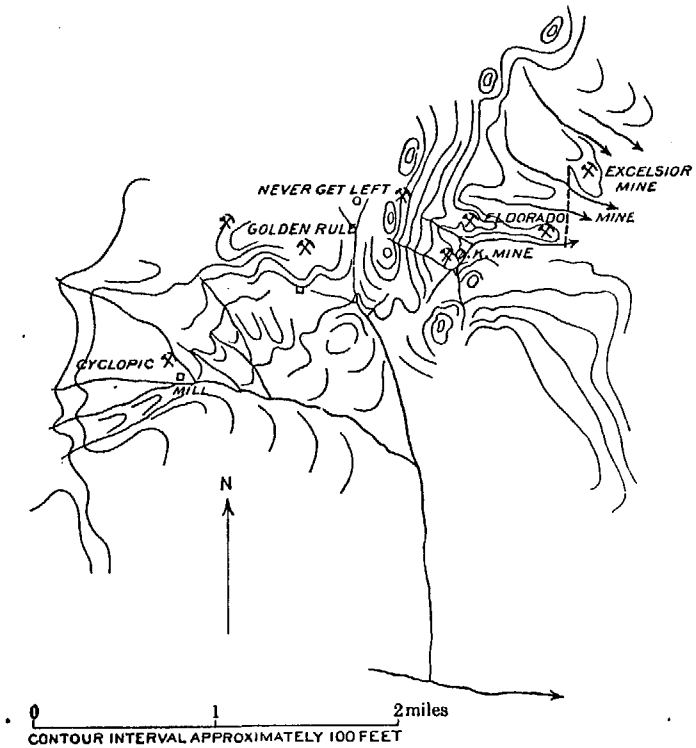


FIGURE 18.—Sketch map of Gold Basin district.

The deposits occur mainly in fissure veins in the pre-Cambrian crystalline rocks. The veins dip southeastward or northwestward, mainly at angles of 40° or 70°. The gangue is quartz, in places with siderite, and the metal is gold, mostly free milling, but it is associated with lead or copper ores, copper stain being a good indication of the gold values. Pyrite, chalcopyrite, galena, molybdenite, and wolframite are found, but the ore is largely oxidized, the water level not having been reached. Among the oxidized products are limonite, malachite, cerusite, and vanadinite.

The district contains about half a dozen small mines and about an equal number of good-looking prospects. The relative location of the most important is shown in the small sketch map (fig. 18). The principal mines are the Eldorado, Excelsior, Golden Rule, Jim Blaine, Never-get-left, O. K., and Cyclopic. The production of the district is given as more than $100,000, most of which came from the Eldorado mine.

ELDORADO MINE.

Location and history.—The Eldorado mine is located in the high foothills in the eastern part of the district, at about 4,000 feet elevation and 1,000 feet above Hualpai Wash, which is about 2 miles distant. The mine is reached by wagon road, over which most of the ore was hauled to the Basin or O. K. mill, 4 miles distant in Hualpai Valley. This mill, which was burnt while in operation in August, 1906, contained 10 stamps and a cyanide plant.

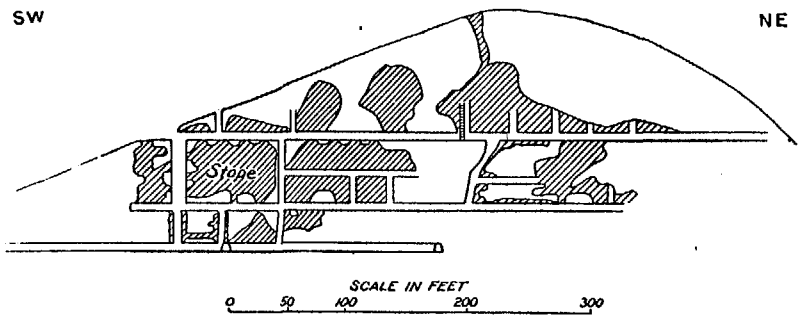


FIGURE 19.—Longitudinal section of Eldorado mine, showing stopes.

The mine was discovered late in the seventies and produced the first bullion taken from the district, much of its ore being at first worked in arrastres. It is owned by the Arizona-Minnesota Gold Mining Company, of Minneapolis. The production is reported to be $65,000, of which $5,000 was produced prior to 1902.

Developments.—The mine is developed principally by about 2,000 feet of tunnels and drifts and 40,000 cubic feet of stopes on three levels, aggregating probably about 90,000 cubic feet of underground work and distributed approximately as shown in the accompanying diagram (fig. 19). The lower tunnel trends about N. 33° E. and strikes the vein at about 200 feet in from the mouth. From this point the drift extends about 200 feet to the northeast.

Geology.—The country rock is a reddish schistose medium-grained granite. On the northeast, however, as shown at the surface and in the bottom of the mine, this rock gives way to a dark friable biotite granite. The contact between the two rocks dips about 30° W. It is usually sharp and is probably a fault plane, which seems to cut off the vein on the northeast.

Veins and ores.—The deposit is a fissure vein, which strikes about N. 50° E. and dips 65° SE. It is continuous from the apex at the crest of the ridge to the contact in the lower tunnel of the mine and is stoped out through most of this extent. The walls are fair, but not regular. The vein averages several feet and the ore shoot about 20 inches in width. It contains iron-stained, free-milling gold-quartz ore, and is reported to average from $12 to $15 a ton in gold. The other associated minerals are malachite, lead carbonate, and vanadinite, the last occurring locally as incrustations of crystals one-fourth inch in maximum length. The principal mill treatment given to the ore was crushing, plate amalgamation, and cyanidation.

Just northwest of the apex of the vein above described and about 80 feet above it is the blanket vein, which is exposed for a length of 600 feet and a width of about 100 feet and which has contributed largely to the output of the mine. It dips about 25° E.

O. K. AND EXCELSIOR MINES.

The O. K. and Excelsior mines were discovered and located by three prospectors, Patterson, Rowe, and Fox, early in the eighties. They worked the ores in arrastres and hauled some to the 4-stamp mill at Grass Springs. In 1886 the O. K. was sold to a Kansas City company, which at once put up the O. K. mill in Hualpai Valley and ran it intermittently from 1887 to 1890. The mill burned down in 1893, but was rebuilt in 1896 and operated by lessees for a time, and then again shut down. It started once more early in 1902 and ran intermittently until 1906, when it burned down while in operation. The water used at the mills was piped from the springs or water tunnels in the upper part of Grand Wash Cliffs, 7 miles to the northeast. The mines are now owned by the Arizona-Minnesota Gold Mining Company.

O. K. mine.—The O. K. mine is about half a mile south of the Eldorado mine and about 100 feet below it, on the opposite side of O. K. Wash. The mine is developed mainly by adit drifts, winzes, and stopes on four levels. There is about 1,600 feet of underground work, distributed approximately as shown in the section (fig. 20). The production is reported to be about $25,000.

The country rock is a dark biotite granite, about the same as that which occurs in the bottom of the Eldorado mine. The strike is N. 30° E., with dip vertical. Slickensides pitch northeast-east toward the mouth of the drifts at angles of about 35°.

The vein trends N. 65° E., but curves to the north in its course and dips about 75° NW. It averages about 18 inches in width and is

composed mainly of seamed, gold-bearing limonite-stained quartz, said to average about $10 in gold to the ton. The hanging wall of the fissure is regular, but rough. Small faults 2 to 6 feet in throw occur, locally accompanied by overlap and enlargement of the vein. The ore favors the hanging wall, but where the vein overturns on the third level and the hanging wall becomes the foot wall the ore, nearly 1 foot thick, occurs in the foot-wall side.

The ore is free milling, but not so much so as the Eldorado ore, the gold being associated with cerusite. The principal other associated minerals are limonite, hematite, siderite, galena, molybdenite, and wolframite.

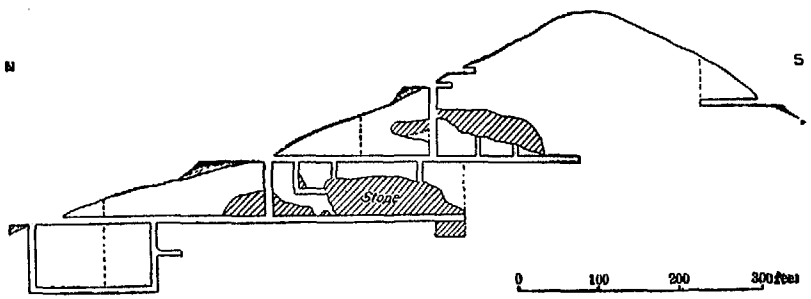


FIGURE 20.—Longitudinal section of O. K. mine, showing stopes.

Excelsior mine.—The Excelsior mine is about a mile northeast of the Eldorado and O. K. mines, in the low foothills near the edge of Hualpai Valley and about 500 feet above it, on the north side of O. K. Wash. The mine is developed to a depth of about 100 feet, principally by inclined shafts, drifts, and stopes, aggregating 500 feet of underground work. The production is reported to be $5,000.

The country rock is a coarse reddish granite associated with black amphibolite schist. The vein dips about 45° NW. It is from 1 to 4 feet in width and is locally occupied by gouge only. The ore shoot contains deeply iron-stained gold-bearing quartz or ore. It varies from three-fourths to 1 foot in width and occurs mainly on the hanging wall. The ore is said to be cyaniding ore, only a small percentage of the values yielding to amalgamation.

MASCOT MINE.

The Mascot, formerly the Old Homestake mine, is situated north of the Excelsior mine in the foothills at the edge of Hualpai Wash, and is said to contain a vein only 3 inches in width, which, however, is reported to be very rich. It is owned by the Arizona-Minnesota Gold Mining Company.

NEVER-GET-LEFT MINE.

The Never-get-left mine is located in the upper part of a cliff fault scarp that overlooks the Eldorado mine on the east, from whi it is but a few hundred yards distant. It is situated at about 4,5 feet elevation, or 1,600 feet above Hualpai Valley. It is owned Henry Paully, of Basin, and is developed principally by an ad drift, shallow shafts, and open cuts, aggregating several hundred fe of work.

The country rock is dark gneissoid schist. The structure di about 50° W., but the principal deposit dips about 80° N. It has width of 6 or 8 feet and contains mainly iron-stained or coppe stained crushed gold-bearing quartz. The country rock is great disturbed by jointing, fracturing, and faulting, and its true charact is somewhat doubtful. The mine has been a small producer for son years and was shipping ore in April, 1906.

GOLDEN RULE MINE.

Location and history.—The Golden Rule mine is about 1 mile we of the Never-get-left mine, at the extreme head of O. K. Wash, about 4,550 feet elevation. It was discovered in the early eighties Robert Patterson and Saul Rowe, who hauled some of the ore to t Grass Springs mill. Subsequently they leased the mine to M Quackenback, and in 1900 sold it to the present owner, the Arizon Minnesota Gold Mining Company. This company did but lit development work on it till 1906. From May 15 to November 1 was operated with a force of ten men, but was closed on the latt date. The production of the mine is estimated to be about $5,0 most of which came from the blanket vein.

Development.—The mine is developed by a 75-foot shaft, about 3 feet of drift, stopes, and a 25° incline about 100 feet long and 20 40 feet in width, the incline being on the south, where the depos occur in the form of a blanket vein. The workings are contain within a horizontal distance of about 700 feet and a vertical distan of about 100 feet. The mine is handicapped by lack of water, whi has to be hauled from the Cyclopic mine or from Basin, in Hual Valley.

Geology and ore deposits.—The country rock is the pre-Cambri gneiss and schist. The fissure vein containing the principal part the deposits strikes N. 20° E. and dips about 70° ESE. The cr pings, which in part are prominent, form a reef of iron-stain firmly cemented quartz breccia. The vein is best exposed in the no drift. It is about 2½ feet in average width and contains gold-beari normal vein quartz, locally crushed, recemented, and iron-stain Associated with it on either side is a sheet of pale grayish or whit

gouge. The vein is said to yield good values throughout, the average being about $10 in gold to the ton, but the honeycombed quartz is the richest part of it.

At 120 feet in from the mouth of the drift the vein is abruptly cut off by a fault, immediately beyond which occurs a dark schistose rock that may be an intrusive. Near the fault the vein enlarges to about 12 feet in width, the enlargement being mainly on the foot-wall side and containing much honeycombed quartz, and the ore, greatly increased in quantity, is said to contain higher values. Some of it averaged about $100 a ton in a large chamber, from which much ore has been removed.

The fault hades north at an angle of about 10°. It is a normal one and the lost portion of the vein has risen toward the southeast. The amount of throw was not determined, but it is probably not very great. Beyond the fault the drift extends about 100 feet on the projected course of the vein which, however, has not been found.

On the south the deposits occur in a blanket vein, which is 3 to 5 feet thick, dips about 25° SE., and is probably a portion of the vein in the north drift, for it straightens up in that direction toward the top of the hill. The blanket portion has been mined over an area of about 100 feet along the strike and a breadth of 35 feet down the dip, and it probably produced good values.

CYCLOPIC MINE.

Location and history.—The Cyclopic mine is located in the southeastern part of the district, about 5 miles southwest of the Eldorado mine, near the head of Cyclopic Wash, at about 4,500 feet elevation, on open ground. It was discovered in the early eighties by Patterson, Rowe, and Glen, and about 1896 it was leased to a Seattle company. In 1901, with the Golden Rule mine, it was sold to Robbins & Walker, of Minneapolis, who milled some ore. The coarse tailings still on the ground are said to contain about $7 in gold to the ton. Since 1904 the mine has been owned by the Cyclopic Gold Mining Company, of Denver. A considerable amount of bullion is said to have been produced, but the exact amount was not ascertained.

Developments.—The mine is developed mainly by shallow, mostly inclined shafts, drifts, and crosscuts to a maximum depth of about 70 feet, but most of the workings do not extend below 30 feet. The developments probably aggregate about 1,000 feet of work.

As the mine is located in a broad wash, some of the workings have become filled with wash débris at times of flood. The principal equipments are an Ellspass mill, operated by a 26-horsepower engine, and a cyanide plant. The water supply is pumped by a small gasoline plant from the west side of the range, several miles distant.

Geology.—The country rock is a medium-grained coarsely porphyritic granite. It outcrops in association with the deposits and forms the foothills immediately on the southwest. Paralleling this rock, the wash, and the deposits on the northeast, and constituting the ridge on which the office and other buildings stand, is a fine-grained reddish granitic rock, with which is associated some of the same biotite granite that underlies the Eldorado mine. In contact with the deposits, particularly to the northwest, there is also a coarse red pegmatite.

Deposits.—The deposits are ill defined and not well understood. They consist of gold-bearing iron-stained breccias and sands of vein quartz, in a few places somewhat resembling conglomerate. This material is cemented by silica and iron oxide, but is in part loosely coherent. It trends from a point near the mill N. 57° W. up the wash and is contained in, and for the most part seems to occupy, an area three-fourths of a mile in length by about 200 feet or more in width. Prominent reefs of silicified iron-stained breccia several or more feet in width outcrop several feet above the surface. They are in practically all respects identical with the croppings of the Golden Rule and other veins that have been described. They do not, however, as a rule, continue in depth in the manner of a fissure vein, nor seem to have any definite fissure wall, but usually at a short distance below the surface give way to less firm material having an imperfect synclinal structure. In the northern part, the pseudovein croppings dip toward each other and their attitude suggests that they may be synclinal limbs of the same vein deposit.

From the principal openings near the mill in the southeastern part of the deposit the croppings representing the main or Cyclopic vein extend N. 57° W. They are continuous for the first 400 feet and are accompanied by some underlying vein quartz or ore and show ore in sight at both ends of the 400-foot excavation. Between this vicinity, however, and the northwest limits of the deposits, the croppings of the vein are interrupted, and some pits and cuts have failed to find ore there.

The croppings of the other vein extend without interruption from a point about one-fourth of a mile northwest of the principal opening for a distance of 350 feet to the northwest. They are nearly parallel with the main vein, from which they are about 350 feet distant.

The ore thus far has been derived mostly from these veins, but crosscuts 80 feet or more in length have been run in a considerable portion of the deposits between them and report fair values, which, however, seem to occur in lines or zones paralleling the deposit. Practically no mining has been done below a depth of about 30 feet. Near this level there is reported to occur a bed of red clay or gouge, which was formerly supposed to mark the lower limit of the ore, but

ore is said to have been found below it. The altered granite for a width of 100 feet or more bordering the deposit is also said to contain $2 to $4 a ton in gold.

The ore is of low grade, and is said to mill on the average from $7 to $8 a ton in gold, and to cyanide well. It contains also a little silver and a trace of copper, the latter occurring chiefly as malachite and not in sufficient amount to interfere with the cyanidation. The company is reported to have recently computed about 1,000,000 tons of ore in sight.

GOLD BELT MINE.

The Gold Belt mine is located on the southeast side of Banker Wash, at about 5,000 feet elevation. It is owned by Henry Paully. The country rock is an amphibolite schist, dipping about 30° W. At the western of the two principal openings the deposits are contained in a blanket vein of quartz 15 feet thick, inclining gently eastward, but thinning out in a distance of about 30 feet. The eastern opening shows two quartz blanket veins, each 2 to 6 feet in thickness, dipping gently westward and separated by a 4-foot dike of some volcanic rock that seems to be basalt, but is altered beyond identification.

The ore is said to be of two grades, the lower grade yielding from $4 to $7 in gold to the ton and the better grade from $16 to $20 to the ton and some as high as several hundred dollars a ton, that occurring in the porous or honeycombed quartz being the best. The deposit is reported to have produced a few hundred dollars' worth of ore.

SENATOR MINE.

The Senator mine is located some distance beyond the border of the Gold Basin district, about 7 miles northwest of the Eldorado and Golden Rule mines and about 7 miles south of Colorado River, on a low round hill at the southeast base of a prominent landmark known as "Senator Mountain." The mine was discovered late in the eighties by John Burnett, who in 1892 sold it for $14,000 to Senator Page, of Los Angeles, who in turn sold it to a Colorado company. The company at once installed a 10-stamp mill on Colorado River, 2 miles below Salt Springs, operated the mine and mill for about six months, and then suspended. Later the property was acquired by or leased to the Salt Springs Mining Company, which operated it about a month in 1903 and shut down, the ore being of too low grade to pay for its haulage to the mill, 7 miles distant, and for bringing supplies from Hackberry and Kingman, 50 and 60 miles distant, respectively. The mine is reported to have been abandoned since then.

The mine is developed principally by open work, cuts, and adit drifts. The deposits are said to be nearly flat lying and similar in character to those of the Cyclopic mine (p. 125), but they form a larger body. The ore is said to be similarly low in grade, averaging about $3 in gold to the ton. According to Comstock,[a] the deposits exhibit structural features resembling those of "brecciated fusion" and "cooling lamination" and in origin seem to be associated with igneous intrusion.

DEPOSITS AT SALT SPRINGS.

The Salt Springs mine is about 7 miles northeast of the Senator mine and several miles south of Colorado River, in the first canyon west of Hualpai Wash. It is owned by the Salt Springs Mining Company, which is said to include members of the Arizona-Minnesota Gold Mining Company. The country rock is granite. The gold ore is said to occur sporadically in quartz bodies, and its downward limit is usually indicated by copper-stained quartz.

Other properties in this district are the Smuggler-Union group, the Eureka mine, and the Lutley group.

WHITE HILLS DISTRICT.

GENERAL DESCRIPTION.

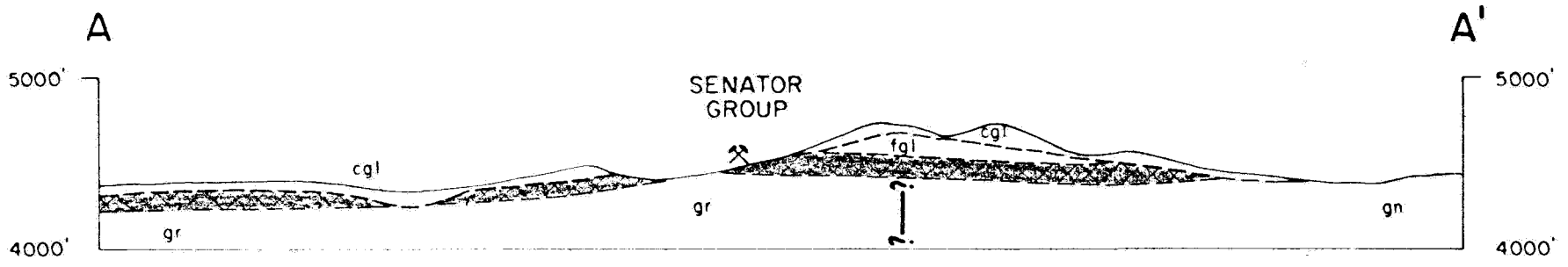
LOCATION AND HISTORY.

The White Hills district is located about 28 miles north of Chloride, in the western border of the White Hills, at about 3,000 feet elevation. It comprises an area about 2 miles in diameter and is a part of the Indian Secret mining district, so named because the knowledge of the presence of its mineral was for a long time withheld from the whites by the Indians.

The first discovery of mineral in the district by white men was made by Henry Shaffer in May, 1892, through the aid of an Indian known as Hualpai Jeff, who exhibited a piece of rich silver ore at Gold Basin and showed Shaffer its source, where the Indians procured the supply of red iron oxide with which they adorned their faces. The locality is at the site of the Hidden Treasure mine.

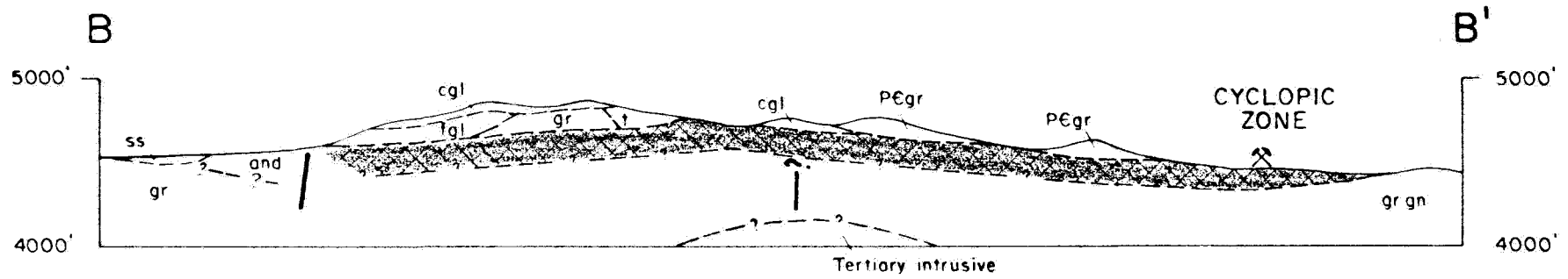
After making several locations, Shaffer reported the discovery at Gold Basin and was soon joined by John Burnett and John Sullivan, who also located what later proved to be some of the best mines. The trio began work and were soon shipping very rich ore, some averaging $1,000 a ton. The camp soon became the largest in the region and reached its zenith in 1894, with a population of 1,200. Within a short time the camp was owned by one company, the White Hills Mining Company, of which the chief men were R. T. Root and D. H. Moffatt, of Denver. A 10-stamp mill was built early in 1904; in

[a] Comstock, Theodore B., Geology and vein phenomena of Arizona: Trans. Am. Inst. Min. Eng., vol. 30, 1900, pp. 1048–1049.



LOOKING NORTHWEST

IN THE VICINITY OF THE SENATOR MINE



LOOKING NORTHWEST

IN THE VICINITY OF THE CYCLOPIC MINE

SECTIONS SHOWING THE GOLD BASIN CRUSH ZONE

GOLD BASIN DISTRICT

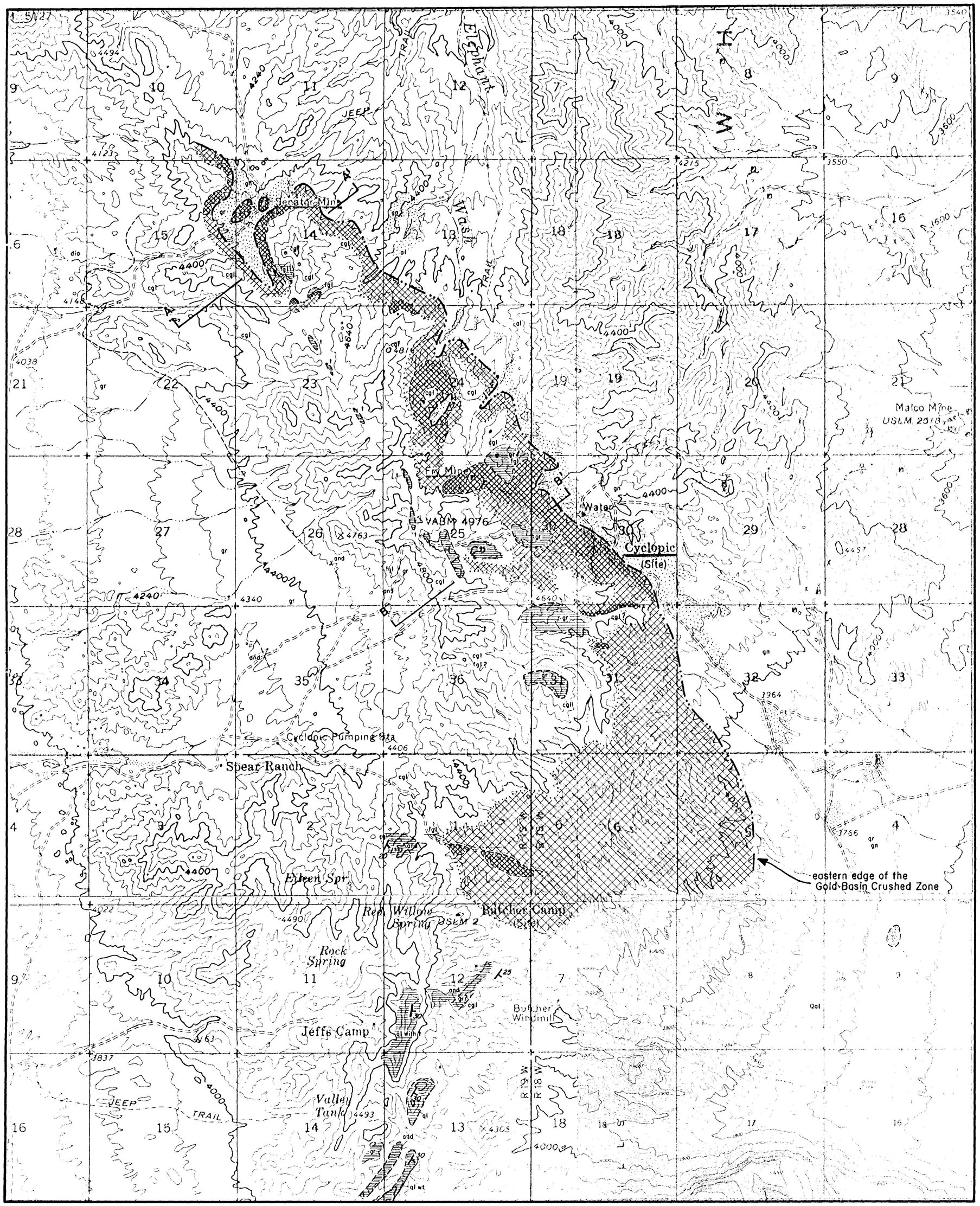
MOHAVE COUNTY, ARIZONA

1" = 1,000' H=V

GOLD BASIN CRUSH ZONE

For explanation of rock symbols, see Plate I

PREPARED FOR: PACIFIC COAST MINES, INC.	*CORN & AHERN CONSULTING GEOLOGISTS TUCSON, ARIZONA*
PREPARED BY: R. M. CORN and R. AHERN	TO ACCOMPANY DECEMBER, 1981 REPORT, EXPLORATION POTENTIAL FOR BULK TONNAGE GOLD MINERALIZATION, GOLD BASIN DISTRICT
DATE: NOVEMBER, 1981	PLATE 2



STRUCTURAL PSEUDO-STRATIFICATION LAYERS

UPPER PLATE: tilted listric fault blocks of pre-Tertiary igneous and metamorphic rocks overlain by tilted Tertiary volcanic and sedimentary rocks

CRUSHED ZONE: 50 to 150 feet thick gouge, breccia, and rubble derived from both rotated Tertiary rocks and Precambrian rocks, including dikes and pre-Middle Tertiary quartz veins; (lighter pattern represents covered area with crushed zone inferred)

LOWER PLATE: uniform competent rocks that grade to fractured and irregularly sheared rocks adjacent to crushed zone

EASTERN EDGE OF GOLD BASIN CRUSHED ZONE; dashed where approximately located, dotted where concealed

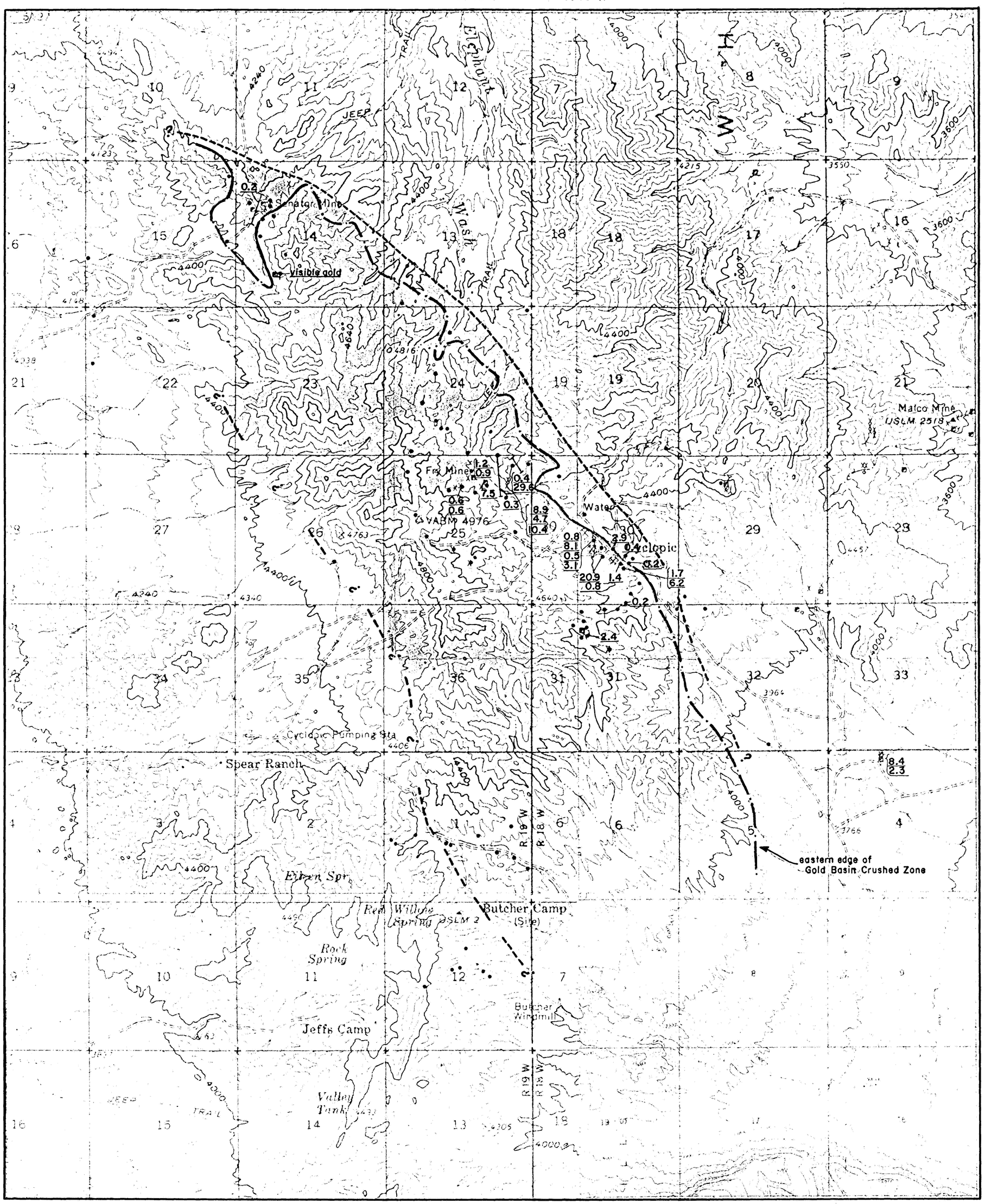
ROCK TYPES

Qal	ALLUVIUM
cgl	CONGLOMERATE
	LISTRIC FAULTING
ss	SANDSTONE
t	TUFF
	LISTRIC FAULTING; GOLD BASIN CRUSHED ZONE
fgl	FANGLOMERATE
qt, wt	QUARTZ LATITE, WELDED TUFF
and	ANDESITE
gr	PORPHYRITIC GRANITE
dio	DIORITE
gr	PRECAMBRIAN GRANITE
al	ALASKITE
gn	GNEISS

STRUCTURE - GEOLOGY MAP
GOLD BASIN DISTRICT
MOHAVE COUNTY, ARIZONA

1" = 2,000'

PREPARED FOR: PACIFIC COAST MINES, INC.	CORN & AHERN CONSULTING GEOLOGISTS TUCSON, ARIZONA
PREPARED BY: R. M. CORN and R. AHERN	TO ACCOMPANY DECEMBER, 1981 REPORT, EXPLORATION POTENTIAL FOR BULK TONNAGE GOLD MINERALIZATION, GOLD BASIN DISTRICT
DATE: NOVEMBER, 1981	PLATE 1



GOLD GEOCHEMICAL MAP
GOLD BASIN DISTRICT
MOHAVE COUNTY, ARIZONA

1" = 2,000'

PREPARED FOR: PACIFIC COAST MINES, INC.	CORN & AHERN CONSULTING GEOLOGISTS TUCSON, ARIZONA
PREPARED BY: R. M. CORN and R. AHERN	TO ACCOMPANY DECEMBER, 1981 REPORT, EXPLORATION POTENTIAL FOR BULK TONNAGE GOLD MINERALIZATION, GOLD BASIN DISTRICT
DATE: NOVEMBER, 1981	PLATE 4

JDS

GEOLOGY AND GOLD MINERALIZATION

GOLD BASIN – LOST BASIN MINING DISTRICTS

MOHAVE COUNTY, ARIZONA

GEOLOGY AND GOLD MINERALIZATION

GOLD BASIN - LOST BASIN MINING DISTRICTS

MOHAVE COUNTY, ARIZONA

RUSSELL M. CORN

February, 1991

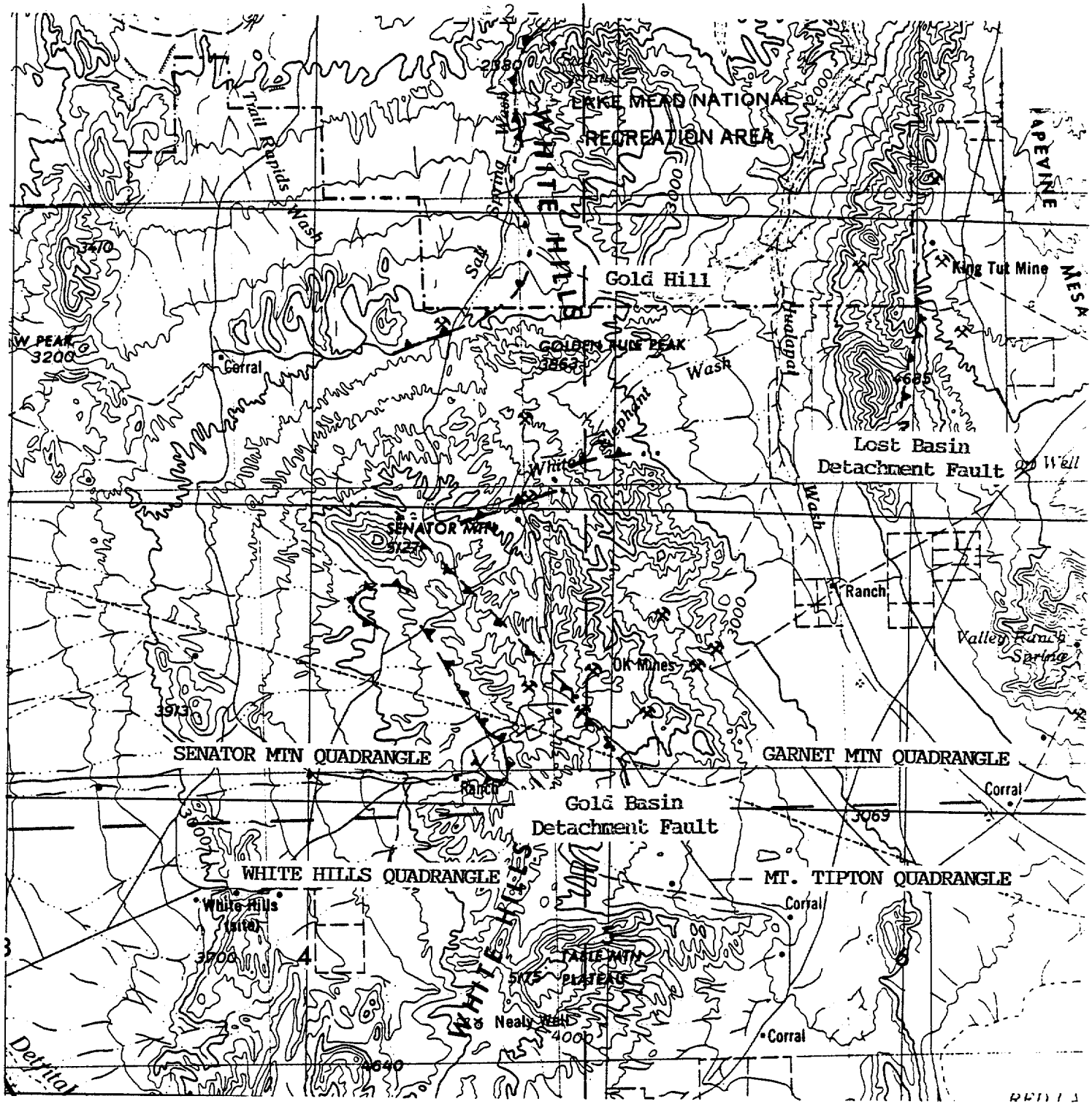
GEOLOGY AND GOLD MINERALIZATION
GOLD BASIN - LOST BASIN MINING DISTRICTS
MOHAVE COUNTY, ARIZONA

General

This report summarizes the geologic research and compilation studies of the Gold Basin - Lost Basin area of northern Mohave County, Arizona carried out during January and February, 1991. The area involved in the study encompasses the Garnet Mountain and Senator Mountain 15' topographic quadrangles and the adjacent northern half of the White Hills quadrangle and the Mt. Tipton NW 7½' quadrangle. The available geologic maps and data on geology and mineralization, supplemented by field observations, were integrated and are presented on a uniform 1:24,000 scale topographic base. The geologic compilation and study indicated that (1) the dominant structural features in the area are the Mid-Tertiary low-angle detachment-type faults, (2) a stratiform zone of extensive chlorite-siderite-hematite alteration is associated with the detachment faults, (3) placer gold deposits and prospects are preferentially located down-slope from the projected eroded detachment fault zone at positions where the Mid-Tertiary erosion surface has been exhumed, and (4) diffuse, non-vein, Tertiary, epithermal gold mineralization is localized in and near the detachment fault zone.

Geologic mapping in the area has been limited in both detail and scope and the compiled maps are based on a mixture of original mapping on a detailed 1:12,000 scale and generalized photo interpretation on 1:100,000 and 1:250,000 scales. The geologic maps of the Garnet Mountain quadrangle are based primarily on pre-1975 field work by P. M. Blacet, presented in USGS Open File Map 75-93 and USGS Professional Paper 1361, supplemented by later detailed mapping in the Lost Basin district by A. Deaderick and in the Gold Basin District by Corn and Ahern. There is very little detailed data available on the Senator Mountain and White Hills quadrangles and the geology in these quadrangles is very generalized. The compiled maps for these quadrangles are based mostly on the generalized maps presented in Professional Paper 1361 and MM-88A, Santa Fe's regional map of Mohave County, supplemented by personal data and field observations made during this study. Rock units throughout the area are coordinated with those described in USGS Professional Paper 1361.

Data presented on mineralization in the area were compiled from private reports, Ariz. Dept. of Mineral Resource files and published USBM and USGS descriptions. Descriptions of mineralization and the list of prospects published in USGS Professional Paper 1361 were utilized in this study. However, the list presented is not an exhaustive list of all prospects and mines; it includes all types and sizes of prospects regardless of the intensity or economic importance of the mineralization, and it is often erroneous because of the lack of sampling and analytical data. Data presented in Prof.



INDEX MAP OF THE GOLD BASIN - LOST BASIN
MINING DISTRICTS, MOHAVE COUNTY, ARIZONA

Detachment Fault Zone

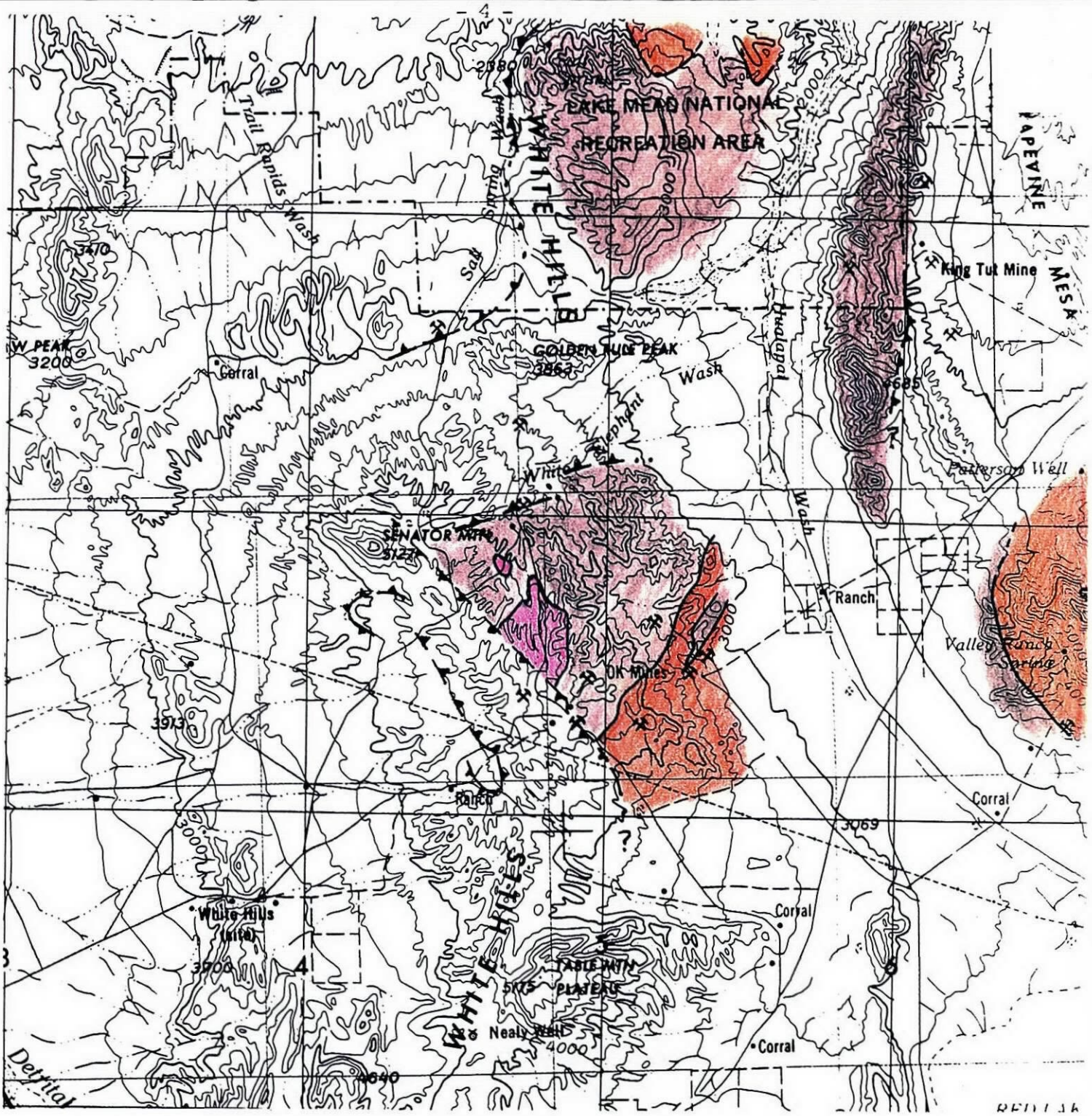
Paper 1361 is also biased because the Survey personnel did not recognize the diffuse, low-sulfide, Tertiary, epithermal gold mineralization hosted by the detachment fault zones. Larger mines and prospects that have received exploration attention are tabulated separately in an appendix together with brief notes on past production, exploration history, and results.

Geologic Relationships

The Gold Basin - Lost Basin area is at the west edge of the Colorado Plateau and exhibits an abrupt change and an extreme contrast in structural style between the structurally stable plateau and the adjacent area of structural distention, low-angle faulting and structurally rotated Tertiary volcanic and volcaniclastic rocks floored by detachment-type low-angle faults. Basement rocks in the area are Proterozoic, amphibolite-grade, gneissic metamorphic rocks intruded extensively by large granitic intrusives. The USGS separated the intrusives and carried out detailed petrographic studies on them in the Garnet Mountain quadrangle, but they are not differentiated elsewhere in the area. Protoliths of the various metamorphic rocks are noted in limited areas where data was available. Metavolcanic and metasedimentary units include basalt, marble, quartzite, iron formation and tourmalinite horizons.

Northwest of the Cyclopic Mine the Precambrian rocks have been intruded by a Cretaceous, quartz-rich, two-mica monzo-granite. The two-mica monzo-granite exhibits extensive alaskitic alteration to a siliceous, muscovite-only facies near the trace of the Gold Basin Detachment Fault zone.

Tertiary rock units include a thick sequence of pre-mineral volcanic, volcaniclastic and fanglomerate units that are structurally rotated and floored by the extensive low-angle detachment-type faults. Overlying the older Tertiary units are post-mineral Late Tertiary, gently-dipping, limestone, fanglomerate and basalt. The major problem with previous geologic mapping in the area has been that of differentiating the pre-mineral and post-mineral fanglomerate units. The older fanglomerate is associated with volcanic rocks and commonly contains interbedded rhyolitic tuffs that are steeply-dipping. The younger, post-mineral fanglomerate, although similar in lithology, is gently-dipping and draped on to the older Tertiary erosion surface. The younger fanglomerate was derived in large part from the older one and there is no clear-cut contact between the two units. Tertiary lamprophyre dikes are associated with the White Hills veins and lamprophyre is common along the trace of the Gold Basin Detachment Fault and may have been localized by the fault. They cut the Cretaceous granite and structurally rotated Tertiary volcanic rocks, are variably sheared, altered and mineralized and appear to be the youngest pre-mineral rock unit.



GENERALIZED GEOLOGY OF THE PRECAMBRIAN BASEMENT

GOLD BASIN - LOST BASIN DISTRICTS

- Cretaceous Granite
- Precambrian Granite
- Precambrian Gneiss

Structure

Structural features include north-south trending, Late Tertiary high-angle faults and earlier, (Cretaceous?) north-south, and northeast-trending, steep to moderate-dipping faults and shear zones. The N20-30E trend is reflected by rock boundaries, veins and faults and may be inherited from Precambrian structures.

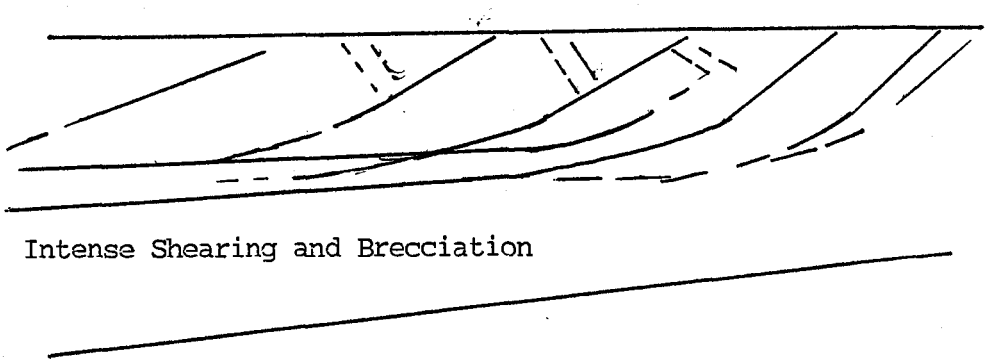
The dominant structural features in the area are the complex, stacked sequence of Mid-Tertiary, low-angle detachment-type faults that mantle the cohesive block of Precambrian basement rocks. The detachment faults can be visualized as a sandwich-like sequence of sub-horizontal lithotectonic units consisting of (1) a lower unit of relatively competent cohesive Precambrian rocks, (2) a middle unit of variable thickness that consists of numerous low-angle fault slivers, coalesced listric faults and highly sheared, brecciated, and disaggregated rocks, and (3) an upper unit consisting of one or more cohesive, low-angle fault slices of structurally-rotated Tertiary and older rocks. Precambrian granite and gneiss in the upper plate units commonly appear shattered, exhibit numerous small slips and faults, and are characterized by variable siderite-chlorite alteration. The detachment fault zone and lithotectonic units are illustrated on the accompanying maps by (1) the indicated low-angle fault zone above the competent Precambrian basement and (2) the overlying low-angle fault zone at the base of the structurally rotated Tertiary rocks. A semi-stratiform zone of chlorite-siderite alteration that is several hundred feet thick is associated with the intensely sheared middle plate unit and is reflected by a widespread color anomaly. The lithotectonic plates can not be easily differentiated where Precambrian rocks occur in the upper plate or as possible intermediate slices such as in the area north of White Elephant Wash and southwest of the Cyclopic Mine in the southern part of the Senator Mountain SE quadrangle. In these areas the granite and gneiss in the intermediate slice exhibit widespread chlorite-siderite alteration and appear sheared and highly fractured as reflected by the subdued topographic relief. The upper plate slices appear to thicken and increase in number south and west of the Cyclopic-Senator Mountain area.

In the Cyclopic-Senator Mountain area, upper plate rock units, the Gold Basin detachment fault zone and gold mineralization all exhibit a northwest strike direction. This is a pronounced contrast to the general north-south strike direction of the rotated upper plate rocks farther south and west. These relationships suggest the presence of a concealed northwest-trending tear fault that influenced both detachment faulting and subsequent mineralization.

Mineralization

Gold has been the dominant metal of economic interest in the Gold Basin-Lost Basin districts, with silver dominant at the adjacent White Hills district. Hydrothermal alteration and mineralization occurred in the Mid-Tertiary, Cretaceous, and possibly the

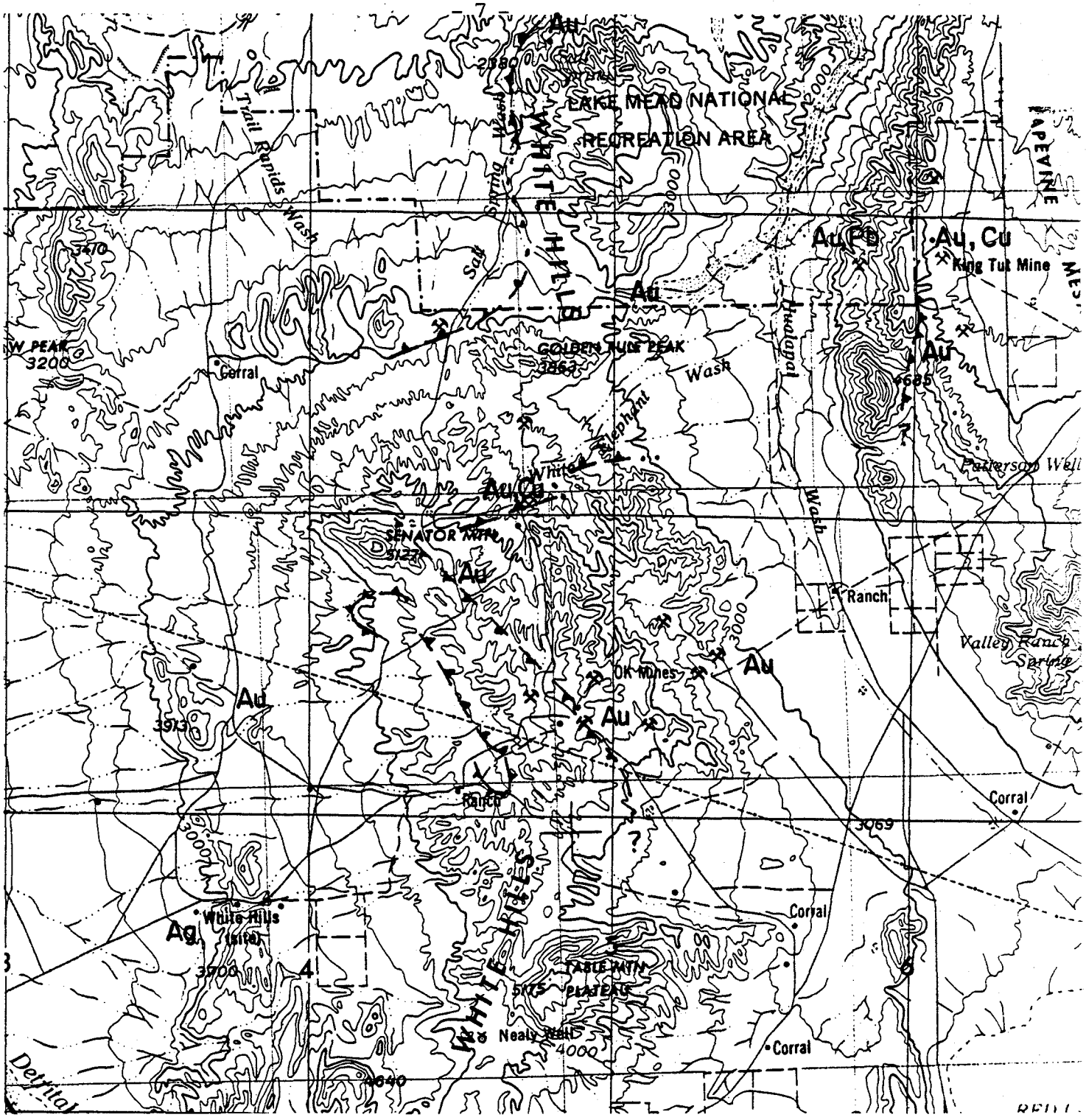
SCHEMATIC SECTION THROUGH GOLD BASIN DETACHMENT FAULT



UPPER PLATE
Structurally rotated & displaced rock units

MIDDLE PLATE
Thin sheets of displaced rocks & coalesced listric faults

LOWER PLATE
Competent Basement



METALLOGENIC MAP OF THE

GOLD BASIN - LOST BASIN

MINING DISTRICTS

Au Dominant Metal

Proterozoic, with most mineralization closely related to major structural features. Base metals are not associated with the Tertiary epithermal mineralization at the White Hills or the Fry and Cyclopic Mines and are not significant in most of the earlier veins. Appreciable amounts of copper occur in pyritic veins in the Lost Basin Range and in the detachment-related mineralization at the Owens Mine east of Senator Mountain. Copper here is associated with specularite and gold may have been superimposed on earlier copper-specularite mineralization. Lead is common in veins on the west slope of the Lost Basin Range and occurs together with copper and zinc in veins northeast of the Cyclopic Mine. The limited available data does not indicate a definite metal zoning pattern, but instead suggests that the abundance of different metals is associated with different ages and phases of mineralization. The generalized distribution of metals is shown on the accompanying page size map and the dominant metals, together with the characteristic gangue minerals, are noted on the larger maps of gold mineralization.

Fluorite was noted by the USGS in a number of small veins northwest and east of the Cyclopic Mine, and also occurs in Tertiary mineralization in the vicinity. Fluorite appears to be spatially related to the Cretaceous two-mica granite and occurs in two clusters of associated veins. It is not directly associated with gold mineralization and is not reported in the larger gold veins. The episyenite pipes in the vicinity of the eastern cluster of fluorite veins at Gold Basin contain fluorite, while fluorite was not noted in episyenite in the Lost Basin Range. The OK and El Dorado veins adjacent to the cluster of fluorite veins east of the Cyclopic Mine contain wolframite. Elsewhere in the district, tungsten occurs as scheelite, both in veins and in skarn zones adjacent to Precambrian intrusives.

Gold Mineralization

Precious metal mineralization of past or potential economic interest is widespread in the area and occurs as relatively narrow well-defined veins; as small episyenite pipes and dikes; as diffuse, non-vein, epithermal mineralization in low-angle detachment fault zones and overlying high-angle fault breccias, and as placer deposits in relatively thin surficial gravels. Past gold production is estimated at 5,000 to 10,000 ounces respectively from the Cyclopic mine, the OK-Malco-Eldorado veins, and the Lost Basin vein and placer deposits. Production from the White Hills district was dominantly silver with perhaps 5,000 ounces of associated gold. The characteristics of mineralization and the production and exploration history for the major mines are briefly summarized in an appendix to this report and known mineralization is shown on overlays to the geologic maps.

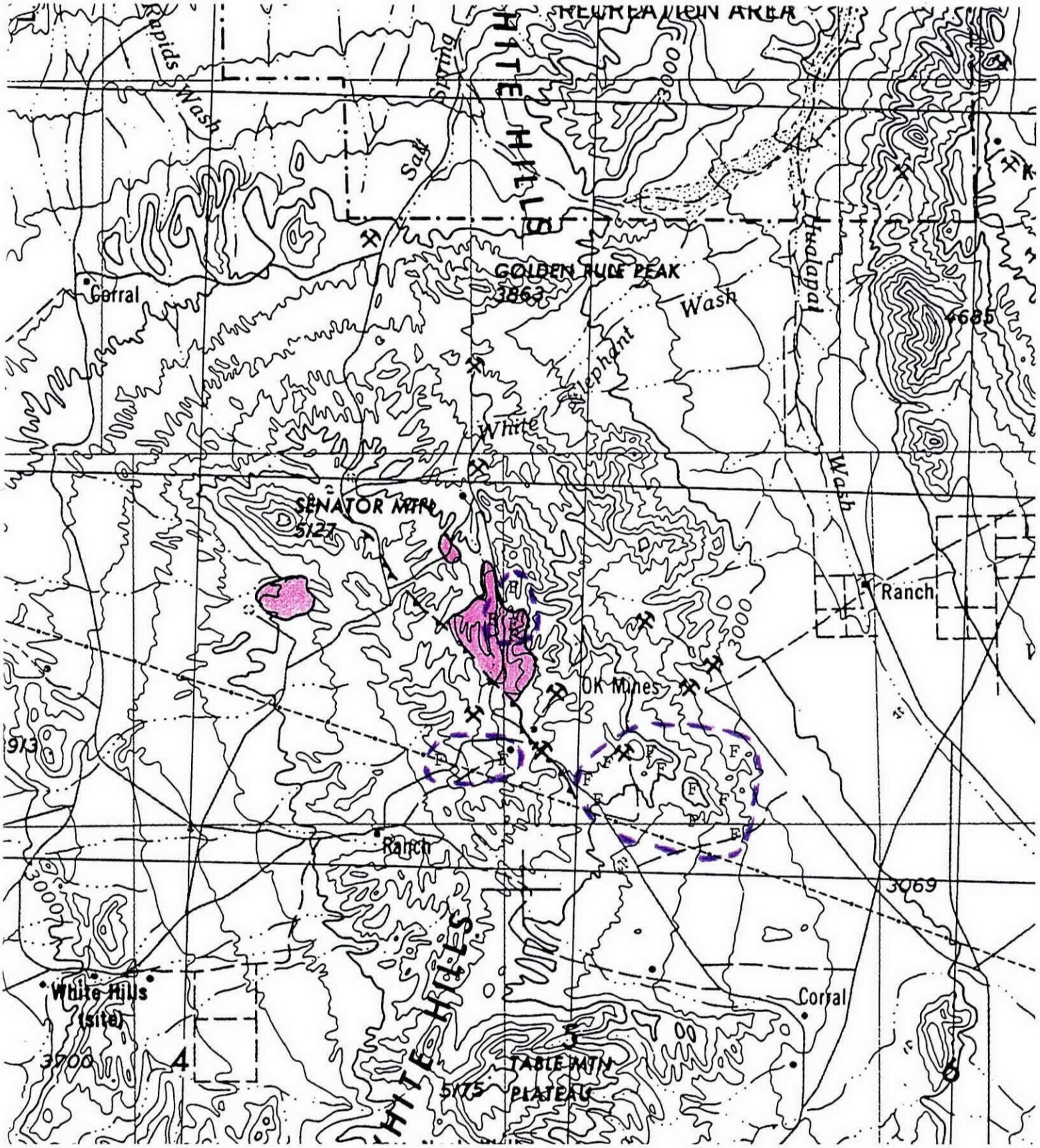
DISTRIBUTION OF FLUORITE

GOLD BASIN - LOST BASIN MINING DISTRICTS

F Fluorite Vein or Occurrence

Cluster of Fluorite Veins

Cretaceous Granite



Episyenite

Two clusters of gold-bearing episyenite pipes and dikes occur in the area, (1) along the east edge of the White Hills in the SE part of T28N, R18W and (2) in the Lost Basin Range in the central part of T29N, R17W. The episyenite (a desilicated metasomatic rock) consists of fresh feldspar, carbonate minerals, fluorite and pyrite and is described in detail in Professional Paper 1361. The episyenites commonly contain values of .10 oz Au/T and a large mineralized episyenite could be an attractive bulk-tonnage exploration target. However, known dikes and pipes are relatively small and are not of exploration interest. Santa Fe Minerals drilled the episyenites in Secs 34 and 35, T28N, R18W. Reportedly both gold values and the size of the episyenite were the same at depth as in surface exposures.

Cretaceous (?) Veins

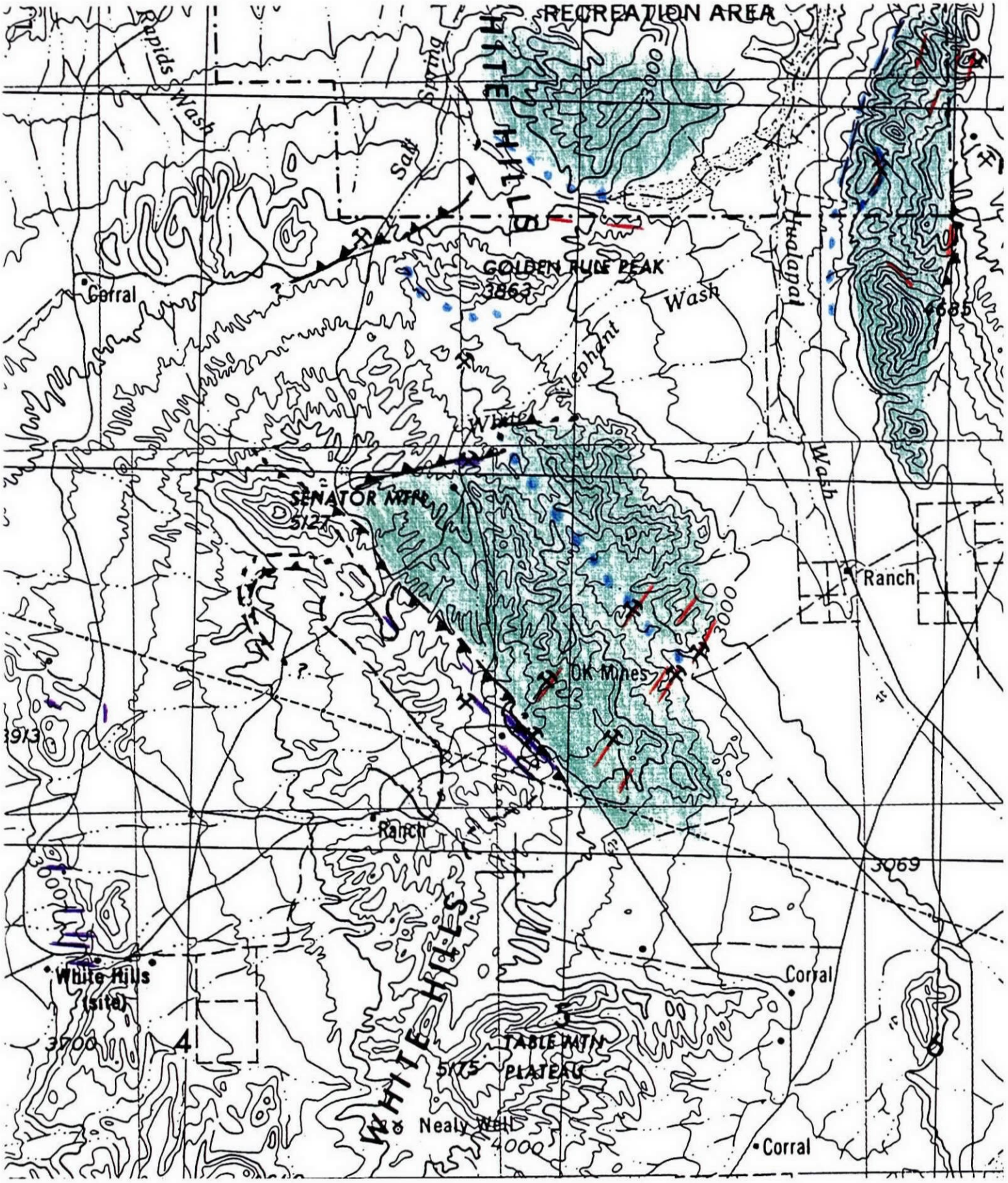
Most of the early prospecting and mining was directed toward well-defined, N-S to N 30°E trending veins in the Lost Basin District and the eastern side of the Gold Basin district. The veins consist of white quartz, coarse-grained carbonate (ankerite-siderite) and variable, but generally minor amounts of coarse-grained sulfides, pyrite, galena, chalcopyrite and sphalerite. They exhibit associated chlorite-siderite alteration. Age dating by the USGS has indicated that the veins are Cretaceous. Most veins are relatively narrow and gold values of interest are concentrated in zones of later shearing or brecciation. The higher-grade gold values are commonly associated with fine-grained hematitic limonite and clear druzy quartz, suggesting superimposed or late phase mineralization. Available data indicates that the veins could contain limited tonnages averaging .20 to .30 oz Au/T over widths of three to five feet. None of the known veins are of economic interest at the present time. Several of the veins in the Lost Basin Range are associated with wide shear zones, but it is not known if there is potential for larger-scale mineralization or if this possibility has been tested previously.

Tertiary Epithermal Veins

The White Hills district exhibits a compact cluster of east-west trending, relatively-narrow, epithermal veins with dominant silver values. The veins are hosted by a thick upper plate slice of Precambrian gneiss and many veins appear to be listric structures, flattening with depth. The veins are commonly associated with lamprophyre dikes and exhibit deep oxidation and supergene enrichment. They consist of vuggy quartz, limonite after pyrite, and manganese oxides with little or no associated base metals. The veins are exposed in a narrow zone sandwiched between post-mineral basalt to the east and extensive gravel cover to the west. The White Hills veins continue beneath post-ore cover and are probably much more extensive than indicated by the limited exposures.

GOLD MINERALIZATION AND MAJOR STRUCTURAL FEATURES
GOLD BASIN - LOST BASIN MINING DISTRICTS

Cretaceous vein
Tertiary vein & mineralized zone
Precambrian Basement
Detachment Fault Zone
Fault
Inferred Fault or Shear Zone



Tertiary, Epithermal, Detachment Fault-Related Mineralization

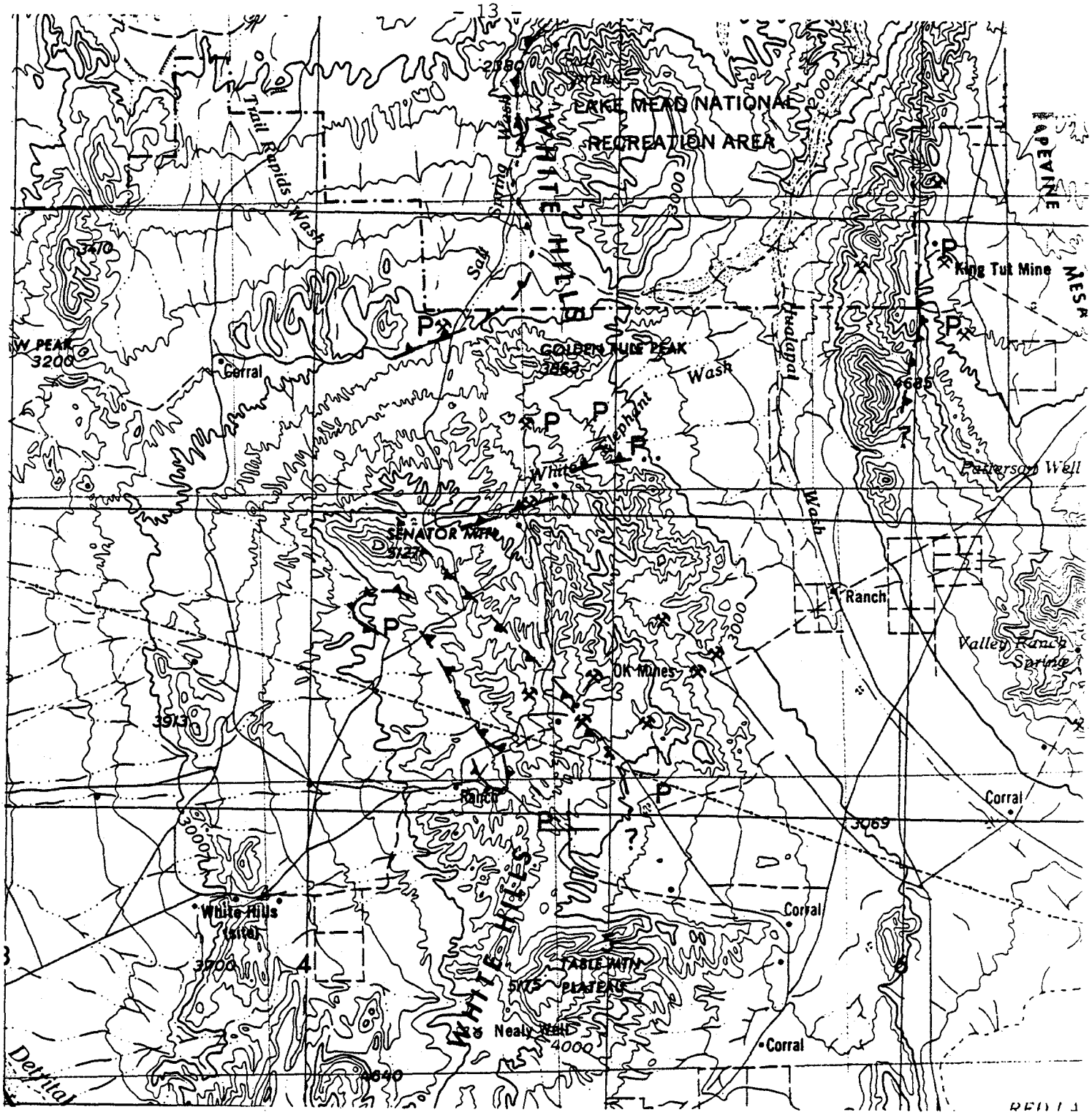
The detachment fault related mineralization, exemplified by that in the vicinity of the Cyclopic mine consists of diffuse, non-vein, epithermal gold mineralization hosted by intensely sheared and brecciated rocks in the middle plate of the detachment fault zone and in fault breccias in overlying upper plate rocks. Values are dominantly gold with little or no associated silver or base metals. The mineralized zones exhibit associated siderite-chlorite-hematite alteration, fine-grained hematitic limonite, anomalous As, Hg, W, and Pb and little associated sulfides or silica.

The quartz breccias described from the Cyclopic Mine appear to be earlier white quartz vein or pegmatitic material caught in the detachment fault, thoroughly brecciated and later recemented by clear druzy quartz that accompanied the epithermal mineralization. Gold values are specifically related to the later quartz and are much more extensive in associated clay altered brecciated rock matrix. Exploration near the Cyclopic mine indicates that the larger-scale mineralization occurs in elongate tabular zones with steep-dipping margins within the sub-horizontal detachment fault zone. The mineralized zones are up to several hundred feet wide and thick and several thousand feet in length. They are parallel, probably occur in an en echelon fashion, and contain both extensive lower-grade gold values (.02 - .05 oz Au/T) and less-extensive higher-grade zones of .10 - 1.0 oz Au/T.

The epithermal, detachment fault-related gold mineralization is extensive. It is known over a distance of more than six miles along the Gold Basin detachment fault; it occurs in high-angle faults in upper plate rocks eight to ten miles west of the Cyclopic Mine, and it probably also occurs along the Lost Basin Detachment Fault and on Salt Spring Wash along the northern extension of the Gold Basin Detachment Fault. Near the Cyclopic Mine there are at least two parallel elongate northwest-trending mineralized zones with a combined width of 300 to 400 feet within the approximately 3,000 foot wide partial exposure of crushed and brecciated rocks of the middle plate of the detachment fault zone. Similar, but narrower mineralized zones are exposed near the Fry and Senator Mines.

Gold Placers

Placer gold was discovered at Lost Basin and White Elephant Wash in the early 1930's, but production has been limited to intermittent small-scale dry washers and several failed attempts at larger-scale mining at Lost Basin. The placer gold concentrations occur in thin recent gravels resting on older consolidated and caliche cemented gravels and are not associated with major drainage systems, well washed gravels, or other features considered favorable for placer gold accumulation. The distribution of gold placers is shown both on the large-scale 7½ minute sheets and on an accompanying page size map. The placer gold deposits and prospects occur as:



PLACER GOLD DEPOSITS

GOLD BASIN - LOST BASIN

MINING DISTRICTS

P Placer Gold Deposit

Detachment Fault Zone

1. Limited, small-scale placer prospects in narrow washes down-slope from eroded veins.
2. Extensive placer gold concentrations, (King Tut, White Elephant Wash, etc.) that are down-slope from a projected eroded detachment fault zone, particularly where the Late Tertiary fanglomerates have been removed and the older Tertiary surface has been exhumed by recent erosion. This association indicates that the placer accumulations are probably a reflection of lode gold mineralization in the detachment fault zones.

The Lost Basin placers have been extensively explored but there is little reliable data on the grade and extent of placer values and there is no data available on those in White Elephant Wash. The placer deposits do not appear to be of economic significance. Available data suggests that at Lost Basin placer gold values of .01 to .03 oz Au/yd occur in restricted, thin, recent alluvial channels and that older conglomerates contain .0015 oz Au/yd or less.

Exploration Considerations

The detachment fault-hosted epithermal gold mineralization is more important and has a greater exploration potential than other types of mineralization in the Gold Basin - Lost Basin Mining Districts. Mineralized zones similar to those known, but somewhat more extensive and higher grade, or a combination of several related zones of mineralization would provide an exploration target with a potential in excess of several hundred thousand ounces of contained gold. Past exploration for concealed mineralization has been limited and there is a favorable exploration potential for epithermal gold mineralization hosted by the intensely sheared middle plate unit of the detachment fault zone and concealed beneath upper plate rocks or post-ore Late Tertiary fanglomerate.

The known vein and episyenite occurrences do not have the size potential to be of interest. However, the possibility that more extensive mineralization could occur in concealed larger episyenite pipes or dikes, or wide zones of brecciation and shearing should be considered in future exploration of the area.

Exploration Activity and Land

The Gold Basin - Lost Basin districts are in the railroad checkerboard of Mohave County and alternate sections throughout the area are owned by the Santa Fe Railroad. Exploration access to the northern part of the districts is limited by the Lake Mead National Recreation Area although leases reportedly can be obtained from the Park Service. Other major land holders include American Heavy Minerals holding 176 lode and 92 placer claims along the detachment fault in the eastern part of the Lost Basin district and the Consolidated Rhodes - Toltec venture that is believed to hold approxi-

mately 10 sections in unpatented claims and 7 sections leased from Santa Fe along the Gold Basin detachment fault in the vicinity of the Cyclopic and Fry mines.

Since 1980, exploration activity has been focused on the Lost Basin properties of American Heavy Minerals (Apache Oro) and the Gold Basin detachment fault zone in the vicinity of the Cyclopic and Owens mines. American Heavy Minerals states that drilling at Lost Basin was poorly conceived and results are not representative or reliable. However, the gold values reported indicate widespread gold mineralization. Most of the earlier drilling along the Gold Basin detachment fault was positioned on exposed mineralization in or near the lower plate of the fault and did not explore for non-outcropping mineralization concealed by post-ore fanglomerate or upper plate rock units. Kennecott's recent program included widespread geochemical sampling and limited drilling in the immediate vicinity of exposed mineralization at two prospects near Senator Mountain. The only exploration that has attempted to explore for mineralization concealed by post-ore fanglomerate or upper-plate rock units was that near the Cyclopic Mine by U.S. Borax in 1982, and the later continuing program by Toltec and Consolidated Rhodes.

Exploration Concepts and Areas of Interest

Exploration concepts that could be of value in the area include:

(1) Localization of the detachment-hosted mineralization in the middle plate unit of intensely-sheared, brecciated, and crushed rocks and by northwest-trending, sub-surface, tear faults and related tensional fractures.

(2) Preservation of gold mineralization within the non-resistant middle plate unit where it is concealed by post-ore cover or upper-plate rock units.

(3) Localization of mineralization by the chemical/physical influence of different rock types within the intensely sheared and brecciated middle plate unit of the detachment fault.

There was no data on the use of geophysics in the area or the potential application of various geophysical methods. There is a geochemical association of introduced mercury, arsenic, and tungsten with the epithermal gold mineralization and geochemical surveys are of value in defining large-scale patterns and trends of mineralization. A combination of geophysical surveys that would indicate mineralized zones or subsurface features controlling mineralization with surface geochemical sampling within and above favorable lithotectonic host horizons may be useful in exploration for concealed gold mineralization.

Areas of potential exploration interest that appear to be reflected by northwest structural trends and/or placer gold occurrences include:

(1) The Cyclopic - Senator Mountain part of the Gold Basin detachment fault zone and projections to the southeast and northwest.

(2) The concealed Gold Basin detachment fault zone in the area south of the Cyclopic Mine and Senator Mountain.

(3) The Lost Basin detachment fault zone.

(4) The Gold Basin detachment fault zone in the White Elephant - Salt Spring Wash area north of Senator Mountain.

Respectfully submitted,

Russell M. Corn

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APPENDIX

Summary of Known Mineralization and Exploration History

Larger Mines and Prospects

Gold Basin - Lost Basin Mining Districts

LOST BASIN DISTRICT

Placers

King Tut Placer, Lone Jack Placer

Secs 27, 33, 34, T30N, R17W, Secs 4, 9, 10, 15, 16, T29N, R17W

Placer gold was discovered in 1931-1932 and is concentrated in thin recent gravels resting on caliche cemented gravel and Late Tertiary fanglomerate, downslope and adjacent to an eroded detachment fault zone. Placer gold deposits at Lost Basin include:

(1) Placer gold in Quaternary channel gravels: Available data indicates that these placers may have values of .01 to .03 oz Au/yd in small and very restricted alluvial channels.

(2) Placer gold in Tertiary conglomerates: Data indicates that recoverable gold values in any substantial volume of material is less than .0015 oz Au/yd and that these placers are not economically significant.

The King Tut Placer area is held by American Heavy Minerals (Apache Oro) and has been explored by several groups since the late 1960's. The exploration history and results include:

AZ DMR Files, Rept. - 1933

Placer reserves estimated at 300,000 yds @ .02 oz Au/yd.

AZ DMR Files, Rept. - 1936

Estimated placer potential of several million yds @ .02 oz Au/yd. Gold occurs in thin channels on older caliche-cemented gravels.

1969 Western Nuclear - Churn Drilling of placer ground. Five foot intervals from drill holes were processed and panned to concentrate recoverable gold. Four of the 225 samples processed contained recoverable values of .0014 oz. gold (50¢/yd at 350/oz Au) while the others had either smaller amounts or no recoverable gold.

1969 Apache Oro - Nine 80 foot deep Hammer holes were drilled in Secs. 33, 4 and 9. Composite assays of the entire 80 foot interval drilled in each hole were:

8 holes - .01 oz Au/ton or less

1 hole - .02 oz Au/ton

1 hole - .05 oz Au/ton

(Reliability of the assays is not known.)

1974-1975 Vanguard Partners/Western Contracting -- Backhoe Trenches of placer gravel. Reported values were extremely variable. Reserves reported were 1½ million yards averaging .0012 oz recoverable gold (40¢/yd at 350/oz Au). One 243 foot DDH in NW cor. Sec. 9. No data on core assays. (Rumored sludge assay of .083 oz Au).

1976 Resources International Partners - Sampled placer gravels with several hundred percussion drill holes (results are not known -- data not available).

1977 Resources International Partners attempted to cyanide heap leach placer gravels and recovered a minor amount of gold in a wet placer operation.

1979 Resources International sampled veins and mineralized breccias in exposed Precambrian rocks. No reliable data is available on this sampling. Deaderick reports numerous .01 oz - .02 oz Au/T values from partial assays of shallow holes in Precambrian rocks.

1980 AMAX sampled placer gravels with 16 drill holes. Recoverable values were all less than .01 oz gold/yd.

1981 Charter Gold Corp. sampled placer gravels by drilling. Results were not reported.

1986 Channel Mining drilled 32 churn drill holes to an average depth of 30 feet in the eastern fanglomerate and southern alluvial gravels. All holes were reported as blank.

1986 Leased to Santa Fe Minerals Corp - exploration results are not known. Warren Mallory, (American Heavy Minerals) presents numerous reasons why gold was not recovered during the previous drilling and why the previous drilling results were unreliable, but he does not have any definitive data on the extent or grade of the placer values.

Veins

Apache Oro claims - drilled by Apache Oro and Resources International Partners (RIP) in 1976-1979. Over 100, 50 ft. percussion holes, 24 holes at an average 80 foot depth, and one 240 foot core hole were drilled in Precambrian rocks. Partial assays reported by Deaderick show widespread .01 - .12 oz Au but the reliability of assays is questionable.

Bluebird Mine - AZ DMR report - 1915 - vein - average width 5 ft., avg grade .35 oz Au/T.

Climax Mine - AZ DMR report - 3 ft. vein, 2,000 ft. long, .40 - .50 oz Au/T. Apache Oro reports that drilling to a depth of 50 feet outlined 12,800 tons @ .51 oz Au/T.

Scanlon Mine - AZ DMR report - vein, .15 oz Au/T to 1.2 oz Au/T.

GOLD BASIN DISTRICT

Episyenite - Secs. 34 & 35, T28N, R18W.

Drilled by Santa Fe Mining in early 1980's. Gold values (.10 oz Au/T) and size (narrow dike and 10 ft. diameter pipe) are similar at depth to values and size of surface exposure.

Veins - El Dorado - Malco - Excelsior

Secs. 21 & 22, T28N, R18W.

AZ DMR reports - veins are 8 inches to 3 feet wide. Ore shoot reported by Schrader was 20 inches wide @ .50 -.75 oz Au/T.

1988 - Heap Leach by Clyde Hutcheson, Sedona, Ariz. - 30,000 tons of ore @ .076 oz Au/T.

Gold Hill Mine - Secs 15,16,17, T29N, R18W.

AZ DMR records

Narrow E-W trending quartz-siderite-pyrite vein. Gold is concentrated in narrow zones of later shearing and brecciation.

1940 - shipments of 20 to 40 tons each @ .75 to 1.25 oz Au/T.

1970's - drilled by Hecla. Best intercept 27ft. @ .17 Oz Au/T.

Others - 15 ft. @ .025 oz Au/T.
10 ft. @ .03 oz Au/T

Late 1980's - Trenched & drilled by High Frontier Resources (?)

Golden June Mine (Red Norse)

SE¼, Sec 29, T28N, R18W.

AZ DMR records.

Vein - 1 t0 3 ft. wide @ .30 - 1.0 oz Au/T.

Golden Rule Mine

NW¼, Sec 29, T28N, R18W.

Schrader describes vein as 2½ foot brecciated quartz vein avg. .50 oz Au/T.

LPM Mine (Queen Ann)

NW¼, Sec 4, T27N, R18W

AZ DMR records

Vein - 18 inches to 2 feet wide @ .30 to .50 oz Au/T. Shipped 500 T @ .30 oz Au/T. Several holes drilled by Saratoga Mines in 1981 (?). Reynolds Metals drilled 15+ shallow holes in 1990 - results reportedly were discouraging.

Uno Mine (Nineteen Forty)

Secs. 16, 17, T28N, R18W.

Vein and shear zone @ 45° dip. High Frontier Resources & Kennecott drilled 15 holes in area during 1990. One vertical hole contained 40 ft. @.112 oz Au/T

which included 10 ft. @ .30 oz Au/T. Results of other holes were discouraging.

Tertiary Detachment - Hosted Mineralization

Cyclopic

Sec 30, T28N, R18W

Currently leased to Toltec-Consolidated Rhodes Venture

AZ DMR records - Elongate, sub-horizontal, mineralized zone (3,000 ft. long), several hundred feet wide and up to 50 ft. thick. Production in early 1900's and again in 1930's is estimated at 50,000 tons @ .20 - .35 oz Au/T - tailings average .06 oz Au/T.

1938 report by Manta de Oro - tonnage estimate @ more than 100,000 T @ .10 oz Au/T. Other reports by Crabtree and Billings estimated proven reserves of 100,000 - 200,000 tons @ .10 -.20 oz Au/T and a potential of 1,000,000 to 2,000,000 tons. The Cyclopic was trenched and sampled extensively by Wyman & King in the 1970's and drilled by Inspiration, C.F. Millar, and AMOCO. Reserve estimates include:

Estimator	Indicated	Possible	Lower-grade Potential
Wyman - King	300,000 T @ .15 oz Au/T		12,000,000 T @ .06 oz Au/T
McIntyre	67,000 T @ .28 oz Au/T	150,000-300,000 T @ .15 oz Au/T	Several million tons @.05 oz Au/T.
Millar	800,000 T @ .04 oz Au/T		
Don Jenkins (Gold River-Mtn States)	Drill proven - 150,000 T @ .07 oz Au/T.		

Fry Mine

Sec 25, T28N, R19W

Currently leased to Toltec-Consolidated Rhodes Venture.

AZ DMR records

Inclined shaft is 200 ft. deep. Ore was found in narrow NW trending and NE trending shear zones.

E.H. Crabtree report (1930's) estimated reserves of 94,000 T @ .60 - 1.0 oz Au/T. Toltec (1991) reports trench samples of 10 ft. @ .67 oz Au/T and .97 oz Au/T over 5 ft. width.

Red Cloud Prospect

Sec 25, T28N, R19W and Sec 31, T28N, R18W.

Currently leased to Toltec-Consolidated Rhodes Venture.

The northwest-trending mineralized zone is 100 to 150 feet wide, 100 to 200 feet thick and more than 5,000 feet long. Road cut samples at the east end of the

zone show 60 ft @ .05 oz Au/T and an adjacent 60 ft @ .01 oz Au/T. Toltec's drilling results on the western projection of the mineralized zone include one hole with 80 ft. @ .35 oz Au/T.

Owens Mine

NW¼, Sec 1, T28N, R19W

Tertiary detachment-hosted mineralization. The mineralization consists of numerous erratic small veins & veinlets of vuggy quartz, pyrite, chalcopyrite, siderite and specularite. The mineralized zone is at the edge of cover, poorly exposed over a distance of 700 ft. at the base of the detachment fault, and is reported to be a zone 150 to 200 ft. thick that dips north at a low-angle. Contained values are from both copper and gold with sample data indicating values of .10 to .25 oz Au/T

Drilled by MAPCO in the early 1980's. Nerco drilled the prospect in the mid 1980's. American Copper and Nickel drilled in the area and one mile to the southwest along the base of the detachment fault in 1989-1990.

MAPCO's drilling indicated a mineralized zone that expanded with depth, and near-surface mineralization of 300,000 tons @ .03 oz Au/T. The results of later drilling by Nerco and American Copper and Nickel are not known.

White Hills District

T27N, R20W

Tertiary, epithermal veins 1 to 3 ft. wide, strike WNW and dip north @ 25-75°. The veins are thoroughly oxidized and consist of Fe & Mn oxides, vuggy qtz & clay in sheared gneiss and lamprophyre. The ore mineral was cerargyrite and the veins probably averaged less than 25 oz Ag/T with higher-grade values due to supergene enrichment. Production is estimated at 6-8 million ounces silver and 5,000 ounces gold. The gold/silver ratio is extremely variable with some of the northern veins carrying gold values of up to .50 oz. The district was evaluated and drilled by Charles Steen in 1962-1963. The mines were opened by Arizona Silver-Corval in the early 1980's and closed due to the low price of silver in the late 1980's.

ASARCO

JDS

EXPLORATION DEPARTMENT

JAMES D. SELL
MANAGER

January 9, 1995

Mr. Warren M. Mallory
P.O. Box 4446
Oceanside, CA 92054

Lost Basin Mining District
T29-30N, R17W
Mohave County, AZ

Dear Warren:

On my way back from Nevada I had a chance to stop by and have a relook at your Lost Basin area with a particular look at the Copper Blowout zone.

As noted, the skarn area had a number of drill holes, scattered pods of copper oxide - silicate and narrow 1"-3" veins of oxide-chrysocolla.

I would suggest that drill hole LB-10 probably intersected one of these veins which have a steep dip to them. The extremely rapid drop-off of copper values also suggests the hole penetrated a vein zone and when exiting went into barren wall rock.

You may want to review the assays from the other holes for the same type of variation. The low gold numbers also preclude any interest on our part.

As before, I cannot find any support to go after placer ground or source area mineralization.

I am returning your booklet on the Large Arizona Gold Property (yellow binder), and the blue folder with the Tour Guide of Lost Basin.

Thank you for sharing the data with us.

Sincerely,

James D. Sell

James D. Sell

JDS:mek
encs. (folders)

cc: P.G. Vikre (Reno)
F.T. Graybeal (NY)

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