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ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: ORACLE RIDGE

ALTERNATE NAMES:
CONTROL
CONTROL COPPER PROPERTY
MARBLE PEAK
GEESMAN
COPPER PRINCESS
HARTMAN - HOMESTAKE
LEATHERWOOD
DAILY
SOUTHERN COPPER COMPANY
SOUTH ATLANTIC VENTURES

PIMA COUNTY MILS NUMBER: 881

LOCATION: TOWNSHIP 11 S RANGE 16 E SECTION 16 QUARTER W2
LATITUDE: N 32DEG 28MIN 34SEC LONGITUDE: W 110DEG 43MIN 39SEC
TOPO MAP NAME: BELLOTA RANCH - 15 MIN

CURRENT STATUS: PRODUCER

COMMODITY:
COPPER SULFIDE
SILVER
GOLD
IRON MAGNETITE

BIBLIOGRAPHY:
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LEHNER, R.E. 1973 ADMMR.FIELD REPORT
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CONTINUED ON NEXT PAGE

CONTINUATION OF ORAC[illegible]E RIDGE

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CONTINENTAL MATERIALS CORP 1975 ANNUAL REPORT
CONTINENTAL MATERIALS CORP 1976 ANNUAL REPORT
ROSCOE, JOHN G. 1971, STATEMENT BEFORE THE
IMPACT SURVEY TEAM OF THE CATALINA MULTIPLE
USE PLAN BY CONTINENTAL COPPER INC.
ADMMR "U" FILE CU 58
AGS 1995 SPRING FIELD TRIP GUIDEBOOK

RCL

ORACLE RIDGE PROJECT

HISTORY, CONCENTRATOR DESIGN AND CURRENT STATUS

RCL 9/16/77

ARIZONA CONFERENCE
A.I.M.E.
TUCSON, ARIZONA

By Richard C. Laird
Oracle Ridge Mining Partners
Oracle, Arizona

December 5, 1977

The Oracle Ridge Project is a joint venture between Continental Materials Corporation of Chicago and Union Miniere of Brussels, Belgium, formed to develop the Oracle Ridge Property, formerly known as the Control Mine, located 2½ miles NE of Mt. Lemmon and approximately 16 miles N-NE of Tucson, Arizona. (See Figure 1)

Continental Materials Corporation, in addition to its mining activities, manufactures gas-fired wall furnaces in Los Angeles, California, and produces ready-mix concrete and related building materials in Colorado Springs, Colorado. Union Miniere is an international mining and metallurgical company specializing in non-ferrous metals, with activities mainly in Europe and North and South America. Directly and through affliates it is presently operating in more than eight different countries.

In 1968, the property of Arizona Copper Mines was examined by personnel from Continental Copper, Inc. a subsidiary of Continental Materials and subsequently leased with option to purchase. In the period 1968 to 1974, 138 diamond drill holes totaling 103,656 feet and 2,653 feet of tunneling were completed. The drilling delineated a series of ore zones containing approximately 11 million tons of ore containing 2.25% copper with small amounts of silver and gold.

Historical records indicate that copper mining activities have taken place since 1881, with construction of a 20 ton per day copper smelter. About 100,000 pounds of copper is said to have been produced using charcoal as a fuel. After spending $200,000 the smelter was closed. Subsequent attempts to reopen the smelter were unsuccessful.

In 1937, a 90 ton per day flotation mill was erected, treating ore from the Geesaman and Daily Mines. The mill operated until 1944 producing 1,091 tons of copper concentrate averaging 8.6 ounces of silver and 27.4% copper. Past production to date is estimated to be 115,000 tons of 3.5% copper ore.

The ore consists of a group of pyrometasomatic replacement deposits in paleozoic carbonates in a roof pendant. Ore is confined to the rather pure carbonates, mostly limestones. Ore quantity is about equal in the upper member of the Abrigo Formation and in the purer carbonate zones of the Martin Formation. Less is present in the Escabrosa Limestone.

Ore minerals are bornite and chalcopyrite with lesser chalcocite and covellite. A half ounce of silver per ton, minor scheelite and traces of gold, molybdenum, lead and zinc are also present. Gangue minerals are mainly magnetite, and silicates, including epidote, garnet, diopside, quartz, tremolite, phlogopite, chlorite, and serpentine. A typical ore body is a moderately irregular, laterally thinning tabular mass in the plane of bedding of an altered carbonate.

In early 1974, a metallurgical test program was undertaken on core samples to determine the amenability of the ore. The test work indicated that a fine grind of 60-70% minus 200 mesh (74 microns) was necessary to obtain acceptable recoveries. It was also determined that best recoveries were achieved at a natural pH as floculation and froth problems developed with lime addition. The reagent scheme developed in the lab consisted of Aero 238 and Z-6 for collectors and a 50-50 blend of Dowfroth 250 and pine oil for frother. Recoveries of 89% copper and a concentrate grade in excess of 32% Cu were consistently obtained with the exception of one ore zone. Pyrite

is minor, so high concentrate grades are common.

The one ore zone that gave lower than average recoveries, contains considerable amounts of talcose minerals which interfere with copper flotation and lower concentrate grades.

Copper losses in the other ore zones are associated with bornite locked with magnetite, and test work is now underway to determine the feasibility of magnetic separation and regrind to improve copper recovery and possibly produce a saleable magnetite concentrate, as the orebody averages 15 to 20% magnetite.

Also, in 1974, a feasibility study was initiated to determine the economics of the property. The results of the feasibility study indicated a 2,000 ton per day conventional flotation plant would be a viable operation and plans were initiated to bring the property into production. Since Continental could not undertake a project of this size on its own, a search for a suitable partner to aid in the development was initiated. This search brought Union Miniere and Continental together and in July, 1977, project financing was arranged through Citibank in New York. Union Miniere has a 45% interest with Continental Materials holding the balance.

Davy Powergas of Lakeland, Florida in association with Rod Gomez and Associates of Tucson, were awarded the design and engineering contract for the concentrator on September 1, 1977. The mill design is well underway at this point and the plot plan and flow sheet are presented in the appendix. A conventional crushing, grinding, flotation plant is being designed. The concentrator will be constructed at an elevation of 5,900 feet on the NE slope of the Catalinas.

Minus 20 inch ore will be received from the mine in rail cars and dumped from a trestle to the coarse ore pad. Ore will be

recovered from the pad by an apron feeder and crushed in a 36" x 48" Kue-Ken jaw crusher. Jaw crusher discharge will be screened with the oversize going to a 1500S Telsmith cone crusher. Cone crusher discharge will join jaw crusher discharge to close the circuit. Screen undersize will report to a 10,000 ton fine ore storage pile. Crushing will take place two shifts a day, ten days per week, at a nominal rate of 215 tph.

Fine ore will be reclaimed by belt feeders and fed to an 8½' x 13' Koppers rod mill at a feed rate of 2,000 tons per day, 7 days per week. Rod mill discharge will be cycloned with cyclone underflow going to an 11½' x 15' Koppers ball mill. Ball mill discharge will join rod mill discharge. Cyclone overflow will report to flotation. The flotation circuit will consist of 14 rougher and rougher scavenger cells. All cells will be 170 cubic foot Agitair machines. Rougher scavenger concentrate and cleaner scavenger concentrate will go to a regrind circuit with regrind product going to cleaning and re-cleaning for final concentrate production. Provision has been made to by-pass the re-cleaning step if feasible. Cleaner scavenger tail can be re-cycled to the rougher scavengers or sent directly to final tailing, depending on ore types received. Space has also been left for a talc cleaning circuit if high talc zones are troublesome. The first three cells of the rougher circuit will be used for a talc rougher if this is necessary. Final concentrate will report to a fifty foot thickener ahead of a disc filter. Filter cake will discharge to a storage area directly under the filter. Concentrates will go by truck or truck-rail combination to a yet to be designated smelter.

Final tailings will be pumped to cyclones for production of sand fill material. Cyclone over-flow will be thickened by a 35 foot

diameter Enviroclear thickener and transported in a polyethylene pipeline, to the tailings disposal area, three miles away, at an elevation of 4,700'. If magnetic separation is incorporated into the plan it will be on the final mill tailing.

The two stage crushing circuit with rod mill, and ball mill grinding was selected because of the possibility of wet, sticky ore. Semi-autogenous grinding was investigated and looked favorable, but time and adequate representative samples were not available to do the necessary testing to design a semi-autogenous circuit. The ore is quite dense having a bulk density of 125-135 pounds per cubic foot. It is also very abrasive, having indexes up to .51 or similar to taconite. The ore is tough but not particularly hard. A crushing work index of 14.3 is average but tests of 18.1 were recorded. Bond grinding work indexes however, are about 10.9.

Tailings disposal will be fairly conventional using cyclones to build berm, with a pond and decant system for water recovery. The plant is being designed for zero discharge so all water will be recovered and carefully controlled. The face of the tailings dam will be revegetated as the berm is built and the surface will be revegetated upon cessation of operation. As the ore is mainly limestone, and little pyrite is present, little difficulty is expected in revegetation efforts.

The Enviroclear tailings thickener was selected over a conventional thickener due to the difference in size, 35 feet versus 130 feet diameter, and the resulting savings in cost and in real estate.

Water for the mine and mill will be obtained from wells from the San Pedro Valley about 10 miles east and 2,700 feet below the mine site. A well field of about 500 gpm capacity is being developed

but usage is expected to average about 250 gpm. The mine is relatively dry and water losses will be in sand fill, concentrate, tailings residual and evaporation.

Power will be supplied by Trico Electric Co-operative from an existing 115 KV transmission line about 15 miles from the property. A 69 KV line will be constructed to the property and reduced to 4.16 KV for distribution. Power demand for the property is estimated at 5,000 KW.

Mine development is currently taking place two shifts per day, five days per week. A production crew of 24 and a total staff of 14 are at the site. Mining equipment being used consists of two 25 ton Wagner four-wheel-drive trucks, three 5 yard Wagner loaders, and three Gardner Denver drill jumbos. A ramp system of mining is being developed with three main openings to service the ore zones. These are the Daily decline, the 5900 level and the 6400 level. No hoisting is required. The majority of mining will be by overhand cut and fill but open stope and room-and-pillar methods may be employed. Forty-five thousand feet of underground workings are to be developed before the start of production.

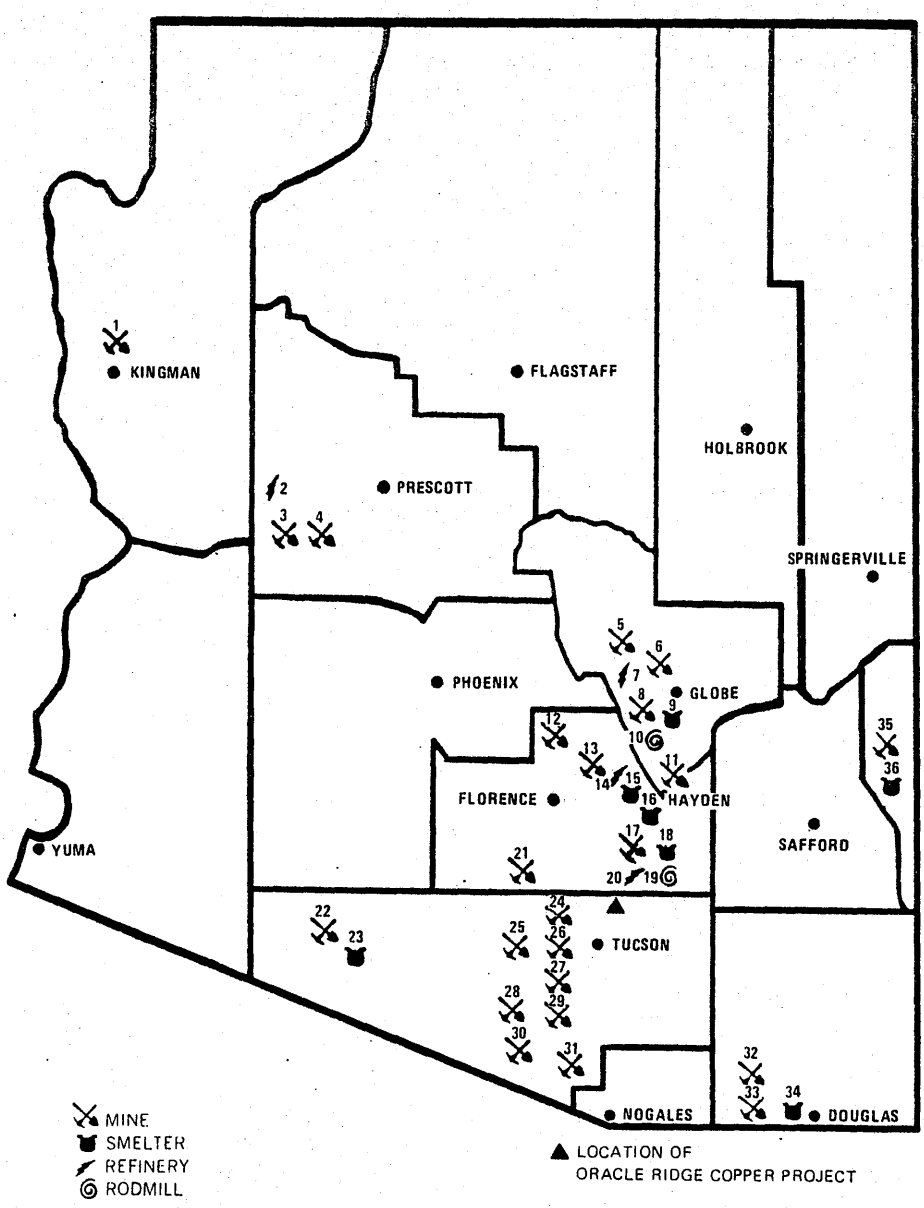
A new private access and haulage road is being built to the mine site from State Highway 76, south of San Manuel near the Black Hills Quarry.

It is expected that engineering for the concentrator will be completed in April, 1978 with a construction contract to be let in July of 1978. Construction on the concentrator facility is expected to start in the third quarter of 1978 with the first concentrate production in the last quarter of 1979.

Capital costs are currently estimated at $11.8 million for the concentrator facility. $2.9 million for services, including water, power and tailings disposal and $25.3 million for land acquisition, mine plant and equipment, mine development and interest expenses. When the project is on stream, the work force will total about 150 employees with an annual payroll cost of approximately 3 million dollars. Supply costs are expected to be 3.5 million per year. Sales and property taxes will total at least 1 million per year.

I would like to take this opportunity to thank the Arizona Conference A.I.M.E., Oracle Ridge Mining Partners, and everyone who helped make this paper possible.

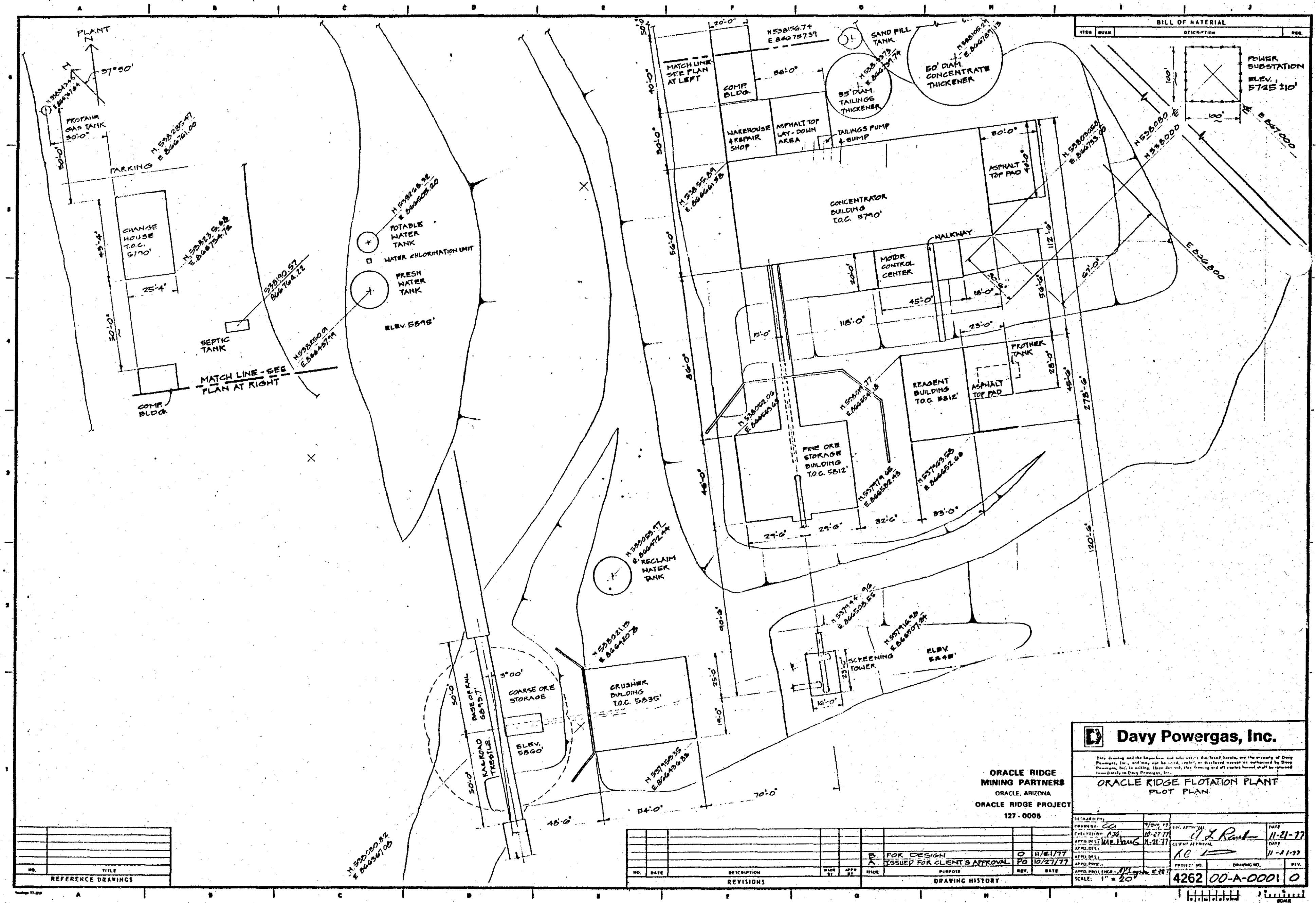
Arizona Copper Producers



1 Duval Corporation's Mineral Park Mine
2 Bagdad Copper Corporation's Electrowinning Plant
3 Bagdad Copper Corporation's Mine
4 Cyprus Mines Corporation's Bruce Mine
5 Cities Service Company's Pinto Valley Mine
6 Cities Service Company's Miami Copper Operations Mine
7 Inspiration Consolidated Copper Company's Electrolytic Refinery
8 Inspiration Consolidated Copper Company's Mines
9 Inspiration Consolidated Copper Company's Smelter
10 Inspiration Consolidated Copper Company's Rod Mill
11 Inspiration Consolidated Copper Company's Christmas Mine
12 Magma Copper Company's Superior Mine
13 Kennecott Copper Corporation's Ray Mine
14 Kennecott Copper Corporation's Electrowinning Plant
15 Kennecott Copper Corporation's Hayden Smelter
16 American Smelting and Refining Company's Hayden Smelter
17 Magma Copper Company's San Manuel Mine
18 Magma Copper Company's San Manuel Smelter
19 Magma Copper Company's Rod Mill
20 Magma Copper Company's Electrolytic Refinery
21 Hecla Mining Company's Lakeshore Mine
22 Phelps Dodge Corporation's New Cornelia Mine
23 Phelps Dodge Corporation's Ajo Smelter
24 American Smelting and Refining Company's Silver Bell Mine
25 American Smelting and Refining Company's San Xavier Mine
26 American Smelting and Refining Company's Mission Mine
27 Pima Mining Company's Pima Mine
28 Banner Mining Company's Properties
29 The Anaconda Company's Twin Buttes Mine
30 Duval Corporation's Sierrita Mine
31 Duval Corporation's Esperanza Mine
32 Phelps Dodge Corporation's Lavender Pit Mine
33 Phelps Dodge Corporation's Copper Queen Mine
34 Phelps Dodge Corporation's Douglas Smelter
35 Phelps Dodge Corporation's Morenci Mine
36 Phelps Dodge Corporation's Morenci Smelter

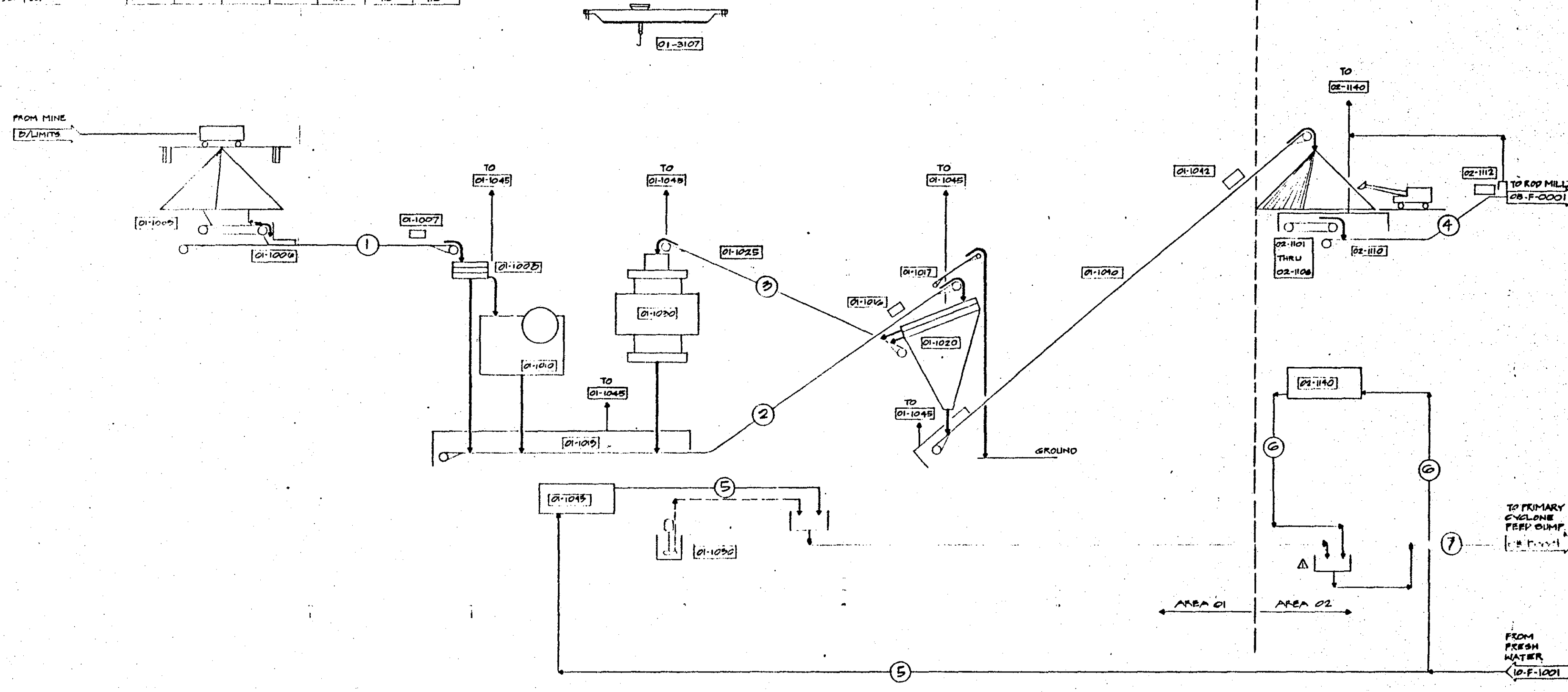
ARIZONA MINING ASSOCIATION MAP

Figure 1. Oracle Ridge Project Location.


PLANT N
PROPANE GAS TANK
PARKING
CHANGE HOUSE T.O.C. 5790'
SEPTIC TANK
MATCH LINE - SEE PLAN AT RIGHT
COMP. BLDG.
POTABLE WATER TANK
WATER CHLORINATION UNIT
FRESH WATER TANK
ELEV. 5898'
MATCH LINE - SEE PLAN AT LEFT
COMP. BLDG.
SAND FILL TANK
55' DIAM. TAILINGS THICKENER
50' DIAM. CONCENTRATE THICKENER
POWER SUBSTATION
ELEV. 5725 ±10'
WAREHOUSE & REPAIR SHOP
ASPHALT TOP LAY-DOWN AREA
TAILINGS PUMP & SUMP
ASPHALT TOP PAD
CONCENTRATOR BUILDING T.O.C. 5790'
WALKWAY
MOTOR CONTROL CENTER
FROTHER TANK
REAGENT BUILDING T.O.C. 5812'
ASPHALT TOP PAD
FINE ORE STORAGE BUILDING T.O.C. 5812'
RECLAIM WATER TANK
SCREENING TOWER
ELEV. 5848'
COARSE ORE STORAGE
BASE OF RAIL 5895.7
RAILROAD TRESTLE
ELEV. 5860'
CRUSHER BUILDING T.O.C. 5835'
ORACLE RIDGE MINING PARTNERS
ORACLE, ARIZONA
ORACLE RIDGE PROJECT
127-0005
Davy Powergas, Inc.
ORACLE RIDGE FLOTATION PLANT
PLOT PLAN
REFERENCE DRAWINGS
REVISIONS
DRAWING HISTORY
B FOR DESIGN 0 11/21/77
A ISSUED FOR CLIENT'S APPROVAL P0 10/27/77
SCALE: 1" = 20'
4262 00-A-0001 0

STREAM No		1	2	3	4	5	6	7 △
DESCRIPTION		JAW CRUSHER FEED	SCREEN FEED	CONE CRUSHER FEED	ROD MILL FEED	CRUSHING DUST COLLECTOR	ORE STORAGE DUST COLLECTOR	DUST COLLECTOR TOTAL DISCHARGE
SOLIDS	STPD				2106	—	—	—
SOLIDS	STPH	215			88	—	—	—
WATER	STPD				100	180	108	288
TOTAL	STPD				2216	180	108	288
FLOW	USGPM				128	30	18	48
% SOLIDS	W/W				95	—	—	—
SG SOLIDS					3.2	—	—	—
SG PULP					—	1.0	1.0	1.0

BILL OF MATERIAL			
ITEM	QUAN.	DESCRIPTION	REQ.



EQUIPMENT No	DESCRIPTION	SIZE	EQUIPMENT No	DESCRIPTION	SIZE	EQUIPMENT No	DESCRIPTION	SIZE
01-1005	COARSE ORE APRON FEEDER		01-1030	SECONDARY CONE CRUSHER		02-1105	BELT FEEDER No 10	
01-1006	No 1 CONVEYOR		01-1040	No 4 CONVEYOR		02-1110	No 11 CONVEYOR	
01-1007	METAL DETECTOR		01-1042	BELT SCALE		02-1112	BELT SCALE	
01-1008	VIBRATING GRIZZLY		01-1045	CRUSHING SECTION DUST COLLECTOR				
01-1010	PRIMARY JAW CRUSHER		01-1050	CLEAN UP PUMP		02-1140	FINE ORE STORAGE DUST COLLECTOR	
01-1015	No 2 CONVEYOR		02-1101	BELT FEEDER No 5				
01-1016	METAL DETECTOR		02-1102	BELT FEEDER No 6				
01-1017	ELECTRO-MAGNETIC CLINKER BELT		02-1103	BELT FEEDER No 7		01-3107	BRIDGE CRANE	
01-1020	VIBRATING SCREEN		02-1104	BELT FEEDER No 8				
01-1025	No 3 CONVEYOR		02-1105	BELT FEEDER No 9				

NO.	TITLE

REFERENCE DRAWINGS

NO	DATE	DESCRIPTION	MADE BY	APPD BY

REVISIONS

ISSUE	PURPOSE	REV.	DATE
B	ADDED LINE #7, LINES #5 & #6 REVISED	1	10/19/77
A	ISSUED FOR CONSTRUCTION	0	10/5/77

DRAWING HISTORY

ORACLE RIDGE MINING PARTNERS
ORACLE, ARIZONA
ORACLE RIDGE PROJECT
127 · 0008

Davy Powergas, Inc.

ORACLE RIDGE FLOTATION PLANT
CRUSHING & FINE ORE STORAGE, AREA 01 & 02
PROCESS FLOWSHEET

DESIGNED BY:
DRAWN BY: AD 9/28/77
CHECKED BY: [illegible] 10/4/77
APPD. DES.:
APPD. DES.:
APPD. DES.:
APPD. PROC.: [illegible] 10-5-77
APPD. PROJ. ENGR.: [illegible] 10-5-77
SCALE: NO SCALE

ISSUED FOR CONSTRUCTION
DPG APPROVAL: [signature] DATE 10/5/77
CLIENT APPROVAL: [signature] DATE 10/6/77

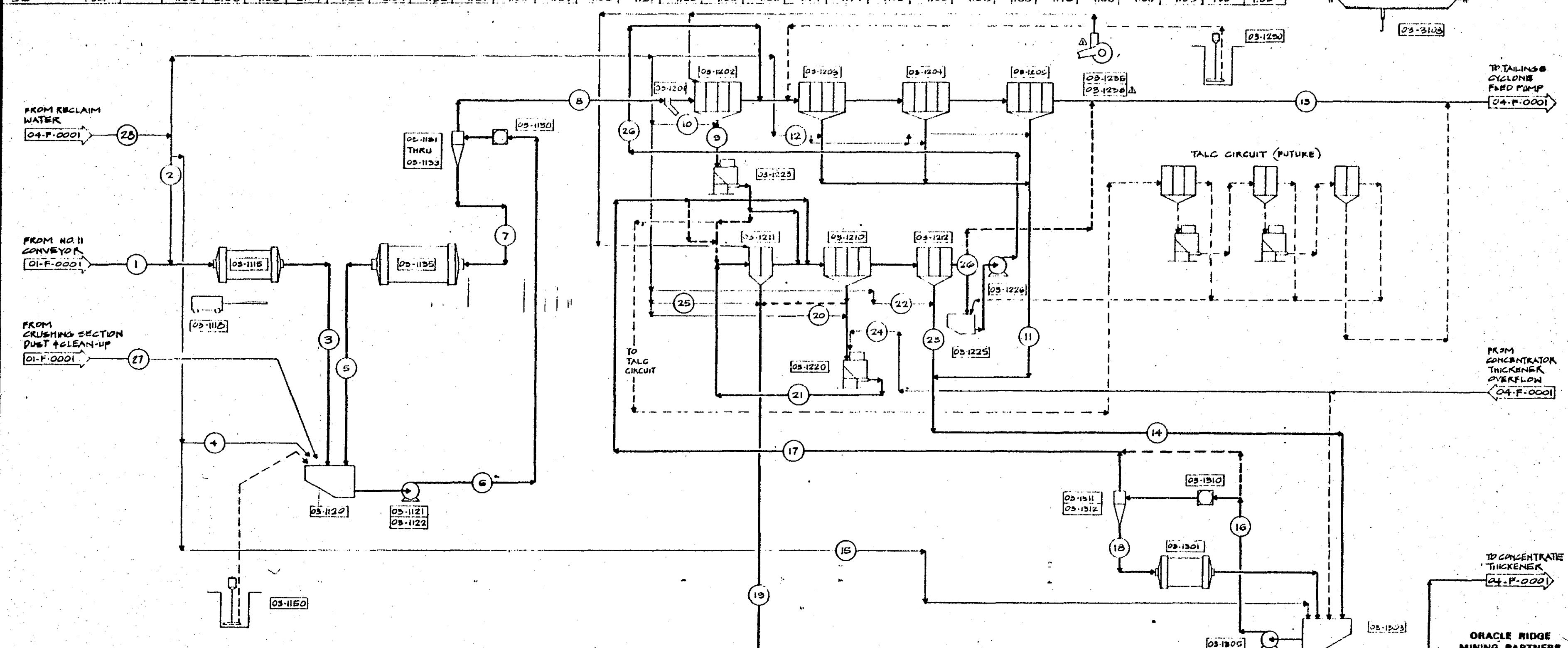
PROJECT NO.	DRAWING NO.	REV.
4262	01-F-0001	1

STREAM NUMBER		1	2	3	4	5	6	7	8	9	10	11	12	13	14
DESCRIPTION		ROD MILL FEED	ROD MILL FEED WATER	ROD MILL DISCHARGE	CYCLONE FEED WATER	BALL MILL DISCHARGE	CYCLONE FEED	CYCLONE UNDER-FLOW	FLOTATION FEED	ROUGHER CONC.	ROUGHER CONC. DILUTION	ROUGHER SCAV. CONCENT	ROUGHER SCAV. DILUTION	FLOTATION TAIL	TOTAL MIDDLINGS
SOLIDS	STPD	2106	–	2106	–	8318	8424	8318	2106	141	–	218	–	1058	263
WATER	STPD	110	592	702	2921	2189	6100	2189	3911	423	2162	594	249	5874	834
TOTAL	STPD	2216	592	2808	2921	8507	14524	8507	6017	564	2162	812	249	7832	1097
FLOW	USGPM	128	98	226	486	693	1453	693	740	78	27	120	41	1080	152
% SOLIDS	W/W	95	–	75	–	74	58	74	35	25	–	25	–	25	24
SG	SOLIDS	3.2	–	3.2	–	3.2	3.2	3.2	3.2	3.4	–	3.2	–	3.16	3.24
SG	PULP	–	1.00	2.06	1.00	2.04	1.46	2.04	1.32	1.21	1.00	1.21	1.00	1.21	1.20

STREAM NUMBER		15	16	17	18	19	20	21	22	23	24	25	26	27	28
DESCRIPTION		REGRIND CYCLONE WATER	REGRIND CYCLONE FEED	REGRIND CYCLONE OVERFLOW	REGRIND CYCLONE UNDER-FLOW	FINAL CONC	CLEANER CONC. DILUTION	CLEANER CONC.	CLEANER SCAV. CONC. DILUTION	CLEANER SCAV. CONC	CONC THICKENER OVERFLOW	FINAL CONC DILUTION	CLEANER SCAV. TAIL	DUST COLLECTOR WATER	PROCESS WATER
SOLIDS	STPD	–	789	263	526	148	–	176	–	45	–	–	211	–	–
WATER	STPD	417	1602	1251	351	839	518	1516	Δ 74	180	819	Δ 565	2629	288	5496
TOTAL	STPD	417	2391	1514	877	987	Δ 518	1692	Δ 74	225	819	Δ 565	2840	288	5496
FLOW	USGPM	69	307	221	80	147	86	260	12	32	137	94	449	48	918
% SOLIDS	W/W	–	33	17.4	60	15	–	10.4	–	20	–	–	7.4	–	–
SG	SOLIDS	–	3.24	3.24	3.24	3.8	–	3.6	–	3.4	–	–	2.2	–	–
SG	PULP	1.00	1.30	1.14	1.74	1.12	1.00	1.08	1.00	1.16	1.00	1.00	1.05	1.00	1.00

BILL OF MATERIAL

ITEM	QUAN.	DESCRIPTION	REQ.



EQUIPMENT No	DESCRIPTION	SIZE
03-1115	ROD MILL	
03-1118	ROD CHARGER Δ	(BY OTHERS)
03-1120	PRIMARY CYCLONE FEED SUMP	
03-1121	CYCLONE FEED PUMP	
03-1122	CYCLONE FEED PUMP (STAND-BY)	
03-1130	3-WAY CYCLONE DISTRIBUTOR	LATER
03-1131 THRU 33	PRIMARY CYCLONE (ONE STAND-BY)	
03-1135	BALL MILL	
03-1150	CLEAN UP PUMP	
03-1201	MILL FEED SAMPLER	
03-1202	COPPER ROUGHER FLOTATION 1 BANK OF 4 CELLS	
03-1203	COPPER ROUGHER SCAVENGER No 1 1 BANK OF 4 CELLS	

EQUIPMENT No.	DESCRIPTION	SIZE
03-1204	COPPER ROUGHER SCAVENGER No 2 1 BANK OF 4 CELLS	
03-1205	COPPER ROUGHER SCAVENGER No 3 1 BANK OF 4 CELLS	
03-1210	COPPER CLEANER FLOTATION 1 BANK OF 4 CELLS	
03-1211	COPPER RECLEANER FLOTATION 1 BANK OF 2 CELLS	
03-1212	COPPER CLEANER SCAVENGER 1 BANK OF 4 CELLS	LATER
03-1220	RECLEANER FEED PUMP & SUMP	
03-1223	CLEANER FEED PUMP & SUMP	
03-1225	ROUGHER SCAVENGER FEED SUMP	
03-1226	ROUGHER SCAVENGER FEED PUMP	

EQUIPMENT No.	DESCRIPTION	SIZE
03-1230	CLEAN UP PUMP	
03-1235	FLOTATION BLOWER	
03-1236 Δ	FLOTATION BLOWER (STAND-BY)	
03-1301	REGRIND BALL MILL	
03-1303	REGRIND CYCLONE FEED SUMP	
03-1305	REGRIND CYCLONE FEED PUMP	LATER
03-1306	REGRIND CYCLONE FEED PUMP (STBY)	
03-1310	REGRIND CYCLONE DISTRIBUTOR	
03-1311	REGRIND CYCLONE	
03-1312	REGRIND CYCLONE (STAND-BY)	
03-3108	BRIDGE CRANE	

EQUIPMENT NO.	DESCRIPTION	SIZE

NO.	TITLE

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	MADE BY	APPD BY

REVISIONS

ISSUE	PURPOSE	REV.	DATE
B	ADDED ITEM #03-1236; REVISED FLOWS	1	10/19/77
A	ISSUED FOR CONSTRUCTION	0	10/5/77

DRAWING HISTORY

ORACLE RIDGE MINING PARTNERS
ORACLE, ARIZONA
ORACLE RIDGE PROJECT
127-0008

Davy Powergas, Inc.

ORACLE RIDGE FLOTATION PLANT
GRINDING AND FLOTATION AREA 03
PROCESS FLOWSHEET

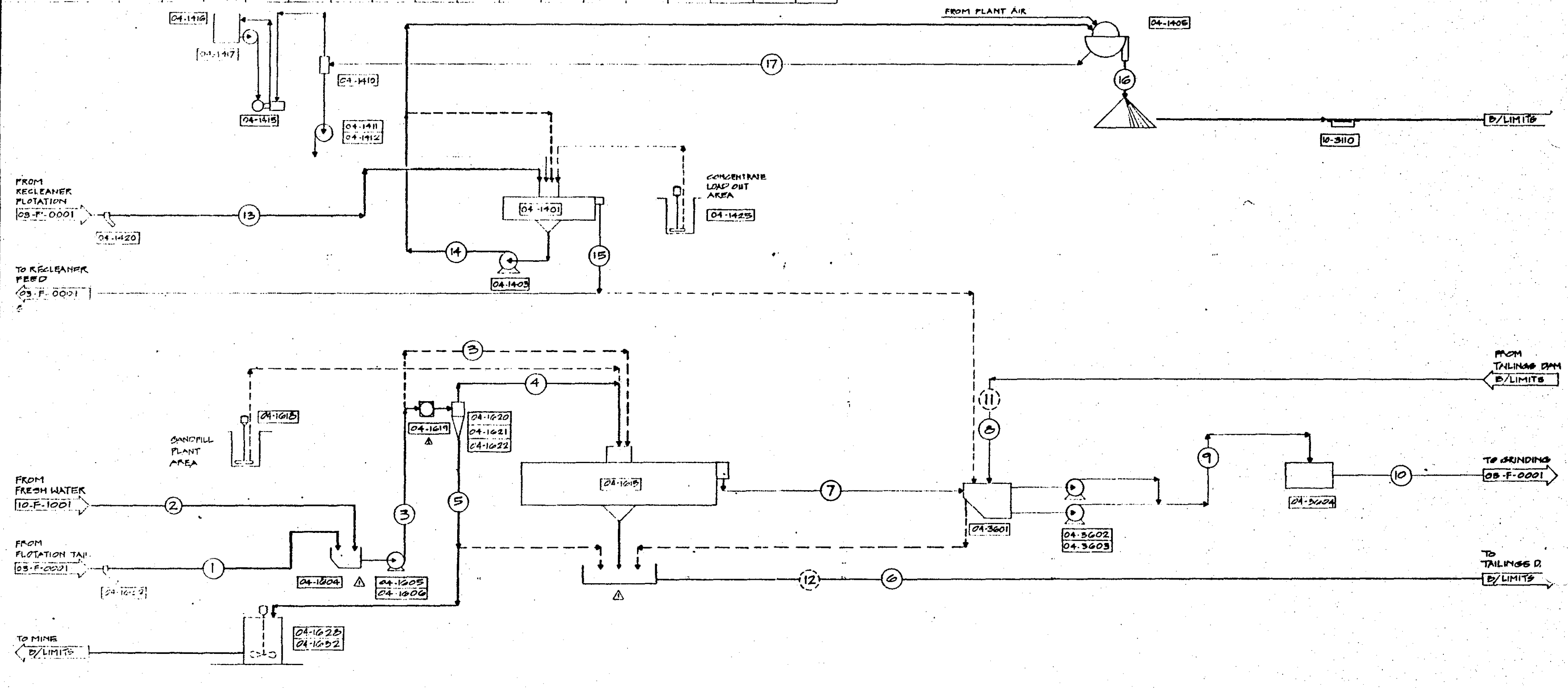
DESIGNED BY:
DRAWN BY: AL EG 9/28/77
CHECKED BY: 10/4/77
APPD DES.:
APPD DES.:
APPD DES.:
APPD PROJ. ENGR. 10-3-77
APPD PROJ. MGR. 10-3-77
SCALE: NO SCALE

ISSUED FOR CONSTRUCTION
DPI APPROVAL: A.K. Rau[illegible] DATE 10/5/77
CLIENT APPROVAL: K.C. [illegible] DATE 10/5/77

PROJECT NO.	DRAWING NO.	REV.
4262	03-F-0001	1

⚠1

STREAM No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DESCRIPTION	FLOTATION TAIL	FRESH WATER MAKE-UP	SAND CYCLONE FEED	SAND CYCLONE OVERFLOW	SAND CYCLONE UNDERFLOW	TAIL THICKENER UNDERFLOW	TAIL THICKENER OVERFLOW	DAM RETURN WATER	RECLAIM WATER	PROCESS WATER	DAM RETURN WATER (SAND&SLIME)	TAIL THICKENER UNDERFLOW (SAND&SLIME)	CONC. THICKENER FEED	CONC. THICKENER UNDERFLOW	CONC. THICKENER OVERFLOW	FILTER DISCHARGE	FILTRATE
SOLIDS STP[illegible]	1958	–	1958	979	979	979	–	–	–	–	–	1958	148	148	–	148	–
WATER ST[illegible]	[illegible]74	638	6512	5985	527	979	5006	490	5496	5496	979	1958	839	98	819	20	78
TOTAL [illegible]	[illegible]	638	8470	6964	1506	1958	5006	490	5496	5496	979	3916	987	246	819	168	78
FLOW [illegible]	[illegible]	106	1187	1050	137	213	833	82	915	915	163	350	147	23	137	10	18
% SOLIDS W/W	[illegible]	–	23.1	14.0	65.0	50.0	–	–	–	–	–	50.0	15.0	60.0	–	88.0	–
S.G. SOLIDS	3.16	–	3.16	3.02	3.30	3.16	–	–	–	–	–	3.16	3.8	3.8	–	3.8	–
S.G. PULP	1.21	1.00	1.19	1.10	1.83	1.52	1.00	1.00	1.00	1.00	1.00	1.52	1.12	1.79	1.00	–	1.00



EQUIPMENT No	DESCRIPTION	SIZE	EQUIPMENT No	DESCRIPTION	SIZE	EQUIPMENT No	DESCRIPTION	SIZE
04-1401	CONCENTRATE THICKENER	LATER	04-1425	CLEAN UP PUMP	LATER	04-1622	SAND FILL CYCLONE	LATER
04-1403	CONCENTRATE FILTER FEED PUMP		04-1652	TAILINGS SAMPLER		04-1628	SAND FILL STORAGE TANK	
04-1405	CONCENTRATE DISC FILTER		04-1604	TAILINGS CYCLONE FEED SUMP		04-1632	SAND FILL TANK AGITATOR	
04-1410	FILTRATE RECEIVER		04-1605	TAILINGS CYCLONE FEED PUMP		04-3601	TAILING THICKENER OVERFLOW SUMP	
04-1411	FILTRATE PUMP		04-1606	TAILINGS CYCLONE FEED PUMP (STD.BY)		04-3602	TAILING THICKENER OVERFLOW PUMP	
04-1412	FILTRATE PUMP (STAND BY)		04-1615	TAILINGS THICKENER		04-3603	TAILING THICKENER OVERFLOW PUMP	
04-1415	FILTER VACUUM PUMP		04-1615	CLEAN UP PUMP		04-3604	RECLAIM WATER STORAGE TANK	
04-1416	COOLING TOWER		04-1619 ⚠1	TAILINGS CYCLONE FEED DISTRIBUTOR				
04-1417	COOLING TOWER CIRCULATING PUMP		04-1620	SAND FILL CYCLONE				
04-1420	CONCENTRATE SAMPLER		04-1621	SAND FILL CYCLONE		10-3110	TRUCK SCALE	

NO	TITLE

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	MADE BY	APPD BY

REVISIONS

ISSUE	PURPOSE	REV.	DATE
B	REVISED STREAM LINES & CAPACITIES	1	10/19/77
A	ISSUED FOR CONSTRUCTION	0	10/5/77

DRAWING HISTORY

ORACLE RIDGE MINING PARTNERS
ORACLE, ARIZONA
ORACLE RIDGE PROJECT
127 - 0006

Davy Powergas, Inc.

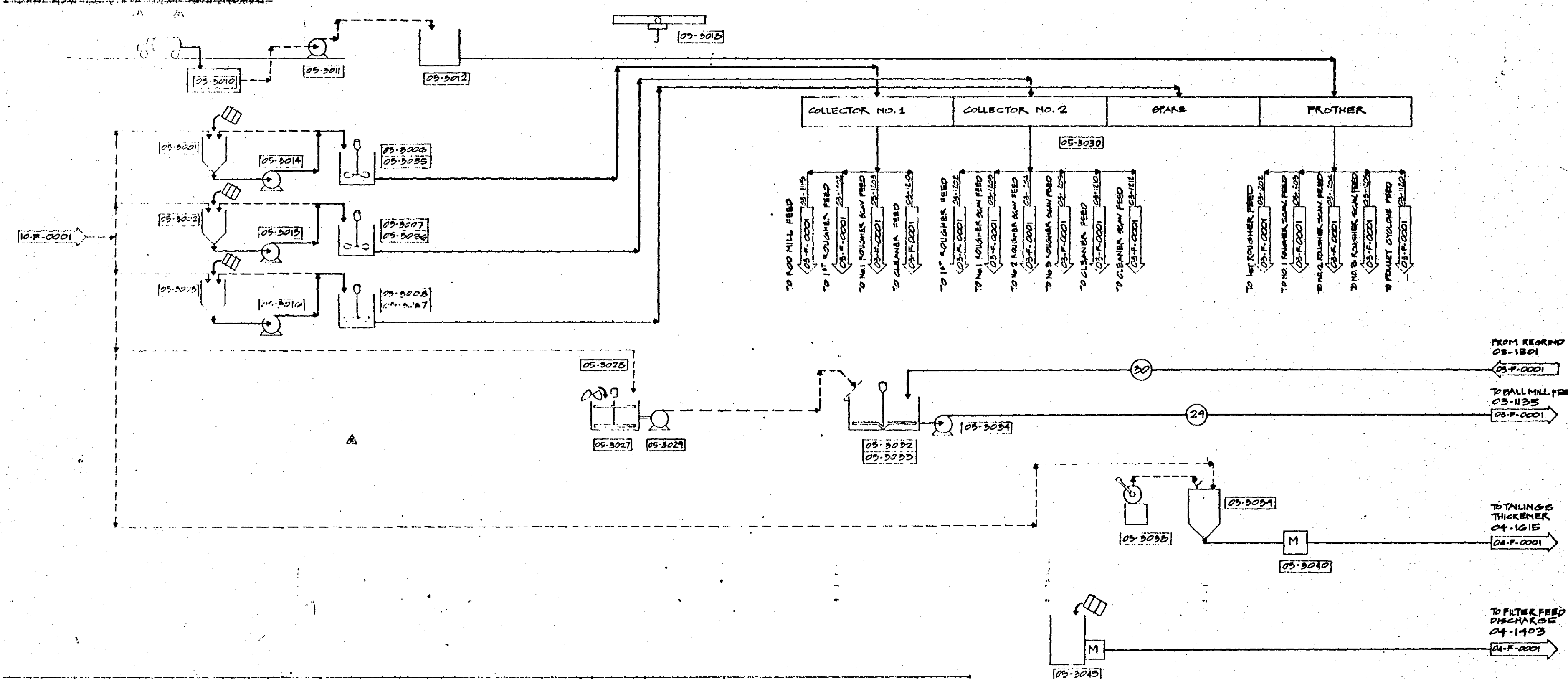
ORACLE RIDGE FLOTATION PLANT
CONCENTRATE & TAILINGS DISPOSAL & PROCESS WATER SYSTEM AREA 04
PROCESS FLOWSHEET

DESIGNED BY:
DRAWN BY: AD CG 7.29.77
CHECKED BY: [illegible] 10.6.77
APPD. DES.:
APPD. DES.:
APPD. DES.:
APPD. PROC.: [illegible] 10.5.77
APPD. PROJ. ENGR.: [illegible] 10.5.77
SCALE: NO SCALE

ISSUED FOR CONSTRUCTION
DPG APPROVAL [signature] DATE 10/5/77
CLIENT APPROVAL [signature] DATE 10/5/77

PROJECT NO.	DRAWING NO.	REV.
4262	04-F-0001	1

STREAM NUMBER		27	28	29	30
DESCRIPTION		BURNT LIME FEED	LIME TO ATTRITION	LIME TO CIRCULATION	LIME FROM CIRCULATION
SOLIDS	STPD	120	24	69	67.5
WATER	STPD	–	–	275	271
TOTAL	STPD	120	24	344	339
FLOW	USGPM	–	–	50	49
% SOLIDS	W/W	–	–	10	10
SG	SOLIDS	3.35	3.3	⚠2.5	⚠2.5
SG	PULP	–	–	⚠1.06	⚠1.06



EQUIPMENT NO.	DESCRIPTION	SIZE	EQUIPMENT No	DESCRIPTION	SIZE	EQUIPMENT No	DESCRIPTION	SIZE
05-3001	REAGENT MIX TANK-COLLECTOR No 1		~~05-3020~~	~~SCREW CONVEYOR~~ ⚠2		05-3037	REAGENT HOLDING TANK AGITATOR-SPARE	
05-3002	REAGENT MIX TANK-COLLECTOR No 2		~~05-3021~~	~~BUCKET ELEVATOR~~ ⚠2		05-3038	FLOCCULENT HAND PUMP	
05-3003	REAGENT MIX TANK COLLECTOR SPARE		~~05-3023~~	~~STORAGE BIN~~ ⚠2		05-3039	FLOCCULENT STORAGE TANK	
05-3006	REAGENT HOLDING TANK COLLECTOR No 1	LATER	~~05-3024~~	~~VIBRATING FEEDER~~ ⚠1	LATER	05-3040	FLOCCULENT METERING PUMP	LATER
05-3007	REAGENT HOLDING TANK-COLLECTOR No 2		~~05-3025~~	~~LIME FEED SCREW CONVEYOR~~ ⚠2		05-3045	DRYING AGENT METERING PUMP W/ INTEGRAL TANK	
05-3008	REAGENT HOLDING TANK-COLLECTOR SPARE		05-3027	ATTRITION PULP TANK				
05-3010	UNDERGROUND FROTHER STORAGE TANK		05-3028	ATTRITION PULP TANK AGITATOR				
05-3011	FROTHER TRANSFER PUMP		05-3029	LIME TRANSFER PUMP				
05-3012	FROTHER HOLDING TANK		05-3030	REAGENT HEAD TANK				
05-3014	REAGENT TRANSFER PUMP-COLLECTOR No 1		05-3032	AGITATED LIME SLURRY TANK				
05-3015	REAGENT TRANSFER PUMP-COLLECTOR No 2		05-3033	LIME SLURRY TANK AGITATOR				
05-3016	REAGENT TRANSFER PUMP-SPARE		05-3034	LIME CIRCULATING PUMP				
05-3018	[illegible] HOIST-MANUAL TRAVEL		05-3035	REAGENT HOLDING TANK AGITATOR-COLL 1				
~~05-3019~~	~~LIME DUMP HOPPER~~ ⚠2		05-3036	REAGENT HOLDING TANK AGITATOR-COLL 2				

NO.	TITLE

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	MADE BY	APPD BY

REVISIONS

ISSUE	PURPOSE	REV.	DATE
C	ELIMINATED EXTERIOR LIME BATCH SYSTEM	2	11/18/77
B	ELIMINATED ITEM # 05-3024, REVISED FLOWS	1	10/19/77
A	ISSUED FOR CONSTRUCTION	0	10/5/77

DRAWING HISTORY

ORACLE RIDGE MINING PARTNERS
ORACLE, ARIZONA
ORACLE RIDGE PROJECT
127 - 0005

Davy Powergas, Inc.

ORACLE RIDGE FLOTATION PLANT
REAGENTS, AREA 05
PROCESS FLOWSHEET

DESIGNED BY:
DRAWN BY: AV CG 9-1A-77
CHECKED BY: CG 9/8/77
APPD. DES.:
APPD. DES.:
APPD. DES.:
APPD. PROC.: [signature] 10-5-77
APPD. PROJ. ENGR.: [signature] 10-5-77
SCALE: NO SCALE

ISSUED FOR CONSTRUCTION
DPG APPROVAL: [signature] DATE 10/5/77
CLIENT APPROVAL: RC [signature] DATE 10/5/77

PROJECT NO.	DRAWING NO.	REV.
4262	05-F-0001	2

UNITED STATES DEPARTMENT OF THE INTERIOR

Harold L. Ickes, Secretary

BUREAU OF MINES

R. R. Sayers, Director

Oracle Ridge Mine File

War Minerals Report 16

SANTA CATALINA COPPER DEPOSITS

(CONTROL MINES, INC.)

PIMA COUNTY, ARIZ.

WASHINGTON: 1942

The War Minerals Reports of the Bureau of Mines are issued by the United States Department of the Interior to give official expression to the conclusions reached on various investigations relating to domestic minerals. These reports are based upon the field work of the Bureau of Mines and upon data made available to the Department from other sources. The primary purpose of these reports is to provide essential information to the war agencies of the United States Government and to assist owners and operators of mining properties in the production of minerals vital to the prosecution of the war.

WAR MINERALS REPORT

UNITED STATES DEPARTMENT OF THE INTERIOR — BUREAU OF MINES

W.M.R. 16 — Copper November 1942

SANTA CATALINA COPPER DEPOSITS
(Control Mines, Inc.)

Pima County, Ariz.

SUMMARY

Operations at the Santa Catalina Copper Deposits, Pima County, Ariz., utilize only two-thirds of the plant capacity. Prospecting in and adjacent to producing mines might increase reserves by 100,000 tons of ore containing at least 3 percent copper. With this quantity of reserves, mine production could increase to the mill capacity of 100 tons of ore a day, corresponding to an output of about 2,000,000 pounds of recoverable copper a year. Should exploratory work in other areas in this vicinity indicate still greater reserves, mine production could be increased further and the mill enlarged accordingly.

Copper ore with some scheelite occurs in metamorphosed limestone near a diorite contact that encircles Marble Peak in a great oval nearly 4 miles in circumference. Prospecting has disclosed mineralization at many points along this contact, but these showings lack development except along a half-mile length. The oxidized zone is shallow. The sulfide ore minerals

are chiefly chalcopyrite and bornite in a garnet-epidote gangue. In addition to the copper content, one deposit has considerable lead and zinc with some silver.

Production totals over 83,000 tons of ore averaging about 3 percent copper. Of the five groups of claims covering the contact zone, three are owned or leased by the Control Mines, Inc.

The Bureau of Mines will promptly undertake diamond drilling, drifting, and surface trenching to explore (1) for downward extensions of known deposits and (2) for other deposits along the contact zone. Metallurgical tests will be initiated with a view to improving the milling practice and to recovering the scheelite. The estimated cost of the exploration and metallurgical work is $50,000. The time required is 6 months.

INTRODUCTION

The Santa Catalina Copper Deposits, Pima County, Ariz., were visited by a Bureau of Mines engineer* in May 1942. They are about 25 miles by air line northeast of Tucson. The area is known as the Old Hat Mining District and is reached from Oracle over the Mount Lemmon road, a distance of 63 miles from Tucson. The road skirts the district on the east and south, a short road to the Geesman mine branching off at the Lower Control. A gate is established here for control of traffic on a one-way road to Mount Lemmon. The Geesman and Daily mines are reached by truck. The other prospects are reached only by trails.

The five principal groups consist of the Geesman, Daily, Leatherwood, Stratton, and Hartman-Homestake.

* J. H. Hedges, district engineer.

HISTORY

There is no available record of any production previous to 1910. In that year Phelps—Dodge Corporation acquired options on several groups of claims. During the next 3 years over 6,000 feet of development work was done. Most of the work was on the Camp Apache group, now called the Geesman mine, owned by Control Mines, Inc. Development comprised sinking the Geesman shaft to a depth of 280 feet and drifting on the 100-, 200-, and 250-foot levels. This work developed two ore bodies — one on each side of the shaft. These two shoots have since been mined (1937, to date) and yielded about 60,000 tons of 3- to 3 1/2-percent copper ore.

Although the ore was too low-grade to be mined profitably at that time, the showing was considered sufficient to justify patenting the five claims of the group. The Leatherwood group of 10 claims, about half a mile south, also was retained by the Corporation, and five of the claims were patented.

The Daily property, situated between the Geesman and Leatherwood groups, has been developed by means of a tunnel and laterals. A tunnel on the Copper Princess claim developed a sizable body of low-grade ore averaging about 2 1/2 percent copper. Some of the richer streaks were mined previous to 1930, and nearly 500 tons of ore was shipped. The ore was reported to contain 5.5 percent copper, 2 ounces of silver, and 45 cents in gold.

There is no record of production from the Geesman mine until 1937. In that year the Catalina Consolidated Copper Co. leased the Camp Apache group and the adjoining property of the Daily Arizona Consolidated Copper Co., which included the Copper Princess claim. In 1937 the Catalina company built a 100-ton flotation plant on the Daily ground and mined and treated ore from the Geesman and Daily properties.

In the 10 months from August 1937 to May 1938, the company treated about 18,000 tons of ore averaging 2.7 percent copper, derived from the following sources:

Source	Tons	Copper, percent
Daily mine	5,600	2.35
Geesman dump	1,500	1.70
Geesman mine	10,900	3.00
Total	18,000	2.69

The enterprise proved to be unprofitable at the low price of copper, and in May 1938 operations were suspended.

In October 1939, Control Mines, Inc., bought the Catalina mill and leased the Daily property, treating 1,500 to 2,000 tons a month from the Copper Princess tunnel. In May 1940, Control Mines acquired the Geesman property on bond and lease from Phelps—Dodge Corporation. Since that time production has averaged about 2,000 tons a month, mostly from the Geesman mine. The ore is reported to have averaged between 3 and 4 percent copper, with mill recovery at 90 percent or better. Concentrates are said to average about 26 percent copper, indicating a ratio of concentration of 8 or 10 to 1. Exact data are not available.

From the proceeds of its operations since October 1939, the Control company has completed purchase of the Geesman property and the Leatherwood group of claims. This transaction has been accomplished at the expense of advance development, with the result that ore reserves in the Geesman mine are now small. Reserves in the Daily mine, still under lease, are a matter for conjecture.

Available records and reports indicate the production from the Geesman and Daily mines to be about as follows:

		Geesman mine		Daily mine	
		Ore mined, tons	Copper, percent	Ore mined, tons	Copper, percent
Before	1930	--	--	500	5.5
	1937	4,800	3.0	2,500	2.35
	1938	6,100	3.0	3,100	2.35
	Dump	1,500	1.7	--	--
	1939	--	--	4,500	2.35
	1940	14,000	3.3	10,000	2.35
	1941	24,000	3.3	--	--
8 months,	1942	12,000	3.3	--	--
Total		62,400	3.25	20,600	2.48

PHYSICAL FEATURES

The topography is rugged. The hillsides are cut by deep gullies, which rise at steep angles from an altitude of about 5,700 feet at the Control camp to 7,600 feet at the summit of Marble Peak. The slopes are covered with brush and timber and, except for trails leading to mine workings, are accessible only on foot. A few of the gullies on the north slope have springs that flow throughout the year and furnish enough water for camp use. The main supply of water for milling is pumped from the mines. Deepening the mine workings should increase this flow. It is believed that enough water to mill 200 tons a day could be developed if exploration results justify this scale of operations. A small amount of road construction would enable ore mined from any point to be trucked to the mill on the Daily claims.

OWNERSHIP

The eliptical area of limestone and the limestone-diorite contact encircling Marble Peak are completely covered by five principal groups of claims.

The Geesman group consists of six patented claims on the northeast quadrant of the oval contact. This property, originally developed by Phelps-Dodge, is now owned and operated by Control Mines, Inc. These claims have produced about three quarters of the tonnage from the district.

The Daily Arizona Copper Co. group consists of 16 claims, 8 of which are patented. Although the largest group in acreage, it has the shortest length along the contact — about 2,500 feet. It adjoins the Geesman group on the south and extends westward over the center of the limestone area. This property is under lease to the Control Mines. The Control's mill is on the Daily ground.

The Leatherwood group is owned by Control Mines. This group lies south of the Daily and consists of 10 claims, 5 of which are patented. These claims cover nearly 4,000 feet of the contact.

The Stratton group of 14 claims is owned by Mrs. Keeney of Indianapolis, Ind. The claims lie northwest of the Leatherwood group and cover the southwest quadrant of the contact for a length of about 4,000 feet.

The Hartman—Homestake group of 6 claims occupies the northwest quadrant of the oval. It lies north of the Stratton and west of the Geesman, closing the circle. It covers about 5,000 feet of the contact.

DESCRIPTION OF DEPOSITS

The Old Hat Mining District comprises the contact-metamorphic copper deposits circling Marble Peak. The ore occurs in altered limestone near a diorite contact. The limestone is a remnant, about 7,000 feet from east to west and 4,500 feet from north to south, occurring as a covering over the diorite mass. The limestone-diorite contact encircles Marble Peak in a great oval nearly 4 miles in circumference. Prospecting along the contact has disclosed mineralized ore at many points, but its development has been confined to strip half a mile long in the northeast quadrant.

Structural features that influence localization of ore bodies are obscure but appear to be related to fracturing caused by minor deformation

of the limestone beds. Detailed study of the formations may be helpful in directing exploration to the most favorable areas.

Ore bodies have been developed only on the Geesman and Daily groups. These partly developed and partly mined shoots have yielded 15,000 to 40,000 tons each.

On each of the five principal groups of claims, small lots of high-grade ore have been sorted and shipped from time to time. High transportation costs and low metal prices have discouraged general development of the area.

The five groups are described below:

Geesman Group. -- The Geesman shaft follows the dip of the contact to the southwest to a depth of approximately 280 feet. Drifts at the 100-, 200-, and 250-foot levels developed two ore shoots. The stopes are 15 to 20 feet wide, 70 to 80 feet long, and have been carried down to the 250-foot level. About 60,000 tons of ore averaging 3 to 4 percent copper has been mined from these two shoots. The lower limits of the ore have not been reached at the 250-foot level, although there is some evidence of decreasing width of vein and grade of ore. A few thousand tons of ore remain above the 250-foot level, and no ore has been extracted below this bottom level.

Scheelite occurs in the Geesman mine chiefly in thin bands in the white marbleized limestone of the hanging wall immediately above the ore. It is possible that enough scheelite may be found to justify its separation as a byproduct of copper-mining operations.

Daily Arizona Copper Co. Group. — Workings consist of the Copper Princess tunnel, about 390 feet in length, and laterals to stoped areas. About 20,000 tons of 2 1/2-percent ore has been mined from this tunnel since 1937. The product from this tunnel goes to the Control Mines mill, which treats 2,000 tons of ore a month.

Leatherwood Group. — Although considerable work has been done on the property, the workings for the most part are inaccessible. Those accessible are shallow open cuts along steeply dipping veins that carry some copper carbonates and chrysocolla. These veins, averaging about 5 feet in width, follow fractures in the limestone that dip toward the northeast. In recent years leasers have mined some ore from these veins and have also sorted the best ore from the dumps. The dump material does not indicate that sulfide ore was found in the underground workings.

Stratton Group. — The main working is a 20° incline shaft 80 feet deep sunk in a mineralized bed of garnetized limestone. The bottom and sides show 2 1/2 to 3 feet of ore, mainly bornite and chalcopyrite, with a little pyrite. A few cuts and shallow tunnels show some mineralization in the form of copper oxides. Some small shipments totaling probably not more than 100 tons have been made from this property.

Hartman—Homestake Group. — The workings comprise some 1,500 feet of crosscut tunnels and drifts and several winzes and raises following fractures and veins in the limestone. This property is unique in that the ore carries high values in lead and zinc as well as copper. It is reported that one ore body opened for a length of 235 feet and further explored by 90 feet of raises ranges in width from 2 to 12 feet. The average width is about 6 feet, and the average grade is 3 percent copper, 6 percent lead, 7.6 percent zinc, and 2.35 ounces of silver a ton.

THE ORE

The ore minerals are chiefly chalcopyrite and bornite in a garnet-epidote gangue. The zone of oxidation is very shallow, as sulfides occur close to the surface. The ore is readily concentrated by flotation. With

a concentration ratio of 8 or 10 to 1, a recovery above 90 percent is reported. The concentrates run about 26 percent copper.

ORE RESERVES

On each of the five principal groups of claims mineralized areas nave been found in the limestone near the igneous contact.

On the Geesman property, a few thousand tons of ore containing about 3 or 4 percent copper remain above the 250-foot level. These shoots produced some 60,000 tons of 3- or 4-percent ore above the 250-foot level. It is assumed that these shoots continue downward to an undetermined depth, although the minable width of stope and grade of ore appear to be decreasing. Lateral exploration along the contact for other ore bodies and development of downward extensions of known ore shoots offer the best possibilities for additional ore on this property.

Ore from the Copper Princess tunnel on the Daily Arizona property is now going to the nearby Control Mines mill. The Leatherwood Group underground workings are inaccessible but offer opportunity for developing ore along the 4,000 feet of contact.

The Stratton Group has been developed least. A 20°, 80-foot incline shaft exposed a 2 1/2- to 3-foot bed of bornite and chalcopyrite ore. The Hartman—Homestake contains a partly developed ore body averaging about 6 feet in width and carrying values in copper, zinc, lead, and silver. The probable tonnage from this deposit has not yet been estimated.

PROPOSED WORK BY BUREAU OF MINES

A Geological Survey party has been working in the district since August 1942, and geologic mapping of the surface and underground workings was nearly completed by mid-October 1942. This work is expected to

reveal features of the mineralization that will aid in locating sites for diamond-drill holes. Drilling from the surface and underground stations will explore favorable geological areas and downward extensions of known ore bodies. Five hundred feet of drifting to develop any ore that might be indicated by drilling is included in the estimates of costs that follow.

Short holes will be drilled in the Geesman mine to explore a block along the contact zone west of the stoped area above the 100-foot level. Continuation of the ore below the mine workings will be determined by diamond drilling. A sector of the contact zone as yet unexplored for a distance of 3,000 feet will be trenched and sampled. The most favorable areas will be drilled.

The estimated cost of the Bureau's exploratory work and ore testing is summarized below:

5,000 feet of diamond drilling, including sampling and assaying, at $5 a foot	$ 25,000
1,500 feet of trenching and trench sampling at $5 a foot	7,500
500 feet of exploratory headings at $14 a foot	7,000
Surface and underground surveying, mapping, and underground sampling	5,000
Metallurgical tests to improve milling practice and to recover scheelite	5,500
Total	50,000

CONCLUSIONS

It is estimated that the exploration program of the Bureau will indicate enough ore to increase the present mining and milling operation by 50 percent. This would increase production to 3,000 tons of ore a month. Metallurgical tests will be made with a view to improving milling practice and to recovering the scheelite. Should enough ore be indicated to warrant enlarging the 100-ton mill, suitable recommendations will be made for development and construction work.

The occurrence of scheelite in the marbleized hanging wall in the Geesman property might be worth investigating. This might lead to a small byproduct of tungsten concentrates. A small quantity of scheelite is now being 'high-graded' and sold to tungsten buyers in Tucson.

The Bureau of Mines will explore the properties of the Control Mines, Inc. at once.

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UNITED STATES DEPARTMENT OF THE INTERIOR

Harold L. Ickes, Secretary

BUREAU OF MINES

R. R. Sayers, Director

Oracle Ridge Mine File

War Minerals Report 16

SANTA CATALINA COPPER DEPOSITS

(CONTROL MINES, INC.)

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WAR MINERALS REPORT

UNITED STATES DEPARTMENT OF THE INTERIOR — BUREAU OF MINES

W.M.R. 16 — Copper November 1942

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(Control Mines, Inc.)

Pima County, Ariz.

SUMMARY

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are chiefly chalcopyrite and bornite in a garnet-epidote gangue. In addition to the copper content, one deposit has considerable lead and zinc with some silver.

Production totals over 33,000 tons of ore averaging about 3 percent copper. Of the five groups of claims covering the contact zone, three are owned or leased by the Control Mines, Inc.

The Bureau of Mines will promptly undertake diamond drilling, drifting, and surface trenching to explore (1) for downward extensions of known deposits and (2) for other deposits along the contact zone. Metallurgical tests will be initiated with a view to improving the milling practice and to recovering the scheelite. The estimated cost of the exploration and metallurgical work is $50,000. The time required is 6 months.

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* J. H. Hedges, district engineer.

HISTORY

There is no available record of any production previous to 1910. In that year Phelps-Dodge Corporation acquired options on several groups of claims. During the next 3 years over 6,000 feet of development work was done. Most of the work was on the Camp Apache group, now called the Geesman mine, owned by Control Mines, Inc. Development comprised sinking the Geesman shaft to a depth of 280 feet and drifting on the 100-, 200-, and 250-foot levels. This work developed two ore bodies — one on each side of the shaft. These two shoots have since been mined (1937, to date) and yielded about 60,000 tons of 3- to 3 1/2-percent copper ore.

Although the ore was too low-grade to be mined profitably at that time, the showing was considered sufficient to justify patenting the five claims of the group. The Leatherwood group of 10 claims, about half a mile south, also was retained by the Corporation, and five of the claims were patented.

The Daily property, situated between the Geesman and Leatherwood groups, has been developed by means of a tunnel and laterals. A tunnel on the Copper Princess claim developed a sizable body of low-grade ore averaging about 2 1/2 percent copper. Some of the richer streaks were mined previous to 1930, and nearly 500 tons of ore was shipped. The ore was reported to contain 5.5 percent copper, 2 ounces of silver, and 45 cents in gold.

There is no record of production from the Geesman mine until 1937. In that year the Catalina Consolidated Copper Co. leased the Camp Apache group and the adjoining property of the Daily Arizona Consolidated Copper Co., which included the Copper Princess claim. In 1937 the Catalina company built a 100-ton flotation plant on the Daily ground and mined and treated ore from the Geesman and Daily properties.

In the 10 months from August 1937 to May 1938, the company treated about 18,000 tons of ore averaging 2.7 percent copper, derived from the following sources:

Source	Tons	Copper, percent
Daily mine	5,600	2.55
Geesman dump	1,500	1.70
Geesman mine	10,900	3.00
Total	18,000	2.69

The enterprise proved to be unprofitable at the low price of copper, and in May 1938 operations were suspended.

In October 1939, Control Mines, Inc., bought the Catalina mill and leased the Daily property, treating 1,500 to 2,000 tons a month from the Copper Princess tunnel. In May 1940, Control Mines acquired the Geesman property on bond and lease from Phelps—Dodge Corporation. Since that time production has averaged about 2,000 tons a month, mostly from the Geesman mine. The ore is reported to have averaged between 3 and 4 percent copper, with mill recovery at 90 percent or better. Concentrates are said to average about 26 percent copper, indicating a ratio of concentration of 8 or 10 to 1. Exact data are not available.

From the proceeds of its operations since October 1939, the Control company has completed purchase of the Geesman property and the Leatherwood group of claims. This transaction has been accomplished at the expense of advance development, with the result that ore reserves in the Geesman mine are now small. Reserves in the Daily mine, still under lease, are a matter for conjecture.

Available records and reports indicate the production from the Geesman and Daily mines to be about as follows:

		Geesman mine		Daily mine	
		Ore mined, tons	Copper, percent	Ore mined, tons	Copper, percent
Before	1930	--	--	500	5.5
	1937	4,800	3.0	2,500	2.35
	1938	6,100	3.0	3,100	2.35
	Dump	1,500	1.7	--	--
	1939	--	--	4,500	2.35
	1940	14,000	3.3	10,000	2.35
	1941	24,000	3.3	--	--
8 months,	1942	12,000	3.3	--	--
Total		62,400	3.25	20,600	2.48

PHYSICAL FEATURES

The topography is rugged. The hillsides are cut by deep gullies, which rise at steep angles from an altitude of about 5,700 feet at the Control camp to 7,600 feet at the summit of Marble Peak. The slopes are covered with brush and timber and, except for trails leading to mine workings, are accessible only on foot. A few of the gullies on the north slope have springs that flow throughout the year and furnish enough water for camp use. The main supply of water for milling is pumped from the mines. Deepening the mine workings should increase this flow. It is believed that enough water to mill 200 tons a day could be developed if exploration results justify this scale of operations. A small amount of road construction would enable ore mined from any point to be trucked to the mill on the Daily claims.

OWNERSHIP

The eliptical area of limestone and the limestone-diorite contact encircling Marble Peak are completely covered by five principal groups of claims.

The Geesman group consists of six patented claims on the northeast quadrant of the oval contact. This property, originally developed by Phelps-Dodge, is now owned and operated by Control Mines, Inc. These claims have produced about three quarters of the tonnage from the district.

The Daily Arizona Copper Co. group consists of 16 claims, 8 of which are patented. Although the largest group in acreage, it has the shortest length along the contact — about 2,500 feet. It adjoins the Geesman group on the south and extends westward over the center of the limestone area. This property is under lease to the Control Mines. The Control's mill is on the Daily ground.

The Leatherwood group is owned by Control Mines. This group lies south of the Daily and consists of 10 claims, 5 of which are patented. These claims cover nearly 4,000 feet of the contact.

The Stratton group of 14 claims is owned by Mrs. Keeney of Indianapolis, Ind. The claims lie northwest of the Leatherwood group and cover the southwest quadrant of the contact for a length of about 4,000 feet.

The Hartman—Homestake group of 6 claims occupies the northwest quadrant of the oval. It lies north of the Stratton and west of the Geesman, closing the circle. It covers about 5,000 feet of the contact.

DESCRIPTION OF DEPOSITS

The Old Hat Mining District comprises the contact-metamorphic copper deposits circling Marble Peak. The ore occurs in altered limestone near a diorite contact. The limestone is a remnant, about 7,000 feet from east to west and 4,500 feet from north to south, occurring as a covering over the diorite mass. The limestone-diorite contact encircles Marble Peak in a great oval nearly 4 miles in circumference. Prospecting along the contact has disclosed mineralized ore at many points, but its development has been confined to strip half a mile long in the northeast quadrant.

Structural features that influence localization of ore bodies are obscure but appear to be related to fracturing caused by minor deformation

of the limestone beds. Detailed study of the formations may be helpful in directing exploration to the most favorable areas.

Ore bodies have been developed only on the Geesman and Daily groups. These partly developed and partly mined shoots have yielded 15,000 to 40,000 tons each.

On each of the five principal groups of claims, small lots of high-grade ore have been sorted and shipped from time to time. High transportation costs and low metal prices have discouraged general development of the area.

The five groups are described below:

Geesman Group. -- The Geesman shaft follows the dip of the contact to the southwest to a depth of approximately 280 feet. Drifts at the 100-, 200-, and 250-foot levels developed two ore shoots. The stopes are 15 to 20 feet wide, 70 to 80 feet long, and have been carried down to the 250-foot level. About 60,000 tons of ore averaging 3 to 4 percent copper has been mined from these two shoots. The lower limits of the ore have not been reached at the 250-foot level, although there is some evidence of decreasing width of vein and grade of ore. A few thousand tons of ore remain above the 250-foot level, and no ore has been extracted below this bottom level.

Scheelite occurs in the Geesman mine chiefly in thin bands in the white marbleized limestone of the hanging wall immediately above the ore. It is possible that enough scheelite may be found to justify its separation as a byproduct of copper-mining operations.

Daily Arizona Copper Co. Group. — Workings consist of the Copper Princess tunnel, about 390 feet in length, and laterals to stoped areas. About 20,000 tons of 2 1/2-percent ore has been mined from this tunnel since 1937. The product from this tunnel goes to the Control Mines mill, which treats 2,000 tons of ore a month.

Leatherwood Group. — Although considerable work has been done on the property, the workings for the most part are inaccessible. Those accessible are shallow open cuts along steeply dipping veins that carry some copper carbonates and chrysocolla. These veins, averaging about 5 feet in width, follow fractures in the limestone that dip toward the northeast. In recent years leasers have mined some ore from these veins and have also sorted the best ore from the dumps. The dump material does not indicate that sulfide ore was found in the underground workings.

Stratton Group. — The main working is a 20° incline shaft 80 feet deep sunk in a mineralized bed of garnetized limestone. The bottom and sides show 2 1/2 to 3 feet of ore, mainly bornite and chalcopyrite, with a little pyrite. A few cuts and shallow tunnels show some mineralization in the form of copper oxides. Some small shipments totaling probably not more than 100 tons have been made from this property.

Hartman—Homestake Group. — The workings comprise some 1,500 feet of crosscut tunnels and drifts and several winzes and raises following fractures and veins in the limestone. This property is unique in that the ore carries high values in lead and zinc as well as copper. It is reported that one ore body opened for a length of 235 feet and further explored by 90 feet of raises ranges in width from 2 to 12 feet. The average width is about 6 feet, and the average grade is 3 percent copper, 6 percent lead, 7.6 percent zinc, and 2.35 ounces of silver a ton.

THE ORE

The ore minerals are chiefly chalcopyrite and bornite in a garnet-epidote gangue. The zone of oxidation is very shallow, as sulfides occur close to the surface. The ore is readily concentrated by flotation. With

a concentration ratio of 8 or 10 to 1, a recovery above 90 percent is reported. The concentrates run about 26 percent copper.

ORE RESERVES

On each of the five principal groups of claims mineralized areas nave been found in the limestone near the igneous contact.

On the Geesman property, a few thousand tons of ore containing about 3 or 4 percent copper remain above the 250-foot level. These shoots produced some 60,000 tons of 3- or 4-percent ore above the 250-foot level. It is assumed that these shoots continue downward to an undetermined depth, although the minable width of stope and grade of ore appear to be decreasing. Lateral exploration along the contact for other ore bodies and development of downward extensions of known ore shoots offer the best possibilities for additional ore on this property.

Ore from the Copper Princess tunnel on the Daily Arizona property is now going to the nearby Control Mines mill. The Leatherwood Group underground workings are inaccessible but offer opportunity for developing ore along the 4,000 feet of contact.

The Stratton Group has been developed least. A 20°, 80-foot incline shaft exposed a 2 1/2- to 3-foot bed of bornite and chalcopyrite ore. The Hartman—Homestake contains a partly developed ore body averaging about 6 feet in width and carrying values in copper, zinc, lead, and silver. The probable tonnage from this deposit has not yet been estimated.

PROPOSED WORK BY BUREAU OF MINES

A Geological Survey party has been working in the district since August 1942, and geologic mapping of the surface and underground workings was nearly completed by mid-October 1942. This work is expected to

reveal features of the mineralization that will aid in locating sites for diamond-drill holes. Drilling from the surface and underground stations will explore favorable geological areas and downward extensions of known ore bodies. Five hundred feet of drifting to develop any ore that might be indicated by drilling is included in the estimates of costs that follow.

Short holes will be drilled in the Geesman mine to explore a block along the contact zone west of the stoped area above the 100-foot level. Continuation of the ore below the mine workings will be determined by diamond drilling. A sector of the contact zone as yet unexplored for a distance of 3,000 feet will be trenched and sampled. The most favorable areas will be drilled.

The estimated cost of the Bureau's exploratory work and ore testing is summarized below:

5,000 feet of diamond drilling, including sampling and assaying, at $5 a foot	$ 25,000
1,500 feet of trenching and trench sampling at $5 a foot	7,500
500 feet of exploratory headings at $14 a foot	7,000
Surface and underground surveying, mapping, and underground sampling	5,000
Metallurgical tests to improve milling practice and to recover scheelite	5,500
Total	50,000

CONCLUSIONS

It is estimated that the exploration program of the Bureau will indicate enough ore to increase the present mining and milling operation by 50 percent. This would increase production to 3,000 tons of ore a month. Metallurgical tests will be made with a view to improving milling practice and to recovering the scheelite. Should enough ore be indicated to warrant enlarging the 100-ton mill, suitable recommendations will be made for development and construction work.

The occurrence of scheelite in the marbleized hanging wall in the Geesman property might be worth investigating. This might lead to a small byproduct of tungsten concentrates. A small quantity of scheelite is now being 'high-graded' and sold to tungsten buyers in Tucson.

The Bureau of Mines will explore the properties of the Control Mines, Inc. at once.

oOo

STATEMENT BEFORE THE IMPACT SURVEY TEAM OF

THE CATALINA MULTIPLE USE PLAN

by

CONTINENTAL COPPER, INC.

John G. Roscoe, Mgr.

August 2, 1971

The following information has been prepared for the benefit of the study group and the interested public on behalf of the employees of Continental Copper Inc. Continental is a subsidiary of Continental Materials Corporation, a publicly owned corporation with numerous stockholders and employees in the Tucson area. We have acquired the Control mine property on the northeast slopes of the Catalinas and have been conducting an exploration program for copper, silver and molybdenum minerals for the last 3 years. This property consists of a consolidation of patented and unpatented mining claims which date from 1900 to 1970. Our knowledge of the property at present is not complete enough to form exact plans and schedules but it appears that geologic study and diamond drilling to date indicate the need for additional drilling and underground mining. It is our tentative plan that this will be an underground mine--the ground surface will be relatively undisturbed. In addition, it is expected that waste material will be returned to the

mine--reducing the volume of dumps and storage places and eliminating subsidence. We are fortunate to be able to concentrate most surface activity in ravines and small canyons of the less scenic areas. An outline has been prepared to guide rehabilitation and reforestation of responsive areas--many disturbed long ago by fire and construction activity. We are considering underground installation of the concentrator--if we reach that point. Visible, semi-permanent related activity will be mostly below an elevation of 6,000 feet.

As employees of an organization engaged in the production of raw materials we at Continental live and work close to the land, and use it for recreation--hunting, camping, fishing, hiking--as much as anyone. We are not organized in recreational groups--though as individuals we may belong to them; we are slightly organized as miners; and, although we are not vociferous as some organizations are, I contend, and strongly defend the contention, that we have a keener, more accurate, sense of land responsibility and more activ ely practice the principles of conservation than most so-called preservationists. Boundless surplus of raw materials no longer exist, we are working in the present era, and we must meet current demands while providing for the future. Burial and sterilization are not conservation. Good conservation can best be achieved by the most efficient harvest of today's resources while providing access and pathways for tomorrow's. This can be accomplished, and will provide more benefits to the public for the longest period of time.

There is a tremendous demand for scenery, campsites, trails, all kind and phases of outdoor activity. There is also a tremendous demand for mineral resources, employment, tax dollars, and a high standard of living. In the case of the first category some of these can be provided by the Catalina mountains as well as many other scenic areas. But the other category can only be provided from unique deposits emplaced by natural geological phenomena, and mining in the Catalinas can make an important contribution. We believe that blanket exclusion of mineral entry within the Catalinas would be a disservice to the public, and based upon our knowledge of the area and our experience in mining we feel that recreational interests and mining activity (the chief competitors for acreage) can compatibly exist in the Catalinas. In fact we believe that in many instances they can exist simultaneously within close proximity.

Therefore, it is recommended that for the present, until there is time and necessity for detailed evaluation, the priority use of the Catalinas be divided as follows:

1. Grazing and lumbering remain status quo.
2. Areas most suitable for recreation, mining restricted or prohibited.
3. Areas most suitable for mining, recreation permitted though secondary.
4. Areas where suitability isn't critical.
5. Areas which at this time cannot be accurately classified.

Grazing permit areas do not seem at present to conflict with any other uses; it would seem none will arise. Lumbering is under strict direction of the Forest Service and should be continued to prevent waste of mature timber.

Many areas of the Catalinas are definitely most desirable for recreation. Recreation, of course, may be subdivided in ad finitum, but compared to mineral extraction it is a single entity. There is no question that the major portion of the Catalinas is composed of rock formations considered unfavorable as hosts for ore deposits. This applies almost without exception to elevations above 6,000 feet. In the exceptions, mining would most likely not be undertaken for economic reasons alone--prohibitive access costs, small target areas, costly utilities. In the event a commodity required for urgent national defense or interest was found in these areas there is little doubt that the urgency would have to overshadow the land classification before exploitation would occur. There is a general fear that present mining laws can flout recreational classification to use the land for non-mining purposes. This has happened in the past, but we cite administrative withdrawals of the Santa Catalina Natural Area and the Butterfly Peak Natural Area as cases where there has been no intrusion by mining interest. We believe current regulations are sufficiently protective. Of the 211,000 plus acres in the Catalina area, it is our opinion that more than 60% are naturally immune to bona fide mineral entry, and therefore create no use conflict, except perhaps as to degree of recreation

to be permitted. Further, we submit that this 60% contains the highest recreational value acreage of the mountains.

Certain areas can be determined at this time as being most suitable for mining. Patented mining claims, per se, cannot legally be classified otherwise, and even if not used for mining purposes they constitute private property. Recent mining law permits public land agency regulation of the surface of newer patented claims. The greatest effect of patented claims is to outline the general vicinity of a mineralized area and this can be an aid in selecting lands for classification categories in conjunction with geologic environment. Some of the Oracle Ridge end of the Catalinas falls in this group; where there is active mine development or prospecting, where there are valid claims, and where there is interspersed geologic favorability. Much of this area is lower in elevation than the heavily used mountain top. Water is scarce. Essentially one road and one trail traverse the area and foot and auto traffic is very light.

There are small areas where priority is moot. These are principally at the lowest elevations which are geologically unfavorable for mining and environmentally unattractive for most recreation, and while they do exist, they may not be important for the discussion.

The last category includes areas which appeal to some recreationists and are in favorable geologic settings. These are principally along the east slope of the main range, areas of the Oracle Ridge, and eastern portion of Canada del Oro. These areas may aggregate 70,000 acres.

They are all remote, mostly dry, unevaluated geologically, and mostly bordered by non-forest lands. The east side of the range is the most extensive. It is visible in part by the majority of Catalina visitors only at San Pedro Vista and north of Soldier Camp; and most of the view is of non-forest land. The entire length of this side of the range contains a narrow strip of favorable rocks, mostly below 4,500 feet upon the forest lands, and it has never been adequately mapped or studied to determine its mineral potential. Old prospects attest mineral exposures and recent investigations in some portions have been undertaken. These occurrences are adjacent to similar ones upon private, state, and BLM controlled ground, so it is conceivable that mining upon those lands would obviate a forest withdrawal which restricted all but scenic uses nearby. It would seem equitable to defer frozen classification of this area until evaluation is more conclusive.

The western fork of Canada del Oro, Reef of Rocks, and Samaniego Ridge appear to be within a "barren" geologic zone, but the eastern fork and the northern portion of the canyon have seen considerable mining activity at various times. There are numerous mining claims throughout the area but a general mineralogical evaluation is lacking. This area strongly invites evaluation, and should not be arbitrarily classified. It should be pointed out the scenic incompatibility of mining and landscape is more fiction than fact. The Bingham Canyon Mine is the second largest tourist attraction in Utah, following the man made Tabernacle of the Latter

Day Saints Church. Numerous "tourist" mines thrive in Colorado, and there is no question about the fascination of old mines to the relic hunter and the attraction of new ones to the sidewalk superintendent.

To summarize, it is requested that the above facts and information be weighed and considered. While there is a local outcry for recreational development by many, a demand for forest restriction by some, most of the people are fundamentally concerned about jobs, income and a high living standard. Mining is basic to these. In fact, all of our material needs and desires are fulfilled from the land or the sea; all else are merely transposed shapes. National statistics (1968) show that 100 new jobs provide annually:

$710,000 income

165 additional workers

$331,000 retail sales

3 new stores

Of this:

3% State Sales Tax	=	$ 21,000.00
20% Federal Income Tax	=	162,000.00
State Income Tax	=	7,000.00

Also include indeterminate taxes, such as:

50% corporate taxes

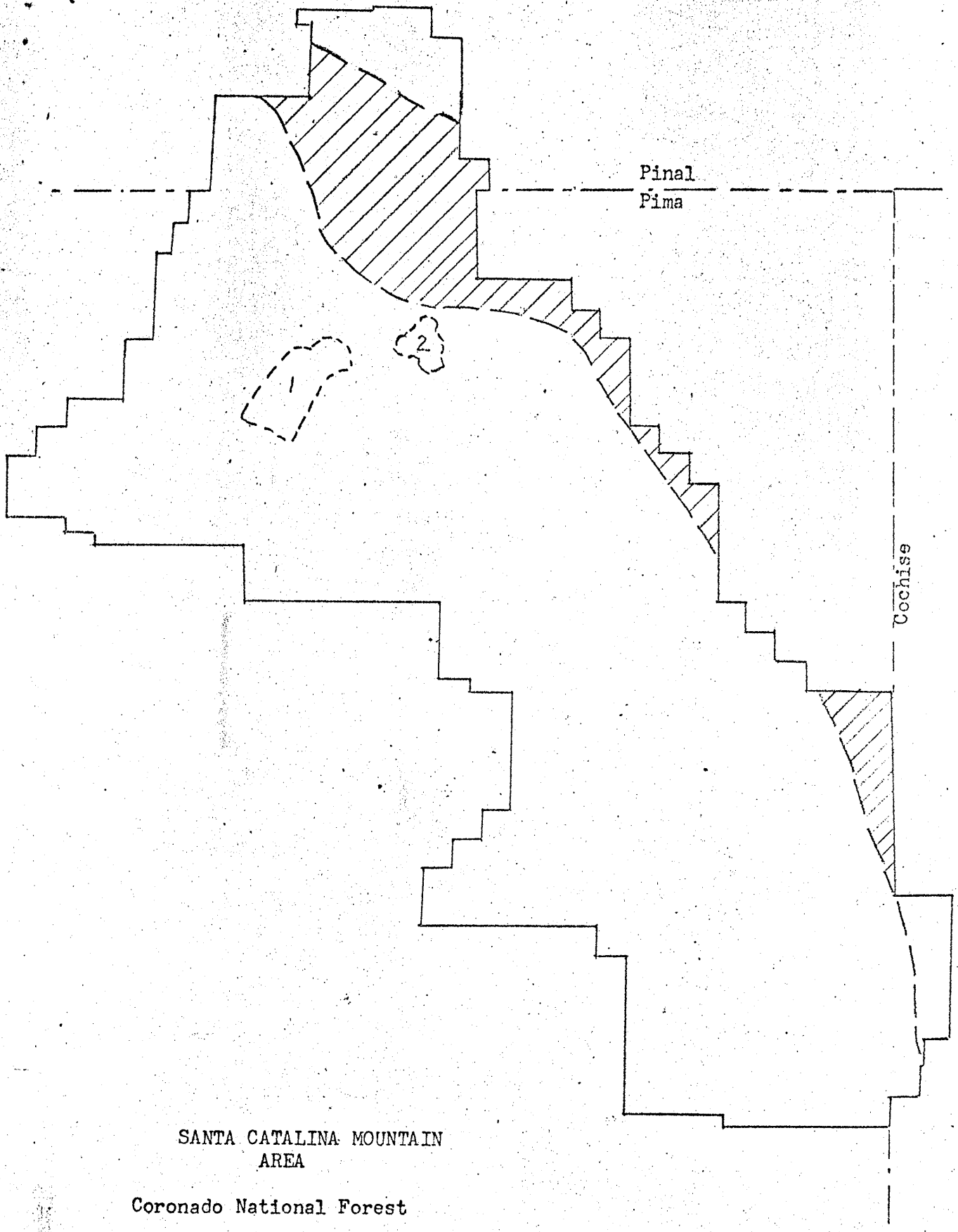
2% gross mineral production tax

$6.00 to $12.00 per $100.00 assessed valuation property tax

Mine evaluation tax

These figures are not a matter of economics alone. The laws of this country commit federal land agencies to multiple use of the land they hold in trust, the Public Land Law Review Commission in 1970 recommended development of minerals upon public lands, and Public Law 91-163, "The Mining and Mineral Policy Act of 1970," sets forth similar objectives. We are not unreasonable to request recognition under national policy. We ask only for rational and equitable consideration under a continued atmosphere in which mining and recreation are friends, neighbors and fellow citizens.

* * *



SANTA CATALINA MOUNTAIN
AREA

Coronado National Forest

1. Santa Catalina Natural Area
2. Butterfly Peak Natural Area

//// Area of Probable Mineral Importance

R E P O R T

MINING PROPERTIES of

ARIZONA COPPER MINES, Inc.

SANTA CATALINA MOUNTAINS

OLD HAT MINING DISTRICT
PIMA COUNTY, Ariz.

Prepared and submitted

by

Travis P. Lane
Consulting Mining Engineer
Phoenix, Ariz.

May 7th 1951

The writer examined and reported upon the properties of the Arizona Copper Mines, Inc. located in the Santa Catalina Mountains in November 1950 and the present report, made following visits to the property during the period April 27 - May 4 of this year, is supplemental to that report. The present situation at the property together with recommended further development and comments regarding ore probabilities, is noted hereunder :

Recent Development

Development since Nov. 1950 has consisted in the continuing of a drift in a westerly direction from the partially stoped area of the Daily mine. The work was surveyed by the writer and the routine mine sampling during the progress of the drifting was checked by a number of random samples. See Sketch No 1 accompanying this report.

It was necessary to clean out caved material and bench out a length of some 20 feet in the floor before starting the drift. The material of the north wall of the drift at the start was limestone but after penetrating a 12 foot zone of faulting the drift was wholly in diorite, the indication being that the fault had displaced the limestone in a northerly direction. The drift was then turned northerly and after advancing 60 feet in diorite it encountered altered material of the contact zone with good copper mineralization accompanied by the usual modest proportion of silver. The ore continued for 60 feet where the

marbelized limestone hanging wall of the contact zone was reached. The contact is very irregular here and several sharp directional changes were made in an attempt to follow along and under the limestone. Values here as in other parts of the property occur in a garnetized zone against a marble hanging wall. The richest mineralization lies immediately against the marble and garnetization and values diminishing with distance from the hanging wall terminating finally in barren diorite of the foot wall. Because of the extreme irregularity of dip and strike of the limestone it is difficult to estimate the average width of ore. The ore however is in all places wider than the drift and it appears to be at least 10' thick and might reach 15 or 20 feet in places.

The last part of the drift diverged from the limestone and the last two rounds were in practically barren material. Accordingly, the machine was brought back to the point where the limestone passed into the wall of the drift and drifting was started along and under the limestone. One round had been blasted here (in ore) at the time of the last visit to the property.

The average of the routine mine samples, consisting of a cut across the face following each blast, is 4.03 % Cu (no silver assay available) and the average of the 6 check samples is 3.12 % Cu, 0.70 Oz Ag. The check samples are underlined with blue crayon on sketch NO 1. The lower average of the latter is accountable to the fact that most of the samples were cut vertically on the left wall of the drift and were therefore further removed

from the hanging wall than the routine mine samples. The average of the averages is 3.57 % Cu with silver probably slightly over 0.70 Oz per ton, and this would seem to be an acceptable figure for the grade of the ore disclosed by this work. A notable feature in the ore area is the presence of numerous vertical NW - SE fractures and as a consequence a broken condition of the alteration zone material.

While the work at this horizon and place has accomplished little in the way of blocking ore it has been valuable in its confirmation of the expectancy of developing extensions of formerly mined ore bodies. A more comprehensive development program is outlined later in this report under the heading "Recommended Development".

Ore Reserves

The estimate of ore reserves noted in the report, dated Nov. 14, 1950 referred to above contains two classifications of reserves, namely : "Indicated ore" and "Inferred Ore"

Calculation of Indicated Ore assumed the existence of ore (of a grade which was submarginal in the old operations) in the pillars and foot wall and ends of the stopes amounting to 50% of the amount which had been extracted. It was also assumed since the ore was continuing in the lowest workings that additional ore would be developed in depth in an amount equivalent to that developed and partially mined above the bottom workings. In

the case of the Geesman mine this would mean an extension of ore for a distance of 250 feet below the lowest level or 500 feet down slope from the outcrop.

In the estimates for Inferred Ore it was assumed that the intensively leached croppings, with residual mineralization, between and slightly beyond the Geesman and Daily workings (2000 ft total length) would be underlain by sulphide ore. Similarly the leached and mineralized croppings on the Leatherwood and Stratton properties (2500 ft length) were assumed to overlie sulphide ore. An extension in depth of 250 feet from the croppings and a width of 20 feet (which are average depth and width factors proven in the Geesman mine) were assumed and an allowance of 50% was made for barren areas in the two blocks.

A grade of 3% Cu. 0.80 Oz Ag, which is slightly below the grade of the ore mined in the past, was assigned to the blocks of Indicated and Inferred ore. The estimated tonnages were as follows :

Indicated Ore	200,000 tons	
Inferred "	800,000 "	
Total	1,000,000 "	3% Cu

The estimated blocks in the Geesman-Daily area are shown on sketch NO 2 which accompanies this report. Inferred ore in the Leatherwood and Stratton properties is not shown. It is calculated on the basis of a length of 2500 feet on the croppings and 250 feet of slope distance into the hill.

Recommended Work

The hillsides below the croppings of the contact zone afford a practical means for exploration and development at depth by crosscut tunnels. The contact dips into the hill at approximately 45 deg. in the vicinity of the Geesman workings and the hillside here is sufficiently steep so that the distance to be driven to develop the zone at the horizon above which the estimated ore reserves are based would not be excessive. The most logical proceedure would appear to be to drive toward a point on the contact about a third of the distance from the Geesman workings to the Daily workings, and after reaching the contact to drift upon it in both directions eventually reaching the downward projection of the Geesman and Daily ore bodies.

A distance of 500 feet on the dip as used in the estimates of Indicated Ore would be equivalent to an elevation difference of 350 feet if the contact is assumed to dip 45 deg. as in the Geesman workings. Since the elevation at the collar of the Geesman shaft is 5976 feet the elevation at the starting point of the tunnel would therefore be 5616 feet. A survey of the area will be needed for exact spotting of the starting point and direction of the tunnel. A small scale topographic map is available and has been used to spot roughly the location of the proposed tunnel, and this is believed to be sufficiently accurate for purposes of preliminary estimation. In any event the variations in dip of the contact will not permit any firm estimate of the

distance to be driven. The approximate location of the proposed tunnel is shown in plan and section on Sketch No 3 of accompanying this report. It will be seen that with a dip contact of 45 deg the contact will be reached at approximately 1200 feet from the tunnel portal. A flatter dip would of course require a longer tunnel.

The tunnel should have a cross-section not less than 6½' x 8'. A mucking machine is available on the property but a compressor plant of greater capacity and efficiency than that now in use will be needed.

The tunnel could probably be contracted at an average price of around $10 per foot for labor. Supplies and other items would probably cost another $10 per foot, and total cost would therefore be around $20 per foot. With adequate equipment and a competent crew the rate of progress ought not to be less than 400 feet per month. The cost per foot for drifting on the contact would probably be about the same as for driving the crosscut tunnel.

Travis P. Lane
Consulting Mining Engineer

May 6, 1951
Phoenix, Ariz.

Control

INTRODUCTION

This is an evaluation report of property owned by Arizona Copper Mines, Inc., located in the Catalina Mountains, Pima County, Arizona.

A brief resume of Geology, History, Physical Features, etc., is included. This evaluation is as of May 23, 1963.

LOCATION AND ACCESSIBILITY

The Arizona Copper Mines, Inc., owns fifty-three (53) patented mining claims totaling 885.283 acres and four (4) mill sites totaling 19.333 acres that are unpatented in Sections 16, 17, 18, 19, 20 and 21, T.11S., R.16E., G&SRM. The property may also be described as lying within the Coronado National Forest (Catalina Division) on the northeast slope of the Santa Catalina Mountains, Pima County, Arizona. The main camp, known as Lower Control, is 60 miles from Tucson via Oracle. The distance from Oracle is 23 miles, all of which is a hard surface but rough and winding road that becomes increasingly difficult the last 6 miles. The closest shipping point and smelter is Hayden, 58 miles distant, or 35 miles north of Oracle. Most of the areas near or at the contact are inaccessible without expensive road building. The Daily-Geesman workings, the lower Leathervood group, and the Hartman group, have roads leading to their portals.

Power to the camp is supplied by Trico Electric.

PHYSICAL FEATURES

Marble Peak, at an elevation of 7600 feet, lies practically in the center of the claims. From this peak radiate steep canyons, some with fair springs and rugged wooded ridges. The vegetation consists of oak, manzanita, mountain mahogany, juniper, fir and small pine.

A survey of the water availability was made by a very competent water geologist in 1954. All sources were measured and the result of that survey is as follows: (Optimum)

Production --- Daily Mine Portal - 1 gallon per minute
Geesman Mine ------ 8 gallons per minute
Hartman Mine ------10 gallons per minute

Mine Water Stored - Daily Mine - 1,000,000 gallons
Geesman Mine 5,000,000 gallons

Springs - "Way Up" Spring - 12 gallons per minute
This spring was contested by John Murphy, owner of UO Ranch. The spring was awarded to the Arizona Copper Mines, Inc., and in 1959 an agreement between the twoccontestants was made whereby UO Ranch was allowed 500 gallons per 24 hours. This is recorded in Docket 1423, Page 236, Pima County.

"Valley Spring" - Located on the Valley Claim produces 1½ gallons per minute.

About 32 gallons per minute appears to be the optimum daily water production. There is no other known source of water in the area that could be economically utilized.

HISTORY AND PRODUCTION

Although mining in the Catalina Mountains is known to have been done since the early 1800's, records of production are not available until 1937, when a small company, The Catalina Consolidated Copper Company, was formed. They constructed a 100 tpd mill and mined and milled ore until late 1938, producing about 1900 tons of concentrates. They sold out to Control Mines, Inc., another small company. This company operated until 1946, aided by a premium price paid by the Government. When this premium was lifted their operations ceased as they could not operate at a profit.

About 3230 tons of crude ore was shipped during the period 1937-1951. This was highly selected and essentially oxide ore found at or near the surface.

The outcrop that encircles Marble Peak was held by various owners, often at war with each other. Arizona Copper Mines, Inc., was formed and consolidated the claims under one ownership and started a modest exploration and development program. A drilling program under a D.M.E.A. loan was started in 1952 and completed in 1953. In July 1954 American Exploration and Mining Company obtained an option on the property and continued, under D.M.E.A., a modest drilling program. They also conducted a magnetometer survey of the Lower Control area. This company dropped their option in 1955.

In 1956, Arizona Copper Mines, Inc., as a trial, mined and shipped about 53 tons of ore with a gross return, after smelting, of $2,138.91. It was unprofitable and operations ceased.

In 1960 they extended the magnetometer survey to cover all the claims. This geophysical work disclosed a few small anomalies and in 1961 the company core drilled four holes, totaling 1042', south and east of the Hartman adit. Two of these drill holes penetrated an ore zone indicating an area about 300' x 100' and 10 to 30 feet in thickness. This would be classified as inferred ore and is not included in calculations. No work has been done since 1961.

From 1937 to 1946, 10,895 tons of concentrates were produced, averaging .015 oz. gold; 8.9 oz. silver; and 27.0% copper. On the basis of 13 to 1 this represents about 142,000 tons of raw ore. In addition, 3,233 tons of crude ore was selectively mined and shipped, averaging .03 oz. gold; 3 oz. silver; and 10.4% copper. This data was obtained from the American Smelting and Refining Company, Tucson, Arizona.

GEOLOGY

The deposits are all of the "contact-metamorphic" type. The contact zone that encircles Marble Peak is irregular with many embayments. In general, the outline is elliptical with

the long axis having a length of 7500' EW and 4500' across its short axis. The tactite would have a total length in excess of 22,000 feet. The width varies, with the greatest thickness in the embayments.

The ore occurs in the altered limestone or tactite zone that contacts the diorite. Above the tactite is limestone that has been altered to marble. Small intrusions, as sills and dikes, of diorite and diabase are found throughout the claims.

The ore lenses, as observed in both the Geesman and Daily mines, undulate and roll. The dip of the contact varies from nearly flat to 55°. There is evidence that the ore lenses are pie shaped down dip. In the Geesman, on #1 level, the ore shoot is 356 feet in length; on the #3 level it has a length of 216 feet; and on the #4 level it is 130' in length.

ORE RESERVES

Daily Mine area:

This area was partially drilled under a D.M.E.A. contract. Of the 11 holes drilled 8 were in ore and this extended the Daily mine ore shoot 750', with a width of 370', and average thickness of 20'. This amounts to 350,000 tons of indicated ore with an average grade of .02 oz. gold; 1.1 oz silver; and 2.0% copper.

The lens was mined by pillar method. Areas below adit level were filled with water and examination was not possible. The Control Mines, Inc., were approaching the end line of an opposing group and ceased mining to avoid litigation. Presuming they were in ore at the time they stopped mining, another 10,000 tons could be added in the lower category of inferred ore.

The distance between the termination of this lens, as indicated by drilling, and the Leatherwood group is about 750 feet. Surface outcrops do not indicate any ore between the two groups. The reserves for the Daily group, then, would be: Indicated: 350,000 tons. Inferred: 10,000 tons.

Geesman - P.D. tunnel:

No available copper ore can be assigned to this group without exploration and development. It is estimated that between the No.1 level of the Geesman and the P.D. adit there is approximately 6800 tons of tungsten ore (sheelite) that would average .7%(14 lbs.) to the ton. This is worth $8.75 per 20# unit or $6.12 per ton at New York. Obviously this has no value at this time.

Hartman group:

No ore can be assigned to this group.

Leatherwood group:

While this one of the most interesting of the various groups of claims, there is no ore in sight that can be placed in either Measured or Indicated ore. The ground is extremely incompetent and openings or tunnels are caved and inaccesible. No ore can be assigned to this group which lies about 1500' west of the Daily.

Stratton group:

This group lies due west and adjoins the Leatherwood. No ore can be assigned to this group without exploration and development.

TOTAL ORE RESERVES

Daily	350,000 tons
	(.02 oz.Au,.03 oz.Ag. 2.0%Cu.)
Geesman	None
Hartman	None
Leatherwood	None
Stratton	None
Total	350,000 tons.

EVALUATION

Premises used in the evaluation:

1. Ore Reserves: There is no measured ore but 350,000 tons of ore is indicated. This figure has been accepted by the U. S. Bureau of Mines who participated, through D.M.E.A., in the exploration of the Daily-Geesman area.

2. Grade of ore and recovery: The recovery by former operators is reported as 90%. Shipping returns of concentrates indicate a 13:1 ratio of concentration. The ore then would average 2.0% copper; .68 oz silver; and .02 oz. gold per ton.

3. Production per day and per year: The former operators had a 100 ton per day capacity mill but were unable to operate at full capacity due to shortage of water. From verbal accounts, their average daily production through the mill was about 60 tons. According to the survey of water availability as of 1955 (and it is less in 1963) 50 tons would be the maximum that could be mined and milled and also support a mining community. On the basis of 50 tons per day at 325 days per year, 16,250 tons would be produced annually, for a life expectancy of $\frac{350,000}{16,250}$ or 21 years.

4. Operating costs:

Mining	$5.00 per ton
Development	.10
(750' drift @ $40.00 - $30,000.)	
(400' raises @ 25.00 - $10,000.)	
Milling & tailings disposal	3.05
Power and water	.70
(Water includes water lines from the various sources to a central takeoff)	
Supervising and Assaying	1.00
Miscellaneous	.20
Total to operate	$10.05 per ton

5. Value of ore:

This is computed using the smelter schedule of American Smelting & Refining Company which is the nearest smelter.
Au -- No returns if under .03 oz per ton.
Ag -- Pay 95% (minimum deduction of $\frac{1}{2}$oz.) Price, 1963, New York, $1.27/oz less $1\frac{1}{2}$¢ or $1.255/oz.
Cu -- Deduct 20 lbs. (1 unit) plus $3.764 per pound of copper accounted for.
Base charge $15.00 per ton plus 15 cents per ton for each unit of copper in excess of 25%.
Taxes other than income taxes - 10%.

5. Value of ore (continued)

Concentrates:

1 ton - 27% Cu. - 540 lbs.
1 ton ------Ag.--- 8.9 oz.
1 ton ------Au. - .02 oz.

Copper:	27%-1% - 26% or 540 lbs.	
	30.6 ¢-3.764¢ --- $.2684 per lb.(Price,May,1963)	
	540# @ $.2684 ----------	$144.94
Silver:	8.9 oz. @ $1.255----------	10.67
Gold:	No payment ----------	00.00
		$155.61
	Less Base charge ----------	15.30
		$140.31
	Less haulage ----------	5.80
		$134.51
	Less taxes - 10% ----------	13.45
		$121.06
	*Less royalty to U.S.(DMEA loan)	6.05
	Net value	$115.01

*Retires after October, 1966.

Value of ore at mine:

$\frac{\$115.01}{13}$ - $8.84 per ton.

SUMMARY OF ANTICIPATED RESULTS

1. Ore reserves ----- 350,000 tons.

2. Tons handled per year ----- 16,250 tons.

3. Anticipated life - $\frac{350,000}{16,250}$ - 21 years.

4. Deferred period to develop ore, construct mill, and rehabilitate camp ----- 1 year.

5. Condensed profit and loss statement:

325 days/year @ 4 tons concentrates/day - 1300 tons/year.

1300 tons @ 115.01 ----------	$149,513.00
Operating cost----------	$163,312.00
Loss to operator-----	$ 13,799.00

PRESENT VALUE

The property cannot be mined at a profit. Therefore, the value given is based on $10.00 per acre for idle or unworkable mining properties.

Value as mining property	$8,852.00
Maximum value of housing (In need of repair)	5,000.00
Equipment (No equipment on property)	00.00

VALUE OF PROPERTY AS REAL ESTATE

Some of the claims have a value as homesites. These are the more accessible claims and have wooded areas. The list would include the Wilson, Garnet, Valley, Centennial, Giant, Blizzard, Gen. R.E.Lee, Apache Central, Copper Princess, Copper Peak, Golden Peak #2, York, Eagle, Grand Central, Roosevelt, Way Up, and Homestake. These claims total 284.582 acres, at $100.00 per acre or $28,458.00.

SUMMARY OF TOTAL EVALUATION

Mining property	$8,853.00
Housing	5,000.00
Real Estate	28,458.00
TOTAL	$42,311.00

F. J. Johnson
Applicant

R E P O R T

on

MINING PROPERTIES in the MARBLE PEAK AREA

SANTA CATALINA MTS

OLD HAT MINING DISTRICT
PIMA COUNTY, ARIZ.

Prepared and submitted

by

Travis P. Lane
Consulting Mining Engineer
Phoenix, Ariz.

Nov. 14, 1950

PROPERTY & LOCATION

The mineral area of the Marble Peak section of the Santa Catalina mountains has practically all been consolidated under one holding. The claims and status of their ownerships are noted as follows : See claim map.

The Geesman and Leatherwood groups (F.S. Nicholas) comprise 15 patented and 4 unpatented claims and are held on purchase contract agreement from the Control Mines Co.

The Daily Group comprising 16 patented claims is held on purchase contract agreement from the Daily Mines Co.

The Hartman-Homestake group comprises 6 patented claims and is held on purchase contract agreement from the owner.

The John W. Daily and C.J. Hellerstedt group comprising 16 unpatented claims is held on purchase contract agreement from the owners.

The Stratton group comprises 14 patented claims and is owned in fee.

10 claims on the north and east border of the above block of claims are held by location and the performance of annual labor.

The purchase contracts are all term agreements with fixed payments due at intervals; and none of the contracts requires royalty payments on production nor specifies production

quotas or work performance.

The above holdings form a block of claims which is solid except for one patented claim, the "Oversight" in the northern part of the block, and steps are being taken toward the acquisition of this claim.

The property is located on the northeast slope of the Santa Catalina mountains in the Old Hat mining district in Pima County, Arizona. The mines can be reached over the old Mt. Lemmon road which passes along the east and south border of the property. The distance by road from Tucson via Oracle is 63 miles of which 37 miles is paved highway to Oracle and the remainder is good hard surfaced mountain road which becomes quite steep and winding as it rises toward the mine. Tucson may also be reached from the mine by continuing for some 7 miles over very rough steep road to the recreation area on the crest of the mountain and thence by paved highway down the south slope of the mountain - a total distance of 48 miles from the mine. The outlet for ore and concentrates in the past has been the A.S.& R. smelter at Hayden, Arizona, which is 54 miles distant northerly from the mine.

Elevation at the mine camp on the eastern lower edge of the property is 5700 ft and the elevation of Marble Peak, the highest point, is 7600 ft.

HISTORY & PRODUCTION

Mining in the district dates back to shortly after the turn of the century. The copper stained croppings in a broad contact zone encircling the Marble Peak near its base attracted the first prospecting in the area; and some closely sorted high

grade oxidized copper ore carrying moderate amounts of gold and silver was shipped in early days from a number of shallow workings. Until recent years poor transportation facilities and long hauls to market outlets was a deterrent to development and mining in the area.

In 1910 the Phelps-Dodge Corp. entered the district and during the next three years actively developed the Geesman and Leatherwood groups of claims, performing some 6000 ft of work principally on the Geesman claims. This development opened several ore bodies averaging 3 to 3½ copper but no production was made since the ore was too low grade for profitable exploitation at that time. The Corporation is said to have planned a broad exploratory program which was abandoned because of a title dispute and an adverse decision regarding the ownership of some ground which was considered essential to the project. Later other disputes among numerous property claimants in the area have throughout the years done much to discourage exploration of the generally recognized attractive ore showing of the area; and such operations as were undertaken at intervals in the past were hampered by these disagreements.

Following cessation of work by the Phelps-Dodge Corp. work in the area was only of an intermittent desultory character until 1937 when the Catalina Consolidated Co. acquired the Geesman group of claims and the adjoining Daily group and operated a 100 ton flotation plant for about a year and then relinquished the property. In late 1939 the Control Mines Inc. bought the mill and leased the Daily property, and in 1940 also acquired the Geesman and Leatherwood mines on bond and lease from the Phelps-Dodge Co.

The Controls Mines Inc. produced at a rate of 1500 to 2000 tons per month until 1943 and completed purchase of the Phelps-Dodge holdings with profits from the operation. In 1943 the property again changed hands becoming the Control Mines Co., and this Co. produced at approximately the same rate as the predecessor Co. until the middle of 1946. At that time the Gov't premium plan was discontinued and the operations were terminated. Factors, other than a decline in the price received for copper, which contributed to the inability to continue profitable operations were the low capacity of the mill, the inadequacy of the mine plant and the backward state of the mine development.

During the period of premium payments a leaser shipped to custom mills a substantial quantity of complex lead-zinc-copper-silver ore from the Hartman-Homestake group.

Since 1946 some small shipments have been made from the Hartman-Homestake property; and a leaser, who is presently active on the Leatherwood property, has shipped an occasional car of closely sorted oxidized ore from scattered surface workings.

Complete figures are not available regarding production from the properties. Recorded production from the Geesman and Daily properties during the period 1937-42 was some 83,000 tons of ore averaging a little over 3% copper and about $1.50 gold and silver; and production from these properties since 1942 principally from the Geesman mine has been estimated at between 30,000 and 40,000 tons of ore of approximately the same grade. According to these estimates the total production from the two properties therefore has been ~~about~~ upwards of 120,000 tons. Some discreptancy

in this total is indicated by the size of the tailings pile measurement of which shows that a total of 150,000 tons or more has been milled.

No records are available regarding production earlier than the start of milling operations in 1937. This early production would of necessity have been high grade ore derived from surface workings, and over the years the tonnage shipped appears to have been rather substantial.

GEOLOGY & MINERALIZATION

The ore deposits of the area occur in a contact-metamorphic zone which encircles Marble Peak in an oval having a long axis length of about 7500 ft in an E-W direction and a short axis length of about 4500 ft in a N-S direction, with circumference of about 4 miles. The underlying rock is diorite and this is overlain by limestone with some minor interbedding of quartzite and shale. In many places dikes and sills, and prongs or tongues of the underlying basic rock have intruded the sedimentaries and there is marked evidence throughout the area of intensive contact metamorphism. This metamorphism has resulted in the alteration of much of the limestone to marble, and to garnatized and epitotized areas in the limestone. Most of the ore of the region occurs in these latter areas, generally near the top of the underlying diorite. In some places, however, notably on the Leatherwood claims the contact alteration zone is several hundred ft wide and contains numerous mineralized garnetized lime beds at considerable distances above the diorite.

The contact everywhere dips into the mountain suggest-

ing that the Marble Peak limestone rests in a saucer-like depression in the diorite. The course of the contact is irregular on the hillsides and its dip into the hill is extremely variable, ranging from nearly flat to angles of 60 deg. and 70 deg., with undulations and rolls on dip a common characteristic in the underground workings. The ore zones appear to be associated with groupings of fractures which strike radially toward the center of Marble mountain.

The surficial zone of leaching and oxidization is shallow and the transition to primary sulphide mineralization is very sharp. The principal oxide copper minerals are malachite, and chrysocolla in lesser amount, and some copper sulphate (chalcanthite), and these minerals are accompanied by a sparse amount of iron oxides. The sulphide minerals are chiefly chalcopyrite, bornite and pyrite. Some secondary copper (chalcocite) is occasionally present in small amounts, and in some parts of the workings magnetite is present in heavy masses associated with the copper sulphides. Lead and zinc has been encountered in places but the occurences have not been in commercial quantity except in the workings of the Hartman-Homestake mine where some production of these metals along with copper and silver was made during the period of high metal prices during and immediately after the war. A minor amount of sheelite is nearly always present in the veins, with greater concentrations in pockets and in fracture seams. To date the tungsten has not been recovered in milling of the ore and investigation of the possibility for recovering it as a by-product is indicated.

DESCRIPTION OF WORKINGS

The workings are generally accessible except in those portions of the Geesman and Daily mines which are filled with water - up to the main tunnel level in each instance. Following is a description of the more important workings. See maps.

The Geesman Mine has made the greatest production among the several mines of the area, and it has been the most extensively developed and appears to offer an excellent chance for development of extensions of its ore bodies. The claims of this group cover about 3500 ft of length of the limestone-diorite contact and there are many attractive surface showings of ore other than that of the main body.

The mine is opened by a shaft, inclined at an average angle of about 40 deg, to a depth of approximately 280 ft with levels at 100 ft, 200 and 250 ft. A crosscut tunnel connects with the shaft at the 100 ft level. The shaft is sunk in about the center of the ore body and ore has been mined under a hard limestone hanging wall for a horizontal length of 150 to 200 ft and a thickness of 30 to 40 ft. The central portion of the ore body has been mined continuously from the collar of the shaft to the floor of the 250 ft level and the empty stope opening here exists as a deep cavern from top to bottom of the mine with many large irregular stoped chambers on each side.

The mine is credited with a production of about 100,000 tons of ore averaging around 3½ % copper with $1 to $2 value in gold and silver. Mining was in progress in the lower

part of the mine at the time of shutting down in 1946. Most of the developed ore of the above grade appears to have been mined out but the ore shoot is reported to have been continuing into the floor of the 250 ft level with dimensions and values about the same as above that level.

The Daily Mine adjoins the south boundary of the Geesman property and its main workings are some 1200 ft distant from the main workings of the Geesman. The claims cover some 2500 ft of length of the limestone-diorite contact.

The mine is opened by a tunnel 390 ft long which develops a flat dipping very irregular ore body. The mine is credited with a production of between 20,000 and 30,000 tons of ore having a grade of slightly under 3% copper and about $1.50 gold and silver. The ore body dips into the Copper Prince claim of the Geesman group and was being developed and mined below tunnel level into that ground when the threat of litigation caused suspension of the work.

The Leatherwood Mine adjoins the Daily mine on its south boundary and the claims cover 3500 ft of length along the contact. The zone of contact alteration here is several hundred feet wide and numerous steep dipping copper bearing veins have developed in fractures in the limestone. Many of these veins have been mined and the steep hill slope is dotted with pits and cuts and short tunnels. The work has been done principally by leasers who mined the oxidized ores of the groppings to shallow depths and shipped a high grade closely sorted product. The rate of production has been small but the work has been carried on intermittently for many years and the size and number of the openings indicates that a substantial total production has been made.

The Stratton Mine adjoins the Leatherwood on the southwest and its claims cover some 4000 ft along the contact. The property is located in high rough country and until recently was accessible only by trail. For this reason it received less attention in the past than the more favorably situated properties in the area. The principal development is an 80 ft shaft inclined at 20 deg. The shaft is sunk in a garnetized limestone bed and shows sulphide copper ore from 3 to 4 ft wide throughout most of its depth. Other workings consist of severals short tunnels and a number of surface cuts, all showing oxide copper mineralization. Several hundred tons of ore is reported to have been shipped from this property.

The Hartman-Homestake is located in the northwest upper part of the Marble Peak area. Elevation at the mine is 6600 ft. A steep road constructed several years ago connects the mine with the camp on the Daily property some 3 miles distant. The claims cover some 5200 ft of length along the contact. The mineralization in this property differs from that obtaining in the contact zone developments in the other properties in that zinc and lead occur in commercial amounts here, along with copper and silver.

The workings consist of some 2500 ft of tunnels, crosscuts, winzes and raises, and several small stopes. The contact zone of alteration is some 30 to 40 ft wide and shows mineralization throughout with however a higher concentration in a band 6 to 8 ft wide against the limestone hanging wall. The workings disclose a continuous of one length of over 200 ft with

width of from 2 to 10 ft, and surface showings indicate a probable additional length of ore of several hundred ft. A total of approximately 550 tons of selectively mined ore was shipped to the Eagle-Picher custom mill at Sahaurita, Arizona, several years ago. Approximate metal content of the ore shipped was as follows :

.02 oz Au 3.75 oz Ag 2.75% Cu 3.75% Pb 8.0% Zn

Work was suspended following sharp declines in metal prices.

ORE

The existence of low grade copper mineralization over large areas in the Old Hat mining district has been known for many years but under early day conditions as regards transportation, power and treatment processes there was little incentive to explore any but moderately high grade ore showings. During recent years however the advent of good roads and auto transport and the development of modern mining technics and mining and milling mechanisms and processes has stimulated the investigation of many areas for their possibilities for developing large low grade copper ore bodies. As a result several aggressive exploration projects have been undertaken at various places in the district. One such undertaking, which resulted in the development of the great San Manuel deposit, is a striking example of the success which might be achieved in this direction. Beginning with exploration by diamond drilling beneath a mediocre surface showing of copper stained material the San Manuel deposit has now been proved to be the third largest copper ore body in the United States.

No serious development has been undertaken in the area beyond the limited amount of work done on the Geesman property by

the Phelps-Dodge Co. many years ago. The work by this company as well as by others was confined to following pay ore on the surface and underground and very little advance was made in non-pay material, and no thought was given toward the development of ore of the low grade which today could be profitably handled.

The mining and milling operations during the period 1939-1946 can clearly not be considered a fair test of the potentialities of the area. The small scale of the operation (60 to 70 tons daily milling capacity) and the inadequacy of the mine equipment and of the mine development precluded the attainment of low costs and required that only material having a grade of 3% copper or more could be mined. In the effort to maintain production of ore above this economic cut-off grade (3% Cu) the ore bodies were selectively mined in irregular stopes and a great deal of material of somewhat lower grade was left in the walls and in pillars.

Blocked Ore While the ore potential of the properties is undoubtedly high and a large amount of ore seems certainly indicated in the present workings and their extensions the irregular nature of the ore deposition and the limited amount of development beyond presently stoped areas does not make possible the measurement of reserves of ore which would fall into the classification of "Measured"or"Blocked"Ore".

Indicated Ore The ore body in the Geesman Mine has been mined continuously, except for a thin leached crust at the surface, to a depth of 250 ft on its dip and at the time of suspension of work the ore body was continuing in the floor of the lowest or 250 ft level with no apparent diminution in size and metal

content. The grade of ore milled averaged approximately 3½% Cu and $1.50 gold-silver. A large amount of material which was of submarginal grade during the former operations was left in the ends and in the foot wall of the stopes and in pillars. With a daily production rate of several hundred tons as proposed instead of the former rate of about 60 tons per day and with mine development efficiently laid out material ranging in grade down to about 1.5 Cu could be profitably mined - at the present copper price of 24½ ¢ per lb ; and a quite substantial tonnage of this formerly marginal material seems certainly assured here. 50% of the tonnage already mined would seem to be a conservative estimate of the additional ore available - or about 50,000 tons. Judging from the irregularity of the stope openings it appears probable that breaking into presently low grade faces will in places open into ore equivalent in grade to that which has been mined, and the grade of this additional ore ought not as a whole to fall far below the grade mined to date.

In the present absence of contrary geological and structural evidence the Geesman ore body can be expected to extend in depth for a considerable distance beyond the shallow depth already attained. An extension of ore for 250 feet below the 250 ft level would be a reasonable expectation, and development to this lower depth ought to provide ore in an amount approximately equal to that above the 250 ft level, or 150,000 tons. Total indicated ore in the Geesman mine is estimated therefore at 200,000 tons having a grade of approximately 3% Cu and $1.50 gold-silver.

In the Daily mine workings the ore outlook is similar to that obtaining in the Geesman mine i.e. a lower economic cut-off grade will permit extending many stope faces beyond their former economic limits. Also, ore was continuing in depth when worked was stopped because the workings were encroaching upon Geesman ground; and with resumption of work and extension of ore in depth for a distance at least equal to that already attained is a reasonable expectation. Indicated ore therefore is upwards of 50,000 tons having a grade approaching that already mined or approximately 2.7% Cu.

Ore is also indicated in the Leatherwood and Stratton properties but the state of their development does not make possible any tonnage estimates. The ore possibilities however are discussed as follows :

The rather extensive workings of the Leatherwood mine are confined almost entirely to the surficial oxidized zone. In view of the extensive mineralization and the substantial oxide ore production which has been made, and judging from the results from development in neighboring properties beneath similar oxidized showings the possibilities for developing ore in the deeper sulphide zone appear to be quite attractive.

The Stratton property carries a strongly mineralized cropping of the contact zone but as previously noted in this report development has been limited because of the relative inaccessibility of the property. Such work as has been done seems to promise good development possibilities.

The ore in the Hartman mine occurs in fractures and

as replacements of beds, and the ore deposition is extremely irregular. Despite this irregularity a continuous shoot of ore is opened for a length of over 250 ft on the upper main level with average metal content of several per cent each of copper and lead, and several ounces of silver per ton, and 6 to 8 % zinc. Surface showings above here warrant the assumption that the ore carries through to the surface - an average distance of some 100 ft. Sulphides appear at depths of several feet below the oxidized cropping in this area and there is thus indicated here a block of sulphide milling ore amounting to between 10,000 and 15,000 tons. The ore is continuing in the east face of the drift and oxidized mineralization on the surface above and beyond here indicates a considerably greater length of ore than is now exposed on the level. Assays on a level 60 ft below this level are rather indifferent due possibly to the workings having missed the main ore because of its irregularity and the folds and variable dips of the formation. More exploratory work is needed here. The ore shoot is fairly large and the chance for its continuing in depth appears to be good.

Milling of the Hartman ore will require differential separation and it is the intention to defer work in this mine until sometime in the future, subordinating it for the present to the much larger copper producing potential of the other properties.

Inferred Ore The Geesman and Daily ore bodies appear to be related and copper oxide mineralization is almost continuous in the leached cropping of the contact zone between the two mines. A large number of shallow prospect pits were made along the cropping in the search for high grade ore many years ago and the mineralization in many of these openings is equally as attractive as that

which exists in the thin oxidized crust which overlies the Geesman and Daily ore bodies. It may be inferred from this that development at depth will find ore extending practically continuously between the two mines and for some distance beyond each mine. The length of the more intensive leaching and mineralization in the croppings is about 2000 ft. If an ore width equal to that shown in the Geesman and Daily workings (av. approx. 20 ft) and a depth of ore such as shown in the Geesman mine (250ft) is assumed the tonnage in the block would be 800,000 tons - at 12½ cu. ft. per ton. Subtracting from this the tonnage already extracted and the estimated indicated ore above the 250 ft horizon the tonnage in the block is approximately 650,000 tons.

A 2500 ft length of intensively oxidized and mineralized croppings of the content zone is present on the Leatherwood and Stratton properties. The ore possibilities in deep development appear to be comparable to those offered in the area of the Geesman Daily mines. Applying the same width and depth factors used in considering the Geesman-Daily block the tonnage here is 1,000,000 tons. The total in the two blocks is therefore about 1,650,000 tons.

An allowance of 50% for portions of the above blocks which might be barren or too low grade for economic mining would leave somewhat over 800,000 tons as an estimate of the ore available. Copper content is estimated at about 3% copper.

Summarizing, the estimated ore available is as follows :

Indicated Ore	200,000 tons	3% Cu
Inferred "	800,000 "	3% "
Total	1,000,000 "	3% Cu

The above estimate covers only a small portion of the

contact zone which encircles the mountain and the projection of ore toward the center of the mountain is relatively slight. Actually the cropping of the contact zone almost everywhere presents a leached appearance with much oxidized mineralization which suggests that much of it will be found to be underlain by ore. The sulphide copper mineralization in the area is primary and has extended to the depths already opened without zonal falling off of metal content. From these considerations the ore potentiality of the properties is very probably many times the tonnage shown in the above estimate.

MINING

The main ore bodies occur in garnetized beds beneath an invariably firm hanging wall. Mining in the past was by shrink and open stope methods. The firmness of the hanging wall and of the ore makes it possible to work safely in high open chambers, and the size of the ore faces makes for a low ore breaking cost. The steep hillsides afford good tunnel sites and development by tunnel to a depth of some 500 or 600 ft will obviate hoisting and pumping. These factors all favor low cost mining, and on a moderately large scale of production the mining cost would probably not exceed $2.00 per ton.

There is no mining equipment on the property at the present time. The important items of equipment required are : air compressors, rock drills, mucking machines, slushers and a locomotive, and cars, rail and pipe.

MILLING

The ore is a simple sulphide ore and bulk conventional

flotation treatment is entirely adequate for satisfactory recovery. Recoveries in past milling operations are reported to have averaged over 90% with concentrates averaging over 20% Cu. Confirmation of the good recovery is shown in a recent mill test on a random sample of pillar and low grade stope faces with results as follows :

	Oz Au	Oz Ag	% Cu
Concentrates	.015	8.4	24.51
Heads	Tr.	1.0	2.80
Tails	Tr.	.10	.29

Copper Recovery 89.07 %
Silver " 90.0 %

Further confirmation is seen in the assays obtained from systematic sampling of the large tailings pile. These show a metal content of .26% Cu and .13 oz Ag remaining after milling material averaging between 3 and 3½% Cu. Incidentally the tailings pile shows a tungstic acid content (WO_3) of .035%. This WO_3 content is small but was contributed by only a small proportion of the ore milled, and its presence even in this small amount in the tailings suggests that some economic benefit might be derived from special treatment of ore from those sections of the mine which contain tungsten.

The proposed milling rate is 300 tons per day and judging from records in other mills of this size and treating similar ore costs ought not to exceed $1.75

The more important items of milling equipment required for the prospective flow sheet are : Primary Crusher, Vibrating Screen, Secondary Crusher, Fine Ore Feeder, Primary Ball Mill, Classifier, Regrend Ball Mill, Regrind Classifier, Concentrate Thickener, Concentrate Filter, Miscellaneous Conveyors, Pumps, Reagent Feeders, Piping, wiring etc., and Housing. Much of this above equipment is available at used prices from a mill in

another part of the state which is being dismantled after a short period of operation. Some other used equipment and some new equipment would be required. It is estimated that the cost of building a mill (of approximately 300 tons per day capacity) will be approximately $250,000. This figure does not include the cost of a power plant nor of a water supply system discussed below.

POWER

Power requirements would be 500 - 600 HP for the prospective plant. Electric Power is not available at the property and the nearest transmission line connection would require the building of an extension for a distance of some 6 to 7 miles, and the rate available would not compare favorably with costs obtainable in a Diesel-Electric plant on the property. A number of Diesel-Generator units, used but in excellent condition, are available in the region. It is estimated that the required Power Plant could be built for $50,000 with housing etc.

WATER

Water was obtained from the mines in sufficient volume to supply the past milling operations with generally some excess. Deeper development is certain to bring in more water and with efficient water reclamation from the tailings enough water seems assured for the prospective plant. Cost for water lines, storage etc is estimated at $10,000.

LABOR

The property is not far removed from population

centers and in the past the labor supply was plentiful. The mining method to be practiced will not require a large labor force. A favorable factor in the labor situation is the large population of Mexican laborers residing in this part of the state. In the event of a future tightening of the manpower situation the property ought to fare somewhat better than most mines of the country.

The possibility of breaking ore in broad faces and in benches will result in a high duty per machine shift, and mechanized loading and motor haulage direct to the mill can be accomplished with but few men. It is believed that an underground force of about 30 men ought to provide 300 tons of ore per day and carry on an appropiate amount of development. Mill operations including tailings disposal ought not to require more than 12 men. The power plant would require 3 men. The manpower needs for clerical, trucking of concentrates and general surface labor, and supervising personnel ought not to exceed 8 men. Altogether the total force required is not expected to exceed 55 men.

CAMP

The camp housing, which was adequate for former small scale operations, consists of a stone office building and two frame cottages, all in good repair, and several other serviceable cottages needing some repair, and a small sheet iron warehouse building. Several cottages on an adjoining property are available on a rental basis and some accomodations are available elsewhere in the immediate vicinity. Water is piped to the various dwellings from springs on the property. Additional housing will be required

when the property is placed upon a full scale producing basis. The principal items of such housing are : an office, laboratory, assay and a number of cottages principally for supervising personel. It is estimated that $25,000 will suffice for this additional Housing and that $10,000 will be required for other camp improvement - roads, water lines, lighting etc.

VALUES and INDICATED PROFIT

Smelter settlements covering the past milling operations show an average concentrate grade of 26,8% copper and 8.2 oz silver. The American Smelting and Refining Co. offers a smelter schedule at its El Paso plant for these concentrates with outcome as follows : (on Copper Cathode Quotation 24.075¢ per pound f.o.b. New York City)

Payments:	Silver 7.7 oz @ .885			$ 6.81
	Copper 517 lb. @ .21075			108.75
				$ 115.56
Deductions:	Base charge		6.00	
	Bullion frt. tax		.17	
				6.17
F.O.B. Smelter				109.39
Less Freight Tucson-El Paso incl. tax, switch, 9% H20				7.16
Net per ton f.o.b. Tucson				$ 102.23

The cost for trucking concentrates to Tucson is estimated at $4.00 oer ton. Net value of the concentrates at the mine therefore is $98.23. The anticipated grade of ore is 3% copper and ore of this grade will have a net value of 98.23 ÷ 9.8 or $10 per ton.

Indicated profit then works out about as follows :

Value of ore			$ 10.00
Less:	Mining	$ 2.00	
	Development	.50	
	Milling	1.75	
	Overhead	.75	5.00
Profit per ton			$ 5.00
" "	day (700 tons)		1,000.00
" "	year (300 days)		450,000.00

COST OF PROJECT

The cost to put the project on a producing basis is estimated as follows :

Preliminary Drilling - 3,000 ft @ $4.50 (contract)	$ 13,500
Crosscut tunnel and drifts - 2500 ft @ $20 per ft	50,000
Mine Equipment	40,000
Mill Equipment and Installation	250,000
Power Plant	50,000
Housing	25,000
Camp Improvement - roads etc	10,000
Water Lines and storage etc	10,000
Operating Capital	51,000
TOTAL	$ 500,000

CONCLUSIONS

The properties under consideration offer an unusual promise for developing a large tunnage of copper ore of moderate grade, and the nature of the deposits and the ease of treatment of the ore favor low operating costs.

Development of the indicated and inferred ore estimated in this report promises to provide a tonnage sufficient to supply a mill of several hundred tons daily capacity with ore for a period of over 10 years. The estimates are based upon the workings and surface showings in only a small part of the property with only short extensions in depth toward the center of the mountain.

The surface mineralization of the contact zone throughout practically its entire encirclement of Marble Peak suggests the probability that further development both on the surface and in depth will prove up a quantity of ore many times that of the present estimates.

Travis P. Lane

Travis P. Lane
Consulting Mining Engineer

November 14, 1950
Phoenix, Ariz.

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Some copper deposits in the Old Hat mining district, Pima, County, Arizona

by

Mels P. Peterson

S. C. Creasey

Open files

September 21, 1943.

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ILLUSTRATIONS

Maps accompanying text

Figures

Some copper deposits in the Old Hat mining district, Pima County, Arizona.

Introduction

From August 20, 1942, to January 20, 1943, a field party of the Geological Survey, United States Department of the Interior, studied a part of the Old Hat mining district, in the Santa Catalina Mountains, Arizona. The area mapped (fig.1) is about 25 miles north-northeast of Tucson, in T. 11 S., R 16 E., Gila and Salt River meridian, in the northeast corner of Pima County. It may be reached by way of Oracle, Arizona, by 35 miles of oiled road and 25 miles of graded dirt road. The topography of the area is rugged, with altitudes ranging from about 5400 to 7700 feet, and it is largely occupied by a single hill whose summit lies a little east of Oracle Ridge.

The principal object of the work was to find additional reserves of copper though an outlying scheelite prospect at the south end of the area also was examined. The work was done chiefly by Nels P. Peterson and S. C. Creasey, with the assistance for short periods of J. B. Hadley and H. H. Sullwold, Jr. The United States Bureau of Mines furnished a survey that facilitated mapping the Geesman mine, and Eldred Wilson of the Arizona Bureau of Mines furnished a partially completed geologic map of the Daily mine that was helpful. Individual property owners assisted in many ways that cannot be adequately acknowledged.

History and production

There is no record of production previous to August, 1937, when the Catalina Consolidated Copper Company leased the Camp Apache group of claims and the adjoining property of the Daily Arizona Consolidated Copper Company. The Catalina Consolidated built a 90-ton flotation concentrating mill on the property of the Daily Arizona Consolidated Copper Company and mined and treated ore from both the Geesman and Daily properties. From August 15, 1937 until the close of their operations in May, 1938, this company treated approximately 18,000 tons of ore averaging 2.7% copper.

In October, 1939, the Control Mines, Inc. bought the Consolidated mill and leased the Daily Arizona property. They acquired the Geesman property in the spring of 1940 from the Phelps Dodge Corporation. In 1940, the Control Mines Inc. mined and milled from the Geesman and Daily properties 24,000 tons of ore which yielded about 1,394,000 pounds of copper. The table (fig.2) gives the production figures for the Control Mines, Inc. for the year 1941 and through September of 1942.

The Geesman mine is the only active mine in the district at the present time. It is operating with a personnel of from 30 to 40 men which includes the mill operators. The Daily mine, owned by the Daily Mines Company, was active in 1939 and 1940 while under lease to the Control Mines, Inc. The

owners have recently stated their intention to reopen the mine in the near future.

Geology

The mines and prospects in the area all lie near the border of a mass of marble that is about a mile and a quarter in length from east to west and about three-quarters of a mile wide. It is mostly from this rock that the hill just mentioned is carved, though the summit consists of a small overlying mass of quartzite. On the west, northwest, and southwest the marble is in contact, partly faulted, with an underlying series of metamorphosed sedimentary rocks that consists chiefly of quartzite, sandstone, and impure limestone but includes a little shale. Igneous rocks, mainly dioritic, have been intruded into all the sedimentary strata.

The formations beneath the marble have not been positively identified. They are believed, however, to include the pre-Cambrian Dripping Springs quartzite, represented by massive slabby sandstone and quartzite interbedded with shale which has been metamorphosed to siliceous hornfels and chloritic schist. They probably include, also, the Mescal limestone, of pre-Cambrian age, and a small thickness of the Cambrian Troy quartzite.

The marble forming the knob is massive and coarsely crystalline, and its original textures have been almost wholly obliterated by metamorphism. Its age is probably Paleozoic, and its general appearance indicates that its lower part may be Mississippian and its upper part Pennsylvanian. At any rate, it is older than the igneous rocks, which are intrusive into it, and is altered along the intrusive contacts to tactite, which consists mainly of brown garnet, epidote, and quartz. The tactite is mapped separately on the detailed maps but not in figure 2.

The intrusive igneous rocks include hornblende-diorite, hornblende-quartz diorite, and diabase, but these varieties are not distinguished from one another on any of the maps. Small masses of diorite and diabase, most of them sills but some of them dikes, have been injected into the marble. The main intrusive contact between the diorite and the marble tends to follow the bedding, but in detail it is very irregular, with numerous rolls, and many tongues of diorite cut across the bedding. Closely associated with the tactite is a rock that is believed to be an altered facies of the diorite, because it grades into unaltered diorite and partly resembles it in texture. At least some of the diabase is much later than the diorite.

In its eastern part the marble is immediately underlain by the diorite. On the south and east sides of the marble mass, the contact has a low dip--from 10° to 18°--but along parts of the north side the dip becomes as steep as 60°. Dikes of diabase cut the diorite as well as the marble and the tactite, and a diabase dike of low dip crosses the Geesman ore body.

The principal structures in the marble are a series of east to northeast striking anticlines and synclines, which apparently have not controlled the

CONTROL MINES, INC.

COPPER PRODUCTION 1941 and 1942

	1941		1942	
	Dry tons of concentrate	lbs of copper	Dry tons of concentrate	lbs of copper
January	219.3530	125,512	113.1120	59,221
February	217.7080	118,787	99.1525	50,805
March	277.2140	152,042	200.6810	108,394
April	189.5275	100,470	113.7165	59,611
May	181.6710	97,501	65.4425	33,456
June	218.5175	117,927 -	206.8620	109,629
July	160.0630	87,128	105.0000	51,483
August	176.8745	94,677	114.5660	56,649
September	185.9275	102,222	55.9510	27,997
October	172.7535	90,610		
November	138.1165	77,764		
December	149.2045	81,535		
TOTALS	2286.9305	1,246,175		

Figure 2

localization of the ore. Faulting is subordinate to folding; only a few small faults of measurable displacement were recognized. Fracturing is common; northeast-striking fractures predominate, but northwest-striking fractures occur also.

The predominate structure in the pre-Cambrian rocks is a series of northeast-striking faults, which are younger than the Paleozoic marbles. The strike and dip of the rocks are in general fairly uniform, apart from folding near the faults. A mineralized fault zone striking about north-northeast forms part of the boundary between the Mississippian (?) and older rocks at the Hartman mine. Northwest-striking tension fractures are common in both the Hartman and the Stratton workings.

Ore deposits

All of the ore deposits are in the metamorphosed sedimentary rocks near the diorite contact, the mineralization being of the pyrometasomatic type, commonly called contact-metamorphic. No two of the deposits, however, are altogether similar in their relations to both country rock and structure.

Ore control.--The Daily and Geesman deposits, on the northeast slope of the marble hill, are both in a well-defined zone of tactite between the supposedly Mississippian marble and diorite. The ore shoots in the Daily mine are localized along the crests and flanks of three small rolls, of ridge-like form, on the marble-diorite contact, which here dips northwestward at a low angle. The rolls are no more than wrinkles in the surface of contact apparently unrelated to any major structures in the limestone. The localization of the ore in the rolls is probably due to minor fractures in the tactite along their axes. In the Geesman mine, the nature of the structural control determining the position of the ore is not entirely clear. Apparently, however, the ore shoot is localized in a recess limited below by a shallow, steeply pitching trough in the diorite contact forming the footwall, and above by an irregular tongue of diorite that extends from the main intrusive mass into the marble. Little evidence remains of any major fracture that may have influenced the mineralization; if such fractures once were present they have been almost completely healed. Faint traces of rather persistent north-south fractures are indeed visible in the stopes, but they are not associated with especially rich ore; in places, on the contrary, they are marked by silicified ribs that are poorly mineralized.

At the Hartman-Homestake workings, on the northwest side of the hill, both the Mississippian (?) marble and the older sedimentary rocks are exposed. The outer parts of the adits are thought to be in the Dripping Springs quartzite. Diorite crops out northwest of the workings, but the workings do not reach the intrusive contact. The metamorphic effect of the diorite is shown, however, by the fact that the marble in this vicinity is partially altered to tactite. Ore minerals are disseminated in a bed of garnetized limestone that is apparently at the base of the Mississippian (?) marble, but they are not abundant enough to make ore. Stronger mineralization has taken place in both the Mississippian (?) and the older rocks, along the fault zone striking N. 70° E and dipping southward, and also along minor northwest-striking cross fractures.

The Stratton workings, on the south side of the marble hill, are apparently all in the rocks underlying the marble. They are several hundred feet from the main body of diorite, but the rocks are highly metamorphosed. Mineralization has occurred in tactite, or garnet rock, formed by alteration of the Mescal (?) limestone. The mineralizing solutions appear to have risen along fault fissures of easterly to northeasterly strike.

The Leatherwood workings, on the southwest side of the marble hill, are all close to the diorite contact and partly in the diorite. The mineralization is mainly in tactite, which appears to be altered Mescal limestone.

The Corregidor sheelite prospect, at the south end of the area shown in figure 2, is in quartzite, presumably of the older series, near its contact with intrusive diorite.

Mineralogy.—The dominant ore mineral in the Daily, Geesman, and Stratton mines is chalcopyrite, which is accompanied by subordinate amounts of bornite and chalcocite and a little pyrite and magnetite. The gangue consists of brown to red garnet, epidote, and quartz. In the Hartman mine, chalcopyrite, galena, and sphalerite are enclosed in a gangue consisting of siliceous hornfels, pyrite-bearing chlorite schist, and a little brown garnet. The oxidized zone is very shallow, sulfides being found in many shallow prospect pits within 10 feet of the surface. Little secondary enrichment has occurred. Oxidation is most in evidence at the Leatherwood mine, from which a little oxide ore has been shipped. Considerable magnetite occurs in this property. Scheelite occurs in the Daily and Geesman mines and in the Corregidor prospect, but not, so far as has yet been shown, in any large quantity. A little molybdenite is found on the Stratton property.

Reserves

The minable reserve, in the Daily and Geesman mines together, of measured ore averaging from 3 to 4 percent copper is estimated to be not over 5,000 tons. A 3 percent cut-off grade is being used by the Control Mines, Inc., because of the high mining costs that result from operating at less than half capacity. If the company continues to produce 30 to 40 tons of ore per day, this reserve will be exhausted in about 6 months. An additional 10,000 tons of inferred ore is estimated to be available in undeveloped ground between the levels of the Geesman mine. Probably a well-organized and well-executed program of development and prospecting could open up enough ore to support continued operations at full capacity (80 to 90 tons per day) for at least as much as a year. Operation at full capacity should make it possible to mine ore of lower grade, with a resulting increase in the minable reserves and in the productive life of the mine.

The reserves of scheelite ore containing more than one percent of WO_3 that can be mined in the Daily and Geesman workings are estimated to be less than 100 tons, and the minable bodies of scheelite are too discontinuous for extensive mining. The scheelite can probably only be mined at a profit in conjunction with the copper mining and then only along the marble-tactite contact between the P. D. drift and part of the 100-foot level west of the hoisting shaft in the Geesman mine.

The Hartman mine is estimated to have, in the fault and fracture zones, reserves of about 8,000 tons of indicated ore plus 15,000 tons of inferred ore, which will average about 2.8 percent copper, 7.2 percent lead, and 8.8 percent zinc. The tactite in this mine does not contain enough copper to be classed as ore. The reserves in the southern mineralized zone on the Stratton property are estimated at 2,000 tons of indicated ore and 8,000 tons of inferred ore. The copper content of the ore exposed for 100 feet in the inclined adit is judged from inspection to be between 2 and 3 percent. The most northerly mineralized zone on the Stratton property is estimated to contain about 15,000 tons of mineralized tactite, which may, however, be too poor in copper to be ore.

Mines

Daily mine.--The Daily Mines Company has 17 patented claims, which make up an irregular area trending eastward from the center of the marble mass. Approximately 2,500 feet of marble-diorite contact lies on the property.

The Daily mine workings, reached through an adit driven under the tactite zone, consist of a fairly continuous stope locally subdivided by large pillars. As the stoping followed the mineralized tactite, the elevation of the floor varies irregularly throughout the mine. Practically no development work has been done outside the stope.

The mined ore bodies, which occupied the crests and flanks of three small, gently plunging ridges on the contact, were roughly crescent-shaped. From the size of the old stope, the ground comprising the three ore bodies is estimated to have been about 160 feet long and 140 feet broad. Their thickness was variable but probably averaged about 10 feet. The ore taken from the Daily mine in 1939 and 1940, when the property was being worked under lease by the Control Mines, Inc., is said to have averaged about 2.95 percent in copper.*

The only measurable reserves in the Daily mine consist of the ore left in the pillars. The chances of finding additional ore down the plunge of the rolls are uncertain. Ore has been followed below the main level, but the workings below that level are now under water, and reports as to what is exposed in the face are conflicting. The ore-bearing horizon along the contact probably rises abruptly northward, however, from the flooded northernmost workings, to emerge on the north edge of the trough-shaped mass of limestone.

Rolls similar to those in the Daily mine occur on the contact north of the mine, and tactite under these rolls shows oxidized copper minerals, which may indicate the presence of ore bodies.

Scheelite has been found in the Daily mine in two small pockets, each estimated to contain less than 10 tons, on the tactite-marble contact at the southeast end of the most northerly roll.

* Oral communication from Newt Wells, President of Control Mines, Inc.

Geesman mine.--The Geesman mine is owned and operated by Control Mines, Inc., which holds 15 patented claims north and south of the Daily Mines Company's property. The Geesman mine was the only operating mine in the district when the field work was being done.

The mine workings comprise an inclined shaft following the contact zone, three main levels, and two sublevels. The main levels, designated as the 100-, 200-, and 250-foot levels, are 78, 175, and 226 feet respectively below the collar of the shaft. An adit connecting the 100-foot level with the surface serves as the main haulageway. The 100-foot level has the most extensive lateral development, with drifts and stopes extending 400 feet east and 500 feet west of the hoisting shaft.

The ore shoot in the Geesman mine pitches from 35° to 50° SW. It is approximately 200 feet wide, 300 feet long, and from 15 to 20 feet thick. The ore shoot appears to be bottomed east of the hoisting shaft by the junction of a tongue of diorite with the main mass. The pitch of the junction projected westward would carry it a short distance west of the hoisting shaft, indicating that the ore does not extend far below the floor of the stope.

From January 1940, to the end of September 1942, the Geesman mine produced about 3,200,000 pounds of copper from 52,200 tons of ore containing on the average approximately 3.4 percent of copper.

Sporadic traces of scheelite are found throughout the Geesman mine, but the only places where scheelite ore can possibly be mined are along the tactite-marble contact in the P. D. drift and on the 100-foot level west of the hoisting shaft. In both these localities the ultra-violet lamp indicates the presence of scheelite wherever the contact is exposed, but the mineralized zone is less than two feet wide in most places.

Hartman-Homestake mine.--The Hartman-Homestake property comprises 4 patented and about 14 unpatented claims. The mine lies about 6,000 feet by airline due west of the Geesman mine (see fig. 3). It is accessible by a trail about 3 miles long, which starts from the Geesman mine. The trail climbs 900 feet to the top of Oracle Ridge and drops about 300 feet on the other side to the mine workings.

Exploration work consists of four adits, two of which have crosscuts along mineralized fault and fracture zones. The mineralization is localized along a fault and a fracture zone striking about N. 70° E. and dipping steeply southward, along northwest-striking cross fractures, and in favorable garnetized beds, presumably at the base of the Mississippian (?) marble. These have been mineralized parallel to the bedding for an unknown distance down the dip.

The principal metal disseminated in the garnetized marble beds is copper. The copper content of this rock is about half as great as that of the ore--containing also lead, zinc, and silver--that occurs in the fracture zones. Assays of that ore, according to a private report by L. C. Orem, show, on the average, 2.8 percent copper, 7.2 percent lead, and 8.8 percent zinc.

Leatherwood property.--The Leatherwood property, held by Control Mines, Inc., lies 1½ miles by road south of that company's mill.

The accessible workings consist of several adits less than 100 feet in length and two longer adits with cross-cuts. Near the portal of most of the afits is a brecciated tactite, which locally, at its contact with thin basic dikes, contains oxidized ore thatcan be hand sorted to 12 percent copper. Leasers, have been shipping about 2 cars a year of the hand-sorted ore.

Only traces of copper sulfide were visible in the acessible adits. On one dump, nowever -- that of the caved adit marked F35 -- there are several tons of copper ore composed of chalcopycrite and bornite in a tactite gangue. No sulfide ore was seen on the other dumps. The known production from Leatherwood ground amounts to above 7 cars of oxide ore, shipped during 1940, 1941, and 1942.

Stratton property.--The Stratton Copper Company's property, consisting of 12 unpatented claims, adjoins the Leatherwood on the west. It lies about 2,500 feet west of Control road and 400 feet higher, and is accessible only by a trail that branches from the road about 2 miles south of the mill of the Control Mines, Inc. The development work consists of a 100-foot inclined adit, two adits less than 50 feet in length, a 50-foot inclined shaft, and several prospect pits.

The copper mineralization is in a garnetized zone at the base of a layer of impure limestone lying between quartzites. In the 100-foot inclined adit, it is restricted to the bottom 5 feet of the tactite and forms a zone not over 2½ feet in average thickness.

The outcrop shows both copper-sulfide and oxide mineralization for 350 feet at both the north and the south end of the area mapped. Just south of the area a fault striking N. 45° -55° E. shifts the mineralized tactite zone about 500 feet to the northeast, and from this fault the tactite can be traced at least 200 feet northwestward. The tactite on the southeast side of the fault contains a few northeast-striking quartz-molybdenite-chalcopyrite stringers, and little molybdenite is disseminated in the sheared tactite rock adjacent to the large fault.

No ore has been shipped from the property.

Corregidor scheelite claim.--The Corregidor shceelite claim, owned by Newt Wells, president of Control Mines, Inc., is about 3,000 feet east of the Geesman mine (see fig.3.). Prospecting to date consists of three trenches and a 30-foot inclined shaft. The scheelite apparently occurs in lenses in quartzite. At least two such lenses have been exposed by trenching, but the prospecting is so incomplete as to give little idea of grade or continuity of possible tonnages. Work is still in progress.

Recommendations for prospecting and exploration

Daily mine

1. North of the Daily mine along the marble-diorite contact are surface indications of at least two small rolls similar to those in the Daily mine which contained ore (see geologic map). The tactite under these

rolls shows a moderate amount of copper mineralization. The first roll north of the Daily mine is the most promising and, if practical, would be the logical choice to explore first. Loci for prospecting are marked on the surface geologic map. These loci mark the surface projection of the crests of rolls where ore is most likely to occur (see section A-A'.).

2. The north contact is well mineralized at a point northwest of the Daily mine on the opposite side of the marble mass. The contact is wide at this point, but the mineralization appears to be localized in a north-south fracture zone. The intersection of this fracture zone with the contact should be a likely place for ore. The area which has been marked on the surface map as the locus for prospecting represents the surface projection of the most favorable location for ore (see section B-B').

Geesman mine-- (east of the hoisting shaft)

1. A body of tactite lies between the surface and the top of the stope on the 100-foot level (see section C-C'). Both the back of the stope on the 160-foot level and the surface show copper mineralization. This area could be explored from the surface or from the 1A level. The possible productive area extends at leat 100 feet east of the hoisting shaft (see geologic map).

2. A large unstoped area of possible ore is bounded by the floor of the stope on the 100-foor level, the back of the stope on the 2A level and the hoisting shaft (see section C-C'). This area could be explored from the 100-foot level, from the hoisting shaft, or from the 2A level. It can be classed as "inferred ore"; however, prospecting would be desirable.

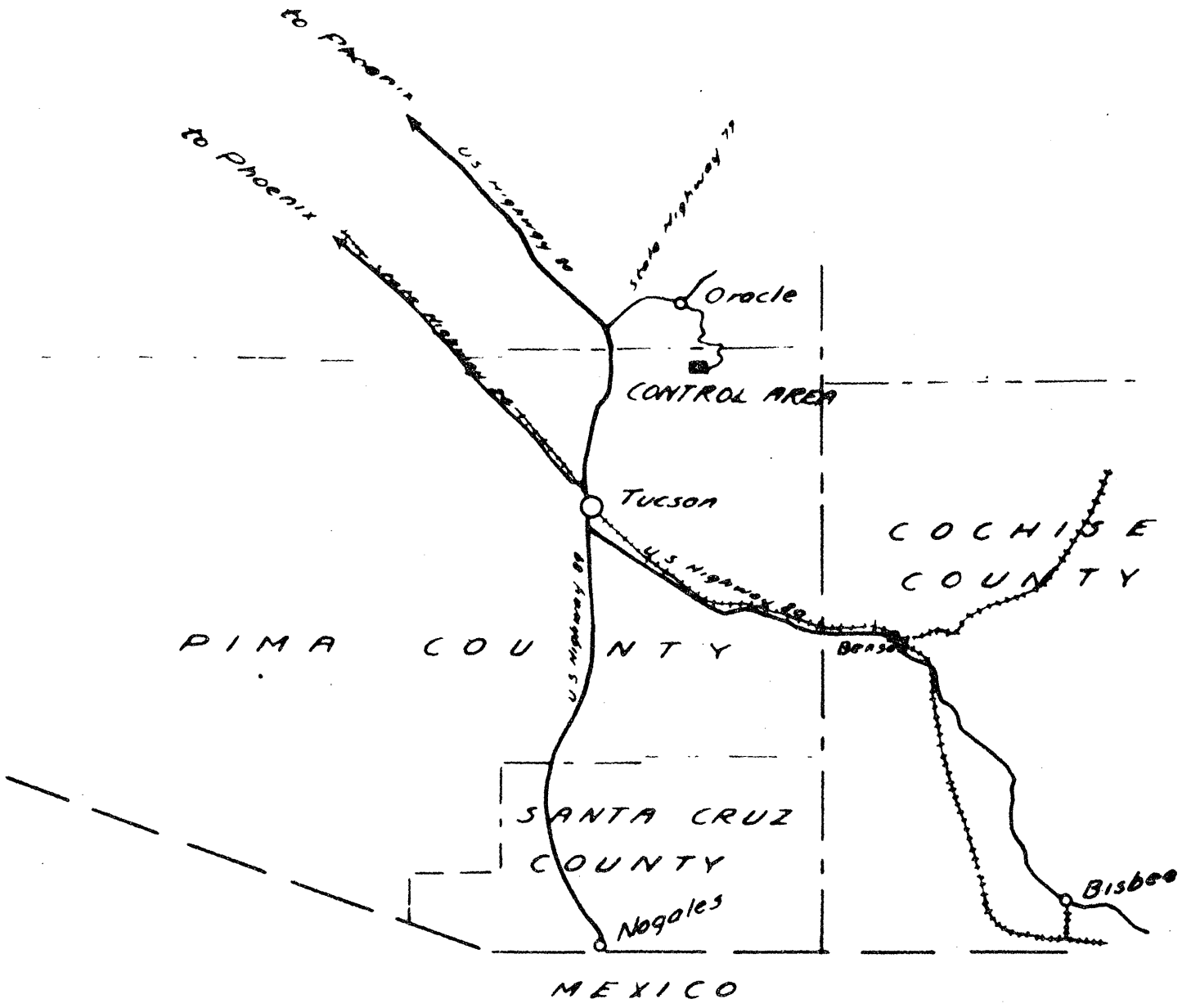
Geesman mine-- (west of the hoisting shaft)

1. The contact tactite zone already stoped between the surface and the 200-foot level continues westward. Locally both the P.D. drift and the 100-foot level are mineralized (see map of P.D. drift and 100-foot level), but the grade is not known. The mineralized area in the P.D. drift and the 100-foot level should be sampled. If and where the results of the sampling warrant it, the area bounded by the P.D. drift on the north (see map), the 200-foot level on the south and the stoped areas on the east should be explored (see sections E-E' and F-F').

2. Another tactite body lies south of the "marble horse" on the 200-foot level (see map of 200-foot level). This ore is the westward extension of the ore mined from the underhand stope shown on the 200-foot level map of the Geesman mine. It could be explored from any place along the 200-foot level west of the hoisting shaft (see section D-D').

3. The floor of the stope on the 250-foot level is in ore. The downward extension should be determined, possibly by drilling.

About 500 feet west of the hoisting shaft for the Geesman mine is an irregular area, locally showing some oxidized copper minerals that may be kept in mind for possible future attention. The elongate shape of the garnet bodies suggests that they follow zones of fracturing. The possiblities of the area may be considered to rise or fall as the explorations recommended above succeed or fail.



INDEX MAP
showing the location
of the Control Area

0 10 20 30 miles

Figure 1.

ORACLE RIDGE (1) 1PM

SANTA CATALINA MINING CORP.

FIRST QUARTER REPORT

MARCH 31, 1997

SANTA CATALINA MINING CORP.
First Quarter Report
March 31, 1997

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SCHEDULE A: FINANCIAL INFORMATION

Reference is made to the unaudited consolidated financial statements of the Company prepared for the three months ended March 31, 1997.

SCHEDULE B: SUPPLEMENTARY INFORMATION

Reference is made to the Schedule attached to the unaudited consolidated financial statements of the Company prepared for the three months ended March 31, 1997 and entitled "Notes and Supplementary Information".

SCHEDULE C: MANAGEMENT DISCUSSION

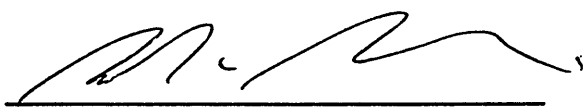
Reference is made to the Report to Shareholders dated May 28, 1997.

SCHEDULE A

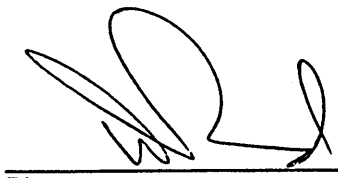
SANTA CATALINA MINING CORP.
CONSOLIDATED BALANCE SHEETS
(Unaudited)

	March 31, 1997	March 31, 1996
ASSETS		
Current assets:		
Cash and short-term deposits	$ 110,561	$ 188,125
Accounts receivable	134,553	289,919
	245,114	478,044
Property and related assets held for sale	2,403,120	3,727,542
Other mining properties and related expenditures	1,310,557	195,691
Other assets	54,819	58,148
	$ 4,013,610	$ 4,459,425
LIABILITIES		
Current liabilities:		
Bank indebtedness	$ 1,186,761	$ 1,903,618
Accounts payable and accrued charges	1,140,577	3,287,796
	2,327,338	5,191,414
SHAREHOLDERS' EQUITY		
Share capital (Note 3)	22,659,630	18,419,629
Deficit	(21,581,979)	(19,721,529)
Cumulative foreign currency translation adjustments	608,621	569,911
	1,686,272	(731,989)
	$ 4,013,610	$ 4,459,425

Approved by the Board:



Director



Director

SANTA CATALINA MINING CORP.
CONSOLIDATED STATEMENTS OF LOSS AND DEFICIT
(Unaudited)

	Three months ended March 31, 1997	Three months ended March 31, 1996
Revenues:		
Interest	$ 291	$ 416
Expenses:		
Depreciation	-	565
Interest	13,728	28,828
Audit and legal	18,826	11,598
(Gain) on foreign exchange	(16,668)	(15,055)
Management fees	53,513	40,352
Office and general	4,867	380
Promotion	1,133	139
Salaries and benefits	-	12,837
Stock exchange filing fees	6,665	5,696
Telephone and telefaxes	1,529	576
Transfer agent fees and shareholders information	4,148	1,830
Travel	482	-
	88,223	87,746
Loss from continuing operations	87,932	87,330
Loss from discontinued operations	496,490	946,370
Net loss for the period	584,422	1,033,700
Deficit, beginning of period	20,997,557	18,687,829
Deficit, end of period	$ 21,581,979	$ 19,721,529
Net loss per share:		
Continuing operations	$ 0.002	$ 0.003
Discontinued operations	$ 0.012	$ 0.026
	$ 0.014	$ 0.029

SANTA CATALINA MINING CORP.
CONSOLIDATED STATEMENTS OF CASH FLOW
(Unaudited)

	Three months ended March 31, 1997	Three months ended March 31, 1996
Funds (used in) operations:		
Loss from continuing operations	$ (87,932)	$ (87,330)
Add (deduct) non-cash items:		
Depreciation	-	565
	(87,932)	(86,765)
Loss from discontinued operations	(496,490)	(946,370)
Add (deduct) non-cash items:		
Loss (gain) on sale of equipment	309,524	(17,803)
	(186,966)	(964,173)
	(274,898)	(1,050,938)
Net changes in non-cash working capital items	(172,518)	276,207
	(447,416)	(774,731)
Funds provided by financing activities:		
Common shares issued	16,500	-
Bank indebtedness	194,234	986,005
Cumulative foreign currency translation adjustments	29,737	(9,624)
	240,471	976,381
Funds (used in) investing activities:		
Property and related assets held for sale	(68,492)	(146,370)
Other mining properties and related expenditures	(129,654)	(109,824)
Proceeds from sale of equipment	279,650	-
Other assets	1,296	76
	82,800	(256,118)
Decrease in cash and short-term deposits	(124,145)	(54,468)
Cash and short-term deposits:		
Beginning of period	234,706	242,593
End of period	$ 110,561	$ 188,125

SCHEDULE B

SANTA CATALINA MINING CORP.
NOTES AND SUPPLEMENTARY INFORMATION
TO THE CONSOLIDATED FINANCIAL STATEMENTS
March 31, 1997
(Unaudited)

1. FOR THE CURRENT FISCAL YEAR-TO-DATE:

(a) OTHER MINING PROPERTIES AND RELATED EXPENDITURES

Pilar Project

Option payments and taxes	$ 4,836
Staking, license fees and permits	3,950
Assays and analysis	35,910
Camp supplies	292
Equipment and vehicle rentals	10,998
Geological consulting fees	50,644
Maps and photos	9,248
Travel and related costs	4,921
General office expenses	5,019
Accounting and legal	3,836
	$ 129,654

(b) GENERAL AND ADMINISTRATIVE EXPENSES

Reference is made to the consolidated statement of loss and deficit of the accompanying unaudited financial statements.

(c) RELATED PARTY TRANSACTIONS

During the three months ended March 31, 1997 the Company incurred management and administrative service fees of $53,513 payable to the Chairman's office and a corporation owned by the President of the Company, which provides office premises, secretarial and other services in Vancouver.

2. FOR THE QUARTER ENDED MARCH 31, 1997:

(a) On February 25, 1997 an incentive option was exercised for the purchase of 25,000 common shares of the Company at $0.66 per share for total proceed of $16,500.

3. AT MARCH 31, 1997:

(a) The authorized share capital consists of an unlimited number of common shares with no par value, of which 40,966,313 were issued and outstanding.

(b) (i) Incentive stock options outstanding and held by directors, officers and employees of the Company are as follows:

Number of Shares	Exercise Price per Share	Expiry Date
310,000	$0.71	July 12, 1997
1,400,000	$0.75	August 29, 1997
50,000	$0.40	January 14, 1998
100,000	$0.80	April 30, 1998
210,000	$0.60	July 9, 1998
35,000	$0.60	October 22, 1998
2,105,000		

(ii) Warrants outstanding and held by directors of the Company and their associates are as follows:

Number of Shares	Exercise Price per Unit	Expiry Date
2,000,000	$0.90	November 15, 1997

Each warrant entitles the holder to purchase one common share.

(c) No shares are held in escrow or subject to a pooling arrangement.

(d) The directors of the Company are:

Adolf H. Lundin
William A. Rand
Brian D. Edgar
Lukas H. Lundin
Pierre Besuchet

SCHEDULE "C"

SANTA CATALINA MINING CORP.
FIRST QUARTER REPORT FOR THE PERIOD ENDING MARCH 31, 1997

The Board of Directors is pleased to present this report to shareholders on the activities of the Company during the first quarter period ending March 31, 1997.

The Pilar Gold Project

The Pilar Project is a promising gold exploration project located in the State of Sonora, Mexico, approximately 145 kilometres southeast of the capital, Hermosillo.

Gold and silver mineralization at the Pilar Project is associated with a series of northwest trending shears which have returned values as high as 55.4 grams per tonne gold from channel samples of 3 metres in length. There are 6 old gold mines in the area which were exploited on a very small scale at the beginning of the century.

At La Guadalupana, one of several prime gold targets at Pilar, a second drilling program was completed in January, 1997 which further indicated the presence of important gold and silver mineralization. The best intercepts of the program include 13.5 metres of 3.06 grams per tonne gold and 29.4 grams per tonne silver and 9 metres of 10.16 grams per tonne gold and 37.8 grams per tonne silver. Mineralization extends to a depth of 100 metres and is open below.

At other prime target areas, an ongoing reconnaissance program continued. The reconnaissance program has included rock and sediment sampling, mapping and interpretation of aerial photography.

To fully evaluate the potential of the Pilar Project and to expand upon the mineralized bodies outlined so far, the Company will continue its aggressive gold exploration program. A third drilling program has recently commenced at the La Guadalupana target area where the deep drilling will be concentrated. Trenching, mapping and sampling of the other target areas will continue and be followed up by drilling.

The Murindo Copper/Gold Project

On February 18, 1997 the Company announced that it had signed a letter of intent with Cyprus Amax Minerals Company which gives the Company the option to earn a 50% interest in four concessions covering several gold rich porphyry copper prospects near the village of Murindo in northwest Colombia. To earn the 50% interest, the Company has to spend a total of U.S. $5,000,000 within 3 years.

The Murindo prospects belong to a well defined belt of Eocene-Oligocene porphyry coppers which extend along the Western Cordillera of Colombia and into Panama. There are three

main anomalous areas within the concessions: La Rica, Jarapeta and Taparos. These are major copper geochemical anomalies with associated gold, molybdenum and zinc anomalies. These form a trend of at least 10 kilometres in a north-south direction.

The Murindo area has the potential to become an important copper/gold producing district. The Company has the opportunity to participate in the exploration of this area which may contain one or possibly several major gold-rich porphyry copper deposits. The Company will be in charge of the technical and legal aspects of the project during the next three years and intends to commence an extensive drilling program to define the potential resources and improve the understanding of the area.

Oracle Ridge Copper Mine

On February 10, 1997, the Company announced that a letter of intent was signed with Hibernia Silver Mines, Inc. ("Hibernia") whereby Hibernia would purchase all of the assets, liabilities and rights held by the Oracle Ridge Mining Partnership. The transaction is subject to satisfactory completion of due diligence by Hibernia, signing of a formal agreement and receipt of regulatory approval. The consideration for the purchase of the Oracle Ridge Mining Partnership is U.S. $3,000,000 payable over 2 years and the issuance of 1,000,000 special shares of Hibernia.

The Company, through Union Copper Inc., holds a 70% interest in the Oracle Ridge Mining Partnership.

ON BEHALF OF THE BOARD

"Lukas H. Lundin"
President

May 28, 1997

Santa Catalina Mining Corp.
Suite 1320 - 885 W. Georgia Street
Vancouver, B.C., Canada V6C 3E8
Tel. (604) 689-7842 • Fax. (604) 689-4250

Corporate development and investor relations activities are carried out by company personnel. For additional copies of this quarterly report and other information, please contact Sophia Shane at the address noted above.

SANTA CATALINA MINING CORP.
CORPORATE DIRECTORY
March 31, 1997

OFFICERS
Adolf H. Lundin,
Chairman
Lukas H. Lundin,
President
Jean R. Florendo,
Corporate Secretary
Wanda Lee,
Controller/Treasurer

DIRECTORS
Adolf H. Lundin
* William A. Rand
* Brian D. Edgar
* Lukas H. Lundin
Pierre Besuchet

* Audit Committee

AUDITORS
Deloitte & Touche
Vancouver, British Columbia, Canada

BANKERS
Canadian Imperial Bank of Commerce
Vancouver, British Columbia, Canada

Cantrade, Ormond, Burrus, Banque Privée S.A.
Geneva, Switzerland

SUBSIDIARIES
Union Copper Inc.
Santa Catalina (Bermuda) I Ltd.
Santa Catalina (Bermuda) II Ltd.
Minera Santa Catalina, S.A. de C.V.

CHAIRMAN'S OFFICE
6 Rue de Rive
Geneva, Switzerland CH-1211
Telephone: (41-22) 311-7488/89/90
Fax: (41-22) 310-3996

COMPANY HEAD OFFICE
1320 - 885 West Georgia Street
Vancouver, British Columbia
Canada V6C 3E8
Telephone: (604) 689-7842
Fax: (604) 689-4250

ORACLE RIDGE MINING PARTNERS
P.O. Box 7
San Manuel, Arizona 85631
Telephone: (602) 576-1412
Fax: (602) 576-1539

REGISTERED AND RECORDS OFFICE
Suite 2100 - 1111 West Georgia St.
Vancouver, British Columbia,
Canada V7X 1K9

SOLICITORS
Campney & Murphy
Vancouver, British Columbia
Canada

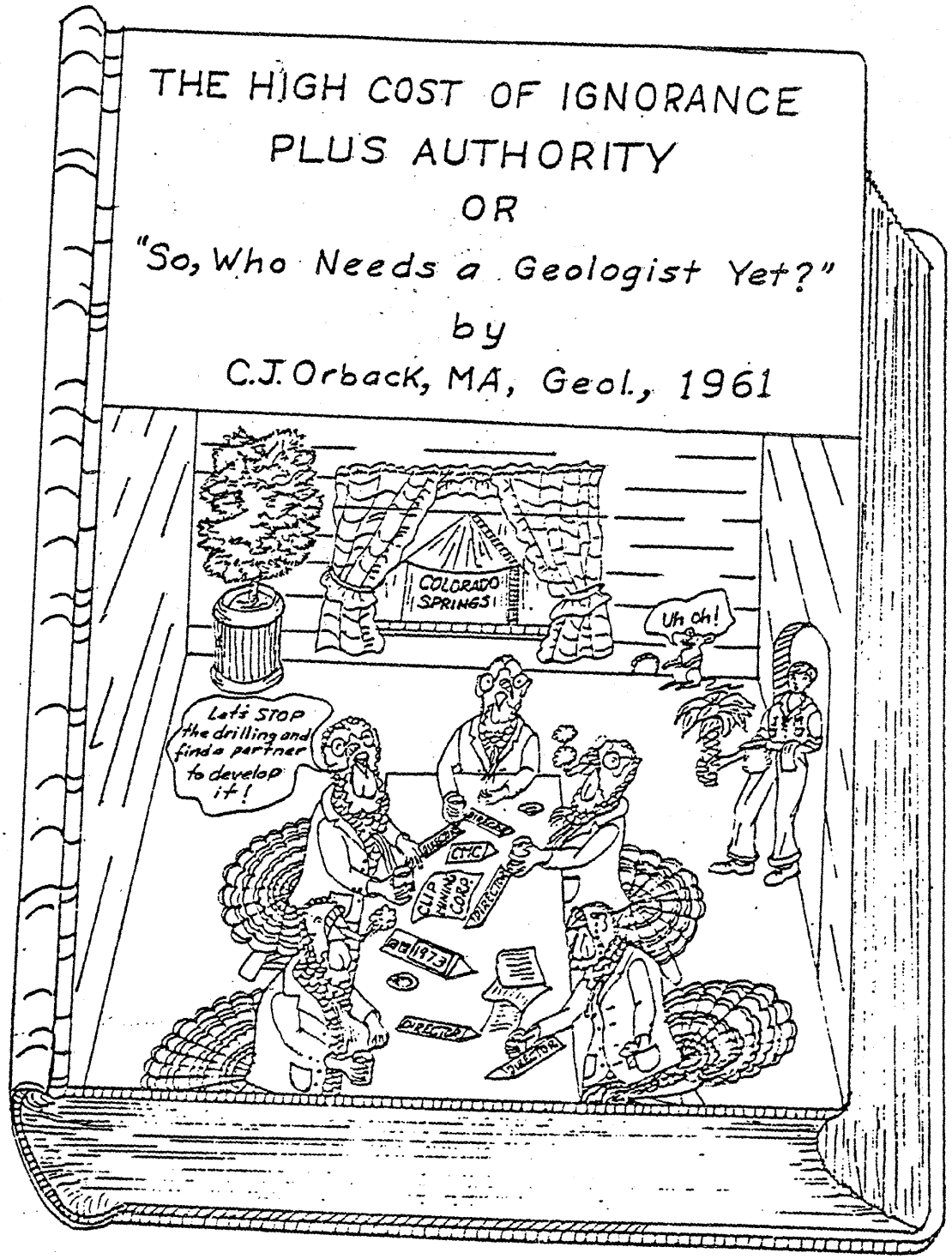
SHARE CAPITAL
Authorized: Unlimited number of common shares
Issued and Outstanding: 40,966,313 shares

REGISTRAR AND TRANSFER AGENT
Montreal Trust Company of Canada
510 Burrard Street
Vancouver, British Columbia
Canada V6C 3E8

SHARE LISTINGS
Vancouver Stock Exchange
Santa Catalina Mining Corp. (SLM)

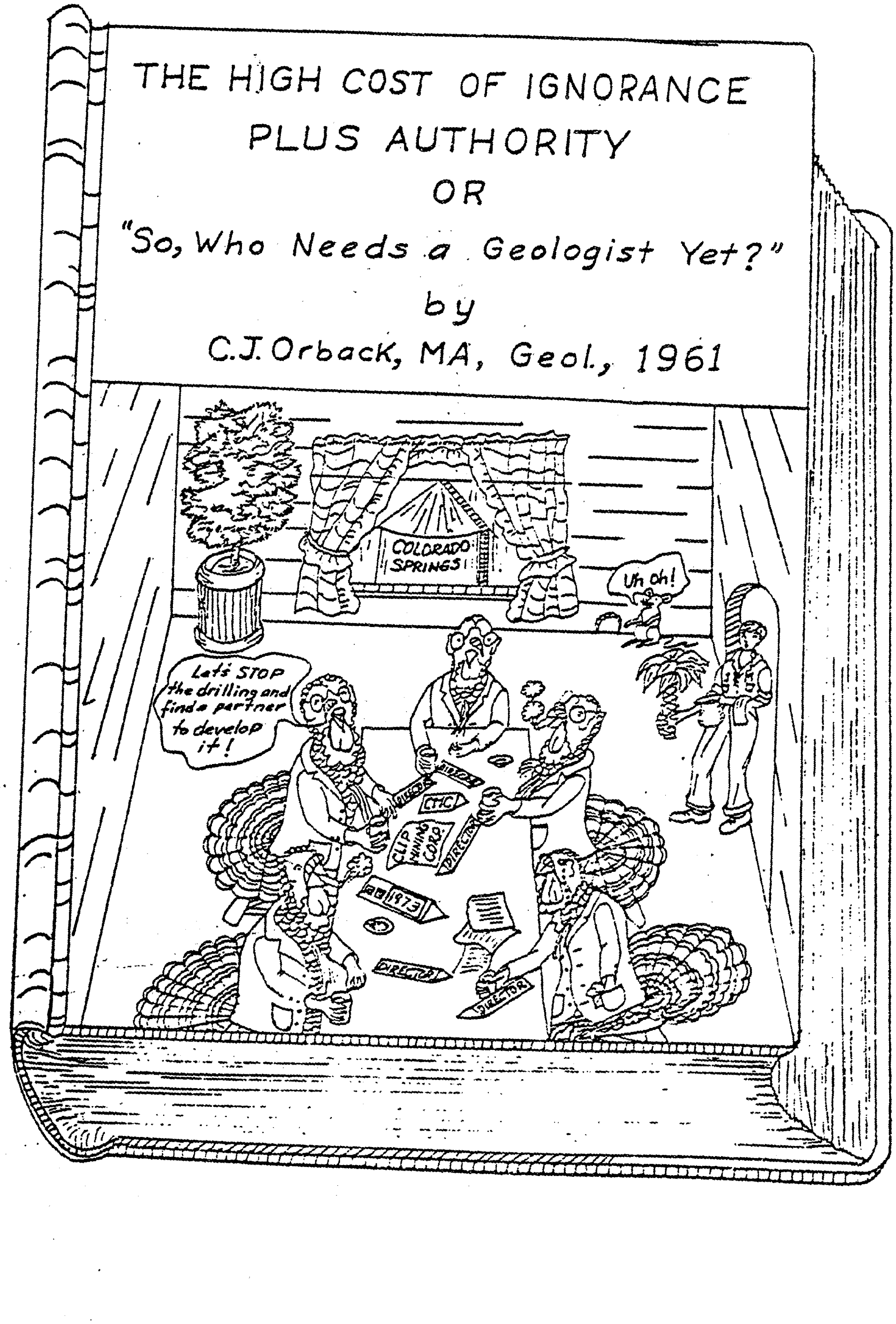
WANTED: GHOSTWRITER

JUNE 30, 1980



ORACLE RIDGE #, PIMA

WANTED: GHOSTWRITER



MEMORANDUM

TO: G. Gidwitz
P. DeMerre

DATE: June 30, 1980

FROM: C. J. Orback

COPIES: F. Breyer, W. Kirkpatrick, R. Thompson, D. Fisher, R. Laird, T. Verbeek, R. Johnson, H. Eyrich, J. G. Gidwitz, S. Gunther, O. LeCompte, J. Roscoe, W. Ryan, C. Reynolds

SUBJECTS: Ethics; Justice; Geology

OR

"What does it avail a man, to have his train
borne up while his soul trails in the dust?"

You may consider this as my response, at last, to all that has been said, written, and done of particular interest to me concerning the Control Property, during the past several years. I'm sure you have been expecting this little note--and I don't want to disappoint you.

Observe, first: A second property-contract has finally been signed. Hopefully, this will decrease that part of the looting of UM's shareholders that followed after CMC's cunning and scheming quacks knowingly and deliberately promoted a half-drilled prospect as "ready for development" to UM's greedy, gullible, and geologically ignorant managing engineers. A hundred years ago in this country, the same quality of ethics, "salesmanship," ignorance, and gullibility was seen in the spectacle of predatory peddlers hawking snake oil ("good for whatever ails you!") from the tailgate of a wagon to a throng of seedy rubes at the county fair. Why was it that UM alone among the many organizations that evaluated the property failed to understand that much more exploration drilling must be done and that CMC's reputation meant that it was not to serve as operator? Confess now, what did you actually think I intended to convey by denoting geologic reserves in a range as wide as 7+ to 13+ million tons, with a significant fraction in a range defined roughly as plus and minus 40% of 70% of that drawn? And why was it that no one in the entire circus had enough sense to recognize that location of tons was no more certain than quantity of tons? About 10 months after the farce began, I pointed this out to Breyer, who, as just another recipe-following engineer, could only appear befuddled and bewildered! Under the circumstances, what is one to think of schlemiels so hungry and innocent as to be duped by those crafty charlatans into signing a contract committing them to spend 40 million of their shareholders' dollars to drive nine miles of drifts and construct a concentrator that would be "embarrassingly" oversized with only 7+ million tons--and all this without ever seeing their ore? Now, let us all agree that we will not embarrass any of the many culpable fools involved in this bungled business by countering their lies to the stockholders and the press! And, to counter the gossip, let us also be sure to continue our sacrifice of the goat!

Incidentally, I find the current twisted propaganda line to be almost amusing. Last year's lies as well as older blunders require the present use of such terms as "development," "resumed work," and that curious invention revealed by apprentice-boss Laird, "developmental-exploration." All the while, "exploration" and "drilling" are to be avoided, unless it can be implied that such activities will be underground. And, it is cute also to hide UM's old embarrassment by attributing 10 million tons to me (rather than 7 to 13 million tons), then stating that you hope to find at least half that much. Of course it must never be mentioned that additional exploration is being confined for the present to roughly half the well-mineralized rock. This neatly tells the industry that I am a blundering crook--and makes "poor, poor" UM my victim. Apparently it is better for UM's hirelings to be victims than bungling, ignorant fools! The bosses and the shareholders will be less irritated this way, wouldn't you say, Mr. Laird? Last year it was bald, deliberate lying; this year it is lying by omission.

Observe, second: A most inappropriate set of exploration plans and methods of handling data have been "engineered." One might have expected that, true to the nature and quality of UM's personnel, these simply had to reflect unreasoning and irrational fear, certainly nothing better than geologic mediocrity subordinated to the ossified "engineering mind," and an engineer-dominated Prussian command system rivaling that used until recently by the "geniuses" of CMC. Incidentally, those simple-minded and obsolete engineering methods of treating reserves and the complex geology of those mineralized carbonates are going to prove quite costly and inadequate. The reality of irregular curves in all directions will not change to accommodate the yearning of simple engineers and their simple geologists for simple formulas and simple geometric forms. Furthermore, considerably smaller units of ore than UM believes can be mined profitably, provided that shape, size, location, etc., are much more accurately drawn and calculated after exploration and later development drilling than can be done with crude, simple, and erroneous projections and sections. Could it be that this Medieval approach was devised by Agricola as a match for the analytical abilities of engineers? No amount of ancient foolishness or engineering sorcery will ever transform those highly irregular, small, and numerous deposits into a simple large vein, a simple large coal bed, or even a simple, uniform, large, high grade, strata-bound copper deposit in the Congo. It is very likely that almost the only usable evidence that will be generated by additional exploration will be assays, and these will be falsified by projection to nearly 300 sections. Ultimately it will be shift bosses, or mining engineers (equally unfortunate for the shareholders), who will paw through this confusion in an effort to conjure a three-dimensional vision of their ore, beyond the faces. In practice, everybody who tries this damn fool process gives it up and tries to stay in ore from day to day according to assays ahead of them and to the appearance of the faces. And with this we are back to Agricola! Also, we are then entitled to ask: "What the hell kind of benefit has the geologist been to the engineer?" But, as long as "the engineering mind" (characterized by an insatiable lust for power, abysmal ignorance of and often contempt for geology, and brainless reverence for ancient rituals) continues to prevail over good sense, such asininities will continue. Except for the influence of engineers, who invented the whole sorry system, all geologists with a

modicum of good sense would have abandoned written drill logs, which necessarily lack data quantification and thoroughness, about the time that churn drilling went the way of the dinosaur. But, of course, witless lickspittle "geologists," glad to serve as engineers' sycophants, refer to this mess as the only right and proper way to do things. For them it was chiseled in stone by Moses! For them it will do nicely until the second coming of Christ! Ben Franklin is supposed to have observed that "experience keeps a very dear school but fools will learn in no other"; however, what are we to say of those fools who will not learn even this way?

Observe, third: It is quite evident that UM's hirelings, in what appears to be their characteristic maladroit fashion, have chosen to pretend(?) that I belong in the same ethical and technical pigsty as the CMC quacks who promoted the property. Oh yes, I know that some of this is meant as smoke to hide, very conveniently, the consequences of UM's abominable misjudgments and general bungling. Some of it is the effect of UM's groping effort to learn and apply Harvard Business School ethics. When they learn this they can apply to CMC for a post-graduate course. And the rest of it is the result of their honest but infuriating geologic incompetence. UM's effort to evaluate my work and to draw the conclusions that I was not allowed to spell out in a thorough report is analogous to the following little story: A gentleman dropped off a pint jar of home brew with a lab technician and asked for an analysis. About a week later the chemist's report arrived, stating: "I believe your horse has diabetes!" This is the story of UM's sorry effort to understand the geology of the Control property! In many respects UM appears to be CMC writ large. Apparently you charming cannibals deserve each other! In thinking about your corporate images I am reminded of an insult flung by one politician at another, namely: "like dead mackerel in the moonlight, there you lie, and shine, and stink!"

The preceding three observations explain why I cannot conceivably further damage the cause of the ignorant, lying, and avaricious promoters, either by my continued silence concerning UM's invention of incredibly bungled and dishonest "alternative geology" which was apparently designed to intimidate CMC's bosses as well as to delude judge and jury, or by my continued revelations of CMC's old technical and other secrets to UM, or by my continued collaboration with UM--the apparent lesser of the two malignancies.

My alienation by UM was quite unnecessary, and constitutes their loss. I have understood for some time and have been sympathetic to UM's need to squirm out of their original misbegotten contract, and necessarily to do it at my expense. However, I have grossly overestimated UM's integrity and underestimated their incompetence and malice. They seem intent on matching CMC and also on believing their own propaganda. Ah, but, the lie once peddled by "little" people must be forever defended, lest the FRONT OFFICE, or worse yet the shareholders, learn some of the truth! And, just how much integrity and geologic ability, mixed with how much clumsy intrigue, should one expect from such mackerel as Johnson and Verbeek? Yet, the plans and policies hatched by these two reflect not only their own mentality but also their estimation of their Commanders' ethics, reasoning abilities, and technical understanding. And certainly they should know their Commanders!

Now, I want to confess to having learned something from you about top-level business ethics. I had, in my innocence, assumed that convoluted and subtle lying, cheating, and stealing for the short-term benefit of the stockholders was the first, rather than the second, principle of greedy and grabby business bosses and their apprentices and apologists. I have learned that short-term self-preservation and advancement, in terms of position, "image," and power, first individually and then collectively, by the most ruthless use of any foul means or methods, precedes all else for the turkeys at the top as well as for the "loyal" apprentice and someday-apprentice turkeys who roost underneath them. Such behavior for the supposed short-term benefit of the individual is of course prompted by insatiable greed and an intense lust for power and "prestige" and is pursued at the expense of truth, justice, and quality--and to hell with the stockholders' legitimate and proper long-term interests. Similar behavior for the supposed benefit of the collective or gang includes the preceding personal motives and methods plus the additional element of earning "security" and the right not to be sacrificed. This is a very serious matter when one's peers are known to be cannibals whose first task after the storm is to repair their "image." Demonstrating such good-soldier loyalty to the gang, especially if the ruthlessness and rottenness are vigorous and consistent, is supposed to strengthen one's grip on the roost, and demonstrate one's fitness to roost on a higher limb where night life is cleaner and more pleasant. One is also supposed to earn a final reward for that boot-licking subservience and devotion to the expediency of the moment such as a steady even if premature retirement pension as a "consultant" on "retainer." Again, this comes at the expense of truth, justice, and quality--and with an attitude of to hell with the stockholders' legitimate and proper long-term interests. But, more amazing than the shameless exhibition of your capacity for depravity, have been your efforts to project an image of respectability and innocence to your underlings all the while, and to hide it all from your stockholders and the public by grossly perverting the truth.

It is obvious enough that your organizations are modeled after the military, with its command system and that system based on power rather than specialized ability, and its division into the privileged "officer gang," plus those wretches known as "the men." This arrangement differs from that of a fully socialized nation such as the apparatus prevailing in the Soviet Union only in that the Soviet Union appears to be one gigantic UM or CMC functioning as a monopoly. Quite likely the corrupt hired "managers" could be exchanged for the corrupt Commissars and vice versa with no one noticing any difference. Bureaucrats are bureaucrats! Just a few years ago it would not have occurred to me that two gangs of brawling "officers" together with some of their "loyal" wretches would reach down among "the men" to find their Dreyfus.

I have consulted attorneys on three different occasions in an effort to stop your flatulent effusions in public and to acquire justice but have been advised that your shysters are earning their pay and that there is no good case--yet. This means that justice is a <u>personal</u> matter.

Same Song: Second Verse

I believe you should now have the thrill of rereading the most interesting of your public perversions of the truth, and I hope you will also avail yourselves of this opportunity to admire some of the new twists developing in your official propaganda line. I expect you will find it convenient to develop a few more twists during the next six years--as you drill, develop, produce, then drill again, and finally expand your facilities and operation. Six years from now we will finally know how well I guessed tons and grade with evidence from only half the drill holes I wanted. The following are my favorites from my collection of your lies. You will note, and I hope appreciate, my annotations.

But first, to establish a point of reference, I want to remind you again of the degree of uncertainty with which I represented geologic reserves. Examine the following table, and then tell me that it means--and that I meant it to mean--something other than one part "probable ore" and three parts "ore that is merely possible, in varying degrees." Yes, dear fellows, I understand that the terms "probable" and "possible" convey meaning ("develop" or "explore") to some of you but that many of you were apparently too incompetent in your own field to translate tonnage ranges into those two simple "engineering" terms. I say "apparently too incompetent" because you may have simply, stupidly, and recklessly chosen to accept a fully recognized enormous risk--due solely to your greed.

Now, let us briefly review the record:

UNCERTAINTY FACTOR % ±	AVERAGE % ±	ESTIMATED TONNAGE RANGE				TONS UNCERTAINTY FACTOR % ±			
		MINIMUM	TOTAL	MAXIMUM	TOTAL	10-15	20-25	30-35	40-45
30		12,000		27,000				21,000	
15		203,000		300,000		262,000			
		90,000		127,000		112,000			
10	11	510,000	2,000,000	645,000	2,600,000	590,000			
10		310,000		391,000		360,000			
15		90,000		125,000		110,000			
10		783,000		985,000		900,000			
20	20	90,000	290,000	130,000	430,000		110,000		
20		200,000		300,000			250,000		
20	20	140,000	140,000	210,000	210,000		175,000		
15	21	333,000		493,000		416,000			
		8,000	440,000	10,000	660,000	9,000			
40		77,000		175,000					125,000
30		95,000		175,000				135,000	
30	30	360,000	510,000	673,000	950,000			322,000	
		20,000		35,000				28,000	
30		35,000		65,000				50,000	
25	25	700,000	700,000	1,170,000	1,170,000		935,000		
15	15	170,000	170,000	230,000	230,000	200,000			
30		35,000		65,000				50,000	
25		173,000		243,000			234,000		
		143,000		240,000			191,000		
25	26	412,500	1,408,000	687,500	2,383,000		530,000		
40		72,000		168,000					120,000
30		70,000		130,000				100,000	
23		500,500		799,500			650,000		
30	30	1,330,000	1,330,000	2,480,000	2,480,000			1,905,000	
40		42,000		98,000					70,000
40	40	18,000	372,000	42,000	868,000				30,000
40		312,000		728,000					520,000
45		138,300		365,400					232,000
45		28,900		76,700					32,300
		53,600		141,400					97,500
45	45	22,000	364,100	58,000	959,900				40,000
45		74,200		195,800					135,000
45		19,200		50,800					35,000
45		27,500		72,500					50,000
35		15,900		32,000				25,000	
35	35	171,000	190,000	360,000	400,000			269,000	
		3,100		8,000				6,000	
± 25 %	25	7,914,100	7,914,100	13,340,900	13,340,900	2,959,000	3,095,000	3,111,000	1,527,000

The following CMC draft contains annotations made by me in an effort to substitute truth for your lies. How naive of me!

CMC Annual Report Draft, March, 1979

There have been insufficient exploration drilling to permit adequate definition of ore characteristics appeared to be a lack of mineral continuity disclosed by underground drilling in certain rock formations. Underground drilling in one block, of 12 blocks, disclosed considerably fewer tons of ore than originally estimated. In addition, a higher than estimated cost per foot of advance raised questions regarding the cost to extract the ore.

As a result, the partners decided to sharply curtail further development work on the project until an evaluation of the problems could be made. CHR Early in 1979, most of the workforce was laid off, all major contracts were placed in suspension and deliveries of mine and mill equipment were delayed. To determine the extent of the problem, the partners commenced a comprehensive study of all geologic data thus far obtained to more precisely determine the additional exploration work required and to define the ore zones and reassess underground mining conditions. It is estimated that the study will be completed in 1979.

This thing finally tore it! Before the weekend was out the lying quacks were missing one Bull Geologist! But even after this incident, they thought that I would stay.

Have you heard the one about "for lack of a nail a shoe was lost, for lack of a shoe a horse was lost, etc., until a kingdom was lost"? When Willy Lump-Lump, the boss engineer, steeped in sophomore Engineering Econ. No. 301, very stupidly and imperiously decided to save the cost of a drill-road down the hillside to a point several hundred feet north of hole 90 in block 6, he denied me the angle hole for which I begged, pleaded, and finally yelled. This angle hole would have been directed southward across the ore intercept of hole 90. The obvious purpose was to determine the width of the set of mineralized joints present under several thrust faults. Incidentally, Willy Lump-Lump has confessed this blunder to at least apprentice-boss Laird. This typical CMC-style "stroke of genius" produced two decidedly undesirable consequences, from CMC's point of view. The long-term consequence was that it allowed their pigeon to escape, by affording UM the opportunity it needed to crawl out from under a very lopsided contract. The short-term consequence was that it forced me to resort to a pure guess of possible reserves associated with a hole whose core indicated the best quality of rock on the property but which was utterly lacking in evidence concerning quantity of such rock. When forced to guess under these circumstances one does not choose the worst case

(zero tons) nor the best, but rather a sensible mid-point tonnage from the very wide range of possibilities. But the truth was found to be the quite improbable worst case--zero minable tonnage associated with the best hole on the property. It was "less than six feet wide," but 170 feet high! Now, think about written logs, sections, straight-line connections of ore intercepts from adjacent holes, polygons, and all the rest of the ancient averaging ritual, and then tell me what you guessers would have "calculated" for the hole 90 area.

The "shrinkage" in block 6 was probably on the order of 500,000 to 600,000 tons, mostly involving hole 90. This is about 5% to 6% of the total, and according to my table I told you it might "shrink" or "swell" 25% (30% without block 1) from the median number of total tons.

In any case my unfortunate guess involving hole 90 is not to be generalized throughout either the Escabrosa Limestone or the entire property! Volume and composition of hydrothermal fluid, together with fluid-composition changes through time, are at least twice as influential on tons, grade, and continuity as are host-rock characteristics among carbonates. Think of block 1 fluid having gone through block 6 instead!

CMC's bubble-heads' attribution of the hole 90-block 6 "tonnage-loss" to "a lack of mineral continuity . . . in certain rock formations" was a deliberate, blatant, damned lie. Drilling proved the lack of ore around hole 90! It wasn't continuity, it was tons, and they knew it! But this lie meshes with and reinforces their next lie, which serves to hang on me the consequences of their ignorant meddling in my business.

"To determine" whether I blundered generally, "the partners commenced" (no, UM "commenced") finally to examine my work superficially, then to reinvent (very differently) the geology of the property, with stress on half the reserves, in order "to more precisely define the ore zones." To "more precisely" define the ore zones? Really? Was that their purpose? Or did they in fact maneuver to charge, first, gross departure from geologic truth, then second, deliberate (fraud and deception) departure from geologic truth, in order to go to court if necessary to break the contract? Did they in fact "more precisely" define the ore zones?

Hagegeorge, a man so dense that he can't blow his own nose without an engineer showing him how each time, apparently produced a checkerboard pattern of rectangles, black for ore and white for waste, for the upper part of block 8. Johnson, I gather, did a bit better with block 9. If the rumor mill is correct, he preferred large black polka-dots, without much intervening white space. Lady Luck was with Eyrich: using crude but well-blessed methods, he managed to come very close to the proper estimate for blocks 1 and 2. For this he will never be pardoned by UM! And, what did these characters do to show location and shape of ore?

How did CMC's intellectual and ethical paupers determine beforehand that UM's motley crew was going to improve on my reserve guesses? Were my guesses, and my work generally, so poor in quality that even UM's crew would without doubt be able to produce an improvement? Did this clumsy and dishonest effort solve the problem?

Was the quality of reserve guesses actually the problem? Was there anyone in either gang of knuckleheads who at that time failed to understand that the second half of the exploration drilling finally had to be done? Could it be that the meddling fools in CMC who terminated drilling over my vigorous objections, then looked for a pigeon who would believe that "it's ready for development," actually wanted to hide their involvement, their guilt, and their actual problem, and needed me as their goat? And, were they not also trying desperately to pacify their unruly pigeon?

Willy Lump-Lump, always the good soldier, led me to believe at the time that he, and he alone, was terminating the drilling. That way all my rage and fury would hopefully be directed at him, and would never reach Chicago! I didn't learn until a year ago that the ignorant and greedy directors, en masse, had done it.

CMC Annual Report, March 1979

there appeared to be a lack of mineral continuity disclosed by underground drilling in certain rock formations.

layed. To determine the extent of the problem the partners commenced a comprehensive study of all geologic data thus far obtained, to more precisely define the ore zones

and reassess underground mining conditions. It is estimated that the study will be completed in 1979.

CMC Annual Report, April 1980

The Partnership is in the development stage, and had no revenues.

The partnership is in the exploration stage!

On January 30, 1979, mine development activities were suspended pending the results of a study of the geological data to define the size and scope of the ore reserves.

To more precisely define? To redefine? To define for the first time?

The study indicated the need to conduct additional drilling before full scale development can continue.

Finally an admission of the obvious! Full scale development--or half scale?

A new study, including the drilling program, is expected to begin in the second quarter of 1980.

Now an exploration program is "a new study." This implies continuation of last year's foolishness, doesn't it? Are you perchance trying to maintain consistency in your lying?

Dear Shareholder:

When unusual underground mining conditions were encountered at the Oracle Ridge copper project in Arizona and it appeared that the quantity of minable ore in one particular block seemed to be less than originally anticipated.

It appeared? And, it seemed to be less . . . ?

a decision was made to reassess the geologic data and development program. This reassessment began in February, 1979 and should be completed within the year. The consequences of the delay will include additional costs to fund the reassessment program, higher equipment and construction costs due to inflation, and on-going interest charges associated with our financing program.

Time wounds all heels! "There ain't no such thing as free lunch." You really saved a bundle by cutting off drilling at mid-point, then finding a pigeon, didn't you?

Sincerely, ??

Chicago, Illinois
March 21, 1979

In January, 1979 the partners commenced a comprehensive study of all of the geological data thus far obtained in order to further define the size and scope of the ore reserves.

Really?

It is estimated that the study will be completed in 1979; however, while the study is in progress, development work has been substantially curtailed. Continued development cannot be assured until such time as sufficient information becomes available to determine the economic viability of the project.

Yes, indeed! First you do the exploration, then you do the development!

UM Annual Report, May 1979

> The development of the Oracle Ridge copper deposit in Arizona, in which Union Copper and Continental Materials Corporation hold interests of 45% and 55% respectively, was continued. However, towards the end of the year, discrepancies appeared between the results of check drilling conducted from the underground workings in one part of the deposit and the initial reserve estimates. As a consequence it has been decided to conduct a new analysis of the geological data and to suspend work on the construction of the concentrator and the power supply line.

Quite damaging, but close enough to the truth that I have no grounds for complaining about lying. You were fully entitled to carefully check my estimates--but this implies that you did not do it before forming the partnership. Also, there is no hint that the real problem was insufficient drilling or geologic evidence, and that I did not represent reserves as ready for development!

UM, Corbiau, May 1979

> **In the case of the Oracle Ridge project in Arizona, discrepancies were determined between the results of underground check drilling and the geological interpretation of previous results.**

Hole 90, block 6

> **This led to a basic re-evaluation of the ore body reserves. A new examination of all the available data was undertaken by our geologists from the end of January 1979.**

Is this really what they did?

> **All development work was stopped while awaiting the results of this investigation. The latter was terminated a month ago and unfortunately confirmed the doubts which had arisen regarding the existence and the mineability of the originally estimated reserves.**

Doubts about the existence and minability of any and all of the reserves that I estimated? How uncertain did I represent reserves to be?

> **Discussions are currently underway with our partners to work out a policy adapted to the new circumstances.**

Adapted to the circumstances originally indicated by my drawings and tables--except for block 6. Adapted, in short, to reality!

April 30, 1979

TO: Richard Laird

FROM: H. T. Eyrich

Tokenism! A "spy" in their midst!

It may be of interest to note that my Probable plus Possible reserves for Blocks 1 and 2 at 1.5 per cent cut off checked out as shown below with C. J. Orback's figures:

Zone	Tons-CJO/HTE	Copper Grade-CJO/HTE	Silver Grade-CJO/HTE	Million lbs Cu	Dev
Cau	1,150,000/1,012,800	1.91%/2.1%	0.5/0.6	43.9/42.5	3.2%
L-2	700,000/ 683,266	2.41%/2.53%	0.71/0.74	33.7/34.6	2.6%
Cau + L2	1,850,000/1,696,066	2.10%/2.27%	- / -	77.6/77.1	.6%

These figures indicate that the two different systems for calculating ore reserves come out very closely where the data points are relatively close together. It also leads me to believe that unless new data, not available to Orback are present, that his figures are more likely to be correct for other blocks than those of geologists with far less exposure to the basic geologic data.

My rough estimate of ore reserves of Zone L3 are just that, an estimate, until more rigorous control is applied. You will note that only these three ore zones in Block 1 (Cau, L2 and L3) are given a 10 per cent uncertainty factor by CJO. Any of his reserve estimates with a higher uncertainty factor should probably be considered Possible only. Obviously in areas where new data are available, the reserves must be recalculated.

Only block I was ready for development! This was my "line" for a good many years.

Spring 1979

Oracle Ridge Management Faces Development Decision On Reassessment Report

Faces exploration decision!

The Oracle Ridge mine could be in full production in six months to a year, if the

Oh, really? Without a new contract?

companies involved in the project respond favorably to reassessment work finding, according to the mine's project manager.

"We are anticipating some work will resume this summer," manager Richard Laird said. "We will hopefully resume full development in six months to a year."

Sure you will resume full development, Richard, after you do the second half of the exploration.

The 1978 annual report of Continental Materials Corporation, parent firm of Continental Catalina Inc., a partner with Union Miniere in the mine, said "there appeared to be a lack of mineral continuity disclosed... in certain rock formations.

Tons, not continuity--remember?

The Oracle Ridge Mine sharply curtailed development work last year and in early 1979 most of the work force was laid off.

During underground development drilling, Laird said, the company discovered possible problems involving the ore zones

Discovered hole 90 didn't have any ore around it!

Original exploration had shown there was approximately 10 million tons of copper ore, Laird said.

7+ to 13+ million tons!

Total expenditures in the project for 1978 were $8.6 million, including $4.5 million for development expenses, $3.4 million for plant and equipment and $0.7 million for financing charges.

This was damned high cost exploration, disguised as "development."

CMC House Organ, Spring 1980

Partners agree to revive mine

. . . agree to resume exploration

After months of negotiations, Continental Materials and Union Miniere signed a new partnership agreement to reactivate the Oracle Ridge Mining Project. The first phase of development is

The first phase, consisting of resumed exploration drilling, is . . .

expected to take about a year; when completed, the new information will be evaluated.

Work stops during 1978

Work at the Tuscon, Arizona, copper mine was halted temporarily late in 1978

. . . TUCSON . . . copper prospect . . .

because mining costs were exceeding estimates and questions arose regarding the continuity of the ore body which was

Because "development" costs . . . .
Tons, not continuity--dammit!

Under the new agreement, Union Miniere will oversee and pay for a drilling

At least we admit to needing more drilling!

and development program which will further define the precise size and position of the complex of ore bodies. The program will be supervised by Union Miniere mining engineer Francoise Breyer

Define the precise size . . .? No! No! This won't do. This is not what you meant last year!

Spring 1980

Work to resume on underground Catalinas mine

Exploration to resume on Catalinas copper deposit.

By BOBBIE JO BUEL
The Arizona Daily Star

After a year's suspension, work is to resume next month on a $40 million project to develop Oracle Ridge Mine on the north

. . . exploration is to resume . . . to place into production the Oracle Ridge copper deposit on the north . . .

side of the Santa Catalina Mountains.

Project manager Richard Laird said study and development of the underground

Come on, Richard, say it; say exploration!

copper mine will continue for about two years before a decision is made on commercial production.

The project was put on hold in February 1979 because preliminary work led owners to doubt the size and continuity of the ore body.

. . . copper deposit. It's damn well not a mine! How many times do I gotta tell ya, "it's tons--not continuity!"

said Melvin Pollack, vice president and treasurer of the Continental Materials Corp.

"During the past year we studied the project, and basically that study indicated that more work needs to be done at the mine in order to find out what's really there

"We"? No, UM! Another confession of the obvious. Yes, dear Melvin, first you do the exploration, then you do the development.

> and whether it warrants commercial operation," Pollack said yesterday from his Chicago office.

This is why you do the exploration first, dear Melvin.

> The owners hope the mine eventually will yield about 5 million tons of copper, Laird said.

From completing exploration on the "best" half, 5 million tons of copper ore are expected. Stop lying, Richard!

Spring 1980

Oracle Ridge Feasibility Studies Are Resuming

Exploration is resuming; feasibility will follow.

> Oracle Ridge Mining Partners is revitalizing its efforts to put into operation an

. . . is resuming exploration in an effort to . . .

> underground copper mine on the north slope of the Santa Catalina Mountains north of Tucson.
>
> Development of the operation was suspended in February 1979 after questions arose about the size, grade and continuity of the orebody.

. . . after the partners finally understood that exploration must precede development.

> Over the next two years, the company, which is a joint venture of Continental Materials Corporation and Union Miniere, a Belgian company, will be spending some $3 million to $4 million on feasibility studies and developmental exploration,

A very large fraction will go for exploration, much less for feasibility studies. For Pete's sake, let go of "development"! Who invented "developmental exploration," and why?

according to Richard Laird, who was recently named project manager.

About 20 persons will be employed at the mine, Laird says. The work will include underground drifting and diamond drilling

The work will consist mainly of drilling.

both into the orebody and to open up some new ore zones, he said.

"I don't know what tonnage we will be mining," Laird said. He added he is "quite confident" the minimum size of the potential orebody will be about five million tons.

Five million? Come on, Richard, tell them your drilling will be two-phased, and for this first phase, and first half, you expect half the tons--5 million.

In its 1978 annual report, Continental Materials pointed out that one of the problems with the operation is that "there appeared to be a lack of mineral continuity disclosed... in certain rock formations."

Again?!

Much of the next two years of study will be to check continuity and minability," Laird said.

It's exploration, Richard, not a goddam study!

Original exploration of the orebody showed about 10 million tons of ore,

7+ to 13+ million tons, for the entire property, not for the half that you're going to drill. Stop lying, Richard!

grading about two percent. Reassessment work done in 1979, however, reduced the tonnage and increased the grade.

Oh, no! Not from "10" to "5" million tons.

This string of artless lies is meant to paper over so many crude and costly strategic blunders! We have the examples of poor Willy Lump-Lump, handicapped by his "engineering mind," and driven by his lust to be "in charge!" of something, just anything at all, even the dozer work, on a mineral exploration job where he had no competence whatsoever. Actually, he could have assisted only by the alacrity with which he got the hell out of the way! A year later the zany and arrogant fatheads who comprised CMC's stable of directors quietly stopped the drilling and, as though saying so made it so, declared the prospect to be ready for development. They did this out of greed, ignorance, and a better understanding of Willy than I had. They didn't trust him to determine when enough drilling had been done because of "his" 4.6-million-dollar fiasco south of Tucson some years ago. It never occurred to any of them to ask the geologist about geologic matters. They are power-mad, two-bit politicians who have never recognized technical specialization of effort. I wonder what CMC's stockholders would think if they knew what their "management's" power madness has cost over, say, the past 20 years.

The committee of slip-slide-and-duck artists that originated CMC's propaganda last year was headed by a little pusillanimous pansy who doubles as a bookkeeper in Chicago, and moonlights as a hypocrite sitting at the right hand of the Rabbi. I doubt that he even asked for the prevailing wage of 30 pieces of silver for what he did. But, a technical writer he ain't! A seer he ain't neither! That committee's members apparently harbored the notion that pitching me into the swamp would appease the crocodiles, but, since the preceding November, I had known that UM's fumblers were going to break their contract by using whatever means they found to be effective. I also knew that CMC's bosses would ultimately be forced to defend my work! In court these slippery dolts would have had to recant and retract--to an exceedingly embittered enemy. But, they had a second purpose for lying as they did. And that was to hide from the stockholders and the public their own responsibility by pointing the finger at me. UM found that it had a similar problem, which called for the same solution.

Finally, here it is a year later and you are attempting to admit that much more exploration drilling is and was needed--but you are doing so by scrambling last year's lies with this year's reluctant, partial confession. So, new and complex lies are being generated, by omission together with the residue from last year. Now, I can well understand the cowardice and misplaced loyalty that prompts "little fish" such as apprentice-boss Laird to play Little Sir Echo--but what will he and others like him do for repeated encores? However, this year I really expected higher quality writing and a longer and cleaner confession from you turkeys at "the top." Your future lies should at least prove to be interesting. "Oh, what a tangled web we weave . . ."!

Same Song: Third Verse

Now I want to regale you with an account of my choicest memories of who said what, and when, and also how, about this affair. Much of the "why" I believe you will or do understand.

This story might as well begin with poor Willy and me, walking the approach road to the 6400 portal while I was drilling hole 91. After gazing about, he said: "Do you have to drill these holes so close together?" I later mentioned this choice bit of engineer's wisdom to John Fritts, and we both laughed--at him, not with him.

A year later poor Willy Lump-Lump, during a three-month interval after the Colorado Springs directors' meeting, dropped remarks half a dozen times to the effect that nearly enough drilling had been done and that it would have to stop soon. I marshaled all my arguments and fired them like cannonballs, but they had no effect: He was impervious! Finally, he could dally no longer, and good soldier that he was, he had to execute the orders he knew to be calamitous. He notified me that "the next hole is your last hole." For three weeks, while hole 134 was being drilled, I had six to eight opportunities to try to get my arguments pounded into his skull. Those sessions were always brief. Usually, at the end I was yelling, and he was walking away and mumbling, "You geologists never get enough holes." At least 15 times I listened to that infuriating piece of idiocy, "you geologists never get enough holes." Then he had the temerity to tell me to draw and calculate reserves--in less than three months. In response to <u>this</u> bit of engineering wisdom I simply gave him a dour smirk. Of course he had in "mind" a few simple skeletal cross sections, straight-edge connections of intercepts, and the rest of the zany ritual, in order to more precisely produce a few simple numbers from which advertising materials could be manufactured in order to more precisely hook a prudent sucker.

This was the same timid and servile rabbit, whom the Fates had so unkindly cast amongst the jackals, who tentatively invited me to accompany him together with his proffered resignation to the jackals' lair, immediately after the disastrous CWT fiasco south of Tucson years ago. I had conducted the autopsy on the geologic portion of their misguided effort to mine that decidedly anemic deposit. The standard, ancient, averaging ritual, including written logs, had been followed but in a manner that was considerably below the industry's average for "quality." Some of the industry responded by suggesting that too few holes had been drilled, by which they meant that there were too few samples (assays) to permit statistically valid "truth" to be derived from the engineers' standard, number-shuffling exercise. This was false! The cause was abominably poor collection, assemblage, synthesis, and analysis of geologic evidence. But poor Willy apparently learned nothing from this experience except "drill more holes." He definitely understood that the Control property needed more drilling! However, he would have had me repeat that wretched engineering ritual.

And then there was the consulting geologist, typical of the many who inspected the property and my drawings, who playfully played Socrates with me as we and poor Willy and his Chief Sidekick were returning in a vehicle from the 6400 portal. He was interested in what I thought my varying degrees of

uncertainty meant, in terms of development versus additional drilling. In short order he was dealing with blocks 5, 10, 11, and 12, and holes 400 to 800 feet apart, and asking what I thought that meant. I answered with a grin that that sort of thing meant "it was a helluva good place to do some prospecting." Poor Willy and the Sidekick were absolutely silent, tried to be devoid of expression, and appeared somewhat embarrassed. It was as though we geologists were busily amusing ourselves by noisily passing gas in the front row of the synagogue! Of course by then the consultant was quite aware of my antagonism toward the engineers and my contempt for the company's plans to develop. For some strange reason, after this I saw fewer of the people sent to evaluate the property. In two instances I was unaware until much later that potential partners had made their evaluation. I also developed the feeling that I was not supposed to be left alone among such people.

On two occasions at about this time I was visited by the elder Gidwitz, a jackal who has deluded himself into believing that he is "The Fox," and poor "Little Billy" Ryan, a 24-karat zany, who, if he ever grows up, will surely grow up to be a Pollack. On my advising them that the property badly needed more drilling--before attempted development--each responded by pretending that he didn't hear me. In each instance, as I continued to wait for an answer, there was an awkward silence, then a glance at someone else followed by a shuffle in that direction and the initiation of a "more sensible" conversation.

Finally, Hagegeorge, a zany incompetent masquerading as a UM stooge, arrived. I believe that sad creature was actually extremely uncomfortable, totally lost, and utterly insecure until much later there arrived one day none other than his perfect complement in the form of Johnson, a UM stooge masquerading as a zany incompetent.

Two days after the incompetent's arrival, I had not yet had an opportunity to determine his mental condition, but Bill Mitts had, by riding a bus with him for about six hours. I asked Bill: "Does that character have any sense?" He said that he didn't have enough sense to come in out of the rain. I was repeatedly assured that the fellow was indeed defective. In response, I urged Bill to be a bit less hasty in making such an adverse judgment. I suggested that he wait a week.

Several weeks later I understood ever so well that Mr. Mitts was so right. John Fritts and I had on one occasion abandoned for the umpteenth time our joint effort to teach him some local geology, and we turned to light banter for some relief. The subjects were taxes, then Socialized Insecurity taxes, then old age, and finally age. At the end of this session The Incompetent blurted out that he couldn't remember his own age. On hearing this Fritts and I glanced at each other, eyes atwinkle, and then each of us flipped out a witty one-liner at his expense before managing to throttle our impulse to have some fun. I glanced at The Incompetent during the witticisms and saw what appeared to be terror splattered all over his countenance--eyes wide and mouth agape! Perhaps he would now say that he had evened the score during the succeeding two years.

In due course The Incompetent sacked Mr. Fritts for "inability to see well enough to avoid danger underground"--whereupon Mr. Fritts, in short order, acquired a chauffeur's license and for a year, while seeking geologic work,

served quite well as a Sears driving instructor. As is normal in such matters, the little queasy fools around such projects shortly came to believe their own lie and peddled it to the public, not as a transparent and crude excuse for a sacking, but as truth!

This act did several things. It revealed the cavalier attitude that the two ignorant supervising engineers had toward recruiting, sacking useful subordinates, the subject of geology, and geologic continuity or a geologic bridge from the past to the future. In terms of strategy it also revealed the numbing stupidity of CMC's strategists.

Of course its most interesting effects concerned The Incompetent. After this he was free to search for an assistant even less competent than himself, with whom he could feel more comfortable. He could also blow smoke at his favorite engineer without the presence of that old obstruction who was on occasion given to laughing at him. And, he was then in a better position to ridicule, "replace," and finally bury "all geologic data thus far obtained." He had spent years trying like a dog or horse to learn the tricks used by engineers in guessing reserves, and he damn sure was not going to waste a good many more years puzzling over a new set of tricks.

Some three months went by. Then one Saturday morning my phone rang. It was the recently sacked new graduate who had replaced Fritts. The ensuing conversation went something like this: "Ah--ah--are you Mr. Orback?" "Yes, indeedy, that's me. What can I do for you, young man?" Then he introduced himself as having been sacked by The Incompetent about 10 days before. My response was something like this: "I know the situation on that hill and I do hope you can find better people with whom to associate in the future. Actually, you are to be commended for having been competent enough to have been fired by the likes of him." With this the kid's reservations and hesitancy disappeared, and as though a dam had burst, for more than three hours he poured out his hurt soul to me as though I were his long-lost big brother. First he told me that Hagegeorge had warned him not ever to contact me--as a condition of employment--and that I would reach through the phone wires and tear him limb from limb! He then said, "Hagegeorge was wrong about everything, including you." Then he told me how he was fired. One day the kid could hold his tongue no longer and said to The Incompetent, "You are the dumbest stupid bastard I've ever known!" Now, this isn't bad for a 22-year-old kid, and I complimented him! And, that's how he was fired by The Incompetent.

This was the oaf recruited and retained to the end by your ignorant engineers! This was the oaf that, for at least 1 1/2 years, CMC's brightest guiding lights could not recognize as a disaster. This was the oaf who finally should have convinced even engineers and CMC's dummies that geology is important. This was the oaf whose defectiveness was recognized by Bill Mitts, the warehouseman, in less than six hours! Finally, more than any other oaf, this was the oaf who served as the unimpeded and utterly unqualified judge of my work. But, that's the way UM wanted it!

The judge was The Incompetent and the jury was a group of ignorant, culpable fools advised by their yapping lap dogs. The verdict was guilty, and it was so advertised throughout the industry. And, the defense has not even yet

been heard! Since money, action, and a semblance of reality finally take precedence over talk, "image," and lies, current action has already made a monstrous lie of the verdict, among the informed. But, being the cheap little fools that you are, you must continue with talk, "image," and lies, in order to more precisely defend your verdict and to more precisely absolve yourselves.

When block 6 began to come unraveled due to underground drilling, Little Billy became ever more hysterical and finally even remembered and turned to me. His first pipe-dream was that I was to "say it isn't so!" Then I was to redesign my cartoons by incorporating "data" from the unsurveyed holes and unquantified written logs in such a way as to reassure UM that the "ore" was there--somewhere. In a cold rage I informed Little Billy and the Lump-Lump that there would be nothing usable in the "data" except assays, that I was sufficiently curious to inspect the assays briefly, that the assays were to be treated as fact, that UM was doing the exploration that I had wanted to do years before, and that I was not about to try to con UM or anyone else. Still Little Billy would not give up! He next tried to convince me that I should visit the property and presumably inspect all the evidence, then demonstrate that the "ore" was there--somewhere. In effect, I told him to go to hell! Think of the stupidity of it all!

Then a few more months went by--the lull before the storm. During this time UM came to understand that it had been had and was immersed deeply in the soup! UM's engineers decided that they required, and could get, a new contract, and they would also be forced to do much more exploration. And, during this time they hatched their battle plans, the centerpiece of which was to bellow "fraud!" and "cheat!" at me.

At this late date poor Little Billy was still trying to use me to persuade UM that "it isn't so!" A meeting was staged in Tucson, to which trooped the Lump-Lump, young apprentice-boss Laird, a very ignorant "mining geologist" from the Congo, Breyer, and quite late none other than the UM stooge--Johnson. Willy Lump-Lump didn't bother trying to program me. He knew that I marched to a different drummer, and he had never seen me cower or cringe, or dodge a good fight. He sat, immersed in silence and gloom. Young Laird was all smiley and very quiet. In short order the Congolese apparently became aware of his own ignorance and irrelevance--and became quiet. Breyer was quite agitated and conveyed the impression that he had just discovered that I, whom he had trusted, had betrayed him. He acted hurt and wanted to accuse and to confront me with the evidence. Most assuredly he was not the least bit receptive to anything that could have come from me! Very quickly the discussion narrowed to my leaning forward over the table and very bluntly, tersely, and directly reminding Breyer again of hole 90 and the termination of drilling, and telling him why block 6 geology was not to be extended throughout the property, the difference between dolomite and limestone as hosts, the movement of hydrothermal fluid, and finally that the attempted development must be stopped until the required additional exploration drilling was completed. I also fished for comments from Breyer about a new contract, but he would not mention the subject.

The UM Stooge stayed late and in a most gentle and polite manner asked me what I thought was really there. I replied by saying something like: "When you finally get it drilled out I think you will find about 10 million tons to be there." Then in a thoughtful and somewhat subdued fashion he indicated that he agreed.

A few days later the Lump-Lump had reported my performance to Little Billy, whereupon I promptly received an invitation to accompany those two to dinner. As I consumed a ten-dollar steak I watched them eat hamburger and hash. I believe that it had finally occurred to them that their pigeon was escaping, and already they were feeling much less prosperous. As the Lump-Lump savored his hamburger in silence and gloom, Little Billy and I entertained the other diners for three tables around. It seems that I was supposed to have been trying to calm and pacify the frantic Belgians, that I should have been pouring oil all over those troubled waters, in brief that I was supposed to have persuaded them to "Have Faith!" But actually I had not even tried! In fact I had made matters worse! I had no savoir-faire! And I ain't got no couth neither! While Little Billy raved about this I was whistling a different tune. I was still trying to get the plain, unvarnished facts of life stuffed somehow into poor Little Billy's skull. And, of course he wasn't listening.

Some days after this episode I came in late one evening from tending a core drill and was greeted by a copy of the damndest vile diatribe that I have ever read. This string of idiocies constituted the opening round of UM's fight to get a new contract. The UM stooge masquerading as a zany incompetent had pumped the zany incompetent masquerading as a UM stooge! And it was The Incompetent's regurgitations that The Stooge chose to pass off as a "report." It didn't matter to him that The Incompetent obviously "didn't have enough sense to pour piss out of a boot, even if the directions were printed on the heel"! It satisfied UM's needs!

I toyed briefly with the idea of writing The Stooge a note, with copies spread around, explaining that he should be aware that an addled oaf had been sending out this sort of thing over his forged signature, but decided that I would wait and eventually have the last word.

It was at this point that I started yelling at what passed for CMC's strategists to get Hank Eyrich to the battlefield to investigate and to match wits with the Philistines, since I was in no position to wade into the affray myself. I will always wonder at UM's blunder of allowing him to attend their "little party."

Then Little Billy began hounding me to provide him with ammunition with which to shoot down The Stooge's "report" were it to surface during the next one of many meetings UM was to call to assess the mood of its enemy after the latest salvo. Finally I relented and very hastily manufactured 22 pages of ammunition. But the timid little mice were still dreaming of appeasement, and my ammunition terrified them. They were appalled and aghast! When the Lump-Lump returned, he rifled my desk and stole the only two copies in Tucson. All four copies soon were supposedly locked inside a California safe! This was the last effort I ever made to aid those fools' cause! Henceforth, whatever I did was calculated to damage them.

A few weeks later, about the first of March of last year, I asked Eyrich if he knew of a group for whom I might do some honest and useful labor, that I'd finally had my fill of those ignorant, meddlesome fools and their ways. But he professed to know of none.

Two weeks after that, late Friday evening just after returning from the field, I discovered the CMC annual report draft--"edited" by the Lump-Lump. The next morning I first phoned the Lump-Lump, who immediately understood that this was the end of our "romance"! Incidentally, a year before, he had told his wife that mining wasn't "fun" any more and that his great hope was that I would find a good ore deposit. In a rattled and excited manner he conveyed the impression that he couldn't change the verbiage, that it was a committee job being done on me, that the committee would scramble the verbiage round and about, that it wouldn't go to press for a week, and that I shouldn't get excited. Next I tried the jackals' lair and raised "The Kid Fox." He was young enough that a trace of integrity was still left in him, and by his tone of voice he indicated that he felt guilty as hell. In short order he turned brusque and that ended that! With this I knew I would fail in rewriting their lies! In the afternoon I tried the Lump-Lump again and for the first time tried out "defamation of character." But the poor fool thought I meant him personally, and he chattered: "Don't you threaten me! Don't you threaten me!" He followed this by shrieking at me a list of cuss words as long as your arm. With this I began separating my property from theirs, at their office. The next day I managed to hold "The Fox" for two hours on his home phone! He was "willing" to change the words but not the meaning! A number of times during the two hours he became agitated and shrill but I found that the magic words "defamation of character" had a very soothing effect on him and I repeated them many times. Finally he could tolerate no more--he had begun yelling at the servants and barking at the dog--and he insisted that I talk it all over the next day with Little Billy in Tucson, then I was to call him at a certain number at Helene Curtis. With that I removed my property from their office, left their vehicle keys on a desk, departed, and felt much cleaner immediately!

About this time, a local friend reported to me that he had received a call from a geologist in Reno. It seems that The Stooge had mouthed off to him that I had "screwed up the geology" of the property and he wanted to know what my friend could tell him about it. Not long after this a local claim staker was hustling business in Denver, dropped in on Freeport Minerals, and chatted with an ignorant mediocrity named Joe Kantor, who said about me and CMC: "That son-of-a-bitch sure cost that company a lot of money!" I came very close at that time to paying the Stupid Stooge a visit!

I just knew that UM's campaign to get a new contract would end in six to eight months of courtroom theatrics and that I would be a witness brawling with, and being mauled by, both sides. I therefor made it my business repeatedly to interrogate and exchange information with everyone who might have anything to say about who, what, when, where, how, and why. And I also wanted to determine the "friendliness" and "loyalty" of the many other future witnesses. I was pleasantly surprised to find so many former associates and others too whose general integrity, and respect for truth, justice, and efficiency so greatly exceeded that of the "loyal" wretches, yapping lap dogs, and

so-called officers within the organizations. Among those who remembered well and whose enthusiastic assistance I especially appreciated were: John Fritts, Jim Palmer, the Mitts family, Ray Larkin, E. A. McVey, Hank Eyrich, and John Roscoe. There were also respectable people within the organizations who were quite helpful, but for the present they shall remain nameless.

Of course Little Billy made an effort to sabotage my information-gathering network by ordering people not to talk to me, but this had almost no effect. Virtually everyone told me in effect that Little Billy could go to Hell!

Until the end of June, UM, at that time officered by a law firm, continued to pound the chiseling promoters with salvo after salvo, and for their efforts received whimpers and whines, but no offer to renegotiate the contract. Finally, UM produced and leaked a realistic and convincing threat to go to court--then all Hell broke loose!

It was as though the farmer's kid had just dropped the hungry tomcat down amongst the rats trapped in a granary. There was instant pandemonium! My, oh my! How those promoters did scurry!

My phone rang, and it was silly Little Billy calling from the granary. In a blunt, matter-of-fact fashion he informed me that his company was being sued; and also being sued, individually, were all officers and directors, plus Roscoe and me. He told me that I was billed as "the star of the show." Also, I would be paid for my time. Then he became strident and informed me that I was in big trouble, "but not to worry!"--CMC would take good legal care of me! I thought, "hmm!" Then it occurred to me that I was going to have lots of independence in court. I then sneeringly asked him: "Is anybody going to fine me?" He said, "well--no." I said: "Is anybody going to lock me up?" Then he made a very stupid mistake. He said, "No, but they might ruin your good name!" With this I exploded all over the silly fool and reminded him of the effects of his lies in his annual report, and what was being mouthed about by the yapping lap dogs! Then he chose smugly to inform me that the little Pusillanimous Pansy would testify that he had heard me say I had "all the drill holes I wanted." I assumed that piece of lunacy was meant to make me "more cooperative." Next, I was supposed to scurry aboard a plane at 8:00 the next morning and scurry to the jackals' lair at 10:00. It seemed that their shysters wanted to see what sort of witness I would be. I yelled at him that viewing me was irrelevant, that he should put his shysters on the phone. He yelled back that I had to scurry to Chicago! I bellowed back: "Like hell I do!" Then suddenly all the wind went out of his sails. He turned to whining and begging, in a low moaning voice--and I almost laughed at him!

There was no way that I was going to have six or eight jackals taking notes while I talked, only to have them all swear in unison in court that I had said whatever they might find to have been "convenient."

The next morning my phone rang again. This time it was "that ol' smoothy," Gunther, a much higher quality jackal. If the stick wouldn't do it, maybe some honey would! For an hour it was palsy-walsy, fun-and-games, little jokes,

and lots of chuckles. Then he very gently asked if I would please consider scurrying to Chicago, at my convenience of course, but hopefully during the next few days, "please? please?" He would personally be sure that I was put up at the very best hotel; I would have champagne, and pheasant under glass; he would get me a very expensive girl, or if I preferred, a boy. Oh, lots of fun! Back in March the fools couldn't see this coming, and had to lie for the sake of their "image." Their only concerns then were: "Did the lies take the heat off the fools themselves? And, could I successfully sue for the job they were doing on me?" I told him that Chicago was a dangerous town. People "fell" out of upper-story windows and splashed all over the sidewalk. They were found mangled in bridge gears. And rented cars blew up! I suggested that CMC owed me at least a fishing trip, that their shyster should meet me halfway, on neutral ground, in Colorado. I further suggested that he come along, to row the boat, pop the tops off beer cans, and take notes. Then a nearby phone rang, I was put on "hold," and in a few minutes he was back, saying, "It's all set!" I said, "What's all set?" I was going fishing, he told me, with Ted Tetslaff. We would fly from Denver to Steamboat Springs, where Tetslaff had a "villa." I then probed the subject of the directors stopping the drilling, which I had known about for several months, and was told: "Why no, the directors would not have done that. Reynolds would have had to recommend!" The game plan, which I confirmed later, was to have me telling the Lump-Lump that I had all the holes I wanted and that it was ready for development. He merely would have passed my recommendations on to the others. Just goddam lovely! This "line" was being pushed hard by the little Pusillanimous Pansy. And the other jackals, including the Lump-Lump, found this perversion to be very pleasing and satisfying.

I found Tetslaff to be a very intelligent, serious, dedicated, and seemingly decent young fellow. But, I harbored no illusions about the "ethics" of his profession and told him so. For a week, on the phone and finally all of one day in Denver, I busily informed him of the dirty ethics and cheap politics of his "customers"; the dirty record of their twisted and bungled wheeling and dealing in technical matters; the shabby injustice of the prevailing contract; the technical generalities of exploration, development, and production; the current technical status of the property; what must be done in the future; and finally costs and efficiency. Of course I was attempting to persuade him to induce his "customers" to surrender! I didn't grant him much opportunity to ask questions; mostly he simply listened to my "speeches," and I was in good form! I made sure he saw that I had my wits about me; that I was wary, determined, blunt, direct, and thorough; and that just below my very thin veneer of self-control and civility there was an enormous reservoir of seething and boiling rage and fury!

Early in these discussions I made it clear to Tetslaff that I was the only character going to "the party" whose interest would be served by the whole truth and nothing but the truth. I was going to sing like a canary, and I knew all the verses! I said that even though the crooked promoters finally understood that they had to defend my work, they intended to suppress the truth about their most interesting blunders, including the hole 90 incident and the termination of drilling, and that they planned to lie like hell to hang their principal blunders on me. Then I instructed him to tell

the scurrying promoters that I would have my own attorney and they were to pay him by reimbursing me. He thought that would be fine, but the lying promoters certainly didn't!

My final dealings with Tetslaff were in Denver, and I left him with a few thoughts to mull over. I told him that I most assuredly was not going to squander my savings by brawling in court with the lying, blundering fools of both companies. He assured me that he would try to keep the affair out of court, that I should trust him, and that he would let me know if or when I personally needed an attorney. I then said that I had two options: I could go underground and surface on an Idaho potato farm, where I would stay for the duration; or, I could take a nice, long, foreign, fishing vacation beginning in New Zealand.. I told him that before disappearing to more precisely preserve my savings I would be ever so happy, in order to more precisely get the truth on the record, to put together a nice, long, detailed deposition with an attorney that I would hire, especially if UM's lawyers had access to me during its writing. Then I asked him if they would. He was just a bit jolted by this, and admitted, "Yes, they would." Finally I told him that I was going to do two things when I returned to Tucson: I was going to get a passport and suitable visas; and I was finally going to consult an attorney!

At this time I was very busy discussing the affairs of the scurrying promoters with my network of spies and friendly witnesses, and to a man--and woman--they said, repeatedly: "Shut up! Don't talk to them! Get a lawyer! Get a lawyer!" They were so persistent that I finally began to lose my nerve. I wondered if I had made or would make mistakes with Tetslaff. I sought and found a reputable mining attorney with a degree in geology. For three hours I explained L'Affaire CMC and UM to him, then asked two questions. I wanted to know whether he thought CMC would retain their old contract. He surprised me very much by saying that from what I had said, CMC would indeed preserve their old contract! Good Lord! Then I asked if he thought my game-playing was riddled with errors. He said: "No, you're all right so far. But don't go to Chicago alone! Be sure to take a witness with you!" I told him that I was quite aware of all that, and asked if he would care to serve as my witness if I should ever consider going there. And yes, he would.

A week later Eyrich returned from a chaotic day at the jackals' lair and, as was his custom, for several hours he told me all about it. They were still panic-stricken, all in a dither, and there was indeed much scurrying hither and thither! All scurried but the Lump-Lump, who tended to sit or stand out of harm's way, immersed in silence and gloom, undoubtedly contemplating his track record, his crashing "empire," and the virtues of "good soldiering." The little Pusillanimous Pansy, ever helpful, was much given to hand wringing and the obsessive spinning of silly scenarios, while "The Fox" was much given to slapping him down with "Shut up, Melvin! We can't do that!" Later in the day it finally occurred to "The Fox" that it was time to surrender. And surrender he did!

Three weeks later, after learning that the surrender was the genuine article and not ersatz, I called, and called on, Breyer. I would not approach UM's personnel sooner because if they wanted a fight with me, I would surely

give them a fight, rather than grovel at their feet! I also wanted UM to quiet its yapping lap dogs and to assist in cleaning the filth from what had once been my good name--but this latter was not to be, and I am still unsure of the former.

Breyer, I found, had regained his composure, his manners, and his poise since discovering my "betrayal" of him. As is true of many Europeans, he normally exudes not only considerable savoir-faire but also abundant savoir-vivre. This of course serves as an efficient mask, and for a time I didn't know whether he was receptive to what I had to tell him or not.

M. Breyer, also, I found to have been by the Fates grotesquely miscast as an organization-engineer. Most assuredly he was originally designed to become a professional "Man of Religion"! Consider, that a man of his age and position within his racket, still retains an embarrassingly large amount of integrity, some conscience and principle, and even a residual sense of justice. Add to this his touching compassion, which he ladles out indiscriminately to any passing victim, and you have a poor organization-engineer with a heavy cross to bear. One can envision him ignoring everything round and about the monastery to devote all his attention to healing a poor, little, ailing puppy. But, one cannot envision him in the corporate front office, more precisely cutting throats, and with gusto and relish yet! Perhaps in his case only, forgiveness (Lord, they know not what they do!) has indeed been earned for an unholy reverence for the Agricola-method of dealing with "ore," and for a lack of appreciation of the finer points of geology. Perhaps! I found him to have a very charming susceptibility to some of my truth, even my "inconvenient" truth; and found that he would confess much of his truth, including, reluctantly, some of his "inconvenient" truth. But ultimately he was to gulp hard, blink back the tears, hold his nose, and then profess group "loyalty" and do what his associates "required" of him--to more precisely further his career.

In short order, during 30 to 40 hours of phone discussions, mostly at his cost, I came to think of him, rather affectionately, as "Francois the Confesser." He had much to confess. And, no! I pitched him no curves!

Very quickly I found that UM's flacks had been desperately trying to convince themselves that I was part of the crooked promoters' conspiracy. It was much more convenient this way since it was necessary that they attack me and my work. I asked him, as I had asked the promoters, what UM's beef with me, in court, would have been. All he would say was what I had consistently heard before, namely: "skarn and Lazlo Dudas." Now this was indeed very thin soup! But, he was quite aware that the jackals might not agree to the terms of surrender demanded by UM, which would have led to the courts, and for that reason I had to be kept at arm's length. Further, I might have been playing "double agent." And, his associates insisted that I be treated as a potential adversary.

Several months before, "Francois the Confesser" had found one surviving copy of my five-year-old map entitled "The 29 Most Urgently Needed Additional Drill Holes." The Lump-Lump had asked for this map, apparently when it appeared, years ago, that his masters might fail to more precisely hook a

prudent sucker, and would be forced to rebait the hook by doing more drilling. After UM had been hooked, the Lump-Lump found the presence of this map to be an "embarrassment" and evidently destroyed three of the four copies. From "Francois the Confesser" I also learned that the Lump-Lump had considered the consultants' four reports to have been, likewise, too embarrassing to submit to UM during the initial bargaining. As quickly as I could after learning this I submitted them to UM, for him. But, the last two reports were difficult for me to acquire. I pried one out of the Lump-Lump 1-1/2 years ago, but couldn't get the last one until this past winter, when I managed to get a copy from the consultant. The first two reports, by Kenyon Richard, made it very clear that mineralized carbonates required close-spaced drilling before development. Now, this is no revelation, except to uninitiated virgins--which included UM! However, after their recent indelicate romance with CMC's promoters, I believe they have finally been "relieved" of their virginity. The last two reports constituted a delicately stated "outsider's" opinion that the property was not ready for development, that it needed more drilling. It is just fascinating to speculate on the type of "deal" UM might have proposed or accepted had the Lump-Lump not chosen to withhold the map and the four reports!

Even without these materials, UM almost understood the situation correctly. "Francois the Confesser" told me some interesting stories about mining in the Congo. The "problems" were logistics and paternalistic "governing," not engineering--and most assuredly not geology. Exploration holes had been spaced 1000 feet apart! The deposit was simple and consistent; the grade was 4.8 to 5.2 percent copper. This information was offered to me apologetically as an "explanation" for UM's geologic naivete. But despite UM's naivete, as I also learned from "Francois the Confesser," in addition to the original written contract there was an oral agreement with the jackals that required that additional exploration drilling begin immediately in those blocks having the widest spacing of holes. "But," said the jackals to their pigeon later, "there must be some mistake here! You have misunderstood! We don't want any more drilling! And, furthermore, there is nothing like this in the contract! So sorry!"

I asked for and received a rather detailed explanation of UM's exploration and development plans. And I advised him that deepening a hole just south of block I would very likely be wasted money, and it was; that he should deepen hole 65, south of block 4, and it clarified some of the geologic murk; and I told him to deepen hole 71, that I had stopped it short.

Soon he advised me that if L'Affaire went to court, UM would treat me as a "friendly" witness--and my savings were "safe"! He also suggested that later I "consult" for UM, but he reckoned without his company's yapping lap dogs and flacks. I believe he was thoroughly berated for that notion. Much as it hurt him, he had to recant and retract.

All the while, I was frantically fishing for something, anything at all, on paper that I could show to the industry to indicate that UM had no real quarrel with me and considered me "worthy of my hire." I proposed writing, without charge, a history of CMC's "management" of the project prior to UM's arrival, in return for a simple, written request that I do so. The request

was supposedly in the mail when I was asked to write rapidly for two days. Twenty-seven pages later, covering about the first four years plus a very sketchy outline of the rest, came the "request" in the mail. "Kirkpatrick the Suspicious" simply wrote that if I wished to write, fine. He would deign to read! This was useless! I then told "Francois the Confesser" to consider the 27 pages to be a free sample, and that the next installment required payment. I would make copies of the check and any accompanying note!

But, UM's flacks didn't want anything in writing that made them appear to be cozy with me, and they said no. Poor Francois very briefly toyed with the idea of paying me himself--I think he was a bit curious. But that would not have served my purpose. They really didn't appreciate, or I should say "find useful," what I wrote. Their original counterproposal was that I patronize their lawyers and, presumably, confess to something. My secondary purpose was to make sure that they never again entertained notions of soliciting or accepting advice, technical or otherwise, from <u>any</u> of the jackals. A very convincing case can be made for CMC's godawful incompetence without bending the truth one iota.

I was even given sketchy reports on the progressive capitulation of "The Fox" and the new terms taking shape.

But, what I just loved was "Francois the Confesser" conveying to me some of the "brilliant effusions" of The Stooge: that I should have quit CMC 8 to 10 years ago. That if my cartoons had not been so neat and "pretty," if they had been 30-minute, rough and sloppy pencil jobs, UM would have understood! And, finally, the Agricola-method was the <u>only</u> right and proper method. Yes indeed, I should have associated with higher-quality people. But this had no relevance to L'Affaire. As it was, I almost won--for both groups of stockholders. All potential partners understood, except UM. And they almost did! I would refer The Stooge to my Reserve Table, and invite "Francois the Confesser," who now understands, to explain it to him. I have <u>never</u> done, nor will I <u>ever</u> do, sloppy and slovenly work! I would also invite The Stooge to learn something about principles of geology--he sounds and acts very much like an engineer. He might also berate his parents for the "analytical ability" and "intelligence" that he inherited!

Finally, what I relished most was "Francois the Confesser" telling me with some sympathy that "<u>all</u> the geologists who had been on the property agreed that it needed more exploration drilling." But, he forgot poor Le Blanc and Kazmitcheff! Did they alone fail to understand? Or were <u>they</u>, <u>too</u>, overruled by ignorant, greedy people in authority?

Now, somewhere in all this there should be a moral or three, but first, kiddies, the voice of experience wants to quote an old Chinese proverb, for the special benefit of Mr. Eyrich, to wit: "He who roots in the sty soon stinks like the swine." On second thought, I retract that--and offer my apologies to all swine!

There are occasions when even Belgians must feel compelled to "rise above principle," but when the war has been won the weapons should be dropped! As to the vanquished jackals, it is in their very genes to conduct themselves in

this manner, and for them there is no hope. One must forever be wary! But even so, they should be reminded that short-term follies laid end to end can only produce long-term disasters.

I think the "essence" of this matter was conveyed most succinctly last fall by a very crusty, middle-aged geologist off a Kansas farm, when he said, about all this: "You take a bucket of shit, stir like hell, and it'll be the turds that rise to the top!"

Same Song: Last Verse

I have no intention of subjecting myself to the depressing and wearying task of combing out and exposing all the blunders and absurdities palmed off as "geology" by "The Little Corporal" Verbeek and The Stooge, and their coterie of little helpers. This would require a book! And they cannot possibly be proud of their handiwork anyway. I will instead drag into the light only their most entertaining asininities, after first disposing of some preliminaries.

According to Apprentice-Boss Laird, they didn't think enough of their effort to pass it on to Thompson, so finally, Laird did so himself.

Theirs was a very crude, ham-fisted effort. It was as though turn-of-the-century, slaughterhouse butchers had invaded the hospital and were practicing "surgery," or as though monkeys were tapping typewriter keys while their keepers were dreaming of more Shakespeare. This comes mainly of every mother's son acquiring a "pedigree" or two (with gentlemanly "C's"), as a matter of right, by merely serving time and spending daddy's money! The other factor in this is the corporate "system," which will not select, and demands merely 8 hours of time per day--and "loyalty" to the bosses. Such "geologists" might just as well be in the construction (or is it destruction?) workers' union. Their "professionalism" and mental and living habits are the same. One wonders whether they have ever read a book, even on geology, since leaving school, and whether they could ever learn anything except by practicing, in the manner of horses and dogs. Such is the stuff of which soldiers are made! But their role was that of officers! The real difficulty is that there is insufficient officer material in the population, and this allows Little Corporals to parade as Captains. Add to this a nonselective or random system of instruction and employment, and you finally get this sort of godawful MESS!

One thinks of what Hazlitt, an "Austrian" economist, said of Keynes, a British socialist who posed as an economist, in reference to the latter's magnum opus. Said Hazlitt of Keynes: "All that was true he borrowed from others, and all that was original was false!" Just so! But Keynes was elegant of expression, though murky, and he succeeded in deluding a generation of "scholars" who had socialist predilections.

One wonders who would have been deluded had the mess reached the courts. What would I and three consultants of my choice have done to them and their mess? I was once in the process of selecting consultants, and would have conducted a "school" for them.

One also may wonder what might have been done, given the Little Corporal's assignment of producing "alternative geology" with which to intimidate the enemy, and, if necessary, delude judge and jury. Certainly the gross, embarrassing errors could have been kept out of the mess. The Stooge's lying was an unnecessary strategic blunder. Contradictions could have been removed. And, the great amount of time spent flogging an obviously very dead horse, "mining reserves," when the second half of exploration drilling so obviously needed to be done, would have been much better spent chasing general geology to more precisely seek out blunders that I might have made. This latter would also have minimized their own blunders. They certainly should have spent a day in the local university library pursuing the subject of regional stratigraphy. And they should have read selected chapters in any good igneous petrology text such as "Turner and Verhoogen." Also, they badly needed to learn about ore genesis, and hydrothermal fluid particularly. And someone, who could observe, should have very carefully studied, at some length, a selected number of microscope thin-sections! Five to ten minutes for each slide, and at low magnification, made one helluva mess. But then, if they had had talent, they wouldn't be "mining geologists" playing at exploration geology!

They used 15 to 18 man-months in their effort, and what did they produce? For comparison, think of the few good-quality Master's and PhD theses and dissertations that have been produced, and the time required. And think of the older USGS Professional Papers. For that matter, think of the old USGS test. It was two hours in length, with about 200 questions, and half the questions concerned a map of quite complex and varied geology. Two hours! Oh yes, I passed, with 14 extra percentage points--when all but 17% who attempted it failed.

They were dishonest, disorganized, unobservant, careless, ignorant of geologic principles, and generally such poor investigators that one is entitled to consider them stupid! Of course this applies primarily to their "leadership." And the stench from their godawful mess would gag a maggot!

They were incapable of reasoning, unacquainted with cause and effect, strangers to analysis and synthesis, cavalier about evidence and its collection, and devoid of principle. Since intelligence, knowledge, and ethics failed them, they turned to wild guessing. And they were stuck with low-grade, school-boy description. For three long months "the inmates were running the asylum"! Now, why was Eyrich so incredibly gentle with them in his dissent and disavowal?

Now, let us consider some of their principal technical loves and hates.

It requires considerable ignorance, arrogance, and simple-mindedness to defend the low-grade foolishness of written drill logs these days, especially now that at least half of all exploration geologists have abandoned them.

They were abandoned more than 30 years ago by Bear Creek and shortly thereafter by ASARCO. Such core logging is simply very crude and quite inadequate. Such information as is recorded is inconsistent, incomplete, and virtually irretrievable, which means that bad as the information is, it is also unusable. The log's worst characteristic is lack of "data" or "evidence" quantification. Nearly as bad is the impossibility of comparing one log with another. Correlation of similar features from different holes is impossible. No two people logging the same core will produce remotely similar words. And, most evidence is simply not recorded. All this--and it could have been much more--explains why thinking, "genuine" geologists abandoned them long ago. There is no defense for written logs except the brainless appeal to engineering tradition. And it is quite a sorry tradition: engineers "handling" mixed cuttings produced by churn drills! But, you might wish to refer to core drilling in "the oil patch." And, yes, some students were misled by their "profs" this way. But in oil geology there are virtually none of the complex, interrelated details whose accurate recording, correlation, and later analysis are so very important when dealing with minerals. Truth in mineralized carbonates is never simple, and a few unquantified generalities are never adequate! Written logs virtually guarantee that nothing will or can be used on a log but the assays. However, this is enough for simpletons and indifferent "good soldiers"! The proof of the simpletons' mental quality is their bellyaching about "confusion" and "difficulty" when forced to use histogram-and-symbol logs. This also means that they do not understand geology.

Another principal piece of low-grade foolishness inherited from ancient engineers working with veins, is also destined to be shunted aside by thinking exploration geologists, and finally engineers too. I refer, of course, to the engineers' assay-number shuffling, and the cross sections that they use to more precisely guess (define and depict) mining or geologic reserves. And also, one day, the two-category, word-defined--and ever redefined--classification of reserves will be dropped as infantile and too crude. Now kiddies, we will not "prove" ore by drilling from the surface!

I have never known an engineer who gave a damn or cared the least about anything geologic except for two items: ore and "waste"! And he damn well wants the two separated and wants to know which is which. If he has any sense at all, he also wants his ore depicted accurately. The final product that the geologist delivers to the engineer might just as well be simple sections showing ore, "waste," and faults. And those sections, horizontal and vertical, should be made by a draftsman, any draftsman, to the scale the engineer wants, and also according to the spacing and direction he desires. In order to do this the draftsman must receive from the geologist a detailed and correct, three-dimensional, "engineering" representation of the ore and faults. This can only be done with contours! Once the actual three-dimensional reality is depicted and defined in three dimensions by contours, any draftsman can be shown in minutes how to derive and plot any sections, at any scale, in any direction, for those who have no ability to visualize in 3-D or haven't enough sense to "read" contours. The same system should be used to show variations in grade, and a draftsman should add grade variations to his sections. Roscoe understood this quite well, would have agreed, and rather fittingly used a junior engineer as his draftsman.

It is vitally necessary that detailed evidence be collected honestly and thoroughly, then analyzed, first to understand correctly the generalities, then the intermediate features, and finally a welter of small features. These features are all related to the ore, either directly or indirectly. And, many or most have either irregularly curving or "planar" surfaces that a real geologist must first visualize in 3-D, then plot in 3-D, before being able to define and depict ore! Of course their correct age relations must also be known.

With 8 to 12 irregularly curving, and "planar," elements, oriented every which way and mixed together in space--and of different ages, too--analysis simply cannot be done except by working with three dimensions and with a relatively large volume of rock involving a number of holes. Cross sections, meaning two dimensions, may be an idiot's delight, but they will not lead to a good estimate of the truth. They will remain riddled with errors!

The very name "cross" section implies veins, or deposits having some regularity, with two long dimensions plus one short one. The further one departs from this ideal the less appropriate are "cross" sections. And one can hardly go further than multiple, highly irregular, complex deposits in carbonates!

"Analysis" by cross section leads naturally to such lunacies as drilling on sections. Is the ore to be mined out only on sections? The engineers' answer is that everything, meaning only ore, is to be "averaged," which means simply that they are totally ignorant and contemptuous of geology. Now this is the tail wagging the dog--with a vengeance! The cartoon governs exploration, then development--but reality governs mining? And what does one do with variations in rock complexity, which require variations in hole-spacing? Further, what does one do with variously oriented angle holes? Is it all just play-acting, to be forgotten during mining, as the shift boss follows his nose in ore? Whatever happened to collection, analysis, and synthesis of evidence from progressively closer-spaced drilling in order to more precisely draw, literally and figuratively, sound conclusions including those of the ore? Is this to be traded off for an oxcart full of ancient, simple-minded, engineering "formulas"?

What can anyone say in defense of the stupid and dishonest practice of "projecting" evidence (assays) from where it was generated to where it would have been more convenient--to a section? Must it not be another brainless appeal to engineering tradition? And, is this practice not also rooted in veins? Of course such "projecting" constitutes pretending that bent sections are straight, and it is done to simplify the "averaging game"! And the averaging game is resorted to in order to more precisely hide ignorance of the following: source, plumbing, host, alteration, and mineralization, together with all of their subsumed parts.

Now kiddies, are you aware that some published definitions of the ore classes--"proven," "probable," and "possible" or their equivalents--do note percentage-ranges by which the estimate may deviate from the truth as ultimately found? Such deviation must be the governing thought that lurks in every evaluator's and engineer's head when considering "probable" or "possible" ore.

This is the core of the matter! There is no rational reason whatever for not dispensing with the superfluous words in favor of dealing only and directly with the ranges themselves. There is nothing "tight and springy" or "scientific" about beginning an ore-class definition by arbitrarily and subjectively choosing an inflexible maximum distance that ore may be projected from a drill hole. Just think of what happens in using your rigid, property-wide, subjective projection-distances for multiple, complex and variable ore blocks, and also different parts of blocks. All of block 9 is "simple"; part of block 8 is a nightmare; and block 5 is still an enigma. In effect, your rubber "scientific yardstick" varies in length from place to place--in terms of actual uncertainty! The truth is that one uniform, property-wide degree of uncertainty would require great variation in hole spacing from place to place. And, by the way, what would that do to your precious sections, hmm? Shall we now make yet another brainless appeal to engineering tradition?

Now listen, knuckleheads! There is something else you should know: Without characters like me, characters like you would be few in number, still in caves, and without the horse or the wheel! And, life would indeed be "short, nasty, and brutish"!

Mineral exploration is so very expensive and so very important that the ignorant, greedy fools in the front office; and their flunkies the engineers; and the engineers' little retarded cousins, the "mining geologists"; should, if they will not assist, at least stay the hell out of the way and keep their goddam politicking hands off until they are told that it is their turn!

Now, as to the meat of the mess, has it occurred to you yet that the deposits were formed from "typical," "porphyry-copper," hydrothermal fluid; derived from typical, porphyry-copper, source magma; and of typical porphyry-copper age? Oh yes, the fluid originally would have had that much sulfur. Almost certainly most of the sulfur went through the system and exited as sulfate--calcium and magnesium sulfate. You doubt it? Investigate the literature of the Ok Tedi deposit!

Since most of the solids in the solution were "retained" in the carbonates, by replacement of clean calcite and dolomite, one need only estimate the present bulk chemistry of the replacement minerals (except for calcium and magnesium), then sensibly add some theoretical components that passed through the host rock, and something to account for subsequent erosion, to have a sound estimate of the solids, or components, that were contained in the hydrothermal fluid. These components were mainly the ordinary igneous-mineral components that otherwise would have crystallized as the lower-temperature, last half of the granodiorite minerals. And these components were also present in the proper magmatic or granodiorite-mineral proportions. The ions in the fluid were the equivalent of all of the following: the essential late quartz and microcline, and you might say "deuteric" for these earlier and mostly second generation minerals; plagioclase (albite rims); epidote, too; and some biotite, sphene, and apatite, plus a few other odds and ends. These were in fact the nonaqueous liquid fraction of the melt after resorption during and due to "second boiling" of the water-rich magma. In addition, some so-called volatiles were present. Quite late, and from lower in the "hydrothermal-fluid reservoir," came much iron, and most of the copper and sulfur. Now, these components produced alteration or gangue minerals and sulfides in the carbonates

by metasomatic replacement--or metasomatism. Do you understand that the metasomatism was of silicon, aluminum, iron, potassium, sodium, titanium, sulfur, copper, and all the rest, including some calcium and magnesium? Why do you emphasize any one of them--say, "potassium"? Could it be that you don't understand, and are not thinking, but merely parroting something you've read? Are you simply dreaming of describing and guessing? And, by the way, can't you think of processes and principles, and then say alteration, instead of wallowing in such homemade nonsense as "skarnification"?

If you were good theoreticians (hell, if you were just good!) and understood geologic processes and principles, you could have anticipated or derived much of the geology of the property from just a few fundamentals, and could have avoided your gross embarrassing blunders! But alas and alack, you were not, and did not, and could not! And your orders were to reinvent the wheel and make it different--so you invented a square one!

Now let us examine the mess; and let us begin with your "ethics"! You were ordered to "reinterpret," or make different; for this, may the order-giver and all his willing followers fry in hell evermore! The term "interpret" can be replaced wherever you use it by the term "guess" with no change in meaning. Once, some time ago, geologists fought about evidence or observations, chemical and physical principles, geologic processes and principles, reason, analysis, synthesis of evidence, and conclusions that did or did not necessarily follow from the evidence. Now are we all supposedly entitled to our guess, with all guesses being equal, except for that guess which proves to be "inconvenient"?

You say you did a literature search? Then why did you so very badly bungle stratigraphy, even that of Cy Creasey (USGS)? and ore genesis? alteration and its zoning? and petrology? You did your "reasoning" by analogy, by visiting other areas. Was this meant to be your substitute for local evidence, hmm? The claim is made that Lefabvre did "detailed" mineralogical work. Think about the time available to him for each of about 280 thin sections! He would have had 5 to 10 minutes for each section. This allowed him to look and guess at low magnification only. And, his conclusions show it! You plainly imply that there is little or no potential for ore outside blocks 1, 2, part of 8, and 9. Could it be that you are taking seriously your own definition of "possible" ore? Do good-grade intercepts in holes more than 280 or 565 feet apart belong in a new class of ore called "impossible!"?--or do we say this of only part of the possible ore? And what are we to say about The Stooge's lying, as revealed by Eyrich? Was The Stooge and his nonsense made more believable and authentic by acquiring his subordinates' signatures and indicated approval of that nonsense? For shame! For shame!

Let us now examine some of your murk and fog. You say that I, in contouring, "projected" data to a horizontal plane? This is a misuse of "projected." In contouring nothing is moved! Everything is plotted to scale in its true position, angles and all! To you, "detailed" means plotting your generalized guesses and murk at 40 feet to the inch. Some detail! To you, subdivisions of "formations" are also "formations." What slovenly ignorance! And how could you manage to stretch your incompetence so far as to use regional-metamorphic terminology for altered and mineralized carbonates? Mineral-"assemblages" indeed!! Don't you know that alteration, especially of carbonates, is "brief,"

and change is inch-by-inch and "day-by-day"? Causes are constantly changing and shifting, and so are effects! There is no stability, nor equilibrium; therefore, there are no mineral "assemblages." Now think about zoning! Regional metamorphism is a nearly "dry" (pore fluid) process, it requires much time, and its causes act with much uniformity over large areas. Recrystallization of local constituents is the dominant process, and the rule is stability and adjustment to equilibrium (mineral assemblages). Mineral changes are gradual and overlapping, and require much distance. Contact metamorphism is a recognizable cousin to this; but, the time is brief, distances are short, temperatures are relatively low, and causal conditions are decidedly nonuniform. But still the result is "dry" recrystallization, generally without equilibrium, and it produces quite variable and nonuniform "assemblages" of minerals from local constituents. Clean carbonates can only recrystallize to form larger carbonate grains. In the case of "S-zones" and Cam sandstone there was virtually no effect except to enlarge the carbonate grains of the cement. Sand (and silt-size grains) is still there almost in its entirety and very well rounded. The contact-surface between quartz-sand grains and dolomite became a very thin film of very small diopside grains. Contact metamorphism is not a form or type of alteration! Alteration is caused by hydrothermal fluid, of which there is virtually none to be had from a freshly-arrived magma, which by its arrival contact-metamorphoses its enclosing rocks. Hydrothermal fluid can only come much later, after much magma has crystallized. You said "lamprophyre" dikes because it sounded more "scientific" than "dark-colored" dikes. But the truth is that it does require some care and some time to identify the minerals in those rocks, and one must have a rough grasp of petrology. You really didn't care, and you didn't have the time! Now, why use such a broad and descriptive basket as "skarn"? And what is a "typical" skarn? As the fluid composition changes so do the minerals. Consider "porphyry copper" fluid, and that of molybdenite, and scheelite, and fluid from magmas of a variety of compositions, and fluid with any number of variations in igneous-rock mineral components as well as values and "volatiles." What is a "typical" skarn? For that matter, what is a skarn? Is it a metamorphic product, regional or contact, of very-impure carbonates; or, is it a hydrothermal-fluid product? And, why is an altered sandstone (Cam) a "quartzite" to you?

Incidentally, whence came block 13? Can't you count either?

I will tell you again that no silicates formed in carbonates, almost none in S-zones and sandstones, and virtually none in the Dmq due to contact metamorphism. It is an ignorant and stupid absurdity to suggest that silicates containing iron, aluminum, or potassium were so formed in those rocks! I will remind you, too, that nearly all the microcline present in those rocks is present as sand, still all there, and still well rounded!

The main "theme" of those rocks is early alteration, by the addition of silicon to produce mainly diopside--silicon reacting with dolomite. In the case of limestone (calcite), silicon at high temperature (~525° C) produces wollastonite; at lower temperatures, quartz and calcite result. But with later Al, Fe, Na, K, and a little Ca and Mg from the fluid, the Si reacts to produce mainly garnet and epidote first, and finally quartz. Epidote in limestone is a medium-to-high temperature mineral--not low temperature--dummies! Since only a trace of wollastonite is present, obviously the required temperatures

did not prevail! Because such temperatures did not prevail, there could be only a trace of monticellite, and no more than a trace of olivine (forsterite), which requires, among other conditions, 90° to 100° higher temperature than the very abundant diopside, dummies! At the high-temperature ends of serpentine masses there are diopside and diopside remnants--didn't you notice? Magnesium in the stock, due to assimilated dolomite mainly, is present (of course) as minor diopside and chlorite, not olivine!

You have invented something new by advocating that hydrothermal fluid was released three times in succession from the magma chamber (and it had to be over a short time span), then passed through 2,000 to 4,000 feet of crystallized granodiorite, then reached the carbonate host rocks at three wildly different temperatures. This is wildly asinine! How long do you think a petrologist, physical-chemist, or typical exploration geologist should laugh at you? Don't you realize that fluid temperature is dropping within the carbonates during crystallization of various alteration minerals? It is highly probable that in many very small volumes of altered rock only one period of fluid release is represented. But, fluid did change in character, second- and third-order plumbing (fractures) became sealed with new minerals, new plumbing formed, fluid from any one pulse consisted of fractions that differed in physical and chemical properties, and these fractions mixed and intermingled. There was certainly no perfect overlap in the development of new plumbing, nor was there repeated use of old plumbing by subsequent pulses of fluid! Mostly, new plumbing in the general vicinity of old, sealed plumbing was formed and allowed a later pulse of fluid to pass. Most assuredly most alteration minerals, except for most magnetite and most sulfides, formed each time new fluid reached the carbonates. However, through time, fluid coming from the chamber varied in composition. Early (first pulse) it was rich in silicon, and later (last pulse) it was relatively rich in iron, copper, and sulfur. So, it is a virtual certainty that most of the common alteration minerals are of two and probably three ages. Do you understand? And, are you not aware of retro-alteration or retrograde alteration? Don't you realize that fluid of later pulses having similar initial temperatures cooled rapidly as it moved through previously altered rock by very devious routes? The mixed and incompatible minerals of most thin sections mean no "assemblages" because they formed at different temperatures, pH, partial pressures of oxygen and carbon dioxide, total pressures, times, and rates. This also means repeated and variable alteration, and mixing and intermixing of ever-changing fluid flowing at ever-changing rates. All this modified and made quite complex what would have been simple and plainly zoned had only one fluid-pulse passed through a simple rock such as calcareous siltstone. This is no place for simple-minded, ignorant amateurs playing the guessing game!

Alkali (K and Na) metasomatism, meaning replacement, was not significant in any rock! Most sodium passed through the system, but what didn't is present in scapolite--which you passed off as wollastonite, high in limestone and with quartz in faults! My! My! But, also, some scapolite is present in the Cam in block 10. There was never much potassium in the hydrothermal fluid, relative to the other ions! But there is general and mild to moderate sericitization of calcic plagioclase in the vicinity of hydrothermal plumbing through the top of the stock. This is the principal K-metasomatism and you missed it! And, some of it may well be "deuteric"--meaning prior to the crystallization of essential microcline and quartz. In and immediately adjacent to the plumbing

(veinlets) in the stock there is minor hydrothermal microcline and slight biotite alteration. This is it! In the carbonates there is slight microcline (K), mainly in limestone, and zoned late and outside there is moderate phlogopite (K), the Mg analog of biotite, in dolomite. All chlorite in carbonate was originally phlogopite, but was later weathered, "oxidized," or retro-altered. All such chlorite retains the very characteristic form of phlogopite--they are pseudomorphs! The two types of microgranodiorite dikes represent a few crystals mixed with liquid magma, and also mixed with hydrothermal fluid (water). This is why their "magma" was so fluid, as opposed to the "dry" coarse granodiorite ("Q-sill"), and why the phenocrysts of plagioclase were altered, and why their characteristics are so uniform, and why they are present only near and among altered host rocks. Their moderate "enrichment" in potassium, and "shortage" of aluminum, is mainly a matter of omission of nearly all calcic plagioclase--the early, coarse solids in the chamber through which liquid and just a few small crystals were strained to enter the principal faults that cut the crystallized granodiorite. In the stock, and also in "Q-sill," mostly up-dip, there was cross-cutting by, and upward movement of, latest dry liquid magma having essential-mineral components that would have formed and finally did form almost solely microcline and quartz--alaskite. This is not K-metasomatism! How could you be so ignorant? Also, in the case of "Q-sill," some "filter pressing" left zones of "solely" plagioclase, which rock appears nearly white. And you ignorantly lumped this together with the quartz-microcline rocks. Ho hum!

By the way, "Q-sill" magma was "dry"; it did not alter carbonates. Because it was "dry," "Q-sill" is hummocky, thick, and unaltered, except where it later received post-crystallization, hydrothermal fluid of the last pulse--dummies! It assimilated some carbonates, which formed epidote and diopside.

Now let us look more closely at the igneous rocks. The stock is granodiorite, not quartz diorite! And the magma contained some 3% to 5% dissolved water, which "segregated" and accumulated to about 10% to 12% during crystallization. Then, pressure forced the water through the crystallized stock roof as hydrothermal fluid. Pressure also forced out some magma, usually with some hydrothermal fluid, which formed four different types of dikes and sills, during and just after fluid release.

One can readily observe that, in the stock, the mineral first formed was biotite (Fe and Ti rich), then plagioclase, which "adjusted" to about An_{38}. By this time some sphene and apatite had also formed, and the Ti in the biotite had crystallized as rutile. At this point during crystallization, half the magma, in the descending zone of crystallization, had formed crystals, and half was liquid; water was "abundant" in the melt, and temperatures had fallen. Then, a vapor phase ("second boiling") developed and caused about a third of the crystals to be resorbed--taken back into solution. With further cooling, crystallization resumed. Albite plated the An_{38}; fine biotite with less Fe formed; more apatite and sphene formed; epidote formed from Al, some Fe, and much Ca; possibly some sericite formed; and finally, the ordinary, essential microcline and quartz crystallized in the last available space! You may term some of these "deuteric," but you may not term any of them either metasomatic, or hydrothermal-alteration products. Incidentally, much later there were formed some hydrothermal epidote, sericite, and other alteration minerals.

Magma released during the first fluid-release crystallized to form the oldest dikes--porphyritic microgranodiorite. These are the only dikes cut off by the thrust. Investigate the southwestern corner of the property! None of these dikes are present above the thrust! The thrust cuts and crushes the oldest alteration. The next oldest dikes and sills, of microgranodiorite, cross the thrusts, are abundant on Marble Peak, and are plainly cut in many places by "Q-sill." "Q-sill" is next to the youngest, intrudes the thrust in many places, and forms dikes above the thrust that cut the microgranodiorite dikes. Only the diorite cuts "Q-sill." By the way, "Q-sill" has some hornblende and some other features that separate it from stock rock. The diorite contains almost solely calcic plagioclase without albite rims, abundant hornblende, little biotite, 2% to 3% magnetite, and a surprising amount of chlorite. The magnetite and chlorite were not derived from prior olivine! This diorite was formed after the fluid-release, but only shortly thereafter. It represents a collection of solids ("residue") left after the fluid had passed through, plus renewed crystallization with little water available. Now, all these various dikes are nicely associated in and among altered and mineralized host rocks. They are in the proper proportions or quantities required to represent early-formed crystals plus some magmatic and some hydrothermal fluid. And the hydrothermal fluid contained the rest of the magmatic components in solution. Their relative ages correlate nicely with their different compositions, and they are dated the same age as alteration. Further, their distribution, and that of the alteration, spread over the 12 blocks, implies something of thickness of crystallized granodiorite in the stock-roof, and this fits nicely the required water, given 20% to 30% solids in solution. Now, instead of "interpreting," why didn't you dolts untangle all this, while making sure that it fit the abundant evidence and also sound principles and processes?

Let us look again at more of your garbled "interpretations," disguised as principles and processes. Apparently you didn't know that chalcocite forms from bornite and chalcopyrite simply by oxidation due to the presence of free oxygen in water moving through them. Late, low-temperature, hydrous alteration minerals, with or without magnetite, are irrelevant to chalcocite development. What is relevant is proximity to the surface, and the presence of open fractures. "Remobilization" is simply false--a pipe dream without theoretical or empirical foundation! It belongs in the same cemetery as "granitization," "sedimentary-syngenetic" lead and zinc, "leached-granite" uranium, "the rotating 'doughnut'" of mineralizing and altering groundwater around an intrusive, "gneissic-dome dreams" applied to the Catalina Range, and all the rest of the kookery in this business! Don't you know that all instances of reported "diagenetic" and "authigenic" K-feldspar have, on careful investigation, been revealed to be false? This nonsense belongs in the same cemetery as your "remobilization." You refer to sulfides "having replaced magnetite." Tell that to any petrologist or physical-chemist--then stand back! But why didn't you simply observe? And calcite replaced garnet? How ludicrous! You could again have simply observed. You had it exactly backwards! Does the rubber mallet indent the steel anvil? To you, "porosity" during mineralization is everything! But, solution and replacement, volume-for-volume mainly, was the dominant process. Nearly all the rest was fracture-filling. What "pores"? Your "porosity" is actually the result of sulfide replacement of remnant carbonate grains, most hydrous silicates in varying degrees, and to a minor extent diopside too. Certain minerals, once formed, were not subject to

replacement. These included: magnetite, quartz, epidote, garnet, microcline, and sphene. Real "porosity," actually permeability, was due to fractures that varied from faults to microfractures, crystal-boundary spaces, and cleavage-plane weakness. Think of the very high total pressure of hydrothermal fluid, and think of its chemical characteristics, then think mainly of solution and deposition! Serpentine is not "porous" as you imagine. It is not composed of loose fibers, or prisms, like your fathers' old felt hats! It is dense, solid, and virtually impermeable except for fractures. But, it is composed of hydrous minerals; it is chemically quite reactive; and it is readily dissolved and replaced!

You claim that the Horquilla Formation is contact-metamorphosed (on Marble Peak?). But the rocks are altered instead! Away from alteration the very heat-sensitive shales and siltstones are quire unaffected! And carbon in limestones and dolomites is also very sensitive to heat. The rocks "bleach" before they recrystallize. What do you say about all the black in the Horquilla? Contact metamorphosed, my ass!

It is a virtual certainty that some of all the various hydrothermal-fluid-derived minerals are present in fracture fillings. Why should it be otherwise? But you saw only a few.

Had you been capable of observing, large and small scale, you would have noticed that tremolite was the first alteration mineral to form in dolomite, that it is widespread and dispersed, not mainly in fractures, that it is a low- to medium-temperature mineral, and that it is all but absent in limestone. To form, its composition requires only the addition of silicon to dolomite. This latter is true also of later and predominant, but higher-temperature, diopside.

You "invented" olivine, then "invented" its retro-alteration to other minerals, some of which have wildly different cation composition. What wildly unprincipled theoreticians you are!

I am prepared to grant you "ludwigite" (x-ray), which was my "actinolite," and perhaps "zeolites" in cracks, but no more!

Your "prehnite" was based on a hasty look and guess at pseudo "bow tie" or "wheat sheaf" structure in one or two slides. Had you investigated and determined the optical characteristics, you would have found this to be clusters of idocrase crystals!

The garnet, you say, is "grossularite"? But it is actually an isomorphous series, from andradite (red, Fe-rich and Al-poor) to grossularite (tan, Fe-poor and Al-rich)!

There is no "spinel" among the alteration minerals! You were quite likely looking and guessing at apatite.

Now, would you care to admit to the dozens of minerals that you simply didn't notice? Do I need to list them?

In view of all the preceding--and I'm not finished yet--let us mercifully bypass and ignore your hilarious sequence of events or paragenesis! The less said of it the better, eh?

Your guesses about ore controls, major and minor, are of the same low quality as the rest of your "interpretations." The very first fluid, under the highest pressure, and with only some 5% to 10% dissolved solids, almost all silicon, went through the most permeable zones near the plumbing through the top of the stock. It moved along avenues of least pressure. These were the sandstone and also the dolomite and fine sand of the "S-zones." This was because, in recrystallizing, dolomite grains have more open space along their borders than do calcite grains. Dolomite grains are harder, crack, and retain cracks more readily than calcite. Limestone (calcite) deforms by translation-gliding along twin planes of calcite without an increase in permeability. With sand in the dolomite, it is, as a unit ("S-zones"), even more brittle and rigid. In response to lateral stress, such rock, and sandstones and quartzites, will split like shingles, and also shatter. So, the first fluid moved through Cam sandstone, the "S-zones," and the most dolomitic central part of Cau. The result was a very tight, diopside-rich rock, not subject to much replacement. But it was quite brittle and later was shattered. The fractures passed fluid to the "L-zones," which were relatively rich in calcite. That is why the base of "L-zones" is better mineralized for greater distances. Dmq was a quartzite before intrusion of the stock. It is thick, and any new fractures were readily sealed. Therefore, there was indeed ponding upward against Dmq, and the top of "L-2" indicates it.

The upper Abrigo member is clean carbonate except for the base, and it consists of very thin and "crinkly" beds. The bedding planes not only were permeable but with any lateral stress became even more so. Very early the central, dolomitic zone was altered largely to diopside, leaving the top and bottom to be much better mineralized later.

The Escabrosa dolomite distributed fluid along grain borders much more readily than did Escabrosa limestone. And the dolomite was converted largely to serpentine, with some diopside, which was readily replaced by sulfides. Grade and continuity can be quite similar to that of "L-2." But Escabrosa limestone (top half) did not alter to the equivalent of serpentine with some diopside. It altered, with Fe, Al, and Si, to garnet, epidote, and quartz primarily. And without bedding, and having few open fractures initially, fluid spread along crystal borders. Contacts can be knife-edge sharp! This formed, in some places, rock very nearly composed of 100% nonreplaceable silicates. Such rock, where not shattered prior to mineralization, can produce "islands" quite barren of sulfides. But if rock with such silicates contained, say, 10% calcite remnants, and was well shattered before mineralization, very good grade ore could result. For sulfides the controls were: completeness or thoroughness of calcite replacement by silicates, and post-silicate, pre-sulfide shattering. From this you may deduce continuity. And don't you <u>ever</u> forget quantity of fluid containing sulfide components! Now, why are you so stupid as to lump together Escabrosa limestone and dolomite? Engineers might be pardoned, but "geologists," <u>never</u>!

Your "stratigraphy" is very funny, too! But first, a few observations: It is the Bolsa Quartzite that is present on the west edge of the roof

pendant as the lowermost rock. It is not the overlying Abrigo Formation. Are you blind, too? If you had investigated the published regional stratigraphy of the Escabrosa you would have found 475 to 500 feet, not 600 feet, to be a sound estimate of the Me thickness at the property. You said that the fine-grained Dmq (quartzite) is similar to the medium-grained, 30% to 40% dolomite-cemented Cam (sandstone)! It's even worse than this: Dmq is light gray, and the Cam is green! What careful observers you are! And why did you say that the Cau is 65 feet thick, then a few sentences later say that its thickness is 74 feet?

You obviously know nothing of marine sedimentation, either clastic or chemical! Nor do you know anything of southern Arizona stratigraphy. And, you couldn't be bothered to learn! But perverting Cy Creasey's USGS "strat" descriptions based on rock 3 to 5 miles to the north takes a helluva lot of nerve! Why didn't you make drawings of his Martin Formation, based on his words, as I did? You would have found that erosion had removed all but the lower few feet (4 to 6 feet) of Dmq and that we virtually agree concerning the rock composing the "S" and "L" zones! There is 15 to 20 feet of rock at the top of Ca and base of Dm that he and I could argue about, but that's all! There are angular unconformities between the formations, which means that the tops of many formations differ in the two areas, but otherwise there are very few differences.

The reasons for the similarity are: both of us understood our subjects; both of us were careful, competent, and honest observers; and of course there was sedimentation continuity over such short distances under the conditions that then prevailed.

During Dm time the landscape was similar to that of southern Florida and offshore from there. Nearly all sediment deposited was chemical sediment, deposited as carbonates, because the land, with exposed Ca, was of low relief and elevation, and consisted of islands(?) and peninsulas. The principal "highlands" shedding clastic sediments were several hundred miles to the northeast! A deep basin, of carbonate deposition, prevailed and was centered some 50 to 100 miles to the south and east of the property throughout nearly all of Paleozoic time. The locality of this property was under shallow water much of the time; again, remember that little clastic sediment was transported from nearby eroding Ca. There was not that much exposure or erosion of Ca.

Clay from eroding Ca was dispersed throughout the basin. Sand formed sheets, Dmq (and Cam, too), from shore outward some miles, and the shoreline migrated through time. Wind and current carried some fine sand and silt outward from there to form mainly very thin zones, interspersed among the carbonates, to form "S-zones." The "L-zones" (and Cau) are virtually pure carbonates. Now, of course there was continuity of sedimentation, and is continuity of sedimentary rock, over short distances such as a mile! The preceding explains why sand and silt grains in the Dm are so well rounded, spherical, and well sorted; why Dm contains so little clay; and why so much clean carbonate prevails from the base of Cau to the middle of Ph. Now, Kiddies, this isn't simply me and mine! It is mainly principles, processes, and the published work of others! How could you be so stupid and ignorant?

One feels embarrassed for you, in reading your drivel about "deltaic deposits," "facies changes" in miniature, and "discontinuous deposition of Dmq"--and in "channels" yet! They were marine, shallow-water sediments with very little clastic sediment contributed! What dummies!

You dream of "shaly" carbonates in the Cau, sand and silt in "L-zones," and "shale" in "S-zones"! All this is very poor observation, bungled principles and processes, and abysmal ignorance of the published work of others--you fools!

You were too dense to notice the structural differences over and under the thrust, and too blind even to be sure of the thrust itself. The thrust was perhaps a "gravity slide"? With 1 to 2 miles of rock above it? Or were you dreaming of the wet-sediment slump in the Ph? It is very likely that the top plate "stood fast," as the bottom was pushed eastward by more magma intruding to the west. Quite likely it is an underthrust! Its age is after first dike and first alteration, and before second dike and second alteration! Movement must have been enough that easternmost porphyritic microgranodiorite dikes in the top plate were later removed by erosion of that top plate to the west of the property! This requires at least a half mile of displacement. The same reasoning and type of evidence applies to the Dmq in the top plate.

The thrust is an irregular and "undulating" surface. Picture the top plate crushing, shattering, and grinding as the lower plate moved eastward. This is why there is so much fracturing in the top plate, why most such structures show little displacement, why so many do not continue into the lower plate, why the surface structure is so varied and complex, and why it is generally related to major curves in the underlying thrust-surface!

Structure in the lower plate is comparatively simple. And incidentally, this is the "home" of more than 90% of the "ore"! The rock adjusted to accommodate the intruding magma mostly by "bending" and by large blocks moving (not by movement along single faults). Later, there was repeated fracturing and some faulting in response to hydrothermal-fluid pressures. Many of these later faults, and some older ones, too, are now occupied by dikes. Picture moving blocks of ice in a tank of turbulent water; then later, when the blocks are all frozen together, picture them locally and repeatedly fractured by intense pressure from below. There was of course repeated (recurrent) movement along some faults.

Later, 28 million years ago, there was regional disturbance with elevation to the west, which increased the dip (tilt) to the east. This was when the quartz monzonite batholith was intruded nearby to the south and west. This act of intruding produced some new structures as well as renewed movement along some old faults and joints on the property. Of course such structure was never "healed" by alteration minerals, because there was no fluid. These, together with unaltered old structures, and zones of weak, hydrous minerals, constitute whatever "bad ground" is present on the property.

Now kiddies, you must never again divorce cause from effect, then lean on your "interpretations"!

And, what was it that the stupid, ignorant, bungling, lying, and slandering Stooge said? Oh yes, that I had "screwed up the geology of the property"! Hey, Stooge! How would you have relished defending your gossamer dreams in court? What would I have done to you?

In guessing your "mining reserves" you very neatly selected a hole-spacing (projection distance) that would make block I "probable," and place all others, as blocks, in the "possible" category. Now why wasn't this done by UM before it was sucked in? Of course the very notion of rigidly projecting certain distances, including projecting a fixed 50 feet outside outer "ore" holes, is bunk, since the rock varies in complexity and predictability through a continuum. But, if it had been, or were to be, drilled on a grid system with holes equally spaced, that spacing would be about 140 and 210 feet for your "probable" ore, in order to leave no gaps of "possible" ore. Except for the rigid and brainless inflexibility, I agree with these numbers, as rough averages for end members of a continuum. But when you refer to "possible" ore, the numbers are 280 and 565 feet, roughly. With "good" holes spaced wider than this, the entire subject-area must be something other than "possible" ore--say, "impossible!" ore?--or the gaps beyond projection distances must be thought of as other than "possible" ore, perhaps as "impossible!" ore! This may pass as good "engineering thinking," but it isn't worth a damn for exploration!

Why did you use a constant 10 cubes per ton, for rock this varied? This alone produced error of up to 25% in your tonnage guess of some rock! But then, you wanted only a rough guess, which was appropriate for a half-drilled prospect.

You advocate drilling about 20 holes in four large areas that remain undrilled. Before you squander that much of your shareholders' time and money, you had damn well better think of surface alteration, zoning, plumbing (up dip), holes updip without any silicates, and the two earliest dikes! Your ignorance and stupidity are not sufficient reasons to squander your shareholders' money!

For 10 million bucks you could now buy more than 400 holes drilled from the surface. You don't need nearly this many more holes to finally "believe in" 9 to 10 million tons, at plus or minus 10%, of, let's say, 1.65% (cutoff) copper ore. And, it is doubtful that you could ever "believe in" that much ore using 1.75% copper as a cutoff, even if you drilled 4,000 holes!

With this I have grown weary of your godawful MESS, and although I chose to ignore much of it, surely even you now understand why its aroma would indeed gag a maggot.

Once Again, Let's Have the Chorus

If there is an overall moral to all this, it is: Defend yourself and the truth! And, I direct this only to the young. The old fools are beyond salvation, redemption, resurrection, and erection. For them there is no hope. They

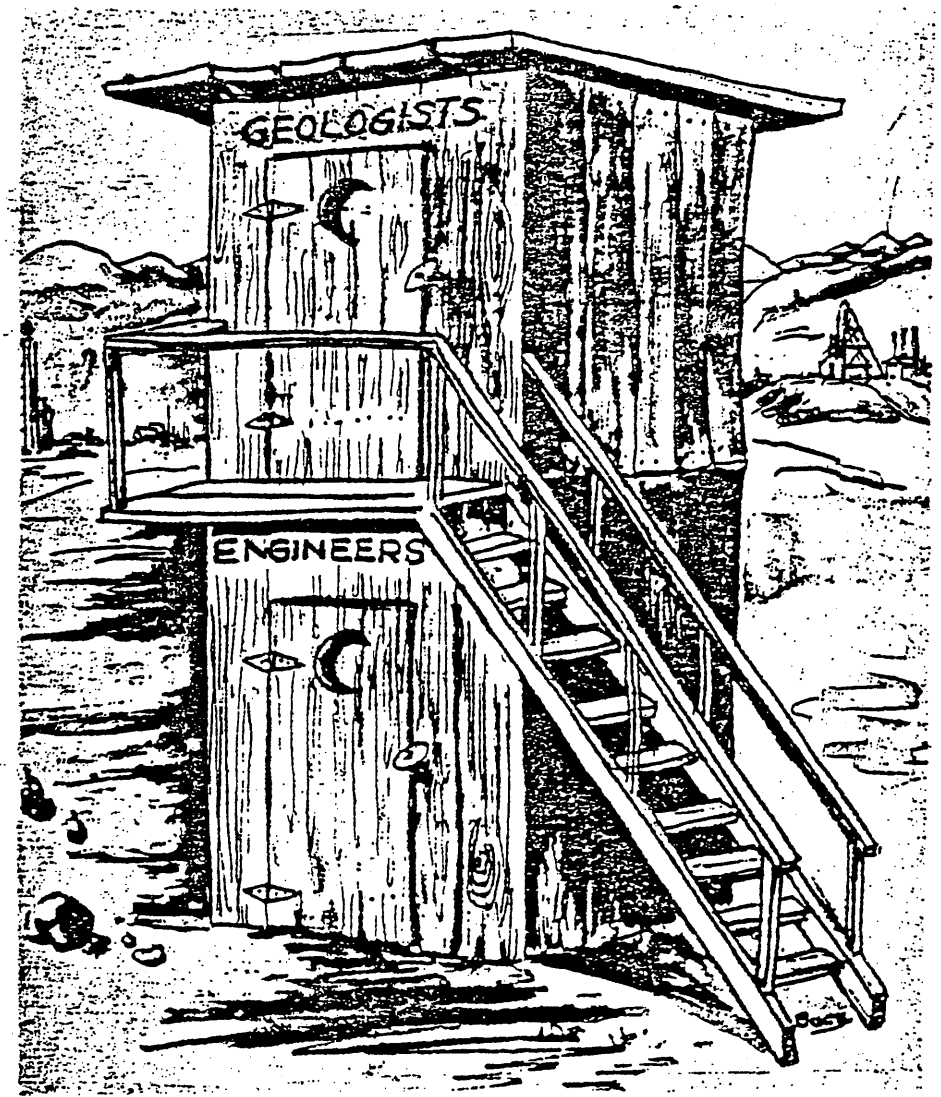
are fully occupied in their senility by avarice, malice, and "image." I state this only for you younger vipers "on the make," for you specialists who are too busy to be wary of your masters' incompetence and "Modern Ethics," and for you younger "good soldiers." Restated, that moral is:

> Piss on the "chain of command" (see Gulliver's Travels)! To hell with it! Drop everything! Take the time! Write it down! Then spread copies "from hell to breakfast"!

The reasons are simple: You are to take damn good care of old Number One, plus the shareholders, too. Neither you nor they can ultimately win by playing with the short-term expediencies of lying, stealing, and forcing. Remember that your crooked, power-mad bosses' short-term follies laid end to end will one day surely require a goat. If you have any trace of conscience, you must maneuver in this manner in order to more precisely preserve and maintain your self-respect, which takes precedence to all else! Finally, remember also:

> The goddamn bosses don't pay you, the shareholders do!

FINIS



ORACLE RIDGE (F) PIMA

Santa Catalina Mining Corp.

1996 Annual Report

SANTA CATALINA MINING CORP.
1996 ANNUAL REPORT
DECEMBER 31, 1996

Report to Shareholders

The Board of Directors is pleased to present this report to shareholders on the activities of the Company during the 1996 fiscal year. The Company is currently involved in two key mineral exploration projects: The Pilar Gold Project and The Murindo Copper/Gold Project.

The Pilar Gold Project

On January 3, 1996 Santa Catalina Mining Corp. announced that it had signed an exploration agreement with an option to purchase claims and concessions known as the Pilar Project in the State of Sonora, Mexico, approximately 145 kilometres southeast of the capital, Hermosillo. The project area encompassed approximately 6,000 acres. Since that time, over 6,000 metres have been drilled, 3,200 metres of trenches have been opened and over 2,300 rock chip samples collected. Today, the Pilar Project encompasses a total of 11,180 acres.

There are several prime gold targets at Pilar: La Guadalupana, Zacatecas, Santa Cruz and Represo Viejo. Most of the work to-date has been conducted at La Guadalupana. This area contains northwest trending shears which carry gold and silver mineralization and there are 6 old gold mines in the area which were exploited on a very small scale at the beginning of the century. The drilling and trenching programs carried out by the Company have outlined several large mineralized bodies.

The best intercepts of the trenching program range from 1.29 grams per tonne gold and 4.20 grams per tonne silver over 9.0 metres, 4.40 grams per tonne gold and 10.20 grams per tonne silver over 13 metres and 52.20 grams per tonne gold and 14.1 grams per tonne silver over 3 metres.

The best intercepts of the drilling program range from 1.06 grams per tonne gold and 6.6 grams per tonne silver over 15.0 metres, 9.64 grams per tonne gold and 7.20 grams per tonne silver over 12 metres and 83.68 grams per tonne gold and 80.1 grams per tonne silver over 10.5 metres. Mineralization extends to a depth of 100 metres and is open below.

At the other prime target areas, an ongoing reconnaissance program is being conducted. The reconnaissance program has included rock and sediment sampling, mapping and interpretation of aerial photography.

The Pilar Project is located in the State of Sonora, Mexico, approximately 145 kilometres southeast of the capital, Hermosillo. The geology of the area is dominated by Cretaceous andesites that intrude Triassic-Jurassic siltstones and sandstones of the Barrancas Formation. The targets are located in a large circular structure, most likely a caldera, within thick volcanic pile. The caldera is crossed by numerous northeast and northwest trending structures.

In order to fully evaluate the potential of the Pilar Project and to expand upon the mineralized bodes outlined so far, the Company will continue its aggressive gold exploration program. The next program will include a minimum of 1,500 metres of reverse circulation drilling. Deep drilling will be concentrated

in the La Guadalupana areas. Trenching, mapping and sampling of the other target areas will continue and will be followed up by drilling.

The Murindo Copper/Gold Project

Santa Catalina Mining Corp. recently signed a letter of intent with Cyprus Amax Minerals Company which gives Santa Catalina the option to earn a 50% interest in 4 concessions covering several gold-rich porphyry copper prospects near the village of Murindo in northwest Colombia. The transaction is subject to signing of a formal agreement and receipt of regulatory approval.

To earn the 50% interest, the Company has to spend a total of U.S. $5,000,000 within 3 years (the "earn-in period"). Santa Catalina will conduct and direct the prospecting, exploration, development and other mining work during the earn-in period. Following the earn-in period, Santa Catalina and Cyprus Amax will jointly manage the project.

The Murindo prospects belong to a well-defined belt of Eocene-Oligocene porphyry coppers which extend along the Western Cordillera of Colombia and into Panama. There are 3 main anomalous areas within the concessions: La Rica, Jarapeto and Taparos. These are major copper geochemical anomalies with associated gold, molybdenum and zinc anomalies. These form a trend of at least 10 kilometres in a north-south direction.

La Rica is a ready to drill prospect with estimated resources of 150 million tons grading 0.9% to 1.0% copper and 0.3 to 0.4 grams per ton gold. The potential resource is 430 million tons. Geophysical surveys suggest that mineralization may extend to a depth of 350 metres and be open below. The copper/gold values appear to be constant over large volumes of rock. The La Rica geochemical anomaly coincides with a well-defined induced polarization and magnetic anomaly that confirms the existence of a body with disseminated sulfides 2,000 metres long by 1,000 metres wide.

The **Jarapeto** anomaly is located 2 kilometres to the north of La Rica covering an area approximately 1 square kilometre with copper grades in soil from 350 to 1,390 ppm and grades in rock from 700 to 15,000 ppm. A gold anomaly of up to 0.11 ppm is also present.

The **Taparos** area located to the north of Jarapeto includes 3 copper anomalies with grades of up to 1,450 ppm in soil and associated gold, molybdenum, zinc and lead anomalies. These anomalies are not completely outlined and are open.

The Andean region of Colombia is formed by the Western, Central and Eastern Cordilleras. The Murindo area lies in the northern part of the Western Cordillera. The basement here is formed by the Cretaceous Canasgordas Group and Santa Cecilia-La Equis Complex which are intruded by the Tertiary Mande Batholith. The granodioritic to gabbroic Mande Batholith extends at least 360 kilometres and varies from 5 to 20 kilometres in width. Five significant porphyry copper prospects are known within the batholith including, from north to south, Rio Pito, Acandi, Murindo, Pantanos-Pegadorcito and Rio Andagueda.

The Murindo concessions straddle the northwest trending western margin of the Mande Batholith. In the project area the intrusive consists of medium to coarse-grained tonalite to quartz diorite which represents the main phase of the batholith. It intrudes an undifferentiated sequence of basalts, gabbros, pyroxenites, serpentinites and diabase.

The Murindo area has the potential to become an important copper/gold producing district. Santa Catalina has the opportunity to participate in the exploration of this area which may contain one or possibly several major gold-rich porphyry copper deposits. Santa Catalina will be in charge of the technical and legal aspects of the project during the next three years and intends to commence an extensive drilling program to define the potential resources of the La Rica prospect and to improve the understanding of the area.

Oracle Ridge Copper Mine

On February 10, 1997 Santa Catalina announced that a letter of intent was signed with Hibernia Silver Mines, Inc. whereby Hibernia would purchase all of the assets, liabilities and rights held by the Oracle Ridge Mining Partnership. The transaction is subject to satisfactory completion of due diligence by Hibernia, signing of a formal agreement and receipt of regulatory approval. The consideration for the purchase of the Oracle Ridge Mining Partnership is U.S. $3,000,000, payable over 2 years, and the issuance of 1,000,000 special shares of Hibernia.

General

On July 26, 1996, Santa Catalina completed a private placement of 4,000,000 units in the capital stock of the Company at a price of Cdn $0.75 per share, for gross proceeds of Cdn $3,000,000. Each unit consisted of 1 common share and one-half of a non-transferable share purchase warrant. Each whole warrant is exercisable over a period of 18 months at a price of Cdn $0.90 per share.

ON BEHALF OF THE BOARD

Lukas H. Lundin
President

April 18, 1997

Santa Catalina Mining Corp.
Suite 1320 - 885 W. Georgia Street
Vancouver, B.C.
V6C 3E8
Ph. (604) 689-7842 Fax. (604) 689-4250

Corporate development and investor relations activities are carried out by company personnel. For additional copies of this annual report and other information, please contact Sophia Shane at the above noted address.

The accompanying consolidated financial statements of Santa Catalina Mining Corp. and its subsidiaries and all information in the annual report are the responsibility of management and have been approved by the Board of Directors. The financial statements necessarily include some amounts that are based on management's best estimates, which have been made using careful judgment.

The financial statements have been prepared by management in accordance with accounting principles generally accepted in Canada. Financial and operating data elsewhere in the annual report are consistent with the information contained in the financial statements.

In fulfilling their responsibilities, management of Santa Catalina Mining Corp. and its subsidiaries have developed and continue to maintain systems of internal accounting controls that are appropriate in the circumstances. Although no cost effective system of internal controls will prevent or detect all errors and irregularities, these systems are designed to provide reasonable assurance that assets are safeguarded from loss or unauthorized use, transactions are properly recorded and the financial records are reliable for preparing the financial statements.

The Board of Directors carries out its responsibility for the financial statements in this annual report principally through its audit committee, comprising management and directors. The audit committee reviews the Company's annual consolidated financial statements and recommends their approval by the Board of Directors. The shareholders' auditors have full access to the audit committee, with or without management being present.

These financial statements have been audited by the shareholders' auditors, Deloitte & Touche, Chartered Accountants, and their report follows.

Lukas H. Lundin
President

Wanda Lee
Controller/Treasurer

Vancouver, British Columbia
March 21, 1997

TO THE SHAREHOLDERS OF SANTA CATALINA MINING CORP.:

We have audited the consolidated balance sheets of Santa Catalina Mining Corp. as at December 31, 1996 and 1995 and the consolidated statements of loss and deficit and cash flow for the years then ended. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with generally accepted auditing standards in Canada. Those standards require that we plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In our opinion, these consolidated financial statements present fairly, in all material respects, the financial position of the Company as at December 31, 1996 and 1995 and the results of its operations and the changes in its financial position for the years then ended in accordance with accounting principles generally accepted in Canada consistently applied.

Deloitte & Touche

Chartered Accountants
Vancouver, British Columbia
March 21, 1997

SANTA CATALINA MINING CORP.
CONSOLIDATED BALANCE SHEETS

	December 31, 1996	December 31, 1995
ASSETS		
Current assets:		
Cash and short-term deposits	$ 234,706	$ 242,593
Accounts receivable	140,281	710,400
	374,987	952,993
Property and related assets held for sale (Note 3)	2,923,801	3,510,582
Other mining properties and related expenditures (Note 4)	1,180,903	85,867
Other assets	56,114	58,789
	$ 4,535,805	$ 4,608,231
LIABILITIES		
Current liabilities:		
Bank indebtedness	$ 992,527	$ 917,613
Accounts payable and accrued charges	1,318,823	3,379,283
	2,311,350	4,296,896
SHAREHOLDERS' EQUITY		
Share capital (Note 5)	22,643,129	18,419,629
Deficit	(20,997,557)	(18,687,829)
Cumulative foreign currency translation adjustments	578,883	579,535
	2,224,455	311,335
	$ 4,535,805	$ 4,608,231

Approved by the Board:

Director

Director

SANTA CATALINA MINING CORP.
CONSOLIDATED STATEMENTS OF LOSS AND DEFICIT

	Year ended December 31, 1996	Year ended December 31, 1995
Revenues:		
Interest	$ 6,297	$ 23,912
Expenses:		
Depreciation and depletion	2,262	13,086
General exploration and project investigation	-	596,444
Interest	57,735	12,949
Audit and legal	26,670	20,184
Capital tax	12,694	8,186
(Gain) loss on foreign exchange	(31,931)	45,691
Management fees	189,729	119,678
Office and general	5,295	26,516
Promotion and public relations	9,530	31,934
Salaries and benefits	23,746	121,744
Stock exchange filing fees	10,258	14,052
Telephone and telefaxes	5,505	5,743
Transfer agent fees and shareholders information	21,392	50,031
Travel	850	34,453
	333,735	1,100,691
Loss before the undernoted items	(327,438)	(1,076,779)
Write-down of abandoned mineral property	-	(125,198)
Severance costs	-	(105,000)
Loss from continuing operations	(327,438)	(1,306,977)
Loss from discontinued operations (Note 3):		
Operating loss	(1,982,290)	(2,512,639)
Write-down of property and mineral interests to estimated net realizable value	-	(6,644,161)
	(1,982,290)	(9,156,800)
Net loss for the year	(2,309,728)	(10,463,777)
Deficit, beginning of year	(18,687,829)	(8,224,052)
Deficit, end of year	$(20,997,557)	$(18,687,829)
Net loss per share:		
Continuing operations	$(0.01)	$(0.04)
Discontinued operations	(0.05)	(0.28)
	$(0.06)	$(0.32)

SANTA CATALINA MINING CORP.
CONSOLIDATED STATEMENTS OF CASH FLOW

	Year ended December 31, 1996	Year ended December 31, 1995
Funds (used in) operations:		
Loss from continuing operations	$ (327,438)	$ (1,306,977)
Add (deduct) non-cash items:		
Write-down of abandoned mineral property	-	125,198
Depreciation and depletion	2,262	13,086
	(325,176)	(1,168,693)
Loss from discontinued operations	(1,982,290)	(9,156,800)
Add (deduct) non-cash items:		
Write-down of property and mineral interests	-	6,644,161
Depreciation and depletion	-	1,233,143
Loss on sale of equipment	199,764	103,817
	(1,782,526)	(1,175,679)
	(2,107,702)	(2,344,372)
Net changes in non-cash working capital items	(1,490,341)	1,066,966
	(3,598,043)	(1,277,406)
Funds provided by financing activities:		
Common shares issued	4,223,500	2,600,391
Bank indebtedness	74,914	917,613
Cumulative foreign currency translation adjustments	(652)	(206,952)
	4,297,762	3,311,052
Funds (used in) investing activities:		
Property and related assets held for sale	122,764	(2,803,892)
Other mining properties and related expenditures	(1,095,036)	(85,867)
Proceeds from sale of equipment	264,666	51,745
Other assets	-	(7,298)
	(707,606)	(2,845,312)
Decrease in cash and short-term deposits	(7,887)	(811,666)
Cash and short-term deposits:		
Beginning of year	242,593	1,054,259
End of year	$ 234,706	$ 242,593

SANTA CATALINA MINING CORP.
NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS
December 31, 1996 and 1995

1. DESCRIPTION OF BUSINESS AND CONTINUANCE OF OPERATIONS

Effective November 1, 1994, Southern Copper Corp. (the "Company") completed a Plan of Arrangement (the "Arrangement") involving the separation of the core businesses of the Company into two separate publicly traded companies involved in each of diamond exploration and base metal mining and exploration. Consequently, the Company's diamond assets were spun off into South Atlantic Diamonds Corp., a newly incorporated public company, while the Company's copper and base metals assets remained in the Company which was renamed Santa Catalina Mining Corp.

The Company, through its wholly owned subsidiary, Union Copper Inc. ("Union"), holds a 70% partnership interest in the Oracle Ridge Mining Partners (the "Partnership"). The initial interest was acquired effective April 26, 1989 upon the purchase by the Company of all the issued and outstanding shares of Union.

The Partnership has an underground copper mine near Tucson, Arizona which commenced commercial production in 1991. In February 1996, the mine was shut down (Note 3).

The recoverability of the carrying values of property and related assets held for sale (Note 3) is dependent primarily on the ability of the Company to sell these assets for amounts in excess of their carrying values, failing which there would be doubt as to the Company's ability to continue to operate in the normal course of business.

2. SIGNIFICANT ACCOUNTING POLICIES

These consolidated financial statements have been prepared in accordance with accounting principles generally accepted in Canada which require management to make assumptions and estimates that affect the reported amounts and other disclosures in these consolidated financial statements. Actual results may differ from those estimates.

The significant accounting policies used in these consolidated financial statements are as follows:

(a) Basis of consolidation

The consolidated financial statements include the accounts of the Company, its wholly-owned subsidiaries: Union, Santa Catalina (Bermuda) I Ltd., Santa Catalina (Bermuda) II Ltd., and Minera Santa Catalina, S.A. de C.V., and Union's proportionate interest in the Partnership.

(b) Foreign currency translation

Monetary items denominated in a foreign currency are translated into Canadian dollars at the exchange rate prevailing on the balance sheet date. Exchange gains and losses arising from translation are charged to operations.

Integrated foreign operations are translated into Canadian dollars as follows: monetary assets and liabilities are translated at the exchange rate prevailing on the balance sheet date; non-monetary assets and liabilities, revenues and expenses are translated at exchange rates prevailing on the dates of transactions. Exchange gains and losses arising from translation are charged to operations.

Self-sustaining foreign operations are translated as follows: assets and liabilities are translated at the exchange rate prevailing on the balance sheet date; revenues and expenses are translated at exchange rates prevailing on the dates of transactions. Exchange gains and losses arising from translation are deferred and shown as a separate component of shareholders' equity.

(c) Mining properties and related expenditures

The Company carries its mining properties at cost less accumulated depletion. The Company also capitalizes exploration and development costs, including interest and a portion of technical and administrative expenditures, which are related to specific projects until the commercial feasibility of the projects are determinable. The costs of each property and related expenditures are amortized over the economic life of the property on a units-of-production basis. Costs are charged to operations when a property is abandoned or when impairment in value that is other than temporary has been determined.

General exploration costs are charged to operations as incurred.

The recoverability of the amounts shown for other mining properties and related expenditures is dependent on the confirmation of economically recoverable reserves, the ability of the Company to obtain the necessary financing to successfully complete their development and upon future profitable operations.

(d) Property, plant and equipment

Property, plant and equipment are carried at cost less accumulated depreciation. Depreciation is provided on the straight-line basis over the estimated useful lives of the assets. The annual rates of depreciation are as follows:

Buildings	6.7%
Plant and mine equipment	12.5%
Office furniture and equipment	12.5% to 20.0%
Company vehicles	20.0%

Provision is made for any impairment in value which is other than temporary.

(e) Revenue recognition

Revenue is recognized when product is delivered in satisfaction of sales agreements and title passes to the buyer. Final revenue amounts are adjusted based on the results of final assays of the copper concentrate approximately 60 to 90 days after shipment.

(f) Comparative figures

Certain of the comparative figures have been reclassified to conform with the classifications used in the current year.

3. PROPERTY AND RELATED ASSETS HELD FOR SALE

	Net Book Value	
	December 31, 1996	December 31, 1995
Mineral properties and related exploration and development expenditures	$ 5,079,216	$ 5,081,751
Plant and mine equipment	3,851,558	4,423,870
Building, office furniture and equipment	130,260	138,540
Company vehicles	1,360	-
Other	505,568	510,582
	9,567,962	10,154,743
Write-down to estimated net realizable value	(6,644,161)	(6,644,161)
	$ 2,923,801	$ 3,510,582

In early 1996, the Partnership decided to sell the copper mine in Arizona. In February, 1996 the mine was shut down until a sale can be consummated. Accordingly, at December 31, 1995 Union's proportionate interest in the property and related assets held for sale has been written down to reflect the Company's best estimate of the net realizable value to the Company of those assets. In these circumstances, the actual amounts ultimately realized on the sale of those assets could differ from this estimate and the difference could be material (Note 11(a)). In addition, the Partnership is expected to continue to incur losses to the date of sale of the Company's interest therein. However, since the date of sale is currently not determinable, it is not possible to estimate the Company's share of the losses being incurred by the Partnership to that date.

During the years ended December 31, 1996 and 1995, the Company's share of the Partnership's sales of concentrate was $368,992 and $6,617,643, respectively. Also, accounts payable and accrued liabilities include $981,721 relating to the Partnership.

4. OTHER MINING PROPERTIES AND RELATED EXPENDITURES

	Year ended December 31, 1996	Year ended December 31, 1995
Pilar Project:		
Option payments and taxes	$ 159,720	$ -
Staking, license fees and permits	3,269	23
Assays and analysis	114,397	3,034
Camp supplies	2,209	-
Drilling	493,617	-
Equipment and vehicle rentals	57,168	3,691
Geological consulting fees	211,639	61,815
Maps and photos	5,422	251
Research	4,152	73
Travel and related costs	9,767	6,783
General office expenses	18,019	2,846
Accounting and legal	15,657	7,351
Incurred during the year	1,095,036	85,867
Balance, beginning of the year	85,867	-
Balance, end of the year	$ 1,180,903	$ 85,867

(a) The Company, through its subsidiary, Minera Santa Catalina, S.A. de C.V., entered into an option agreement dated December 21, 1995 to purchase a 100% interest in certain claims and concessions known as the Pilar Project, comprising of approximately 2,431 hectares (6,000 acres), located in the state of Sonora, Mexico. The term of the agreement is three years. The total purchase price of U.S. $1.7 million is payable as to U.S. $260,000 over a period of 2½ years with a final payment of U.S. $1.44 million payable at the end of the third year.

(b) In July, 1995, the Company, through its subsidiary Union, entered into an agreement with a corporation (the "Optionor"), two directors of which are also directors of the Company, whereby the Company was granted an option to acquire up to a 75% interest in the DSA claims located in Idaho by the expenditure of U.S. $2,000,000 over three years. Subsequently, the Company decided not to proceed further with the project and charged all expenditures incurred of U.S. $292,722 (Cdn $401,732) to operations.

Included in accounts payable at December 31, 1996 is an amount due to the Optionor of U.S. $75,700 (Cdn $103,679) for expenditures on the project.

5. SHARE CAPITAL

The authorized and issued share capital is as follows:

Authorized - Unlimited number of common shares with no par value

Issued:	Number of Shares	Amount
Balance, December 31, 1994	30,522,863	$ 15,819,238
Stock options exercised	2,286,000	1,109,070
Warrants exercised	2,532,450	1,491,321
Balance, December 31, 1995	35,341,313	$ 18,419,629
Stock options exercised	100,000	68,500
Warrants exercised	1,500,000	1,305,000
Private placement (net of issue costs) (i)	4,000,000	2,850,000
Balance, December 31, 1996	40,941,313	$22,643,129

(i) On May 16, 1996 the Company arranged a private placement of 4,000,000 units at $0.75 per unit, for gross proceeds of $3,000,000. Each unit consisted of one common share and one-half of one non-transferable share purchase warrant. Each whole warrant will be exercisable over a period of 18 months at $0.90 per share. A commission of $150,000 was paid to the Agents.

(a) Incentive stock options outstanding at December 31, 1996 and held by directors, officers and employees of the Company, are as follows:

Number of Shares	Exercise Price per Share	Expiry Date
25,000	$0.66	February 27, 1997
310,000	$0.71	July 12, 1997
1,400,000	$0.75	August 29, 1997
50,000	$0.40	January 14, 1998
100,000	$0.80	April 30, 1998
210,000	$0.60	July 9, 1998
35,000	$0.60	October 22, 1998
2,130,000		

(b) Warrants outstanding at December 31, 1996 are as follows:

Number of Shares	Exercise Price per Share	Expiry Date
2,000,000	$0.90	November 15, 1997

Each warrant entitles the holder to purchase one common share.

6. INCOME TAXES

At December 31, 1996, the Company had accumulated non-capital losses for Canadian income tax purposes of approximately $2,345,000 which expire as follows:

1997	405,000
1998	140,000
1999	207,000
2000	684,000
2001	111,000
2002	484,000
2003	314,000

At December 31, 1996, Union had accumulated operating losses for U.S. tax purposes of approximately U.S. $13,000,000 which expire at various times between 2004 and 2011. As a result of the Company's acquisition of Union in 1989, U.S. income tax laws have imposed limitations on approximately U.S. $1,000,000 of this amount, which may be utilized to a maximum of approximately U.S. $50,000 per year.

Union, through its interest in the Partnership, has deferred development costs in excess of the carrying value of its mineral interests, which have not yet been deducted for U.S. tax purposes. The precise amount of these deferred development costs attributable to Union has not yet been determined.

No recognition of the future potential tax savings associated with these items has been made in these consolidated financial statements.

7. COMMITMENT

Under an arrangement with the State of Arizona, the Partnership has provided a U.S. $45,000 bond and also pays the State a further U.S. $0.05 for each ton of ore mined up to a total of U.S. $99,000 to be used for reclamation. Management of the Partnership believes that the amounts required under this agreement will be sufficient to pay for all reclamation costs.

8. CONTINGENT LIABILITIES

As a partner, the Company's subsidiary, Union, is contingently liable for the other partner's share of the Partnership's liabilities, which approximated U.S.$907,000 at December 31, 1996.

9. RELATED PARTY TRANSACTIONS

(a) During the year ended December 31, 1996, the Company incurred management and administrative services fees of $189,729 (December 31, 1995 - $101,678) payable to the Chairman's office and a corporation owned by the President of the Company. Included in year-end accounts payable are amounts owing to these related parties of $312,051 (1995 - $352,361).

The Company is related to certain other companies through common directors and management. Included in year-end accounts receivable are amounts owing by these related companies of $912 (1995 - $32,033).

(b) Additional related party transactions have been disclosed in Notes 4 and 5.

10. FINANCIAL INSTRUMENTS

The fair value of the Company's cash and short-term deposits, accounts receivable, bank indebtedness and accounts payable and accrued charges at December 31, 1996 and 1995 is estimated to approximate their carrying values due to the immediate or short-term maturity of these financial instruments.

11. SUBSEQUENT EVENTS

Subsequent to year end, the Company:

(a) Signed a letter of intent with Hibernia Silver Mines, Inc. ("Hibernia") for the sale of all the assets, liabilities and rights (collectively the "Partnership Assets") held by the Oracle Ridge Mining Partnership (the "Partnership"). In consideration for the purchase of the Partnership Assets, Hibernia is to pay to the Partnership U.S. $3,000,000 cash, payable over a period of 2 years, and issue 1,000,000 special shares of Hibernia ("Hibernia Shares"). The Hibernia Shares are to be issued on the earlier of the completion of Hibernia's financing or October 1, 1997 and will be convertible into common shares of Hibernia on the completion of a feasibility study demonstrating the positive economics of the Oracle Ridge Mine. In the event Hibernia fails to make any of the cash payments within 30 days of the due date, the Partnership shall have the option to terminate the arrangement and Hibernia will forfeit any previous cash payments made and will cease to earn an interest in the Partnership Assets. The transaction is subject to satisfactory completion of due diligence by Hibernia's lenders, signing of a formal agreement, and approval by the Board of Directors of all parties involved. This transaction is further subject to receipt of all required shareholder and regulatory approvals and arrangement of Hibernia's financing.

(b) Signed a letter of intent with Cyprus Amax Minerals Company whereby the Company will have the right to earn a 50% interest in four concessions which cover a major copper-gold porphyry system in the Murindo area of Northwest Colombia. In order to earn a 50% interest, the Company is required to spend a cumulative total of not less than U.S. $5,000,000 within three years. The Company is to be the operator during the earn-in period. The transaction is subject to the signing of a formal agreement and receipt of regulatory approval.

SANTA CATALINA MINING CORP.
CORPORATE DIRECTORY
December 31, 1996

OFFICERS
Adolf H. Lundin,
Chairman
Lukas H. Lundin,
President
Jean R. Florendo,
Corporate Secretary
Wanda Lee,
Controller/Treasurer

DIRECTORS
Adolf H. Lundin
* William A. Rand
* Brian D. Edgar
* Lukas H. Lundin
Pierre Besuchet

* Audit Committee

SENIOR PERSONNEL
Rene Tourigny
General Manager, Oracle Ridge Mine

AUDITORS
Deloitte & Touche
Vancouver, British Columbia, Canada

BANKERS
Canadian Imperial Bank of Commerce
Vancouver, British Columbia, Canada

Cantrade, Ormond, Burrus, Banque Privée S.A.
Geneva, Switzerland

SUBSIDIARIES
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Santa Catalina (Bermuda) I Ltd.
Santa Catalina (Bermuda) II Ltd.
Minera Santa Catalina, S.A. de C.V.

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SOLICITORS
Campney & Murphy
Vancouver, British Columbia
Canada

SHARE CAPITAL
Authorized: Unlimited number of common shares
Issued and Outstanding: 40,941,313 shares

REGISTRAR AND TRANSFER AGENT
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510 Burrard Street
Vancouver, British Columbia
Canada V6C 3E8

SHARE LISTINGS
Vancouver Stock Exchange
Santa Catalina Mining Corp. (SLM)