CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
1520 West Adams St.
Phoenix, AZ 85007
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

The following file is part of the

Arizona Department of Mines and Mineral Resources Mining Collection

ACCESS STATEMENT

These digitized collections are accessible for purposes of education and research. We have indicated what we know about copyright and rights of privacy, publicity, or trademark. Due to the nature of archival collections, we are not always able to identify this information. We are eager to hear from any rights owners, so that we may obtain accurate information. Upon request, we will remove material from public view while we address a rights issue.

CONSTRAINTS STATEMENT

The Arizona Geological Survey does not claim to control all rights for all materials in its collection. These rights include, but are not limited to: copyright, privacy rights, and cultural protection rights. The User hereby assumes all responsibility for obtaining any rights to use the material in excess of "fair use."

The Survey makes no intellectual property claims to the products created by individual authors in the manuscript collections, except when the author deeded those rights to the Survey or when those authors were employed by the State of Arizona and created intellectual products as a function of their official duties. The Survey does maintain property rights to the physical and digital representations of the works.

QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.

PRINTED: 04-10-2009

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: ROOSEVELT 1 AND 2

ALTERNATE NAMES:
MORNING STAR
TANTALOS

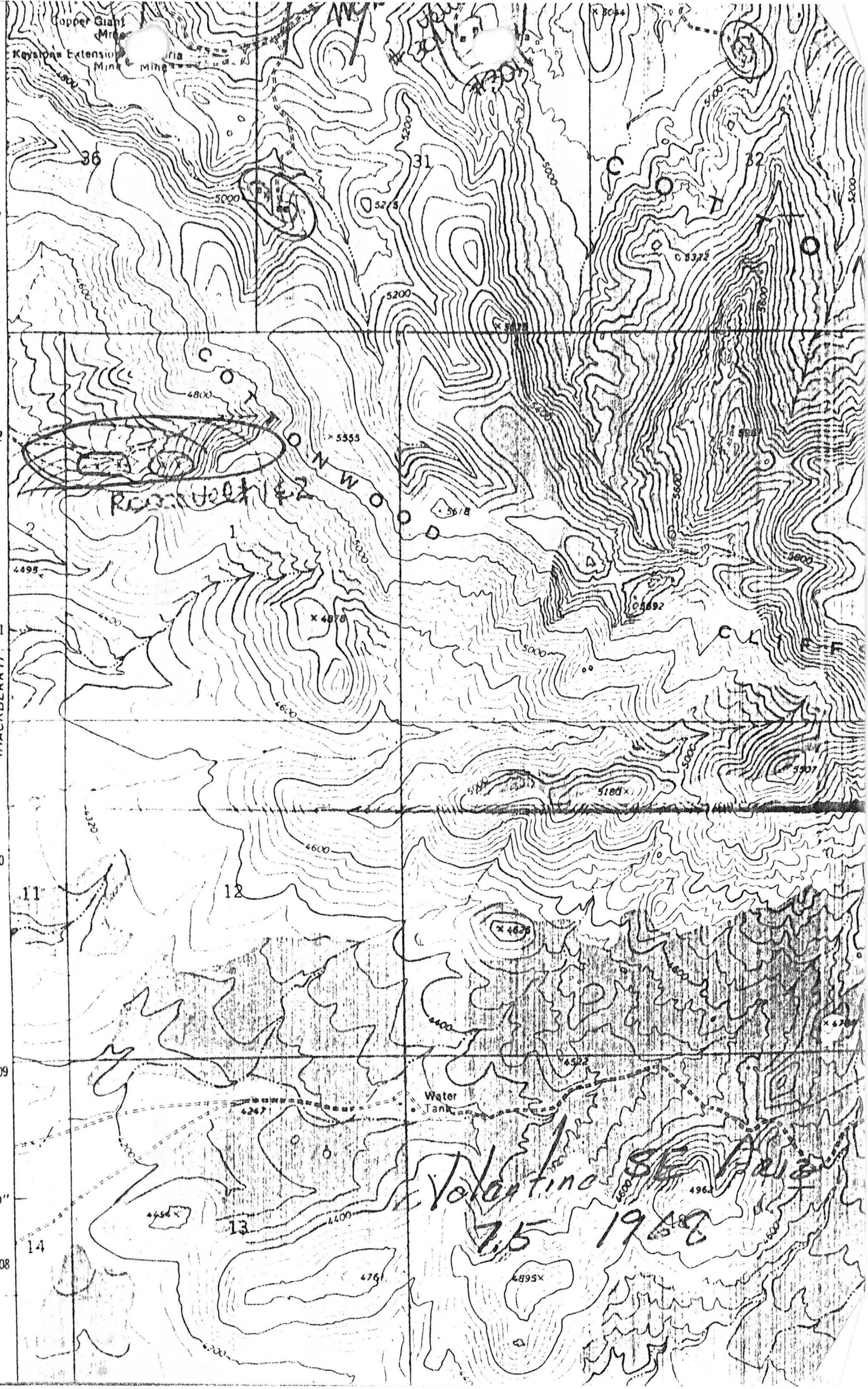
MOHAVE COUNTY MILS NUMBER: 592A

LOCATION: TOWNSHIP 22 N RANGE 13 W SECTION 1 QUARTER NW
LATITUDE: N 35DEG 19MIN 02SEC LONGITUDE: W 113DEG 37MIN 09SEC
TOPO MAP NAME: VALENTINE SE - 7.5 MIN

CURRENT STATUS: PAST PRODUCER

COMMODITY:
GOLD LODE

BIBLIOGRAPHY:
ADMMR ROOSEVELT 1 AND 2 MINE FILE



Copper Giant Mine
Keystone Extension Mine
36
31
32
COTTON
20'
T. 23 N
T. 22 N
COTTONWOOD
CLIFF
3912
3911
3910
3909
3908
17'30"
3254 I SW (HACKBERRY)
1
2
11
12
13
14
Water Tank
5000
5200
4800
4600
4400
× 5555
5618
4495
× 4878
× 4626
4522
4267
4761
4895×
4964

Roc_ver 1+2 (f)

FOR OFFICE USE ONLY
START-UP NUMBER 74352223
STATE NUMBER 10155300
MSHA NUMBER _____

Na
Hamm

NOV 3 1987

NOTICE TO ARIZONA STATE MINE INSPECTOR

In compliance with Arizona Revised Statute Section 27-303, we are submitting this written notice to the Arizona State Mine Inspector of our intent to start X stop ___ move ___ (please check one) a mining operation.

If this is a move, please show last location: _____
If you have not operated a mine previously in Arizona, please check here: ___ If you want the Education & Training Division to assist with your mine safety training, please check here: X If this operation will use Cyanide for leaching, please check here: ___

~~COMPANY~~ NAME: Jon Smock & Edwin Marsh

DIVISION: _____

MINE OR PLANT NAME: Tautlos TELEPHONE: _____

CHIEF OFFICER: _____

~~COMPANY~~ ADDRESS: P.O. Box 14

CITY: Valentine STATE: Arizona ZIP CODE: 86437

MINE OR PLANT LOCATION: (Include county and nearest town, as well as directions for locating property by vehicle). Valentine, Az 86437
From Rt 66 4.2 mi down Hackberry Rd to turn-off into Cottonwood Mts. 3.35 mi
Sec 1, T 22 N, R 13 W. Mill at.

TYPE OF OPERATION: ~~development~~ Underground PRINCIPAL PRODUCT: Gold

STARTING DATE: Sept 1, 86 CLOSING DATE: _____ DURATION : _____

PERSON COMPLETING NOTICE: Edwin Marsh TITLE: OWNER

DATE NOTICE MAILED TO STATE MINE INSPECTOR: Handed to inspector

FORM 101-106 REV. 10/85

OMMODITIES Unknown GOLD

D NO. ~~Not on MILS~~ 592 h DATE 4/21/80

PROPERTY SUMMARY

I. MINE NAME: Morning Star AKA;

AKA; Roosevelt No. 1 & 2 AKA;

AKA; AKA;

I. LOCATION: T 22N R 13W Sec(s) SW 1 UTM;

ELEV.; 4640 DIST.; Cottonwood STATE; Arizona CO.; Mohave

DIRECTIONS; On the south side of Cottonwood Cliffs East of Hackberry

Map Attached /x/

II. OWNERSHIP: Name; Fred C. Grigg NC Phone;

Address: P.O. Box 32, Hackberry, AZ 86411

Date of Information; 4/12/80

DBA; Title Report Attached / /

V. PROPERTY: At least 1 claim, maybe more. Not in BLM's AMC as of 4/21/80.

Date of Property Status; Map Attached / /

. HISTORY: First Located; 1933 Operated;

Remarks; Apparently located at that time by Lawrence Hall, Box 567, Kingman

Report(s) Attached / /

/I. PAST PRODUCTION: Apparently a small producer - shaft and adit and one long stope which connects the workings and goes 60' below the adit level. Guesstimate of tonnage 20,000 tons±.

Schedule(s) Attached / /

WORKINGS: 200'± shaft on ore shoot. One long adit to vein and 260'± of 30 x 5' stope.

Map Attached / /

II. GEOLOGY: Deposit Type; Vein Vein Strike; NW
Distance; Width; 4"-6' Dip; 70° NE Age;
Host Rock; precambrian horn blend schist Age; Ore
Control apparent flexure
Existing Report(s) Attached / / Report Based on New Examination Attached / /

MINEROLOGY: Economic Minerals; Could not determine
Gossan Minerals; No flourescence, no sulfides
Alteration; Not apparent
Gangue; Calcite
Petrographic Study; Report(s) Attached / /

METALLURGY: Unknown Report(s) Attached / /
Method of Determination; Metallurgical Reports Attached / /
Remarks;

SAMPLE DATA: Needed Sampling Technique;

Samples Taken By; Number of Samples;
Date; Assay Report(s)/Maps Attached / /
Drilling; Type; Total Footage;
When Drilled; Drilling/Report Attached / /

GEOCHEMISTRY: Type; Type Anomolies;
Report(s)/Map(s) Attached / /

I. GEOPHYSICS: Type;
Anomolies;
Report(s)/Map(s) Attached / /

AERIAL PHOTOGRAPHY:_____ Photo Attached / /

RESERVES: Proven;_____Calculations Attached / / Probable;_____
Calculations Attached / / Possible;_____Calculations Attached / /
Total;_____ Calculations Attached / / Potential;_____
Calculations Attached / /

VI. ECONOMICS: Mine Life;_____Yrs. Annual Production;_____
Capital Outlay;_____Time;_____
Operating Cost;_____/Yr. _____
Gross Annual Income;_____DCF/ROI;_____
Metal Prices Used;_____
Sensitives;_____ _____ Report(s)Attached / /

VII. REFERENCES:

Author;_____ _____ Title;_____
Date;_____ Abstracted By;_____ Date;_____
Status;_____
Remarks;_____

Author;_____ _____ Title;_____
Date;_____ Abstracted By;_____ Date;_____
Status;_____
Remarks;_____

Author;_____ _____ Title; Mine Operations Report
Date; 8/12/39 Abstracted By; H.M. Coggin Date; 4/22/80
Status; ADMR File Roosevelt No. 1 & 2 Mine
Remarks;_____

VIII. REMARKS:

Owner should be contacted for possible field trip. Field inspection by Ken Phillips and H.M. Coggin.

ARTMENT OF MINERAL RESC ES
STATE OF ARIZONA

MR-8

OWNERS MINE REPORT

Date August 12, 1939

1. Mine Roosevelt # 1 and 2
2. Mining District & County Cottonwood
3. Former name
4. Location
5. Owner Lawrence Hall
6. Address (Owner) Kingman
7. Operator Lawrence Hall
8. Address (Operator)
9. President
10. Gen. Mgr.
11. Mine Supt.
12. Mill Supt.
13. Principal Metals Gold
14. Men Employed
15. Production Rate
16. Mill: Type & Cap.
17. Power: Amt. & Type
18. Operations: Present Exploration & development.
19. Operations Planned Mining & milling, with 25 ton mill.
20. Number Claims, Title, etc. 2 Roosevelt # 1 and 2.
21. Description: Topography & Geography Country rock shist with a porphyretic dike about 12 to 20 ft. wide adjoining & paralled to ore lead. Ore vein 2½ ft. to 4½ ft. wide content valuation $12.00 gold, average.
22. Mine Workings: Amt. & Condition Shaft 100 ft. deep, 2 drifts at 20 ft. level, north drift 10 ft., south drift 14 ft. shaft needing small amount of timbering.

(over)

23. Geology & Mineralization — Contains gold, copper, arsenit[illegible]on, 1 oz. silver cannot amalgamate or cyanide.

24. Ore: Positive & Probable, Ore Dumps, Tailings — Small amount on dumps, all indications of large amount in mine.

24-A Vein Width, Length, Value, etc.

Road Conditions, Route:

25. ~~Mine, Mill Equipment & Flow Sheet~~ — Fairly good - 9 miles from Hackferry and railroad.

Mine, Mill Equipment & Flow Sheet:

26. ~~Road Conditions, Route~~

27. Water Supply — 4 possible water supplies from 1/4 mile to 1 mile and 1½ miles from shaft.

28. Brief History — Have owned property since 1933, doing small development work at intervals every year since.

29. Special Problems, Reports Filed — Reason for non-production. I am of non-sufficient funds to install small mill.

30. Remarks

31. If property for sale: Price, terms and address to negotiate. Price $4,000 on terms. Royalty to be applied on purchase price. Other arrangements can be made if desired.

32. Signed Lawrence Hall
Kingman, Arizona
General Delivery

33. Use additional sheets if necessary.

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA

OWNERS MINE REPORT

Date August 12 1939

Mine Roosevelt # 1 and 2

District Cottonwood

Location

Former name

Owner Lawrence Hall

Address Kingman.

Operator Lawrence Hall

Address

President

Gen. Mgr.

Mine Supt.

Mill Supt.

Principal Metals gold

Men Employed

Production Rate

Mill: Type & Cap.

Power: Amt. & Type

Operations: Present Exploration & development

Operations Planned Mining & Milling, with 25 Ton mill

Number Claims, Title, etc. 2 Roosevelt # 1 and 2.

Description: Topog. & Geog. country rock Schist with a porphyritic like dike abot 18 to 20 ft wide adjoining & parallel to ore lead, ore value 2½ ft to 4½ ft wide content valuation $12 oz gold. average

Mine Workings: Amt. & Condition

1 shaft 100 ft deep, 2 drifts at 20 ft level, north drift 10 ft south drift 14 ft.
1 shaft needing small amount of timbering

(over)

Geology & Mineralization Contains gold coper arsnite iron lead silver can not amalgamate or cyanide.

Ore: Positive & Probable, Ore Dumps, Tailings Small amount on dumps, all indications of large amount in Mine

Mine, Mill Equipment & Flow Sheet

Road Conditions, Route fairly good, 9 Miles from Hackberry and Rail road.

Water Supply 4 Possible water supplys from ¼ Mile to 1 mile and 1½ Mile from shaft.

Brief History Present owned property since 1933, doing some development work at intervals every year since

Special Problems, Reports Filed

Reason for non production, I am of non sufficient funds to install small Mill,

Remarks

If property for sale: Price, terms and address to negotiate. Price $4000.00 on terms $200.00 down + $100.00 per Mo with a 10 per cent royalty to be applyed on purches price. other arangments can be made if desired.

Signed Lawrence Hall

Use additional sheets if necessary. Kingman Ariz

Gen del

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA

MR-8

OWNERS MINE REPORT

Date August 12, 1939

1. Mine Roosevelt # 1 and 2
2. Mining District & County Cottonwood
3. Former name
4. Location
5. Owner Lawrence Hall
6. Address (Owner) Kingman
7. Operator Lawrence Hall
8. Address (Operator)
9. President
10. Gen. Mgr.
11. Mine Supt.
12. Mill Supt.
13. Principal Metals Gold
14. Men Employed
15. Production Rate
16. Mill: Type & Cap.
17. Power: Amt. & Type
18. Operations: Present Exploration & development.
19. Operations Planned Mining & milling, with 25 ton mill.
20. Number Claims, Title, etc. 2 Roosevelt # 1 and 2.
21. Description: Topography & Geography Country rock shist with a porphyretic dike about 12 to 20 ft. wide adjoining & paralled to ore lead. Ore vein $2\frac{1}{2}$ ft. to $4\frac{1}{2}$ ft. wide content valuation $12.00 gold, average.
22. Mine Workings: Amt. & Condition Shaft 100 ft. deep, 2 drifts at 20 ft. level, north drift 10 ft., south drift 14 ft. shaft needing small amount of timbering.

(over)

23. Geology & Mineralization — Contains gold, copper, arsenite ron, 1 oz. silver cannot amalgamate or cyanide.

24. Ore: Positive & Probable, Ore Dumps, Tailings — Small amount on dumps, all indications of large amount in mine.

24-A Vein Width, Length, Value, etc.

25. Road Conditions, Route: Fairly good - 9 miles from Hackferry and railroad.

26. Mine, Mill Equipment & Flow Sheet:

27. Water Supply — 4 possible water supplies from 1/4 mile to 1 mile and 1½ miles from shaft.

28. Brief History — Have owned property since 1933, doing small development work at intervals every year since.

29. Special Problems, Reports Filed — Reason for non-production. I am of non-sufficient funds to install small mill.

30. Remarks

31. If property for sale: Price, terms and address to negotiate. Price $4,000 on terms. Royalty to be applied on purchase price. Other arrangements can be made if desired.

32. Signed..... Lawrence Hall
Kingman, Arizona
General Delivery

33. Use additional sheets if necessary.

OC / MR 8

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
OWNERS MINE REPORT

Date August 12, 1939

Mine Roosevelt # 1 and 2

District Cottonwood

Location

Former name

Owner Lawrence Hall

Address Kingman

Operator Lawrence Hall

Address

President

Gen. Mgr.

Mine Supt.

Mill Supt.

Principal Metals Gold

Men Employed

Production Rate

Mill: Type & Cap.

Power: Amt. & Type

Operations: Present Exploration & development

Operations Planned Mining & milling, with 25 ton mill

Number Claims, Title, etc. 2 Roosevelt # 1 and 2

Description: Topog. & Geog. Country rock shist with a porphyretic dike about 12 to 20 ft. wide adjoining & parallel to ore lead. Ore vein 2½ ft. to 4½ ft. wide content valuation $12.00 gold, average.

Mine Workings: Amt. & Condition Shaft 100 ft. deep, 2 drifts at 20 ft. level, north drift 10 ft., south drift 14 ft.
shaft needing small amount of timbering

(over)

Geology & Mineralization Contains gold, copper, arsenite iron, 1 oz. silver cannot amalgamate or cyanide

Ore: Positive & Probable, Ore Dumps, Tailings Small amount on dumps, all indications of large amount in mine

Mine, Mill Equipment & Flow Sheet

Road Conditions, Route Fairly good - 9 miles from Hackberry and railroad

Water Supply 4 possible water supplies from 1/4 mile to 1 mile and 1½ miles from shaft.

Brief History Have owned property since 1933, doing small development work at intervals every year since

Special Problems, Reports Filed Reason for non-production. I am of non-sufficient funds to install small mill.

Remarks

If property for sale: Price, terms and address to negotiate. Price $4,000 on terms. Royalty to be applied on purchase price. Other arrangements can be made if desired.

Signed Lawrence Hall

Use additional sheets if necessary.

Kingman, Ariz.
General Delivery

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
OWNERS MINE REPORT

Date August 12 1939

Mine Roosevelt # 1 and 2

District Cottonwood

Location

Former name

Owner Lawrence Hall

Address Kingman.

Operator Lawrence Hall

Address

President

Gen. Mgr.

Mine Supt.

Mill Supt.

Principal Metals gold

Men Employed

Production Rate

Mill: Type & Cap.

Power: Amt. & Type

Operations: Present Exploration & development

Operations Planned Mining & Milling, with 25 ton mill

Number Claims, Title, etc. 2 Roosevelt # 1 and 2.

Description: Topog. & Geog. country rock Schist with a porphoretic like about 12 to 20 ft wide adjoining & parallel to ore lead. ore vein 2½ ft to 4½ ft wide content valuation $12 oz gold. average

Mine Workings: Amt. & Condition

Shaft 100 ft deep, 2 drifts at 20 ft level, north drift 10 ft south drift 14 ft.
Shaft needing small amount of timbering

(over)

Geology & Mineralization — Contains gold coper arsnite iron 1 oz silver can not amalgamate or cyanide.

Ore: Positive & Probable, Ore Dumps, Tailings — Small amount on dumps, all indications of large amount in Mine

Mine, Mill Equipment & Flow Sheet

Road Conditions, Route — fairly good, 9 miles from Hackberry and Rail road.

Water Supply — 4 Posible water supplys from ¼ Mile to 1 mile and 1½ Mile from shaft.

Brief History — Have owned property since 1933, doing some development work at intervals every year since

Special Problems, Reports Filed — Reason for non production, lack of non sufficient funds to install small Mill,

Remarks

If property for sale: Price, terms and address to negotiate. — Price $4000.00 on terms $1000.00 down + $100.00 per Mo with a 10 per cent Roalty to be applyed on purches price. other arongements can be made if desired.

Signed Lawrence Hall

Use additional sheets if necessary. — Kingman Ariz
Gen del

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA

MR-8

OWNERS MINE REPORT

Date August 12, 1939

1. Mine Roosevelt # 1 and 2
2. Mining District & County Cottonwood
3. Former name
4. Location
5. Owner Lawrence Hall
6. Address (Owner) Kingman
7. Operator Lawrence Hall
8. Address (Operator)
9. President
10. Gen. Mgr.
11. Mine Supt.
12. Mill Supt.
13. Principal Metals Gold
14. Men Employed
15. Production Rate
16. Mill: Type & Cap.
17. Power: Amt. & Type
18. Operations: Present Exploration & development.
19. Operations Planned Mining & milling, with 25 ton mill.
20. Number Claims, Title, etc. 2 Roosevelt # 1 and 2.
21. Description: Topography & Geography Country rock shist with a porphyretic dike about 12 to 20 ft. wide adjoining & parallel to ore lead. Ore vein 2½ ft. to 4½ ft. wide content valuation $13.00 gold, average.
22. Mine Workings: Amt. & Condition Shaft 100 ft. deep, 2 drifts at 20 ft. level, north drift 10 ft., south drift 14 ft. shaft needing small amount of timbering.

(over)

23. Geology & Mineralization — Contains gold, copper, arsenite iron, 1 oz. silver cannot amalgamate or cyanide.

24. Ore: Positive & Probable, Ore Dumps, Tailings — Small amount on dumps, all indications of large amount in mine.

24-A Vein Width, Length, Value, etc.

Road Conditions, Route:

25. Mine, Mill Equipment & Flow Sheet — Fairly good - 9 miles from Hackferry and railroad.

Mine, Mill Equipment & Flow Sheet:

26. Road Conditions, Route

27. Water Supply — 4 possible water supplies from 1/4 mile to 1 mile and 1½ miles from shaft.

28. Brief History — Have owned property since 1933, doing small development work at intervals every year since.

29. Special Problems, Reports Filed — Reason for non-production. I am of non-sufficient funds to install small mill.

30. Remarks

31. If property for sale: Price, terms and address to negotiate. — Price $4,000 on terms. Royalty to be applied on purchase price. Other arrangements can be made if desired.

32. Signed Lawrence Hall
Kingman, Arizona
General Delivery

33. Use additional sheets if necessary.

STATE OF ARIZONA
BEFORE THE ARIZONA CORPORATION COMMISSION

In the matter of: Skull Valley Associates, Inc.	**AUTHORIZATION FOR DISCLOSURE OF INFORMATION**

A request having been made under A.A.C. Rule R14-4-303 for disclosure of information in connection with the above-captioned matter by the Department of Mines & Mineral Resources.

IT IS THEREFORE ORDERED that the following information or documents obtained by officers and employees of the Securities Division, Arizona Corporation Commission, in the course of an examination or investigation may be made available to the Department of Mines & Mineral Resources:

1. Geologic Evaluation of the Tantolos Mine in the Cottonwood Cliffs, Mohave County, Arizona.
2. Reports and Assays from the Tantolos Strip and Hard Rock Veins Prospect.

The disclosure of the above information or documents is determined to be not contrary to the public interest.

DATED this 9th day of July, 1997.

Victor Rodarte

VICTOR RODARTE
Acting Director of Securities

RE Skull Valley Assoc. Inc 7/97

ARIZONA CORPORATION COMMISSION

RIA

MARCIA G. KWASMAN
SPECIAL COUNSEL
SECURITIES DIVISION

n\enforce\cases\skullval\pleading\disclosu.doc

1300 WEST WASHINGTON
PHOENIX, ARIZONA 85007

PHONE (602) 542-0151
FAX (602) 594-7439

SKULL VALLEY ASSOCIATES, INC.

PROJECTS UNDERWAY

TANTOLOS STRIP AND HARD ROCK VEINS PROSPECT.

A. Seven (7) twenty acre claims and one (1) five acre mill site. All Bureau of Land Management (contigious) claims that are in total compliance and current (through 1995) with all federal regulations, assessments and payments. All claims located in Section 1, R 13 W, T 22 N, Mohave County, Arizona. Title to claims are vested in Skull Valley Associates, Inc. (Arizona corp) and recorded in the deed records of Mohave County, Arizona, dated 12/17/93. (Claims attached)

B. Project reserves are calculated from geological vein structure volume projections, lab tests, assays, vein sampling (surface and sub-surface), screening, grinding, processing of materials and recovery results.

C. Reports and assays prepared by:

1. PRECAMBRIAN RESEARCH AND EXPLORATION, INC.
   Lab work by IRON KING and ROOT & NORTON

2. S.J.S., INC.
   Aqua regia solution tests

PRECAMBRIAN RESEARCH AND EXPLORATION, INC.

Samples from the Tantolos claims (VT1 - VT21) & (VTA - VTE)

Assayed by IRON KING
Assayed by ROOT & NORTON

Weighted average of samples VT1 - VT21	0.929 AU - oz. per ton
Weighted average of samples VTA - VTE	0.017 AU - oz. per ton

S.J.S, INC.
Aqua Regia Tests

Surface samples from Tantolos claims (W1 - W17)

Taken from vuggy red quartz vein on the east side of the Tantolos claims.

Weighted average of samples W1 - W17	0.335 AU - oz. per ton

ASSAY RESULTS AND DESCRIPTIONS OF TANTOLOS MINE SAMPLES

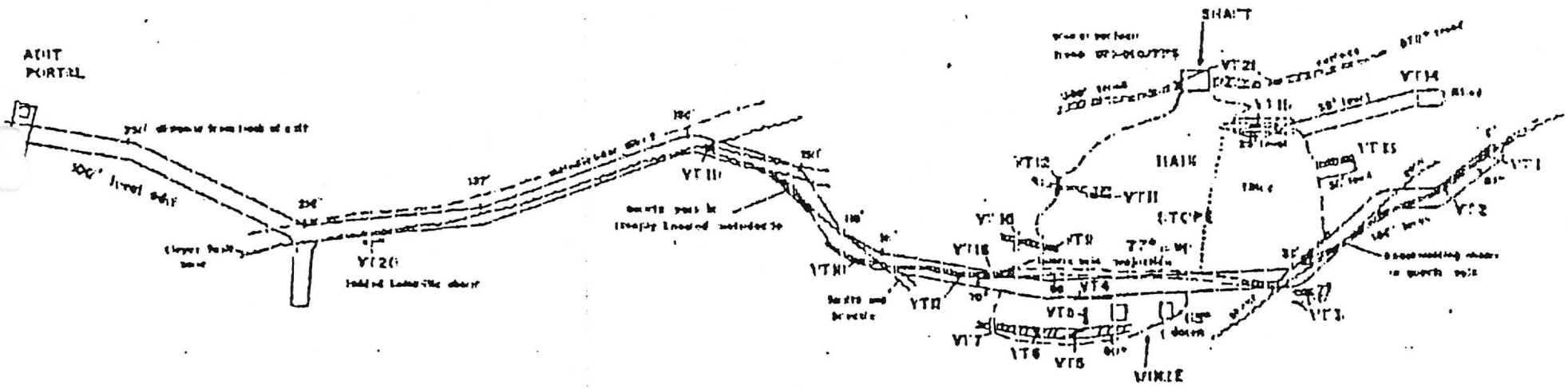
Sample	Iron King	Root and Norton			Chosen Value	Sample Description
	(2 assay ton)	(1 assay ton)	(1/2 assay ton)	(repeat)		
VI1	1.004	.804*	1.37		1.37 oz/t Au	Quartz vein in very back of adit at last round; chip taken over 1.5 feet
VI2	0.085	0.084	0.092		.092 oz/t Au	Chip sample of mainly wall rock with some quartz vein taken over 3 feet
VI3	0.003	0.008	0.016		.016 oz/t Au	Quartz pod and altered wall rock 2 to 6 feet into hanging wall from vein
VI4	0.163	0.136	0.178		.178 oz/t Au	Chloritic hanging wall rock 1 to 2 feet adjacent to vein; chip over 10 feet length
VI5	0.707	.768*	1.33	1.18	1.33 oz/t Au	Channel sample of quartz vein in bottom of winze taken over 8 feet; 2 foot square
VI6	0.66	1.34	1.33		1.34 oz/t Au	Accurate channel sample of total vein; 1.5 feet of malachite rich quartz vein
VI7	0.215	0.28	0.32	0.328	.328 oz/t Au	Sheared up limonitic quartz vein above VI7; channel over 1 foot of faulted vein
VI8	0.021	0.012	0.024		.024 oz/t Au	Altered and silicified footwall rock beside vein in winze; chip over 3 feet wide
VI9	0.641	.356*	0.032		.632 oz/t Au	Sample west slope wall 10' above drift; 1 foot chip of leached quartz vein
VI10	0.227	0.124	0.162		.227 oz/t Au	10' higher, limonite-sericite-clay shear cutting 4' of quartz vein and wallrock
VI11	2.324	2.05	2.02	2.01	2.324 oz/t Au	60' up in slope, chip of wallrock 1 foot into hanging wall from vein; visable gold
VI12	0.504	0.726	0.662		.726 oz/t Au	Sheared limonitic quartz vein, clay gouge and wallrock taken over 2.5 feet total
VI13	3.021	5.34	3.42	3.13	5.34 oz/t Au	Visible gold in 1 foot wide malachite-rich vuggy quartz vein of east slope wall
VI14	0.143	0.222	0.198		.222 oz/t Au	Sheared limonitic quartz vein breccia, gouge and wallrock over 4 foot width
VI15	2.913	4.48	3.16	3.09	4.48 oz/t Au	Uppermost slope area; en echelon quartz vein pod 0.7 feet wide; malachite rich
VI16	0.382	0.634	0.658		.658 oz/t Au	Chip of 1 foot wide sheared quartz vein at adit level, just west of main slope
VI17	0.087	0.115	0.16		.160 oz/t Au	Chip of 2 foot wide quartz vein 20 feet west of slope just before cutoff by fault
VI18	0.02	0.02			.020 oz/t Au	Quartz vein pod .5 feet wide just west of fault; may be quartz vein continuation
VI19	0.008	0.009			.009 oz/t Au	1 foot hematitic sheared zone between two faults; with small reddish quartz pod
VI20	0.003	0.004			.004 oz/t Au	Hematitic sheared zone at edge of metadiabase dike, chip sample over 1 foot
VI21	0.026	0.039			.039 oz/t Au	Main quartz vein at surface over sample VI14 and 15; taken over .5 feet of vein
	Other Prospects sampled at surface:					
VI A	0.019	0.012			.019 oz/t Au	Grab sample of the Rib quartz vein prospect at surface
VI B	0.005	0.026			.026 oz/t Au	Grab sample of the rock pile pit to the east over the ridge crest
VI C	0.019	0.008			.019 oz/t Au	Grab sample of the Columbia prospect on surface
VI D	0.008	0.013	0.014		.014 oz/t Au	Spot chip over 30 feet; gossanous quartz-rich schist of Loki prospect
VI E	0.006	0.008			.008 oz/t Au	Mn-Fe-rich seams in chlorite-clay-rich schist just north of Loki prospect

* Notable slag loss of 1 assay ton detected by Root and Norton Assayers

MULTI-LEVEL PLAN OF THE TANTOLOS MINE WORKINGS

by

Precambrian Research and Exploration Inc., 1990



S.J.S., INC.
Tantolos Mine Lab Results
Aqua Regia Test

AA Begin 1-17-94
All Solutions are 1:3:1 Aqua Regia - 100 Ml. total
All Sample Weights are 31.1 Grams = 1AT
All Samples are W Series

	Au		Ag		Rh		Pt		Pd		Total Precious Metals P/T
	PP/M	Oz/T	PP/M	Oz/T	PP/M	Oz/T	PP/M	Oz/T	PP/M	Oz/T	
1	1.6	.179	2.5	.28	0.7	.078	10.6	1.187	3.6	.403	2.127 oz. per T
W-2	10.6	1.187	6.7	.75	0.7	.078	11.6	1.3	4.2	.470	3.785
W-3	2.3	.257	1.0	.112	0.9	.1	14.7	1.646	5.1	.571	2.686
W-4	1.6	.179	1.2	.134	0.3	.033	9.5	1.06	3.4	.380	1.786
W-5	1.2	.134	0.9	.1	0.8	.089	5.4	.604	2.2	.246	1.173
W-6	2.9	.324	0.9	.1	1.4	.156	14.1	1.579	4.9	.548	2.707
W-8	2.5	.28	4.0	.448	1.1	.123	8.8	.985	3.9	.436	2.272
W-9	1.5	.168	0.4	.044	0.9	.1	10.7	1.198	3.6	.403	1.913
W-10	1.8	.201	1.0	.112	0.7	.078	11.1	1.243	4.2	.470	2.104
W-11	3.0	.336	1.0	.112	1.9	.212	14.6	1.635	5.5	.616	2.911
12	5.6	.627	2.8	.313	1.6	.179	13.3	1.489	4.5	.504	3.112
W-13	5.0	.56	5.9	.660	1.4	.156	11.4	1.276	4.7	.526	3.178
W-14	2.5	.28	1.3	.145	1.3	.145	11.6	1.299	4.4	.492	2.361
W-15	2.5	.28	1.5	.168	1.7	.19	18.2	2.038	6.0	.672	3.348
W-16	3.2	.358	2.7	.302	2.2	.246	22.9	2.56	8.4	.94	4.406
W-17	0.2	.02	0.5	.056	0.8	.089	3.4	.380	1.0	.112	0.657
Total	48.0	5.37	34.3	3.836	18.4	2.052	191.9	21.479	69.6	7.789	40.526

TANTOLOS MINE

GROSS INCOME PROJECTION FOR 12 MONTHS
TO 100% WORKING INTEREST

MONTH 1 — BASED ON 10 TONS A DAY AT .5 oz. AU.
Per Ton for 24 working days
240 Tons x .5 oz. = 120 ozs. AU.
120 ozs. x $350.00 = $42,000.00 Gross Month 1
ACCUMULATIVE: $42,000.00

MONTH 2 — BASED ON 15 TONS A DAY AT .5 oz. AU.
Per Ton for 24 working days
360 Tons x .5 oz. = 180 ozs. AU.
180 ozs. x $350.00 = $63,000.00 Gross Month 2
ACCUMULATIVE: $105,000.00

MONTH 3 — BASED ON 30 TONS A DAY AT .5 oz. AU.
Per Ton for 24 working days
720 Tons x .5 oz. = 360 ozs. AU.
360 ozs. x $350.00 = $126,000.00 Gross Month 3
ACCUMULATIVE: $231,000.00

MONTH 4 & 5 — BASED ON 30 TONS A DAY AT .5 oz. AU.
Per Ton for 48 working days
1,440 Tons x .5 oz. = 720 ozs. AU.
720 ozs. x $350.00 = $252,000.00 Gross Month 4 & 5
ACCUMULATIVE: $483,000.00

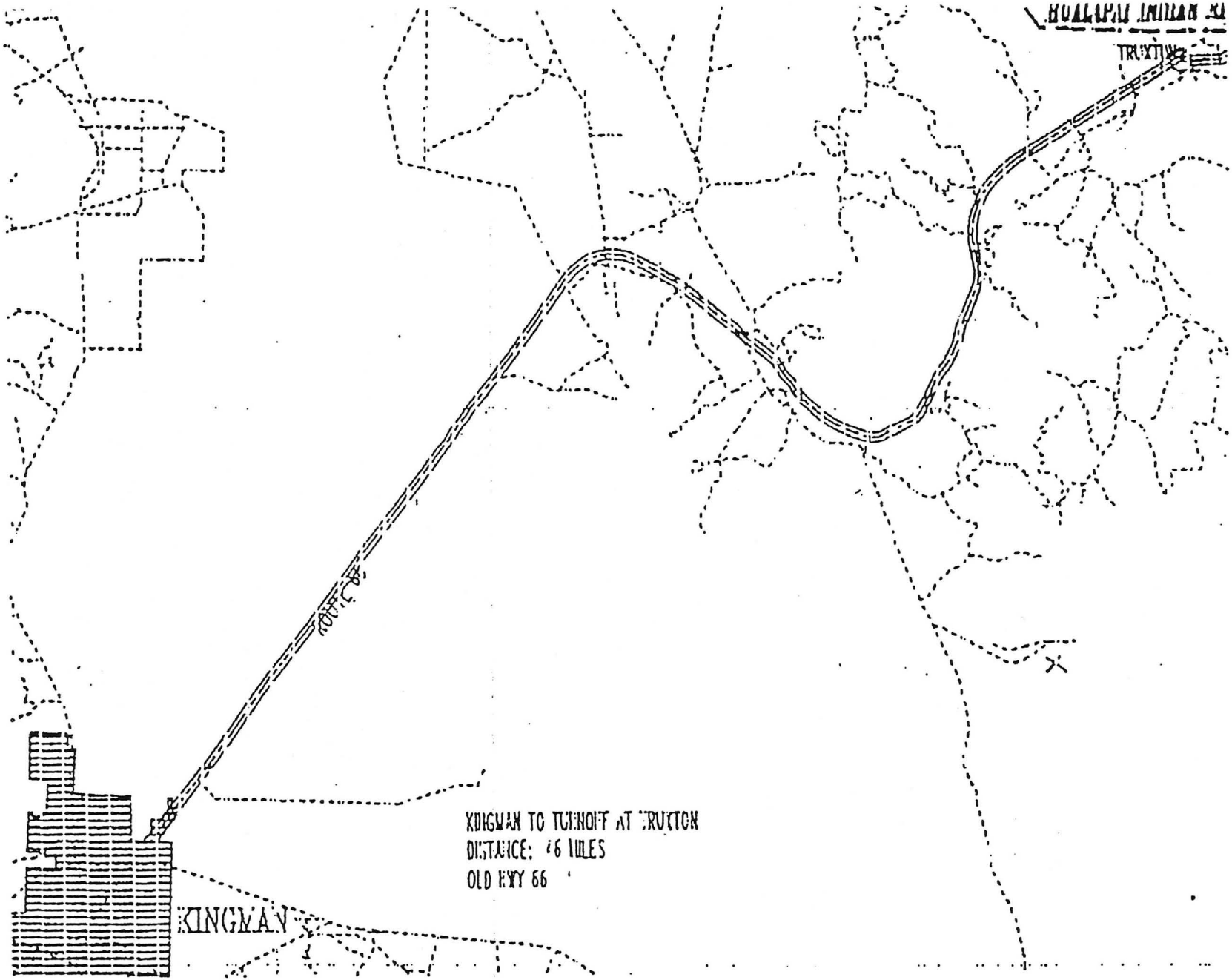
MONTH 6 thru 12 — BASED ON 50 TONS A DAY AT .5 oz. AU.
Per Ton for 168 working days
8,400 Tons x .5 oz. = 4,200 ozs. AU.
4,200 ozs. x $350.00 = $1,470,000.00 Gross Month 6 - 12
ACCUMULATIVE: $1,953,000.00

TOTAL GROSS: 12 MONTHS $1,953,000.00

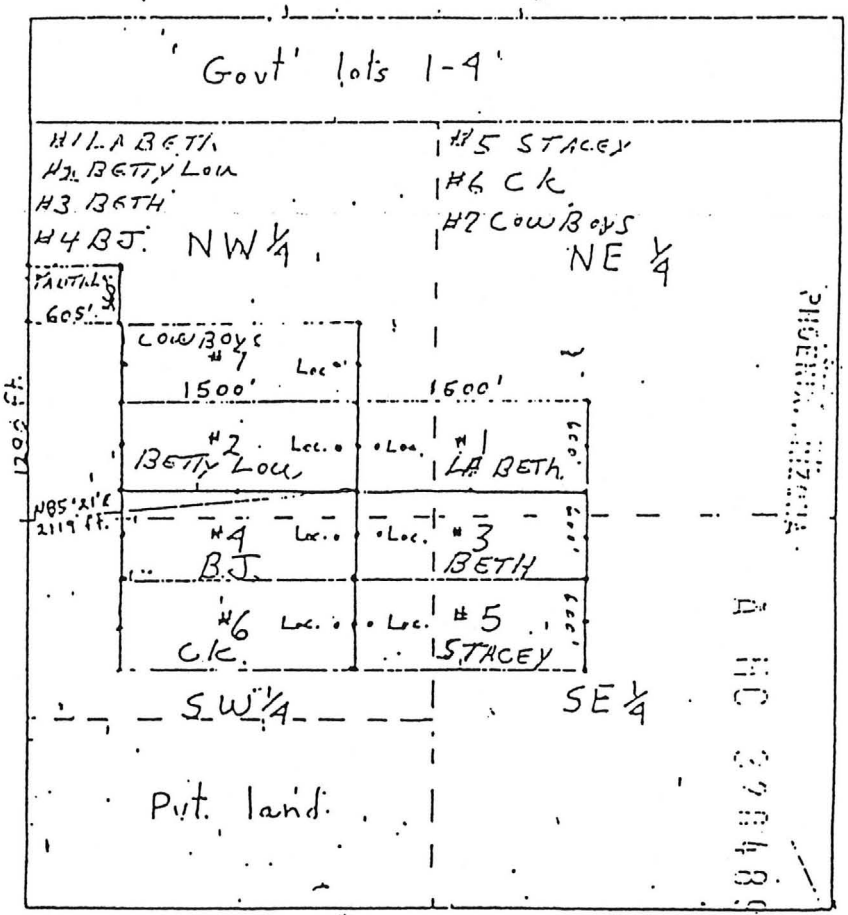
TANTOLOS MINE
OPERATIONS COST
12 MONTH PERIOD

Mining, crushing, trucking, screening, insurance, processing, labor and fuel:

		$ 36.00 P/Ton
Total tonage - 12 months 11,600 x $36.00	=	$ 401,760.00
12 Month Gross	=	$1,953,000.00
Less operations		401,760.00
PRE-TAX NET TO 100% WORKING INTEREST		$1,551,240.00


KINGMAN
KINGMAN TO TURNOFF AT TRUXTON
DISTANCE: 16 MILES
OLD HWY 66
SCALE 1" = 16,500'
OTHER ROADS
WOOD CUTTING

Mining Location Map
Tantalos Group 1 through 7
& Millsite



Section 1 Township 22 North
Range 13 West G. & S.R.M.
1 inch = 1,000 ft.

Exhibit "A"

GEOLOGIC EVALUATION

OF

THE TANTOLOS MINE

IN THE

COTTONWOOD CLIFFS,

MOHAVE COUNTY, ARIZONA

12 January, 1990

Precambrian Research and Exploration Inc.

GEOLOGIC EVALUATION
OF
THE TANTOLOS MINE
IN THE
COTTONWOOD CLIFFS,
MOHAVE COUNTY, ARIZONA

Prepared for

John J. Schmidt, Chicago, Illinois

12 January, 1990

Precambrian Research and Exploration Inc.

INTRODUCTION

Regional Geologic Setting

The Tantolos mine lies in the south-central part of the Cottonwood Cliffs gold district of northeastern Mohave County and is a high-grade gold-bearing quartz vein in early Proterozoic schistose metavolcanic rocks. The Cottonwood Cliffs gold district is known to contain some of the highest grade gold occurrences in the Precambrian of Arizona, but the full extent of gold mineralization and full range of deposit types in the district have never been fully assessed by any recent, regional mineral exploration program.

Central in the Cottonwood Cliffs gold district is the Alabama, Silver Bell and Walkover mines, all of which contain high-grade gold-bearing quartz veins like that of the Tantolos. Other gold deposits in the district are also of the Tantolos-vein type. All such deposits contain visible free gold in deformed quartz veins that were produced when the Precambrian metavolcanic and tuffaceous rocks of the district were regionally metamorphosed about 1720 m.y. ago.

Regional study of the district by the writer intermittently during the past 10 years has shown that the quartz veins are metamorphic in origin, and their gold was largely if not wholly mobilized from the enveloping volcaniclastic strata during metamorphic recrystallization and deformation, and was concentrated into the siliceous fraction of metamorphism -- the quartz veins themselves. Consequently, the quartz veins are syntectonic, deformed, commonly bulbous in shape, pinch and swell, and vary in gold content along strike depending on original syngenetic gold contents of the host rocks that the veins cut. In addition, the veins were deformed into vertically elongate, en echelon rods parallel to steeply plunging mineral lineations in enveloping metavolcanic rocks. Because of this structure, ore shoots also typically plunge vertically.

Location, Logistics and Ownership

The Tantolos mine lies in the central Cottonwood Cliffs, approximately 37 miles east of Kingman. Access is gained by traveling east along State Route 66 to the old Hackberry road between the localities of Valentine and Hackberry, thence south for four miles along the original Hackberry graded dirt road, thence east 3 miles along a jeep road to the foot of the Cottonwood Cliffs where the road terminates at the Tantolos mine property. A four-wheel drive vehicle is generally not required, except perhaps in wet weather.

The mine lies at 4620 feet elevation in the transition zone from Mohave desert below the Cottonwood Cliffs to Pinyon-Juniper Woodland higher on the cliffs. Because of the generally low rainfall and the fact that Tertiary volcanic rocks which cap the Cottonwood Cliffs dip regionally to the northeast, washes on the Tantolos property are usually dry and groundwater lies relatively deep below the mine area. Farther out on the pediment to the west, however, it is possible to reach groundwater at shallower depths.

The Tantolos mine has had several owners in the past, but approximately 3 years ago it was acquired jointly by Ed Marsh and Jon Smock, P.O. Box 14, Valentine, Arizona, 86437. Their property contains other gold-bearing quartz veins similar to the Tantolos and mineralized shear zones that are as yet unevaluated. The property includes 60 claims that extend into the central part of the Alabama gold district from the Tantolos mine site in the south (figure 1). Nineteen of the claims lie in the central Cottonwood Cliffs mining district south and west of the Alabama mine, 41 claims cover the Tantolos mine area and related land in sections 1, 31 and 36, and about 12 claims are involved in covering the Tantolos mine itself and its immediately related mining and milling facilities. All claims are unpatented lode mining claims, the Tantolos mine area is occupied by the owners, and they apparently have clear title to their entire claim block.

Mining History

During the early and middle 1900's, the Tantolos mine was opened up by sinking a shaft on an outcropping of the Tantolos quartz vein and hauling some of the high-grade gold ore up the shaft. Sometime later, about 100 feet below the shaft collar, an adit was drifted in for several hundred feet to intersect the shaft. At that time, about half of the main high-grade ore shoot in the quartz vein was stoped and extracted as gold ore. The volume of material removed from the Tantolos workings during the total mining activity has been estimated by this study to have been about 2,200 tons of high- to very high-grade gold ore. Some of the lower grade ore, mixed with wallrock, remains on the 500 ton dump; the remaining mineralized waste was used to backfill much of the stope in three timbered columns.

At some time after 1939, the Tantolos mine became inactive until just recently, when it was acquired by Mr. Marsh and Mr. Smock. Their rehabilitation work over the last three years has included cleaning and retimbering the main stope, removing the stope fill, bulk sampling, as well as ore evaluation and assessment. During the writer's latest inspection, the quality of the Tantolos workings were first-class in terms of accessibility, structure, safety and ventilation.

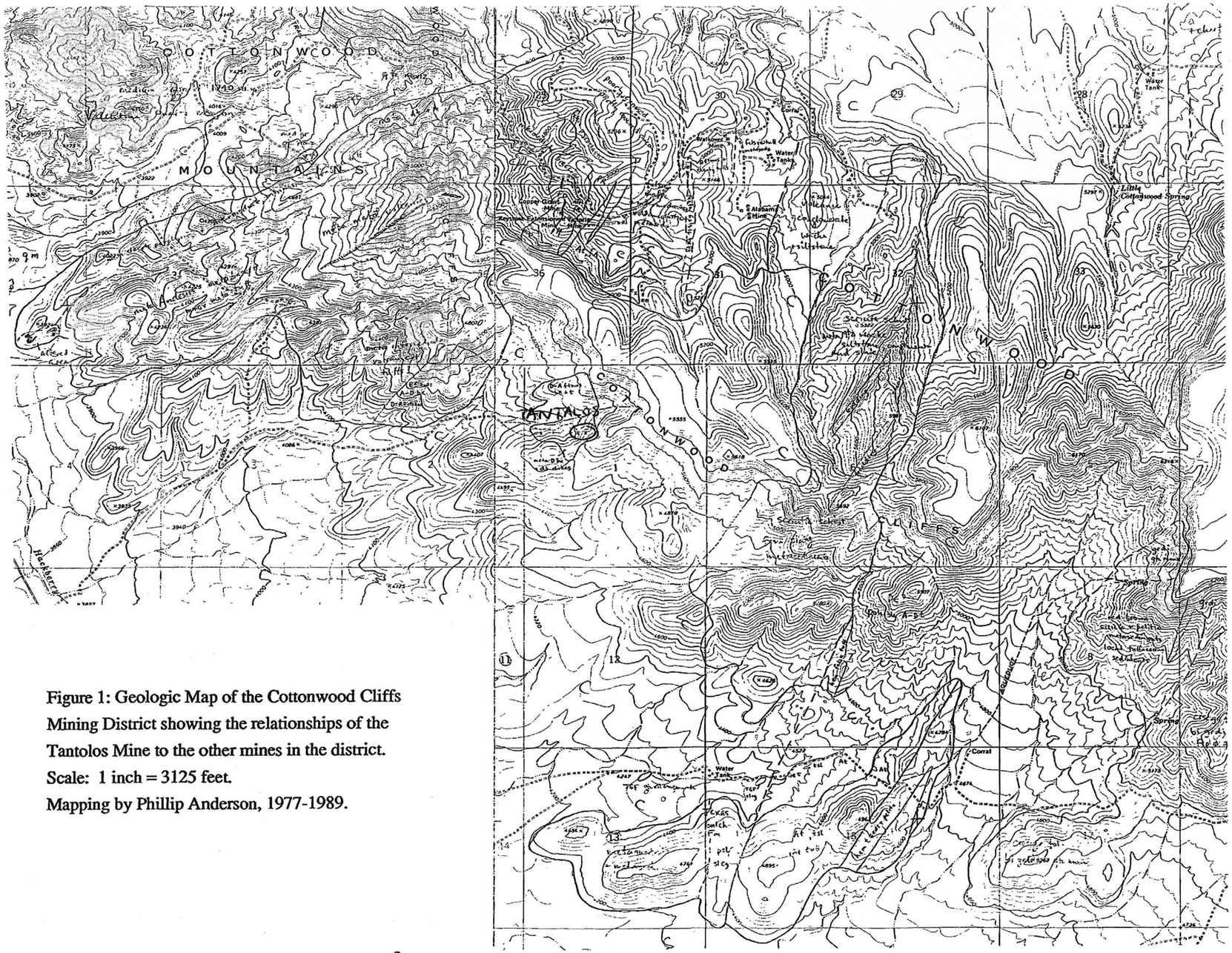


Figure 1: Geologic Map of the Cottonwood Cliffs Mining District showing the relationships of the Tantolos Mine to the other mines in the district.
Scale: 1 inch = 3125 feet.
Mapping by Phillip Anderson, 1977-1989.

GEOLOGY OF THE TANTOLOS MINE

Property Geology

Figure 1 is a location map of the Tantolos mine area relative to other mines and prospects in the Cottonwood Cliffs mining district, and figure 2 is an enlargement of the Tantolos mine area. Most Precambrian rocks of the Cottonwood Cliffs to the west and north are mafic to intermediate metavolcanic flows, tuffs and breccias, commonly of basaltic, andesitic and dacitic composition. Rhyodacitic and other felsic tuffaceous strata crop out more easterly that the Tantolos mine area, and include a separate belt of gold mineralization of the Alabama mine area that extends south under Tertiary volcanic cover into the eastern part of section 1 (figure 1).

In the Tantolos mine area itself, original dacitic tuff and breccia lithologies can be discerned through a middle amphibolite-grade metamorphic overprint. The interlayering of such flows, breccias and tuffs define thick stratigraphic units trending generally northeast, slightly oblique to the Tantolos vein itself. The prominent saddle just south of the Tantolos adit is dominantly a tuffaceous zone now rendered to garnetiferous schists, whereas stratigraphy in the mine area itself consists of interbedded breccias and coarse tuffs, and units to the west are primarily massive metadacite flows. This is clearly a southeast-facing dacitic flow-breccia-tuff sequence whose attitude is in accord with regional easterly facing of the rest of the stratified Precambrian volcanic sequence farther north (figure 1).

In the tuffaceous garnetiferous zone just east of the Tantolos adit are several small, microcrystalline magnetite-pyrolusite chert lenses that were evidently thin iron formation interbeds deposited near the top of the tuff sequence. Lower in the breccia and coarse tuff portions of the dacitic sequence is abundant carbonate, which occurs both interstitially and as discrete carbonate iron formation bodies (originally dolomite and ankerite, now metamorphosed to calcite and siderite). These carbonate beds, lenses, pods and interstitial patches pervade both the breccia and tuff portions of the sequence and were most likely produced by interaction of the Ca-rich volcanics with sea water in the original submarine setting. Some are gold-bearing. In addition, massive basaltic units appear to cut off continuity of the dacitic sequence in places. Based on information deduced underground in the Tantolos mine, these mafic units appear to be metadiabase dikes that cut slightly oblique to stratigraphy. Such dikes are common in the high-grade metamorphic terranes of northwestern Arizona but are usually mistaken as mafic flows.

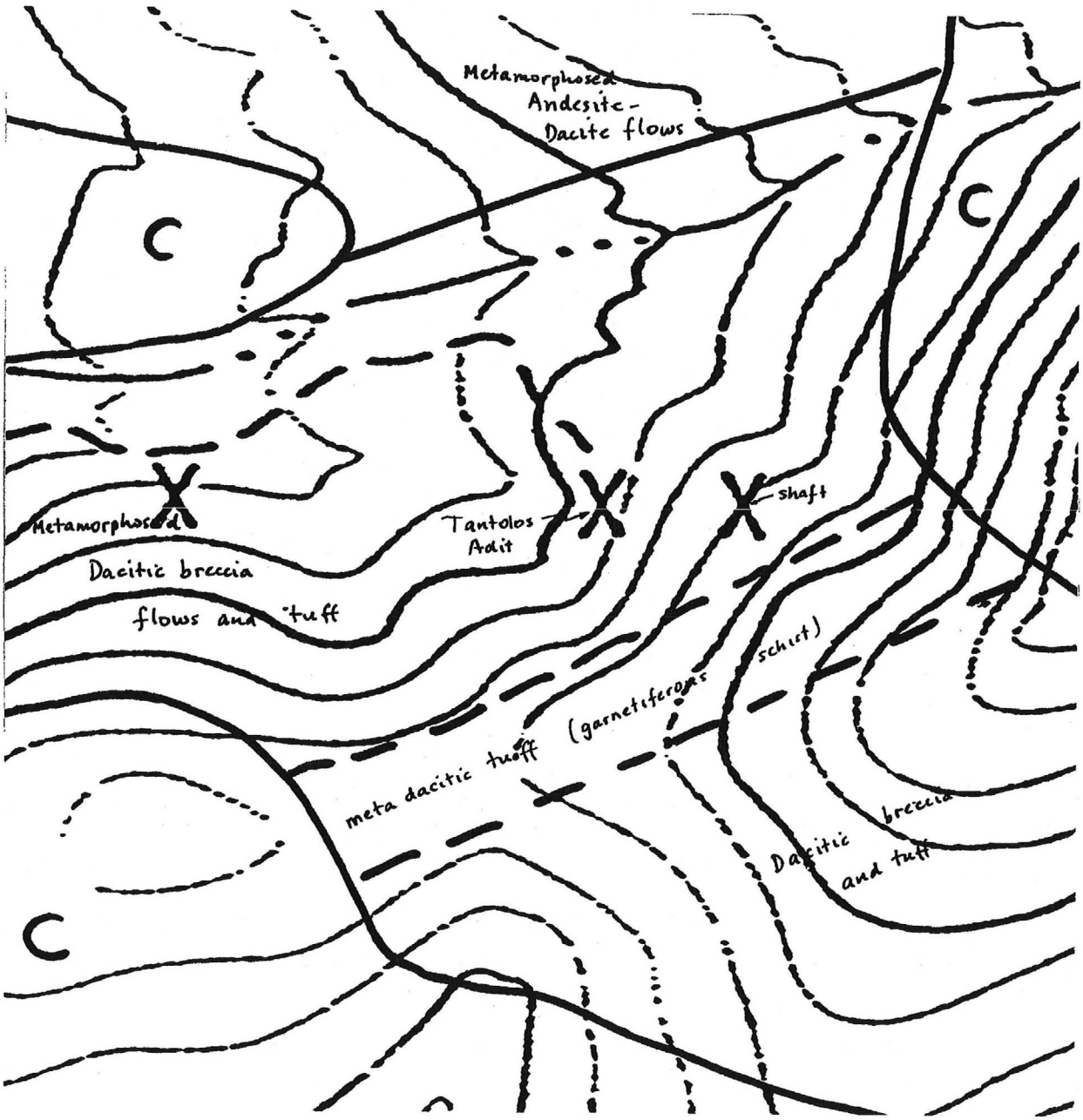


Figure 2: Geology of the Tantolos Mine area at 1" = 250 feet. Geology by P. Anderson 1989.

Thus major stratigraphic units can be readily identified in the metavolcanic units of the Tantolos mine area, and a preliminary example is shown in figure 2. Once the premetamorphic volcanic stratigraphy is fully defined, the relationship of gold-bearing quartz veins to the main stratigraphic horizons can be tested and any correlations used as a powerful tool to predict which zones would be most productive for hosting gold-bearing quartz veins. This type of regional evaluation of the Tantolos mine property has not yet been done by any exploration effort to date.

Most work by the writer on the Tantolos property has concentrated on evaluating the mined quartz vein for its additional gold-ore potential. There are numerous other structures on the property that warrant future evaluation: many are quartz veins like the main Tantolos vein and some carry visible gold. In fact, the property could contain several more veins that, when exposed by workings and drifts, may prove as rich as the Tantolos itself. A sample of the main Tantolos quartz vein at surface at the discovery shaft carried 0.04 oz/t Au, but no more than 30 feet below this sample in the workings, the vein carries 4 oz/t Au -- a 100-fold increase of gold values in a very short distance below surface. Such a sharp increase in gold values lucidly demonstrates that any structure on the Tantolos property carrying gold values in the 0.2 to 0.4 oz/t Au range at surface -- of which there are several, including both quartz veins and semi-gossanous, sheared zones rich in quartz and hematite after sulfides -- could become as productive as the Tantolos vein itself when opened up at depth.

Tantolos Quartz Vein at Surface

In outcrop the main Tantolos quartz vein resembles many Precambrian quartz veins in the region: it is white to clear, moderately foliated (quartz is microscopically recrystallized), and contains small streaks of red-brown hematite derived from leaching of sulfides. Locally there are abundant black streaks implying a significant magnetite or pyrolusite content in places. The vein varies from 1 to 3 foot wide, as exposed in outcrop and in several small prospect pits and cuts directly above the stoped mine workings. Along strike to the east (uphill) the vein appears to pinch out, but several pods of white quartz below the strike projection imply that the vein may persist as a series of en echelon pods offset from one another along strike of foliation. This type of geometry results from foliation intersecting bedding (or the quartz vein in this case) at shallow acute angles, so that eventually stratigraphy (or the vein in this case) cuts across foliation after it is traced along strike for some distance (see figure 3).

To the west, the quartz vein can be traced discontinuously for more than 500 feet down the hill, across the access road beyond the adit portal, into a small ravine, then onto a low ridge

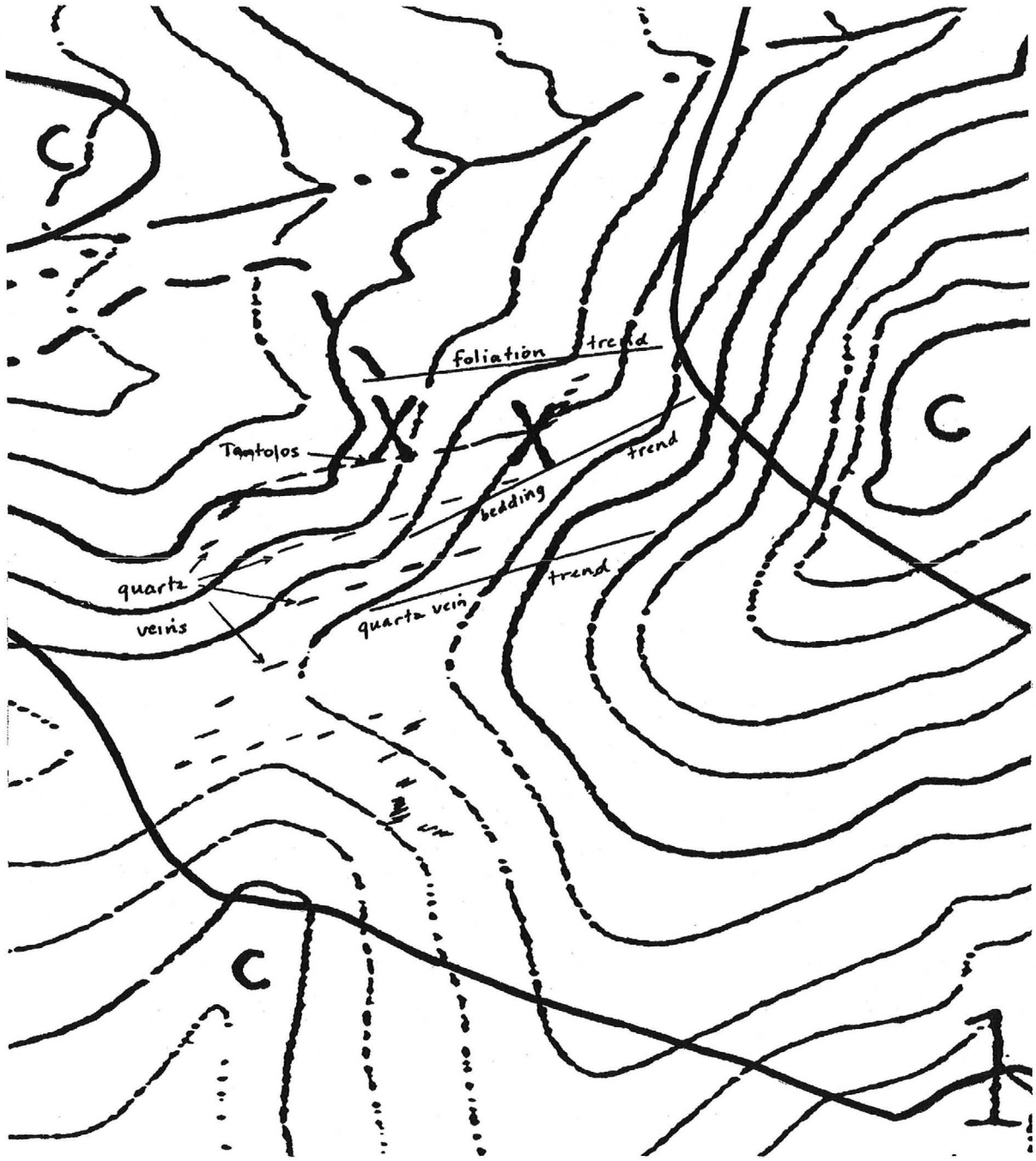


Figure 3: Sketch of relationships between foliation, deformed stratigraphy and quartz veins in the Tantolos Mine area at 1" = 250 feet. Geology by Phillip Anderson, 1989.

just below where the access road climbs up to the saddle (figure 2). The vein could not be found farther west than this ridge because of poor outcrop. On the saddle to the south, however, there is at least one major quartz vein and several smaller quartz (metachert?) layers. These bodies suggest that the main Tantolos vein trends more southerly than foliation and cuts across foliation to be folded back up onto the saddle. The presence of small amounts of visible gold in the quartz vein on the saddle support this possibility. Figure 3 shows the apparent relationship of foliation to the quartz vein (and also probably foliation to bedding) in the Tantolos mine area.

The quartz vein narrows to 0.5 to 1.0 feet wide over much of this western area, and locally it appears to be pinched out for short distances (25% of its outcrop area). Thus, it appears from surface exposures that the quartz vein is thickest and most continuous in the immediate area of the Tantolos workings, specifically directly above the stoped workings. However, the underground workings show the vein to be thicker and much more persistent at 60 foot depth than at the surface, so its apparently thin discontinuous character in outcrop is likely a function of poor exposure at surface. If so, the thickness of the vein in outcrop cannot be taken as a reliable indicator of the thickness of the vein at depth. Moreover the assays clearly show that the 0.039 oz/t gold content of the vein at surface is an equally unreliable representation of the true gold content of the vein at depth, which is up to 100 times higher.

In summary, the Tantolos quartz vein is sufficiently unspectacular at surface that if the mine workings did not exist, most geologists would walk right over the vein and dismiss it as "just another barren quartz vein in the vast, indecipherable Precambrian terrane of Mohave County". The implications of this conclusion are far-reaching: How many more similar quartz veins on the Tantolos property and in the adjacent region also have minable gold ore at depth, but are not recognized today as viable mining prospects because no old mine workings have opened them up to reveal their true gold contents?

Mine Workings

The Tantolos mine includes approximately 500 feet of workings, 300 feet at the main adit level, 130 feet of vertical workings in the main stoped area, and 70 feet of other horizontal workings at higher levels. Most workings are 3.5 feet by 5 feet, but some are 4 feet by 6 feet. The stoped area generally maintains a 4 to 5 foot width regardless of its length, which is about 70 feet wide above the main adit level, but narrows to 12 feet near the top of the shaft. Narrow gauge track currently exists from the portal to the end of the main stope, and a hoist heads the winze. Only the eastern of the three waste pillars still remained in the stope at the end of 1989.

Figure 4 is an underground map of the mine workings, produced by this study, on which the projection of the stoped area to surface is shown as a dotted line above the main vein at the adit level. Figure 5 is a companion cross section to this map which shows the stoped workings and winze in vertical section. The main adit is approximately 100 feet below the shaft at the top of the stope, so it is referred to as the 100 level (or adit level). In addition to the 100 foot-high stope, there is a winze that declines for approximately 30 feet below the adit level. This winze was obviously sunk to explore the depth continuation of the gold ore shoot.

The reason for stopping the original underground mining is not clear from the workings themselves. Both the back of the adit, literally in the last round, was still in 1 oz/t Au ore and the bottom of the winze also ended in 1 oz/t gold ore. Certainly subeconomic grades did not stop the original mining. The current owners report that the most likely cause was a powder shortage during the war. Either this situation or advancing age of the original owner was more likely the reason for ceasing mining than geologic-economic conditions of the mine workings.

Mine Geology

Structure

At surface above the stoped area, the Tantolos quartz vein trends 075° to 090° and dips 75° south. To depth in the mine workings, the strike and dip of the quartz vein are much the same, although the strike varies to 110° and the dip varies from 70° to 80°. Huge rodded lineations in the host metadacites plunge steeply southwest at 220/70°. These rodded lineations were produced during deformation of the volcanic sequence and their attitude can be taken to indicate the trend and plunge of the mined ore body in the quartz vein. Thus, the workings represent the mining of the upper portion of a near-vertically plunging, prolate-shaped ore shoot within a quartz vein that has a dominantly vertical planar continuance.

Mineralization

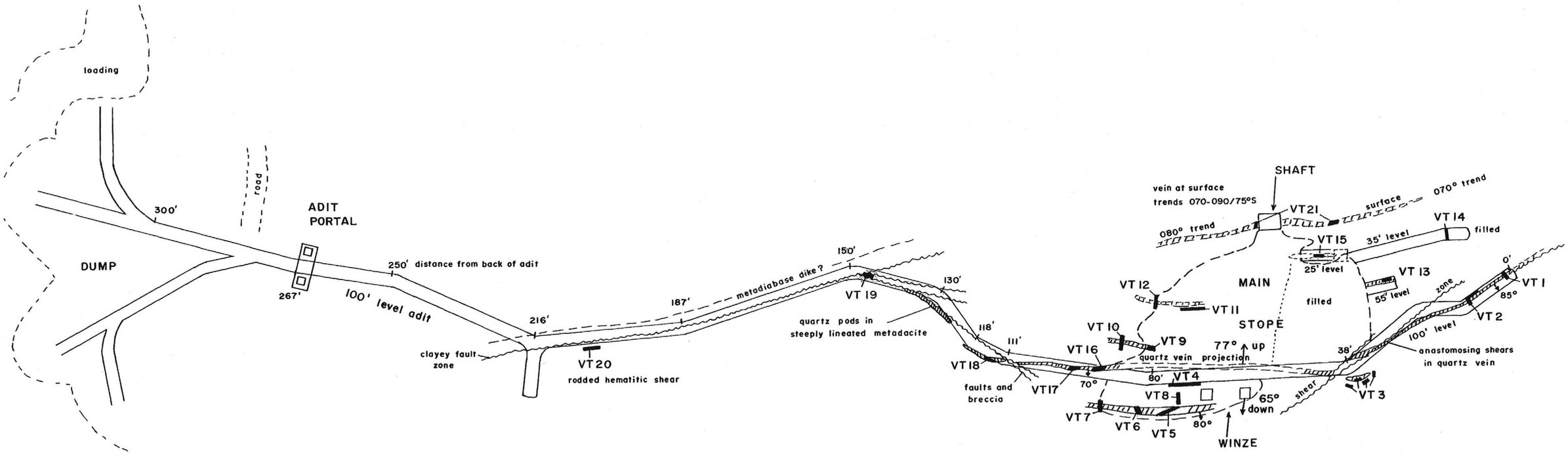
The quartz vein transects bedding in the host metadacites at a shallow oblique angle, and is associated with minor alteration of the host rocks, specifically chlorite, biotite, calcite, minor hornblende and disseminated sulfides, chiefly pyrite and chalcopyrite. This alteration persists for about 1 foot either side of the vein into the wall rocks, but is locally up to 2 to 3 feet wide in places. In addition, surface oxidation of the primary mineral assemblage to hematite-goethite, limonite, malachite, azurite, chrysocolla, manganite (wad), bornite, chalcocite, tenorite and free

figure 4 :

MULTI-LEVEL PLAN OF THE TANTOLOS MINE WORKINGS

by

Precambrian Research and Exploration Inc., 1990



gold caused the gold values to spread even farther into the wall rocks adjacent to the vein.

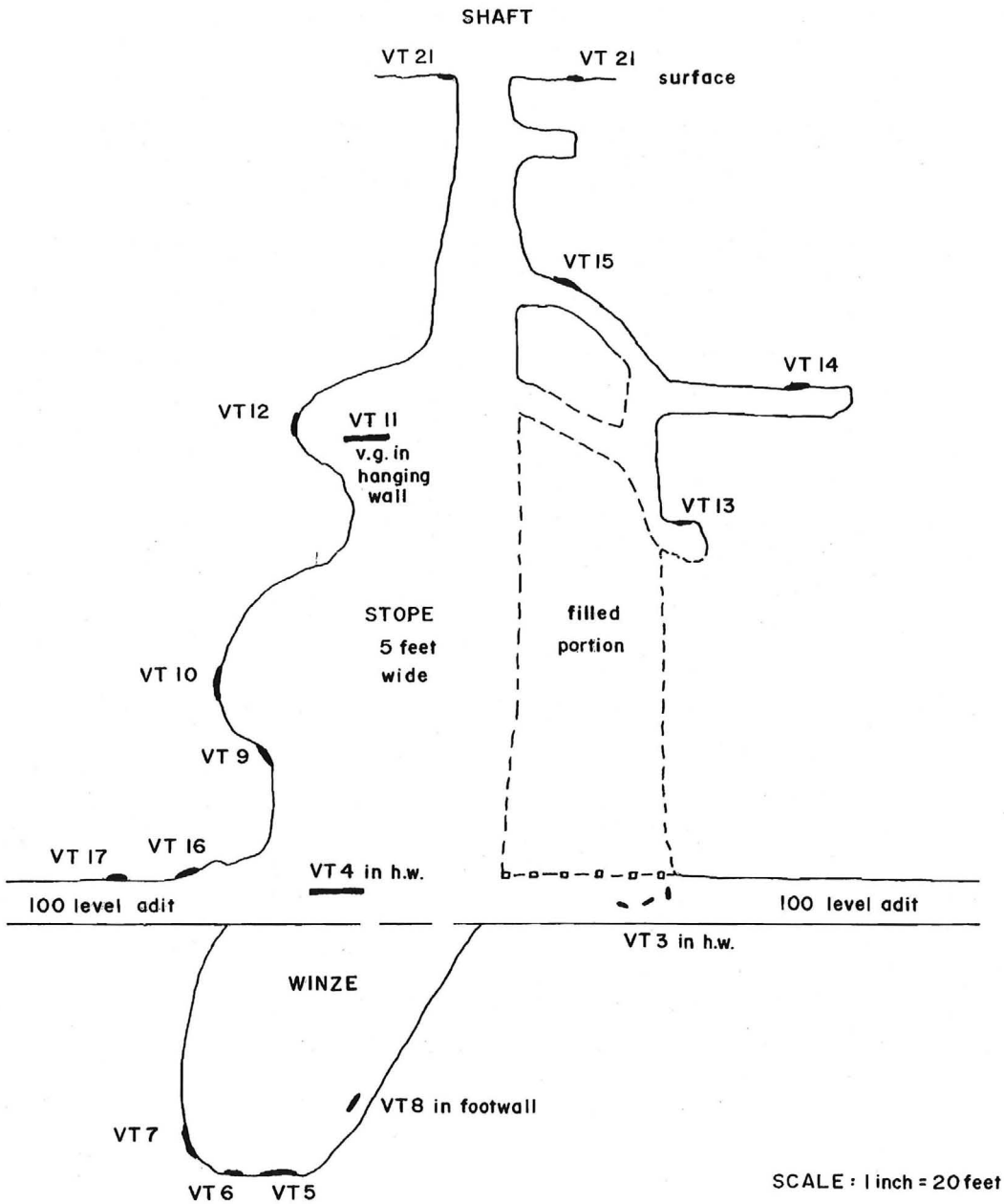
The vein itself varies from 0.5 to 3 feet in width, but maintains a 1.0 to 1.5 foot width throughout much of the workings. In addition to the quartz vein, the altered margins of the vein are associated with significant gold values, so the miners were justified in taking at least 1 foot of wall rock either side of the vein together with the vein. In places the mineralized, altered wall rock contains as much gold as the vein itself. This indicates that, at least above the 100 level, a total width of 4 feet was not mined just to facilitate access, but because 4 feet represented the *minimum* economic width of the ore zone that exceeded 1 oz/t Au. The reason this mining width must have been a minimum is that parts of the remaining altered wall rock exceeds 2 oz/t Au in parts of the main stope. Thus, the realistic mining width for the Tantolos ore is at least 5 feet, and up to 8 feet in places, so that all gold-ore grades exceeding 1 oz/t can be recovered.

The primary quartz vein structure, its mineralization and its wallrock alteration have been overprinted throughout the mine by an event of shearing, faulting and clay-gouge development. The faults offset the vein by typically 1 to 5 feet, which means that the vein is absent for short intervals down its plunge, but not in a systematic way that creates holes in the orebody. Instead, the faults are dominantly of a shear-zone character, and have caused small but abundant offsets of the vein in the vertical direction. In comparable Precambrian settings, similar fault gouges represent grade cutoffs, but in other settings the gouges represent zones of gold enrichment. In the Tantolos mine, neither seems to be true -- the fault and gouge zones are neither barren nor richer than the vein itself. They represent sites of grade decrease where they cut the quartz vein, but the decreases do not appear to seriously interrupt the vertical continuity of the ore block.

Leaching and Enrichment

In the narrow (1" to 6" wide) fault, gouge and shear zones, the quartz vein is either highly comminuted or sheared off, and the mineralogy is degraded to sericite, limonite, clay, carbonate, minor malachite, chrysocolla, manganite and free gold. The increased permeability of these zones has promoted leaching of gold out of the zones and transport to greater depth.

Surface leaching and supergene enrichment of the quartz vein and its mineralized wall rocks are very noticeable features of the Tantolos mine workings. At the surface, all sulfides are leached, and limonite with minor hematite-goethite fill boxworks remaining from leaching of sulfides, gold and carbonate. About 20 feet below surface in the stope workings, supergene minerals begin to appear in the least sheared and open parts of the vein structure. These



CROSS-SECTION OF TANTOLOS STOPE LOOKING NORTH 10° WEST

by

Precambrian Research and Exploration Inc.

1990

supergene minerals include tenorite, chalcocite, malachite, azurite, chrysocolla, pyrolusite-manganite (wad), turquoise, hematite, goethite and iron sulfates. This zone of supergene deposition produced by a receding groundwater table with time, extends from just below surface (about 20 feet down) to the bottom of the winze, a total depth extent of more than 100 feet.

A supergene enrichment blanket, signifying a stable base-level to the groundwater table for a significantly long period of time, has not yet been found in the mine workings. In fact, the predominance of malachite, chrysocolla, limonite, goethite and Mn minerals in the upper stoped area and the increasing abundance of chalcocite, tenorite and minor bornite with depth (between the 100 level and the floor of the winze) suggest that the very lowest levels of the mine could be just impinging on a zone of strong supergene enrichment -- if such a blanket exists in the mine.

An alternative interpretation is that the extent of leaching and enrichment in the mine depends on the permeability of particular structures to groundwater: the quartz vein itself contains supergene-enrichment minerals as high as 60 feet up in the stope, whereas the most broken up sheared and faulted sections of the vein contain limonite even in the very depths of the winze. Thus, it could be concluded that the mine workings span the depth of the entire supergene zone, from the surficial levels where leaching is strongest, down to the zone between levels 60 and 130 feet where enrichment predominated. This variable leaching-enrichment picture is supported by the fact that primary sulfides exist in the biotite-chlorite-altered wall rocks adjacent to the vein over much of the stope's vertical extent, whereas primary sulfides are rare to absent, except in the lowest levels of the mine.

Gold Mineralogy

Regardless of how the nature of leaching and supergene enrichment in the Tantolos mine is viewed, one fact is certain -- the workings have not yet gone completely out of the zone of surface oxidation and enrichment and into a totally sulfide-based mineralogy that reflects the quartz vein's original makeup. Based on select sulfide-bearing samples this primary mineralogy appears to be quartz with minor calcite, pyrite and pyrrhotite, lesser chalcopyrite, possibly arsenopyrite and magnetite, and native gold, which is both encapsulated in sulfides and biotite, and as free intermineral platings between quartz, biotite, sulfides and carbonate. Gold in the mine contains a small but significant percentage of silver, and possibly native amalgam.

In contrast to the nature of gold in the primary mineralogy, in the secondary setting of the exposed mine workings, gold is almost exclusively free. Some is encapsulated in limonite-

goethite and encased by clay, but almost all gold in the workings is freely extractable by normal free-milling practices. The grain size varies from 0.001 mm to as large as 3 mm, but most visible flakes are about 0.5 mm long. The gold occurs both as flat platings on fracture surfaces with secondary copper minerals and manganese stain, and as flakes interstitial to quartz, mica and less-common carbonate grains. In the central levels of the stope, the highest-grade clusters of free gold were observed in cavities that appear to have been primary vugs in the quartz vein, and which are now filled with micas, supergene copper minerals, hematite, and free gold. Select hand samples of such high-grade ore may assay 100 oz/t Au in some vuggy patches.

GOLD GEOCHEMISTRY AND DISTRIBUTION

Purpose of Sampling Program

In 1987, the writer took a grab sample of ore from the Tantolos mine that assayed 1.68 oz/t Au. This result, plus the abundance of visible gold in the quartz vein, made the mine of considerable interest. The vein was traced at surface for at least 500 feet, and at that time it was assumed that if the vein had a comparable depth extent and a conventional underground mining width of 10 feet, the possibility of a 250,000 ounce gold target was represented by the Tantolos mine. In 1989 the property owners sampled the stoped area of the quartz vein and sent the samples to Independent Milling Co. in Wikieup for assay. The results varied from 1.6 oz/t Au to 10.2 oz/t Au, with many in the range 3 to 6 oz/t Au. These results suggested that most of the mined rock carried in excess of 5 oz/t Au and some of it was as rich as 10 oz/t Au.

Several factors were taken into account before the Tantolos mine was sampled:
(1) Surface sampling would give no realistic representation of the ore grades at depth, so surface sampling was ruled out as a viable means to determine the gold contents of the vein;
(2) The 100 level adit cut the quartz vein for only a small part of its length, specifically in the stoped area (see figure 4), which meant that the underground workings could only effectively sample the stoped area, not other parts of the vein along strike from the stoped area.

Consequently, sampling the underground workings could only realistically evaluate gold grades in the main stope and winze, so the sampling program was directed specifically at:
(1) confirming the gold results obtained by the owners previous sampling of the stoped area;

(2) evaluating gold grades in the area immediately adjacent to the stope to see if grade cutoffs were a major factor in limiting the size of the stoped area and ceasing the mining activity; and (3) trying to find the lateral extent of the main quartz vein farther west in the workings. No attempt was made to evaluate the continuity of gold grades throughout the full 500 feet of strike of the vein; this could be done neither from the surface nor from the existing underground workings, so drilling would be necessary to evaluate the total size of the orebody.

Gold Variability and Assay Strategy

Because of the presence of relatively coarse visible gold and its observed variability in the workings (particularly with very high concentrations in vuggy patches), it was anticipated that the nugget effect would play a major part in influencing gold assays. In an effort to offset this variability, larger samples than normal were fused for assay. The samples were first sent to Iron King Assay Labs in Humboldt, Arizona, where 2 assay-ton samples were fused. Many of the results were too low to confirm even the amount of gold visible to the eye when the samples were taken, so the rejects were sent to Root and Norton Assayers in Silverton, Colorado so that all samples could be completely reassayed on a 1 assay-ton basis.

Root and Norton detect slag loss in some samples, so the samples were once again reassayed on a 1/2 assay-ton basis. This significantly decreased the slag loss in most samples, and demonstrated that the 1 assay-ton results were most reliable in some samples, but that the 1/2 assay-ton results were more reliable in others. Loss of gold values into the slag is not unexpected in fusing high-grade gold ore, and the larger the sample, the greater the slag loss. In fact, the nugget effect and slag loss are factors that work in opposition in determining a realistic value for the extractable gold in high-grade gold ore. The owners have confirmed the well-known principle in high-grade gold mines like the Tantolos that normal free-milling of the ore recovers more gold than does fusion (i.e. assay), especially where gold values are highest.

Consequently, the assay results likely represent minimum values for gold extractable from the ore by free milling methods, hence the highest values for each sample would most closely approach free-milling extractability. Iron King's results from 2 assay-ton samples in many cases are too low to be an accurate representation of the gold contents in the samples. Either from agreement among the three assay runs, or by repeats of the 1/2 assay-ton samples, gold values believed to be realistic for fusion of the samples were determined. Table 1 shows all the assay results obtained from the three sample runs, and the highest values have been chosen as the most accurate approximations to the real gold values in the samples.

Assay Results and Significance

Samples VT 1 to VT 20, whose gold results are shown in table 1, represent underground samples from the Tantolos mine and VT 21 is the sample of the vein at surface directly above the stope. Samples VT-A to VT-E are representative surface samples taken from other quartz vein and gossan prospects on the Tantolos property. The general route of the sample traverse starts in the back of the adit, works down into the winze, goes up the west side of the stope, then the east side, and finally from the west end of the stope out through the rest of the workings at the 100 level, as shown in plan (figure 4) and cross section (figure 5). In many places, a sample of the vein material was immediately followed by a sample of the wallrock nearby, which explains the alternating high and low gold values of adjacent samples (table 1).

Sample VT 1, at 1.37 oz/t Au, represents the vein at the last round of mining in the main 100 level drift. Certainly the mining activity did not limit the ore shoot to the east at the 100 level, because it ended in ore. At the same locality, Independent Mining Co. (IMC) found 7.42 and 9.89 oz/t Au in samples taken by the owners. This serious discrepancy in gold values of samples from the same site probably results from sampling differences, but may imply that IMC did not accurately separate gold from silver in the fused bead. Samples VT 2, of wallrock immediately adjacent to the vein, was not as high as the vein, but its $ 40 gold value indicates that the footwall material could easily be mined with the main quartz vein ore.

There exist throughout the metavolcanic rocks of the Tantolos mine area numerous bull quartz vein pods that represent local silica mobilization during metamorphism. Sample VT 3 was from such a pod underground, near the main quartz vein, to test its gold content. The low gold value was expected and indicates that the smaller quartz pods are not highly mineralized like the vein itself. VT 4 is an important sample because it represents the chloritic wallrock immediately adjacent to the vein that was not taken in the previous mining. The $ 70 value of this 0.178 oz/t Au sample clearly demonstrates the importance of taking several feet into the hanging wall as well as several feet into the footwall.

From its typical 1 foot width at the 100 level, the quartz vein widens 1.5 to 2 feet in the bottom of the winze, and is much more continuous than it is at higher levels. Across this width, the vein runs consistently 1.33 oz/t Au, which is clearly ore grade. Hence the deepest levels of mining certainly did not terminate the depth projection of the main ore shoot; instead they show that the quartz vein seems to continue to widen and thicken consistently with depth, which is a very encouraging indication for further exploration.

TABLE 1 -- ASSAY RESULTS OF TANTOLOS MINE SAMPLES

Sample	Iron King (2 assay ton)	Root and Norton (1 assay ton)	(1/2 assay ton / repeat)		Chosen Value	
VT 1	1.004	0.804 *	1.37		1.37	oz/t Au
VT 2	0.085	0.084	0.092		.092	oz/t Au
VT 3	0.003	0.008	0.016		.016	oz/t Au
VT 4	0.163	0.136	0.178		.178	oz/t Au
VT 5	0.707	0.768 *	1.33	1.18	1.33	oz/t Au
VT 6	0.660	1.34	1.33		1.34	oz/t Au
VT 7	0.215	0.280	0.320	0.328	.328	oz/t Au
VT 8	0.021	0.012	0.024		.024	oz/t Au
VT 9	0.641	0.356 *	0.032		.632	oz/t Au
VT 10	0.227	0.124	0.162		.227	oz/t Au
VT 11	2.324	2.05	2.02	2.01	2.324	oz/t Au
VT 12	0.504	0.726	0.662		.726	oz/t Au
VT 13	3.021	5.34	3.42	3.13	5.34	oz/t Au
VT 14	0.143	0.222	0.198		.222	oz/t Au
VT 15	2.913	4.48	3.16	3.09	4.48	oz/t Au
VT 16	0.382	0.634	0.658		.658	oz/t Au
VT 17	0.087	0.115	0.160		.160	oz/t Au
VT 18	0.020	0.020			.020	oz/t Au
VT 19	0.008	0.009			.009	oz/t Au
VT 20	0.003	0.004			.004	oz/t Au
VT 21	0.026	0.039			.039	oz/t Au
Other Prospects sampled at surface:						
VT A	0.019	0.012			.019	oz/t Au
VT B	0.005	0.026			.026	oz/t Au
VT C	0.019	0.008			.019	oz/t Au
VT D	0.008	0.013	0.014		.014	oz/t Au
VT E	0.006	0.008			.008	oz/t Au

* = Notable slag loss at 1 assay ton detected by Root and Norton Assayers

TABLE 1 (cont'd) -- DESCRIPTIONS OF TANTOLOS MINE SAMPLES

Sample	Sample Description
VT 1	Quartz vein in very back of adit at last round; chip taken over 1.5 feet
VT 2	Chip sample of mainly wall rock with some quartz vein taken over 3 feet
VT 3	Quartz pod and altered wall rock 2 to 6 feet into hanging wall from vein
VT 4	Chloritic hanging wallrock 1 to 2 feet adjacent to vein; chip over 10 foot length
VT 5	Channel sample of quartz vein in bottom of winze taken over 8 feet; 2 foot true
VT 6	Accurate channel sample of total vein; 1.5 feet of malachite-rich quartz vein
VT 7	Sheared up limonitic quartz vein above VT 7; channel over 1 foot of faulted vein
VT 8	Altered and silicified footwall rock beside vein in winze; chip over 3 feet wide
VT 9	Sample west stope wall 10' above drift; 1 foot chip of leached quartz vein
VT 10	10' higher, limonite-sericite-clay shear cutting 4 feet of quartz vein and wallrock
VT 11	60' up in stope, chip of wallrock 1 foot into hanging wall from vein; visible gold
VT 12	Sheared limonitic quartz vein, clay gouge and wallrock taken over 2.5 feet total
VT 13	Visible gold in 1 foot-wide malachite-rich vuggy quartz vein of east stope wall
VT 14	Sheared limonitic quartz vein breccia, gouge and wallrock over 4 foot width
VT 15	Uppermost stope area; en echelon quartz vein pod 0.7 feet wide; malachite rich
VT 16	Chip of 1 foot wide sheared quartz vein at adit level, just west of main stope
VT 17	Chip of 2 foot wide quartz vein 20 feet west of stope just before cut off by fault
VT 18	Quartz vein pod 0.5 feet wide just west of fault; may be quartz vein continuation
VT 19	1 foot hematitic sheared zone between two faults; with small rodded quartz pods
VT 20	Hematitic sheared zone at edge of metadiabase dike, chip sample over 1 foot
VT 21	Main quartz vein at surface over sample VT 14 and 15; taken over 0.5 feet of vein
Other Prospects sampled at surface:	
VT A	Grab sample of the Rib quartz vein prospect at surface, taken by JJS
VT B	Grab sample of the rock pile pit to the east over the ridge crest; taken by JJS
VT C	Grab sample of the Columbia prospect on surface; taken by JJS
VT D	Spot chip over 30 feet; gossanous quartz-rich schist of Loki prospect, NE red pit
VT E	Mn-Fe-rich seams in chlorite-clay-rich schist just north of Loki prospect

At the west end of the stope, the main quartz vein is displaced slightly by a fault, but the mining did not extend far enough past the fault to determine how much the vein is offset to the west. Samples VT 10 and 12 include both wallrock and the comminuted vein in this fault zone, and the results show that faulting causes leaching and removal of some of the gold values, but the material that remains is still ore grade (1/4 to 3/4 oz/t Au). Similar leaching of gold in the fault is seen in the winze, where 1/3 oz/t Au remains (sample VT 7). On the edge of the fault zone, the vein is less leached and has higher gold values (0.632 oz/t Au, sample VT 9).

In the coherent part of the quartz vein removed from the main stope, sampling by the owners indicates that the vein itself carried 5 to 6 oz/t Au (their samples T-4 and T-5 at 6.39, 1.76, 5.30 and 6.07 oz/t Au). It is important to note that the silicic, chloritic rock 1 foot into the hanging wall from the vein carries 2.3 oz/t Au (sample VT 11), which indicates that a mining width greater than the 4 to 5 feet of the stope would have easily been economical today.

On the eastern side of the stope, the highest gold samples in the mine were found in the remnants of a small drift at about the 75 foot level. This highly malachite-stained, vuggy quartz carries gold visible to the unaided eye, and sample VT 13 contained up to 5.34 oz/t Au (note that difference between assays of VT 13 suggest gold variability in the sample -- the nugget effect). The owners' samples from this same locality returned 5.30 and 6.07 oz/t Au, in good agreement with Root and Norton's results. The lower 3 oz/t Au values may be due to in-sample variability, but even a visual estimate of the gold content in the sample suggests 5 oz/t Au.

Vertically above this in the stope is a longer drift that explored the vein east until it encountered another fault or shear zone. A 4-foot width of this material carried 1/4 oz/t Au (VT 14) much like the other faulted samples: gold values are reduced, but are still of economic interest. Inasmuch as this sample lies 60 feet up-stope from VT 1 (see figure 4), and the highest grade sample -- VT 13 -- lies between them, the sampling results decisively show that the gold ore in the quartz vein persists to the east beyond the limit of workings.

At the highest point accessible in the stope, the quartz vein is only 0.7 feet wide and forms a series of en echelon sheared pods that are locally disconnected from one another by shears and minor faults. The vein carries 4.5 oz/t Au at this locality in a relatively high-grade sample (VT 15). This value was exceeded by previous samples taken by the owners at the same locality of 7 and 10 oz/t Au. No more than 30 feet above this sample is the shaft collar, where a surface chip sample of the same vein carries 0.039 oz/t Au, a ten-fold decrease in gold grade because of the leaching environment at surface.

Samples VT 16 to VT 20 attempted to test the continuation of the quartz vein west of the stope. This met with limited success because the vein is cut by a series of small cross faults and is displaced south along a fault. Because of this, the west part of the 100 level drift missed the western projection of the quartz vein entirely (figure 4). Sample VT 16 is comparable to sample VT 9, ten foot above it, and both carry 0.6 oz/t Au. A little farther west, sample VT 17 shows a drop in grade to 0.16 oz/t and still farther west the grade appears to drop further to 0.02 oz/t Au (sample VT 18). However, the quartz pod sampled by VT 18 lies between two faults and does not resemble the main quartz vein or appear to be its western continuation. Instead, it resembles one of the many isolated quartz pods in the district, is similar to the pod sampled by VT 3, and has comparably low gold values. Both samples VT 19 and VT 20 tested small hematitic shear zones to the west in an effort to pick up gold values related to the quartz vein, but neither sample succeeded. The conclusion from attempting to sample the western extension of the quartz vein is that it is not intersected by the 100 level drift, and therefore could not be properly evaluated.

SIZE AND EXTENT OF OREBODY

Grade Continuity and Cut Offs

From the sampling program conducted, and from supplementary assays supplied by the owners, it is clear that the old miners concentrated on mining a vertical shoot in the quartz vein to the convenient depth of the 100 level adit, along which material could be easily hauled out, then simply stopped mining. They made no significant effort to pursue the lateral extensions of the planar quartz vein for continuance of the known orebody, *or for nearby similar ore shoots like the one mined*, nor did they pursue its depth extent significantly. It appears that they were looking for 5 oz/t ore and better, and they found it only in the central ore shoot of the stope. Everywhere they found 1.5 to 0.6 oz/t Au ore, they stopped mining. Apparently their cut off was about 1 oz/t Au and they did not venture into anything below this value. This cut off is especially apparent wherever they encountered faults at the margins of the high-grade ore shoot -- they stopped at these faults and made no attempt to pursue the vein past the fault offsets.

What was waste to the old miners is economically viable gold ore today. In this type of underground mining situation where high-grade gold ore is mixed with lower grade, everything carrying 1/4 oz/t Au and better is potentially profitable ore. Virtually all samples of the quartz

vein in the main stoped area, whether sheared or not, and even those samples that included a significant volume of wallrock, exceed this 1/4 oz/t Au economic threshold. If the orebody were mined today, a significantly different width could be used. In addition to the 4 feet stoped out, an extra 3 feet of hanging wall and about the same of footwall could be taken to average 1 oz/t Au and better in mixed ore. This means that the mining width could have been 8 to 10 feet, hence the volume of rock removed could have been more than doubled.

The maximum grade in the ore shoot appears to have been 5 to 6 oz/t Au (although select small pockets could exceed 10 or even 20 oz/t Au). The minimum in the mined stope was likely lower than 1 oz/t Au, because of the disconnected structure of the quartz pods higher in the workings, as noted. The average grade probably exceeded 2 oz/t Au for the operation to be profitable in the early part of the century. The apparent cut off was 1 oz/t Au or less, especially when the miners saw no higher grade quartz vein material immediately in sight. There was little or no exploration, and no significant effort to search for any offsets of the vein. Consequently, the mining effort has left the entire orebody open in all direction.

Specifically, the ore shoot is completely open to depth: the grade of the quartz vein exceeds 1 oz/t Au and it appears to be thickening. The ore shoot is open to the east, as supported by greater than 1 oz/t Au in samples VT 1 and VT 13, but there is an indication from the drift sampled by VT 14 that faulting and shearing affect the quartz vein to the east, as is the case for the western extension. The immediate western extension of the ore shoot appears to be cut off by a fault along the western edge of the stope, the plane of which cuts from between VT 17 and VT 18 at the adit level up to near samples VT 10 and VT 12 in the stope. However, the western extension of the quartz vein beyond this fault to the west has not been found nor sought, and as a result, the orebody is also open to the west. From the trace of the quartz vein at surface, it can be inferred that the western continuation of the vein at the adit level should lie south of the main drift between the portal and sample VT 18 (see figure 4).

Structure of Ore Shoot

The orebody, as mined and outlined by the sampling program, is a steeply plunging prolate shoot of high-grade gold values in an otherwise tabular, steeply dipping plane of the host quartz vein. This plane is locally dissected by small faults, but is known from surface exposures to be continuous for at least 500 feet of strike. In addition, there is every indication that the vein is thicker and more continuous at depth than near surface, as explained below.

In the upper workings of the stope, the structure of the quartz vein is a series of narrow quartz pods less than 1 foot wide and about 5 to 10 feet long, which are intersheared with their chloritic, sericitic and clay-altered wallrocks along later fault planes. In sheared parts of the quartz vein, the rock and gold values are significantly leached, just as they are in faulted zones deeper in the workings. Beyond each sheared section, however, is more unleached vein that is rich in gold. Consequently, it is reasonable to assume the same en echelon structure for the entire ore shoot: gold values will increase both west and east of where the stope stopped in faulted vein material, once unsheared quartz vein is encountered again beyond the stope edges.

In contrast to the pod-like nature of the vein at higher levels, only from the 60 foot level down is the quartz vein a continuous structure across the width of the stope. This continuity persists down to the deepest levels of the mine, namely the winze, although the vein is still locally cut by cross faults. Whether the high gold grades that make up the main ore shoot persist throughout the length of the vein, however, can only be determined by exploratory work. There is an indication that gold grades drop significantly in the west end of the stope at the 100 foot level. Because steeply plunging prolate ore shoots always have edges to the high-grade portions, this is not unexpected. The common situation in Precambrian terranes, however, is that the vertical cigar-shaped pods are largely a function of deformation, not just a primary feature, and like the numerous rods and boudins in the mine itself, the stoped ore shoot is likely to be just one of a series of stacked, en echelon ore shoots in the plane of the quartz vein. This means that exploration along strike could find additional ore shoots like the one already mined, especially at depth where the vein appears to be thicker and more continuous.

Tonnage Calculations

Based on the plan and cross section of the stoped workings (figures 4 and 5), the total tonnage mined in the stope was 2,200 tons over a 5 foot width of the stope. The ore shoot in the quartz vein at the 100 level has a proven strike of 110 feet and a proven depth of 125 feet to the bottom of the winze. If this volume had have been mined on a ten foot width, taking all rock exceeding 1/4 oz/t Au as discussed above, the total tonnage would be 11,000 tons. This tonnage greatly exceeds the mined tonnage because of the difference between calculating the tonnage as a rectangular area versus planimetrically mapping a mined stope. Rectangular areas necessarily must be used in tonnage projections prior to development drilling. Table 2 shows the calculated tonnages of various classes of ore in the Tantolos mine under the various constraints listed. Although a 10 foot mining width is reasonable for the high gold values, only a conservative 5 foot mining width was used in the calculations, which are discussed below.

TABLE 2 -- CALCULATED TONNAGES OF TANTOLOS MINE ORE

Class of Ore	Tonnage *	Grade Range
Main Ore Shoot:		
Mined ore	2,200 tons	1 - 10 oz/t Au range
Blocked Out ore	5,700 tons (38% mined)	1 - 10 oz/t Au range
Depth Projected ore 125'- 250' depth)	5,700 tons	1-5 oz/t Au range
TOTAL INDICATED ORE	11,500 tons	1 - 5 oz/t Au range
Expected Ore:		
Total main ore shoot (500' total depth)	22,500 tons	1 - 5 oz/t Au range
Deeper projected ore (250-500 feet)	11,000 tons	1 oz/t Au range
Strike projected ore (to 125' deep)	8,500 tons	?
Strike projected ore (125' to 500' deep)	20,500 tons	?
ADDITIONAL EXPECTED ORE	40,000 tons	1/2 oz/t Au range
Total & Maximum Tonnages:		
Probable total vein tonnage	51,500 tons	?
Maximum Tonnage over exposed 500' strike	105,000 tons	?

* Note: All tonnage calculations assume 5 foot mining width and 12 cu.ft. per ton. For 10 foot mining width, double all calculations. For very conservative estimates, halve all calculations.

The mining activity to date has defined an area 110 feet long, 125 feet deep and 5 feet wide of gold ore ranging from 1 to 10 oz/t Au; thus, it has blocked out 5,700 tons of ore, 38% of which has been mined to date. Because 125 feet of depth has been proven, and the ore contains in excess of 1 oz/t Au at the bottom of this ore block, it is reasonable to infer that at least another 125 feet depth of ore exist beneath this. However, the grade is likely to be less at the highest grade range (1 to 5 oz/t Au instead of 1 to 10 oz/t Au) because of the likelihood of entering unenriched protore in the next 125 feet. This means that the total indicated ore for the main ore shoot in the Tantolos vein is 11,500 tons.

The tonnage to be expected from the ore shoot and the entire quartz vein, however, are much larger than this 11,500 ton figure. Typically, steeply plunging ore shoots in this style of deformation have axial elongations of 5:1 in the vertical direction, as indeed do the vertically elongate tectonic rods in the mine stratigraphy itself. Hence it is reasonable to expect that the ore shoot will extend to a 500 foot depth. Therefore, an additional 11,000 tons of ore can be expected to lie below the 250 foot level, which brings the total ore in the main shoot to 22,500 tons of 1 to 5 oz/t Au ore (table 1).

The above calculations of the main ore shoot assume no lateral extent beyond the 110 feet of exposed strike of the vein in the stope workings. Clearly this is not the case. Mining of the stope in no way cut off the gold ore at the limits of the workings. One oz/t Au ore clearly extends farther east, but it is impossible to deduce from surface exposures how far east, because the quartz vein does not crop out at surface to the east. Thus, the rake of the vein termination plunges east with depth, which means that a greater tonnage exists at depth than at surface. Because of the lack of surface data on the extension of the vein to the east, the eastern projection of the quartz vein is not even included in any of the tonnage calculations.

In contrast, the western extent of the vein can be defined from surface exposures. The vein is traceable at surface an additional 165 feet west before it is lost under the road and in the ravine to the west. This body of ore to 125 feet depth represents about 8,500 tons of additional expected ore at the current mining level, the presence of which could easily be substantiated by drifting south off the main 100 level adit with two cross cuts. Assuming the same projection to 500 foot depth for this western area as well, an additional 20,500 tons of ore of unknown grade could be expected at depth (table 2). Therefore, taking into account the expected deep projection of the main ore shoot and its defined western extension to 500 feet depth, the total additional ore to be expected is 40,000 tons. Under the assumption that the lateral extent is likely not as rich as the main shoot, a grade of about 0.5 oz/t is not unreasonable for this additional expected ore.

From the above figures it can be deduced that the total probable tonnage of gold ore in the quartz vein is approximately 51,500 tons, of widely varying gold grades. If the entire 500 foot exposed strike of the Tantolos quartz vein is mineralized at depth and constitutes minable gold ore, the 500 by 500 by 5 foot orebody calculates out at 104,000 tons, or approximately 2 times the probable total vein tonnage deduced from the above analysis. At present no data exists to accurately determine whether or not the entire exposed strike of the quartz vein is mineralized with significant gold concentrations to make the full length economically interesting.

Furthermore, instead of the quartz vein containing a single continuous orebody, minable gold ore is most likely to occur in the quartz vein as a series of discrete, en echelon pods, all elongate in the vertical direction, and stacked beside each other, as variable foliation intensity acted to dissect the vein into tectonic rods. Simply put, there may exist underground a series of steeply plunging gold ore shoots, of which the existing workings mined only a single shoot. This structure is much more likely for the region than a single, continuous, planar orebody.

EXPLORATION AND DEVELOPMENT

Exploration Methods

Given a 1 to 10 oz/t free-milling gold ore body such as the Tantolos that is open in all directions, the logical next step is to conduct a drilling program to explore for lateral and depth extensions of the gold mineralization and develop additional ore tonnages to see if the total value in the mine is in the range of interest. Although drilling is an obvious next step, in the case of the Tantolos mine, it is not necessarily the only viable option. The choice of a drilling method, the problems in assuring good recovery, and the interpretation of the final results are not always clear-cut. In fact, poorly designed drilling programs invariably demote otherwise good mining properties and provide little useful information for extending orebody reserves.

In the Tantolos mine, another sensible option is to continue drifting, cross cutting and sinking as a means to explore for lateral and depth continuations of the known orebody, as well as to search for additional en echelon ore shoots. Underground exploration leaves no doubt as to the real gold grades in the rocks because there are no limitations to sampling them accurately. In contrast, drilling gives only one chance at evaluating grades, and intercepts are always too small

to represent an orebody. The chief drawback to underground exploration is its $ 250 per foot cost -- 10 times that of diamond drilling. Nevertheless, it may be the only way to accurately evaluate the Tantolos gold vein, and if done in ore, can pay for itself in the gold recovered.

Core obtained from diamond drilling provides both mineralogic and accurate grade data on the small sample of the ore it represents. The volume of rock is, however, about 1/3rd that of a rotary hole, and in high-grade gold mines, volume is a key factor in gold-assay accuracy. Also, the constant washing action of the diamond drilling process can seriously deplete gold grades from broken, fractured or vuggy vein material, as can poor core recovery in faulted and sheared zones. The main advantage of diamond drilling is the ability to accurately correlate geologic information to gold assays from the sampled core intervals.

Reverse-circulation rotary or percussion drilling is a very fast and inexpensive means to quickly drill out and evaluate any potential orebody. The method has acquired a reputation for losing metal values, particularly gold, because the quality of recovery and sample accuracy is so dependent upon the quality of the drill crew and how conscientiously they work at maintaining maximum recovery. Even with theoretically perfect reverse-circulation recovery, a certain small percentage of gold is still lost from the drilling due to density stratification of material in the air column and sinking of dense gold below all other minerals. If rock recovery is 90% and better, however, this density loss in minimized, and in fact is likely to be less than the loss by washing of the core in diamond drilling. The principal drawback to rotary drilling is that it produces only cuttings, and therefore causes difficulty in accurately correlating sample results to geology.

Also in the case of a narrow vein like the Tantolos, the short vein intercept so critical to the orebody's viability may become split between two adjacent sampled intervals. The result is a serious *apparent dilution* in gold grades, which can lead directly to dismissing the presence of ore. For example, if a 1 foot-wide vein carrying 2 oz/t Au becomes split halfway between two 5 foot samples, the apparent grade in each sample is 0.2 oz/t Au, but each sample may assay only 0.15 oz/t Au because of gold loss in the drilling method. Consequently, the geologist concludes that the structure at the drilled position has lost its high-grade gold values, and as a direct result, the orebody written off, when in fact the vein actually does contain ore-grade gold values.

Careful monitoring of the drilling progress can minimize the apparent sample dilution, but never fully eradicate it. This problem is generally not so severe with diamond drill core, but can be a negative factor that, combined with the extremely small sample of a vein that a BQ diamond core represents, can cause one to miss the gold values that really do exist in the vein.

Although drilling is ideally suited to evaluating large low-grade deposits where mineralization is spread across many samples, it is a less desirable way to evaluate a high-grade gold vein, where the entire usefulness of each hole hinges upon perfect recovery in a single, crucial five-foot intercept. Moreover, it is that intercept where the faulting, shearing and brittle quartz is found, so the chances of the poorest recovery are maximized in this key interval. In fact, because of the combined brittle but clayey nature of the mineralized interval at the Tantolos mine, good-quality reverse-circulation rotary drilling is likely to get better recovery in the ore zone than diamond drilling, where recovery can be typically as low as 10% in very broken, clay-rich zones.

Drilling Strategy

All the above factors considered, probably the fastest, most cost-efficient method of drilling the Tantolos vein for its depth and strike extent is by high-quality reverse circulation rotary drilling. The entire project can be completed in a short option period, and the target can be fully evaluated by a relatively inexpensive program. Cost estimates of $ 7.50 per foot for reverse-circulation rotary drilling have been secured from reliable drillers locally in Kingman, whereas the cost for diamond drilling out of Kingman is approximately $ 22 to $ 24 per foot. The most risky part of such a program comes in the interpretation of the results. If assays in the 1 oz/t Au range are recovered, then the program would have been highly successful. If however the results peak in the only 0.15 to 0.25 oz/t Au range, this is not a valid basis for dismissing the presence of ore grade intercepts, because of the apparent and real dilution factors noted above.

If the program returns only inconclusive low values in the 1/4 oz/t range, it then becomes appropriate to follow up the rotary drilling with a diamond drilling program at selected or key sites. If the 15 planned holes were all drilled at the outset by diamond drilling, the project would take 4 times as long and cost at least three times as much as the drilling program outlined below.

Budget for Proposed Drilling Program

Phase 1 drilling is budgeted as reverse-circulation rotary drilling at $ 7.50 per foot, all inclusive cost, from Brown Drilling in Kingman, Arizona. Phase 2 drilling is budgeted as BQ wire-line diamond drilling at $ 22.00 per foot, all inclusive cost, from Thatcher Drilling in Kingman, Arizona. Local drilling companies have been chosen for both drilling phases to minimize costs, eradicate mobilization charges, and relieve the program of down-time charges. These budgets represent probably the minimum costs possible for each phase of the evaluation, including geologic and overhead costs. The budget is realistic only under careful direction.

BUDGET FOR 1- AND 2-PHASE DRILLING PROGRAM

Phase 1 -- Reverse Circulation rotary drilling

Targets:	(1) Intermediate depth extent to 250 feet of main ore shoot (see figure 6);
	(2) Deeper extent of main ore shoot, where feasible from existing pads;
	(3) Lateral extent or Tantolos quartz vein to west at 100 to 200 foot depths;
	(4) Brief testing of eastern extent of main ore shoot at 100 to 200 foot depth;
	(5) Miscellaneous holes for testing of various structures and hole repeats.
Drilling:	15 holes, average 200 feet per hole = 3000 feet of drilling @ $ 7.50 per foot = $ 22,500
Duration:	estimated 12 days
Geologic:	$ 6,000 including field expenses and sampling materials and equipment
Assays:	average 10 samples per hole, 15 holes plus extras = 200 samples @ $ 15.00 = $ 3,000
Physical:	Up to $ 5,000 for caterpillar work, roads, preparing drill pads, reclamation
Report:	$ 5,500 including maps, plans, drill sections, orebody evaluation, further work

TOTAL PHASE 1 COST = $ 42,000

Phase 2 -- BQ wire-line Diamond drilling

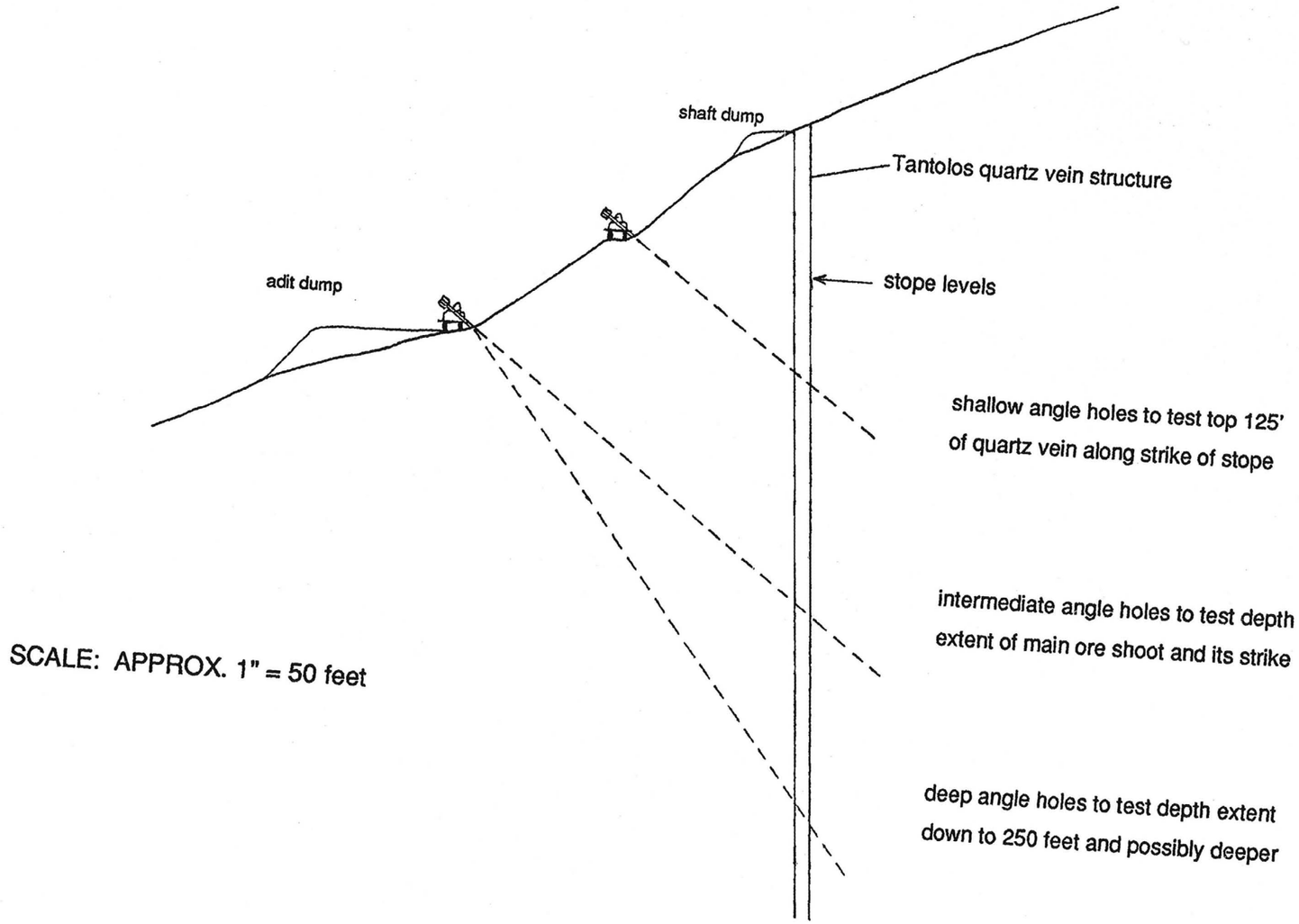
Phase 2 contingent upon the need for confirmation, support and deepening of phase 1 drilling.

Targets:	(1) Checking grades on rotary holes -- 3 holes at 200 feet
	(2) Testing deeper extent of main ore shoot -- 1 hole at 400 feet
	(3) Checking shallow western extent of vein -- 1 hole at 200 feet
	(4) Testing deeper western extent of vein -- 1 hole at 400 feet
Drilling:	1600 feet of drilling @ $ 22 per foot = $ 35,200
Duration:	estimated 30 days
Geologic:	$ 10,000 including field expenses and sampling materials and equipment
Assays:	average 30 samples per hole, 6 holes = 200 samples @ $ 15.00 = $ 3,000
Physical:	$ 2,000 for caterpillar work, preparing drill pads, reclamation
Report:	$ 4,800 including maps, plans, drill section, final orebody evaluation

TOTAL PHASE 2 COST = $ 55,000

Figure 6: DRILLING PLAN FOR TESTING STRIKE AND DEPTH EXTENT OF TANTOLOS QUARTZ VEIN

COMPOUND SECTION LOOKING NORTHEAST



SCALE: APPROX. 1" = 50 feet

At the conclusion of the two-phase program, or with very optimistic results forthcoming at the end of the phase 1 program, and given that the dollar value vs cost analysis of the mine is favorable, the Tantolos mine would be in a position either for full-scale mine development, or for immediate expansion of the workings to undertake mining of the new ore reserves found. The choice at this stage is largely a matter of approach. For complex ores and large orebodies, extensive feasibility studies are usually necessary. For a small high-grade gold mine where the ore can be easily mined and very simply processed, it is often better to move quickly into the mining stage to realize immediate profits than to spend those profits in advance with feasibility studies that may be unwarranted, given the relatively simple ore type and mining method.

CONCLUSIONS

The Tantolos mine stoped part of a Precambrian quartz vein bearing visible gold in a bedded dacitic volcanic sequence metamorphosed to low amphibolite grades in the Cottonwood Cliffs east of Kingman. The gold vein is a product of regional metamorphism, and the vertically elongate shape of the gold ore shoot is largely a function of regional deformation, indicating that the vein has considerable vertical extent comparable to its 500 foot strike length. Orebodies within the vein are most likely to occur as a series of stacked, en echelon vertical shoots.

The 5 to 20 pound samples taken for this evaluation contained gold grades up to 5 oz/t, but much higher gold values exceeding 10 oz/t Au are known to exist. The most accurate way to substantiate these higher grade gold values is to bulk sample the existing workings, by taking one ton samples, and by measuring the amount of gold extracted with normal free milling. This bulk sampling will completely circumvent the inaccuracies (such as nugget effects and slag loss) inherent in fusing highly mineralized gold ore for conventional assay determinations. It will also provide the accurate prototype extractability tests that will ultimately be required in order to correctly design the mill before full-scale mining and milling can commence.

Approximately 2,200 tons has been stoped to date out of 11,500 indicated tons of 1 to 10 oz/t gold ore from the steeply plunging ore shoot. Sampling has also shown that early mining did not reach the limits of the 1 oz/t gold ore, so the orebody remains open in all directions. Specifically, it is open below 125 foot depth, open to the east for an unknown distance at depth below where no outcrop exists at surface, and for at least 160 feet to the west where the quartz

vein crops out. Thus, approximately 40,000 tons of additional 0.5 to 1.0 oz/t Au ore may be expected along strike and at depth, suggesting a total tonnage of about 51,500 tons.

In order to test the presence of this additional indicated and expected ore, either drifting or a drilling program is necessary to extend the known limits of the orebody beyond its current 110 feet of strike and 125 feet of depth. The preferred method of evaluation is a high-quality reverse circulation rotary drilling program first, because of its speed and low cost, later to be followed by diamond drilling to confirm the rotary grades and test even deeper extensions of the ore zones, if such a second-phase diamond drilling program is warranted. The minimum cost of the first phase is budgeted at $ 42,000 and the second phase at $ 55,000. With successful results from this one- or two-stage program, the Tantolos mine would be ready for either additional developmental drilling and feasibility studies, or else direct mining and milling.

CERTIFICATION

Precambrian Research and Exploration Inc. has been designing and conducting base- and precious-metal exploration programs for major mining and oil exploration companies in Arizona for the past 15 years, and has had many of the Fortune 500 companies as its frequent clients. Precambrian Research and Exploration Inc. is now widely considered to be the foremost experts on regional Precambrian tectonics of the southwestern United States and its mineral deposits.

Precambrian Research and Exploration Inc.'s principal, Dr. Phillip Anderson, holds a Bachelor's Honours Degree in Geology with High Distinction from the University of British Columbia (1971), and a Ph.D. Degree in Geosciences from the University of Arizona (1986). He has or has had membership in many national and international geologic societies, including Fellow of the Geologic Association of Canada, the Geological Society of America, the Society of Economic Geologists, the International Union of Geologists, the International Association on the Genesis of Ore Deposits, and is U.S. Coordinator for the International Geologic Correlation Programme on Precambrian Ore Deposits and Tectonics, a global scientific endeavor.

He has conducted Precambrian investigations on 5 continents of the globe, including North America, Australia, South America, South Africa and Europe, and is one of the pioneers

of cooperative Precambrian Plate Tectonic studies between these continents. Previously in British Columbia he was a porphyry copper specialist from 1967 to 1973 and discovered a small copper mine in British Columbia. His mineral exploration experience totals 22 years.

Precambrian Research and Exploration Inc. is a profit corporation incorporated in the State of Arizona for the purpose of conducting geologic investigations and mineral exploration programs. Precambrian Research and Exploration Inc. prepares all its reports to the highest standards available in the industry and guarantees the quality of its work. How that work is subsequently used by other parties, however, is beyond the control of Precambrian Research and Exploration Inc. Consequently, neither Precambrian Research and Exploration Inc. nor its principals assume any liability whatsoever for intentional or unintentional use or misuse of its reports, or assume any liability for any incidental or consequential damages arising from the use or misuse of its reports, or from conflicts in opinion based on interpretation of its reports.

Precambrian Research and Exploration Inc. reserves the right to subsequently adapt or change its perspective on the geology and/or gold potential of the Tantolos Mine based on the incoming of new or updated information, either from other individuals or from further work. This process of refining the perspective on a property's mining potential is the essence of the scientific process and in no way invalidates prior reports prepared at earlier stages in the process. All subjective conclusions in this report are based on best-faith evaluation and assessment of a great number of very complex geologic criteria, any one of which may change at a later date.

Submitted this 12th day of January, 1990, by :

Precambrian Research and Exploration Inc.

Phillip Anderson, Ph.D.
President

W. R. Jones, R.A., Manager
J. G. Cole, Asst. Manager

ROOT & NORTON ASSAYERS

(303) 387-5492
Established 1900

CERTIFIED REGISTERED ASSAYERS
P.O. Box 309 — 1025 Empire Street
Silverton, Colorado 81433 USA

CERTIFICATE OF ASSAY

Silverton, Colorado DEC 14-1989

NO.	DESCRIPTION	OZ PER 2000# Gold	OZ PER 2000# Silver		OZ/TON GOLD	GOLD Duplicate				Remarks
		1 ASSAY TON			½ ASSAY TON					Prepared from
VT-A		0.012								Crushed Reject
B		0.026								
C		0.008								
D		0.013			0.014					
VT-E		0.008								
VT-1		0.804	*		1.37					
2		0.084			0.092					
3		0.008			0.016					
4		0.136			0.178					
5		0.768	*		1.33	1.18				
6		1.34			1.33					
7		0.280			0.320	0.328				
8		0.012			0.024					
9		0.356	*		0.632					
VT-10		0.124			0.162					
11		2.05			2.02	2.01				
12		0.726			0.662					
13		5.34			3.42	3.13				
14		0.222			0.198					
15		4.48			3.16	3.09				
16		0.634			0.658					
17		0.115			0.160					
18		0.020								
19		0.009								
20		0.004								
VT-21		0.039								
*	= Probable SLAG Loss at 1 AT.									
=										

ATED IN SILVERTON

Assayed for PRECAMBRIAN R+D - P. ANDERSON

Charges $ 553 00

REGISTERED ASSAYER CERTIFICATE NO. 19627 WILLIAM R. JONES Date Signed 12-14-89 ARIZONA, U.S.A.

Assayer

IRON KING ASSAY INC.

13-Dec-89

LAB JOB #: MSC04217

Client name: Precambrian Research & Exploration Inc.
Billing address: 810 Owens Lane Payson AZ 85541

Phone number: 474-2108

No. Samples: 26
Date Received: 11-16-89
Submitted by: P. Anderson

INVOICE ATTACHED

ANALYTICAL REPORT

Client ID MSC04217	Lab ID	Fire Assay Au oz/ton
VT-1	4217- 1	1.004
VT-2	4217- 2	0.085
VT-3	4217- 3	0.003
VT-4	4217- 4	0.163
VT-5	4217- 5	0.707
VT-6	4217- 6	0.660
VT-7	4217- 7	0.215
VT-8	4217- 8	0.021
VT-9	4217- 9	0.641
VT-10	4217- 10	0.227
VT-11	4217- 11	2.324
VT-12	4217- 12	0.504
VT-13	4217- 13	3.021
VT-14	4217- 14	0.143
VT-15	4217- 15	2.913
-16	4217- 16	0.382
VT-17	4217- 17	0.087

REGISTERED ASSAYER CERTIFICATE NO. 14315 ROBERT G. CROOK 12-13-89 ARIZONA, U.S.A.

P.O. Box 56 • Humboldt, Arizona 86329 • Phone (602) 632-7410
4410 S. Grass Valley Road • Winnemucca, Nevada 89445 • Phone (702) 623-1055

Client ID MSC04217	Lab ID	Fire Assay Au oz/ton
VT-18	4217- 18	0.020
VT-19	4217- 19	0.008
VT-20	4217- 20	0.003
VT-21	4217- 21	0.026
VT-A	4217- 22	0.019
VT-B	4217- 23	0.005
VT-C	4217- 24	0.019
VT-D	4217- 25	0.008
VT-E	4217- 26	0.006
Std #1		1.226
Std #2		1.228
Accepted Value of Std		1.190

RAL RESOURCES
zona
airgrounds
ZONA

Mr. Lawrence Hall

Kingman,

Arizona

ARIZONA DEPARTMENT OF MINERAL RESOURCES
MINERAL BUILDING, FAIRGROUNDS
PHOENIX, ARIZONA

July 14, 1958

To the Owner or Operator of the Arizona Mining Property named below:

Roosevelt #1 and 2 (Mohave County)	Gold
(Property)	(ore)

We have an old listing of the above property which we would like to have brought up to date.

Please fill out the enclosed Mine Owner's Report form with as complete detail as possible and attach copies of reports, maps, assay returns, shipment returns or other data which you have not sent us before and which might interest a prospective buyer in looking at the property.

Frank P. Knight

FRANK P. KNIGHT,
Director.

Enc: Mine Owner's Report