

SUNSHINE MINING COMPANY

Memorandum for: G. L. Ojala Date 2-2-84

Regards: Amoco Minerals Company - Little North
Sanitiam Cu-Au-Ag breccia Pipe.

Reserves	MM Tons	Cu %	Ag oz ₂	Au oz ₂
	5	2.9%	.5	.027
	1.7	3.9%	.9	.06
	1	4.2%	1.1	.11

400' dia x 700' deep host rock Andesites

Amoco wants a buy out or retained interest say (10%).

Contact Mr. Herman Bauer P.O. Box 3299

Vice President Exploration Englewood, Colorado

Amoco Minerals Company 80155

+ Northumberland

NOTES

Ruth Mining Claims + Morningstar Mining Claims

Shiny Rock Mining Corporation

1) Record Owner: Shiny Rock Mining Corporation a subsidiary of Persis Corporation

2) The Santiam No. 1 and Mandalay claims are leased to Amoco Minerals a subsidiary of Standard Oil of Indiana

3) In 1977 Freeport Mineral Company had a lease on the entire property. When their lease terminated Amoco Minerals took up their current lease and at times rent a portion of the Hewitt and Poor Boy mill sites.

4) Lest ~~er~~ Mining District

5) The 3 mill sites and Ruth No. 4 are presently being developed and operated in accordance with USFS approved operating plan March 4, 1977. Ruth No. 1, Ruth No. 2, and Morning Star claims were clear-titled by USFS under the 1955 Surface Rights Act and not subject to the operating plan.

6) Ruth No. 1+2 have been developed as a single mine. Thus are reserve on three levels

7) Ruth No 4 - adit 52' long

Ruth # 142

8.7%	Zn	.45	72.00
3.7%	Pb	.35	21.00
.5%	Cu	.75	7.50
.033 oz	Au	400.00	13.20
1.4 oz	Ag	8.00	11.20
			<u>125.90</u>

Ruth # 4

1.3%	Zn	.45	11.70
1.27%	Pb	.35	8.96
1.63%	Cu	.75	25.20
.038	Au	400.00	15.20
2.67	Ag	8.00	21.36
			<u>82.42</u>

Morning Star

9.35%	Zn	.45	84.15
2.5%	Pb	.35	17.50
.68%	Cu	.75	10.20
1.54 oz	Ag	8.00	12.32
			<u>127.17</u>

- 8) Morning Star 500 ft drift same ore in caved slope
- 9) Fire part Minerals drilled two holes, for a total of 4000'
- 10) Starvation mill site has small ore reduction plant, portable saw mill etc.
- 11) Mill tailings are trucked back to the mine for fill (plan to do)
- 12) Average grade for Ruth No 1 & 2 mine 8% Zn, 3% Lead, .5% Cu, .033 oz Au, and 1.4 oz Ag per ton. Ore reserves range from a low of 183,000 tons probable and 100,000 tons possible to 196,000 tons prob. and 146,000 tons poss.
- 13) Ruth No. 4 : Grade of ore 1.3% Zn, 1.28% Pb, 1.68% Cu, .038 oz Au and 2.67 oz Ag over 5', no ore reserves developed
- 14) Morning Star average grade is 9.35% Zn, 2.5% Pb, 0.68% Cu, 1.54 oz Ag and tr Au. Pass one Reserve 500,000 tons. Realistic 50,000 tons
- 15) Total Probable ore reserves could be 200,000 tons for the Ruth No 1 & 2, Ruth N4, and Morning Star

16) Tailings + Waste water from mill may be a serious problem

17) Average vein width 7' and better

18) Average mining cost / ton	\$21.69
" milling " "	15.05
Fixed overhead " "	4.50
Contingency Fee 7%	<u>3.00</u>
	\$44.24

19) Average grade for Ruth #1+2 as of Dec 19 1981 prices
\$125.90 / ton Probable Reserves 200,000 tons

20) Average grade for Ruth #4 \$82.42/ton no known reserves

21) Average grade for Morning Star \$127.17/ton
Probable Reserves 500,000 tons

22) The Starvation mill site supports the reduction plant. Based on a 24 hr day the plant has a crushing capacity of 150 tons and a concentrating capacity of 25 tons

	Zn lbs/Ton Recovery 100% / Ton	Pb lbs/Ton	Cu lbs/Ton	Au oz/Ton	Ag oz/Ton	Smelter Chg
Zinc lbs / Ton	160	135.0	@.45	60.75	25%	45.56
Lead lbs / Ton	60	50.8	@.35	17.78	35%	11.56
Cu lbs / Ton	10	7.7	@.75	5.78	25%	4.34
Au oz / Ton	.033	.027	@400.00	10.80		10.80
Ag oz / Ton	<u>1.4</u>	<u>1.4</u>	@8.00	<u>11.20</u>		<u>11.20</u>
				<u>\$106.31</u>	value / ton mill recovery	83.46
				<u>83.46</u>	value / ton after smelter chg	
Mill Recovery	Zn 84.4%	Pb 84.6%	Cu 77.0%	Au 83.2%	Ag 100%	

Net value after all smelter chg. \$83.46 / ton ore

- Ave. mining cost \$21.69
- " milling " 15.05
- overhead 4.50
- Contingency Fee 3.00

\$44.24

Net profit before taxes & royalties \$39.22 / ton ore
 & transportation charges of concentrates to the smelter.

200,000 tons probable ore @ 39.22 = \$7,844,000
 1/3 to owner for royalty 2,614,667
 2/3 to operator 5,229,333

Mine life @ 200 tons / day is +4 years

To ship ore by rail \$27/ton for 600 miles
 To build bear bases mill \$2000/ton/day = \$400,000
 Smelter shipping chg to Bunker Hill equal \$4.62/ton ore
 Mill, new cost \$2.00/ton ore

Cost before concentrate transportation charges	44.24
Cost of building new mill	2.00
Cost of transporting concentrate	4.62
Cost of power water, rent of infrastructure	<u>3.00</u>
Total expense/ton	53.86
Net Smelter/ton	83.46
Net profit/t	29.60
Net profit	5,920,000
Owner	1,973,333
Operator	3,946,667

SCHEDULE 4

FIXED OVERHEAD COSTS ATTRIBUTABLE
TO MINING OPERATION
(EXCLUDING MINE & MILL)

Per Annum
(Total Property)

Office & Administration

Salaries	\$ 57,000.00
Payroll Burden	22,800.00

General Expenses

Supplies	4,500.00
Postage	300.00
Outside Services	11,000.00
Travel	3,600.00
Convention & Conference	3,000.00
Dues	300.00
Subscriptions	100.00
Repair & Maintenance	4,000.00
Dental Insurance	900.00
Medical Insurance	2,000.00
SAIR	2,000.00
Utilities	900.00
Telephone	900.00
Toll Calls	1,500.00
Property Tax	5,000.00
Dep.	10,000.00
Amortization	1,000.00
Interest	16,000.00
Insurance	8,000.00
Internal Charges	5,000.00
Audit	4,000.00
Legal	<u>12,000.00</u>

TOTAL \$175,800.00

Annual Production 39,000 tons

FIXED OVERHEAD COSTS PER TON: \$4.50

SCHEDULE 3

MILLING COSTS
150 TONS PER DAY

	<u>Per Ton</u>
<u>Coarse Crushing</u>	
Labor	\$ 3.25
Power	.30
Depreciation	.90
Repair & Maintenance	1.30
Water	.05
<u>Grinding, Flotation, Filtration, Drying</u>	
<u>Bagging & Tailing Disposal</u>	
Labor	2.75
Power	.15
Depreciation	.50
Repair & Maintenance	1.00
Water	.10
Reagents	2.00
Assays	1.25
Tail Disposal	<u>1.50</u>
	\$15.05

SCHEDULE 2
 UNDERGROUND MINING COSTS
 NORTH SANTIAM DISTRICT

<u>Mining</u> <u>Fix-Operating</u>	<u>Per Set</u> <u>(8x8x8)</u>	<u>Per Ton</u> <u>(40 T Per Set)⁴</u>
<u>Timber</u>		
Logging Per MbF	\$ 40.00	
Sawmilling	50.00	
Transportation	10.00	
Setting	<u>75.00</u>	
Cost per Set/per Ton ¹	175.00	\$ 4.38
<u>Drilling</u>		
Drills	15.00	
Bit & Steel ²	10.00	
Air	4.00	
Labor	<u>100.00</u>	
	129.00	3.23
<u>Blasting</u>		
Wire & Dentonators	8.00	
Explosive - Caps ³	85.00	
Labor	<u>75.00</u>	
	168.00	4.20
<u>Mucking</u>		
Mucker	18.00	
(includes Dep, Repair, Main, Air, Oil)		
Labor	<u>75.00</u>	
	93.00	2.33
<u>Tramming</u>		
Trammer & Cars (see Mucker)	12.00	
Track (Rail, Ties, Plates, etc.)	40.00	
Charging & Batt	15.00	
Labor	<u>65.00</u>	
	132.00	3.30
<u>Transportation</u>		
Labor (Loader, Ramps, etc.)	30.00	
Trucking	75.00	
Labor	<u>65.00</u>	
	<u>175.00</u>	<u>4.25</u>
TOTAL	\$867.00	\$21.69 Per Ton

- NOTES: 1. 1000bF Per 8' Set
 2. Atlas Copco
 3. Timber Supply (Tovex - Ammonium Nitrate)
 4. 12.8 cu ft. per ton, 512 cu. ft. per set, or 40 tons (T)

SCHEDULE 1
SMELTER RETURNS

	Au	Ag	Pb	Zn	Cu	Transportation	Deductions	N.S.R. Con.	Ruth 1, 2, 4 Morning Star Con. Ratio	Santiam 1 Mandalay Con. Ratio	N.S.R. Head	Morning Star Ruth 1, 2, 4 Total	Santiam 1 Mandalay Total
rate	.11	21.2	49.6%	2.7%	2.6%								
st	49.51	314.58	310.38		17.92	(31.50)	(47.50)	613.39	21 x 1		29.20		
rate	.11	2.7	2.7%	68.5%	1.4%								
st	48.45	22.29		408.67	15.12	(28.46)	(75.50)	390.57	8 x 1		48.82	78.02	
rate	.07	7			23%								
st	27.22	92.01			330.87	(18.60)	(85.00)	346.50		2.5 x 1	138.60		138.60

Schedule
Open
Au .11 - .02 = .09 x 92.5% = .08 x 594.81 = \$49.51
Ag 21.2 - 1 = 20.2 x 95% = 19.19 x 16.393 = \$314.58
Pb 49.6% - 1.5% = 48.1% x 95% = 45.69% x 2000# = 913.8 x (.38966 - .05) = \$310.38
Cu 2.6% - 1.3% = 1.3% x 97.5% = 1.26% x 2000# = 25.2 x (.89127 - .18) = \$17.92
Zn Not Paid For

Schedule
Open
Au .07 - .02 = .05 x 92.5% = .046 x (594.81 - 4) = \$27.22
Ag 7 - 1 = 6 x 95% = 5.7 x (16.393 - .25) = \$92.01
Cu 23% - 1% = 22% x 97.5% = 21.45% x 2000# = 429 x (.89127 - .12) = \$330.87

Schedule
Mill Open
Au .11 - 20% = .08 x \$594.81 = 52.34 x 92.57% = \$48.45
Ag 2.7 - 1 = 1.7 x \$16.393 = 22.87 x 80% = \$22.29
Pb 2.7% - 4% Not Paid For
Cu 1.4% x 65% = .91% x 2000# = 18.2 x (.89127 - .06) = \$15.12
Zn 68.5% x 85% = 58.22% x 2000# = 1164.40 x .4059 = 472.62 - 63.95 = \$408.67

1) Engineering & Mining Journal, Vol. 182, No. 1
Quotas 12/80 From

Metals Week and Handy & Harmon: Au:594.814; Ag:16.3933; Pb:.38966; Zn:.40590; Cu:.89127

2) Transportation Rates Published Lyons to East Helena, MT, Lyons to Kellogg-Warner ID, Lyons to Tacoma, WA NPCFB Tariff 39A Supplement 38

3) Smelter Schedules per ASARCO - Pb, ASARCO - Cu, Bunker Hill - Zn, COMINCO - Pb, Zn Phillip Bros. (Hans Gusenhauer) New York, NY, Bureau of Mines Circular 8206

4) Concentrate Ratio and Recoverys Per Denver Equipment Ore Testing Division 3/52, and Shiny Rock Mining Corp. Daily Mill Operating Reports and Assays, 1977

COSTS AND REVENUES
ORE VALUES

a 2

DALAY TIAM NO. 1	Au	Ag	Pb	Zn	Fe	Cu	Insol	Sulpher	Specific Gravity	Gross Value	Transport Penalty Deductions	Concen. Ratio	Per Ton Net Value
Average Price 12/80	594.81	16.39				.89127							
Average Run Average Grade	.03	3				10%			3.34				
Ass Value	17.82	49.17				178.25				245.24 x 90% Recovery = \$232.97			
Concentrate	*				*								
Average Grade	.07	7				23%							
Value	41.63	114.73				409.98				566.34			
P.R. (Schedule 1)	27.22	92.01				330.87				450.10	(103.60)	2.5 x 1	138.60
Storage Costs													
Milling (Schedule 2)													(21.69)
Charge to Concentrator)													
Milling (Schedule 3)													(15.05)
Overhead (Schedule 4)													(4.50)
Contingency Fee 7%													(3.00)
Total Cost Per Ton													<u>(41.24)</u>
Net Profit Before Tax Per Ton													\$97.36

Notes: Based On 1) 150 T Flotation Mill, 24 hr. day and sufficient Ore to Maintain Level of Production
2) Actual Costs During 1977 Mine and Milling (Company Records) Adjusted to 1981 Dollars

COSTS AND REVENUES

ORE VALUES

Page 1

Morning Star Ruth 1, 2, 4	Au	Ag	Pb	Zn	Fe	Cu	Insol	Sulpher	Specific Gravity	Gross Value	Transport Penalties Deductions	Concen. Ratio	Per Ton Net Value
Average Price 12/80	594.81	16.39	.38966	.4059	.736	.89127		1.10	2.8				
Mine Run Average Grade	.033	1.404	3%	8%	6.6%	.2%	60.36	6.92					
Gross Value	19.60	23.01	23.37	64.94		3.56							134.48 x 90% Recovery = \$121.03
Pb Concentrate (Schedule 1)													
Average Grade	.11	21.2	49.6%	2.7%	7.8%	2.6%	3.44						
Value	65.42	347.53	386.54	21.91		46.34				867.74			
N.S.R.	49.51	314.58	310.38			17.92				692.39	(79.00)	21 x 1	29.20
Zn Concentrate (Schedule 1)													
Average Grade	.11	2.7	2.7%	68.5%	8.3%	1.4%	2.56						
Value	65.42	44.26	21.04	552.02		24.95							
N.S.R.	48.45	22.29		408.67		15.12				494.53	(103.96)	8 x 1	48.82
Combined N.S.R. (Schedule 1)													78.02
Average Costs													
Mining (Schedule 2)													(21.69)
(Mine to Concentrator)													
Milling (Schedule 3)													(15.05)
Overhead (Schedule 4)													(4.50)
Contingency For 7%													(3.00)
Total Cost Per Ton													<u>(44.24)</u>
Net Profit Before Tax Per Ton													33.78
Annual Profit 39,000 Tons													1,317,420.00
Ruth 1, 2, 4 Bureau of Mines Proved Reserve 200,000; Morning Star, Estimate 50,000													250,000 x 33.78 Net Value - Ruth 1, 2, 4; Morning Star
													\$8,445,000.00

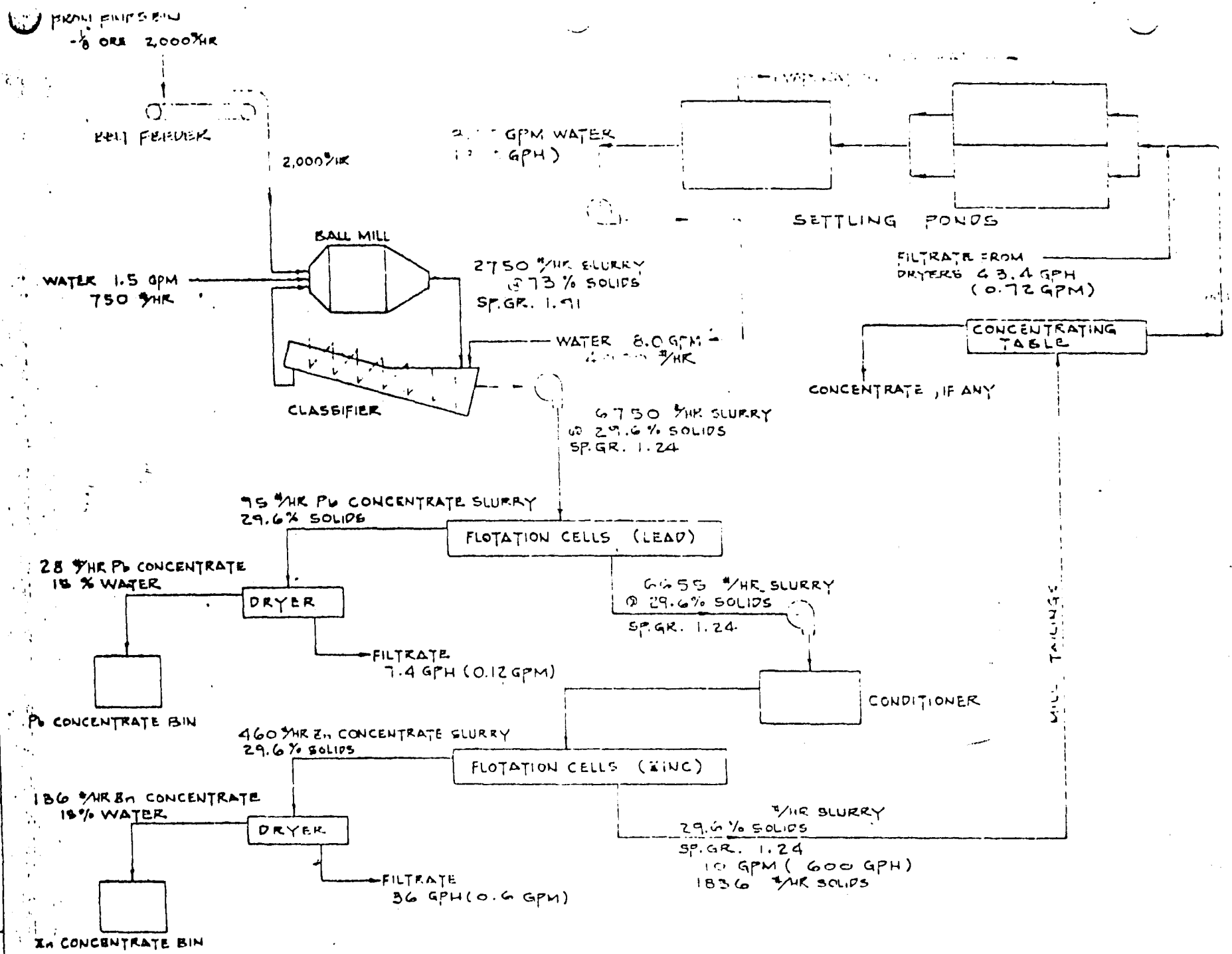
Note: Based on 1) 150 T capacity, 24 hr. day
 2) Actual Costs During 1977 & Mill Operation (Company Records) Adjusted to 1981 Dollars.

LEAD-ZINC FLOTATION FLOWSHEET
SHINY ROCK MINING CORP.

STORCH CORPORATION
FLOWSHEET NO. 12 P.P.S. 5-11-50

Drawn M.Y.
Checked
Job No. 0231

P 5-2



BASIC LEAD-ZINC FLOTATION FLOWSHEET
SHINY ROCK MINING CORPORATION

STARVATION
PATENT EXPENDITURES
STARVATION MILLSITE

ORE MILL

1.	Coarse ore bin	
2.	Buzz screen feeder	
3.	4' flume	
4.	60' conveyor	
5.	9 x 28' jaw crusher	
6.	Grizzly	
7.	60' conveyor	
8.	4 x 8 1/4" shaker screen	
9.	30" rolls crusher	
10.	60' conveyor	
11.	Fine ore bin	
12.	60' conveyor	
13.	3 x 4 ball mill	
14.	Cyanide feeder	
15.	Classifier	
16.	Slurry pump	
17.	Conditioner	
18.	Reagent feeder (2)	
19.	Flotation cells pb.	
20.	Conditioner	
21.	Flotation cells 2n	
22.	Concentrating table	
23.	Pan filters (4)	
24.	Bins	
25.	Settling pond	
26.	150 KW Murphy Generator set	
27.	Generator shed	
28.	Electrical controls & boxes	
29.	Wood furnace	
30.	Fine ore pond	
	Subtotal	\$50,516.26
	Mill Building	3,436.85
	Saw Mill Mobile Dimension Saw	<u>4,295.00</u>
	TOTAL	\$58,248.11

NATIONAL ZINC CONCENTRATE ASSAYS
 AS QUOTED BY PHILLIP BROS.
 1978, 1981.

ZINC CONCENTRATE

Lead Concentrate

zn	55.4%	Sn > 0.01
Pb	2.0%	Ge > 0.0001
Ca	0.25%	Se 0.001
Cu	1.2%	
Au	-	
Ag	1.8 oz.	
Fe	3.8%	
S	31.41%	
As	0.01%	
Sb	0.016%	
Bi	0.016%	
Co	> 0.07%	
Ni	> 0.001%	
Mg	0.17%	
Ca	0.26%	
Mn	0.18%	
Insol	3.75%	
Si	3.28%	
Al	0.01%	
F	0.006%	
Te	0.003%	
Hg	0.001%	

Pb	51.7%
Au	0.972 oz.
Ag	22.25 oz.
Zn	10.5%
Cu	1.88%
Bi	0.12%
S	18.05%
As	0.015%
A	0.01%

Smelter charges may represent
 25% the value contained in
 35% " " " Pb
 25% " " " Zn

Combined Pb + Zn Sm. Recoveries before smelting

Au - 83.2%
 Ag - 100.0%
 Pb - 84.6%
 Cu - 74.1%
 Zn - 84.4%

it is light green. One of the ore shoots of the Amalgamated mine is unusual in having a gangue of minute epidote needles and calcite. Specularite occurs only in the Mineral Harbor and Silver Star veins in contact rock and is not nearly so abundant as in the Bohemia district. Ankerite and adularia occur at the Ogle Mountain mine. As the veins are mostly down in the valleys, erosion has nearly kept pace with weathering and oxidation. No weathered zones comparable with those in the Bohemia district were seen. Oxidation was probably deepest at the Ogle Mountain mine, but its exact depth is not known to the writers.

Though at least three of the usual sulphides are common to almost all the veins, the variations in their proportions are sufficient to suggest a classification of the veins. Complex sulphide veins characterized by sphalerite as the dominant sulphide, with variable proportions of galena, chalcopyrite, and pyrite, include the Amalgamated, Blende Oro, Capital, Mineral Harbor, Silver King, Wolz, and the vein on the mountain side northeast of the mouth of Gold Creek. Veins characterized by pyrite as the principal sulphide include those at the Gold Creek M. & M. tunnels and the Santiam group of tunnels on Gold Creek. The Bimetallic vein is transitional between the pyritic type of the Gold Creek M. & M. and the complex sulphide type of the Blende Oro. Chalcopyrite is the dominant sulphide in the Minnie E. vein of the Santiam group and the Crown veins, as well as in the Black Eagle and Silver Star. In the Silver Star vein early epidote and specularite are traversed by quartz containing both sphalerite and chalcopyrite, but the chalcopyrite has also invaded the epidote. Oxidation and leaching of chalcopyrite veins in the Black Eagle and Crown has produced a little chrysocolla, malachite, and azurite. Carbonate veins include the calcite vein on Elkhorn Creek and the Ogle Mountain vein, which also contains sparse sulphides.

In general, the veins in the North Santiam district are less persistent, are narrower, and contain narrower ore shoots and less gold than those in the Bohemia district. The veins and the dioritic intrusive bodies are also more scattered than those of the Bohemia district.

However, the areal zoning of the veins of different types is more evident here than in the Bohemia district. The chalcopyrite veins from the Crown mine to the Santiam form a central zone. This is succeeded in the section up Gold Creek by the pyrite veins, and that in turn by the complex sulphide vein of the Blende Oro. The outer limits of mineralization are represented by the calcite vein on Elkhorn Creek and the Ogle Mountain mine. Probably the zones are not continuous and the pyrite zone appears to be largely absent except on

Gold Creek. No prospects have been opened south of the chalcopyrite veins.

The wall rock of the veins is altered, generally to an aggregate of chlorite, epidote, sericite, quartz, clay minerals, and carbonate. The carbonate is probably mostly calcite, but ankerite occurs in some places, and mesitite occurs in the wall rock of the Capital vein. Sericite is the principal alteration product at the Blende Oro and Bimetallic. Though there are narrow zones of soft altered rock along the veins, none of the large areas of bleached and partly silicified altered rock, such as occur in the Bohemia district, were observed.

Future development in the district should depend largely on high prices for the base metals. Small shoots of complex sulphide and chalcopyrite ores have been explored, but they contain almost no gold and very little silver, according to available assays. Possibly more shoots of base-metal ores will be found, as the district covers a large area, is heavily forested, and has not been thoroughly prospected. Further prospecting might reveal gold-ore shoots like that of the Ogle Mountain mine, in the outlying parts of the district. Only small ore shoots may be expected, and plant and development work should be planned accordingly.

Ruth Mine

MINES AND PROSPECTS

Amalgamated.—Three contiguous groups of claims—the Amalgamated, Columbia, and Blue Jay—constitute the Amalgamated properties, which lie mainly on the south side of the Battle Ax Fork of the Little North Santiam River in unsurveyed T. 8 S., R. 5 E., about 26 miles by road from Lyons. The main workings were formerly the property of the Lewis & Clark Mining & Milling Co.⁸⁷ The present owners were active in 1930. A road 4 miles long was built to the mine, buildings and ore bins were constructed, and foundations were started for a mill, though almost no new development work was done. An ore shoot previously developed was mined, and 43 tons of crude ore was shipped to the smelter.

The underground workings consist of about 1,350 feet of drifts, of which about 1,020 feet is in the workings on the main drift. There are also several short adits and open cuts. The main tunnel enters the south side of the valley several hundred feet above Battle Ax Creek and trends S. 55° E. but curves to the east near the face. The country rock is mainly oligoclase andesite, but a dike of porphyritic rhyolite about 5 feet wide crosses the tunnel near the portal and

⁸⁷ Stafford, O. F., Mineral resources and mineral industries of Oregon: Oregon Univ. Bull., new ser., vol. 1, no. 4, p. 58, 1904. Parks, H. M., and Swartley, A. M., Handbook of the mining industry of Oregon: Mineral Resources of Oregon, vol. 2, no. 4, p. 140. Oregon Bur. Mines and Geology, 1916.

parallels it throughout on the northeast side. The principal vein, the Blue vein, is intersected by the tunnel about 350 feet from the portal. The principal ore shoot lies south of the tunnel and has been opened by a drift 30 feet long from a short crosscut and by a raise and small stope. The trend of the vein ranges from N. 70° W. to west, and the dip is 65° NE. The ore shoot is 30 feet long, about 3 feet wide in the middle, and pinches out to thin seams in the soft gouge.

The vein matter in the ore shoot is composed of sphalerite, galena, chalcopryrite, and very little pyrite, with sphalerite predominating. Sulphides are disseminated irregularly through the vein matter, and large lumps of almost solid sulphides occur in places. The gangue is mainly a soft greenish mass of chlorite with some sericite, but locally calcite cements the other constituents and lines vugs. Quartz is very subordinate. Some of the ore contains yellowish-green needles of epidote. Gouge clays are chiefly chlorite with some clay minerals, sericite, and comminuted rock and vein matter. Assays supplied by the owners are given below.

Assays of samples from Amalgamated properties

	1	2	3	4	5	6	7
Gold.....ounces to the ton..	0.66			Trace	Trace	0.12	0.06
Silver.....do.....	4.00			3.2	2.00	5.20	5.80
Copper.....percent.....	4.4	4.55		2.32	1.20	1.16	1.26
Lead.....do.....	15.08	2.1	23.4	10.10	10.20	7.25	13.5
Zinc.....do.....	3.5	10.1	26.0	26.2	19.00	17.85	23.75

NOTE: Assays (4) and (5) are reported as from the Blue vein; locations of others are not given.

Analysis of ore

Gold.....	Trace	Iron.....percent..	4.3
Silver.....ounces to the ton..	4.1	Zinc.....do.....	35.5
Lead.....percent.....	19.4	Sulphur.....do.....	23.0
Copper (wet).....do.....	1.8	Arsenic.....do.....	.2
Copper (insoluble).....do.....	3.8	Antimony.....do.....	.1

A small stope on the Brown vein, a group of nearly horizontal fractures with calcite veinlets in soft pyritic altered rock, is located at the crosscut 250 feet from the portal of the main adit. Some sulphides occur in this material. A short drift in the innermost part of the tunnel follows a vein trending nearly east and dipping 60° N. It contains 42 inches of quartz and sparse sulphides with 1 foot of gouge on the footwall.

On the south side of a ravine about 200 feet vertically above and to the west of the face of the main tunnel are two tunnels. The eastern one is a drift 80 feet long on a vein trending S. 30° E. in greenish pyritic andesite. The vein is 12 to 20 inches wide and con-

sists of vuggy quartz with sulphides, almost entirely pyrite and sphalerite in about equal proportions. The other tunnel is a cross-cut running 90 feet S. 40° E. to a vein 12 feet wide that consists of brecciated altered rock with streaks of quartz, pyrite, and sphalerite, and a little galena and chalcopryrite. The hanging wall strikes N. 45° W. and dips 65° N.

On the steep slope a short distance above Battle Ax Creek and below the main tunnel are two short tunnels. One is a drift 45 feet long on a seam of brecciated country rock trending S. 30° E. and dipping 61° S. The hanging wall is a somewhat pyritized rhyolite. The other tunnel is about 300 feet upstream and follows a seam of brecciated country rock trending S. 55° E. and dipping 80° SW. The breccia is 4 feet wide at the portal but pinches to 1 inch at the face and is associated with a thin dike of porphyritic rhyolite. Thin seams of pyrite, sphalerite, galena, and chalcopryrite occur in the altered rock. Several other cuts have been made on veins and fractures along Battle Ax Creek.

Bimetallic and Goldbug.—The Bimetallic vein (Wall Street?) and Goldbug claim are on the north branch of the east fork of Gold Creek in unsurveyed T. 8 S., R. 5 E. They are reached by a trail from the road at the mouth of Gold Creek, a distance of about 2 miles. The Bimetallic tunnel, on the west side of the creek, follows the vein for 290 feet N. 30° W. The vein consists of brecciated country rock (diorite) and vuggy quartz and dips 80° SW. The ground is heavy, and the soft white material is largely sericite. The vein matter contains the usual sulphides, including considerable chalcopryrite but with pyrite predominating.

The Goldbug tunnel, on the east side of the creek, is presumably on the same vein. Most of it is timbered, and it follows the nearly vertical vein for 170 feet S. 40° E. The vein matter consists of brecciated andesite, in places 2½ feet wide, with lenticular streaks of quartz 1 to 10 inches thick containing some sulphides, principally sphalerite and pyrite.

Black Eagle.—The Black Eagle mine is on the road on the west side of Horn Creek in sec. 24, T. 8 S., R. 4 E. A compressor house with a few pieces of machinery stands at the portal of the main tunnel, and there is a cabin farther south on the terrace. No production is recorded, and the development work appears to have been done prior to 1916.**

Nearly 1,000 feet of workings, of which about 400 feet is a drift on the main vein, constitute the main level, which is near the break

** Parks, H. M., and Swartley, A. M., Handbook of the mining industry of Oregon: Mineral Resources of Oregon, vol. 2, no. 4, pp. 33-34, Oregon Bur. Mines and Geology, 1916.

Development: The work done consists of a tunnel 70 feet long on the first vein where ore was being taken out in drifting, and sent to the mill. A small amount of ore has been removed from an open cut on the vein above the tunnel. On the second vein, a crosscut tunnel about 86 feet long intersects the vein in about 40 feet, and a short drift has been run about 20 feet to the southeast at this point.

Geology: The immediate area shows andesitic lavas and a rhyolite dike or dikes. There are at least two veins. The one upon which work is being done is a rhyolite breccia, striking S. 20°-25° E. and dipping 60°-65° SW. It has a well-defined footwall, with the hanging wall more indefinite. The vein material consists of both angular and rounded pieces of quartz and rhyolite cemented by soft siliceous material. As exposed in a tunnel, started on the outcrop, the vein is more than 6 feet wide. The values are in free gold, rather finely divided, with a very small amount of residual pyrite showing occasionally. There is some manganese stain which, in places, becomes a sooty deposit. A sample from the vein in this tunnel was submitted to the Department for assay and returned 0.16 ounce of gold and 0.18 percent manganese.

About 500 feet to the east of the first vein is a second vein with a similar strike and probably somewhat flatter dip. The outcrop shows very little oxidation and considerable pyrite. As exposed in a crosscut tunnel about 60 feet below the outcrop, there appear to be more oxidation, less sulphides, and some free gold. Country rock is a hard andesite. Vein filling is a siliceous breccia. The footwall on the surface is well defined; in the tunnel, where cut, the walls are somewhat broken and more indefinite.

Report by: F.W.L., 1938.

Reference: Stafford, 1904.

RUTH MINE (Gold, silver, zinc, lead)

North Santiam District

Old names: Lewis and Clark Mining and Milling Company
Amalgamated

Owner: Pacific Smelting and Refining Company, J. P. Hewitt, president.

Location: Secs. 27 and 28, T. 8 S., R. 5 E., extending on both sides of Battle Axe Creek road about 1 mile from the mouth of the creek. No. 4 level is 40 feet above road level, and No. 5 level is just above creek level 200 feet below. The Blue Jay vein lies 1,800 feet farther east, the main tunnel being about 200 feet above the road. The Bueche group (page 117) openings lie near creek level several hundred feet west of the Ruth.

Area: The holdings now include about 30 claims in the Blue Jay group, and 18 claims in the Ruth group.

History: The Lewis and Clark Mining and Milling Company located five claims sometime previous to 1902, and by that time had opened up, according to Stafford (1904), several hundred feet of tunnel on two levels. In 1920 The Amalgamated Mining and Milling Company took over these claims and located 18 additional claims. In 1929 the Blue Jay vein was located by the Columbia Mines Development Company and during the period 1929-1934 the two concerns constructed a road 4 miles long to the mine, numerous buildings, and a mill, and in 1931-1932 shipped 9 carloads of crude ore and concentrates from the mill. In 1934 the Columbia took over the Amalgamated holdings, and in 1939 both groups were purchased by the Pacific Smelting and Refining Company. In 1931 the workings consisted of about 1,350 feet of drift and crosscuts, of which about 1,020 feet were workings on the main (No. 4) tunnel, on the Ruth vein.

Development: By 1945 the Ruth (formerly called the "Blue") vein had been developed by 1,575 feet of drift on the No. 4 level, with four raises of 110, 110, 45, and 40 feet

respectively, and about 100 feet of crosscuts. On the No. 5 level 212 feet below there is about 1,700 feet of drift with two raises to the No. 4 level. On the Blue Jay vein there is a 300-foot drift and a stope 40 feet high. There are numerous open cuts and short tunnels on several other veins, both between the Ruth and the Blue Jay, and west of the Ruth. Some development activity was reportedly conducted by Pacific Smelting and Refining Company at the Ruth mine in 1948.

Geology: The country rock is principally oligoclase andesite, but a dike of porphyritic rhyolite crosses the No. 4 tunnel near the portal and, according to Callaghan and Buddington (1938:87-88), parallels it throughout on the northeast side. The main fracture zone varies in width from less than 1 foot to more than 60 feet, with an average trend of N. 55° W. and a dip of 55°-70° NE. Within this pinching and swelling zone, bounded by well-defined walls along which much movement has taken place, the vein material is an altered mass consisting of comminuted rock, gouge clays (chiefly chlorite and some clay minerals), soft greenish chlorite with some sericite, with calcite locally cementing the other constituents and lining vugs. Quartz is very subordinate. Sulphides are present disseminated irregularly throughout the zone, in large lumps of almost solid sulphide, and fairly well-defined but irregular lenses. Sulphide minerals are sphalerite, galena, chalcopyrite, and a very little pyrite, with sphalerite predominating. According to Fred Draper, a consultant for the Pacific Smelting and Refining Company, these lenses of high-grade ore dip more steeply than the zone which includes them, averaging 80°, and pinch out against both the foot and hanging walls within fairly short distances.

The thicknesses in 15 blocks of ore, as given in a report by Rosenberg (1941) range from 5.2 to 15.4 feet; in 8 blocks the average thickness was more than 10 feet.

Estimates of ore reserves as high as 800,000 tons have been made by engineers, but an estimate made for the Reconstruction Finance Corporation placed the reserve at 200,000 tons, with an average of 4.33 percent zinc. Some of the shoots have a much higher percentage of zinc. On the fifth level, 280 feet southeast of the second raise, an ore shoot averages 6.62 feet in width and assays 6.04 percent zinc; above, on the fourth level, the same shoot is 30 feet wide and averages less than 4 percent zinc. In the Rosenberg report the average zinc content of the 15 blocks totaling about 200,000 tons of ore, is given as ranging from 6 to 11 percent.

Metallurgical tests made by the U.S. Bureau of Mines and the Denver Equipment Company indicate that simple selective flotation will recover, from 1 ton of ore, 0.0877 tons of zinc (54.4 percent metal); and .011 tons of lead (of similar grade). Gold, silver, and copper are usually low; a few assays gave as high as 0.66 ounce of gold and 4 ounces of silver, but usually they are present only as traces.

The upper workings are on the south side of the ravine, above and to the west of the No. 4 portal. The No. 2 level is a drift 80 feet long on a vein trending S. 30° E. in greenish pyritic andesite. The vein is 12 to 20 inches wide and consists of vuggy quartz with sulphides, almost entirely pyrite and sphalerite in about equal proportions. The No. 1 level runs 90 feet S. 40° E. to a vein 12 feet wide that consists of brecciated altered andesite with streaks of quartz, pyrite, and sphalerite, and a small amount of galena and chalcopyrite. The hanging wall strikes N. 45° W., and dips 65° NE.

Informants: J. P. Hewitt, Fred Draper.

Report by: J.E.A., 1945.

References: Callaghan and Buddington, 1938:87-89
Parks and Swartley, 1916:140
Rosenberg, F. J., 1941 (unpublished report)

Year	Earnings	^{15%} P.V. Factor	P.V.	^{20%} P.V. Factor	P.V.
1	.939 m	.870	.817		
2	.939 m	.758	.712		
3	.939 m	.658	.618		
4	.939 m	.571	.536		
5	.469 m	<u>.532</u>	<u>.249</u>		
		2.932508	←		

1	.939 m	.870			
2		1.626			
3		2.183			
4		2.855			
5		3.352	3.148		
6		3.784			
7		4.160	3.906		
8		4.487	4.213	3.837	3.603
9		4.772			
10		5.019	4.713		

$$\begin{aligned}
 \text{ROI} &= 15\% + \frac{170,500}{170,500 + 439,500} (20\% - 15\%) \\
 &= .15 + .2795 (.05) = .164 = 16.4\%
 \end{aligned}$$

PRELIMINARY ECONOMIC ANALYSIS

1. Technical data and misc. variables

"Bonus" payment(s)
Purchase price of property \$ 1,500,000.00
Rental or ADR payments
Royalty 67% - 33%
Net profit split
Permit schedule and delay time
Reserve tons/volume:
 (a) in-place 250,000 - 500,000 - 1,000,000
 (b) recoverable 225,000 450,000 900,000
Ore grade 8% zinc, 3% lead, .5% copper, .023 ounces gold, 1.4 ounces silver
Depreciation schedule SL
Mining rate 200 t/day ~~500 t/day~~
Mining days/year 250
Milling capacity 200 t/day ~~500 t/day~~
Milling days/year 250
Concentration ratios Zn 8-1, Pb 2-1
Mill recovery 84.44%
Inflation rate 15%
Tax rates:
 (a) Federal 48%
 (b) State 6%
Discount rate 15%

Au \$ 400/oz

Ag 8/oz

Zn .45/lb

Pb .35/lb

Cu .75/lb

<u>2. Capital investment</u>	<u>Total</u>	<u>Per Ton</u>
Option/equity payments (incl. ADRs)	1,500,000	6.68
Other property payments		
Road construction and improvement	50,000	.22
Exploration	500,000	2.22
<hr/>		
Underground rehabilitation	500,000	2.22
Sampling		
Engineering and feasibility studies		
Development		
Total exploration, rehab., engr., develop.	1,050,000	
Buildings + mill pond	500,000	2.22
Mining plant and equipment		
Mill improvement and rehabilitation	400,000	1.78
Mill plant and equipment		
Environmental, reclamation	225,000	1.00
Administration and overhead	1,012,500	4.50
Working capital		
Investment tax credit		
<hr/>		
<hr/>		
<hr/>		
<hr/>		
Contingency (<u>10</u> %)		
	sub total	
	3,675,000	16.23
	4,687,500	20.83
Total	<u>4,042,500</u>	<u>17.85</u>

3. Operating costs

	<u>Total</u>	<u>Per Ton</u>
Mining		21.69
Milling		15.05
Transp., smelting, refining		40.39
Royalty		1.00
Reclamation		
Legal		
Overhead and administration		4.50

Total: 82.63

4. Preproduction Cash Flows

Capital Expenditures

Total
Preproduction
Period

Advance royalty

0

Other acquisition costs

0

Explor., engr., feasibility }
Development }

1,050,000

Mine and mill buildings

900,000

Camp buildings

Mine and mill equipment }

Working capital

Total

1,950,000

Cash Generated

Tax savings:

Advance royalty

Exploration and feasibil. study

Development

Investment tax credit

Total cash generated:

Net cash flow:

Year

1

2

3

4

5

6

5. Cash flow and approximate profitability (production and post-production).

Tons or yd ³		200 T/day	59,000 T/yr	
Gross revenue (sales)		\$2,262/day	\$5,315,500/yr	
Transportation, smelting, refining	\$40.39/ton	\$8078.00	\$2,019,500.00	
Royalty @ _____ %				
Operating costs	\$41.24/ton	\$8448.00	2,112,000.00	
Operating income	\$106.31/ton	21,262.00	5,315,500.00	
Depreciation	\$400,000/yr	8.00/ton	1600.00	400,000.00
Net after costs and depreciation	\$19.68/ton	3168.00	784,000.00	
Property tax	\$30,000/yr			
Mine license tax				
Net after property and license taxes				\$754,000.00
State income tax @ <u>6</u> %	\$45,240			
Net after depreciation and S.I.T.				\$708,760.00
Depletion 15%	\$797,325	50%	<u>\$354,380</u>	
Federal taxable income				\$254,381.00
Federal tax @ <u>48</u> %				170,102.00
Net after-tax income				184,278.00
Add back depreciation				400,000.00
Add back depletion				354,380.00
Cash flow				938,658.00
Working capital	67%	\$28,900		
Net cash flow	33%	\$369,757		\$438,658.00

Profitability

Accounting ROR	.1766	17.66%	5,315,500	
Accounting ROI	.2332	23.32%	938,658	
Payout without interest		4.3 years		Payback 4.3
Annuity	\$938,658		\$438,658	\$498,333
Table factor @ <u>15</u> %				
Present value		\$4,223,961		
Capital investment		\$4,042,500		
Net present value		\$181,461		
DCF-ROI		16.4%		

In the eighth year of production using discount rate .15 will NPV be 170,500

First Full
Production
Year
@ 200 tpd

First Full
Production
Year
@ _____ tpd

Production
Life (8 yrs)
(400,000 ton basis)

Production
Life (20 yrs)
(1,000,000 ton basis)

Year

1

2

3

4

5

6

7

8

9

10

11

6. Return calculations (profitability)

Year	Net Cash Flow	Cumulative Cash Flow	Present Value Factors @ 15%	Present Value @ 15%	Present Value Factors @ 20%	Present Value @ 20%
1	939,000	939,000	.870			
2						
3						
4						
5						
6						
7						
8	939,000	7,512,000	4.487	4,213,000	3.837	3,603,000
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20	939,000	18,780,000	6.259	5,877,200	4.870	4,572,930

Payback period: 8 years
 Net present value @ 15%: 170,500
 DCF-ROI: 16.4%

FEASIBILITY STUDY OF THE ECONOMIC VALUE OF THE RUTH MINING CLAIMS,
THE MORNINGSTAR MINING CLAIM,
THE MANDALAY MINING CLAIM, AND THE SANTIAM ONE MINING CLAIM

By: George Atiyeh
Economic Geologist

December 1980

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INTRODUCTION

The purpose of this report is to determine the economic viability of certain mining claims known as the Ruth No. 1, Ruth No. 2, Ruth No. 4, Morning Star, Mandalay and Santiam No. 1. Additionally, this report will discuss the use and need for three millsites, known as the Hewitt, Poor Boy, and Morning Star, developed and used in support of the exploration and development of the subject mining claims.

GEOGRAPHY

All of the claims and millsites are located in Township 8 South, Range 5 East, Willamette Meridian, Lester Mining District, Marion County, Oregon. The towns of Mehama and Lyons are approximately 34 miles to the southwest of the mine property (see Appendix 1). All of the claims are unpatented lode mining claims.

Ruth No. 1, No. 2 and No. 4 are located in Section 27. Battle Ax Creek, one of the headwaters of the Little North Fork of the Santiam River, flows along the northern boarder of the Ruth No. 1 and No. 4 claims. The discovery point of the Ruth No. 1 is approximately 2700 feet above sea level, the discovery of the Ruth No. 2 is approximately 3000 feet above sea level, and the discovery point of the Ruth No. 4 is approximately 2400 feet above sea level. The Ruth No. 1, No. 2 and No. 4 are highlighted in red on the overview claim map in Appendix 2.

The Morning Star is also in Section 27, and is located approximately

1200 feet to the east of the Ruth claims. The discovery point is approximately 2600 feet in elevation. The Morning Star is highlighted in green on the map in Appendix 2.

The Mandalay is located in Section 30. The Little North Fork of the Santiam River flows through the claim, approximately 2½ miles downstream and to the west of the Ruth claims. The discovery point of the Mandalay is approximately 2400 feet above sea level. The Mandalay is highlighted in blue on the map in Appendix 2.

The Santiam No. 1 lies in sections 19 and 30, approximately three miles west of the Ruth claims. The Little North Fork of the Santiam River also flows through this claim adjacent to the discovery point, which is approximately 1900 feet in elevation. The Santiam 1 is highlighted in yellow on the map in Appendix 2.

The Hewitt, Poor Boy, and Starvation Millsites are in Section 28. The millsites are centrally located between the lode claims, approximately one mile west of the Ruth claims and 1½ miles east of the Mandalay. The confluence of Battle Ax and Opal Creeks forms the Little North Fork of the Santiam River on the millsites, at an elevation of approximately 2100 feet. The millsites are highlighted in purple on the map in Appendix 2.

CLIMATIC CONDITIONS

The claim area is representative of the west slope of the Cascade Range, with a mild, humid climate and moderate ranges in temperature. Winter seasons bring substantial precipitation with snow in the mountains and rain at lower elevations. Spring rains are heavy and are followed by generally fair and mild weather from June through Autumn. Within the mine

area winter snows of three to four feet can be expected, with a range of up to twenty feet in particularly heavy years to no snow in mild years. Historically, the mines have remained open through the winter, although snow removal and winter transportation equipment has sometimes been necessary.

ACCESSIBILITY

The mine is reached from Portland by travelling south on Interstate 5, to Salem, east on Highway 22 to the Lyons-Mehama area, and northeast up the Little North Fork Road, which ends at the gate to the mine. The total distance from Portland is approximately 95 miles and takes an hour and 50 minutes by car.

There is a radio telephone at the millsites in the camp area which is connected with the Mehama Telephone Exchange. A post office box in Mehama is used for mail. United Parcel Service and other common carriers make deliveries to the off-site office of Shiny Rock Mining Corporation which is approximately eleven miles up the Little North Fork Road from Mehama. This off-site office is maintained primarily for the purpose of providing a base during severe weather conditions and to alleviate security and liability problems which might otherwise arise if open access were generally permitted on the mine road.

The nearest rail transportation is in Lyons, Oregon, at a station on the Detroit Branch of the Southern Pacific Railroad. Rail siding is available at the Old Simpson Lumber Mill, presently owned by Young and Morgan Lumber, Inc. (see Appendix 3). Access to the rail loading facilities for the purpose of shipping ore and concentrates has been agreed to by

Young and Morgan. Published freight rates to existing smelter were listed at \$27.10 a net ton of concentrate to Kellogg, Idaho, \$30.00 a net ton to East Helena, Montana, and \$18.60 a net ton to Tacoma, Washington, (see Appendix 4).

Ship transportation is also available from Portland to points on the Pacific rim, with sample tariffs of \$7.00 per ton open, and \$6.00 per ton closed, shipped from Portland to Japan via Mitsubishi. Ore and concentrate transport by local truck from the mine property to the Portland shipping docks would cost approximately \$8.00 per ton.

GENERAL DESCRIPTION OF THE PROPERTY

Each of the six mining claims is approximately twenty acres in size, and each of the three millsites is approximately five acres in size. The Ruth No. 1, No. 2, and No. 4 were each located on July 1, 1929 and amended on December 28, 1978. The Morning Star was located on July 6, 1925 and amended on December 28, 1978. The Mandalay was located on July 17, 1979. The Santiam No. 1 was located October 25, 1954 and amended December 28, 1978. The Starvation and Poor Boy millsites were located December 15, 1975. The Hewitt millsite was located March 17, 1970 and amended August 25, 1979.

The Morning Star, Ruth No. 1, Ruth No. 2, Mandalay, and Santiam No. 1 were stipulated to be valid mining claims by the United States Forest Service, Department of Agriculture, in October, 1966 (see Appendix 5). The Hewitt, Poor Boy and Starvation millsites have been recognized as valid millsite locations by the United States Forest Service (see Appendix 5).

The mining claims and millsites have been recorded with the Marion

County Clerk and the Bureau of Land Management in accordance with state and federal laws and regulations. The Bureau of Land Management has assigned the following Oregon mining claim serial numbers to the claims:

Ruth No. 1	ORMC 0027356
Ruth No. 2	ORMC 0027357
Ruth No. 4	ORMC 0027359
Santiam No. 1	ORMC 0027391
Mandalay	ORMC 18926
Morning Star	ORMC 0027304
Hewitt millsite	ORMC 0027446
Starvation millsite	ORMC 0027447
Poor Boy millsite	ORMC 0027448

All claims are held by right of location and actual possession, which rights are undisputed.

Shiny Rock Mining Corporation, a subsidiary of Persis Corporation, is the record owner of the claims and millsites. The Santiam No. 1 and Mandalay claims were leased to Amoco Minerals, a subsidiary of Standard Oil of Indiana, on December 29, 1980. Amoco Minerals is now proceeding with the exploration and development programs described in the lease of these and other mining claims belonging to Shiny Rock which are subject to the Amoco Minerals lease.

Mineral survey orders were issued by the Bureau of Land Management Cadastral Engineer. Mineral surveys were made by the mineral surveyor John W. Howe and plats were prepared and issued by the cadastral engineer. The Starvation, Poor Boy and Hewitt millsite surveys were issued under Mineral Survey No. 990. The Mandalay survey was issued under Mineral Survey No. 991. The Santiam No. 1 survey was issued under Mineral Survey No. 992. The Morning Star survey was issued Mineral Survey No. 993. The Ruth No. 1, No. 2 and No. 4 surveys were issued under Mineral Survey No. 994. Copies of the mineral survey plats are shown in Appendix 6 to this report.

The surface and underground improvements made upon the claims and millsites are shown on the Mineral Survey plats. Buildings are of frame construction and in excellent repair. A commissary, located on the Hewitt millsite, is stocked with all necessary mining equipment to continue development of the mine property. Assay equipment is complete, with the exception of a spectrograph. There are plenty of workman's tools, as well as fire fighting equipment, including two fire trucks and live reels and hydrants throughout the millsites. Camp facilities are adequate for 35 men. All mine openings are open with new timbers. Access roads and trails have been developed to all portals and openings. Operating compressors, mucking machines, trammers, cars and other equipment necessary for production and other operations are presently on the property.

Extensive operations have occurred and have resulted in significant development of each of the six lode claims. Underground development includes approximately 6,000 feet of drifts, crosscuts, raises, stopes, and a winze. Most of the underground workings have been retimbered and mining systems in place have been revitalized or repaired and replaced in recent years. Service buildings and systems on the surface have been erected or revitalized to support recent development activities and operations.

POWER

A hydro-electric plant is located on the Poor Boy Millsite. It is capable of developing twenty-five KW, and provides power to the millsites. Additional electric generation capacity for the millsites is supplied by a 150 KW diesel generator located on the Starvation millsite and a 20 KW

diesel plant on the Hewitt millsite. Five to ten KW hydro-electric and diesel plants are used to provide power for the mine openings and underground lighting. Present plans call for the installation of a 60 KW generator and pelton wheel, powered by flume waters drawn by Battle Ax and Opal Creeks. Power generated by this new hydro-electric plant will satisfy the electrical needs of the flotation mill, thereby eliminating reliance upon the 150 KW diesel power plant presently used.

TIMBER

There is sufficient timber on all of the claims to provide for mining timbers and building materials for further development. Varieties are mainly Douglas Fir, Western Red Cedar and Western Hemlock. Most of the fir is saw timber, although some is overripe.

WATER SUPPLY

Battle Ax and Opal Creeks form the headwaters of the Little North Fork of the Santiam River at Jawbone Flats, where the three millsites are located. There is sufficient, perennial water for all domestic and milling purposes.

Ruth Creek crosses the Ruth No. 1 and No. 2 claims and provides water for drilling and hydro-electric power for underground development.

The Morning Star claim is crossed by Morning Star Creek. This creek is intermittent, but is sufficient to provide water for drills and other underground activities.

The Mandalay and Santiam No. 1 are crossed by the Little North Fork of the Santiam River, which flows throughout the year and provides more than

sufficient water for mining activities.

All of the mines make water in sufficient amounts to be used for drilling and other needs.

Water and power for the millsites are currently developed from Flume Creek, a tributary to Opal Creek, southeast of the millsites. Thirty-two hundred feet of PVC pipe, with an initial eight-inch diameter and a terminal diameter of six inches, carry water from Flume Creek to the power station on the Poor Boy millsite. Three hundred fifty feet of head is developed, with a static pressure of 150 PSI at the discharge nozzle. Unused water from hydroelectric power is used for fire protection and domestic purposes on the Hewitt and Poor Boy millsites. Additionally, water is tapped from the flume above the hydro-electric plant and used at the ore reduction mill on the Starvation millsite.

LABOR

Skilled mining and milling labor must presently be imported from Idaho, Washington and British Columbia, as well as from parts of Nevada. Imported labor generally costs more than local labor, but, based upon historical experience within the district, local, experienced mine labor should be developed within a relatively short period as the development of these and other nearby claims proceeds. Equipment operators for above ground development, along with mechanics and builders, are readily available in the local surrounding the mine area.

HISTORY

First discoveries and activities in the Little North Santiam District,

of which the Lester Mining District is a part, date from between the 1860s and the 1890s when the oxidized sulfides were prospected for free gold and silver. Because of the isolation of the district and the complex nature of the ore bodies (which are a combination of base sulfides), most of the early mine development in the district was not profitable. At various times since the 1930s, the mines in the district have run profitably. At other periods the mines became inactive due to market cycles or changed economic conditions. Good transportation and governmental cognizance of the need to develop domestic natural resources should provide some stability to the boom-bust cycles that this district has experienced in the past.

The Ruth and Morning Star mines on Battle Ax Creek were originally known as the Lewis and Clark Mine, and until 1929 consisted of a few short tunnels and prospect holes with indications of a rich vein of lead/zinc. In the 1930s, the ore body was explored on two levels, with ore milled off the fourth and fifth levels in 1933-34. A combination floatation and gravity separation ore mill was built just east of the present millsites. In the 1940s, the Bureau of Mines, under reconstruction financing, developed three small stopes in the fifth level of the Ruth mine and prepared a report on the property.

The Santiam No. 1 was originally a placer mining claim at the junction of Gold Creek and the Little North Fork of the Santiam River. This property has been operated under various names such as Freeland Consolidated, Electric Mining and Smelting, Consolidated Copper Mining and Power, Lotts Larson Mine, and Northwest Copper Company. It is referred to in Geology and Mineral Industries Bulletin 14 D, published in 1951, as the Santiam No.

1 or Minnie E. During its history, approximately 1300 feet of drift was put in along the vein and a winze sunk to 96 feet. The winze is now full of water. Crude ore and sorted ore concentrates have been shipped over the years. In 1941, a small mill was installed and concentrates were shipped. Of the sorted ore shipped, averaged assays show 10% copper, 3 ounces of silver and .03 ounces of gold to the ton. Of the concentrates, averaged assays show 19.09% copper, 4.96 ounces of silver, and .04 ounces of gold per ton. Gravity concentration methods were used in order to produce the concentrate.

The Mandalay claim consists of two adits at opposite ends of the claim, each following the same strike. They were put in during the 1940s and 1950s. During the late 1970s, ore was transported from both the upper and lower adits and processed through the concentrating mill now located on the Starvation millsite. Crude ore assays show 3% copper, 1.4 ounces of silver, and .02 ounces of gold to the ton.

The Hewitt millsite consists of five acres on which 18 buildings have been constructed from 1932 to the present. The Starvation millsite is also five acres in size and is the site of the ore reduction plant which was constructed in 1976. The reduction plant has a crushing capacity of 150 tons and a concentrating capacity of 25 tons, based on a 24 hour day. The Poor Boy millsite consists of hydro-electric generation facilities, a cook house designed to feed 50 men, a core shed to store and log core from ongoing exploration projects, and storage buildings for heavy mining equipment, such as dumptrucks, muckers, air lines and rails. The cook house is of the same vintage as buildings on the Hewitt millsite, while the power house and buildings protecting the mining equipment were constructed in the

latter 1970s.

In 1977 the entire area was leased to Freeport Mineral Company. After the expiration of that lease, the Santiam No. 1 and Mandalay claims were leased to Amoco Minerals. Portions of the Hewitt and Poor Boy millsites have been rented to Amoco at various times to support its operations on the leased group of claims.

GEOLOGY OF THE AREA

The rocks of the Lester Mining District has been dated by Peck, 1964, to be late Miocene volcanic sardine formation. The formation is the thickest in the Cascade Range in the vicinity of the Lester Mining District, which may be due to the proximity to volcanic vents. The sardine formation consists of several mapable units, subdivided as lahars, lapilli tufts, flow breccias, flows, and welded tufts. Intrusive into the above units are at least five phases of a composite rock, named the Jawbone Stock by Decker and Jones in 1977. Associated with the Jawbone Stock is hydrothermal alteration characteristic with the Cascade's environment. Alteration types are propylitic, phyllic (quartz-sericite) and potassic (biotite-orthoclase). Subordinate tourmalinization and quartz veining is present in the structurally-favorable area.

Widespread propylitic alteration is defined by Peck as extending west to include Ogle Mountain to the east to Elk Lake. The phyllic alteration zone is found from Cedar Creek northeast along the Little North Fork of the Santiam River to the Ruth Mine. The potassic alteration is found in the lower part of Stony Creek and west along the river to a few hundred feet east of the Mandalay claim. These three alteration facies define the zone

hydrothermal system present in the district.

Mineralization has long been noted in the North Santiam Mineral District, of which the Lester Mining District is a part (Callahan and Buddington, 1938, page 35). The central zone and chalcopyrite veins referred to in Callahan and Buddington coincide with the central potassic alteration. The complex sulfide veins are found peripheral to the potassic zone in the propylitic alteration. The carbonate veins are found at the outer edge of the propylitic zone.

The veins in the mining claims in this report all trend northwesterly and display structural control in ore disposition. The veins in the district's predominate strike run North 15° to North 70° West, with the greatest concentrations of metallic minerals taking place in veins striking North 35° West. Veins in the district are predominately lenticular masses along sheared or brecciated country rock. Veins open up to 20+ feet wide and pinch down, both horizontally and vertically, to areas a few inches wide.

Principal rock types underground are calcitic andesite, porphyritic rhyolites, and a minor occurrence of red rock phenocryst of oligoclase, a fine grained ground mass which has tentatively been classed as rhyolite. The coloration is attributed to the iron limonites. The degree of wall rock alteration varies, but the zones of soft alteration are generally narrow. The alteration product is an aggregate of chlorite, epidote, sericite, quartz minerals, and clay minerals, with some associated carbonate (mostly calcite).

The chief five minerals are sphalerite, galena, chalcopyrite, pyrite, and silver, with a trace of gold. The gangue of most of the altered rock

is mainly chlorite and minor amounts of quartz, with calcite as the cementing medium. Gouge clays are chiefly chlorite, some clay minerals, sericite, comminuted rock and vein matter. The presence of quartz and pyrite, together with the alterations of the hanging wall, in the number four level of the Ruth Mine suggests proximity to intrusives. Intrusives have been noted or mapped in close proximity to or in contact with almost all the ore bodies discussed in this report.

PRESENT DEVELOPMENT OF THE MINING CLAIMS

The three millsites and the Ruth No. 4 claim are presently being developed and operated in accordance with an operating plan approved by the United States Forest Service on March 4, 1977 (see Appendix 7). The Santiam No. 1, Mandalay, Ruth No. 1, Ruth No. 2, and Morning Star claims were earlier clearlisted by the Forest Service under the 1955 Surface Rights Act and are not subject to the operating plan.

Ruth No. 1 and No. 2 have been developed as a single mine. Present underground development consists of approximately 5,000 feet of drift, numerous crosscuts, two 200-foot raises, and five levels. The fifth, fourth and third levels are connected with various stopes and some runaround tunnels paralleling the ore deposit (see Appendix 12). Most recent development work was done in 1976 through 1978, although some development work continues. In 1976, the fifth level of the Ruth mine was retimbered, starting at the 800 foot crosscut and then back to the first raise. New timbers and blocking were put into two stopes. A runaround tunnel was driven around an old stope left open by the Bureau of Mines, and mucking was started in an area caved just prior to the first raise between

the fifth and fourth levels.

Various mining methods were used to try to hold the ground from caving just prior to the first raise. Because the muckpile was making water over the top of the pile it was decided to drive a parallel drift in the hanging wall and crosscut in approximately 175 feet behind the first raise, between the first and second raises. When that was accomplished, pumps were placed in the area behind the first raise and water pumped out for approximately a week, and then mucking continued. Still, the mucking station continued to run ore and various methods of spiling and blocking ore in place were ineffective to go through the area. The determination was made that it would no longer be safe to try to timber through the first raise, so miners stayed at the station and mucked for about eight weeks. At some points, 150 feet of hanging wall were exposed forward and above the mucking station. By placing small bombs up on the vein, concussion started the ore flowing again. No dilution from breakage was observed at the hanging or foot walls in the ore.

A portion of the fifth level of the Ruth mine, where it transverses from the Ruth No. 1 into the Ruth No. 2, has been developed as previously described. In addition, the fourth level was mucked to a station (just prior to the raise between the fourth and third levels) where a caving stope on the third level was causing the fourth level to cave. The portal of the fourth level was retimbered and an access road developed in preparation of going in and reopening this portion of the mine. The first and second levels have been mucked to remove small cave-ins at the portals and the portals have been retimbered and drained to make them accessible for sampling. In addition, in 1976 new rail track and ties were put in from

the fifth level portal to the face, along with new air lines.

Development of the Ruth No. 4 consists of an adit approximately 52 feet long. In 1980, 35 feet of open cut was exposed and old workings were cleaned out with a backhoe. The vein was opened up and sampled. The vein itself is approximately five feet wide and runs the length of the adit. The vein is loose gouge along a shear, comprised primarily of chalcopyrite, pyrite, lead, zinc and silver.

The Morning Star has approximately 500 feet of drift with the first 350 feet being accessible at this time. A 40 foot stope has collapsed just past the 350 foot station. It is still possible, however, to climb across mining timbers and remains of the old ladders to a point approximately 25-30 feet above the old tunnel and take samples from the hanging wall of this vein. By shining a light on the ceiling it is apparent that the vein is still well exposed but will require more development work in order to make it safe for sampling and mining. Ore from the Morning Star vein, which is sitting in a bunker directly in front of the portal, was run through the ore reduction mill on the Starvation millsite in 1977.

The Mandalay discovery adit was mucked out in 1979-1980 and was retimbered approximately 35 to 40 feet back. The portal area was cleaned and a new drainage system was installed. In 1980, the road and trail leading from the Elkhorn/Elk Lake Road to the Mandalay discovery adit was reconstructed. In 1977, the lower cut on the vein of the Mandalay was retimbered and mucked out and a new trail cut from the Elkhorn/Elk Lake road down to the adit, and ore was then transported and run at the mill on the Starvation millsite. In addition, work was done along the road in order to expose the vein where it crosses the road and to provide for

better access. Amoco Minerals, under lease agreement, will conduct channel sampling of both the discovery and lower adits during the summer of 1981.

Development of the Santiam No. 1 (Minnie E Vein) consists of approximately 925 feet of drift on the south side of the river and 300 feet on the north side, with a 96 foot winze off the main north tunnel. In 1976, a new roof was placed on the change shed at the portal and building was refurbished. In addition, the entrance was mucked out and new timbers placed at the portal. In 1981, Amoco Minerals will pump out the standing water in the winze and sample the 14 inch vein of chalcopyrite at the bottom, as provided in the lease between Shiny Rock Mining Corporation and Amoco Minerals Corporation. Results of sampling will be available in the summer of 1981.

PRESENT DEVELOPMENT OF THE MILLSITES

Since 1972, a new operations center, generator building and truck garage were constructed at the Hewitt millsite to replace their predecessors which were destroyed by fire. New porches, wood sheds, and support buildings have also been recently constructed, along with a mining timber storage area. Earlier buildings, constructed in the 1930s, have been refurbished since 1972. Roofs were replaced in 1973. Substantial work has been done to building foundations. A new water and electric system now provides running water and electricity to the miners' quarters and support buildings.

Development of the Poor Boy millsite consists of a hydroelectric generation plant constructed in 1976, a cook house constructed in 1930 (presently being refurbished), and equipment sheds covering heavy mining

equipment needed for the present operations. A core shed stores approximately 4,000 feet of core from two drill holes put in by Freeport Minerals Corporation in 1977. In addition, a truck shop/core shed is planned for construction in the summer of 1981 to facilitate equipment maintenance and the logging and storage of core from the six holes to be drilled by Amoco Minerals.

The ore reduction mill is located on the Starvation millsite. Technical information about the mill is set forth in Appendix 8. Constructed in 1975 and 1976, the mill consists of an ore bin, conveyors to the jaw crusher, conveyor to a quarter-inch Simons double-deck screen, and a conveyor to a Traylor 30-inch rolls crusher. The coarse crushing capacity of the mill is 150 tons per day from mine run to quarter-inch minus. The flotation circuit in the mill consists of a fine ore bin, conveyors to a Harding Conical ball mill, classifiers, and two banks of flotation cells for selective flotation of the lead-silver and zinc. A variable circuit is incorporated to provide selective flotation for other complex ores found on the mine property. In addition, a Wifley concentrating table and four pan filters are used in the lower part of the circuit. Tailings go to a settling pond where excess water is pumped off and recycled through the mill. Dry tailings are loaded into trucks, hauled to the mine, and pumped under ground for stope fill over a cement seal. In addition, a small shed has been built for the operator of the Mobile Dimensional sawmill used for cutting mine timbers and making construction materials.

ORE DEPOSITS AND GRADE

Ruth No. 1 and No. 2: Assays from the Ruth mine range from a high

(Bulletin 14-D, page 88) of 18% lead, 35% zinc, 5.6% copper and 4.1 ounces of silver per ton, and an ore grade low (War Minerals Report, 1943) of 4.7% zinc, 1.4% lead, .2% copper and 1 ounce of silver per ton, (see Appendix 9). Additional reports by Fred J. Rosenberg, 1941, W. L. Merritt, 1939, and E. W. Lazell, all verified by Shiny Rock Mining corporation, give assays between the high reported by Bulletin 14-D and the low reported by the Ore Minerals Report. The average grade appears to be 8% zinc, 3% lead, .5% copper .0333 ounces gold, and 1.404 ounces silver per ton. Samples were taken by Shiny Rock Mining Corporation in 1977 by channel sampling at intervals along the mine on the fifth level, and also taking random samples of head ore as it entered the concentrating mill. The approximate gross value of this ore in 1980 dollars is \$134.48 per ton. Ore reserves range from a low of 183,000 tons probable and 100,000 tons possible (Ore Minerals Report referred to by Decker, 1980), to 196,000 tons probable and 196,000 possible in Rosenberg's Report (1941), and as high as 500,000 (Merritt, 1935-1941).

Ruth No. 4: Assays of ore taken from the 35 feet of open cut in 1980 show an average grade of 1.3% zinc, 1.28% lead, 1.68% copper, .038 ounces of gold and 2.67 ounces of silver per ton (see Appendix 9). The approximate value of this ore in 1980 dollars is \$112.14 per ton. Although the probable ore reserves of the Ruth No. 4 have not as yet been determined, judging from the five foot width of the exposed vein, the 52 foot length of the adit, and the 35 foot height of the open, exposed cut, it is contemplated that development of the Ruth No. 4 can proceed contemporaneously with development of the Ruth No. 1, Ruth No. 2, and Morning Star mines to provide continual ore feed for the mill and to stockpile ore reserves for

mill feed.

Morning Star: The Morning Star vein is analyzed in the reports of Rosenberg, Merritt, Frizzel, Libbey, and Decker. In some cases it is referred to as the Blue Jay or Blue Vein due to the color of the ore in this particular vein, which color is not dissimilar to that of the ore exposed on the Ruth No. 4. The vein runs parallel to the veins in the Ruth mine. It has not been as extensively developed as the Ruth mine. Assays taken by Shiny Rock Mining Corporation and Decker show an average value of ore at 9.35% zinc, 2.5% lead, .68% copper, 1.54 ounces of silver, and a trace of gold per ton (see Appendix 9). The approximate value of of this ore in 1980 dollars is \$134.74 per ton. Ore reserves have been estimated to be as high as 500,000 (United States Geological Survey Data).

The combined ore reserves of the Ruth No. 1, Ruth No. 2, Ruth No. 4 and Morning Star are estimated at no less than 250,000 tons. This figure is based upon the 200,000 tons of minimum estimated ores reserves for the Ruth mine (Ore Minerals Report, 1943) and a realistic estimate of 50,000 tons of ore reserves for the Morning Star mine. Using the December, 1980 net smelter return value for such ore of \$78.00 per ton (see Appendix 4), the gross value of the known reserves on these four claims is \$19,500,000.00.

Mandalay: The Mandalay was sampled by Decker for copper, silver and gold and shows an average value of 3% copper, 1.4 ounces of silver, and .02 ounces of gold per ton (see Appendix 9). The approximate value of this ore in 1980 dollars is \$88.30 per ton. The sampling and exploration programs to be conducted by Amoco Minerals in 1981 are expected to accurately establish initial ore reserves.

Santiam No. 1: Ore from the vein on the Santiam No. 1 has been assayed

and shows an average of 10% copper, 3 ounces of silver, and .03 ounces of gold per ton (see Appendix 9). The approximate value of this ore in 1980 dollars is \$245.24 per ton. At the bottom of the winze, there is a strong vein of chalcopyrite reported to be fourteen inches wide and nearly pure. The sampling and exploration programs to be conducted by Amoco Minerals on the Santiam No. 1 are also expected to accurately establish initial ore reserves. Other values on these ore deposits are covered in the cost and revenue section of this report (Appendix 10).

EXPEDITURES AND FINANCING

Since 1972, Shiny Rock Mining Corporation has obtained approximately 1.3 million dollars in financing for exploration and development of the deposits of the mining claims and millsites discussed in this report. Financing has principally been obtained from the Persis Corporation, a company which has historically invested heavily in natural resources development. Additionally, Freeport Minerals invested approximately \$300,000 in the mine property during the two year period their lease was in effect. Amoco Minerals has budgeted approximately \$180,000 during 1981 for exploration and development of the Santiam No. 1, Mandalay, and other claims under lease. Development expenditures for improvements to the claims and millsites are nearly \$500,000.00 (see Appendix 11).

Exploration and development results up to this point in time have warranted the continued development of the claims and additional spending by the parties having interest in the claims. The United States National Bank in Portland has established a substantial line of credit for Shiny Rock Mining Corporation with respect to its operations. Additionally, the

small business administration has tentatively indicated that it would guarantee a loan for the continued development of the Ruth and Morning Star mines. With respect to the Santiam No. 1 and Mandalay, which are under lease to Amoco Minerals, Amoco's management has determined that an aggressive exploration program will be pursued for this area. Amoco will provide its own financing for the balance of the exploration and development phases of the project.

RECOMMENDATIONS

The Ruth No. 1, No. 2, and No. 4, together with the Morning Star, should be developed as a single producing unit, as the ores are similar in composition and grade. The reserves of these four claims are conservatively estimated at 250,000 tons of mineable ore. This should provide a minimum of 6½ years of production to a 150 ton per day mill, with an average of 39,000 tons processed annually.

Financial arrangements should be completed at this time for a working capital loan of \$500,000 in order to reopen the fourth level of the Ruth and rehabilitate a raise between the fifth and fourth levels. At a station just prior to the first raise (now caved) between the fifth and fourth levels, a drift in the foot wall should be put in parallel to the old workings. Cross cuts at 50 foot intervals should be placed along this drift to serve as ore chutes and manways to a subsequent shrinkage stoping operation in the area between the fourth and fifth levels. Initial production should come from this area while crews are developing ore as they rehabilitate the fourth level. If the two raises between the fifth and fourth levels are determined to be unusable, a new raise should be driven

in the structurally sound rock of the footwall to the fourth level. In the fourth level, a new portal should be opened and a cross cut should be driven approximately 500 feet southeast through the footwall to intersect the old workings on the fourth level. Down drilling and blasting may then be conducted from the fourth level to permit mining and removal of the ore at the fifth level. That ore could not otherwise be mined due to instability, as demonstrated by previous caved-in stopes at the fifth level.

Mining equipment should be moved into the Morning Star and the existing workings should be reopened. In the vicinity of the old stope an underground core drill should be brought in to drill vertically along the vein and drilling stations should be put in at the end of the drift to drill horizontally along the vein. Larger ore reserves may then be developed in preparation for putting this claim into production.

When the initial rehabilitation efforts have been completed with respect to the Ruth No. 1, Ruth No. 2 and Morning Star as described above, rehabilitation efforts should then be commenced at the Ruth No. 4 discovery adit. Again, an underground core drill should be utilized to drill horizontally along the vein at the end of the drift for the purpose of developing larger ore reserves. Ore that is developed during the rehabilitation of the old workings at the Morning Star and Ruth No. 4 can be mixed with ore removed from the Ruth No. 1 and No. 2 and run through the mill at the same time.

As to the Mandalay and Santiam No. 1 claims, Amoco Minerals is expected to continue its exploration program and to develop the ore reserves on these claims. Ore from these properties appears to be compatible with the ore deposit drilled out by Amoco in Cedar Creek and would lend itself to be

commingled with Cedar Creek ore at any mill facilities constructed to process that deposit. Amoco's Cedar Creek deposit is approximately one mile south of the Santiam No. 1 and Mandalay claims.

A mining engineering consulting firm should be retained to evaluate the present ore reduction facility on the Starvation millsite. A larger flotation plant should be designed with a minimum of 150 tons of daily capacity, in accordance with the flow sheet developed by Denver Equipment Ore Testing Division (Appendix 8) and the practical information developed by Shiny Rock Mining Corporation during its operations of the 24 ton mill currently operating on the property.

The cook house on the Poor Boy millsite should continue to be renovated in preparation for its use by Amoco as a temporary core storage and future cook house facility. Additional facilities should be provided for logging core from the underground drilling program previously recommended. In addition, a storage facility/truck shop should be built in order to store mining equipment now sitting out in the weather and to provide long-term core storage a maintenance facility for the equipment associated with the mining operations.

The access road from the mining company's gate three miles west of the millsites to the mining camp should be improved as defined in Shiny Rock Mining Corporation's operating plan previously filed with the Forest Service (see Appendix 7). An estimated cost of \$50,000 is anticipated to complete improvements to this road. The road from the mill to the Ruth and Morning Star claims should be improved through the addition of adequate drainage facilities and rockings to provide a medium speed haul road between these mines and the mill. Particular attention should be paid to improving

the access to the fifth level of the Ruth and the adit on Ruth No. 4. Access is too steep at this time for conventional haul vehicles, as Shiny Rock Mining Corporation must presently rely on a four-wheel-drive dump truck. The grade, as surveyed by the United States Forest Service, for an access road to the fifth level also appears marginal. The best solution to the access problem appears to be revitalization of the old tram road, which is situated well above Battle Ax Creek, is nearly level, and intersects with the main haul road, close to the millsites. Such renovation should be done in cooperation with the Forest Service.

CONCLUSION

In conclusion, based upon the substantial amount of data available, it is believed this property possesses considerable profit potential for development by a small to medium sized mining company. Based on the grade, tonnage and previous development work in the underground workings, and the information and concentrates produced at the ore reduction mill, the Ruth No. 1, Ruth No. 2, Ruth No. 4, Morning Star and the three millsites provide the opportunity for a substantial profit with a minimal capital investment when compared to potential gain. The table entitled "Ore Values and Costs" (Appendix 10) projects an annual net profit of \$1,317,420 at today's market. Since it is generally recognized that the zinc/lead market is at the low-medium end of its cycle (see Appendix 4), present political change regarding domestic development of defense and strategic minerals indicates these markets will remain relatively stable and will likely improve over the next four to eight years. In addition, the global instability now being experienced tends to raise prices of precious metals in

relationship to the dollar. Since global stability does not appear imminent, these prices should either hold at their current levels or increase. Of course, small variations can be expected due to the natural fluctuations of confidence by the buyers and investors over various periods during the year.

With respect to development of the Santiam No. 1 and Mandalay, the copper market is forecast to remain at its present low levels until the economic conditions in the United States reverse themselves and the current period of recession is ended. Copper development will be more long range. Since the continued development schedule of the Santiam No. 1 and Mandalay is in the hands of Amoco Minerals, their future of becoming productive seems well assured in view of Amoco's impending development of its commercial copper ore body located at Cedar Creek.

If Shiny Rock Mining Corporation determines that its best interests will not be served by continuing as a mine operator and developer, a concerted effort should be made to lease this property to one of the many small to medium sized United States or Canadian mining companies. Noranda and Bunker Hill (Western Resources), which specialize in the operation and development of this type of project, have expressed substantial interest in leasing and developing the property.

The six mining claims and three millsites reviewed in this study were all found to be economically viable when viewed in today's market and should be exploited to their full potential.

BIBLIOGRAPHY

- American Law of Mining, Rocky Mountain Mineral Law Foundation.
- Class and Commodity Transportation Rate Schedules, Published for Shiny Rock Mining Corp. by Southern Pacific Railroad.
- Company Assays Taken by Shiny Rock Mining Corp., Freeport Minerals, Amoco Minerals, Periods 1972-1980.
- Correspondence Between Shiny Rock Mining corp. and Phillip Brothers, Division of Englehart Minerals and Chemicals Corp.
- Engineering and Mining Journal, Vol. 182, No. 1.
- The Feasibility of a Combined Mining, Milling and Smelting Operation in Northwestern Oregon, author unknown, 1939.
- The Feasibility of Electrolytic Zinc and Cadmium Production in the Lower Columbia River Area, by Ray M. Miller, War Department, July 1937.
- Final Environmental Statement, Willamette National Forest, U. S. Forest Service, 1977.
- Geology of the Central and North Parts of the Western Cascade Range in Oregon, U. S. Geological Survey, paper 449, Peck, 1964.
- Geology And Mineralization Of The North Santiam Mining District, Oregon State University, unpublished M. S. Thesis, James P. Olson, 1979.
- Geology Of Several Properties Held By Shiny Rock Mining Company, Marion County, Oregon, by Donald J. Decker, April, 1980.
- Gold And Silver In Oregon, Oregon Department of Geology and Mineral Industries, Bulletin 61, by Brooks and Ramp, 1968.
- Marketing of Ores and Concentrates of Gold, Silver, Copper, Lead and Zinc in the United States, Bureau of Mines Information Circular No. 8206, 1964.
- Metalliferous Mineral Deposits of the Cascade Range in Oregon, E. Callahan and A. F. Buddington.
- Mineral Deposits, Lindgren.
- The Mineral Industry in Oregon, Jerry J. Gray, published Oregon Geology, Vol. 43, No. 3, 1980.
- Mineral Lease between Shiny Rock Mining Corp. and Amoco Minerals, December, 1980.

Mineral Surveys Nos. 990, 991, 992, 993, 994.

North Santiam Porphyry Copper Prospect, Marion County, Oregon, Freeport Exploration Company, by Donald J. Decker and M. B. Jones, 1977.

Notes on the Zinc Deposits on the Santiam River, Oregon, Fred W. Draper.

Open Smelter Shcedule, ASARCO, East Helena, Montana.

Open Smelter Schedule, ASARCO, Tacoma, Washington, Reference Don Beane.

Open Smelter Schedule, Bunker Hill, Kellogg, Idaho.

Oregon Metal and Mines Handbook, Bulletin 14-D.

Preliminary Report on the Ruth Group of Mining Claims, by L. E. Frizzell, 1966.

Pyrite Instructive Rocks and Contact Metamorphosis in the Cascade Range in Oregon, American Journal of Science 31-421, Callahan and Buddington, 1938.

Reconnaissance of Some Mineral Deposits in the North Santiam Area, by F. W. Libbey, 1956.

Report by Fred J. Rosenberg, March 1941.

Report on the Exploration Program of West Hills Exploration on the Ruth Vein, Santiam Mining District, Marion County, Oregon, by Lloyd Frizzell, 1966.

Report on the Ruth Vein of Columbia Mines Development, by William L. Merritt and Dr. E. W. Lazzell, 1937-1939.

Ruth and Old Amalgamated Mine, Marion County, Oregon, U. S. Bureau of Mines, War Minerals Report, 1943.

Shiny Rock Mining Corporation Internal Company Records covering Assays of the Ruth 1, 2, 4 and Morning Star, Mandalay, Santiam No. 1, Daily Operating Mill Reports, Daily Operating Mine Reports as supervised by Gerald Hartley, Mining Engineer, Reno, Nevada.

Shiny Rock Mining Corp. 1981 Operating Budget.

Shiny Rock Mining Corp. and U. S. Forest Service Operating Plan, 1977.

The Ruth Vein, Wm. L. Merritt, 1935-1941.

The Structure of the North Santiam River Section of the Cascade Mountains in Oregon, Journal of Geology, 44-701, T. P. Thayer, 1936.

Textbook on Ore Dressings, Richards and Locke.

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MARKETING ORES AND CONCENTRATES OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE UNITED STATES

By Melford H. Salsbury, William H. Kerns, Frank B. Fulkerson,
and George C. Branner

* * * * * information circular 8206



UNITED STATES DEPARTMENT OF THE INTERIOR
Stewart L. Udall, Secretary

BUREAU OF MINES
Marling J. Ankeny, Director

APPENDIX J. - TYPICAL ZINC SMELTER BUYING SCHEDULE APPLYING TO WESTERN ORES

Quotation for zinc concentrates for calculations only

Payments

Gold: If 0.03 of a troy ounce per dry ton or over, pay for 80 percent at 92.57 percent of the net price per ounce paid by U.S. Mints for gold recovered from domestic mine production on the 15th day following the rate of delivery of product at buyer's plant, provided however, that the payment to be made for the gold content of seller's product shall be subject to the terms and conditions of the Gold Schedule hereto attached and expressly made a part hereof. Nothing paid for gold if assaying less than 0.03 of a troy ounce per dry ton.

Silver: If 1.0 ounces per dry ton or over, pay for 80 percent on the basis of the mint price as defined in the Silver Schedule hereto attached and expressly made a part hereof, except as therein otherwise provided. Minimum deduction 1.0 ounces per dry ton. Nothing paid for silver if assaying less than 1.0 troy ounces per dry ton.

If however, the seller shall so elect, the price payable for the silver content of seller's product shall be based on the average of the Handy and Harman, New York, quotations for silver for the calendar week following date of delivery at the plant of the buyer, provided, however, that written notice of such election shall be given to the buyer prior to said date of delivery, and further, that if during said calendar week, in the sole judgment of the buyer, the market for silver for 3 months' forward delivery shall be inadequate, and the buyer shall so notify the seller, said price shall be based on the average of the Handy and Harman, New York, quotations for silver for the calendar week including the 19th day following said date of delivery. In case Handy and Harman, New York, shall discontinue publishing quotations for silver then the New York quotations for silver as published by the Engineering and Mining Journal shall govern.

Lead: From the wet lead assay deduct four units and pay for 80 percent of the remainder at the price for common desilverized domestic lead for delivery in New York City, as published in the Engineering and Mining Journal of New York, averaged for the calendar week including date of arrival of the last car of each lot at buyer's smelter, less a deduction of 2 cents per pound of lead accounted for. Nothing paid for lead if assaying less than 4.0 percent by wet assay.

Copper: If 1.0 percent or over wet assay pay for 65 percent of content at the daily net refinery domestic quotation for electrolytic cathodes, as published in the Engineering and Mining Journal of New York, averaged for the calendar week including date of arrival of the last car of each lot at buyer's smelter, less a deduction of 6.0 cents per pound of copper accounted for. Nothing paid for copper if assaying less than 1.0 percent by wet assay.

Zinc: If 40 percent or more contained pay for 85 percent of content, or, if assaying less than 40 percent deduct eight units and pay for remainder. Payment in either case shall be made at the East St. Louis price for prime western zinc as published by the Engineering and Mining Journal of New York, averaged for the calendar week including date of arrival of the last car of each lot at buyer's smelter, less a deduction of 57.5 cents per 100 pounds of zinc accounted for.

From the total of the above payments make the following deductions.

Deductions

Base charge: \$38.00 per net dry ton of 2,000 pounds. (If the full East St. Louis quotations for zinc applicable under the above zinc payment clause if more than 6.0 cents per pound, there shall be added to the base charge \$1.00 per net dry ton for each one-cent increase above 6.0 cents, fractions in proportion.)

Iron: Plus manganese 7.0 percent free; charge for excess at 50 cents per unit, fractions in proportion.

Arsenic and antimony combined: 0.5 percent free; charge for excess at \$1.00 per unit, fractions in proportion. In the event materials delivered hereunder contain in excess of 2.0 percent combined arsenic and antimony it shall be optional with the buyer to accept or refuse such material.

Lime and magnesia combined: 1.0 percent free; charge for excess at \$1.00 per unit, fractions in proportion.

Moisture: Minimum deduction 1.0 percent.

Labor:¹ This quotation is based on an average hourly labor cost of \$1.677 at buyer's plant, based on the wage rates, shift differentials, holiday, vacation, and overtime payments and payroll taxes paid to or on behalf of the employees (excluding foremen and other salaried employees and men on construction work) at said plant. Any increase or decrease in said average hourly labor cost in effect during the month prior to (including) date of delivery of product shall be for seller's account and to adjust, add 15 cents per dry ton for each 1 cent per hour that the average hourly labor cost shall be in excess of \$1.677 and deduct 15 cents per dry ton for each 1 cent per hour that the average hourly labor cost shall be less than \$1.677, fractions in proportion.

¹Labor adjustment--Average labor cost December 1958 \$2.327
Schedule 1.677
Increase at \$0.15 .650 = \$9.75 per dry ton

SHIPPER: _____ ADDRESS: _____
MINE: _____ LOCATION: _____
PRODUCT: _____ R.R. STATION: _____

The following purchase terms are subject to the General Clauses shown on the back of this sheet and subject to change on 30 days notice. Unless shipments are begun within 30 days, this quotation is automatically cancelled.

DELIVERY: Freight prepaid FOB rail cars at unloading bins of the ASARCO Incorporated Smelter at East Helena, Montana. The rates quoted are based on shipment in open-top gondola equipment. Extra unloading charges of up to \$2.00 per wet ton will be assessed for product received in other equipment. A charge of \$5.00 per wet ton will be assessed for product received in sacks or drums.

PAYMENTS

GOLD: Deduct 0.02 troy ounces per dry ton and pay for 92.5% of the remaining gold content at the daily London Final Gold Quotation, as published in Metals Week, averaged for the calendar month following date of delivery of product, less a deduction of 100¢ per troy ounce of payable gold. All purchases of gold will be subject to U.S. Governmental regulations pertaining to transactions in gold.

SILVER: Deduct 1.0 troy ounces per dry ton and pay for 95% of the remaining silver content at the Handy & Harman New York Quotation for refined silver, as published in Metals Week, averaged for the calendar month following date of delivery of product, less a deduction of 7.0¢ per ounce.

LEAD: Deduct from the wet lead assay 1.5 units and pay for 95% of the remaining lead at quotations for common domestic lead for delivery in New York as published in Metals Week, averaged for the calendar month following date of delivery of product, less of deduction of 5.2¢ per pound of lead accounted for. The quantity of lead not paid for shall equal a minimum of 3.0 units per net dry ton.

COPPER: Deduct from the wet copper assay 1.3 units and pay for 97.5% of the remaining copper at the daily domestic refinery quotations for electrolytic wire bars, as published in Metals Week, averaged for the calendar month following date of delivery of product, less a deduction of 18¢ per pound of copper accounted for. The maximum quantity of copper paid for shall not exceed 5 units.

NO PAYMENT WILL BE MADE FOR ANY METAL OR CONTENT EXCEPT AS ABOVE SPECIFIED.

DEDUCTIONS

SMELTING
DEDUCTION

The smelting deduction shall be \$47.50 per dry ton based on
(a) A cost of employment of \$7.75 per hour at East Helena,
(b) A cost of fuel of 280¢ per MMBtu at East Helena,
(c) A cost of electric power of 10.0 mills per kwh at East Helena.

SMELTING
DEDUCTION
ADJUSTMENT:

(a) Increase or decrease smelting deduction by 8.0¢ for each 1¢ per hour that the average hourly cost of employment during the calendar month including date of delivery is greater or less than \$7.75, fractions in proportion.

(b) Increase or decrease smelting deduction by 6.0¢ for each 1¢ per MMBtu that the average cost of fuel used during the calendar month including date of delivery is greater or less than 280¢, fractions in proportion.

(c) Increase or decrease smelting deduction by 6.0¢ for each 1 mill per kwh that the cost of electric power used during the calendar month including date of delivery is greater or less than 10 mills, fractions in proportion.

CRUDE
ORE:

Charge \$3.00 per wet ton for crushing and sampling.

ARSENIC:
ANTIMONY:
BISMUTH:
NICKEL:
MOISTURE:

Allow 0.5 units free; charge for excess at \$1.00 per unit)
Allow 0.5 units free; charge for excess at \$1.00 per unit)
Allow 0.05 units free; charge for excess at \$0.05 per pound)
Allow 0.3 units free; charge for excess at \$3.00 per unit)
Allow 10.0 units free; charge for excess at \$0.50 per unit)

FRACTIONS IN PROPORTION

TONNAGE: Limited to _____ tons per month.

ASARCO Incorporated

By _____

SHIPPER _____

ADDRESS _____

MINE _____

LOCATION _____

PRODUCT CONCENTRATES

R. R. STATION _____

The following purchase terms are subject to the General Clauses shown on the back of this and are subject to change on 30 days notice. Unless shipments are begun within 30 days, quotation is automatically cancelled.

DELIVERY

Freight prepaid f.o.b. rail cars at unloading bins of the ASARCO Incorporated smelter at Washington. The rates quoted are based on shipment in open-top gondola equipment. Extra unloading charges of up to \$2.00 per wet ton will be assessed for product received in other equipment.

PAYMENTS

GOLD

Deduct .02 troy ounce per dry ton and pay for 92.5 % of the remaining gold content the daily London Final Gold Quotation, as published in Metals Week, averaged for the third calendar month following date of delivery of product, less a deduction of 400.0¢ per ounce of payable gold.

SILVER

Deduct 1.0 troy ounces per dry ton and pay for 95 % of the remaining silver content at the Handy and Harman New York Quotation for refined silver, as published in Metals Week averaged for the third calendar month following date of delivery of product, less a deduction of 25.0 ¢ per ounce.

COPPER

Deduct from the wet copper assay 1.0 units and pay for 97.5 % of the remaining copper the daily quotation for "MC" Copper Composite as published in Metals Week, (current _____), averaged for the third calendar month following date of delivery of product, a deduction of 12.0 ¢ per pound of copper accounted for. Nothing paid for copper if less than 1.0 % by wet assay.

NO PAYMENT WILL BE MADE FOR ANY METAL OR CONTENT EXCEPT AS ABOVE SPECIFIED.

DEDUCTIONS

SMELTING DEDUCTION

The Smelting deduction shall be \$ 85.00

- (a) A cost of employment of \$ --- per hour at Tacoma Plant
- (b) A cost of fuel of --- ¢ per MBTU at Tacoma Plant
- (c) A cost of electric power of --- mills per kWh at Tacoma Plant

SMELTING DEDUCTION ADJUSTMENT

- (A) Increase or decrease smelting deduction by --- ¢ for each 1¢ per hour that the hourly cost of employment during the calendar month including date of delivery is greater or less than \$ ---, fractions in proportion.
- (B) Increase or decrease smelting deduction by --- ¢ for each 1¢ per MBTU that the cost of fuel used during the calendar month including date of delivery is greater or less than --- ¢, fractions in proportion.
- (C) Increase or decrease smelting deduction by --- ¢ for each 1 mill per kWh that the cost of electric power used during the calendar month including the date of delivery is greater or less than --- mills, fractions in proportion.

SMALL LOT CHARGE

Minimum charge \$ 25.00 per lot. For product received in sacks or drums charge \$ 10.00 per ton of material as received.

LEAD
ZINC
ARSENIC
ANTIMONY
BISMUTH
NICKEL
MOISTURE
UMINA
FREIGHT

Allow --- units free; charge for excess at --- per unit)
 Allow 3.0 units free; charge for excess at 50¢ per unit)
 If --- units or more, charge for all at 200¢ per unit)
 Allow --- units free; charge for excess at 150¢ per unit)
 Allow .05 units free; charge for excess at 1000¢ per unit)
 Allow .3 units free; charge for excess at 500¢ per unit)
 Allow 5.0 units free; charge for excess at 50¢ per unit)
 " 3.0 " " " " " " " " 50¢ " ")

FRACTIONS IN PER

All railroad freight and delivery charges for account of Shipper. Deduct from settlement and other advances made by Buyer.

TONNAGE

Limited to _____

GENERAL CLAUSES GOVERNING ALL OPEN SCHEDULES

1. **TAXES:** All taxes or other governmental charges, national, local or municipal, now or hereafter imposed in respect to or measured by the product purchased hereunder, or the production, extraction, smelting, refining, sale, transportation, proceeds or value thereof or of the metal derived therefrom, other than income taxes levied upon the BUYER, shall be for the account of the SELLER and shall be deducted from the purchase price payable hereunder.
2. **SAMPLING:** Weighing, moisture and ore sampling (at which SELLER or a representative may be present) as done by the BUYER according to standard practice, promptly after receipt of product, will be accepted as final. The absence of SELLER or a representative shall be deemed a waiver of the right in each instance. After sampling, the product may be placed in process, commingled, or otherwise disposed of by BUYER.
3. **ASSAYING:** As soon as available, BUYER will furnish a pulp sample to SELLER, or to SELLER's representative or the firm handling SELLER's assay work. On SELLER's request BUYER will make assay comparison with SELLER, or his representative, by exchange of assay certificates over the counter. Comparison may be made by exchange of certificates through the mail, and in such event, BUYER and SELLER will mail to each other their respective assay certificates on the sixth day following date appearing on smelter pulp sample envelope, or other such date as may be agreed upon. Gold and silver assays are to be determined by commercial fire assay method, unadjusted for slag loss and cupel absorption, and umpire assayers shall be so informed. The following splitting limits will be used for comparison of assays under either exchange method listed above:

Gold	-	.02 troy ounce per ton	Lead	-	.5%	Antimony	-	.2%
Silver	-	.5 troy ounce per ton	Zinc	-	.5%	Bismuth	-	.02%
Copper	-	.3%	Arsenic	-	.3%	Nickel	-	.1%
4. **SMALL LOT:** The rates quoted herein are for carload lots. On truck shipments and/or any lot containing less than 20 tons, there will be a handling charge of \$25.00.
5. **REFINED COPPER FREIGHT:** The rates quoted herein are based on present published all rail freight rates on refined copper from ASARCO Incorporated, Tacoma, Washington to New York City. Any increase or decrease is for account of SELLER, and proper deduction or credit will be made accordingly.
6. **DEFINITIONS:** In this schedule the word "ton" means a ton of two thousand pounds avoirdupois; the word "ounce" as referring to gold and silver, means the troy ounce; and the word "unit" means one percent of a ton, or twenty pounds avoirdupois.
7. **FORCE MAJEURE:** Performance of this agreement is subject to any delays caused by strikes or other disabling causes beyond the control of either party.
8. **FREIGHT AND ADVANCES:** All freight and other charges paid by BUYER for SELLER's account will be considered as an advance payment and will be subject to an interest charge. Such interest will be charged from the date of the advance payment to the date of final settlement at a rate of 1.25 times the rate quoted to Asarco from time to time by the Chase Manhattan Bank, N. Y.
9. **SELLER** should consign his shipments to ASARCO Incorporated, Tacoma, Washington

and it is required that the original bill of lading covering each such shipment be delivered to the BUYER promptly on release of the shipment to the carrier. Full details as to the disposition of settlement returns, including royalty instructions if any, must be furnished by SELLER to BUYER before shipments can be processed.

METALS WEEK QUOTATIONS

SILVER, GOLD, STERLING

COFFER (a)				LEAD		ZINC		TIN		SILVER (e)			STERLING		GOLD (g)	
DEC. 1980	US Producer		c.i.f. Europe	Atlantic Seab'd	US Producer (b)	US PW (c)	MW Composite (d)	DEC. 1980	SILVER (e)		STERLING EXCH. (f)	London Final	H&H, NY			
	Deliv-ered	Refin-ery							H&H, NY	London Spot						
1	95.568	94.568	89.462	86.162	39.000	40.430	791.200	1	1895.000	804.350	2.34850	635.000	635.300			
2	95.568	94.568	89.462	86.162	39.000	40.430	791.200	2	1840.000	791.500	2.34150	627.000	627.000			
3	92.982	91.982	88.217	84.417	39.000	40.080	745.020	3	1849.000	789.000	2.34600	627.250	627.250			
4	92.982	91.982	88.217	84.417	39.000	40.080	745.020	4	1869.000	793.100	2.34420	631.500	631.500			
5	91.839	90.839	86.628	82.828	39.000	40.918	747.800	5	1798.000	772.200	2.33490	617.000	617.000			
WK AVG	93.788	92.788	88.222	84.422	39.000	40.524	748.322	WK AVG	1839.400	790.630	2.34384	627.550	627.610			
8	89.568	88.568	86.103	82.303	39.000	40.800	746.370	8	1752.000	744.100	2.34350	617.250	617.250			
9	89.568	88.568	85.545	81.745	38.756	40.379	747.710	9	1680.000	736.300	2.33550	604.000	604.000			
10	86.612	85.612	83.374	79.574	39.000	40.344	752.830	10	1572.000	689.700	2.34000	579.000	579.000			
11	85.982	84.982	80.576	76.776	39.000	40.163	747.320	11	1432.000	643.000	2.33150	558.000	558.000			
12	85.982	84.982	79.677	75.877	39.000	40.596	762.490	12	1497.000	618.500	2.32350	562.750	562.750			
WK AVG	87.542	86.542	83.055	79.255	38.951	40.456	751.344	WK AVG	1556.600	686.320	2.33140	584.200	584.200			
15	85.982	84.982	84.460	80.660	39.000	40.552	776.470	15	1545.000	684.700	2.32750	579.000	579.300			
16	85.982	84.982	81.170	77.370	39.000	40.604	759.370	16	1454.000	623.100	2.32900	561.000	561.000			
17	85.982	84.982	82.490	78.690	39.000	39.828	760.550	17	1572.000	681.000	2.33000	575.500	575.500			
18	85.982	84.982	83.015	79.215	39.000	40.669	761.730	18	1540.000	671.000	2.32400	573.500	573.500			
19	86.711	85.711	84.419	80.619	39.000	40.639	765.430	19	1530.000	679.200	2.34100	575.000	575.000			
WK AVG	86.128	85.128	83.111	79.311	39.000	40.458	764.710	WK AVG	1540.200	687.800	2.32630	572.600	572.860			
22	88.189	87.189	85.153	81.353	39.000	40.673	769.410	22	1615.000	677.600	2.35100	594.750	594.750			
23	89.238	88.238	85.661	81.861	38.540	40.687	771.860	23	1650.000	681.050	2.36500	602.500	602.500			
24	89.238	88.238	86.281	82.481	39.000	41.144	771.230	24	1640.000	694.150	2.36000	HOLIDAY	601.000			
25	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	25	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY			
26	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	26	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY			
WK AVG	88.888	87.888	85.698	81.898	38.847	40.835	771.123	WK AVG	1635.000	684.267	2.36450	598.625	599.417			
29	89.238	88.238	87.252	83.452	39.000	40.823	763.980	29	1585.000	667.500	2.36600	593.750	593.750			
30	89.238	88.238	86.294	82.494	39.000	40.820	767.080	30	1540.000	654.600	2.36000	589.750	589.750			
31	89.238	88.238	85.825	82.025	39.000	41.059	772.850	31	1545.000	650.300	2.36960	HOLIDAY	586.000			

AVERAGES FOR MONTH: 89.127, 88.127, 85.162, 81.362, 38.967, 40.590, 759.558, 1639.333, 700.760, 2.34594, 594.921, 594.611

(a) Copper quotations are cents per lb. MW US Producer Delivered. Quotation is estimated weighted average based on US mine production and current selling prices of US producers, quoted on a delivered wirebar basis. Discounts on cathodes are 0.625¢ per lb. MW US Producer Refinery. F.o.b. quotation is US Producer Delivered price minus 0.9¢ shipping cost. eff. Aug. 1, 1976. MW c.i.f. Europe. Quotation is LME cash asked wirebar price. MW Atlantic Seaboard. Quotation is calculated by deducting shipping costs from the c.i.f. Europe price; eff. March 1, 1975. 2.653¢ per lb is deducted (2.286¢ ocean freight, 0.104¢ insurance, and 0.263¢ lighterage).

(b) Lead, MW US Producer, cents per lb: Quotation is a weighted average based on fixed price sales of domestically refined lead sold by domestic producers to domestic consumers. Eff. Dec. 31, 1971, price is for common grade on a nationwide, delivered basis.

(c) Zinc, MW US PW, cents per lb: Quotation is a weighted average that reflects fixed-shipment sales of prime western zinc, as well as a compilation of sales of other grades, by domestic producers to domestic

consumers. Eff. Jan. 1, 1971, PW zinc is sold on a delivered basis.

(d) Tin, MW Composite, cents per lb: Quotation is the average of Penning price and LME three-month HG price, plus fixed charges (freight, insurance, etc.), finance charges, and a risk factor; the quotation represents the cost to US consumers for Grade A tin (99.895%), ex dock major port, duty paid.

(e) Silver, cents per tr oz: Handy & Harman NY: Quotation is the lowest price at which offers can be obtained by H&H for silver in commercial bar form in accordance with ASTM designation B413-69 specification for refined silver, grade 0.999, for nearby delivery at New York, in quantities sufficient to meet its daily requirements. The price paid by H&H in settlement for silver contained in unrefined silver-bearing materials submitted to the company for refining is at a 1% discount from the published price, eff. Feb. 18, 1975. (By trade custom, the H&H price for silver in unrefined materials is widely used by smelters and refiners as the basis for making settlement for silver contained in silver-bearing materials and in ores; the discount is in

recognition that such silver at the time of purchase is not available in commercial bar form for nearby delivery at New York and is designed to cover carrying, selling, delivery, and other charges involved in marketing of refined silver.) London spot, pence per tr oz: Quotation is the consensus of London bullion dealers.

(f) Sterling Exchange: Noon buying rate as established by Federal Reserve Bank of New York.

(g) Gold, dollars per tr oz: London Final: Quotation is the second of two settings established daily by consensus of London bullion dealers; purity is 99.5% fine. H&H, NY: The lowest price at which offers can be obtained by Handy & Harman for gold, minimum 99.95% purity, for nearby delivery at New York in quantities sufficient to meet its daily requirements.

(h) London Metal Exchange: Quotations are official morning session prices on the LME, in pounds sterling per metric ton. Settlement is cash asked. Purities: lead, 99.97%; standard grade tin, 99.75% (Grade B); zinc, 98%.

LONDON METAL EXCHANGE QUOTATIONS (h)

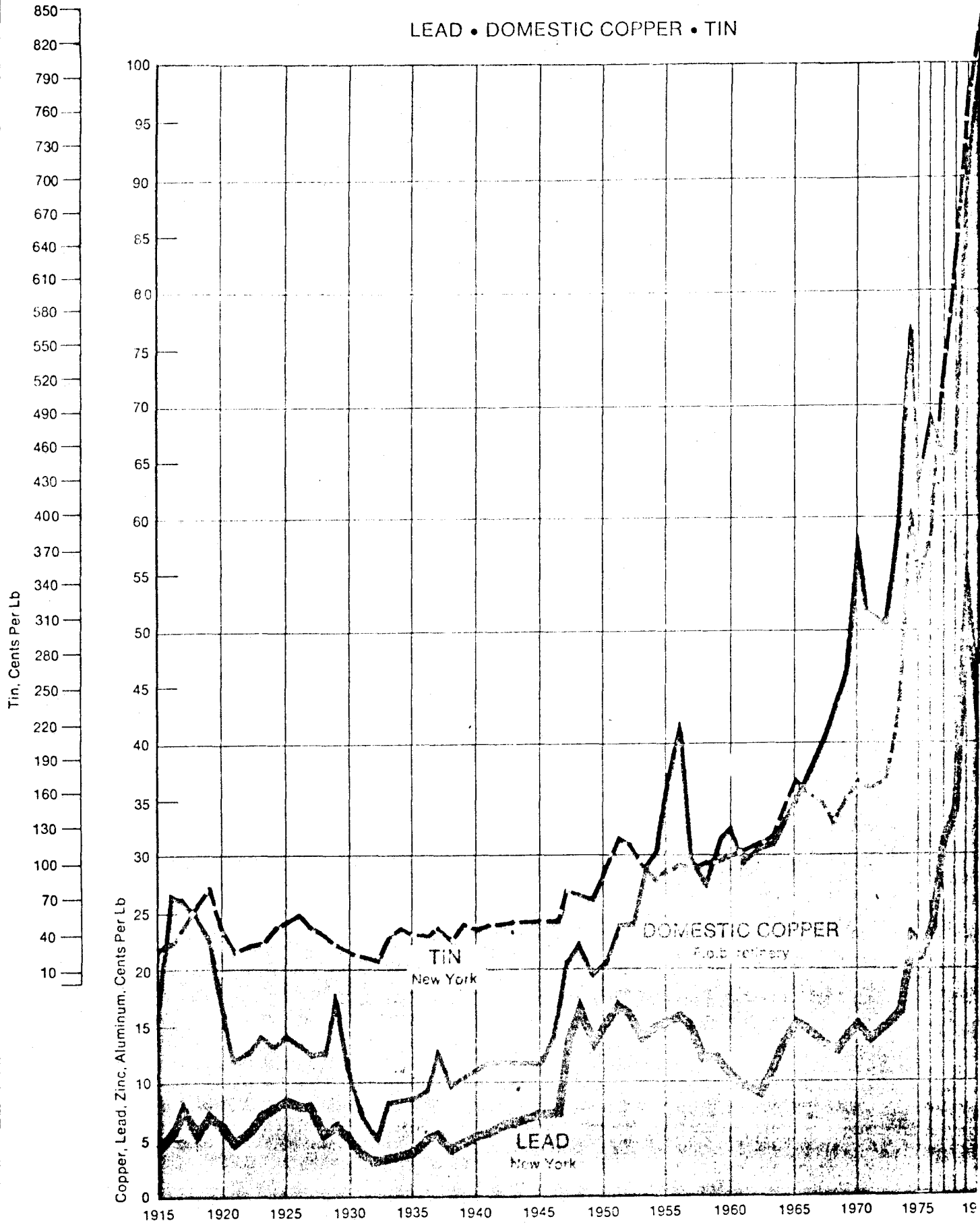
DEC. 1980	COPPER WIREBARS				LEAD				ZINC				TIN			
	Cash		3 Month		Cash		3 Month		Cash		3 Month		Cash		3 Month	
	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
1	844.00	844.50	869.50	870.00	329.00	329.50	340.50	341.00	347.00	347.50	358.50	359.00	6190	6200	6310	6315
2	830.50	831.00	855.00	856.00	321.00	322.00	333.50	334.00	340.00	341.00	352.00	352.50	6204	6205	6305	6308
3	828.50	829.00	853.50	854.00	321.50	322.00	334.00	335.00	336.00	338.00	348.50	349.00	6130	6135	6280	6285
4	827.00	828.00	850.00	850.50	320.50	321.00	333.00	333.50	339.00	339.50	351.00	352.00	6190	6200	6325	6330
5	818.00	816.50	836.00	836.50	317.00	317.50	328.00	328.50	339.00	340.00	351.00	351.50	6140	6150	6280	6290
8	809.50	810.00	832.50	833.50	320.00	320.50	331.50	332.50	338.00	339.00	350.50	351.00	6140	6150	6285	6290
9	807.00	807.50	828.00	828.50	316.50	317.50	328.00	328.50	339.50	340.00	351.50	352.00	6210	6212	6340	6345
10	784.50	785.50	805.50	806.00	313.25	313.75	326.25	326.50	337.50	338.50	349.50	350.00	6235	6240	6345	6350
11	767.00	767.50	788.00	789.00	307.00	307.50	319.00	319.50	335.50	336.00	349.00	349.00	6310	6320	6380	6385
12	755.50	756.00	774.00	774.50	311.00	312.00	322.50	323.00	322.00	323.00	335.00	335.25	6460	6465	6470	6475
15	798.00	800.00	837.00	839.00	321.00	322.00	332.00	333.00	334.00	335.00	345.00	346.00	6485	6490	6515	6520
16	774.50	775.00	788.00	788.50	315.00	316.00	323.50	324.00	332.00	333.00	339.00	339.50	6365	6370	6415	6425
17	779.50	780.50	792.50	793.50	324.00	324.50	332.00	332.50	335.00	335.50	343.00	344.00	6370	6375	6425	6430
18	787.00	787.50	802.50	803.50	324.50	325.00	332.50	333.00	336.00	337.00	346.50	347.00	6340	6350	6415	6420
19	794.00	795.00	808.00	809.00	316.00	316.50	325.00	326.50	328.00	329.00	339.00	340.00	6310	6320	6400	6405
22	797.50	798.50	814.00	814.50	313.00	313.50	325.00	325.50	326.50	327.50	340.00	340.50	6295	6300	6390	6395
23	797.00	797.50	817.00	817.50	313.00	314.00	325.00	325.50	327.50	328.50	340.00	341.00	6230	6232	6360	6365
24	805.50	806.00	826.00	827.00	312.50	313.00	324.00	324.50	325.00	326.00	337.00	338.00	6230	6240	6352	6355
25	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY
26	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY	HOLIDAY
29	812.50	813.00	833.50	833.00	313.50	314.00	325.00	325.50	325.50	326.00	336.00	338.50	6225	6230	6312	6315
30	795.00	796.00	815.00	816.00	307.00	308.00	319.00	319.50	324.50	325.50	337.50	338.00	6195	6200	6320	6325
31	792.50	792.00	808.50	807.00	304.00	305.00	314.00	317.00	321.00	322.00	332.00	334.00	6155	6265	6345	6350
AVG	800.39		819.48		316.55		327.69		333.62		345.24		6269.67		6362.55	
SETTLE																
MARK	800.79				316.89				334.07				6269.00			

Jan. 4	111.319	103.198	53.480	37.327	822.023	3751.667	365.000	66.000
Jan. 11	108.791	101.647	50.400	37.475	821.950	3499.000	370.000	66.000
Jan. 18	115.758	107.985	48.004	37.427	834.588	4493.000	380.000	66.000
Jan. 25	123.994	124.923	49.616	37.426	856.790	3785.000	385.000	66.000
Feb. 1	130.578	130.858	48.662	37.499	843.638	3531.000	390.000	66.000
Feb. 8	133.040	129.340	49.288	37.442	847.168	3620.000	390.000	66.000
Feb. 15	143.085	137.667	49.543	37.483	861.072	3713.000	390.000	66.000
Feb. 22	131.512	126.427	50.000	37.549	876.563	3243.750	390.000	66.000
Feb. 29	123.784	120.239	49.318	37.506	897.170	3410.000	390.000	66.000
March. 7	119.427	113.912	50.000	37.878	936.476	3471.000	395.000	66.000
March. 14	105.044	101.204	50.000	38.172	957.542	2797.000	395.000	66.000
March. 21	100.568	97.647	49.126	37.838	876.790	1961.000	395.000	66.000
March. 28	97.299	93.243	48.009	37.949	881.136	1822.000	395.000	66.000
April. 4	92.554	88.821	48.000	38.183	859.373	1438.250	395.000	68.000
April. 11	95.268	92.067	45.600	38.051	870.670	1573.000	400.000	68.000
April. 18	95.265	90.828	45.000	38.040	878.880	1443.800	405.000	68.000
April. 25	91.096	89.601	42.600	37.961	854.192	1383.000	405.000	68.000
May. 2	93.959	89.556	37.264	37.637	836.772	1319.600	405.000	68.000
May. 9	91.568	87.567	36.000	37.500	881.452	1298.000	405.000	68.000
May. 16	91.568	88.096	36.000	37.500	862.620	1277.000	385.000	68.000
May. 23	91.863	88.817	36.008	37.478	860.802	1150.800	380.000	68.000
May. 30	95.982	92.861	36.000	37.500	861.168	1296.250	380.000	68.000
June. 6	95.382	90.195	34.800	37.400	861.338	1534.600	375.000	68.000
June. 13	90.594	86.754	34.000	36.966	856.094	1621.800	380.000	68.000
June. 20	89.597	85.562	34.000	36.064	845.978	1554.000	385.000	68.000
June. 27	90.825	86.115	34.000	35.500	851.394	1574.000	385.000	68.000
July. 4	96.232	91.190	34.000	35.500	846.766	1661.250	385.000	68.000
July. 11	100.065	93.948	34.000	35.500	843.912	1638.600	390.000	68.000
July. 18	100.865	93.665	34.000	35.500	837.860	1538.300	390.000	68.000
July. 25	106.891	98.749	36.259	35.500	847.686	1606.400	390.000	68.000
Aug. 1	105.625	95.073	40.000	35.500	839.408	1594.800	390.000	68.000
Aug. 8	101.767	93.355	40.000	35.500	842.850	1589.600	385.000	68.000
Aug. 15	102.452	93.482	40.386	35.500	839.940	1570.800	385.000	68.000
Aug. 22	98.810	87.749	41.675	35.610	834.382	1602.200	390.000	68.000
Aug. 29	95.396	86.768	42.000	36.352	840.176	1602.800	390.000	68.000
Sept. 5	94.018	87.287	42.000	36.467	853.210	1659.250	390.000	68.000
Sept. 12	95.996	90.414	42.000	36.400	877.636	1970.600	395.000	68.000
Sept. 19	97.982	89.162	42.000	36.831	874.230	2066.000	395.000	68.000
Sept. 26	102.644	92.459	42.061	36.581	872.860	2265.400	395.000	72.000
Oct. 3	97.982	87.557	44.828	37.193	852.930	2079.800	395.000	72.000
Oct. 10	97.982	88.616	45.000	37.223	843.910	2133.000	400.000	76.000
Oct. 17	98.384	88.896	45.000	37.242	844.440	2091.750	405.000	76.000
Oct. 24	98.810	89.235	45.000	37.308	836.372	1928.400	410.000	76.000
Oct. 31	98.999	90.306	45.000	37.327	828.772	1896.200	410.000	76.000
Nov. 7	97.507	88.275	45.000	38.211	812.708	1893.750	410.000	76.000
Nov. 14	95.396	87.029	43.900	38.501	807.030	1818.800	405.000	76.000
Nov. 21	95.396	87.576	43.000	38.653	792.962	1888.000	395.000	76.000
Nov. 28	95.396	86.871	43.000	39.215	773.640	1864.333	385.000	76.000
Dec. 5	92.788	84.422	39.000	40.524	748.322	1839.400	375.000	76.000
Dec. 12	86.542	79.255	38.951	40.456	751.344	1586.285	368.000	76.000
Dec. 19	85.128	79.311	39.000	40.458	764.710	1540.200	360.000	76.000
Dec. 26	87.888	81.898	38.847	40.835	771.123	1635.000	355.000	76.000

Prices are cents per pound except silver (cents per troy ounce) and mercury (dollars per flask).

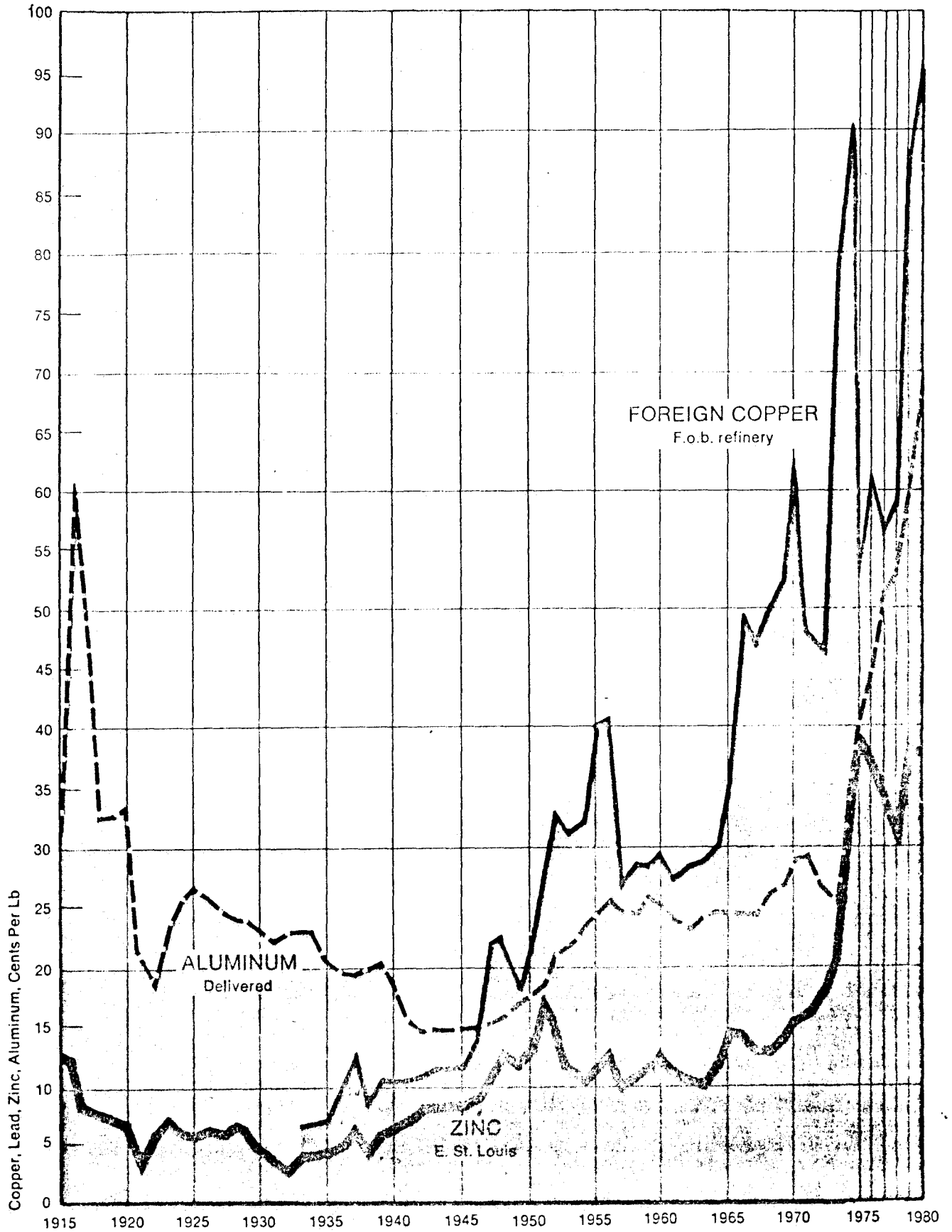
AVERAGE ANNUAL METAL PRICES 1915-1980

LEAD • DOMESTIC COPPER • TIN



AVERAGE ANNUAL METAL PRICES 1915-1980

ALUMINUM • FOREIGN COPPER • ZINC



1915	17 275		4 673	13 054	38 590	49 684	87 01	33 98
1916	27 202		6 858	12 634	43 480	65 661	125 49	60 71
1917	27 180		8 787	8 813	61 802	81 417	106 30	51 59
1918	24 628		7 413	7 890	88 750	96 772	123 47	33 53
1919	18 691		5 579	6 988	63 328	111 122	92 15	32 14
1920	17 456		7 957	7 671	48 273	100 900	81 12	32 72
1921	12 502		4 545	4 655	29 916	62 654	45 46	21 11
1922	13 382		5 734	5 716	32 554	67 528	58 95	18 68
1923	14 421		7 267	6 607	42 664	64 873	66 50	25 41
1924	13 024		8 097	6 344	50 176	66 781	69 76	27 03
1925	14 042		9 020	7 622	57 893	69 055	83 13	27 19
1926	13 795		8 417	7 3337	65 285	62 107	91 90	26 99
1927	12 920		6 755	6 242	64 353	63 370	118 16	25 40
1928	14 570		6 305	6 027	59 427	58 176	123 51	24 300
1929	18 107		6 833	6 512	45 155	50 993	122 15	24 300
1930	12 982		5 517	4 556	31 094	36 154	115 01	23 787
1931	8 116		4 243	3 640	24 467	28 700	67 35	23 300
1932	5 555		3 180	2 876	22 017	27 892	57 93	23 300
1933	7 025	6 713	3 869	4 029	39 110	34 727	59 23	23 300
1934	8 428	7 271	3 866	4 158	52 191	47 973	73 87	23 300
1935	8 649	7 538	4 065	4 328	50 420	64 273	71 39	20 000
1936	9 474	9 230	4 710	4 901	46 441	45 087	79 92	20 000
1937	13 167	13 018	6 009	6 519	54 337	44 683	90 18	19 917
1938	10 000	9 695	4 739	4 610	42 301	43 225	75 47	20 000
1939	10 965	10 727	5 053	5 110	50 323	39 082	103 94	20 000
1940	11 296	10 770	5 179	6 335	49 827	34 773	176 86	18 691
1941	11 797	10 901	5 793	7 474	52 018	34 783	155 02	16 500
1942	11 775	11 684	6 481	8 250	52 000	38 333	196 35	15 000
1943	11 775	11 700	6 500	8 250	52 000	44 750	195 21	15 000
1944	11 775	11 700	6 500	8 250	52 000	44 750	118 36	15 000
1945	11 775	11 700	6 500	8 250	52 000	51 928	134 89	15 000
1946	13 820	14 791	8 109	8 726	54 544	80 151	98 24	15 000
1947	20 958	21 624	14 673	10 500	77 949	71 820	83 74	15 000
1948	22 038	22 348	18 043	13 589	99 250	74 361	76 49	15 733
1949	19 202	19 421	15 364	12 144	99 336	71 930	79 46	17 000
1950	21 235	21 549	13 296	13 866	95 539	74 169	81 26	17 713
1951	24 200	26 258	17 500	18 000	127 077	89 368	210 13	19 000
1952	24 200	31 746	16 467	16 215	120 473	84 941	199 097	19 410
1953	28 798	30 845	13 489	10 855	95 845	85 188	193 032	20 931
1954	29 694	29 899	14 054	10 681	91 838	85 250	264 386	21 784
1955	37 491	39 115	15 138	12 299	94 735	89 099	290 348	23 668
1956	41 818	40 434	16 013	13 494	101 409	90 826	259 923	24 032(e)
1957	29 576	27 157	14 658	11 399	95 261	90 820	246 978	25 416
1958	25 764	24 123	12 109	10 309	95 127	89 044	229 057	24 790
1959	31 182	28 892	12 211	11 448	102 053	91 202	227 484	24 738
1960	32 053	29 894	11 948	12 946	101 438	91 375	210 760	26 000
1961	29 921	27 919	10 871	11 542	113 311	92 449	197 605	25 458
1962	30 600	28 514	9 631	11 625	114 652	108 521	191 208	23 875
1963	30 600	28 413	11 137	11 997	116 652	127 912	189 451	22 623
1964	31 960	30 985	13 596	13 568	157 595	129 300	314 787	23 741
1965	35 017	35 604	16 000	14 500	178 202	129 300	570 747	24 507
1966	36 170	49 512	15 115	14 500	164 070	129 300	441 719	24 500
1967	38 226(f)	47 192	14 000	13 843	153 434	154 968	489 355	24 978
1968	41 847(g)	50 294	13 212	13 500	148 151	214 460	535 555	25 583
1969	47 534(g)	61 969	14 895	14 600	164 498	179 067	505 043	27 176
1970	57.7(h,g)	62.747(h)	15 619	15 319	174 205	177 082	407 769	28 716
1971	51.433(h)	47 870	13 800(i)	16 128(j)	167 348	154 564	292 413	29 000
1972	50 617(h)	46 518(m)	15 029(ii)	17 753(j)	177 474	168 455	218 279	26 409
1973	58 852(h)	78 758(m)	16 285	20 658(j)	227 558	255 756	286 227	25 000
1974	76 649(h)	90 409(m)	22 533	35 945(j)	396 266	470 798	281 688	34 133
1975	63 535(h)	53 249(m)	21 529	38 959(j)	339 818	441 852	158 115	39 786
1976	68 824(h)	60 887(m)	23 102	37 010(jf)	379 815(k)	435 346	121 302	44 341
1977	65 808(h)	56 695(m)	30 703	34 392(j)	534 595(k)	462 302	135 710	51 339
1978	65 510(h)	59 203(m)	33 653	30 971(j)	629 579(k)	540 089	153 322	53 075
1979	92 334(h)	86 901(m)	52 642	37 296(j,l)	753 889(k)	1109 418	281 096	59 395
1980	101 416(h)	95 282(m)	42 455	37 428(j)	846 001(k)	2063 157	389 447	69 566

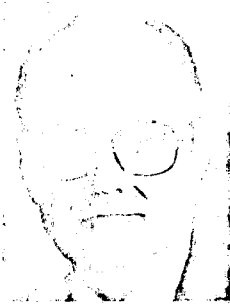
(a) Grade is 99% through 1920 and Straits quality thereafter. Prices for all metals are quoted in cents per pound except silver (cents per troy ounce) and mercury (cents per flask of 76 lb). (d) Average for 11 months. (e) Unalloyed ingot beginning in 1956. (f) Based on the first eight months of 1967, quotation was suspended from September through December. (g) Based on the last nine months of 1968, quotation was suspended from January through March. (h) Beginning in 1970, domestic prices are based on known production and selling rates; foreign prices are LME cash as of . . . Effective Dec 31, 1971, one delivered price nationwide replaced New York basis quotation. (j) Delivered price effective January 1971. East St. Louis quote eliminated. (k) Metals Week composite price effective January 1976. (l) Changed to a high grade base as of Sept 1, 1980. (m) After 1972 Metals Week Atlantic Seaboard price is calculated by deducting shipping costs from the Metals Week c.i.f. Europe price.

ZINC

INDUSTRY GROWS AT PACE, THROUGH HOPEFUL OF IMPROVEMENT

Charles E. Kimbel Jr., vice president, marketing
New Jersey Zinc Div., Gulf + Western Natural Resources Group

The US zinc industry began 1980 with guarded apprehension, and by year end, despite declining consumption, an improving price outlook offered some relief to producers. A severe mid-year slump was followed by firmer demand for zinc during the second



half of the year. Due in part to unusually high interest rates, uncertainty continues to surround the auto and construction industries, zinc's primary markets. US slab zinc supply was sharply curtailed during 1980 and is expected to remain so. As a result, prices remain firm and are expected to rise, especially if economic conditions improve in the auto and construction industries.

Prices. After starting the year at 37.5¢/lb (Prime Western), 1980 slab zinc prices bottomed out at 35.5¢ in June. Prices rose gradually throughout the second half of the year, finally closing at a high for the year of 41.75¢/lb. While the year ended on a somewhat positive note, major producers still insist this price level does not provide a sufficient return. A new development in late August and early September was multi-tier pricing among US and Canadian producers, revising the long-standing industry practice of using Prime Western as the base grade for pricing other zinc products. High Grade emerged as the new base grade. This latest pricing revision came as no surprise, however, given the dominance of the electrolytic process and the gradual elimination of both the pyrometallurgical process and the electrothermic process.

World supply and demand. In 1980, slab zinc demand in the Western World decreased 8%, down from 4.633 million mt in 1979 to about 4.276 million mt. In the Western hemisphere and Western Europe, slab zinc production decreased in 1980, as did production in the remainder of the free market countries.

Western Europe produced 1.819 million mt in 1979. For 1980, the total was an estimated 1.772 million mt. Total Western hemisphere production decreased from 1.433 million mt in 1979 to an estimated 1.271 million mt in 1980. In Africa, Asia, and Oceania, production slipped from 1.449 million mt in 1979 to an estimated 1.360 million mt in 1980.

In January, 1980, producer stocks were at 526,000 mt, while late October reflected an estimated stock decrease to 456,000

US zinc supply and demand

(000 short tons)

	1979	1980
Supply		
Ore production (recoverable)	291	297
Ore imports (zinc content)	248	132
Total zinc in ore	539	429
Metal production	537	353
Metal imports (for consumption)	581	423
Inventory [increase]/decrease	[15]	39
Total metal supply	1,103	865
Metal demand		
Consumption	1,103	865
Exports	0	0
Total demand	1,103	865

mt, a 13% decrease for the year. In Europe, stocks decreased from 165,000 mt at the start of 1980 to 145,000 mt at the end of October. US producer stocks were listed at 59,000 mt in January 1980 and closed out the year at about 27,000 mt, a 54% decrease. These stock reductions primarily reflect capacity shut-downs in the US and Europe.

At the start of 1980, consumer stocks were 199,000 mt. This total dropped to 157,000 by mid-year. In late October, consumer stocks had further declined to an estimated 150,000 mt. The drop in stocks reflected conservative consumer inventory policies resulting from unusually high interest rates and other inventory carrying costs.

In contrast, LME stocks increased from 46,000 mt at the beginning of 1980 to 68,000 mt by late October. This could reflect the anticipated economic slowdown in Europe.

US supply and demand. Zinc consumption in the US fell drastically in 1980. Total estimated US demand for 1980 was 865,000 st, against 1,103 million st in 1979. Galvanizing, zinc's largest market, declined in 1980 as a result of problems facing US auto and steel industries. As in 1979, the auto industry made use of zinc galvanizing to fight corrosion, but a continued slump in auto sales offset any gains that were realized.

Die casting, the second largest zinc market, continued to lose ground during 1980. As in previous years, this downturn was caused primarily by auto makers' production of lighter-weight vehicles, plus the general economic downturn. Several major zinc producers continue to work on new applications for thin-wall die castings. Zinc die castings used in the average 1980 auto totaled an estimated 25 lb, down from 28 lb in 1979.

In November 1980, New Jersey Zinc Co., a unit of Gulf + Western Natural Resources Group, closed its zinc smelting operations at Palmerton, Pa. The Palmerton smelter had a capacity of 118,000 st/yr slab zinc. Zinc oxide, dust, and powder

World zinc production and consumption

(000 metric tons)

	1979		Consumption		1980		Consumption Slab
	Mine	Production Slab	Slab	Slab	Mine	Production Slab	
US	266	488	1,003	270	321	766	
Other Western Hemisphere	2,142	945	477	2,200	950	410	
Western Europe	1,063	1,819	1,721	1,180	1,772	1,640	
Africa	220	185	120	210	182	120	
Asia	414	954	1,196	400	880	1,200	
Oceania	532	310	116	495	298	120	
Totals	4,637	4,701	4,633	4,755	4,403	4,276	
Eastern Bloc	1,699	1,741	1,674	1,700	1,710	1,650	
World totals	6,336	6,442	6,307	6,455	6,113	5,926	

US consumption of slab zinc

(000 short tons)

	1979	1980
Die casting	346	263
Galvanizing	499	396
Brass	156	115
Rolled zinc	24	22
Zinc oxide	39	35
Other uses	39	34
Totals	1,103	865

are still being produced at the Palmerton plant and slab zinc at the Group's 90,000 st/yr Clarksville, Tenn. refinery. Gulf + Western officials cited high energy costs, environmental control expenses, excessive imports and the generally poor condition of the zinc industry as reasons for the closing.

In September 1980, St. Joe Minerals reopened a portion of its Monaca, Pa., smelter, which it had closed in December 1979. The St. Joe facility is currently producing French-process zinc oxide and Prime Western zinc, with a reported combined capacity of 50,000 st/yr.

Electrical vehicles. Again, the uncertainties in the supply of oil and gasoline have rekindled interest in electric vehicles, and zinc battery-powered vehicles were making headlines in 1980. While full realization of this market is a few years away, potential zinc usage may reach an estimated 50,000-100,000 st/yr, depending on market penetration of these vehicles into the overall car market.

Copper-plated zinc penny. Reports from Washington indicate that the Bureau of the Mint is moving ahead with plans to produce a zinc penny. Spurred by a mid-year copper price increase, the Mint has put two solicitations for 20.8 million lb of copper-plated zinc blanks up for bid. The new alloy contains 99% zinc, 0.8% copper, and 0.2% other metals. The penny now in use contains 95% copper and 5% zinc. Mint officials said that the new alloy penny would look the same as the current one cent piece but would weigh 19% less. Mint officials also indicate that a change in the coin alloy from copper to zinc would reduce the manufacturing cost by more than 60%. The Mint currently manufactures about 10 billion 1¢ coins annually, at a cost estimated at 0.7¢/coin.

Using the zinc penny, more than \$50 million per year would be saved by the Treasury, according to Mint officials. Should the Mint convert to the zinc penny, this would provide an additional outlet for about 45,000 st of zinc/yr.

Outlook. Major US producers are looking toward improved sales and higher prices. At year end, producer inventories were low.

World zinc stocks, end of period

(000 metric tons)

	1979		1980	
	June	Dec.	June	Oct.*
Producers				
US	55	59	63	35
Europe	138	165	151	145
Canada	64	98	92	96
Japan	80	84	84	60
Others	107	120	107	120
Total	444	526	497	456
Consumers				
LIME	215	199	157	150
	64	46	59	68

e—Estimated

and demand, while currently depressed, is expected to increase in the second half of 1981. Any increase in consumption could result in tight supplies and higher prices. ■

ALUMINUM STRONG FOREIGN DEMAND CUSHIONS US MARKET

James A. Vais, director of economic and marketing research
Kaiser Aluminum and Chemical Corp.

US aluminum demand decreased during the first three quarters of 1980 but improved in the fourth quarter. The 13.6% year-to-year US decline was partially offset by extremely strong exports, which increased 111%. Thus, total US shipments decreased only 5.1%. Supply of most aluminum products eased as the year progressed. Prices for aluminum ingot increased from 66¢/lb at the start of 1980 to 76¢/lb by mid-October. The prices of fabricated products improved during 1980.



The major aluminum producers reported good profits, although not as high as the record profits reported for 1979. Return on invested capital during the year remained in the 13-18% range, a performance superior to most

other metal industries.

Supply. Total US aluminum supply dropped in 1980 by 163,000 st, or 2.1% below 1979, to an estimated 7.4 million st. The average operating rate for primary aluminum capacity was 95.1%, down slightly from 95.7% in 1979.

At the start of 1980, 165,000 st of Pacific Northwest primary capacity were idle due to power shortages in the Bonneville Power System. Approximately 130,000 st of high-cost capacity, located mostly in the southeast, were also idle. Potlines were both started and shut down at various times during the year, but primary capacity in the Northwest was operating at 100% at year end. Approximately 345,000 st of high-cost capacity at Alcoa and Reynolds were idle at year end.

US primary aluminum imports dropped slightly to 557,000 st in 1980, from 571,000 st the previous year. Mill product imports decreased by 127,000 st to 86,000 st. Secondary recovery operations reflected very weak demand in their largest market (domestic auto production), and decreased 129,000 st to 1,648,000 st. By year end, US suppliers increased inventory slightly by 25,000 st over the 1979 year-end level to an estimated 2.58 million st, a 4.3-month supply, which can be considered a tight but normal position.

Shipments. While final end-use figures for US consumption are not yet available, preliminary figures indicate that shipments to all major US markets declined, with the exception of a 2.5% increase to the container and packaging market. Shipments to the building and construction market fell approximately 15%, while shipments to the transportation sector declined about 28%. The strongest product markets were heat transfer plate, hard-alloy extruded shapes, rod and bar, and ACSR and aluminum cable. Shipments to all other markets decreased.

Prices. At the start of 1980, the US published prices for 99.5% aluminum ingot was 66.0¢/lb. Beginning in March, producers advanced prices by various amounts, reaching 76.0¢ in mid-October 1980. In mid-February 1980, the merchants' spot price

Free World production of primary aluminum

(000 short tons)

	1978	1979	1980 ^e
Africa	371	442	482
North America	5,962	5,976	6,315
Latin America	455	737	906
East Asia	1,241	1,195	1,292
South Asia	425	421	438
Europe	3,887	3,968	4,154
Oceania	456	468	506
Total production	12,797	13,207	14,093

e—Estimated.

ment and development of their natural resources, including energy.

■ Security of investments and associated capital formation problems have tended to slow down mineral development, especially in the underdeveloped countries. Added to such problems are rapidly rising costs and the problems associated with providing a satisfactory distribution of the risks and benefits among the diverse interests in resource development.

■ The continuing increase in the cost of energy is the most important factor behind the continuing escalation in the cost of producing primary aluminum. Since aluminum production is both capital- and energy-intensive, production costs rise with

energy, construction, and equipment costs.

Outlook. The US economic outlook is uncertain at this time. The fourth quarter of 1980 experienced good recovery in aluminum orders. However, if the surge in interest rates experienced at the end of the year continues, recovery would probably be dampened, and the year-to-year average increase would approximate only 1% in real growth. This forecast incorporates higher domestic shipments that are offset by lower export shipments. The operating rate for primary aluminum capacity could be affected by mid-year power curtailments in the Pacific Northwest. Currently, the industry forecasts an average US operating rate of 95%, but some high-cost potlines in Texas are expected to remain idle.

The expected increase in domestic shipments will take place across most markets. The transportation construction industries are expected to improve from the depressed levels in 1980. Imports should increase slightly; secondary recovery will increase; and US producers are expected to build inventories of approximately 200,000 st by the end of 1981.

Growth in aluminum demand outside the US in 1981 is expected to be about 3.5%, a slower rate of growth than in 1980. This modest increase, coupled with a greater increase in the US, should produce a total Free World demand level in 1981 of 14.1 million st, approximately 5% larger than in 1980. Worldwide, producers' inventories could rise by 480,000 st, but this inventory increase would bring producers' stocks back to more normal levels. ■

LEAD

1981 OFF TO A SLOW START BUT DEMAND SHOULD IMPROVE LATER; INNOVATIONS APPEAR ON HORIZON

John A. Wright, president
St. Joe Lead Co.

The pattern of lower lead consumption and prices prevailing in fourth quarter of 1979 carried through the first half of 1980 but was followed by a modest recovery during the second half of the year. The US economic recession resulted in a lead trade surplus,



an unusual event for a nation that is normally 85-90% supply-sufficient. In 1980, the US producer lead price dropped 8¢, while on the LME, settlement prices declined 17¢.

Production. World mine output of lead (excluding Eastern Bloc countries) advanced 1.5% during 1980, reaching 2.84 million st (metal content). Significant gains were reported by Africa (46%), Peru (5%), and the US (11%). European mine output declined more than 6% to its lowest level in three years, reflecting a decrease in zinc mining activity with which lead is co-mined at most European properties. Mexico's mined lead output in 1980 was at its lowest level in more than five years, with a drop of nearly 9%.

Declining world demand and prices slowed international lead concentrate activity near the end of 1980. In the US, lead concentrate imports and exports were down an estimated 45%. Free World production of refined lead (primary and secondary) declined 5%, reflecting lower demand. The Western Hemisphere

recorded the biggest drop with a 10% decline, to an estimated 1.9 million st.

During the next five years, new mine projects could result in a 241,000 st increase in world lead output. As an addition to 1980 output, this figure represents a 1.6% compounded growth rate.

US lead mine production increased about 68,000 st, or about 11%. Total US output represented 23% of Free World lead mine production. US refined lead production dropped 9% in 1980, with primary lead declining 5% to 606,000 st and secondary production dropping 12% to about 624,000 st. For the first time in more than a decade, the US exported more refined lead than it imported, a reflection of reduced domestic demand and expanded opportunities in overseas markets. The deficit in the US in 1979 had been in excess of 200,000 st, or about 14% of US consumption. The increasing trend in US exports of lead-bearing scrap continued in 1980, with an estimated 19% increase over 1979. Major destinations included Canada, China, Japan, and Mexico.

Lead prices

(cents per pound)

	1979		1980	
	US producer	LME settlement	US producer	LME settlement
Jan.	40.760	45.011	49.879	50.729
Feb.	43.632	47.847	49.559	53.005
Mar.	45.749	53.380	49.223	50.865
Apr.	48.000	52.644	44.015	43.943
May	48.805	56.209	36.002	35.557
June	56.510	62.685	34.190	33.505
July	58.066	57.701	35.604	36.782
Aug.	57.913	54.016	40.962	38.693
Sep.	58.004	55.828	42.259	40.048
Oct.	61.057	59.826	45.000	39.545
Nov.	57.262	55.543	43.806	36.918
Dec.	55.947	53.394	38.966	33.721

Source: Metals Week

World production of refined lead*

(Primary and secondary, 000 short tons)

	1976	1977	1978	1979	1980**
Europe	1,603	1,714	1,696	1,742	1,700
Africa	140	148	136	148	165
Americas	1,831	1,959	1,993	2,119	1,900
Canada ¹	194	207	214	278	231
Mexico	191	227	249	248	210
Peru	80	87	82	94	91
US	1,220	1,289	1,310	1,351	1,230
Asia	365	385	394	397	435
Japan	311	317	321	312	320
Oceania	234	238	263	281	270
Australia	234	238	263	281	270
Total ...	4,173	4,444	4,482	4,687	4,470

Source: International Lead-Zinc Study Group Monthly Bulletin. *Excludes China, USSR, and other Communist Bloc countries. **Estimate. ¹Prior to 1979, primary lead only.

World consumption of refined lead*

(Primary and secondary, 000 short tons)

	1976	1977	1978	1979	1980**
Europe	1,746	1,818	1,803	1,826	1,845
Africa	87	82	91	99	110
Americas	1,731	1,913	1,887	1,910	1,600
Canada ¹	68	70	72	134	115
Mexico	89	97	119	121	107
Peru	0	9	9	16	40
US	1,399	1,558	1,542	1,478	1,230
Asia	516	562	605	617	680
Japan	342	368	388	406	425
Oceania	93	94	95	91	95
Australia	83	83	82	78	80
Total ...	4,173	4,469	4,481	4,543	4,330

Source: International Lead-Zinc Study Group Monthly Bulletin. *Excludes China, USSR, and other Communist Bloc countries. **Estimate. ¹Prior to 1979, primary lead only.

US stockpile. Since 1975, when the trigger point for lead was lowered to a year-end inventory of 52,584 st, there have been no sales of lead by the GSA. However, in 1980, the stockpile objective was increased from 865,000 st to 1,100,000 st. The GSA lead inventory currently stands at 601,000 st, and it is not anticipated that lead will be affected by the GSA program in 1981.

Consumption. Free World consumption of refined lead declined 5% in 1980 to 4.33 million st. The economic recession in the Western Hemisphere caused consumption in the Americas to drop 16%, but elsewhere consumption continued steady gains. Consumption increases included 1% in Europe, 11% in Africa, 10% in Asia, and 4% in Oceania.

In the US, consumption declined 16% to 1.23 million st, the third consecutive year of lower lead consumption. The drop was primarily due to an economic recession, which lowered automotive battery output, and a further decline in the production of lead-based gasoline additives.

In 1980, the lead-acid battery market accounted for more than 60% of refined lead consumption, and it remains the dominant growth area for future lead consumption. Automotive battery shipments were estimated at 60 million units in 1980, a decline of 14.7%. Use of lead in gasoline additives dropped sharply in 1980 as a result of a government-mandated phase-out of lead in gasoline and the trend toward smaller cars. Once the second largest lead market, gasoline additives in 1980 represented only 10% of total consumption. Further US declines in this market segment will not have a significant impact on the lead industry.

World mine production of lead*

(000 short tons lead)

	1976	1977	1978	1979	1980**
Europe	500	517	535	561	525
Africa	159	194	196	209	305
Americas	1,406	1,454	1,490	1,459	1,454
Canada	268	362	403	376	310
Mexico	205	176	181	192	175
Peru	202	203	202	203	213
US	623	606	597	592	660
Asia	158	152	154	140	140
Japan	57	61	63	52	50
Oceania	420	456	419	434	420
Australia	420	456	419	434	420
Total ...	2,643	2,773	2,794	2,803	2,844

Source: International Lead-Zinc Study Group Monthly Bulletin. *Excludes China, USSR, and other Communist Bloc countries. **Estimate.

Estimates for other US consuming market segments show lead consumption for pigments and chemical applications declined 10% in 1980, and all other uses dropped 6%.

A steady growth of about 2%/yr in US consumption is anticipated, with most of the gain in the battery market. This growth should occur despite the continuing US trend toward smaller cars requiring batteries containing less lead. The increase in diesel cars, which may achieve 10-20% of the US auto fleet by 1985, should buoy sales because of the larger batteries or dual battery systems required for starting, lighting, and ignition of diesel-powered autos.

The electric vehicle (EV) remains a significant new potential application for the lead industry. As a result of rising gasoline prices and the growing need to conserve oil, the EV represents an important alternative to conventional automobiles. A market for 1 million EV's annually, using lead-acid batteries, would create a lead demand of nearly 200,000 st. Government-sponsored EV research and demonstration programs were active during 1980. The battery program continues to focus on near-term electric vehicle power systems, such as lead-acid batteries.

Also active during 1980 were programs designed to use lead-acid storage batteries for electric load-leveling. Storage of energy, which is produced during low electric utility demand periods for use during periods of high demand, is being tested in New Jersey in a government-funded program. The peak power shaving concept has traditionally involved pumped water storage for hydroelectric generators or gas turbines, but cost considerations and fuel availability are causing attention to be focused on alternative systems, including lead-acid batteries.

Government regulations. In October, 1980, the final Environmental Protection Agency (EPA), lead-in-gasoline phase-down rule went into effect, lowering lead consumption for gasoline additives in the US by about 40%, compared to 1979 levels. The trend in this segment will continue downward, reflecting the turnover in automobile population to vehicles requiring non-leaded fuel. Eventually, fuel refiners will adopt the unleaded fuel for all gasoline grades, but this final phase-out will have only a marginal impact after 1980.

In 1980, the US Supreme Court turned down an appeal by the Lead Industries Association and others to overturn environmental and occupational health standards for lead. In 1978, the EPA and the Occupational Safety and Health Administration (OSHA) had issued regulations to control exposure to lead. The EPA standard involves ambient air fence-line measurements, without regard to background concentrations from nonindustrial sources. The OSHA standard involves reductions in work place exposure to lead and decreased reliance on the use of respirators to accomplish these goals.

Additional appeals are likely, because the US lead industry has taken the position that the standards are unnecessarily stringent and are both technically and economically infeasible.

Prices. Lead prices dipped sharply during the first half of 1980, mounted a shallow recovery during the third quarter, and dropped again by year end. For the year, the LME settlement price decreased from 50.7¢ to 33.7¢, a decline of 34%.

In general, US producer prices were lower than LME prices during the first half of 1980 but remained above LME quotes during the second half of the year. The trends of the LME and US producer prices were similar throughout the year. The largest gap between the two prices occurred in November, when the US producer price exceeded the LME price by 6.89¢. For the year, the US producer price declined 22%, from 49.9¢ to 39.0¢.

Outlook. Based on a moderate US economic recovery in 1981 and a modest European decline, the outlook for lead suggests a sluggish first quarter and a gradual strengthening during the second half of the year. Indicators to watch include the replacement automotive battery market and trends in international movements of lead concentrates, refined lead, and lead-based scrap. The long-term future will be dependent on the success of new innovations, such as electric vehicles and batteries for load-leveling applications.

TIN

US STOCKPILE SALES POSE UNCERTAINTY FOR 1981

George Kam, director
The Malaysian Tin Bureau

The prospects for tin in 1981 may be darkened by the combined effects of the following factors: escalating production costs, a downward trend in world prices, sales of tin from the US strategic stockpile that could disturb the supply-demand equilibrium, and the protraction of talks on a new International Tin Agreement.



Prices. Tin is traded at three world markets—Penang in Malaysia, the London Metal Exchange, and New York. Malaysia continues to be the world's largest producer. In Penang, tin metal is open to bidding by international buyers who operate six days a week.

On Dec. 31, 1980, the Malaysian dollar was worth US\$0.4525. During the 1980 calendar year, the monthly average tin price in Penang was M\$2,159/picul (1 picul = 133 1/3 lb) against M\$1,959 for 1979. In nominal terms, the price has increased by 10.2%. But when compared to the 12.4% rate of inflation in the US during the year, there has been a price slide in real terms of 2.2%. On Jan. 2, 1981, the Penang market switched from the picul to the metric system and began quoting in kilos.

The Penang market started off January 1980 at a daily average price of M\$2,144/picul, building up to a high for the year of M\$2,338 in March. The average price began to slip in April to M\$2,317, with prices falling for another three months until the daily average dropped to M\$2,143 in July. In August and September, there were small rallies to M\$2,151 and M\$2,195, respectively. In the last three months of the year,

prices slipped from M\$2,105 in October to an average daily price in December of M\$1,920.

Tonnage of the metal offered for sale each day in Penang averaged 186 mt, down from 194 mt in 1979. The lowest daily turnovers were in March and April, at 163 mt and 169 mt, respectively. These were the two months in 1980 which posted the highest average daily price.

At the London Metal Exchange, the three months forward price for high-grade tin averaged £7,243/mt in 1980, up a mere 1.9% in nominal terms. The physical cash tin price actually fell, the monthly average for the year being £7,228 against £7,287 for 1979. The LME three-months forward price averaged £7,348/mt in January, rose to £7,942 in March, and fell each month for the rest of the year from £7,710 in April to £6,362 in December, except for a small rally in September.

New York followed the same pattern. In January 1980, the METALS WEEK composite price averaged US\$837/lb, dropping

Consumption of primary tin by end use

(metric tons)

	1977	1978	1979	1980 ¹
US				
Tinplate	18,539	17,280	17,929	13,023
Solder	12,173	12,952	13,249	7,318
Chemicals	4,655	4,557	4,797	w
Tinning	2,291	2,349	2,498	1,283
Bronze and brass	2,833	3,012	2,709	1,176
White metal	1,505	1,484	1,258	1,176
All other	5,600	6,769	7,056	7,701
Sub-total				30,894
Undistributed consumption ²				3,350
Grand total	47,596	48,403	49,496	34,244
Japan				
Tinplate	13,202	12,307	12,655	3,315
Solder	9,665	—	10,234	2,676
Tinning	864	—	1,218	311
Bronze and brass	1,162	—	1,586	358
White metal	1,012	—	874	235
All other	3,780	17,146	4,652	1,069
Total	29,685	29,453	31,219	7,964
Federal Republic of Germany³				
Tinplate	5,114	4,947	4,255	2,239
Solder	2,353	2,222	2,324	1,299
Tinning	484	428	456	293
Bronze and brass	121	233	379	208
White metal	—	—	—	—
All other	7,086	7,231	7,849	4,322
Total	15,158	15,061	15,263	8,361
UK³				
Tinplate	6,372	6,024	5,718	2,026
Solder	1,052	767	1,022	626
Tinning	1,066	919	876	569
Bronze and brass	1,574	1,639	1,410	883
White metal	2,224	2,196	1,957	982
All other	2,576	2,374	2,256	1,542
Total	14,864	13,919	13,239	6,628
France				
Tinplate	5,278	4,969	4,581	—
Solder	2,630	2,510	2,512	—
Tinning	300	249	280	—
Bronze and brass	595	565	545	—
White metal	—	—	—	—
All other	1,875	1,619	1,742	—
Total	10,678	9,912	9,660	N/A

Sources: US consumption—USBW; all other—International Tin Council.
w—White metal included in "other."
¹Figures indicate consumption only during the first nine months for the US; first six months for the UK and Germany; first three months in Japan.
²Estimated consumption of approximately 500 plants reporting on annual basis, redistributed when actual annual figures become available.
³Primary and secondary consumption.

NATIONAL ZINC CONCENTRATE ASSAYS
AS QUOTED BY PHILLIP BROS.
1978, 1981.

ZINC CONCENTRATE

zn	55.4%	Sn > 0.01
Pb	2.0%	Ge > 0.0001
Ca	0.25%	Se 0.001
Cu	1.2%	
Au	-	
Ag	1.8 oz.	
Fe	3.8%	
S	31.41%	
As	0.01%	
Sb	0.016%	
Bi	0.016%	
Co	> 0.07%	
Ni	> 0.001%	
Mg	0.17%	
Ca	0.26%	
Mn	0.18%	
Insol	3.75%	
Si	3.28%	
Al	0.01%	
F	0.006%	
Te	0.003%	
Hg	0.001%	
Cl	0.006%	

Lead Concentrate

Pb	51.7%
Au	0.072 oz.
Ag	22.25 oz.
Zn	10.5%
Cu	1.88%
Bi	0.12%
S	18.05%
As	0.015%
A	0.01%

MINE DEVELOPMENT MONTHLY

April 1981

THE SMELTER CONTRACT

Current Practices in Copper, Lead and Zinc Concentrate Sales

One of the crucial tasks the mine operator is faced with in assuring maximum profitability for his production is deciding how best to sell his concentrate. Assuming economics do not justify building a smelter for the mine output, the miner will be looking to sell concentrate to a "custom" smelter that will buy the material at the prices prevailing for the contained metal in refined form, less charges for processing.

These processing charges may represent a significant percentage of the ultimate value of the contained metal. At today's metal prices and smelter charges (this term is used here to refer to both treatment and refining charges) copper smelters are charging about 25% of the value of the contained copper, lead smelters about 35% of the value of the lead, and zinc smelters about 25% of the value of the zinc. Hidden contract costs and the cost of freight may increase the ultimate charge to the miner by as much as half again.

Smelter contracts are complex: the value of a contract is determined not only by the processing charges but also by deductions for metal losses, differing arrangements for how the metal price ruling the contract is determined, provisions for the smelter's participation in metal price movements, and penalties and credits for deleterious materials and byproducts. Understanding how the value of smelter contracts is determined is extremely important not only for concentrate sales negotiations, but also for arriving at realistic cost projections for mine feasibility studies.

In the following section we will review a "typical" current copper smelter contract clause by clause, and also discuss the common features of lead and zinc smelter contracts.

A Typical Contract

All of the discussion that follows is meant to illustrate only the ranges of current smelter terms. Specific smelters will often vary widely in their bids on similar materials and even give different terms for two similar productions for their own plant. Two contracts with a similar overall value may differ widely in how the individual clauses are structured and valued.

Following are the main clauses of a hypothetical contract for copper concentrate shipped from Canada to Japan, as they might appear shortened on a telex. These clauses have been put together from a number of actual current

contracts to illustrate typical smelter practice.

Tonnages are in metric tonnes, the standard usage outside of the US and Canada (one tonne contains 2204.6 lbs). "Wmt" refers to wet metric tonnes, as delivered, and "dmt" refers to dry metric tonnes, calculated after moisture has been removed.

A Hypothetical Copper Concentrate Contract

Assays: Copper 26%, Gold 0.15 oz/dmt, Silver 2.4 oz/dmt

Quantity: 20,000 wmt quarterly. Ex Canada

Delivery: CIF Yokohama

Treatment Charge: \$65/dmt

Refining Charge: \$6/lb of payable copper content

Pricing: Copper less one unit, at the LME monthly wirebar settlement

Contractual Period: Month of scheduled shipment

Payment: 90% thirty days after arrival, balance upon finalization of assays

Credits: Gold less 0.03 oz, pay for 95% less \$5/oz
Silver less 1.0 oz, pay for 95% less 25¢/oz

Penalties: Arsenic \$1.00 for every 0.10% over 0.50%
Bismuth \$1.50 for every 0.10% over 0.10%
Antimony \$1.50 for every 0.10% over 0.50%

Escalation: 7% per annum (with the fifth shipment)

Participation: Add 10% of every 1% copper price goes over \$1.00 to the refining charge

Length: Two years starting April 1981

The Material: Copper concentrates will typically contain from 22% to 30% copper with iron and sulfur the other major constituents.

Zinc concentrates typically run 48% to 60% zinc with iron, sulfur and often some lead. Lead concentrates fall into two broad types-- the "clean" lead concentrates, such as those originating from Missouri or Morocco, which typically grade about 68% to 75% lead, and the "dirty" material, such as is found in many South American productions, with much lower lead, high silver and high impurities and associated values. In what follows we will refer primarily to terms for the "clean" lead concentrates.

INSIDE THIS ISSUE

○ Where the Funds Are

○ Current Gold Production Costs

The smelter contract may carry assays for a number of elements to which the material will be expected to conform.

Treatment Charge: In the case of both copper and lead, the "treatment charge" refers to the charges for smelting the material. Copper and lead undergo further refining steps, which carry an additional charge. In the case of zinc, the treatment charge covers all processing costs from concentrate through to refined metal.

Treatment charges are quoted for material delivered to the smelter, meaning that the miner must bear the costs of freight.

As of this writing, typical ranges of treatment charges for standard concentrates are as follows:

Copper	\$65 - \$70/mt
Lead	\$85 - \$150/mt, with many in the \$110- \$120 range
Zinc	\$90 - \$135/mt, with many in the \$90 - \$110 range

Refining Charge: With respect to copper and lead, the refining charge represents the cost of turning the smelter product into refined metal. These are currently as follows:

Copper	6½¢ - 8¢/lb outside the US, up to 14¢/lb in the US
Lead	1¢ - 2½¢/lb

It is interesting to note that refining charges for copper tend to be higher in the US than outside. This is because most US refineries are located near the mines and smelters, a substantial freight distance from the industrial centers into which the refined copper is sold. This is less frequent in other parts of the world, where refineries treating custom material tend to be close to major industrial centers. The high US freight costs are picked up by the higher refining charges.

By adding treatment and refining charges one arrives at the total charges for a contract. In our example we have a 26% copper concentrate. The treatment charge is \$65/mt. We can convert this to a cost per lb of contained copper by dividing \$65 by 573 lbs and arriving at 11.3¢. If we add an 8¢/lb refining charge, we have 19.3¢ total charges per lb of contained copper.

It is very important to note, however, that the actual cost of this contract to the miner will probably be closer to 30¢/lb, once we figure in process deductions, finance charges and so on, as we will see below.

Pricing: Treatment and refining charges are expressed as a deduction from a commonly quoted price for the refined metal in question. In the cases of both copper and lead, the US producer price is most often used in the US for domestic production and the London Metal Exchange quote for imports and for most business outside of the US. For zinc, the US producer price is used within the US

and the European producer price (the G.O.B.) is the most commonly used price outside of the US.

All of the metal contained in concentrate, as determined by the smelter's assay, is not paid for. This reflects the smelter's need to account for inevitable losses of metal in processing, as well as in some cases, providing another source of income.

Deductions may take two forms. There is the unit deduction, a certain fixed amount subtracted from the assayed content. Units are percentage points: a 1.0 unit deduction from material containing 26.0% would result in 1.0 percentage points being subtracted from 26.0%, leaving 25.0% of each ton to be paid for. Unit deductions on copper contracts are typically 1.0 to 1.2 units.

Percentage payment deductions are made by paying for only a percentage of the contained metal, often after unit deductions have already been taken. Some US copper smelters currently will deduct 1.0 unit and then pay for 97.5% of the remainder. Copper smelters outside of the US generally pay for 100% of the contained copper.

Unit deductions and percentage payment deductions can be traded off against each other. For example, a major US copper smelter today takes no unit deductions but pays for only 95% of the contained copper. With lead, typically 95% of the contained material is paid for. Unit deductions range from none to 1.5.

Zinc smelters typically pay for 85% of the contained zinc, with, as a rule, no unit deductions. However, they often will impose a minimum 8-unit deduction, if that is higher than the 85%. What this means is that if smelters get a concentrate with for instance, 40% zinc, they calculate that if a payable content formula of 85% is applied, it would result in 34% to be paid for. Using the 8-unit deduction, however, would result in a payable basis of only 32%. The lower basis is then used. In this way the smelters, in effect, guard against and penalize lower grade material.

Quotational Period: It may be several months from the time that the concentrate is shipped by the mine until the metal is refined from it and sold to a consumer. The concentrate buyers often prefer to have the price basis on which they pay the miner as close as possible to the price basis on which they sell the final metal. Thus, in the US copper industry, for example, it is fairly standard for the quotational period--the month during which the daily prices are averaged so as to arrive at a price basis for the contract--to be the third month following the month that the material arrives at the smelter.

The concentrate sellers will be more interested in having the pricing conform to their view of the markets. For example, if the

current price for lead yields a good return and the outlook is for the market to weaken, a miner will want to have the pricing take place as close to the time of shipment as possible. In the reverse situation, where the miner anticipates the market will strengthen, he will try to delay pricing. The settlement on a specific pricing period by the two parties could clearly be an important negotiating point.

However, in our example, the quotational period is for the month of scheduled shipment, meaning that if shipment is delayed, pricing could still take place. This represents another approach.

Smelters tend to be less concerned with the absolute price for the metal and more with the differential between the price they pay for the concentrate and the price that they will receive for the metal several months later. Smelters (or metal traders buying concentrate to sell to smelters) can and often do take advantage of the price spreads between months on the futures market, by pricing the material early and hedge-selling it for several months later when the later months are at a premium to the earlier ones.

This is a complex subject. Since this practice does not directly affect the mine operator but only the smelter or merchant selling the end product, we will not go into it further here.

Payment Terms: The miner will clearly be interested in getting payment as soon as possible, while the smelter will look to pay later rather than sooner.

The structure of payment terms will be often in a direct relationship to the method of determining the quotational period. When prices are not decided until several months after the arrival of the material, payment may not be made until prices are known. In these cases, if an earlier provisional payment of, say, 70% to 90% is negotiated (for example, to be paid on arrival of the material at the smelter, as is often done) the smelter's terms may include a financing charge. In weak concentrate markets, contracts calling for payment before the smelter actually sells its metal product may carry invisible financing charges in the form of slightly higher treatment or refining charges.

Typical payment terms will run the gamut from 85% to 90% payment against shipping documents (with the balance when final assays are known) to payment 90 days after arrival. With the high cost of money making the value of earlier payment even greater, the structure of this clause may be a key negotiating point in contract deliberations.

Gold and silver may occasionally carry payment terms and quotational periods separately determined from that for the contract metal.

Credits: The most commonly credited by-products in copper, lead and zinc concentrates

are the precious metals -- most commonly gold and silver in the case of copper and lead, and silver in the case of zinc. Lead smelters may also credit copper and zinc above certain amounts. Some zinc smelters will pay for a percentage of lead. Some copper smelters may credit lead or zinc above certain levels, or may penalize them.

Copper and lead smelter payment terms for precious metals tend to be fairly similar. Zinc smelters pay less for silver, typically deducting several ounces and paying for 80% of the remainder. They may also pay for cadmium.

Credits for other base metals tend to be much lower. One US lead smelter today is paying 50% for contained copper, with a 25¢ to 35¢ refining charge, and for zinc, 25% of the US high-grade producer price minus a 10¢ refining charge. Only several zinc smelters pay for contained lead, and then typically at below 50% of its value.

Credits sometimes are not paid directly but are reflected in lower treatment charges. For example, some Bolivian zinc concentrate containing indium fetches favorable terms for its byproduct value, although no direct payment is made.

Depending on the specific needs of the smelter, credits may be given for a host of elements, ranging from silica to sulfur. These will be the exceptions, rather than the rule.

Penalties: There are certain impurities that any given smelter--depending on the technology of its particular process, on local environmental constraints, on the levels of impurities in the feed it already has, and on the requirements for its end products--will not be able to tolerate to any great extent.

Zinc smelters do not usually have specific penalty schedules, but copper and lead smelters are particularly wary of arsenic, bismuth and antimony--impurities often associated with copper and lead-bearing ores--and contracts usually carry penalties for concentrations of any of these above a certain level.

The specific penalty charges vary widely from smelter to smelter, depending both on their tolerance for the impurity and the concentrate market. An arsenic penalty from a current lead contract calls for an increase in the treatment charge of 20¢/st for each 0.05% of arsenic above 0.05%. A penalty for the same impurity from a current copper contract calls for an increase of 30¢ for each 0.10% of arsenic above 0.50%.

Smelters will usually penalize moisture above about 8%, and set limits for anything they suspect may be in the concentrate, from mercury to nickel. Penalty clauses also reflect market conditions. They tend to disappear as the smelters' scramble for concentrates intensifies and the need to get material to keep operations going overshadows quality considerations.

Escalation Clauses: In longer term contracts there will often be provisions for

a price increase each year (or possibly at shorter intervals). This can take the form of a fixed-percentage increase (6% to 8% in some current copper contracts), a direct pass-through of fuel, labor, transportation and other cost increases to the seller, or an increase based upon the movements in some general index of the costs of goods and services.

Participation: The participation clause allows the smelter to benefit from an increase in the metals price by tying the smelting charge to price increases by a specific formula. In lead and zinc, but much less frequently in copper, the charge may also be reduced as the price goes down, although often at a slower rate than that at which it will increase.

A typical participation clause in a current copper contract might call for a 1¢ to 1½¢ credit to the smelter (often accounted for as an increase in the refining charge) for every 10¢ that the copper price is over a certain price--today, most possibly \$1/lb. In zinc, the treatment charge might increase by \$2.50 to \$3.00 for every 1¢ the zinc price ruling the contract is above 40¢/lb (or whatever the price was at the time the contract was signed) and decrease \$1.50 for every 1¢ the zinc price is under 40¢.

Length of Contract: In recent years, contract lengths have tended to become much shorter. In the 1960s and early 70s the Japanese and others were signing ten- to twenty-year contracts to provide a base for their booming domestic smelting and refining industry. Typical contracts are today for two to three years, with some as long as five. Longer contracts are usually "frames" within which the terms are renegotiable, say every two years.

Currencies: Floating exchange rates can cause problems for contracts written between two parties in different countries. As exchange rates shift, so does the value of the contract. Each party may prefer to have the contract in its own currency so as to ensure its revenue. Alternatively, dollars or pounds sterling are often used as acceptable third currencies.

Typically, potential exchange rate problems can be at least minimized by hedging the foreign currency on the currency markets, in the same way metals purchases or sales are hedged. However, if the shift in currency values is too great during the life of the contract, the party at a disadvantage will usually call for renegotiation.

Other Terms: Smelter contracts will also usually carry detailed clauses ruling the procedure for exchange of assays, the "splitting limits" beyond which the final assay must be determined by an umpire, the procedures for arranging an umpire analysis, and how the costs

for these services are to be allocated.

In certain contracts, charges may also be included for a number of other items, including environmental compliance expenditures, sampling, insurance, specialized freight considerations and so on.

The Value of the Contract

Let's now look at the total value of our hypothetical copper contract. The producer takes a 1.0 unit deduction and is paid for all of the remaining copper. His concentrate contains 26% copper, so he is paid for 26 minus 1 = 25%. He is therefore "losing" 3.8% of the contained value or 22 lbs of copper. At 35¢/lb copper, this is worth \$18.70/mt or 3.4¢ if distributed over the pounds of copper that he is credited for.

In addition, the miner is being paid thirty days after arrival. That means he has probably two months, from the time he produces the material until he is paid for it, in which he has to finance his output himself. At current interest rates that would add about 2.5¢/lb to the cost of the contract.

Then there are the costs of freight that the miner picks up. They of course vary widely, but in this case, freight from Canada to Japan would probably be about \$25/mt or 4.4¢/lb of contained copper.

Therefore, in this particular contract, we have close to 10.2¢ of "hidden charges." If we add that to our original charges, calculated as 19.3¢, we find the "true" charges to the miner to be 29.5¢/lb of contained copper. For cash flow purposes we would more accurately call this 26.2¢/lb, with the 3.4¢/lb represented by the deductions considered a cost in terms of value lost, but not an out-of-pocket expense.

Terms Will Vary

Smelter terms will tend to vary widely as a function of the size, purity, duration and importance of the production being purchased. The ranges we have given for smelter charges include both spot (current shipment) and longer term business. The market outlook will determine the value of these relative to each other.

For example, the zinc concentrate market is currently tight, with smelters scrambling for feed. Therefore, a spot shipment will get a lower charge than a long-term contract being negotiated today. In a more balanced market we would expect the long-term arrangement to get a more favorable contract. Similarly a larger shipment should command a discount, as might business from an established customer, as opposed to a new feed source.

Smelters may quote favorable terms for productions that they can advantageously blend with their other feed, thus allowing them latitude to take higher impurity shipment from

other producers.

Smelter Charges Independent of Metals Prices

It is very important to remember that smelter charges will move up and down independently of metals prices. The two may be tied together in many contracts by participation clauses, but the basic charges reflect simply the availability of smelting space, which has nothing to do with the demand for refined metal that ultimately determines the metal price.

For example, let's look at the world price for copper against the combined charges for copper concentrate at various times over the past years. In late 1973 when the copper price was about \$1/lb (and extremely volatile) typical combined charges were in the 13¢ to 14¢/lb range. In the fall of 1974, prices were down to the low 60s, but charges up to 18¢. Six months later, the copper price had dropped several cents and combined charges were 20¢. The 1973 data showed charges at 13% to 14% of the price. In early 1975 they stood at 35%.

Now to jump to 1979. In the early months of that year, severe competition for concentrates drove charges down to the 12¢ to 13¢ level (and below), while the copper price was close to 90¢/lb, thereby making combined charges equal to less than 15% of the metal price. With prices in the low 80s today, charges are up to 20¢/lb and over.

Today copper is in a buyer's market with relatively more supply of concentrates than demand. Anaconda's decision to go out of the concentrate business and its sale to Japan of its own material helped create this situation as did expanded sales from Mexico's huge La Caridad project. Lead is also in a relative surplus position. Therefore, in both copper and lead, charges can be expected to rise in the near future.

Zinc alone is experiencing a concentrate shortage and current charges are at quite low levels, yielding little or no profit to the smelters.

Implications for Feasibility Studies

With treatment and refining charges such a significant but unpredictable part of a miner's costs, how can we best account for them in feasibility studies? As we can see from the examples above, it is clearly unsatisfactory to plug in a percentage relationship between smelter charges and metal prices (assuming, for example, that copper smelting charges will continue to be equal to, about 25% of the copper price). It is slightly less dangerous to get a fix on current charges in dollars and cents and use that number for future projections.

Ideally, one should try to get a feel for the likely course of concentrate markets in coming years and express this in projections

as a range of likely charges. ■

WHERE THE FUNDS ARE

A Survey of Current Financing Options for Mine Development

Part One: The Banks

In this two-part series, we will look first at a primary source of funds for larger mining projects--the banks. In the next article we will look at other sources of loan capital--consumer credits, equipment loans and so on, and also at the financing options open to the junior companies not able or interested in securing loans.

Once a company has proven a sufficient amount of reserves in a mine prospect, completed metallurgical and economic studies and finally completed a favorable overall feasibility study, it has two avenues open in seeking development capital.

One is to sell equity to raise the capital required. The options in this case range from bringing in a minority financial partner to selling the entire property and retaining a royalty interest, with many possibilities in between. If a company does not wish to give away equity, which is often the case, then the other avenue of possibilities leads to the doorstep of the lending institutions, primarily the commercial banks. The company can either borrow on the strength of its own balance sheet alone, or to some extent, on the strength of the project itself.

It is on the current bank practices and attitudes with respect to mine project financing that this article will concentrate.

Project Financing

Project financing got started over twenty years ago, primarily in the iron ore business, when the huge amounts of money involved in new mine developments made it desirable to devise a way to carry the debt off of the corporate balance sheet. Therefore, a new form of financing was developed in which the project itself rather than the company would ultimately be looked to for repayment of the loan.

Under a project loan, the company or companies involved guarantee to complete the project--typically to develop it until it is producing for a predetermined amount of time at a given rate of capacity and metal recovery, and to absorb any cost overruns generated. At that point the company or companies involved are no longer liable and the bank has only the project to look to for repayment of the loan. The bank then assumes any risks of inadequate reserves or of lower than expected metal prices until such time as the loan is paid off.

STIPULATION
DETERMINATION OF SURFACE RIGHTS

Pursuant to the provisions of Section 5(c) of the Act of July 23, 1955 (69 Stat. 367),

I, Philip L. Heaton, Acting, Regional Forester, Region Six, United States, Forest Service, do hereby stipulate as to the validity and effectiveness of the asserted rights in the following mining claims for which a verified statement has been filed

by Pacific Smelting and Refining Company pursuant to the publication of notice of a determination of surface rights for an area including such mining claims, and do further stipulate that such asserted rights shall be deemed to be unaffected by that particular published notice.

Name and description of claims, as recorded in Mining Records of Marion County, Oregon:

- Ruth No. 1 mining claim located 7/1/29, recorded in volume 4, page 308
- Ruth No. 2 mining claim located 7/1/29, recorded in volume 4, page 311
- Santiam No. 1 mining claim located 10/25/54, recorded in volume 6, page 391

Location of claim

Santiam No. 1 is situated in Section 19, T. 8 S., R. 5 E., Willamette Meridian, and Ruth No. 1 and Ruth No. 2 are situated in Section 27, T. 8 S., R. 5 E., Willamette Meridian, all within Marion County, Oregon, Willamette National Forest.

Nothing herein shall be construed as precluding the United States from contesting the validity of the mining claim.

DATE 1-6-66	SIGNATURE <u>Philip L. Heaton</u> Philip L. Heaton	TITLE Acting Regional Forester
DATE	SIGNATURE OF CLAIMANT PACIFIC SMELTING AND REFINING CO. by J. P. Hewitt, President	NAME AND ADDRESS OF CLAIMANT Pacific Smelting and Refining Co. P.O. Box 132 Mehama, Oregon

STIPULATION

DETERMINATION OF SURFACE RIGHTS

Pursuant to the provisions of Section 5(c) of the Act of July 23, 1955 (69 Stat. 367),

I, Philip L. Easton, Acting, Regional Forester, Region Six, United States, Forest Service, do hereby stipulate as to the validity and effectiveness of the asserted rights in the following mining claims for which a verified statement has been filed

by Bertha E. Hewitt pursuant to the publication of notice of a determination of surface rights for an area including such mining claims, and do further stipulate that such asserted rights shall be deemed to be unaffected by that particular published notice.

Name and description of claim

Morning Star mining claim, located July 6, 1925, recorded in volume 4, page 262, Mining Records of Marion County, Oregon.

Location of claim

Situated in Section 27, T. 8 S., R. 5 E., Willamette Meridian, within Marion County, Oregon, Willamette National Forest.

Nothing herein shall be construed as precluding the United States from contesting the validity of the mining claim.

DATE 1-6-66	SIGNATURE <u>Philip L. Easton</u> Philip L. Easton	TITLE Acting Regional Forester
DATE	SIGNATURE OF CLAIMANT <u>Bertha E. Hewitt</u> Bertha E. Hewitt	NAME AND ADDRESS OF CLAIMANT Bertha E. Hewitt P.O. Box 132 Hebena, Oregon

MEETING JANUARY 17, 1961

Time: 9:30 a.m. to 11:15 a.m.

Present: J. P. Hewitt, C. F. Anderson, L. E. Holmgren, K. M. Suchy and
R. F. Shirley

Below Camp

Santiam No. 1 O. K.--believed to have a discovery.

— Santiam No. 2 Clean out adit and may also be good.

Santiam No. 3 According to J. P. Hewitt adit is over 1,500 feet long (1550') on No. 2 so No. 3 should be O. K. Ray Shirley sampled cut on aplite dike--assay and structure no good, should clean out.

— Donald No. 1 Ray Shirley wants to re-examine--structures and values fair. Will not commit himself now.

Mandalay O. K.--believed to have a discovery.

Alex Not on same structure as on Mandalay. No structure--no sulfide.

Babe J. P. Hewitt says should be O. K. Ray Shirley has not been able to find cut.

Santiam No. 8 Cuts on creek. J. P. Hewitt cut on river, upper tunnel no good.

Santiam No. 9 Cut on east side river. Will examine again.

Santiam No. 10 Cut on north bank of creek--also adit--will look for.

Santiam No. 15 Cut on E. W. creek at about south endline--workings nearby.

Eureka No. 23 Good sized tunnel 20 - 30 feet above creek--will look for.

Eureka No. 22 Might show something better on hill.

Santiam No. 4 (No. 5 on J. P. Hewitt Map) 3 inches narrow, poor values.

Santiam No. 5 (No. 4 on J. P. Hewitt, Map) 10 - 11 inches, no value.

Santiam No. 6 Caved tunnel south side of river.

— Santiam No. 7 Cut sloughed. No sample.

Santiam No. 12 Did not find anything. J. P. Hewitt--should be open cut and tunnel.

Santiam No. 14 Samples 14A - .25% cu. - 5 inches No discovery.
14B - 1.25% cu. - 12 inches

Santiam No. 13 Structure measures 5 inches, 14 inches, 7 inches.
1.1% cu. -- No discovery.

Paul Discover cut. Cut and adit--.55% cu. 2 inches
 J. P. Hewitt--another cut 50 feet west of cut and adit.

Oregon Bell 14 foot cut Sta. 2 - 7 (No good) 6 other samples no good.

Golden Bear On creek--.20 and .25% cu., J. P. Hewitt another cut--
 should be on tributary that goes through Culvert near
 main road.

Mr. Hewitt stated he would discuss with the mining companies concerned the 9 claims that were believed to lack discoveries as a result of the mineral examination. Also Mr. Hewitt did not believe there were any other workings of any concern on these 9 claims, which are underlined.

Two claims the Santiam No. 1 and Mandalay were believed to be valid claims as a result of field examinations and Mr. Hewitt was informed of this.

In regard to the remaining 12 claims, Mr. Hewitt stated he would open up the caved workings present on some of these claims and guide or direct the engineers to the discoveries on the claims for which none were found during previous examinations.

RIGHT-OF-WAY EASEMENT DEED

THIS EASEMENT, dated this 23rd day of SEPTEMBER, 1969, from SANTIAM COPPER MINES, INC., a corporation of the State of Oregon, hereinafter called "Grantor", to the United States of America, hereinafter called "Grantee".

WITNESSETH:

Grantor, for and in consideration of One (\$1.00) Dollar received by Grantor, does hereby grant to Grantee and its assigns, subject to existing easements and valid rights, a perpetual easement for a road along and across a strip of land, hereinafter defined as the "premises", over and across the following described lands in the County of Marion, State of Oregon:

Mandalay Fraction (Lode) mining claim located
in Sec. 30, T.8S., R.5E., W.M.

all as shown on the plat attached hereto marked Exhibit A.

The word "premises" when used herein means said strip of land, whether or not there is an existing road located thereon. Except where it is defined more specifically, the word "road" shall mean roads now existing or hereafter constructed on the premises or any segment of such roads.

Said premises shall be variable feet on each side of the center line with such additional width as required for accommodation and protection of cuts and fills. If the road is located substantially as described herein, the center line of said road as constructed is hereby deemed accepted by Grantor and Grantee as the true center line of the premises granted. If any subsequent survey of the road shows that any portion of the road, although located substantially as described, crosses lands of the Grantor not described herein, the easement shall be amended to include the additional lands traversed; if any lands described herein are not traversed by the road as constructed, the easement traversing the same shall be terminated in the manner hereinafter provided.

The acquiring agency is the Forest Service, Department of Agriculture.

This grant is made subject to the following terms, provisions, and conditions applicable to Grantee, its permittees, contractors, and assigns:

- A. Except as hereinafter limited, Grantee shall have the right to use the road on the premises without cost for all purposes deemed necessary or desirable by Grantee in connection with the protection, administration, management, and utilization of Grantee's lands or resources, now or hereafter owned or controlled, subject to such traffic-control regulations and rules as Grantee may reasonably impose upon or require of other users of the road. Grantee shall have the right to construct, reconstruct, and maintain roads within the premises.

Grantee alone may extend rights and privileges for use of the premises to other Government Departments and Agencies, States, and local subdivisions thereof, and to other users including members of the public.

- B. Grantee shall have the right to all timber now or hereafter growing on the premises, including the right to cut, remove, and dispose of said timber for the benefit of Grantee.

This easement is granted subject to the following reservations by Grantor, for itself, its permittees, contractors, assigns, and successors in interest:

1. The right to cross and recross the premises and road at any place by any reasonable means and for any purpose in such manner as will not interfere unreasonably with use of the road.

The herein granted easement and right-of-way crosses the Mandalay Fraction unpatented mining claim owned and held by the Grantor; acceptance of this easement by the Grantee shall not constitute a recognition by the Grantee of the validity of the Grantor's mining claim.

It is agreed that the Grantor shall have the right to use the road hereinafter to be constructed for all purposes deemed necessary or desirable by Grantor in connection with the protection, administration, management, and utilization of Grantor's lands or resources now or hereafter owned or controlled, subject, however, to traffic-control regulations as Grantee may reasonably impose under 36 C.F.R. 212.7(a) (1) and (2), the bearing of road maintenance costs proportionate to use as provided in 36 C.F.R. 212.7(d), and the sharing of the cost of construction or reconstruction proportionate to use, as provided in 36 C.F.R. 212.11.

If for a period of five (5) years, the Grantee shall cease to use, or preserve for prospective future use, the road or any segment thereof for the purposes granted, or if at any time the Regional Forester determines that the road or any segment thereof is no longer needed for the purposes granted, the easement traversed thereby shall terminate. In the event of such nonuse or of such determination by the Regional Forester, the Regional Forester shall furnish to the Grantor, its successors, or assigns a statement in recordable form evidencing termination.

IN WITNESS WHEREOF, Grantor has caused this instrument to be executed by its duly authorized officers and its corporate seal to be hereunto affixed on the day and year first above written.

[Signature]
By _____
(Title)

(Seal)
Attest: [Signature]

(Secretary)

State of OREGON)
County of Multnomah) ss.

On this 23re day of September, 19 69, before me the undersigned, a Notary Public in and for said County and State, personally appeared J. P. HEWITT and VICTOR ATTIYEH, known to me to be the President and Secretary, of SANTIAM COPPER MINES, INC., the Individuals that executed the within instrument, known to me to be the persons who executed the within instrument on behalf of the corporation therein named, and acknowledged to me that such individuals executed the within instrument pursuant to its bylaws or a resolution of its Board of Directors.

WITNESS my hand and Official Seal,

[Signature]
Notary Public in and for said
County and State

My Commission expires 12-19-72

APPENDIX 6

MINERAL SURVEYS

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MS 993: Morning Star	51
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APPENDIX 7

OPERATING PLAN

OPERATING PLAN

SHINY ROCK MINING CORP.

U.S. FOREST SERVICE

This Plan of Operation does not constitute relinquishment of rights to surface control by either party.

We concur with these management requirements and constraints.

1/ by Ray A. Otych Pres. March 4, 1977
Swiny Rock Mining Corporation Date

Approval of this operating plan does not constitute certification of ownership to any person named as owner herein.

Approval of this operating plan does not constitute recognition of the validity of any mining claim named herein, or of any mining claim now or hereafter covered by this plan.

This plan of operation is hereby approved subject to compliance with the management requirements and constraints and subject to furnishing a bond, cash or securities in the amount of \$11,000.00.

1/ Approved: Delton Duda March 4, 1977
District Ranger Date

1/ Joint approval of this plan is made with the exception of Section N., Use of Timber. SRMC does not agree with the price and policy regarding use of timber and will appeal this decision.

I. Introduction

On December 15, 1976 Shiny Rock Mining Corporation of Mehama, Oregon submitted a Plan of Operations for their activities in the Little North Fork drainage of the North Santiam River. This plan is herein presented followed by Management Requirements and Constraints that further clarify what will be necessary to protect surface resources.

The signatures on the cover page indicate joint agreement and approval of the Plan of Operation and requirements.

A copy of 9/1/74 Regulations for Surface Resource Protection is included in the appendix Exhibit A for reference.

The Management Constraints and Requirements portions of this plan were prepared early in June 1976 and were used as a guide to the administration of activities. A price for the timber was not established and signing of the plan was delayed pending appraisal and decision.

The timber cutting policy is explained in this plan. The establishment of a price will be done for each case.

Supplemental or revised plans for SRMC operations will be filed as addendums to this plan of operations.

Note: The current operations covered under this plan have not been of a nature to require an Environmental Impact Statement. Future plans involving road construction and or timber removal within the boundaries of the roadless study area may require an E.I.S. under the requirements of the National Environmental Policy Act.

III. Management Requirements and Constraints

Reference to the applicable section of the Regulations is shown in () at the beginning of each topic.

A. (252.8--a Air Quality)

State of Oregon Department of Environmental Quality regulations relating to air quality control will be used in governing activities under this plan.

In the appendix are copies of correspondence with State of Oregon Department of Environmental Quality indicating that if the project is constructed, operated and maintained properly it should comply with applicable air quality control rules and statues. See DEQ letters to Shiny Rock Mining Corporation dated September 30, 1975, January 20, 1976 and February 12, 1976, Exhibits B,C,D respectively.

Also included is a copy of a May 27, 1976 letter from DEQ (Exhibit E) to George Atiyeh clarifying that land clearing slash and related debris burning requested by the Forest Service will not be in Violation of the Air Contaiminant Discharge Permit. However, "burning of material such as tires, garbage, trash, or any material which results from the operation or maintenance of the mining site, processing plant and/or mining community is prohibited." This is interpreted as applying to the ore reduction plant site.

B. (252.8--b Water Quality)

Reference is made to the September 20, 1975 (Exhibit B) letter to George Atiyeh from David St. Louis of DEQ located in the appendix. In the letter is shown that "the established water quality standards dictate that any proposed waste water treatment system be designed such that recirculation is maximized. No discharge from the system will be permitted to either directly or indirectly enter the waters of the State."

The plans include provision for maximum recycling of water within the mill and settling ponds. A sprinkling system may be developed for discharge of any remaining excess water. The Water Pollution Control Facilities Permit application has been submitted. PERMIT received 5/31/76
Exhibit B(1)

The U.S. Environmental Protection Agency is working with the Forest Service to determine metal levels existing within the waters of the Little North Fork. In the appendix is a November 10, 1975 letter from Gary A. Chapman of EPA (Exhibit F) indicating quite low metal levels and no concern from the fish toxicity view. It is planned to continue this study with EPA during future stages of the operation.

Forest Service analysis work was done during 1975 and 1976 to supplement the study with EPA. Copies of the results are included in the appendix. (Exhibit G & H) The study will continue and results will be on file at Detroit.

Solid waste and tailing disposal concerns effecting water quality will be described in other parts of this plan.

Department of Environmental Quality Regulations relating to Water Quality control in Oregon will be used in governing activities under this plan.

Specific Standards are:

Chapter 340, Section 41-100 Special Water Quality and Waste Treatment Standards for the McKenzie River Basin and the Santiam River Basin. A copy of these regulations are shown as exhibit I in the appendix.

C. (252.8--c Solid Wastes)

Solid wastes in the form of unusable equipment tires, cans and related material resulting from this operation are to be removed from the National Forest. Land clearing slash, road construction slash and other slash resulting from the operation is to be piled and burned or disposed of as instructed by the Forest Service. Burning permits will be issued by Forest Service for this type of disposal.

The Mining Company and Forest Service will agree upon places to pile and dispose of timbers removed from the old tunnels. These timbers and other wastes from the tunnels are not to be placed in streams or where high water or leaching will result in placement in the stream.

Tailings will be piled in areas agreed upon by the Forest Service. The long range plan indicates tailings may be used as fill back in the tunnels. At present the Forest does not accept use of tailings as road surfacing. If future evidence indicates this is feasible a modification to the plan can be made. Location of tailing piles will be influenced by a desire to reduce visual impact or practicable as well as locating where erosion and leaching won't deposit residue in streams.

D. (282.8--d Scenic Values)

The Regulations quite clearly state the objective for scenic values. This will guide planning and approval of new structures and improvements as well as set direction for improving the appearance of existing improvements through maintenance and use of vegetation.

E. (282.8--e Fisheries and Wildlife Habitat)

Plan to do as shown in the Regulations. Considering the isolated location of the operations the Company will alert its employees that it is necessary to comply with applicable game laws.

F. (282.8--f Roads and 252.12 Access)

1. Road Plans and Permits

Access to the operations will be via the Elkhorn-Elk Lake Road S80 and spur roads from the Ruth claims and the Morning Star claim.

The use and reconstruction of the Elkhorn-Elk Lake Road S80 will be authorized through a Road Use permit that is supplemental to this operating plan. The permit will include all of Road S80 from the Forest boundary in Section 32, T8S., R4E., to the East boundary of the Morning Star claim in Section 27, T8S., R5E., with the exception of where it crosses stipulated claims which are Santiam #1, Mandalay Fraction, Ruth 5 and Morning Star.

The status of road rights across the stipulated claims is unresolved with both the mining company and the Forest Service claiming control. This will be settled sometime in the future.

In preparation for the road use permit, stationing has been marked on the ground and brief notes made describing planned reconstruction at each station. The planned reconstruction will be done during the summer of 1976. Reconstruction completed during Fall 1977.

The original Plan of Operation proposed improving the "Tram" road from the 5th level of the Ruth claim to its junction with the Elkhorn-Elk Lake road. This has been inspected on the ground and the decision made that unacceptable resource damage would occur by reopening this old road. A new route has been surveyed and is being designed which will involve about 600 feet of new construction at an average of 18% grade from the 5th level of the Ruth up to the Elkhorn-Elk Lake road. Construction of this spur is approved if done as designed. A

copy of the design was given to SRMC.

Specific proposals for location and reconstruction of the spurs to the other portals of the Ruth claims and the Morning Star will be made and approved by supplemental letters to this operating plan. The proposals will consist of stationing and brief descriptions of the work to be done. Of particular concern will be drainage crossings and stability of cut and fill slopes.

As specified in the regulations all roads are to be constructed and maintained "so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water and other resource values".

2. Gates

Recognizing the uncertain status of road rights across the stipulated claims, the public safety advantage and the reduced vandalism opportunity the decision has been made to continue use of locked gates limiting vehicular access.

The western gate will continue to be located at the end of the wide construction on S80 near the eastern section line of Section 24, T8S., R4E. This will be called the Gold Creek gate.

The upper or eastern gate will be called the Morning Star gate and is located near the Whetstone Trailhead above the Morning Star claim in the NE $\frac{1}{4}$ of Section 27, T8S., R5E.

At each gate SRMC will furnish material, install and maintain signs. The Forest Service will make the signs with wording as shown in Section G -- public safety. The signs are to have a neat, professionally made appearance and preferably be reflectorized. In the event of continued vandalism of signs a supplemental type of signing may need to be approved in the future.

Locking will continue to be done by SRMC padlock and 1 Forest Service padlock.

Authorized vehical use will continue to be SRMC associated vehicles and Forest Service administrative use.

3. Rock Sources

Sources of material for road surfacing will require on the ground approval.

There are several places along road S80 West of the Gold Creek bridge where bank ravel may be used for a rock source. These places are below rock faces where removal will not contribute to additional slough of the cut slopes. These sources are to be jointly agreed on and flagged prior to use as a source.

Other sources will be reviewed on the ground and approval given for those that are acceptable.

Tailings are not considered as acceptable surfacing at this time. If further evidence is gained that the flour-like quality can be combined with other material to make a satisfactory surface this decision will be reevaluated.

G. (252.9 Maintenance during operations and Public Safety)

The operator will maintain his structures, equipment and other facilities in a safe, neat and workmanlike manner.

Specific things planned include:

1. Signing at the access gates (See section F for gate locations) that states access policy. The wording will be:

No. 1 - Sign on gate stating

Authorized vehicles only

Another sign will be developed indicating

Public foot travel is
allowed and

Please do not block gate

SRMC will prepare and place in strategic locations at gate and on the stipulated claims and mill sites other signs that state:

Trespassing within tunnels,
buildings and other improve-
ments is prohibited.

Other wording may be negotiated to meet liability Insurance requirements.

2. SRMC employees will contact public travelers encountered in the area and alert them to hazards and the requirement to stay out of developments.

3. The Forest Service will provide an explanation of the access and public safety situation to their receptionists, The Oregon State Forestry Dept., Mehama Ranger Station, Detroit District employees and others as appropriate. A sample statement is included as Exhibit K in the appendix.

4. SRMC plans to fence or put doors on the portals to their most hazardous tunnels.

5. SRMC or their contractors will notify Mining Enforcement and Safety Administration (MESA) Room 205, Building 2, P.O. Box 70, Albany, Oregon 97321 before starting or closing each mine. A sample form, that can be used, is shown as Exhibit L in the appendix.

6. Full time residence of a least two employees at the mill site will help provide for public safety as well as reduce vandalism and theft of company equipment.

7. SRMC will continue, as practicable, to remove or utilize old abandoned equipment and structures from previous mining operations. This will improve the appearance of the site as well as provide a safer area.

H. (252.10 Cessation of Operations, Removal of Structures and Equipment)

The regulations provide that an operator who plans a nonoperating period, other than season shutdown, may file an annual statement with the District Ranger. This will allow the operator to maintain the operating site, structures, equipment and other facilities in a neat and safe manner without activation of reclamation.

I. (252.11 Prevention and Control of Fire)

In compliance with this section of the regulations the following action will be taken:

1. Annually, before July 1, the Operator and Forest Service will conduct a fire inspection of the operation and jointly prepare a fire prevention and action plan. This plan will include:
 - a. List of key personnel for both parties and means of contacting them.
 - b. Listing of SRMC equipment available for fire suppression.
 - c. A brief discussion of potential fire hazards associated with the operation and plans for correction. e.g. fuel storage area and fueling operation.
 - d. Equipment inspection and required tools, spark arrestors, fire extinguishers etc.
2. Plan location and construction of a helispot.
3. Plan and conduct fire prevention contacts where message is provided to employees and their families.
4. Provide follow up inspection by prevention guards and other Forest Service personnel.

J. (252.13 Bonds and 252.8g Reclamation)

Section 252.13 (a thru c) of the regulations outlines requirements for bonds and adjustments in the amount of bond as the operating plan is modified. Section 252.13 (d) explains that the amount of bond may be reduced proportionately as the Forest Service accepts completed portions of reclamation work.

Reclamation work is to be done upon exhaustion of the mineral deposit, or at the earliest practicable time during operations, or within 1 year of the conclusion of operations unless longer time is authorized by the Forest Officer.

The calculations for the reclamation work are separated into sections to facilitate proportional adjustments in the amount of bond.

30% inflation based on work being done about 1980. All machinery rates include operator.

Item 1 - Spur roads:

Close spur roads to vehicular use; remove culverts; construct cross drains, dips, or water bars; reshape road surface to as near a natural contour as practicable.

Ruth spur from 5th level - $\frac{1}{2}$ mi.

Upper Ruth spur - $\frac{1}{2}$ mi.

Morning Star spur - $\frac{1}{2}$ mi.

Loader @ \$22.47 per hour - 8 hours	\$179.76
Backhoe @ \$16.25 per hour - 4 hours	65.00
Grader @ \$24.49 per hour - 2 hours	50.98
J.D. Dozer @ \$15.12 per hour - 16 hours	241.92
10 yard dump @ \$20.68 per hour - 4 hours	82.72
10 yard dump @ \$20.06 per hour - 4 hours	80.24
Chase truck @ \$.32 per mile - 80 miles	25.60
Total	<u>726.22 + 30% inflation</u>
	round to \$1000

Item 2 - Main roads

Maintain road S80 to Forest Service level II condition - one final maintenance on 7 miles of road.

Loader @ \$22.47 per hour - 8 hours	\$179.76
Backhoe @ \$16.25 per hour - 16 hours	260.00
Grader @ \$25.49 per hour - 16 hours	407.84
J.D. Dozer @ \$15.12 per hour - 4 hours	60.48
10 yard dump @ \$20.68 per hour - 4 hours	82.72
10 yard dump @ \$20.06 per hour - 4 hours	80.24
Chase truck @ \$.32 per mile - 80 miles	25.60
	<hr/>
	1096.64 + 30% inflation
	= \$1426
	round to \$1400

Item 3 - Close open mine shafts

Cost estimates on a per shaft basis

Two men @ \$16.50 per hour - 4 hours	\$ 66.00
½ to ½ case powder inc. caps	20.00
½ T. pickup @ \$0.18/mi.	14.40
Loader @ \$22.47 per hour - 8 hours	179.76
	<hr/>
	280.16
+ 30% inflation round to \$360 per shaft	
5 shafts equals	\$1800

Note: Some type of fencing may be used in lieu of blocking by collapse.

Item 4 - Utilization or disposal of tailings and stock piles at Mill sites.

Includes reshaping to as near original contour as practicable, isolating areas from drainage into water courses, preparing for revegetation.

Loader @ \$22.47 per hour - 16 hours	\$359.52
J.D. Dozer @ \$15.12 per hour - 16 hours	241.92
10 yard dump @ 20.68 per hour - 16 hours	330.88
10 yard dump @ 20.06 per hour - 16 hours	320.96
Chase truck @ \$.32 per mile - 160 miles	51.20
Implement trailer @ \$5.38 per day - 2 days	11.16
	<hr/>
Total	1315.64 + 30% inflation
	Round to \$1700

Item 5 - Plant approximately 10 acres of mill sites roads to trees.

Erosion seed and fertilizer approximately 8 acres of remaining disturbed mill sites and roads. Forest Service to furnish trees.

Plant 10 acres @ \$70	\$700
Seed and fertilize 8 acres @ \$20	160
	<hr/>
	860 + 30% inflation
	Round to \$1100

Item 6 - Bury or remove solid wastes, equipment etc. left on area.

Loader @ \$22.47 per hour - 8 hours	\$179.76
Backhoe @ \$16.25 per hour - 8 hours	130.00
J.D. Dozer @ \$15.12 per hour - 8 hours	120.96
10 yard dump @ \$20.68 per hour - 8 hours	165.44
10 yard dump @ \$20.06 - 8 hours	160.48
Chase truck @ \$.32 per mile - 80 miles	25.60
	<hr/>
Total	\$782.24 + 30% inflation
	Round to \$1000

Item 7 - Remove water line

Backhoe @ \$16.25 per hour - 8 hours	\$130.00
J.D. Dozer @ \$15.12 per hour - 8 hours	120.96
Chase truck @ \$.32 per mile - 160 miles	51.20
two men @ \$10 per hour - 8 hours	80.00
	<hr/>
Total	\$382.16 + 30% inflation
	Round to \$500

Item 8 - Reclaim area where ore reduction mill is located including mill, settling ponds and stock piles of ore.

Loader 30 hours @ \$22.47	\$647.10
S.D. Dozer 30 hours @ \$15.12	453.60
Chase truck - 3 days @ \$.32/ mi - 8 mi/day	76.80
Implement trailer 1 day @ \$5.58	5.58
	<hr/>
Total	1210.08 + 30% inflation
	Round to \$1600

Item 9 - Slabpile, sawdust and logging
Slash cleanup after mine
Timber cutting

Estimate \$1000.00 this can vary depending upon amount of material needing disposal.

Summary

<u>Item</u>	<u>Amount</u>
1. Spur roads	\$1000
2. Main roads	1400
3. Close shafts	1800
4. Tailing disposal	1700
5. Revegetation	1100
6. Solid waste disposal	1000
7. Water line removal	500
8. Structure reclamation	1600
9. Slash clean up	1000
Total	<u>11,100 round to \$11,000</u>

K. (252.7 Inspection, non compliance)

The regulation specify that inspections will be conducted by Forest Officers and outlines action that will be taken in case of non-compliance by the operator.

Inspections will be conducted by the Detroit District person responsible for minerals (Dave Black at this time June 1976), The District Ranger and the fire prevention patrolman for the Little North Fork area. Other people may be called upon as special expertise or knowledge is needed to evaluate operations.

The representative for SRMC is George Atiyeh.

L. Cultural or Natural History Resources

The operator agrees to notify the District Ranger of any discovery of cultural or natural history resources within the area covered by this plan.

Should such resources be discovered during operations they shall be left unharmed until provisions can be worked out for their protection or preservation. Modification of this plan may be necessary to provide this protection if warrented.

M. Water Line

In 1935 a Special Use Permit was issued to Amalgamated Mining Corporation for a flume to provide water and power for the Old mill site and operations of J.P. Hewitt. Use of the flume has been discontinued and the permit terminated. Several times since 1970 SRMC has requested permission to install a water line that will replace the flume and be in a different location.

Battle Axe Cr.

R S80.3

← Brass Cap on Poor Boy Mill Site 94' on
45 Az from end of water line

East of Battle
Axe bridge

50'

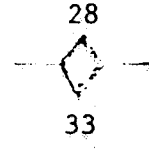
← Az 160 305'

Little North
Santiam

← Az 144 750'



Approximate locati
of 1/4 corner



T.8S., R.5E., W.M.

← Az 126 660'

← Az 130 140'

← Az 126 80'

← Az 130 310'

← Az 132 90'

Shiny Rock Mining Corporation

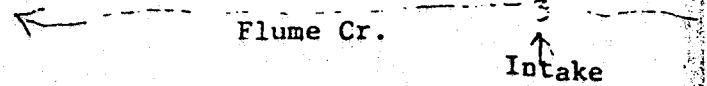
Water Transmission

← Az 126 420'

February 1976

← Az 124 60'

← Az 120 310'



Flume Cr.

Intake

The requests were discouraged for various reasons until February 1975 when favorable response was indicated. The Forest Service intended to issue a Special Use permit for the new line but as the Plan of Operations developed and the Poor Boy and Starvation Mill sites filed it was decided to include the water line with this Plan of Operations.

Inclusion in this plan constitutes authorization for the water line.

Description of water line:

1. Intake in Flume Creek in the Opal Creek drainage Section 33, T8S., R5E., W.M.
2. 3220 feet of 8" and 6" plastic P.V.C. pipe, 700 feet of which will be buried, the remainder layed on the surface.

A traverse of the water line was made and is shown on the next page.

Exhibit J. in the Appendix is a September 18, 1975 letter to the Water Resources Department requesting appropriation of water for use by SRMC.

SRMC shall indemnify the United States against any liability for damage to life or property arising from the construction and use of this water line.

For authorization of power generation SRMC will need to apply to the Federal Power Commission for a license. The current address is FPC Regional Engineer, U.S. Customs House, 555 Battery Street, San Francisco, California 94111, Telephone 8-556-3581.

N. Use of timber

Timber needed for mining development and cut from a valid claim may be used free of charge for development of the claim from which it is cut. This use may be made either on the claim or on other property. It is required that the timber be needed for a use reasonably incident to legitimate mining operations in connection with the claim.

Timber cut from a stipulated or unpatented claim and used for development of claims other than the one from which it is cut is to be paid for by the mining company.

All timber cutting must be authorized in advance. Prices will be established for each case where timber is to be purchased. The appraisal premise will be for a normal development sale in the area. An average over bid based on competitive sale experience will be computed and added to the appraised rates.

Volumes will be determined by log scale in the woods or deck depending upon the circumstances.

Advance deposits will be requested based on estimates of volume to be removed. Arrangements can be made for a payment bond if SRMC prefers.

A free use permit will be issued each season for fire wood utilized in the mining activities. This will be for dead and down material in the area.

O. Items to Resolve Later

1. Road Use Permit for commercial hauling.
2. Road R/W status across stipulated claims.
3. Establish price for timber.

P. Supplemental Plans

Supplemental or additional plans for SRMC operations will be filed as addendums to this plan of operations.

On August 6, 1976 Dave Black was contacted by D.L. Stevens representing Freeport Exploration Company. The company had leased claims from Shiny Rock Mining Corporation and wanted to present their notice of intent to do exploratory drilling.

This intent is documented in a 8/13/76 letter from Freeport to the Forest Service. A copy of the Freeport letter and the 9/30/76 response is included as Exhibit P in the appendix.

Drill site #1 (refer to attached map) was used. The plan to construct access to site #2 was dropped and no construction started. Clearing was started to site #3 but the plan changed before completion. The revised plan provided for a drill hole at site #4 on the map.

The Freeport Drill rig crew were allowed to camp at an undeveloped site east of Horn Creek in the SW $\frac{1}{4}$ of Section 24, T8S., R4E., W.M. They discontinued use of the site early in February 1977.

Future operations of Freeport will be covered under a separate operating plan in their name.

APPENDIX

- A. Regulations for Surface Resource Protection
- B. 9/30/75 DEQ letter to SRMC
- B1. Water Pollution Control Permit 8/31/76
- C. 1/20/76 DEQ letter to SRMC
- D. 2/12/76 DEQ letter to SRMC
- E. 5/27/76 DEQ letter to SRMC
- F. 11/10/75 letter from EPA to Willamette N.F.
- G. Water sample results
- H. Water sample results
- I. Water Quality and Waste Treatment Standards
- J. 9/18/75 letter from SRMC application for water rights.
- K. Little North Fork public information statement
- L. MESA notification form
- M1. Starvation Mill Site description.
- M2. Poor Boy Mill Site description
- N. Fire plan for 1976
- O. Road reconstruction notes - 1976.
- P. Freeport Exploration Co. Notice of Intent.
- Q. Site plan for mill sites.
- R. Area map

DEPARTMENT OF ENVIRONMENTAL QUALITY
8. W. Morrison Street
Salem, Oregon 97205
Phone: (503) 229-5696


Permit Number: 2462
Expiration Date: 5/31/81
File Number: F1035
Page 1 of 6

State of Oregon
Department of Environmental Quality
PERMIT CONDITIONS

Permit Number: 2462
Expiration Date: 5/31/81
Page 2 of 6

WATER POLLUTION CONTROL FACILITIES PERMIT

Issued pursuant to ORS 468.740

ISSUED TO: Shiny Rock Mining Corporation P.O. Box 132 Mehama, OR 97384	SOURCES COVERED BY THIS PERMIT:			
	<table border="1"><thead><tr><th>Type of Waste</th><th>Method of Disposal</th></tr></thead><tbody><tr><td>Ore Processing Waste</td><td>Recirculation and Seepage</td></tr></tbody></table>	Type of Waste	Method of Disposal	Ore Processing Waste
Type of Waste	Method of Disposal			
Ore Processing Waste	Recirculation and Seepage			
PERMIT TYPE AND LOCATION: Permit No. 111616 NW 1/4 of Section 20, Township 8 South Range 5 East of Willamette Meridian, Marion County, Oregon	RIVER BASIN INFORMATION Major Basin: <u>Willamette</u> Minor Basin: <u>Santiam</u> County: <u>Marion</u>			
Issued in response to application number _____ received <u>1/12/76</u>	Nearest surface stream which could be influenced by waste disposal system: <u>Little North Fork Santiam</u>			
 Loren K. Fisher, Director	<u>AUG 31 1976</u> Date			

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify or operate waste water treatment, control and disposal facilities in conformance with requirements, limitations and conditions set forth in attached schedules as follows:

	Page
Schedule A - Waste Disposal Limitations	<u>2</u>
Schedule B - Minimum Monitoring and Reporting Requirements	<u>3</u>
Schedule C - Compliance Conditions and Schedules	<u>--</u>
Schedule D - Special Conditions	<u>4</u>
General Conditions	<u>5-6</u>

All direct discharges to public waters are prohibited.

This permit does not relieve the permittee from responsibility for compliance with other applicable Federal, state or local laws, rules or standards.

SCHEDULE A

Waste Disposal Limitations

1. No wastes shall be discharged to public waters either directly or by seepage and no activities shall be conducted which, either alone or in conjunction with other wastes or activities, will cause any measurable increase in the natural turbidity of adjacent public waters.
2. Prior to constructing or modifying any waste water control facilities, detailed plans and specifications shall be approved in writing by the Department.
3. The permittee shall, during all times of disposal, provide personnel whose primary responsibility are to assure the continuous performance of the disposal system within the limitations of this permit.

State of Oregon
Department of Environmental Quality
PERMIT CONDITIONS
Shiny Rock Mining Corporation

Permit Number: 2462
Expiration Date: 5/31/81
Page 3 of 6

SCHEDULE B

Minimum Monitoring and Reporting Requirements

Unless approved otherwise in writing by the Department the permittee shall observe and inspect all waste handling, treatment, and disposal facilities and adjacent streams at least daily to insure compliance with the conditions of this permit. A written record of all such observations shall be maintained at the plant and shall be made available to the Department of Environmental Quality staff for inspection and review upon request.

State of Oregon
Department of Environmental Quality
PERMIT CONDITIONS
Shiny Rock Mining Corporation

Permit Number: 2462
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SCHEDULE D

Special Conditions

1. Sanitary wastes shall be disposed of to a septic tank and subsurface disposal system (or by other approved means) which is installed, operated and maintained in accordance with the requirements of the Department of Environmental Quality and the local health department and in a manner which will prevent inadequately treated waste water from entering any waters of the state or from becoming a nuisance or health hazard.
2. An adequate contingency plan for prevention and handling of spills and unplanned discharges shall be in force at all times. A continuing program of employee orientation and education shall be maintained to ensure awareness of the necessity of good implant control and quick and proper action in the event of a spill or accident.
3. All settling pond dredge spoils, tailings and other waste solids shall be utilized or disposed of in a manner which will prevent their entry or the contaminated runoff therefrom into the waters of the state, and such that health hazards and nuisance conditions are not created.

State of Oregon
Department of Environmental Quality
PERMIT CONDITIONS

Permit Number: 2462
Expiration Date: 5/31/81
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Shiny Rock Mining Corporation

GENERAL CONDITIONS

- G1. The permittee shall provide an adequate operating staff which is duly qualified to carry out the operation, maintenance and testing functions required to insure compliance with the conditions of this permit.
- G2. All waste collection, control, treatment and disposal facilities shall be operated in a manner consistent with the following:
- At all times all facilities shall be operated as efficiently as possible and in a manner which will prevent discharges, health hazards and nuisance conditions.
 - All screenings, grit and sludge shall be disposed of in a manner approved by the Department of Environmental Quality such that it does not reach any of the waters of the state or create a health hazard or nuisance condition.
 - Bypassing of untreated waste is generally prohibited. No bypassing shall occur without prior written permission from the Department except where unavoidable to prevent loss of life or severe property damage.
- G3. Whenever a facility expansion, production increase or process modification is anticipated which will result in a change in the character of pollutants to be discharged or which will result in a discharge to public waters, a new application must be submitted together with the necessary reports, plans and specifications for the proposed changes. No change shall be made until plans have been approved and a new permit or permit modification has been issued.
- G4. After notice and opportunity for a hearing this permit may be modified, suspended or revoked in whole or in part during its term for cause including but not limited to the following:
- Violation of any terms or conditions of this permit or any applicable rule, standard, or order of the Commission;
 - Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts.
- G5. The permittee shall, at all reasonable times, allow authorized representatives of the Department of Environmental Quality:
- To enter upon the permittee's premises where a waste source or disposal system is located or in which any records are required to be kept under the terms and conditions of this permit;
 - To have access to and copy any records required to be kept under the terms and conditions of this permit;
 - To inspect any monitoring equipment or monitoring method required by this permit; or

State of Oregon
Department of Environmental Quality
PERMIT CONDITIONS

Permit Number: 2462
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Page 6 of 6

Shiny Rock Mining Corporation

- To sample any discharge of pollutants.
- G6. The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.
- G7. The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.
- G8. The Department of Environmental Quality, its officers, agents and employees shall not sustain any liability on account of the issuance of this permit or on account of the construction or maintenance of facilities because of this permit.
- G9. In the event the permittee is unable to comply with all of the conditions of this permit because of a breakdown of equipment or facilities, an accident caused by human error or negligence, or any other cause such as an act of nature, the permittee shall:
- Immediately take action to stop, contain and clean up the unauthorized discharges and correct the problem.
 - Immediately notify the Department of Environmental Quality so that an investigation can be made to evaluate the impact and the corrective actions taken and determine additional action that must be taken.
 - Submit a detailed written report describing the breakdown, the actual quantity and quality of resulting waste discharges, corrective action taken, steps taken to prevent a recurrence and any other pertinent information.
- Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.
- G10. Definitions of terms and abbreviations used in this permit:
- BOD means five-day biochemical oxygen demand.
 - TSS means total suspended solids.
 - mg/l means milligrams per liter.
 - Kg means kilograms.
 - m³/d means cubic meters per day.
 - MGD means million gallons per day.
 - Averages for BOD and TSS are based on arithmetic mean of samples taken.
 - Average coliform or fecal coliform is based on geometric mean of samples taken.
 - Composite sample means a combination of samples collected, generally at equal intervals over a 24-hour period, and apportioned according to the volume of flow at the time of sampling.

Air Quality Control
1234 S. W. Morrison St.
Portland, Oregon 97205

NOTICE:

NOTICE OF COMPLETION

Oregon Administrative Rules (OAR) Chapter 340, Section 20-030(6) requires that within "thirty (30) days after any person has constructed an air contamination source..., he shall so report in writing on a form furnished by the Department, stating the date of completion of construction and the date the source was or will be put in operation." This form is provided for your convenience to assist you in complying with this part of the Regulation.

Owner or Applicant Section

Mail to: Department of Environmental Quality
Air Quality Control Division
1234 S. W. Morrison Street
Portland, Oregon 97205

Attention: Technical Services Section

Gentlemen:

The project described below was completed on _____
and was or will be in operation on _____. Please send tax
credit application instructions for this project: yes no

Signature

Title

Date

FOR DEPARTMENT USE ONLY

City Jawbone Flats AQ. File No. 24-2316 NC No. 696

Name of Applicant Shiny Rock Mining Corporation

Date NC-4 Received _____ Date of cc to Tax Credit Section, AHE _____

Type of Installation Ore processing plant including the crushing and screening
operation located at the Poor Boy Millsite.

Assigned for Inspection to _____ by _____ on _____

Date of Inspection Report _____ by _____

Summary of Inspection:

See Attachment

Date of cc to Emission Inventory Section _____

11/5/75

<u>Sample No.</u>	<u>Site Description</u>	<u>Time of Sample</u>
C 1	Opal Creek, ca. 1/4 mi. above Jawbone Flats	1140 hrs
D 2	Battleaxe Creek, 50 yds below bridge at Jawbone Flats	1100
E 3	Little N. Fk. Santiam, between Jawbone Flats and Gold Creek	1155
G 4	Gold Creek, at mouth	1220
F 5	Little N. Fk. Santiam, 50 yds below Gold Creek	1225
A 6	Little N. Fk. Santiam, at Elkhorn Bridge (Road S 825)	1000
7	Little N. Fk. Santiam, at N. Santiam Highway Bridge	1400

<u>Sample No.</u>	<u>pH</u>	<u>Total Hardness (mg/l)</u>	<u>Total Alkalinity (mg/l)</u>		<u>Cd ^{1/} (µg/l)</u>	<u>Cu ^{1/} (µg/l)</u>	<u>Zn ^{2/} (µg/l)</u>
1	7.2	21	7	C	.01	2.2	0
2	7.3	24	8	D	.17	1.1	31
3	7.4	22	7	E	.09	1.9	16
4	7.2	21	8	G	.02	2.0	2
5	7.2	21	7.5	F	.05	1.8	11
6	7.2	21	7	A	.03	1.4	13
7	7.4	22	8		.00	0.1	0

^{1/} Direct analysis of 25 or 50 µl of non-acidified samples by Perkin Elmer HGA-2000 flameless atomic absorption

^{2/} Direct analysis of samples by regular flame a.a.

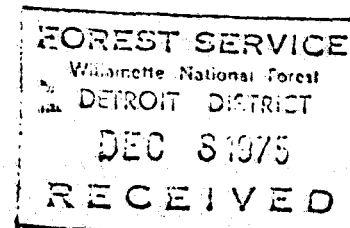
Wanette National Forest
 Detroit Range District
 Detroit P.O. 313
 (8-18-76) 10-184-76
 December 24, 1975

Stations	S.C μmhos/cm	Cu μg/l	Zn μg/l	Cd μg/l	Pb μg/l	Mg* mg/l	Fe μg/l	Hardness* μg/l (CaCO ₃)	Alkalinity* μg/l (CaCO ₃)	HCO ₃ ⁻ μg/l	CO ₃ ⁼ μg/l
Little North Santiam	19.2	1.11	0.42	1.21	0.69	<.01	8.0	6x10 ³	8x10 ³	9.8x10 ³	0
Battle Ax Creek	21.2	1.26	0.44	1.22	0.15	<.01	7.0	8x10 ³	1.0x10 ⁴	1.2x10 ⁴	0
Opal Creek	18.3	1.03	0.33	1.12	0.10	<.01	12.0	6x10 ³	8x10 ³	9.8x10 ³	0
Battle Ax Creek--NO SAMPLE SUBMITTED											
Little North Santiam	19.8	2.26	0.66	1.05	0.41	<.01	9.0	7x10 ³	1x10 ⁴	1.2x10 ⁴	0
Little North Santiam	21.2	0.80	0.46	1.02	0.31	<.01	2.0	8x10 ³	9x10 ³	1.1x10 ⁴	0
Gold Creek	24.2	0.68	0.31	1.13	0.26	.01	9.0	1.1x10 ⁴	9x10 ³	1.1x10 ⁴	0

* As Mg is usually present in ppm, values less than 0.1 ppm are not really meaningful, although we did lower the limit to .01 ppm or 10 ppb. To obtain significant figures below this limit would be very difficult and probably not worth the effort.

* I would suggest that these parameters be expressed in μg/l as the methods are not really sensitive enough to give significant results in ppb.

Analyze the following water samples for
 Copper-Cu (Ug/L), Zinc-Zn (Ug/L), Iron
 Fe (Ug/L), Lead Pb (Ug/L), Magnesium Mg
 (Ug/L), Specific Conductance, Total
 Hardness (Ug/L), Calcium Ca (Ug/L),
 Alkalinity (HCO₃, CO₃)



Lamette National Forest
 Croit Ranger District
 Market P.O. 313
 (8-18-76)
 November 24, 1975

<u>Stations</u>	S.C. µmhos/cm	Cu µg/l	Zn µg/l	Cd µg/l	Pb µg/l	Mg mg/l	Fe µg/l	Hardness µg/l (CaCO ₃)	Alkalinity µg/l (CaCO ₃)	HCO ₃ ⁻ µg/l	CO ₃ ⁼ µg/l
Little North Santiam	35.0	0.17	0.45	1.55	0.24	0.43	3.0	1.3x10 ⁴	1.2x10 ⁴	1.5x10 ⁴	0
Battle Ax Creek	30.0	1.16	0.16	1.07	0.30	0.08	7.0	1.0x10 ⁴	1.3x10 ⁴	1.6x10 ⁴	0
Opal Creek	32.0	0.13	0.13	1.31	0.26	0.05	3.0	1.3x10 ⁴	1.4x10 ⁴	1.7x10 ⁴	0
Battle Ax Creek	37.0	0.19	1.36	1.29	0.22	0.24	2.0	1.4x10 ⁴	1.4x10 ⁴	1.7x10 ⁴	0
Little North Santiam	37.0	0.17	1.06	1.28	0.23	0.16	2.0	1.4x10 ⁴	1.4x10 ⁴	1.7x10 ⁴	0
Little North Santiam	42.0	0.46	0.89	1.05	0.27	0.61	2.0	1.4x10 ⁴	1.35x10 ⁴	1.65x10 ⁴	0
Gold Creek	55.0	0.18	0.60	1.30	0.19	1.35	5.0	2.1x10 ⁴	1.3x10 ⁴	1.6x10 ⁴	0

Analyze the following water samples for
 Copper-Cu (Ug/L), Zinc-Zn (Ug/L), Iron
 Fe (Ug/L), Lead Pb (Ug/L), Magnesium Mg
 (Ug/L), Specific Conductance, Total
 Hardness (Ug/L), Cadmium Cd (Ug/L),
 Alkalinity (HCO₃, CO₃)

Environmental Protection Agency
Western Fish Toxicology Station

Little North Fork Santiam Water Samples

08-31-76

Sample	U.S.F.S. design	pH	Mg/l as CaCO ₃		Cd	µg/l (ppb)		
			Alk.	Hard.		Cu	Zn	Pb
1	C	7.46	15	12	0.03	0.6	<10	<4
2	-	7.46	15	13	0.25	0.9	41	<4
3	D	7.43	15	14	0.26	1.2	44	<4
4	G	7.40	14	18	0.03	1.8	<10	<4
5	F	7.30	14	15	0.11	1.5	18	<4
6	-	7.33	14	13	0.14	0.6	24	<4
7	-	7.31	15	12.5	<.01	0.5	<10	<4
8		7.63	38	71	0.03	24	<10	<4

<u>Sample</u>	<u>Description of Sampling Site</u>
1	Opal Creek 1/4 mil. above Jawbone Flats.
2	Battleaxe Creek above tailings, Ca 100 yds above Jawbone Flats.
3	Battleaxe Creek 50 yds. below bridge at Jawbone Flats.
4	Gold Creek (at mouth).
5	Little N. Fk. Santiam 50 yds. below confluence of Gold Creek.
6	Little N. Fk. Santiam between Jawbone Flats and Gold Creek.
7	Little N. Fk. Santiam at N. Santiam Hiway Bridge.
8	Seepage from mine shaft 1/2 mi. above Gold Creek, bridge on road to Jawbone Flats.

Filed 5-24-71 as DEQ 28.
Amended 6-15-72 by DEQ 46

^{Exhibit =}
section if the Department has published the method or has approved the method in writing.

Hist: Filed 7-2-73 as DEQ 55

41-023 MIXING ZONES. (1) The Department may suspend the applicability of all or part of the water quality standards set forth in this subdivision, except those standards relating to aesthetic conditions, within a defined immediate mixing zone of very limited size adjacent to or surrounding the point of wastewater discharge.

(2) The sole method of establishing such a mixing zone shall be by the Department defining same in a waste discharge permit.

(3) In establishing a mixing zone in a waste discharge permit the Department:

(a) May define the limits of the mixing zone in terms of distance from the point of the wastewater discharge or the area or volume of the receiving water or any combination thereof,

(b) May set other less restrictive water quality standards to be applicable in the mixing zone in lieu of the suspended standards; and

(c) Shall limit the mixing zone to that which in all probability, will

(A) not interfere with any biological community or population of any important species to a degree which is damaging to the ecosystem; and

(B) not adversely affect any other beneficial use disproportionately.

Hist: Filed 7-2-73 as DEQ 55

41-024 TESTING METHODS. The analytical testing methods for determining compliance with the water quality standards contained in this subdivision shall be in accordance with the most recent edition of Standard Methods for the Examination of Water and Waste Water published jointly by the American Public Health Association, American Water Works Association, and Water Pollution Control Federation, unless the Department has published an applicable superseding method, in which case the testing shall be in accordance with the superseding method; provided however that testing in accordance with an alternative method shall comply with this

41-025 GENERAL WATER QUALITY STANDARDS. The following General Water Quality Standards shall apply to all waters of the state except where they are clearly superseded by Special Water Quality Standards applicable to specifically designated waters of the state. No wastes shall be discharged and no activities shall be conducted which either alone or in combination with other wastes or activities will cause in any waters of the state:

(1) The dissolved oxygen content of surface waters to be less than six (6) milligrams per liter unless specified otherwise by special standard.

(2) The hydrogen-ion concentration (pH) of the waters to be outside the range of 6.5 to 8.5 unless specified otherwise by special standard.

(3) The liberation of dissolved gases, such as carbon-dioxide, hydrogen sulfide or any other gases, in sufficient quantities to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation, or other reasonable uses made of such waters.

(4) The development of fungi or other growths having a deleterious effect on stream bottoms, fish or other aquatic life, or which are injurious to health, recreation or industry.

(5) The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish.

(6) The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation or industry.

(7) Objectionable discoloration, turbidity, scum, oily slick or floating solids, or coat the aquatic life with oil films.

(8) Bacterial pollution or other conditions deleterious to waters used for domestic purposes, livestock watering, irrigation, bathing, or shellfish propaga-

OREGON ADMINISTRATIVE RULES

be otherwise injurious to public

9) Any measurable increase in temperature when the receiving water temperatures are 64°F. or greater; or more than 0.5°F. increase due to a single-source discharge when receiving water temperatures are 63.5°F. or less; or more than 2°F. increase due to all sources combined when receiving water temperatures are 62°F. or less.

(10) Aesthetic conditions offensive to the human senses of sight, taste, smell or touch.

(11) Radioisotope concentrations to exceed Maximum Permissible Concentrations (MPC's) in drinking water, edible fishes or shellfishes, wildlife, irrigated crops, livestock and dairy products or pose an external radiation hazard.

(12) The concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection to exceed hundred and five percent (105%) of saturation, except when stream flow exceeds the 10-year, 7-day average flood.

Hist: Amended 4-5-72 by DEQ 39

Amended 7-2-73 by DEQ 55

41-030 BENEFICIAL USES OF WATERS TO BE PROTECTED BY SPECIAL WATER QUALITY STANDARDS. The Special Water Quality Standards contained in this subdivision are adopted for the purpose of protecting, together with pertinent general water quality standards, the beneficial uses of specified waters of the state as set forth in Table A and to conserve the waste assimilative capacity of the waters as to accommodate maximum development and utilization of the resources of the state.

41-035 SPECIAL WATER QUALITY STANDARDS FOR PUBLIC WATERS OF GOOSE LAKE IN LAKE COUNTY. The provisions of this section shall be in addition to and not in lieu of the General Water Quality Standards contained in Section 41-025, except where this section imposes a conflicting requirement with

discharged and no activities shall be conducted which either alone or in combination with other wastes or activities will cause in the waters of Goose Lake:

(1) Dissolved Oxygen (DO). DO concentrations to be less than 7 milligrams per liter.

(2) Organisms of the Coliform Group Where Associated with Fecal Sources. (MPN or equivalent MF using a representative number of samples) Average concentrations of coliform bacteria to exceed 1000 per 100 ml, with 20% of samples not to exceed 2400 per 100 ml.

(3) Hydrogen Ion Concentration (pH). pH values to be outside the range of 7.5 to 9.5

(4) Temperature. Daily average temperatures, to exceed 70°F. or the daily mean ambient air temperature, whichever is greater.

41-040 SPECIAL WATER QUALITY STANDARDS FOR PUBLIC WATERS OF THE MAIN STEM KLAMATH RIVER. The provisions of this section shall be in addition to and not in lieu of the General Water Quality Standards contained in Section 41-025, except where this section imposes a conflicting requirement with the provisions of Section 41-025, this section shall govern. No wastes shall be discharged and no activities shall be conducted which either alone or in combination with other wastes or activities will cause in the waters of the Klamath River:

(1) Dissolved Oxygen (DO).

(a) (Main stem Klamath River from Klamath Lake to Keno Regulating Dam located approximately 16 river miles above the Oregon-California border). DO concentrations of surface waters to be less than 5 milligrams per liter unless caused by natural conditions.

(b) (Main stem Klamath River from Keno Regulating Dam to Oregon-California border). DO concentrations to be less than 7 milligrams per liter.

(2) Organisms of the Coliform Group Where Associated with Fecal Sources. (MPN

WATER QUALITY AND WASTE TREATMENT STANDARDS FOR THE MCKENZIE RIVER BASIN AND THE SANTIAM RIVER BASIN.

41-100 SPECIAL WATER QUALITY AND WASTE TREATMENT STANDARDS FOR THE MCKENZIE RIVER BASIN AND THE SANTIAM RIVER BASIN. (1) The provisions of these sections shall be in addition to, and not in lieu of existing STANDARDS OF QUALITY FOR PUBLIC WATERS OF OREGON AND DISPOSAL THEREIN OF SEWAGE AND INDUSTRIAL WASTES (Oregon Administrative Rules, Chapter 340, Division 4, Subdivision 1). Where these sections impose conflicting requirements with the provisions of Section 41-025, these sections shall govern.

(2) Special Water Quality Standards. No wastes shall be discharged and no activities shall be conducted which either alone or in conjunction with other wastes or activities will cause in the waters of the McKenzie River Basin and the Santiam River Basin:

(a) Organisms of the Coliform Group where Associated with Fecal Sources. () or equivalent MF using a representative number of samples.) Average concentrations to exceed 240 per 100 milliliters, except during periods of high surface runoff.

(b) Dissolved Oxygen. (D.O.) Dissolved Oxygen concentrations to be less than 90 percent of saturation at the seasonal low, or less than 95 percent of saturation in spawning areas during spawning, incubating, hatching, and fry stages of salmonid fishes.

(c) pH (Hydrogen Ion Concentration). Any change in naturally occurring pH values (normal range is between 7.0 and 8.0).

(d) Turbidity (Jackson Turbidity Units, JTU). Any measurable increases in natural stream turbidities when natural turbidities are less than 30 JTU, or more than a 10 percent cumulative increase in natural stream turbidities when stream turbidities are more than 30 JTU, except for certain short-term activities which are specifically authorized by the Department of Environmental Quality under such conditions as it may prescribe and

which are necessary to accommodate essential dredging, construction, or other legitimate uses or activities where turbidities in excess of this standard are unavoidable.

(e) Temperature. Any measurable increases when stream temperatures are 58° F. or greater; or more than 0.5° F. increase due to a single-source discharge when receiving water temperatures are 57.5° F. or less; or more than 2° F. increase due to all sources combined when stream temperatures are 56° F. or less, except for certain short-term activities which may be specifically authorized by the Department of Environmental Quality under such conditions as it may prescribe and which are necessary to accommodate legitimate uses or activities where temperatures in excess of this standard are unavoidable.

(f) Dissolved Chemical Substances. Guide concentrations listed below to be exceeded except as may be specifically authorized by the Department of Environmental Quality upon such conditions as it may deem necessary to carry out the general intent of Section 41-010 of Oregon Administrative Rules, Chapter 340, and to protect the beneficial uses set forth in Table A.

	mg/l
Arsenic (As)	0.01
Barium (Ba)	1.0
Boron (Bo)	0.5
Cadmium (Cd)	0.003
Chloride (Cl)	25.
Chromium (Cr)	0.02
Copper (Cu)	0.005
Cyanide (Cn)	0.005
Fluoride (F)	1.0
Iron (Fe)	0.1
Lead (Pb)	0.05
Manganese (Mn)	0.05
Phenols (totals)	0.001
Total dissolved solids	100.
Zinc (Zn)	0.01

(3) Minimum Standards for Treatment and Control of Wastes. Prior to discharge or release to the public waters of the McKenzie River Basin and the Santiam River Basin all wastes shall be treated

OREGON ADMINISTRATIVE RULES

in accordance with the

Wastes.

stream flow periods (approximate 1 to October 31).

(i) For discharge to public waters of the Kenzie River Basin upstream from Lebanon Bridge, river mile 14.8, monthly average effluent concentrations not to exceed 5 milligrams per liter of 5-day 20°C. Biochemical Oxygen Demand (BOD) and 5 milligrams per liter of suspended solids (SS).

(ii) For discharge to public waters of the Kenzie River Basin from its confluence with the Willamette River upstream to Lebanon Bridge, river mile 14.8, monthly average effluent concentrations not to exceed 10 milligrams per liter of 5-day 20°C. Biochemical Oxygen Demand (BOD) and 10 milligrams per liter of suspended solids (SS).

(iii) For discharge to public waters of the mainstem of the Santiam River from its confluence with the Willamette River upstream to the junction of the North and South Santiam rivers, river mile 11.3, and the South Santiam River from its confluence with the North Santiam River upstream to the Lebanon Dam, river mile 11.3, monthly average effluent concentrations not to exceed 20 milligrams per liter of 5-day 20°C. Biochemical Oxygen Demand (BOD) and 20 milligrams per liter of suspended solids (SS).

(iv) For discharge to the public waters of the North Santiam River Basin and the South Santiam River Basin upstream from the Lebanon Dam, river mile 20.3, monthly

average effluent concentrations not to exceed 10 milligrams per liter of 5-day 20°C. Biochemical Oxygen Demand (BOD) and 10 milligrams per liter of suspended solids (SS).

(v) Positive protection shall be provided to prevent bypassing raw or inadequately treated sewage to any public waters.

(B) During the period of high stream flows (approximately November 1 to May 31) all waste treatment and control facilities shall be operated at maximum efficiency and effectiveness so as to minimize waste discharges to public waters.

(C) All sewage wastes shall be disinfected, after treatment, equivalent to thorough mixing with sufficient chlorine to provide a residual of at least 1 part per million, after 60 minutes of contact time.

(D) More stringent waste treatment requirements may be imposed, especially in headwater and tributary streams, where waste loads may be large relative to stream flows.

(b) Industrial Wastes.

(A) Industrial waste treatment requirements shall be determined on an individual basis in accordance with the provisions of Section 41-010, 41-015, 41-020, 41-025 and 41-030 of Oregon Administrative Rules, Chapter 340.

(B) Where industrial effluents contain significant quantities of potentially toxic elements, treatment requirements shall be determined utilizing appropriate bioassays.

Hist: Filed 3-3-70 as DEQ 3
Amended 7-2-73 by DEQ 55

WATER QUALITY AND WASTE TREATMENT STANDARDS
FOR THE
McKENZIE RIVER BASIN AND THE SANTIAM RIVER BASIN

Table A
Beneficial Uses to be Protected

<u>Beneficial Use</u>	<u>McKenzie River Basin</u>	<u>Santiam River Basin</u>
Domestic		
Private	X	X
Municipal	X	X
Industrial		
Process	X	X
Boiler Feed	X	X
Cooling	X	X
Agricultural		
Irrigation	X	X
Livestock Watering	X	X
Natural Resources		
Fish	X	X
Aquatic Life	X	X
Wildlife	X	X
Recreation		
Fishing	X	X
Hunting	X	X
Water Contact Sports	X	X
Pleasure Boating	X	X

The Whetstone Trail #3369 was reopened during the Summer of 1975 through cooperative efforts of the Chemeketans and the Forest Service.

Ogle Mountain Trail #3357 and Henline #3352 are also cooperatively maintained by the Chemeketans. The Stony Ridge Trail is not presently maintained.

For additional information contact the District Ranger Dalton Du Lac or Resource Assistant Dave Black at the Detroit Ranger Station, Ph. # 854-3366

Active mining and ore milling is now occurring in the area between the gates. This creates hazardous situation for the public on the roads and in the vicinity of the mill or tunnels.

NOTIFICATION OF MINE OPENING OR CLOSING

To: Mining Enforcement and Safety Administration
Metal and Nonmetal Mine Safety
Room 205, Building 2
P. O. Box 70
Albany, Oregon 97321

From:

(Town and State)

(Zip)

In accordance with Standard .26-1, Metal and Nonmetal Mine Health and Safety Standards, which reads as follows:

(55,56,57).26-1 Mandatory--The owner, operator, or person in charge of any metal and nonmetal mine shall notify the nearest Mining Enforcement and Safety Administration, Metal and Nonmetal Mine Health and Safety subdistrict office of the State agency if the mine is located in a State which has a State Plan Agreement in effect, before starting operations, of the approximate or actual date mine operation will commence. The notification shall include the mine name, location, the company name, mailing address, person in charge, and whether operations will be continuous or intermittent.

When any mine is closed, the person in charge shall notify the nearest subdistrict office or State agency as provided above and indicate whether the closure is temporary or permanent.

We wish to inform you that the following mining operation will:

Begin continuous operation

Begin intermittent operation

Be temporarily closed

on or about

(date)

Be permanently closed

(Mine name)

(Identification Number, if any)

(Location)

(Official in charge)

Signed _____

Starvation Mill site

Beginning at the NE corner of the parcel described
mill site, from which the west end of the
Battle Ave bridge lies.

N68-48-24 W, 591.26 feet

Thence, S49-15-57E, 117.02 feet to a corner marked
by a 4" x 4" x 4' cedar post,

Thence, S26-26-04E, 164.88 feet to a corner marked
by a 4" x 4" x 4' cedar post,

Thence, S15-01-03E, 74.25 feet to a corner marked
by a 4" x 4" x 4' cedar post,

Thence, S17-56-35W, 437.46 feet to a corner etc.

Thence, N49-15-43W, 600.00 feet to a corner etc.

Thence, N51-51-59E, 518.88 feet to the point of
beginning and containing 5.000 acres, more or less.

The herein described mill site lies in the SW¹/₄
of Section 28, T8S, R5E, W.M. Marion Cty.
Iowa.

Four Bay - Malletts

Beginning at the NE corner of the former
 Malletts Mill, following the north-south line
 in both directions - 300 feet from which
 a 4" x 4" x 4" section post was

driven, 300 feet, and from which the
 west end of the Dutton Ore Bridge Road

533-30-45 W, 297.36 feet

Thence, S15-06-01 E, 173.66 feet to a corner

marked by a 4" x 4" x 4" section post,

Thence, S49-15-45 E, 451.89 feet to a corner

marked by a 4" x 4" x 4" section post,

Thence, S51-51-59 W, 518.88 feet to a corner

marked by a 4" x 4" x 4" section post,

Thence, N15-06-00 W, at 416.01 feet a 4" x 4" x 4"

section post and at a total distance of 750.00

feet the corner, marked by a 4" x 4" x 4" corner

post,

Thence, N 75-00-00 E, 322.76 feet to the point

of beginning and containing 5.00 acres, more

or less.

The above described Malletts lies in the SW 1/4
 of Section 28, T8S, R5E, W.M., Town of Bay Ave.

FIRE PLAN

1870 1870

SHINY ROCK MINING CORP.

CONTRACT # N/A

Construction of Road# N/A

Reconst. of Road# N/A

1. Representatives; Authorized to act for contracting parties.

a. purchaser

Name	Operating Title	Business Telephone	Home Tel.
George Atiyeh	Company Representative	854-3505 Mobile	897-2336
Tom Eaton	Field Representative	854-3594 "	897-2407
Ray Weber	Fierman	854-3594 "	(Camp)

b. Forest Service

Sweet home - 367-5186
Telephone: Detroit - 854-3366

Name	Operating Title	Address or Location	Home Ph
Dalton Dulac	District Ranger	Mill City	897-2164
Albert Cadola	Fire Duty Officer	854-3366	854-3623
Dave Black	Sale Officer	Detroit Ranger Station	854-3494
Frank Bergman Or Jim Jordon	Field Representative	854-3599 Mobile Peral Creek	

2. Equipment and personnel Available.

a. Name of Men with special Qualifications;

Dozer Operators Doug Holderdorf

Pumper Operators Ray Weber (500 gal)

Fallers Tom Eaton, George Atiyeh

Other Scott Loft, Scott Coulter, Rick McCarly

b. Tools and Equipment;

Bulldozers John Deere 350 Bucket Loader, T-D9 Bucket Loader, D6C.

Pumper Trucks 1. 650 feet Hose

Power Saws (4) And Operator

Hand Tools Tools for six Men

Other Small fire pump 2" Dia. Discharge Pressure ;
" " " " " " Volume.

Portable Electric Generators (2) 1.5 KW. 1 (6) Kw. (1) 4Kw.

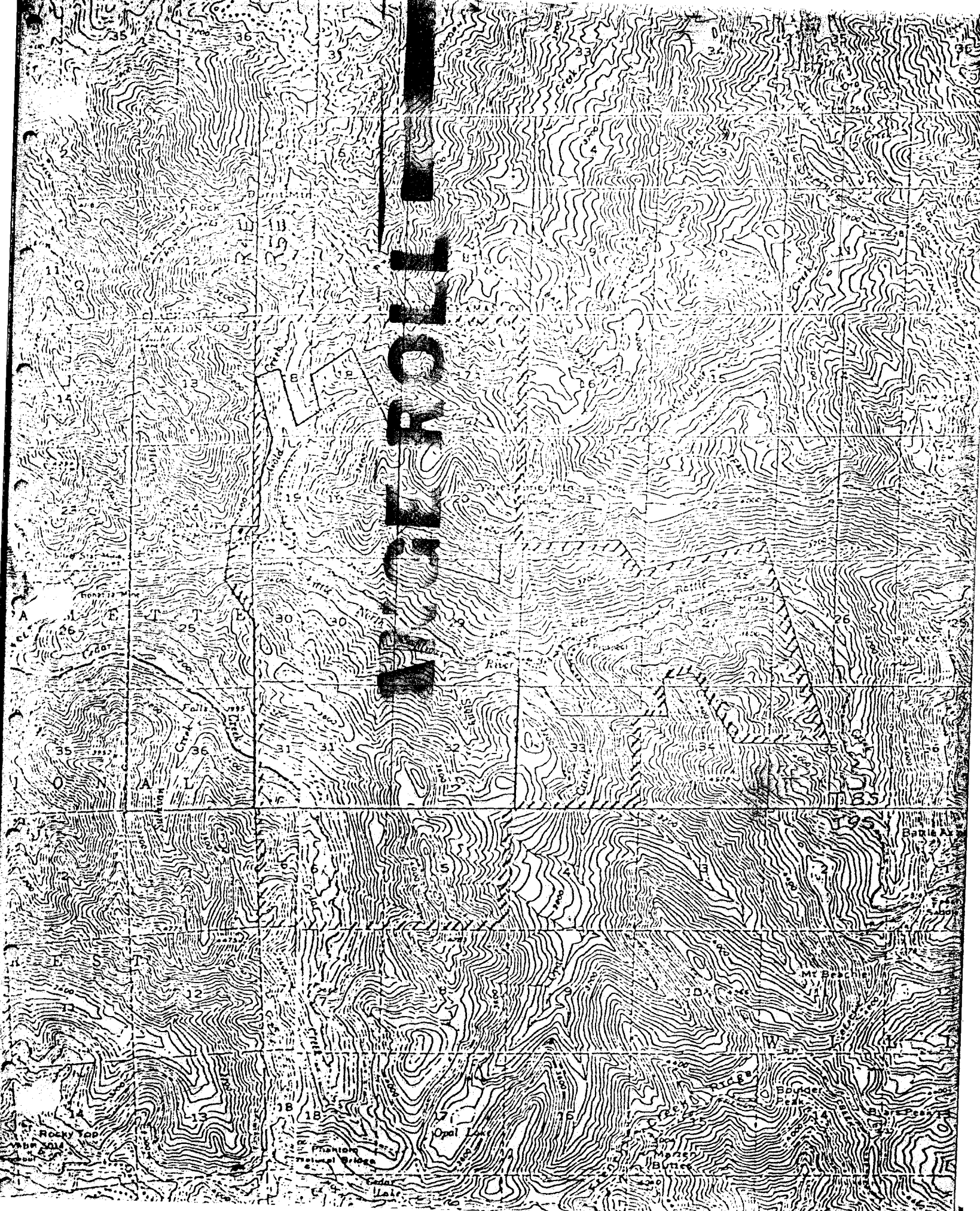
3. Communcations:

a. Type and location of Base 854-3594-Jawbone Base)(897-2407-76 Base)(897-2336-Elkhorn.

Joint Agreement of this Fire Plan is Acknowledged:

Name	CAU
GEORGE ATIYEH	79
TOM EATON	72
TOM HIRONS	55
RAY WEBER	78

OTHER REQUIREMENTS:



TOP SECRET

APPENDIX 8

ORE MILL SPECIFICATIONS

ORE MILL

DENVER LAB TESTING REPORTS

FLOW SHEET (STORCH CORP.)



DENVER EQUIPMENT COMPANY

ORE TESTING DIVISION

Denver, Colorado

March 3, 1952

Pacific Smelting & Refining Co.
P.O. Box 132
Mehama, Oregon

Attention: Mr. James P. Hewitt
Reference: Ore Test DW-21331

Gentlemen:

We are pleased to submit the following report of the results of laboratory batch ore tests conducted upon your sample of lead, zinc ore.

SAMPLE IDENTIFICATION

We received on January 15, 1952, via prepsid Railway Express, 4 powder boxes of ore sample, weight 288 lbs., marked from Pacific Smelting & Refining Company, P.O. Box 132, Mehama, Oregon.

OBJECT OF TESTS

The object of the tests was to determine the correct flowsheet and conditions for treatment of the ore represented by the sample tested to produce highest grade and recovery of the values in separate mineral concentrates. A zinc concentrate is desired with 90 percent recovery, or higher, that will have a zinc content of at least 50.0% Zn with less than 1.0% Pb and iron and copper content as low as possible.

The lead concentrate should assay 50% to 60% Pb and contain less than 5.0% zinc and contain 90.0 percent of the total lead.

Distribution of gold and silver values is flexible.

Separate concentrates of iron and copper are desirable, if possible, or a mixed iron-copper concentrate would be acceptable.

PREPARATION OF SAMPLE.

The entire contents of the four boxes of sample were combined and crushed to minus 3/4 inch and the resulting product split by means of the Jones Sampler. One-half was further crushed through rolls to minus 1/4 inch and this product again split by the Jones Sampler. One-half of the minus 1/4 inch product



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was then crushed by rolls in closed circuit with the Denver-Dillon Vibrating Screen to minus 10 mesh and a head sample and work sample cut out of the -10 mesh product by repeated passes through the Jones Sampler. All reject portions of the entire sample were stored for possible future use.

DESCRIPTION OF THE ORE

The ore represented by the sample submitted is a primary sulphide ore containing sphalerite and pyrite as the predominating sulphides with lesser amount of galena. Small values in gold, silver and copper are present. The silver and copper appear to be present in a combined form representing some sulpho-salt mineral, probably tetrahedrite while the gold does not register predominately with the sulphides and appears to be associated with the gangue.

A closely panned concentrate consisted of a mixture of sphalerite, pyrite and galena. No free gold was observed.

The specific gravity of the ore is 2.88 and a portion of the minus 10 mesh ore when pulped with an equal amount of Denver City water having a pH of 7.8 produced a pulp water having a pH of 7.4.

Our tests for the presence of oxide lead minerals indicate that this ore is unusually free from oxidation.

Following is a partial chemical analysis and assay of the head sample:

Oz. gold/ton	0.02
Oz. silver/ton	0.88
Percent lead	1.35
Percent zinc	5.05
Percent copper	0.23
Percent iron	6.60
Percent insoluble60.36
Percent sulphur	6.92

RESULTS OF TESTS

Our preliminary examination of this ore demonstrated that primary concentration by Denver Mineral Jig is not feasible on account of the low lead content and relatively high pyrite

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and sphalerite content and the low values in precious metals.

A number of trial flotation tests were conducted in order to determine the best reagent combination and grind of the ore, the results of which were determined by microscopic examination of the products. The use of xanthate, the most commonly used promoter for galena or sphalerite flotation was found to be not applicable to this ore because of the presence of some of the sphalerite in a very pure zinc-sulphide form that renders it easily floatable with the galena in the presence of zinc inhibiting reagents and also because of the highly floatable character of the pyrite by xanthate.

The reagent combination which produced the best results includes thiocarbonyl which is best added into the ball mill to promote the galena and American Cyanamid Company sodium aerofloat for the zinc promotion. An alcohol frother, Shell Oil Co., methyl isobutyl carbinol was found to aid selectivity in flotation.

The results of a final complete Denver "Sub-A" selective flotation test to produce separate lead and zinc concentrates followed by gravity table concentration to produce a pyritic concentrate are shown in detail on Data Sheets Nos. 1 and 2. Test conditions and reagents are shown on Data Sheet No. 1 and the metallurgical results on Sheet No. 2.

The results of the test show the production of a rougher lead concentrate which after cleaning once by refloatation represented a ratio of concentration of 71.5 into 1, assayed 0.06 gold oz/ton, silver 13.57 oz/ton, Pb 53.17%, Zn 4.95%, copper, 6.47%, iron 8.2% and acid insoluble 3.44% and which contained 84.12 percent of the total lead. Some additional recovery of the lead can be expected from retreatment of the lead cleaner middlings which is automatically accomplished in Denver "Sub-A" flotation.

The once cleaned zinc concentrate represented a ratio of concentration of 14.7 into 1, assayed trace gold, 1.0 oz/ton silver, 0.52% Pb, 62.05% Zn, 0.55% Cu, 3.85% Fe and 2.56% insol, and contained 83.04 percent of the total zinc.

The table pyritic concentrate represented a ratio of concentration of 27.3 into 1, and assayed trace gold, 0.40 oz/ton silver, 0.48% Pb, 0.15% Zn, 0.17% Cu, 41.2% Fe and 7.45% insol.



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In a regular milling operation with a larger table a slightly higher yield of pyrite can be expected because of the more accurate cutting of the pyrite concentrate.

ENGINEERING DATA

The grindability of the ore is classed by the grinding time in our standardized laboratory ball mill when compared to that required for our standard grind test ores as being "medium" to "medium soft" to grind. Grinding to all minus 65 mesh to economically free the values is recommended.

The concentrates produced in the test have normal settling and filtration rates for lead and zinc concentrate. The lead concentrates may be filtered direct on account the small tonnage and filter capacity at the rate of 300 pounds dry concentrate per sq. ft. of effective area per 24 hours should be provided.

The zinc concentrate should be thickened before filtration and while the settling rate of the concentrate is rapid, a thickener having an area of 10 sq. ft. per ton of concentrate as produced in the test should be provided to accommodate some storage ahead of the filter and to allow for a peak grade of ore, of at times, considerably higher than that of the sample tested. The filter for zinc concentrate should have a capacity of 600 lbs./sq. ft./24 hours.

It is stated that the proposed mill will treat ¹⁵⁰100 tons of ore/24 hrs.

RECOMMENDATIONS AND CONCLUSION

The flowsheet recommended for the treatment of the ore represented by the sample tested is shown on Print No. A-5460. (Supersede
by Flowsheet

This flowsheet shows Denver "Sub-A" selective flotation for B4204 lead and zinc followed by gravity table concentration for the production of pyrite concentrate from the flotation tailing. While our trial flotation tests indicated that a pyritic flotation concentrate could be produced this would be accomplished at the expense of considerable more flotation reagents and equipment.

Flotation would be expected to yield a somewhat larger tonnage of pyrite concentrate but, until a firm market can be assured for this product at which time the economical advantage can be



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investigated it appears logical to take the lower tonnage of this product at the least cost.

All recommendations are based upon the treatment of ore represented by the sample tested. It is understood, however, that the expected grade of actual mill feed will be higher on the average than this sample and adjustments of the reagents and other conditions, as well as capacity of machines should be made when actual grade of ore is determined.

Respectfully submitted,

DENVER EQUIPMENT COMPANY

Clarence Thom
Clarence Thom, Director
Ore Testing Division

Henry J. Gislser
Henry J. Gislser, Manager
Ore Testing Division

Three copies to customer



Denver, Colorado

FLOTATION TEST DATA: METALLURGICAL RESULTS

SAMPLE IDENTIFICATION See Data Sheet No. 1

REPORT NO. DW-21331 TEST NO. 1

PRODUCT	Percent Weight	oz/ton								ASSAYS	
		Au	Ag	Pb	Zn	Fe	Cu	Insol	S		
Head Sample Assay		0.02	0.88	1.35	5.05	6.6	0.23	60.36	6.92		
Calculated Head Assay	100.0	0.005	0.72	0.97	4.79	-	0.251				
Cleaned Lead Flot. Conct.	1.40	0.06	13.57	58.17	4.95	8.20	6.47	3.14			
Lead Flot. Cleaner Midds.	2.00	0.01	6.69	2.15	11.85		3.11				
Cleaned Zinc Flot. Conct.	6.80	Trace	1.00	0.52	62.05	3.85	0.55	2.56			
Zinc Flot. Cleaner Midds.	1.68	Trace	1.20	0.94	7.91		0.50				
Table Pyrite Concentrate	3.60	Trace	0.40	0.48	0.15	41.20	0.17	7.48			
Table Sand Tailing	40.60	0.005	0.50	0.05	0.10		0.06				
Table Slime Tailing	43.92	0.005	0.20	0.05	0.20		0.05				

PRODUCT	Percent Weight	PERCENT RECOVERY					SCREEN ANALYSIS OF Table Sand Tailing				
		Au	Ag	Pb	Zn	Cu	Mesh	Percent Weight	% Pb	ASSAYS % Zn	
Calculated Head	100.0	100.00	100.0	100.00	100.00	100.00	#100	3.75	0.05	0.17	
Cleaned Lead Flot. Conct.	1.40	15.9	26.38	81.12	1.44	36.10	#150	15.75	0.05	0.10	
Lead Flot. Cleaner Midds.	2.00	3.8	18.57	4.44	4.95	24.75	#200	21.25	0.05	0.05	
Cleaned Zinc Flot. Conct.	6.80	-	9.45	3.65	88.04	14.90	-200	59.25	0.05	0.17	
Zinc Flot. Cleaner Midds.	1.68	-	2.8	1.63	2.77	3.35	aver-	100.00	0.05	0.133	
Table Pyrite Concentrate	3.60	-	2.0	1.79	0.11	2.43	Total	Flotation Tailing			
Table Sand Tailing	40.60	33.5	28.6	2.10	0.85	9.71	#100	1.8			
Table Slime Tailing	43.92	41.8	12.2	2.27	1.84	8.76	#150	7.57			
							#200	10.21			
							-200	80.42			
								100.00			



Denver, Colorado

FLOTATION TEST DATA: CONDITIONS AND REAGENTS

SAMPLE IDENTIFICATION Head Ore Crushed to minus 10 mesh before grinding REPORT NO. DW-21331 TEST NO. 1

TEST PROCEDURE: A charge of 2500 grams of head ore crushed to minus 10 mesh was ground in the Denver all steel laboratory 12" x 5" ball mill with classification to all minus 65 mesh with reagents shown below. Density of ball mill pulp was 67.0% solids. The resulting pulp was diluted to 3 to 1 W/S ratio and subjected to regular Denver "Sub-A" selective flotation for the production of separate lead and zinc concentrates. Each concentrate was cleaned once by refloatation in the 500 gram machine. The rougher flotation tailing was tailed to produce a pyritic table concentrate.

Grinding and Treatment				Reagents: Pounds per ton heads—(2)									NOTES: GRINDING PERFORMED IN STANDARD DENVER 12" x 5" DENVER BALL MILL. BALL CHARGE = 40 POUNDS, R.P.M. = 54. CLASSIFICATION BY DECANTATION THROUGH LIMITING SCREEN, UNDECANTED SANDS REGROUND. FLOTATION PERFORMED IN DENVER "SUB-A" LABORATORY FLOTATION MACHINE.
Operation	Time Min.	Percent Solids	pH	S.A.	ZnS	Cn	Thio	MIC	Ca(OH)	CuSO ₄	NAA		
Grinding (1)	30	67.0		3.0	1.5	0.16	0.16						
Lead Rougher Flot.	3	25.0	7.8					0.032					
Zinc Conditioner	5	24.0	10.0						8.0	1.0			
Zinc Rougher Flot.	6	24.0	10.0					0.032			0.08		
Lead Cleaner	2	5.0	8.0	0.4	0.4	0.04							
Zinc Cleaner	3	10.0	11.0						0.8				

Grinding (1)

Time, minutes 15
Classification, mesh 65
Sands reground, minutes 15

(2) Reagent Symbols:

S.A. - Soda Ash
ZnS - Zinc Sulphate
Cn - Sodium Cyanide
Thio - Thiocarbonyl
MIC - Shell Co. Methyl Isobutyl Carbinol
Ca(OH) - Hydrated Lime
CuSO₄ - Copper Sulphate
NAA - American Cyanamid Co. - Sodium-Aerofloat

METALLURGICAL TEST REPORT

DENVER EQUIPMENT CO.
1419 17th Street - Denver, Colorado.



F- 3109
ORDER NUMBER

Ore Tested For **Amalgamated Mines Inc.**

Date **Nov. 19, 1935**

J.P. Hewitt.

Process **Flotation followed by Table Concentration on
Sample of Table Concentrates submitted.**

TEST NO. 124 B-2

ASSAY NO	PRODUCT	WEIGHT GRAMS	PRODUCT %	TROY OZ. PER TON		ANALYSIS %				
				GOLD	SILVER	Pb	Cu	Zn		
	Calc. Head Assay			0.049	1.53	5.36	0.84	16.89		
	Lead Conc.		8.1	0.24	13.90	55.0	3.48	7.8		
	Cleaner Tailings		1.5	0.64	1.53	28.9	6.43	8.0		
	Zinc Conc.		26.4	0.01	--	tr	0.40	53.4		
	Cleaner Tailings		10.6	tr	--	tr	0.32	6.2		
	Table Conc.		5.8	0.13	--	3.0	0.08	0.4		
	" Sands		33.6	0.02	--	tr	0.02	0.4		
	" Slimes		24.0	0.02	--	1.4	0.03	2.0		

PER CENT RECOVERY

AMOUNT TESTED	PRODUCT	Au.	Ag.	Pb.	Cu.	Zn.
1000 Grms.						
DILUTION 3-1/2 to 1	Lead Conc.	38.8	89.5	82.6	33.3	3.7
GRINDING Was classified all	" CleanerTails	20.4	10.5	8.0	10.7	0.7
	Zinc Conc.	6.1	--	--	14.3	88.2
THROUGH 65 MESH	" CleanerTails	--	---	---	39.3	3.9
TIME REQUIRED FOR CONDITIONING MINUTES	Table Conc.	4.3	--	3.1	--	0.1
FLOTATION MINUTES	" Sands	10.2	--	--	--	0.5
TOTAL MINUTES	" Slimes	10.2	--	6.3	2.4	2.9

Remarks:

Ore was subjected to classified grinding which was done wet, dilution 1 to 1 - in 5 grinding periods each of 4 minutes duration with all minus 65 mesh material removed between grinding periods by screening.

Ore so ground was then placed in a Denver "Sub A" Laboratory Flotation Machine and dilution increased preparatory to the flotation test work.

By *F. Briles*

METALLURGICAL TEST REPORT

DENVER EQUIPMENT CO.
149 17th Street - Denver, Colorado.



F- 3109
ORDER NUMBER

Ore Tested For **Amalgamated Mines Inc.**

Date **10-22-33**

Process **Selective Flotation on sample of bulk table Concentrates as submitted.**
J.P. Hewitt.

TEST NO. 124 B

ASSAY NO	PRODUCT	WEIGHT GRAMS	PRODUCT %	TROY OZ. PER TON		ANALYSIS %		
				GOLD	SILVER	Pb	Cu	Zn
	Calc. Hand Assay			0.044	1.88	5.70	0.53	15.67
	Lead Conc.		7.3	0.24	17.01	61.30	3.33	5.26
	Zinc "		24.5	0.08	1.93	0.30	0.69	53.4
	Tailings		67.7	0.005	--	1.30	0.30	3.6

The Hewitt - This was the first test of very good work.
J.P.H.

PER CENT RECOVERY

AMOUNT TESTED	PRODUCT	Gold	Silver	Lead	Copper	Zinc
2000 Gms.						
DILUTION 3-1/2 to 1	Lead Conc.	43.2	73.5	83.7	46.4	2.6
GRINDING was classified	Zinc "	52.0	28.5	0.9	30.4	81.8
THROUGH 60 MESH	Tailings	3.8	-	15.4	23.2	15.5
TIME REQUIRED FOR CONDITIONING MINUTES						
FLOTATION MINUTES						
TOTAL MINUTES						

Remarks: Ore was ground wet - 1 to 1 dilution, in an iron ball mill. Grinding was classified in 5 periods each of 20 minutes duration with all 60 mesh material removed after each grinding period by screening.

Ground ore then diluted to 3-1/2 parts of water to 1 of ore by weight and all placed in a Denver Sub A Laboratory Flotation Machine. To this pulp the following reagents, which are always reported in pounds per ton of head ore, were added:

J.P. Hewitt

Ore Tested For Amalgamated Mines, Inc.

10-29-32

Process: Selective Flotation on sample of bulk table Concentrates as submitted.

Test No. 124 B

Lead Flotation {

- 6 Lbs. Soda Ash
- 1/10 Lbs. Cyanide
- 3/10 " Zinc Sulfate
- 2/100 " Ethyl Xanthate
- 12/100 " Cresylic Acid

} followed by 5 minutes conditioning.
 followed by 2 minutes conditioning.
 followed by 1 minute conditioning.

These Reagents were in preparation for lead flotation.

Lead Flotation followed immediately and it lasted 3 minutes. This operation yielded the Lead Concentrates which were assayed and are reported herein. These Concentrates represented 7.8% by weight of the material tested indicating that 7.8 tons of such concentrates would be obtained from every 100 tons so treated.

In these Concentrates we had

- 83.7% of the total Lead in the sample tested
- 48.4% " " " Copper in the sample tested
- 3.6% " " " Zinc in the sample tested
- 43.2% " " " Gold in the sample tested

We also wish to call attention to the fact that these Concentrates assayed 81.2% Lead, only 3.33% Copper and 5.26% Zinc.

This we consider an exceptional product with recoveries all that could be expected.

Zinc Flotation followed the completion of above described Lead Flotation. The Reagents for floating Zinc, which were added directly to pulp remaining in Flotation Cell after Lead had been floated, were as follows:

Zinc Flotation {

- 3 Lbs. Lime - - - - followed by 5 minutes conditioning.
- 1/2% Copper Sulphate
- 1/10% Ethyl Xanthate
- 2/100% Yarrow Steam Distilled Pine Oil
- 6/100% #1 Flotation Oil

} followed by 1 minute conditioning.

Flotation lasted 8 minutes and yielded Zinc Concentrates which were sampled and assay reported herein under Zinc Concentrates.

Ore Tested For Amalgamated Mines Inc.

10-22-32

Process: Selective Flotation on sample of
bulk table Concentrates as submitted.

Test No. 124 B

These Concentrates represented 34.5% by weight of sample tested indicating that 34.5 tons of such Concentrates would be obtained from every 100 tons so treated.

You will note that this is a very high grade Zinc concentrate carrying practically no other values of importance. These Concentrates contain 81.8% of the total Zinc that was in the sample tested, a most satisfactory result.

Tailings. The material remaining in the flotation cell upon completion of Zinc flotation was sampled as tailings and assays reported as such.

You will note that these Tailings represented 37.7% by weight of the sample tested indicating that 37.7 tons of such material would be discarded from every 100 tons so treated.

These Tailings are all that could be expected and when you consider that this is our first test, the results are unusually satisfactory and give a clear indication of how amenable your ore is to flotation.

Recoveries Combining the Lead and Zinc Concentrates are as follows:

Gold - -	83.2%
Silver -	100.0%
Lead - -	81.6%
Copper -	77.0%
Zinc - -	81.8%

These recoveries when you consider the amounts in the respective concentrates must be considered very good.

REMARKS. The results obtained and reported herein are true indications of results you can expect from your operation.

These results are truly indicative that the plans outlined by Mr. Hewitt when he called upon us here in Denver, are obtainable.

Respectfully submitted,

J. Brubaker

DENVER EQUIPMENT COMPANY.

Ore Tested For Amalgamated Mines Co.

11-18-32

Process: Flotation followed by Table Concentration on Sample of Table Concentrates submitted.

Test No. 124 B-2.

This Operation yielded the three products, namely, Table Concentrates, Table Sands and Table Slimes as assayed and reported.

A study of these products would indicate that a slightly finer grind was desirable in order to reduce the Gold and Lead found in the Table Concentrates.

The Table Slimes were assayed for Oxidized Lead and Zinc and there was found to be 0.9% Lead oxide and 0.7% Zinc oxide.

We do not know if this has resulted since sample as submitted was milled, or whether it is an inherent condition of your ore. While these Oxides are small as assayed, still they represent the greater portion of the values of these metals as reported in the Slimes and therefore lost.

CONCLUSIONS:

Results as reported herein are most gratifying and clearly indicate the products which you can expect from your operations.

Grinding should be slightly finer than all minus 65 mesh.

We would not recommend the separation of the Copper from the Lead as it reduces the Gold content in these concentrates from approximately \$6.00 per ton to \$4.80 and the Lead grade is only raised from about 51% to 55%. It would reduce the Silver, somewhat increase the Copper content, while the Zinc would be practically unchanged.

Respectfully submitted,

By J. E. Buber

DENVER EQUIPMENT COMPANY.

APPENDIX 9

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5th LEVEL ASSAYS

TABLE III

Sample Number	Location Level	Location in line Sta-plus	Width ft	Zinc %	Feet X%	Classification
201	5	5	54	(<u>1</u>)	3.3 3.3	Talc & sulfides
202				(<u>6</u>)	1.7 10.2	Horse
203	5	5	77	6	3.7 22.2	Disseminated
204	5	6	15	6	4.7 27.2	Disseminated
205	5	6	21	(<u>4</u>)	7.0 28.0	Diss. & FW gouge
206				(<u>2.5</u>)	2.6 6.5	Horse & Stringers
207	5	7	15	6	6.9 41.5	Horse & 3' good ore.
208	5	7	21	6	5.0 30.	Disseminated
209	5	7	30	6	9.8 58.7	Disseminated & 2 1/2' good ore.
210	5	8	40	7	9.1 63.7	Good seams ore
211	5	9	28	4	6.8 27.2	Half ore & half horse.
212	5	9	24	2.3	11.5 26.8	Seam talcy ore
213	5	9	45	2	5.0 10.0	8" seam hi-grade
214	5	11	48	4	6.0 24.0	Disseminated
215	5	12	20	4.5	5.2 23.4	Disseminated
216				(<u>5</u>)	8.0 40.	Brecciated ore
217	5	13	16	(<u>6</u>)	8.7 52.2	Hard ore
218				(<u>5</u>)	9.2 46.0	Hard ore
219	5	16	9	(<u>5</u>)	3.7 18.5	Disseminated
220				(<u>2.9</u>)	6.7 26.2	Ore
221				(<u>7</u>)	3.5 24.5	Mineralized ande-site.
222	5	15	20	(<u>4</u>)	6.4 25.6	Hard ore
223				(<u>3.5*</u>)	27.8 96.1	Soft hi-grade
224	5	17	10	(<u>6*</u>)	6.5 39.0	Average ore
225				(<u>7</u>)	2.6 18.2	Disseminated
226	5	17	35	(<u>8</u>)	1.3 10.4	Dissem. & streak
227				(<u>6</u>)	4.8 28.8	Hard ore
228	5	17	55	5*	9.0 45.	Hard ore
229	5	18	35	14	5.7 79.8	Everything
230	5	18	74	8	5.8 46.4	Disseminated
231	5	at face		8	6.4 51.2	Disseminated
				<u>167.7</u>	<u>1052.6</u>	

$1052.6 \div 167.7 = 6.35\%$ Weighted Average.

Average Width: 7', calculated from total of 26 sampling zones.

* Ore actually wider than sample cut, but inaccessible.

TABLE IV
RAISE, STOPE & 4th LEVEL ASSAYS

Sample Number	Location in Mine Level; S or R*	Width Ft.	Zinc %	W x %	Remarks
232	5 R#1 up 65'	6.5	4.1	26.5	Sulfide & gouge
233	4 S#16 plus 10'	20	5.0	60.0	18' sampled
234	4 S#16 plus 10' up 1 set.	13	3.5	45.5	Above & opn 232
235	5 R#2 at top	5	1.9	9.5	Mineralized andesite.
236	4 S#20	10	5.9	59.0	Along face behind ladder.
237	4 S#23 plus 5'	4	10.8	43.2	In branch drift
238	4 S#21 plus 18'	16.3	5.6	91.3	Stringers of sulfide.
239	4 S#21 plus 6'	8	3.8	30.4	$\frac{1}{2}$ sulphide & $\frac{1}{2}$ horse.
240	4 S#22 up 4 sets	10.6	6.9	73.1	Sulfides and quartz.
241	4 S#22 up 1 set	(6	5.5	33.0	FW ptly oxides
242	and 25' north	(12	2.9	34.8	HW less oxides
243	4 23' from face	2	5.5	11.0	Streak in roof
244	4 S#31 plus 10' up 1 set.	6	4.5	27.0	Stope
245	4 S#26 plus 6' up 3 sets.	3.5	4.4	15.4	Stope face
246	4 S#26 up 4 sets	6	2.2	13.2	Stope face
247	4 S#27 plus 30' up 4 sets.	3	9.4	28.2	Soft ore & gouge
248	4 S#26 up 6 sets	(6	0.9	5.4	FW cut low grade
249		(6	5.1	30.6	HW 2' soft ore & 4' hard ore
250		(5	2.3	11.5	N end crosscut
251	5 R#2 up 80'	(2	4.6	9.2	Soft streak S end crosscut.
252		(4	1.0	4.0	Red andesite
253		(14	1.9	26.2	From #250 to R.
254	5 R#2 up 25'	6	2.6	15.6	Erecc. andesite
255	5 R#1 up 65'	7.5	5.4	40.5	Streaky ore in crosscut.
256	5 R#1 up 25'	4.0	6.1	24.4	Face incl. HW gouge in short drift.

(* S-Station.)

(. R-Raise)

186.4' 769.1

769.1 / 186.4 = 4.12% Weighted Average; Average Width: 9.32', calculated on basis of 20 sampling zones.

TABLE V

ASSAYS OF 5th LEVEL FROM MINE RECORDS

Sample Number	Location in Mine Sta.	Plus Ft.	Width	% Zinc	% X Width
1	6	10	7.0	4.3	30.1
2	7	9	7.0	5.4	37.8
3	7	16	7.0	12.5	87.5
4	7	21	7.0	9.2	64.4
5	7	30	7.0	6.2	43.4
6	8	11	7.0	6.1	42.7
7	8	16	2.5	6.4	16.00
8	8	21	7.0	5.0	35.00
9	8	24	7.0	4.0	28.00
10	8	35	7.0	5.8	40.6
11	8	39	2.0	7.0	14.00
12	8	43	7.0	15.0	105.
13	8	47	7.0	11.0	77.
14	8	53	7.0	15.7	109.9
15	8	59	7.0	5.5	38.5
16	8	63	6.0	8.2	49.2
17	8	67	4.0	16.70	66.8
18	9	2	2.0	7.9	15.8
19	9	6	7.0	12.0	84.00
20	9	11	7.0	13.0	91.00
21	9	17	5.0	9.5	47.5
22	9	23	9.5	5.7	54.14
23	9	28	7.0	4.4	30.8
24	11	39	7.0	7.6	53.2
25	12	45	7.0	4.1	28.7
26	12	49	7.0	3.0	21.0
27	12	52	7.0	9.6	67.2
28	12	56	6.0	6.8	40.8
29	12	60.5	5.5	2.8	15.40
30	12	65.5	6.0	12.90	77.4
31	12	70.0	7.0	6.0	42.0
32	12	74.5	7.0	2.1	14.7
33	12	79.0	7.0	6.3	44.1
34	13	46.0	7.0	10.7	74.9
35	13	50.0	7.0	8.4	58.8
36	13	53.5	7.5	8.3	62.25
37	13	58.0	7.0	4.5	31.5
38	13	62.0	5.0	4.6	23.0
39	13	65.0	5.0	5.2	26.0
40	13	69.0	6.0	8.4	50.4

TABLE V (Continued)

Sample Number	Location in Mine Sta.	Plus Ft.	Width	% Zinc	% X Width
41	13	72	6.0	9.2	55.2
42	15	20	6.0	5.1	30.6
43	15	24	6.0	7.7	46.2
44	15	28.5	6.0	6.2	37.2
45	15	33	6.0	6.0	36.0
46	15	60	5.5	8.1	44.55
47	16	54.5	6.0	4.9	29.4
48	16	58.5	6.0	5.0	30.0
49	16	62.0	5.0	6.7	33.5
50	16	66	5.5	7.2	39.60
51	16	70	6.0	7.4	44.8
52	16	74	7.0	9.5	66.5
53	16	78	6.0	4.5	27.0
			<u>331.0</u>		<u>2461.32</u>

$2461.32/331 = 7.43\%$ Weighted Average Zinc.

6.2' = Average Width.

53 Sampling Zones.

TABLE V (Continued)

Sample Number	Location in Mine* Sta.	Plus Ft.	Width**	% Zinc
1	R3	13	6'	5
2	R3	20	6'	8
3	R3	28	6'	9
4	R3	37	6'	15
5	R3	46	6'	12
6	R3	61	6'	10
7	R3	68	6'	12
8	R3	80	6'	15
9	R3 into Level		6'	7
10	Plus 6 into Level		6'	7
11	Plus 20 Raise		6'	5
12	plus 21 Raise		6'	8
13	Raise		6'	11
14	Raise		6'	7
15	Raise		6'	10
16	Raise		6'	8
17	Raise		6'	6
18	Raise		6'	8
19	Raise		6'	7
20	Raise		6'	11
21	Raise		6'	8
22	3rd Level		6'	6
23	3rd Level		6'	5
24	3rd Level		6'	6
25	3B	30	6'	8
26	3B	38	6'	5
27	3B	43	6'	12
28	3B	55	6'	11
29	3B	67	6'	12
30	16	8	6'	8
31	17	18	6'	7.5
32	17	25	6'	6.5
33	17	35	6'	7.25
34	17	44	6'	9
35	17	85	6'	8
36	17	17	6'	7.5
37	17	32	6'	6.75
38	17	42	6'	9
39	19		6'	10
40	20		16'	8.5
41	20	10	16'	9.0
42	20	80	20'	6.5

TABLE V (Continued)

Sample Number	Location in Mine* Sta.	Plus Ft.	Width**	% Zinc
43	20	38	12'	8.0
44	20	44	12'	4.5
45	21		12'	7.75
46	20	1	16'	8.5
47	20	8	16'	9.0
48	22	15	10'	10.0
49	22	25	10'	7.45
50	21		16'	7.0
51	21	18	20'	10
52	21	25	30'	8
53	21	30	30'	7.75
54	22		30'	8.25
55	22	8	20'	9.0
56	23		8'	8.0
57	23	10	8'	10.0
58	23	34	8'	4.75
59	23	60	16'	5.25
60	25	20'NE	16'	10.0
61	25		16'	8.0
62	25	10	8'	11.0
63	26		16'	9.0
64	25	20	8'	8.5
65	27		8'	7.75
66	27	15	8'	10.0
67	27	28	8'	8.0
68	27	38	8'	9.0
69	29	50		11.0
70	29	60		11.0
71	31	5		8.0
72	31	18		8.0
73	32	27 N		7.75
74	32	12 N		12.00
75	32			10.25
76	32	10		10.25
77	32	20		8.25
78	32			9.0
79	80' Raise			10.0
80	80' Raise			8.0
81	80' Raise			10.0
82	80' Raise			8.5

* Location in mine has been revised to agree with new survey notes.

** Sample widths not furnished. Width of opening given.

TABLE VI

ASSAYS OF SAMPLES TAKEN BY W. L. MERRITT, E. M.

Merritt Number	Location in Mine Level	Positions	Width	% Zinc	% X Width
104	4th	Sta. 27-stope	6.0	9.60	57.6
105	4th	Sta. 27-stope	12.0	11.00	132.0
106	1st	Face	9.0	4.25	38.25
107	2nd	Face	2.0	4.50	9.0
108	3rd	Face	16.0	9.85	157.60
109	Betw. Levels 3 & 4		4.0	12.50	50.0
110	4th	Sta. 3B, Plus 15'	3.5	11.50	40.25
111	4th	Sta. 32-stope	5.0	6.00	30.00
112	4th	Sta. 22-stope	10.5	7.90	82.95
113	4th	Sta. 22-23 stope	3.5	5.00	16.5
114	4th	Sta. 20-21 stope	25.0	7.00	175.00
115	4th	Sta. 20-21 stope	16.0	5.40	38.4
116	4th	Sta. 20-21 stope	3.5	9.00	31.5
117	4th	Sta. 16, Plus 8'	7.0	10.20	71.4
			<u>123.0</u>		<u>930.45</u>

$930.45/123 = 7.56\%$ Weighted Average.

8.8' = Average Width.

14 Sampling Zones.

COMPOSITE SAMPLES

No. 66: 300'; Sta. 6, Plus 10' to Sta. 11, Plus 39';
Zinc 4.9%.

No. 746: 160'; Sta. 3, Plus 81' to Sta. 6, Plus 10';
Zinc 8.10%.

TABLE VII

ASSAYS BY E. W. LAZELL, Ph.D.

Lab. No.	Location in Mine		Width	% Zinc	% X Width
	Sta.	Plus Ft.			
39951	13	20'	12.7	7.29	92.58
39952	15	15'	32	20.09	642.88
39953	16	10'	20	11.89	237.8
39954	17	20'	17	3.69	62.73
39955	17	50'	15	8.44	126.60
39956	18		27	8.44	227.88
39957	18	80'	8	12.54	100.32
39958	18	120'	20	6.51	126.20
39959	19		8	8.53	68.24
39960	12		14	4.02	56.28
39961	5		14	10.49	146.86
			<u>187.7</u>		<u>1888.37</u>

$1888.37/187.7 = 10\%$ Weighted Average Zinc.

17.06' = Average Width.

11 Sampling Zones.

TABLE VIII

MILL FEED ASSAYS FROM AUGUST, 1933 TO MARCH, 1934
From Mine Records

1933	% Lead	% Zinc	1934	% Lead	% Zinc
AUG. 3	2.1	6.3	Feb. 2	1.2	6.2
AUG. 4	3.2	8.3	Feb. 8	1.3	8.3
AUG. 4	2.8	8.7	Feb. 9	1.6	5.5
AUG. 5	2.8	7.5	Feb. 11	1.2	6.3
AUG. 5	3.1	7.8	Feb. 17	1.1	6.4
AUG. 13	2.1	7.8	Feb. 19	1.4	5.7
AUG. 16	1.8	7.8	Feb. 24-28	0.9	5.5
AUG. 17	2.1	6.8	March 1	1.1	5.1
AUG. 18	2.0	7.1	March 2	0.8	4.3
AUG. 20	1.9	7.2	March 3	1.0	6.1
AUG. 21	1.5	6.9	March 4	1.2	7.6
AUG. 25	1.2	6.9	March 5	1.3	7.7
AUG. 28	1.0	1.0	March 6	1.0	8.2
AUG. 30	0.9	5.6	March 8	2.4	7.3
Oct. 3	1.1	5.6	March 10	2.1	6.8
Oct. 8	1.2	5.1	March 12	2.1	7.0
Oct. 11	1.2	3.4	March 14	2.2	6.1
Oct. 12	1.8	5.5	March 16	2.6	6.9
Oct. 13	1.1	6.2			
Oct. 17	1.9	5.0			
Oct. 19	1.8	6.3			

AVERAGES BY MONTHS

	% Lead	% Zinc
August, 1933	2.3	7.5
October, 1933	1.4	5.3
February, 1934	1.28	6.32
March, 1934	1.78	6.48

AVERAGE FOR ENTIRE OPERATING PERIOD

% Lead	1.67
% Zinc	6.47

TABLE IX

ORE RESERVES IN BLOCK A

Assay No.	Width	% Zinc	Width X %
201)	1	3.3	3.3
202)	6	1.7	10.2
203	6	3.7	22.2
204	6	4.7	27.2
205)	4	7.0	28.0
206)	2.5	2.6	6.5
1	7	4.3	30.1
2	7	5.4	37.8
3	7	12.5	87.5
4	7	9.2	64.4
39961	8	10.5	84
Comp. #746	8	8.1	64.8
	<u>69.5</u>		<u>466.0</u>

$466/69.5 = 6.7\%$ Weighted Average.

$69.5/10 = 6.95'$ Average Width of Sample

10 Sampling Zones.

Probable ore (108'x50'x6.95'/13) = 2890 tons of
6.7% ore.

Basis: 50' of probable ore has been allowed
below 5th level.

TABLE X
ORE RESERVES IN BLOCK B

Assay No.	Width	% Zinc	Width X %
204	6	4.7	27.2
205)	4	7.0	28
206)	2.5	2.6	6.5
207	6	6.9	41.5
208	6	5	30
209	6	9.8	58.7
210	7	9.1	63.7
211	2.3	11.5	26.8
212	4	6.8	27.2
213	2	5.0	10
Comp. #66	7	4.9	34.3
Weighted aver- age mine sam- ples #5 to 23	6.2	8.5	52.7
	<u>63.0</u>		<u>406.6</u>

$406.6/63 = 6.4\%$ Weighted Average.

$63/12 = 5.2'$ Average Width.

12 Sampling Zones.

Probable ore $(200' \times 50' \times 5.2' / 13) = 4000$ tons.

Basis: 50' of probable ore has been allowed below 5th level.

TABLE XI
ORE RESERVES IN BLOCK C

Assay No.	Width	% Zinc	Width X %
214	4	6.0	24.0
215	4.5	5.2	23.4
216)	5	8.0	40.0
217)	6	8.7	52.2
221)	7	3.5	24.5
222)	4	6.4	25.6
223)	3.5	27.8	96.1
39951	12.7	7.29	92.6
39952	32	20.09	642.9
39953	20	11.89	237.8
39960	14	4.02	56.3
Average Mine Samples #24 to 53	<u>6.0</u> 118.7	7.0	<u>42.0</u> 1367.4

$1367.4/118.7 = 11.5\%$ Weighted Average.

$118.7/9 = 13.1'$ Average Width of Vein.

9 Sampling Zones.

Probable ore $(200' \times 50' \times 13.1'/13) = 10080$ tons of
 11.5% ore.

Basis: 50' probable ore has been allowed below
 5th level.

TABLE XII
ORE RESERVES IN BLOCK D

Assay No.	Width	% Zinc	Width X %
221)	7	3.5	24.5
222)	4	6.4	25.6
223)	3.5	27.8	96.1
224)	6	6.5	39.0
225)	7	2.6	18.2
226)	8	1.3	10.4
227)	6	4.8	28.8
228)	5	9.0	45.0
218)	5	9.2	46.0
219)	5	3.7	18.5
220)	2.9	6.7	26.2
39953	20	11.89	237.8
39954	17	3.69	62.7
39955	15	8.44	126.6
39956	27	8.44	227.9
	<u>138.4</u>		<u>1033.5</u>

$1033.3/138.4 = 7.5\%$ Weighted Average.

$138.4/9 = 15.4'$ Average Width of Vein.

9 Sampling Zones.

Probable ore $(200' \times 50' \times 15.4' / 13) = 11850$ tons of
 7.5% ore.

TABLE XIII
ORE RESERVES IN BLOCK E

Assay No.	Width	% Zinc	Width X %
229	14	9.0	79.8
230	8	5.8	46.4
231	8	6.4	51.2
39957	8	12.54	100.3
39958	20	6.31	126.2
39959	8	8.53	68.2
	<u>66</u>		<u>472.1</u>

$472.1/66 = 7.1\%$ Weighted Average.

$66/6 = 11.0'$ Average width of Vein.

6 Sampling Zones.

Probable ore (150'x50'x11.0'/13) = 6340 tons of
 7.1% ore.

Basis: 50' probable ore has been allowed below
 5th level.

TABLE XIV
ORE RESERVES IN BLOCK F

From calculations of ore in Block A:

6.7% Weighted Average, 10 sample Zones.

6.95' Average Sample Width.

Probable ore $(103' \times 50' \times 6.95' / 13) = 2890$ tons of
6.7% ore.

Based on allowance of 50' ore above level #5.

Possible ore $(90' \times 50' / 2 \times 103' \times 6.95' / 13) = 3460$ tons.

Based on vein dimensions between Probable ore and
approximate vein outcrop.

TABLE XV

ORE RESERVES IN BLOCK G

From calculations of ore in Block B and Block M:

5th Level: 6.4% Weighted Average, 12 Sampling Zones.

5.2' Average Width.

4th Level: 10.5% Weighted Average, 3 Sampling Zones.

7.7' Average Width of Vein.

Assays	Width	% Zinc	Width X %
4th Level	7.7	10.5	80.8
5th Level	5.2	6.4	33.3
	12.9		114.1

$114.1/12.9 = 8.7\%$ Weighted Average.

$12.9/2 = 6.4'$ Average Width of Vein.

Probable ore $(200' \times 50' \times 6.4'/13 + 180' \times 100' \times 6.4'/13) =$
9350 tons of 8.7% ore.

Possible ore $(90-80-60-45-40-40'/6 \times 200 \times 6.4'/13) =$
5750 tons.

TABLE XVI
ORE RESERVES IN BLOCK H

From calculations of ore in Block C and Block H:

5th Level: 11.5% Weighted Average of 9 sample zones.

13.1' Average Width of vein.

4th Level: 10.5% Weighted Average of 3 sample zones.

7.7' Average Width of Vein.

Assays	Width	% Zinc	Width X %
4th Level	7.7	10.5	80.8
5th Level	<u>13.1</u>	11.5	<u>150.3</u>
	20.8		231.1

$231.1/20.8 = 11.1\%$ Weighted Average.

$20.8/2 = 10.4'$ Average Width.

Probable ore $(200' \times 200' \times 10.4'/13 - (70 \times 40'/2 \times 10.4'/13)) = 30880$ tons of 11.1% ore.

Possible ore $(70' \times 40'/2 \times 10.4'/13) = 1120$ tons.

TABLE XVII

ORE RESERVES IN BLOCK I

Assays	Width	% Zinc	Width X %
Total of Block D, 9 Samples:	133.4	7.5	1033.3
232	6.4	4.1	26.5
235	5	1.9	9.5
251	2	4.6	9.2
254	6	2.6	15.6
255	7.5	5.4	40.5
256	4	6.1	24.4
	<u>169.4</u>		<u>1159.0</u>

$1159/169.4 = 6.8\%$ Weighted Average.

$169.4/15 = 11.3$ Average Width.

Probable ore: 16,875 tons of 6.8% ore.

$$\frac{(200' \times 200' \times 11.3')}{15} - \frac{(\{190' \times 200' - 50' \times 43'\} \times 11.3)}{2 \times 15}$$

Possible ore: 17,925 tons.

$$\frac{(\{190' \times 200' - 50' \times 43'\} \times 11.3)}{2 \times 15}$$

TABLE XVIII
ORE RESERVES IN BLOCK J

Assays	Width	% Zinc	Width X %
Block E,		ples)	
5th Level	66-(6 Sam-	7.1	472.1
235	5	1.9	9.5
251	2	4.6	9.2
252	4	1.0	4.0
253	14	1.9	26.8
254	6	2.6	15.6
233	20	3.0	60.0
234	13	3.5	45.5
236	10	5.9	59.0
238	16.5	5.6	91.3
239	8	3.8	30.4
240	10.6	6.9	73.1
241	6.0	5.5	33.0
242	12.0	2.9	34.8
114	25.0	7.0	175.0
115	16.0	5.4	38.4
116	3.5	9.0	31.5
117	7.0	10.2	71.4
	<u>245.0</u>		<u>1280.6</u>

$1280.6/245 = 5.2\%$ Weighted Average.

$245/24 = 10.2'$ Average Width.

Probable ore: 30,800 tons of 5.2% ore.

$$\left((200' \times 200') - \frac{(40' \times 40')}{2} \right) \times \frac{10.2}{13} = 30,800 \text{ tons.}$$

Possible ore: 630 tons.

$$\frac{40' \times 40'}{2} \times \frac{10.2'}{13} = 630 \text{ tons.}$$

TABLE XIX
ORE RESERVES IN BLOCK K

Assays	Width	% Zinc	Width X %
240	10.6	6.9	73.1
241)	6.0	5.5	33
242)	12.0	2.9	34.8
245	3.5	4.4	15.4
246	6.0	2.2	13.2
247	3.0	9.4	28.2
248)	6.0	0.9	5.4
249)	6.0	5.1	30.6
104	6.0	9.6	57.6
105	12.0	11.0	132.0
112	10.5	7.9	82.9
113	3.5	5.0	16.5
	<u>85.1</u>		<u>522.7</u>

$522.7/85.1 = 6.1\%$ Weighted Average.

$85.1/10 = 8.5'$ Average Width

6.1 Above Weighted Average

6.47 average ore milled*

6.33% General Average

Probable ore: 9420 Tons of 6.33% ore.

$$\frac{180' \times 160' \times 8.5'}{2 \times 13} = 9420 \text{ tons.}$$

Possible ore: 16,780 tons.

$$(200' \times 200' \times \frac{8.5'}{13}) - 9420 = 16,780.$$

* This average gives equal weight to assays and to average of mill heads from nine records.

TABLE XX

ORE RESERVES IN BLOCK L

<u>Assay No.</u>	<u>Width</u>	<u>% Zinc</u>	<u>Width X %</u>
108	16	9.85	157.6
109	4	12.50	50.0
110	3.5	11.5	40.3
	<u>23.5</u>		<u>247.9</u>

$247.9/23.5 = 10.5\%$ Weighted Average.

$23.5/3 = 7.7'$ Average Width.

Probable ore: 4886 tons of 10.5% ore.

$$\begin{array}{r} \frac{130' \times 85' \times 7.7'}{13} = 6545 \text{ tons} \\ -1658 \text{ tons Stoped Ore} \\ \hline \underline{4886} \text{ tons } 10.5\% \text{ ore.} \end{array}$$

Possible ore: 1954 Tons.

$$\frac{110' \times 30' \times 7.7'}{13} = 1954 \text{ Tons.}$$

TABLE XXI
ORE RESERVES IN BLOCK M

Average Width of Adjacent Blocks:

Block I	11.3
Block L	7.7
Block N	<u>14.2</u>
	39.2'
Average	13.0'

Probable Ore: Undeveloped.

Possible Ore: 40,000 tons.

$$\frac{200' \times 200' \times 13'}{13} = 40,000 \text{ tons.}$$

TABLE XXII
ORE RESERVES IN BLOCK N

Assays	Width	% Zinc	Width X %
234	13	3.5	45.5
236	10	5.9	59.0
238)	10.3	5.6	91.3
239)	8	3.8	30.4
240	10.6	6.9	73.1
241)	6.0	5.5	33.0
242)	12.0	2.9	34.8
114	25.0	7.0	175.0
115	16.0	5.4	86.4
116	3.5	9.0	31.5
117	7.0	10.2	71.4
	<u>127.4</u>		<u>683.0</u>

683.0/127.4 = 5.37% Weighted Average.
 6.47% Average of ore milled.
 $\frac{11.74}{2} = 5.87\%$ Probable Average*

127.4/9 = 14.2' Average Width of Vein.

Probable Ore: 34,560 Tons of 5.87% ore.

$$\frac{(200' \times 210' \times 14.2')}{13} - \frac{(100' \times 180' \times 14.2')}{2 \times 13} = 36060$$

36060 Total
 Less 1500 tons Stopped
34560 Tons of 5.87% ore.

Possible Ore: 9840 Tons.

$$\frac{100' \times 180'}{2} \times \frac{14.2}{13} = 9840 \text{ tons.}$$

* This average gives equal weight to assays and to average of mill heads from mine records.

TABLE XXIII
ORE RESERVES III BLOCK O

Assays	Width	% Zinc	Width X %
240	10.6	6.9	73.1
241)	6.0	5.5	33
242)	12.0	2.9	34.8
245	3.5	4.4	15.4
246	6.0	2.2	13.2
247	3.0	9.4	28.2
248)	6.0	0.9	5.4
249)	6.0	5.1	30.6
104	6.0	9.6	57.6
105	12.0	11.0	132.0
112	10.5	7.9	82.9
113	3.5	5.0	16.5
	<u>85.1</u>		<u>522.7</u>

$522.7/85.1 = 6.1\%$ Weighted Average.

$85.1/10 = 8.5'$ Average Width.

6.1 Above Weighted Average
 6.47 Average ore milled*
6.33% General Average

Probable Ore: 21,561 Tons of 6.33% ore.

$$\frac{230' \times 160' \times 8.5'}{13} = 24061 \text{ tons}$$

$$\begin{array}{r} 24061 \text{ tons} \\ -2500 \text{ tons stoped} \\ \hline 21561 \text{ tons } 6.33\% \text{ ore} \end{array}$$

Possible Ore: 6015 Tons

$$\frac{230' \times 40' \times 8.5'}{13} = 6015 \text{ tons.}$$

* This average gives equal weight to assays and to average of mill heads from nine records.

TABLE XXIV
ORE RESERVES IN MISC. BLOCKS

Possible ore at 6' vein width:

<u>Block</u>	<u>Dimensions</u>	<u>Tons</u>
P	200 x 200 x 5'	15,300
Q	200 x 200 x 5'	15,300
R	200 x 200 x 5'	12,000*
S	200 x 200 x 5'	18,000*
K-1	200 x 200 x 5'	15,300
K-2	200 x 200 x 5'	15,300
		<u>91,200</u>

* This is estimated tonnage because of irregular shape of ore body. See Map No. 252-5:

TABLE XXV

RECAPITULATION OF ORE RESERVES BY BLOCKS

Block	Width	% Zinc	Tons Zinc	Probable Tonnage	Possible Tonnage
A	6.95	6.7	193.6	2890	
B	5.2	6.4	256	4000	
C	13.1	11.5	1160	10080	
D	15.4	7.5	888	11850	
E	11.0	7.1	450	6340	
F	6.95	6.7	193.6	2890	3460
G	6.4	8.7	813	9350	5750
H	10.4	11.1	3430	30380	1120
I	11.3	6.8	1145	16875	17925
J	10.2	5.2	1605	30800	650
K	8.5	6.33	596	9420	16780
L	7.7	10.5	512	4886	1954
M	13.0				40000
N	14.2	5.87	2025	34560	9840
O	8.5	6.33	1362	21561	6015
P	6				15300
Q	6				15300
R	6				12000
S	6				18000
K-1	6				15300
K-2	6				15300
			<u>14629.2</u>	<u>196382</u>	<u>194674</u>

$$\frac{14629}{196382} = 7.5\% \text{ Weighted Average Probable Ore.}$$

Certificate of Analysis

Date: 9/8/77
 Invoice #: 1639
 Client: Donald Decker
 P.O. Box 906
 Winnemucca, Nv. 89445

Client Order No.:

Date Received: 9/6/77

Analysis: Au, Ag, Cu, Pb, Zn, H6

Analytical Methods: Au, Ag, Cu, Pb, Zn; by A.A. Mo; Colorimetric

cc:

<u>SAMPLE #</u>	<u>Au(ppm)</u>	<u>Ag(ppm)</u>	<u>Cu(ppm*)</u>	<u>Pb(ppm*)</u>	<u>Zn(ppm*)</u>	<u>Mo(ppm*)</u>
101-A	-.05	1.4	80	31	7	10
101-B	-.05	-.0	23	17	215	2.5
102	-.05	-.1	18	8	6	7.5
103	-.05	-.1	61	4	28	7.5
104**	-.05	-.1	25	7	78	2.5
106	-.05	-.1	23	3	70	7.5
107	-.05	0.5	93	18	8	12.5
108	-.05	-.1	62	18	45	10
109	-.05	-.1	45	3	57	5
110	-.05	-.1	20	2	27	7.5
111	-.05	-.1	57	9	116	5
112	-.05	-.1	18	2	36	5
113	-.05	-.1	31	13	57	5
114-A	-.05	-.1	71	8	98	7.5
114-B	-.05	-.1	46	13	65	5
115 RUTH No. 4	-.05	20.6	.840%	.620%	.130%	50
116	-.05	-.1	89	62	218	12.5
117	-.05	-.1	22	20	71	2.5
118	-.05	0.2	23	91	61	2.5
119 RUTH No. 1	-.05	-.1	46	36	139	5
120 RUTH No. 1	-.05	-.1	38	33	129	2.5

* Greater than 1000 ppm reported as percent (Assay)

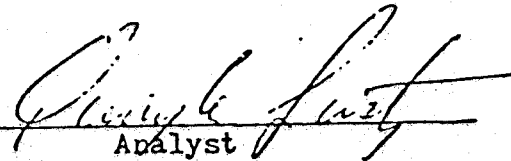
** Break in numerical sequence

Invoice # 1639

Date 9/8/77

<u>SAMPLE #</u>	<u>Au(ppm)</u>	<u>Ag(ppm)</u>	<u>Cu(ppm*)</u>	<u>Pb(ppm*)</u>	<u>Zn(ppm*)</u>	<u>Mo(ppm*)</u>
121	-.05	23.9	.375%	.165%	5.95%	2.5
122 MORNING STAR	.05	72.0	.535%	3.45%	6.70%	5
123 MORNING STAR	-.05	61.0	1.15%	3.75%	15.4%	7.5

by


Analyst

* Greater than 1000 ppm reported as percent (Assay)

** Break in numerical sequence



Certificate of Analysis

Date: October 27, 1977
 Invoice #: # 1681
 Client: Donald J. Decker
 P. O. Box 906
 Winnemucca, Nv. 89445

Client Order No.:

Date Received: 10/24/77

Analysis: Au, Ag, Cu, Pb, Zn

Analytical Methods: Atomic Absorption

cc:

	SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)
	124	-.05	0.1	59	3	68
MILLSITES	125	-.05	-0.1	31	5	74
	126	-.05	0.3	102	3	100
	127	-.05	-0.1	33	3	95
	128	-.05	-0.1	30	24	119
	129	-.05	0.1	29	19	69
	130	-.05	0.7	33	30	66
	131	-.05	0.3	19	33	82
	132	-.05	-0.1	25	19	70
	133	-.05	-0.1	15	2	45
	134	-.05	-0.1	40	20	117
MANDALAY	135	-.05	-0.1	45	8	126
	136	-.05	16.5	2.20%	130	137
	137	-.05	80.0	3.80%	33	63
	138	-.05	0.4	311	4	90
RUTH No. 2	139	-.05	4.1	208	.205%	.370%
RUTH No. 2	140	-.05	17.8	655	.400%	1.35%
SANTIAM No. 1	141	-.05	7.9	.950%	35	171
	142	-.05	18.8	2.45%	5	132
	143	-.05	5.6	.170%	7	15
	144	-.05	1.1	370	5	13
	145	-.05	0.9	198	3	15

* Greater than 1000 ppm reported as percent (Assay)

** Break in numerical sequence



Certificate of Analysis

Date: May 5, 1978
 Invoice #: #1497
 Client: Donald Decker
 P.O. Box 906
 Winnemucca, Nevada 89445

Client Order No.:

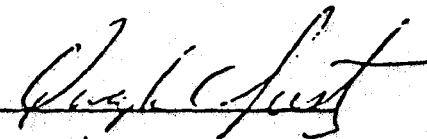
Date Received: May 2, 1978

Analysis: Au, Ag, Cu, Pb, Zn

Analytical Methods: Fire Assay: Atomic absorption

cc:

	SAMPLE #	Au(oz/ton)	Ag(oz/ton)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)
RUTH No. 2	#149	.025	1.90	.370%	.620%	10.65%
RUTH No. 2	#150	Trace	.55	.245%	2.54 %	4.90%
RUTH No. 4	#151	.010	2.95	3.70 %	2.72 %	1.85%
	#152	Trace	.15	.150%	-.05 %	-.05%
MANDALAY	#153	.020	2.15	1.05 %	.05 %	.30%

by 
 Analyst

* Greater than 1000 ppm reported as percent (Assay)

** Break in numerical sequence

POST OFFICE BOX 906
VINNEMUCCA, NEV. 89445

TELEPHONE:
(702) 623-3956

Geochemical rock chip samples taken by Freeport Exploration
Company on the Shiny Rock Mining Company property.

		Au(ppm)	Ag(ppm)	Cu(ppm)	Pb(ppm)	Zn(ppm)	Mo(ppm)
RC	19	.11	-.1	36	22	74	-2.5
	31	-.10	.2	3	10	108	-2.5
	32	.10	-.1	52	16	56	-2.5
SANTIAM No. 1	35	-.10	1.8	585	22	30	-22.5
RUTH No. 2	285	-.5	-.10	51	57	366	2.5
RUTH No. 2	2172	-.10	1.6	108	730	266	17.5
	2236	.10	.7	164	55	76	7.5
	2237	-.10	1.7	640	34	32	22.5
	2243	.51	16.5	.216%	1.16%	5.3%	10
	2244	.48	37.0	.178%	1.23%	5.35%	10
	3001	-.10	-.2	78	12	34	-2.5
	3109	.51	39.0	770	.58%	2.85%	150
	3110	.19	.2	90	110	314	7.5

From The Desk of...

DAVE PUTNAM 4/15-77

George -

We feel these values are pretty good. On the first samples we suspect that digestion of lead and gold was incomplete.

We will continue to run cross checks until we are sure there are no anomalies or interferences in the Perkin Elmer method as applied to your concentrates.

UMPQUA RESEARCH COMPANY

Water and Air Technology

P. O. Box 791

Telephone (503) 863-5732

626 N.E. Division Street, Mistle Creek, Oregon 97457

Gerald V. Colombo

David F. Putnam

ORE ASSAY RESULTS

NAME SHINY ROCK MINING PHONE 897-2336 DATE 4-12-77

ADDRESS PO BOX 132, MEHAM, OR 97384 DATE REPORTED 4-13-77

ATTN: GEORGE ATYEH

SAMPLE NO.
Ruth #1, Ruth #2
Morning Star

TEST	4577-2L	4577-2Z	
BIARIUM			
CADMIUM	0.54	0.17	PER CENT
CHROMIUM			
COPPER	2.0	1.4	PER CENT
GOLD →	0.11	0.11	OUNCES PER TON
IRON	7.3	8.8	PER CENT
LEAD	20.3	2.7	PER CENT
MAGNESIUM			
MANGANESE			
NICKEL			
PLATINUM			
RHODIUM			
SILVER	2.2	2.7	OUNCES PER TON
TIN			
ZINC	2.2	68.5	PER CENT

Bi. 101
C. 101

Approved By David F. Putnam

UMPQUA RESEARCH COMPANY

Water and Air Technology

P. O. Box 791

Telephone (503) 863-5732

626 N.E. Division Street Myrtle Creek, Oregon 97457

Gerald V. Colombo

David F. Putnam

ORE ASSAY RESULTS

NAME SHINY ROCK MINING PHONE 897-2336 DATE 4-4-77

ADDRESS P.O. Box 132, MEHAMA, OR 97331 DATE REPORTED 4-6-77

SAMPLE NO.

FIRST ROW CON.

TEST	33177-L	33177-1Z
BARIUM		
CADMIUM	0.034	0.089
CHROMIUM		
COPPER	1.8	0.78
GOLD	0.04	0.02
IRON	9.2	12.0
LEAD	(1.3)	1.1
MAGNESIUM		
MANGANESE		
NICKEL		
PLATINUM		
RHODIUM		
SILVER	12.1	2.3
TIN		
ZINC	9.7	27.7

PER CENT . 2

PER CENT

OUNCES PER TON

PER CENT

PER CENT

OUNCES PER TON

PER CENT

Approved By

David F. Putnam

UMPQUA RESEARCH COMPANY

Water and Air Technology

P. O. Box 791

Telephone (503) 863-5732

626 N.E. Division Street Myrtle Creek, Oregon 97457

Gerald V. Colombo

David F. Putnam

ORE ASSAY RESULTS

NAME Shiny Rock Mining PHONE 897-2336 DATE May 5, 1977

ADDRESS P.O. Box 132, Mehama, OR 97384 DATE REPORTED May 11, 1977

SAMPLE NO.
70505-1

2

TEST	-1 (HEAD)	-2 (CONCENTRATE)
	427HS	427ZC
BARIUM		
CADMIUM		
CHROMIUM		
COPPER	0.13	1.7
GOLD		
IRON	7.8	3.8
LEAD	1.0	1.4
MAGNESIUM		
MANGANESE		
NICKEL		
PLATINUM		
RHODIUM		
SILVER	7.0	2.3
TIN		
ZINC	4.4	64.7

516

Approved By *David F. Putnam*

UMPQUA RESEARCH COMPANY

Water and Air Technology

P. O. Box 791

Telephone (503) 863-5732

626 N.E. Division Street Myrtle Creek, Oregon 97457

Gerald V. Colombo

David F. Putnam

ORE ASSAY RESULTS *ore mill*

NAME Shiny Rock Mining PHONE 897-2336 DATE May 5, 1977

ADDRESS P.O. Box 132, Mehama, OR 97384 DATE REPORTED May 11, 1977

SAMPLE NO.

70505-3

4

TEST	-3	-4
	(TAIL) 427LT	(CONCENTRATE) 427LC
BARIUM		
CADMIUM		
CHROMIUM		
COPPER	0.10	2.8
GOLD		
IRON	5.8	7.9
LEAD	0.20	34.1
MAGNESIUM		
MANGANESE		
NICKEL		
PLATINUM		
RHODIUM		
SILVER	0.27	26.5
TIN		
ZINC	4.4	10.4

Approved By

David F. Putnam

TABLE V

The following table is based on registered and certified mining engineer's reports. Reports from the United States Geological Survey and authentic data gathered by State Mining and Metal Bureaus and by responsible mine owners.

MINE NAME	DIST. NO.	NAME DISTRICT	OWNERSHIP	Zn	Cu	Pd	Ag	Au	DEVELOPED	TONS ZINC	
										ESTIMATED PROSPECTIVE	RECOVERABLE IN DEVELOPED RESERVES
RUTH (Ruth No. 1, No. 2)		SANTIAM	PACIFIC S. & R. CO.	8.13	.39	1.53	1.04	.02	300,000	2,500,000	19,200
BLUE JAY (Morning Star)		"	CAL. MINES DEV. CO.	12.0	.50	3.0	1.0	.03	6,000	500,000	570
BUSCHE (Ruth No. 4)	1	"	GOOD HOPE CO.	9.0	.50	3.0	1.0	.03	3,600	200,000	260
KING	1	"	AMCOL M & M CO.	12.0	2.0	2.0	2.0	.03		500,000	
LORES	1	"	"	12.0	2.0	3.0	3.0	.03		200,000	
ELENA	2	BOHEMIA	MINES SERVICE	5.9*	1.1		1.1	.05	14,000	50,000	560
MUSICK	3	"	L. M. CAPPS	7.0	.5		2.0	.30	100,000	200,000	5,600
CHAMPION	4	"	HIGGINS-HINSDALE	5.0*	3.0		5.0	.50	180,000	500,000	7,200
SILVER PEAK	5	CURRY CO.	SILVER PEAK CO.	7.0					45,000		2,520
RISING STAR	6	SHASTA CO.	CALIF. ZINC CO.	19.64	2.03		2.0	.02	143,000		22,450
VALLEY HILL	6	CALIF.	"	12.0	2.8		5.1	.06	124,000		11,900
OPPER CITY	6	"	"	HIGH							
AFTERTHOUGHT	6	"	"	15.8	2.65		4.5	.02			3,170
MONKEY	6	"	"	HIGH							
PRICE	6	"	PRICE								
RESPECT	6	"	KING ET AL								
DOCKS RANCH	6	"	COOK	12.0	2.0			.10			
ATTIE	6	"	MOUNTAIN COPPER	1.7*					200,000		1,350
ONE STAR	6	"	"						DIAMOND DRILLING NOW		
ENN	7	FOOTHILL									
		BELT	A. P. BUSEY AGT.	11.01	3.2		3.1	1.07	133,670		11,700
IG BUZZARD	7	CALIF.	"	17.1	3.4		15.0	.70			
UPPER HILL	7	"	DETERT ESTATE								
ONE	7	"	IONE COAL & IRON		5.1		9.0	.38			
CONSTELLATION	7	"	"	9.5							
ENNY LIND	7	"	"								
JAIL HILL	7	"	CAMERON	15.6	5.6		6.5	.40			
POLEON	7	"	WUENSCH-LEASE	6.0	3.2		3.6	.24	15,000	15,000	960
OLLIER	7	"	"	10.0	2.0		5.0	.32			
LANCHARD	7	"	"								
ASSAU	7	"	NASSAU COPPER CO.	17.9	5.2		4.6	.20			
END OREILLE	8	METALINE									
		FALLS	PEND OREILLE CO.	5.0					1,000,000		42,500
EVES		"	"								
DONALD	8	"	"	5.0					2,000,000		95,000
TCH HARBOR	9	ALASKA		8.0							
ARTZ CREEK	10	WRANGELL									
OUND HOG	10	"		17.0	2.5	2.5	2.5				
ACY ARM	10	JUNEAU									
LES, GEORGIA	11	MT. EILSON	GRANT ET AL	11.5					140,000		15,700
KU RIVER	12	WRANGELL	H. MUD ET AL	8.67	1.7	1.41	6.6	.153	489,000		
MPD MGRADO,											
XIGO	13										
LISCO											
MORA, MEX.	14		LONG ET AL						1,000,000		
									TOTAL (TONS)	5,893,270	4,665,000
											275,391

Mines with measurable ore reserves are under District numbered 1-2-3-4-5-6-7-8-9-11-12-14

Mines with known zinc content but awaiting development are under District numbered 10-13

There are 12 mines in Oregon and approximately 24 in California which have known zinc content but awaiting development.

(See Map-Page 19)

* * - Have appreciable values in other metals besides zinc.

Development: The work done consists of a tunnel 70 feet long on the first vein where ore was being taken out in drifting, and sent to the mill. A small amount of ore has been removed from an open cut on the vein above the tunnel. On the second vein, a crosscut tunnel about 86 feet long intersects the vein in about 40 feet, and a short drift has been run about 20 feet to the southeast at this point.

Geology: The immediate area shows andesitic lavas and a rhyolite dike or dikes. There are at least two veins. The one upon which work is being done is a rhyolite breccia, striking S. 20°-25° E. and dipping 60°-65° SW. It has a well-defined footwall, with the hanging wall more indefinite. The vein material consists of both angular and rounded pieces of quartz and rhyolite cemented by soft siliceous material. As exposed in a tunnel, started on the outcrop, the vein is more than 6 feet wide. The values are in free gold, rather finely divided, with a very small amount of residual pyrite showing occasionally. There is some manganese stain which, in places, becomes a sooty deposit. A sample from the vein in this tunnel was submitted to the Department for assay and returned 0.16 ounce of gold and 0.18 percent manganese.

About 500 feet to the east of the first vein is a second vein with a similar strike and probably somewhat flatter dip. The outcrop shows very little oxidation and considerable pyrite. As exposed in a crosscut tunnel about 60 feet below the outcrop, there appear to be more oxidation, less sulphides, and some free gold. Country rock is a hard andesite. Vein filling is a siliceous breccia. The footwall on the surface is well defined; in the tunnel, where cut, the walls are somewhat broken and more indefinite.

Report by: F.W.L., 1936.

Reference: Stafford, 1904.

RUTH MINE (Gold, silver, zinc, lead)

North Santiam District

Old names: Lewis and Clark Mining and Milling Company
Amalgamated

Owner: Pacific Smelting and Refining Company, J. P. Hewitt, president.

Location: Secs. 27 and 28, T. 8 S., R. 5 E., extending on both sides of Battle Axe Creek road about 1 mile from the mouth of the creek. No. 4 level is 40 feet above road level, and No. 5 level is just above creek level 200 feet below. The ^(Morning Star) Blue Jay vein lies 1,800 feet farther east, the main tunnel being about 200 feet above the road. The Bueche (Ruth No. 4) group (page 117) openings lie near creek level several hundred feet west of the Ruth.

Area: The holdings now include about 30 claims in the Blue Jay group, and 18 claims in the Ruth group.

History: The Lewis and Clark Mining and Milling Company located five claims sometime previous to 1902, and by that time had opened up, according to Stafford (1904), several hundred feet of tunnel on two levels. In 1920 The Amalgamated Mining and Milling Company took over these claims and located 18 additional claims. In 1929 the Blue Jay vein was located by the Columbia Mines Development Company and during the period 1929-1934 the two concerns constructed a road 4 miles long to the mine, numerous buildings, and a mill, and in 1931-1932 shipped 9 carloads of crude ore and concentrates from the mill. In 1934 the Columbia took over the Amalgamated holdings, and in 1939 both groups were purchased by the Pacific Smelting and Refining Company. In 1931 the workings consisted of about 1,350 feet of drift and crosscuts, of which about 1,020 feet were workings on the main (No. 4) tunnel, on the Ruth vein.

Development: By 1945 the Ruth (formerly called the "Blue") vein had been developed

respectively, and about 100 feet of crosscuts. On the No. 5 level 212 feet below there is about 1,700 feet of drift with two raises to the No. 4 level. On the Blue Jay vein there is a 300-foot drift and a stope 40 feet high. There are numerous open cuts and short tunnels on several other veins, both between the Ruth and the Blue Jay, and west of the Ruth. Some development activity was reportedly conducted by Pacific Smelting and Refining Company at the Ruth mine in 1945.

Geology: The country rock is principally oligoclase andesite, but a dike of porphyritic rhyolite crosses the No. 4 tunnel near the portal and, according to Callaghan and Buddington (1938:67-68), parallels it throughout on the northeast side. The main fracture zone varies in width from less than 1 foot to more than 60 feet, with an average trend of N. 55° E. and a dip of 55°-70° NE. Within this pinching and swelling zone, bounded by well-defined walls along which much movement has taken place, the vein material is an altered mass consisting of comminuted rock, gouge clays (chiefly chlorite and some clay minerals), soft greenish chlorite with some apatite, with calcite locally cementing the other constituents and lining vugs. Quartz is very subordinate. Sulphides are present disseminated irregularly throughout the zone, in large lumps of almost solid sulphide, and fairly well-defined but irregular lenses. Sulphide minerals are sphalerite, galena, chalcopyrite, and a very little pyrite, with sphalerite predominating. According to Fred Draper, a consultant for the Pacific Smelting and Refining Company, these lenses of high-grade ore dip more steeply than the zone which includes them, averaging 80°, and pinch out against both the foot and hanging walls within fairly short distances.

The thicknesses in 15 blocks of ore, as given in a report by Rosenberg (1941) range from 5.2 to 15.4 feet; in 8 blocks the average thickness was more than 10 feet.

Estimates of ore reserves as high as 800,000 tons have been made by engineers, but an estimate made for the Reconstruction Finance Corporation placed the reserve at 200,000 tons, with an average of 4.33 percent zinc. Some of the shoots have a much higher percentage of zinc. On the fifth level, 250 feet southeast of the second raise, an ore shoot averages 6.62 feet in width and assays 6.04 percent zinc; above, on the fourth level, the same shoot is 30 feet wide and averages less than 4 percent zinc. In the Rosenberg report the average zinc content of the 15 blocks totaling about 200,000 tons of ore, is given as ranging from 6 to 11 percent.

Metallurgical tests made by the U.S. Bureau of Mines and the Denver Equipment Company indicate that simple selective flotation will recover, from 1 ton of ore, 0.0877 tons of zinc (54.4 percent metal); and .011 tons of lead (of similar grade). Gold, silver, and copper are usually low; a few assays gave as high as 0.66 ounce of gold and 4 ounces of silver, but usually they are present only as traces.

The upper workings are on the south side of the ravine, above and to the west of the No. 4 portal. The No. 2 level is a drift 80 feet long on a vein trending S. 30° E. in greenish pyritic andesite. The vein is 12 to 20 inches wide and consists of vuggy quartz with sulphides, almost entirely pyrite and sphalerite in about equal proportions. The No. 1 level runs 90 feet S. 40° E. to a vein 12 feet wide that consists of brecciated altered andesite with streaks of quartz, pyrite, and sphalerite, and a small amount of galena and chalcopyrite. The hanging wall strikes N. 45° W., and dips 65° NE.

Informants: J. P. Hewitt, Fred Draper.

Report by: J.E.A., 1945.

References: Callaghan and Buddington, 1938:87-89
Parks and Scartley, 1916:140
Rosenberg, P. J., 1941 (unpublished report)

respectively, and about 100 feet of crosscuts. On the No. 5 level 212 feet below there is about 1,700 feet of drift with two raises to the No. 4 level. On the Blue Jay vein there is a 300-foot drift and a stope 40 feet high. There are numerous open cuts and short tunnels on several other veins, both between the Ruth and the Blue Jay, and west of the Ruth. Some development activity was reportedly conducted by Pacific Smelting and Refining Company at the Ruth mine in 1945.

Geology: The country rock is principally oligoclase andesite, but a dike of porphyritic rhyolite crosses the No. 4 tunnel near the portal and, according to Callaghan and Buddington (1938:67-68), parallels it throughout on the northeast side. The main fracture zone varies in width from less than 1 foot to more than 60 feet, with an average trend of N. 55° E. and a dip of 55°-70° NE. Within this pinching and swelling zone, bounded by well-defined walls along which much movement has taken place, the vein material is an altered mass consisting of comminuted rock, gouge clays (chiefly chlorite and some clay minerals), soft greenish chlorite with some apatite, with calcite locally cementing the other constituents and lining vugs. Quartz is very subordinate. Sulphides are present disseminated irregularly throughout the zone, in large lumps of almost solid sulphide, and fairly well-defined but irregular lenses. Sulphide minerals are sphalerite, galena, chalcopyrite, and a very little pyrite, with sphalerite predominating. According to Fred Draper, a consultant for the Pacific Smelting and Refining Company, these lenses of high-grade ore dip more steeply than the zone which includes them, averaging 80°, and pinch out against both the foot and hanging walls within fairly short distances.

The thicknesses in 15 blocks of ore, as given in a report by Rosenberg (1941) range from 5.2 to 15.4 feet; in 8 blocks the average thickness was more than 10 feet.

Estimates of ore reserves as high as 800,000 tons have been made by engineers, but an estimate made for the Reconstruction Finance Corporation placed the reserve at 200,000 tons, with an average of 4.33 percent zinc. Some of the shoots have a much higher percentage of zinc. On the fifth level, 250 feet southeast of the second raise, an ore shoot averages 6.62 feet in width and assays 6.04 percent zinc; above, on the fourth level, the same shoot is 30 feet wide and averages less than 4 percent zinc. In the Rosenberg report the average zinc content of the 15 blocks totaling about 200,000 tons of ore, is given as ranging from 6 to 11 percent.

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The upper workings are on the south side of the ravine, above and to the west of the No. 4 portal. The No. 2 level is a drift 80 feet long on a vein trending S. 30° E. in greenish pyritic andesite. The vein is 12 to 20 inches wide and consists of vuggy quartz with sulphides, almost entirely pyrite and sphalerite in about equal proportions. The No. 1 level runs 90 feet S. 40° E. to a vein 12 feet wide that consists of brecciated altered andesite with streaks of quartz, pyrite, and sphalerite, and a small amount of galena and chalcopyrite. The hanging wall strikes N. 45° W., and dips 65° NE.

Informants: J. P. Hewitt, Fred Draper.

Report by: J.E.A., 1945.

References: Callaghan and Buddington, 1938:87-89
Parks and Scartley, 1916:140
Rosenberg, P. J., 1941 (unpublished report)

SANTIAM COPPER MINE (Gold, silver, copper)

North Santiam District

Known at various times as:

Freeland Consolidated (dissolved 1914)
 Electric Mining and Smelting Company (dissolved 1914)
 Consolidated Copper Mining and Power Company (1914-1925?)
 Lotz and Larsen Mine (1916-1925)
 Northwest Copper Company (1926-1930)
 Rainbow Mine (lessees 1941)

Owner: J. P. Hewitt, Mehama, Oregon.Location: Sec. 19, T. 8 S., R. 5 E., on both sides of the Little North Santiam River.

Area: 12 claims, now called Santiam numbers 1 to 12. Old names include Minnie E. or Northwestern (now Santiam No. 2), May Day (now No. 8), Shilo (now No. 10), Lower Granger (now No. 11), Five Spot (now No. 12), as well as the Josephine, Chief Justice, Go Devil.

History: Stafford (1904) reported that the Freeland Consolidated had 300 feet of tunnel, crosscuts, and drifts, with a shaft 84 feet deep. Parks and Swartley (1916:69) reported that the Electric Mining and Smelting Company's claims and the Freeland Consolidated Company's ground, about 25 claims in all, had been combined in 1914 under the Consolidated Copper Mining and Power Company, and leased to Lotz and Larsen in 1916. At this time 210 feet of drifting had been done on the Minnie E. or Northwestern vein at the river's edge. Much of the mining and development was done in 1915-17, and two carloads (138 tons) of ore and some concentrates from a small mill were shipped in 1923, 1924, and 1925. By 1926 the property was in the hands of the Northwest Copper Company. A detailed sampling job was done by the U.S. Bureau of Mines, and a report was written by W. J. Elmendorf. Under his direction the 96-foot winze in the north tunnel was sunk in 1927, and 3 tons of sorted ore was shipped in 1928.

In 1930 the mine was taken over by the Santiam Copper Mines Company, and lessees shipped 14 tons of bulk ore in 1940. A small mill was built, and between May and September 1941, lot totaling 73 tons of concentrate were shipped. Since that time the property has been idle. Smelter returns representing shipments dating from 1923 to and including 1941 are as follows:

Shipments of Ore and Concentrate to the Tacoma Smelter

<u>Tons (dry)</u>	<u>Copper (%)</u>	<u>Silver (oz.)</u>	<u>Gold (oz.)</u>	
20.666	10.16	2.6) sorted ore, No. 1 stope
29.629	11.36	3.49	.01)
31.655	3.97	1.29) crude ore, No. 2 stope
39.934	4.68	1.60)
4.698	20.05	5.17		concentrates
11.479	6.52	2.10		crude ore, north tunnel
3.283	14.54	4.66	.01	sorted ore
14.547	7.39	2.34	.01	bulk ore
3.926	12.68	3.12	.04)
4.760	21.62	6.37	.05)
5.325	23.18	5.43	.05)
5.289	22.88	6.03	.06)
5.491	25.40	6.04	.04) concentrates
5.416	23.41	6.60	.04) (average returns from
5.885	17.34	5.10	.04) smelter \$28.76 per ton)
5.795	16.39	4.45	.04)
5.603	18.28	5.16	.04)
5.144	19.62	4.63	.03)
5.785	16.02	3.46	.02)
8.400	11.33	2.99	.04)

Development: Most of the work has been done on the Minnie E., or Northwestern vein, on both sides of the Little North Santiam River. Nearly all the production has been from the main drift which follows the vein on the south side of the river approximately S. 43° E. for 1,000 feet, the last 100 feet of which was driven in 1941. There are 6 raises in three stopes, the first of which breaks through to the surface. Nowhere except at the extreme end of the tunnel is there more than 160 feet of backs, and the average is closer to 100 feet.

The north tunnel has about 300 feet of drift; 100 feet of it is on a vein branching off to the northwest. Near the face of this branch there is a winze 96 feet deep.

Geology: The Minnie E., or Northwestern vein, strikes N. 43° W., except for 350 feet adjacent to the river. Dips range from 50° E. to vertical, averaging about 70° E. Callaghan and Baulington (1938:56-57) describe the geology as follows:

"The country rock on the north side of the river is agglomeratic oligoclase andesite, and that on the south side is mainly porphyritic oligoclase andesite. Chalcopyrite is the principal ore mineral, but there are also subordinate pyrite, sphalerite, and an unknown white metallic mineral, visible only under the microscope, that contains copper, silver, bismuth, and sulphur.

"Though ore minerals are sporadically distributed throughout the vein, there are four fairly distinct narrow ore shoots, as shown in plate 17. That in the north drift is 100 feet long and in some places 18 inches wide. A winze, now full of water, is reported to have exposed 14 inches of chalcopyrite 96 feet below the tunnel. In places the shoot contains three seams of almost solid chalcopyrite, each 3 inches wide, associated with quartz stringers and altered rock. The vein pinches down to 1 inch at the end of the drift. An assay map by W. J. Elmendorf shows an average metal content for this shoot of 4.47 percent of copper, 1.22 ounces of silver to the ton, and no gold for a width of 6 feet. A shoot at the portal of the drift on the south side contains only a small amount of chalcopyrite. The first 180 feet of drift has an average metal content of 1.25 percent of copper, 0.1 ounce of silver to the ton, and no gold, according to the assay map. A shoot nearly 200 feet long extending southeastward from a point 280 feet from the portal has been partly stoped. This shoot averages, for a width of 5 feet, 2.41 percent of copper, 0.75 ounce of silver to the ton, and a trace of gold. Another shoot about 80 feet long, extending southeastward from a point about 760 feet from the portal, has been partly stoped. The vein at the face of the tunnel consists of 4 to 5 inches of nearly solid chalcopyrite, 1 1/2 inches of quartz with a little calcite, and 7 inches of gouge.

"An open cut about 500 feet east of the main tunnel reveals a seam of chalcopyrite half an inch wide. Some open cuts and a short drift west of the mouth of Gold Creek show gouge seams and some pyrite but no appreciable chalcopyrite.

"Several of the tunnels along Gold Creek are believed locally to be on the same vein. The Mayday or Santiam No. 8 tunnel, on the west side of Gold Creek about 1,700 feet north of the camp, follows a soft pyritic altered zone 6 inches wide N. 40° W. for 100 feet. The Josephine crosscut, about 100 feet south of the footbridge near the forks of Gold Creek, extends 65 feet to a vein that strikes N. 10° W. and dips 70° E. The vein consists of gouge seams in andesite with no appreciable sulphides. The Shilo or Santiam No. 10 drift, 300 feet up the west fork of Gold Creek from the forks, follows a seam of pyritic altered rock with quartz and calcite stringers for 215 feet, mainly N. 15° W. The Lower Granger or Santiam No. 11 is a short distance north of the Shilo. A crosscut extends 155 feet S. 65° W. to the vein, which is followed by drifts of 110 feet N. 10° W. to a cave-in and E. 5° E. to a face that reveals silicified rock with a few quartz stringers. Vein matter on the dump contains scattered pyrite, a few streaks of

State of Oregon Department of Geology and Mineral Industries
 1069 State Office Building, Portland, Oregon 97201

REQUEST FOR SAMPLE INFORMATION

Date: _____ Sec. _____ Twp. _____ R. _____ County: _____
 (For your records)

Please print name and address in space below

SHINY ROCK MINING CORP Geo. Atiyeh 897-2336
 POB 132
 MERAMA, OREGON 97384

Customer's Sample No.	Assay for	(for your records, if desired)		Source of Sample
		Grab	Channel (length)	
101	Au + Ag, Cu, Pb, Zn, 3 element spectrographic analysis		(As, Co, Hg)	MILL CONCENTRATES
102	"			"
103	"			"
	Au + Ag 3 x 1.00 \$24.00		\$111.00	
	Cu 3 x 7.00 \$21.00		- 24.00 quantity discount for chemical analyses (25%)	
	Pb 3 x 8.00 \$24.00		37.00	
	Zn 3 x 9.00 \$27.00		- 3.00 quantity discount for spectrographic analysis (25%)	
			\$ 54.00	
	SPEC 3 x 5.00 \$15.00		3.00 drying of wet samples	
	total	\$111.00	\$ 62.00 TOTAL	

Samples should weigh at least one pound and be dry. Fee for analysis must accompany sample.
 Date Rec'd: 4/22 Amount Rec'd: \$4.00 check Analysis Mailed: 6/9/75

Lab. No.	Cust. No.	Gold oz/ton	Silver oz/ton	% Cu	% Pb	% Zn
39277 - 1	101	0.01	4.07	1.01	9.04	22.0
39277 - 2	102	0.01	3.29	1.88	2.89	40.5
39277 - 3	103	0.01	2.83	0.78	2.80	13.9
Arsenic - 0.5 to 1.0% (spectrographic estimate)		ALL THREE SAMPLES				
Cobalt - 0.01 to 0.001%		"				
Mercury - less than 0.1 lb/ton (estimate)		"				

NOTE: The Department assumes responsibility only for the analytical results and not for the validity of any samples submitted.

Analyzed by Baxter

State of Oregon Department of Geology and Mineral Industries
 1069 State Office Building, Portland, Oregon 97201

REQUEST FOR SAMPLE INFORMATION

Date: _____ Sec. _____ Twp. _____ R. _____ County: _____
 (For your records)

Please print name and address in space below

SHILY ROCK MINING CORP
 POB 132
 WHELAN, OREGON 97234

Customer's Sample No.	Assay for	(for your records, if desired)		Source of Sample
		Grab	Channel (length)	
101	Au, Ag, Cu, Pb, Zn, 3 element spectrographic analysis			MILL CONCENTRATES
102	"			"
103	"			"
	Au 1 x 8.00 \$24.00		\$111.00	
	Cu 3 x 7.00 \$21.00		- 24.00 quantity discount for chemical analyses (25%)	
	Pb 3 x 8.00 \$24.00		87.00	
	Zn 3 x 9.00 \$27.00		- 3.00 quantity discount for spectrographic analysis (20%)	
			\$ 84.00	
	SPEC 3 x 5.00 \$15.00		3.00 drying of wet samples	Please remit
	Total		\$ 87.00 TOTAL	

Samples should weigh at least one pound and be dry. Fee for analysis must accompany sample.
 Date Rec'd: 4/82 Amount Rec'd: \$4.00 check Analysis Mailed:

Lab. No.	Cust. No.	Gold oz/ton	Silver oz/ton	% Cu	% Pb	% Zn
39277 - 1	101	0.01	4.07	1.01		
39277 - 2	102	0.01	3.29	1.88		
39277 - 3	103	0.01	2.83	0.78		
<i>Pb, Zn, + SPEC to follow</i>						
<i>The state geologist said no greater discounts available</i>						

NOTE: The Department assumes responsibility only for the analytical results and not for the validity of any samples submitted.

Analyzed by Baxter

REQUEST FOR SAMPLE INFORMATION

Date: _____ Sec. _____ Twp. _____ R. _____ County: _____
(For your records)

Please print name and address in space below

SHINY ROCK MINING CORP Geo. Atiyeh 897-2336
POB 132
MEHAMA, OREGON 97384

Customer's Sample No.	Assay for	(for your records, if desired)		Source of Sample
		Grab	Channel (length)	
101	Au + Ag, Cu, Pb, Zn, 3 element spectrographic analysis	(As, Co, Hg)	MILL CONCENTRATES	
102	"	"	"	
103	"	"	"	

ANALYTICAL RESULTS

SPECTROGRAPHIC ANALYSIS						
No.	Over 10%	10 to 1%	1 to .1%	.1 to .01%	.01 to .001%	Under .001%
1	Fe Zn Si Al Pb	Cu	Mn Mg	Ca Ti Bi	Ni? Co? B? Cr Zr?	Ba Sr?
2	Fe Zn Si Al	Pb Cu	Mn	Mg Ca Bi Ti	Co?	Cr Ba Sr?
3	Fe Zn Si Al Pb	Cu	Mn Mg	Ca Ti Bi	Ni? Co? B? Cr Zr?	Ba Sr?
4	? indicates presence could not be confirmed. *					
5	All 3 samples: Sb < 0.1%, As < 0.5%, Cd < 0.1%, Ce < 0.01% (< means less than) Sn < 0.01%					
6	" : In, Se, Na (because of hi Zn), & Te were not detectable in these samples					
7	Cl, Pl, & S are not detectable with the spectrograph. However, because of the minerals in the samples					
8	it could be assumed that S would be in the Over 10% range.					
9	detectable					
10						

No.	% ASH	MERCURY		R-ACTIVITY nr/hr	FIRE ASSAY			CHEMICAL ANALYSIS
		+	-		Au oz/ton	Ag oz/ton	Pt oz/ton	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

OTHER _____

ANALYST Baxter
DATE COMPLETED 8/26/75

Nevada Assay Office

675 LESTER AVENUE

Reno, Nevada

May 7, 1977

FRANK W. JONES

Assayer-Chemist

Phone

329-4080

ASSAY CERTIFICATE FOR: Shining Rock Mining Co-Reno, Nev.

ore Mill Concentrates

NO.	SAMPLE	GOLD	SILVER	Copper	Lead	Zinc		
		OZ./TON	OZ./TON	%	%	%	%	%
	#1			0.20	0.4	2.6		Head
	2			2.80	49.6	12.9		Lead Con
	3			0.15	0.6	2.1		Lead Tail
	4			1.70	1.3	49.0		Zinc Cons
	5			0.29	2.4	2.1		Mill Tail

COSTS AND REVENUES
ORE VALUES

Page 1

Morning Star Ruth 1, 2, 4	Au	Ag	Pb	Zn	Fe	Cu	Insol	Sulphur	Specific Gravity	Gross Value	Transport Penalties Deductions	Concen. Ratio	Per Ton Net Value
Average Price 12/80	594.81	16.39	.38966	.4059	.736	.89127		1.10	2.8				
Mine Run Average Grade	.033	1.404	3%	8%	6.6%	.2%	60.36	6.92					
Gross Value	19.60	23.01	23.37	64.94		3.56							134.48 x 90% Recovery = \$121.03
Pb Concentrate (Schedule 1)													
Average Grade	.11	21.2	49.6%	2.7%	7.8%	2.6%	3.44						
Value	65.42	347.53	386.54	21.91		46.34				867.74			
N.S.R.	49.51	314.58	310.38			17.92				692.39	(79.00)	21 x 1	29.20
Zn Concentrate (Schedule 1)													
Average Grade	.11	2.7	2.7%	68.5%	8.3%	1.4%	2.56						
Value	65.42	44.26	21.04	552.02		24.95							
N.S.R.	48.45	22.29		408.67		15.12				494.53	(103.96)	8 x 1	<u>48.82</u>
Combined N.S.R. (Schedule 1)													<u>78.02</u>
Average Costs													
Mining (Schedule 2) (Mine to Concentrator)													(21.69)
Milling (Schedule 3)													(15.05)
Overhead (Schedule 4)													(4.50)
Contingency Fee 7%													<u>(3.00)</u>
Total Cost Per Ton													<u>(44.24)</u>
Net Profit Before Tax Per Ton													33.78
Annual Profit 39,000 Tons													1,317,420.00
Ruth 1, 2, 4 Bureau of Mines Proved Reserve 200,000; Morning Star, Estimate 50,000													250,000 x 33.78 Net Value - Ruth 1, 2, 4; Morning Star
													\$8,445,000.00

Note: Based on 1) 150 T capacity, 24 hr. day

COSTS AND REVENUES
ORE VALUES

Page 2

MANDALAY SANTIAM NO. 1	Au	Ag	Pb	Zn	Fe	Cu	Insol	Sulpher	Specific Gravity	Gross Value	Transport Penalty Deductions	Concen. Ratio	Per Ton Net Value
Average Price 12/80	594.81	16.39				.89127							
Mine Run Average Grade	.03	3				10%			3.34				
Gross Value	17.82	49.17				178.25				245.24 x 90% Recovery = \$232.97			
Cu Concentrate	*												
Average Grade	.07	7				23%							
Value	41.63	114.73				409.98				566.34			
N.S.R. (Schedule 1)	27.22	92.01				330.87				450.10	(103.60)	2.5 x 1	138.60
Average Costs													
Mining (Schedule 2) (Mine to Concentrator)													(21.69)
Milling (Schedule 3)													(15.05)
Overhead (Schedule 4)													(4.50)
Contingency Fee 7%													(3.00)
Total Cost Per Ton													<u>(41.24)</u>
Not Profit Before Tax Per Ton													\$97.3

Note: Based On 1) 150 T Flotation Mill, 24 hr. day and sufficient Ore to Maintain Level of Production
2) Actual Costs During 1977 Mine and Milling (Company Records) Adjusted to 1981 Dollars

SCHEDULE 1
SMELTER RETURNS

	Au	Ag	Pb	Zn	Cu	Transportation	Deductions	N.S.R. Con.	Ruth 1, 2, 4 Morning Star Con. Ratio	Santiam 1 Mandalay Con. Ratio	N.S.R. Head	Morning Star Ruth 1, 2, 4 Total	Santiam Mandalay Total
Concentrate Value/Cost	.11 49.51	21.2 314.58	49.6% 310.38	2.7%	2.6% 17.92	(31.50)	(47.50)	613.39	21 x 1		29.20		
Concentrate Value/Cost Total	.11 48.45	2.7 22.29	2.7% 408.67	68.5%	1.4% 15.12	(28.46)	(75.50)	390.57	8 x 1		48.82	78.02	
Concentrate Value/Cost	.07 27.22	7 92.01			23% 330.87	(18.60)	(85.00)	346.50		2.5 x 1	138.60		138.60

Smelter Schedule
ARCO Open

Au .11 - .02 = .09 x 92.5% = .08 x 594.81 = \$49.51
 Ag 21.2 - 1 = 20.2 x 95% = 19.19 x 16.393 = \$314.58
 Pb 49.6% - 1.5% = 48.1% x 95% = 45.69% x 2000# = 913.8 x (.38966 - .05) = \$310.38
 Cu 2.6% - 1.3% = 1.3% x 97.5% = 1.26% x 2000# = 25.2 x (.89127 - .18) = \$17.92
 Zn Not Paid For

Smelter Schedule
Bunker Hill Open

Au .07 - .02 = .05 x 92.5% = .046 x (594.81 - 4) = \$27.22
 Ag 7 - 1 = 6 x 95% = 5.7 x (16.393 - .25) = \$92.01
 Cu 23% - 1% = 22% x 97.5% = 21.45% x 2000# = 429 x (.89127 - .12) = \$330.87

Smelter Schedule
Phillip Bros Open

Au .11 - 20% = .08 x \$594.81 = 52.34 x 92.57% = \$48.45
 Ag 2.7 - 1 = 1.7 x \$16.393 = 22.87 x 80% = \$22.29
 Pb 2.7% - 4% Not Paid For
 Cu 1.4% x 65% = .91% x 2000# = 18.2 x (.89127 - .06) = \$15.12
 Zn 68.5% x 85% = 58.22% x 2000# = 1164.40 x .4059 = 472.62 - 63.95 = \$408.67

- S: 1) Engineering & Mining Journal, Vol. 182, No. 1
 Quotes 12/80 From
 Metals Week and Handy & Harmon: Au:594.814; Ag:16.3933; Pb:.38966; Zn:.40590; Cu:.89127
 2) Transportation Rates Published Lyons to East Helena, MT, Lyons to Kellogg-Warner ID, Lyons to Tacoma, WA NPCFB Tariff 39A Supplement 38
 3) Smelter Schedules per ASARCO - Pb, ASARCO - Cu, Bunker Hill - Zn, COMINCO - Pb, Zn Phillip Bros. (Hans Gusenhauer) New York, NY, Bureau of Mines Circular 8206
 4) Concentrate Ratio and Recoverys Per Denver Equipment Ore Testing Division 3/52, and Shiny Rock Mining Corp. Daily Mill Operating Reports and Assays, 1977

SCHEDULE 2
UNDERGROUND MINING COSTS
NORTH SANTIAM DISTRICT

<u>Mining</u> <u>Fix-Operating</u>	<u>Per Set</u> <u>(8x8x8)</u>	<u>Per Ton</u> <u>(40 T Per Set)⁴</u>
<u>Timber</u>		
Logging Per MbF	\$ 40.00	
Sawmilling	50.00	
Transportation	10.00	
Setting	<u>75.00</u>	
Cost per Set/per Ton ¹	175.00	\$ 4.38
<u>Drilling</u>		
Drills	15.00	
Bit & Steel ²	10.00	
Air	4.00	
Labor	<u>100.00</u>	
	129.00	3.23
<u>Blasting</u>		
Wire & Dentonators	8.00	
Explosive - Caps ³	85.00	
Labor	<u>75.00</u>	
	168.00	4.20
<u>Mucking</u>		
Mucker	18.00	
(includes Dep, Repair, Main, Air, Oil)		
Labor	<u>75.00</u>	
	93.00	2.33
<u>Tramming</u>		
Trammer & Cars (see Mucker)	12.00	
Track (Rail, Ties, Plates, etc.)	40.00	
Charging & Batt	15.00	
Labor	<u>65.00</u>	
	132.00	3.30
<u>Transportation</u>		
Labor (Loader, Ramps, etc.)	30.00	
Trucking	75.00	
Labor	<u>65.00</u>	
	<u>175.00</u>	<u>4.25</u>
TOTAL	\$867.00	\$21.69 Per Ton

- NOTES: 1. 1000bF Per 8' Set
 2. Atlas Copco
 3. Timber Supply (Tovex - Ammonium Nitrate)
 4. 12.8 cu ft. per ton, 512 cu. ft. per set, or 40 tons (T)

SCHEDULE 3

MILLING COSTS
150 TONS PER DAY

	<u>Per Ton</u>
<u>Coarse Crushing</u>	
Labor	\$ 3.25
Power	.30
Depreciation	.90
Repair & Maintenance	1.30
Water	.05
<u>Grinding, Flotation, Filtration, Drying</u> <u>Bagging & Tailing Disposal</u>	
Labor	2.75
Power	.15
Depreciation	.50
Repair & Maintenance	1.00
Water	.10
Reagents	2.00
Assays	1.25
Tail Disposal	1.50
	<hr/>
	\$15.05

SCHEDULE 4

FIXED OVERHEAD COSTS ATTRIBUTABLE
TO MINING OPERATION
(EXCLUDING MINE & MILL)

Per Annum
(Total Property)

Office & Administration

Salaries	\$ 57,000.00
Payroll Burden	22,800.00

General Expenses

Supplies	4,500.00
Postage	300.00
Outside Services	11,000.00
Travel	3,600.00
Convention & Conference	3,000.00
Dues	300.00
Subscriptions	100.00
Repair & Maintenance	4,000.00
Dental Insurance	900.00
Medical Insurance	2,000.00
SAIR	2,000.00
Utilities	900.00
Telephone	900.00
Toll Calls	1,500.00
Property Tax	5,000.00
Dep.	10,000.00
Amortization	1,000.00
Interest	16,000.00
Insurance	8,000.00
Internal Charges	5,000.00
Audit	4,000.00
Legal	<u>12,000.00</u>

TOTAL \$175,800.00

Annual Production 39,000 tons

FIXED OVERHEAD COSTS PER TON: \$4.50

APPENDIX 11

PATENT EXPENDITURES

	<u>Page</u>
RUTH NO. 1	198
RUTH NO. 2	201
RUTH NO. 4	202
MORNING STAR	203
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MANDALAY	205
HEWITT MILLSITE	206
POOR BOY MILLSITE	209
STARVATION MILLSITE	210

RUTH NO. 1
PATENT EXPENDITURE

WORKINGS 5th LEVEL

1935-1940	1500' Adit	10,000.00	
	700' Timbered	2,800.00	
	400' Raise	6,000.00	
	400' Ore shoot	2,000.00	
	400' Cross cut	4,000.00	
	1500' Rail & ties	<u>1,500.00</u>	
			26,300.00
1947	3 40' stopes		8,000.00
1966	80' timber		
	40' run around tunnel		
	25' Cross cut		
	60' Slusher drift		
	4 200' Core holes (diamond drill)		39,500.00
1977	700 drift mucked		
	700 retimbered		9,000.00
1978	100' slusher drift		
	10 x 20 underground powder hse.		
	115' Slusher crosscut		
	30 days pumping		
	90 days mucking		
	New air line to face 1900'		
	Repair track & ties		
	Blade off work area (outside)		
	Ore dump station		
	Repair haul road		<u>31,000.00</u>
			\$113,800.00
			\$113,000.00

BUILDINGS

- | | |
|------|------------------------------|
| 1935 | 1. Bunkhouse (2 story) |
| | 2. Assay Office |
| | 3. Commisary |
| | 4. Powderhouse (underground) |
| | 5. Two cabins |

	6. Superintendent's house		
	7. Office		
	8. Store house		
	9. Power house		
	10. Cookhouse		
	11. Portal building		
			<u>8,000.00</u>
1977	1. Compressor shed		
	2. Change shed & charging station		
			<u>1,725.00</u>
SUBTOTAL			9,725.00 9,725.00

EQUIPMENT

	1. Boiler		
	2. Steam compressor		
	3. Blower		
	4. Front dump cars 2		
	5. Trammers Manche 1 1/2 ton		
	6. Mucker 12B		
	7. 485 CFM compressor diesel		
	8. Receiver		
	9. 6 kw generator		
	10. Pelton wheel 13"		
	11. Vent tube		
	12. Work bench		
	13. Rail bender		
	14. Rail frogs, bolts, etc.		
	15. Steel		
	16. Pipe		
	17. 4 side dump cars		
	18. Air whirly pump		
	19. Water filtration system		
	20. Water line 1500' 2" abs		
	21. Diesel storage tank		
	22. Misc. mine equipment		
			<u>22,000.00</u>
Subtotal			22,000.00 22,000.00

WORKINGS 4th LEVEL

1935 - 1940	2481' Adit	14,886.00	
	1152' timbered	4,608.00	
	350' Raise	3,500.00	
	350' Raise	1,750.00	
	1300' cross cut	<u>7,800.00</u>	
			32,544.00

1947	Retimber 427'	2,135.00	
1966	125' slusher drift, spilling	4,000.00	
1972	Muck portal Drainage ditch Retimber 3 sets	<u>500.00</u>	
Subtotal		39,179.00	39,179.00

BUILDINGS

	Snow shed Shop 4 ore bins Powderhouse	<u>4,000.00</u>	
Subtotal		4,000.00	4,000.00

EQUIPMENT

	Boiler Steam compressor End dump car	<u>1,046.00</u>	
Subtotal		1,046.00	<u>1,046.00</u>

TOTAL \$189,750.00

RUTH NO. 2

PATENT EXPENDITURES

WORKINGS

1935 - 1940

Third Level

Adit 135'	\$	810.00
Raise 90'		900.00
Timber		168.00

1935 - 1940

Second Level

Adit 80' Drift		480.00
Timber		111.00

1935 - 1940

First Level

Adit 90' Drift		540.00
40' Cross Cut		200.00
Timber		<u>168.00</u>

TOTAL

\$ 3,377.00

RUTH NO. 4

PATENT EXPENDITURES

WORKINGS

ORIGINAL

8' open cut x 2.50	\$ 20.00
52 adit x 250	130.00
Timber	39.00
Rail	13.00
Car	46.00
Raise + shoot	45.00
1980	
35' open cut	<u>1,100.00</u>
Clean out old workings (backhoe)	\$ 1,393.00

MORNING STAR

PATENT EXPENDITURES

WORKINGS

500' Adit	\$ 2,250.00
90' Stope	270.00
Timber	300.00
Rail	225.00
Car	46.00

BUILDINGS

Work Shed	125.00
Powder Magazine	<u>50.00</u>
	\$ 3,266.00

SANTIAM No. 1

PATENT
EXPENDITURE

<u>BUILDINGS</u>	<u>DATE</u>	<u>AMOUNT</u>	
1. Shed (cement floor)	1954	\$100.00	
2. Shed Roof, Metal	1974	50.00	
3. Rebuild Posts	1980	100.00	
4. Ore Mill		400.00	
		<u>650.00</u>	<u>650.00</u>
 <u>WORKINGS</u>			
Adit, crosscuts, adit timber steel ore car rails, winze, winze timber, winze hoist, winze pump		4,130.00	
Ore car		25.00	
Retimber Portal	1980	200.00	
Muck opening (backhoe)	1980	200.00	
Pump		75.00	
Pump water from winze	1978	500.00	
		<u>5,130.00</u>	<u>5,130.00</u>
 <u>ACCESS</u>			
Gold Creek Bridge		40,000.00	
Road from (Elkhorn/Elklake Rd..) to Mine		1,000.00	
		<u>41,000.00</u>	<u>41,000.00</u>
 TOTAL			 <u>\$46,780.00</u>

MANDALAY
PATENT EXPENDITURE

1. Discovery Adit
2. Lower Adit .
3. Muck caved in portion of discovery adit
4. Cut new ditch for drainage at discovery adit
5. Remove old timbers and retimber at discovery and lower adit
6. Fall, buck, split new mine timbers

TOTAL

\$750.00

HEWITT MILLSITE

PATENT EXPENDITURES

EQUIPMENT

1. Telephone wire
2. Misc. doors & windows
3. Assay equipment
4. 6 Misc. pumps
5. 8 lines drills
6. 1 jack leg
7. 2 60 pound hammers
8. 2 chipping hammers
9. 2,000 pounds steel
10. 2 stoping hammers
11. 12 boxes throw away bit
12. Timber templets
13. 1 high pressure gas pump
14. 1 low pressure pump
15. Plumbing supplies
16. Spikes, nails
17. Hot water coils
18. Plumbing tools
19. Stove parts
20. Electric motors
21. Belts
22. Fiberglas (barrel resin)
23. 10 boxes misc. caps
24. 15 cases dynamite
25. Electric wire & switches
26. Paints
27. Trammer parts
28. Rotary air compressor
29. Pelton wheel
30. 2 ram pumps
31. Electrical meters
32. Propane bottles (11)
33. 2 sinks
34. 1 toilet
35. Electrical stoves (2)
36. Refrigerator
37. Refriigeration unit
38. Box of crosscut saws
39. Block & Tackle
40. Wedges

41. Log tongs
42. Axes
43. Shovels, picks
44. Drill press
45. Chain saws (2)
46. Springboard clips
47. Loading tongs
48. Chokers
49. Straps
50. Carpenter tools
51. Butt rigging
52. Office supplies
53. Drafting table
54. Wood stove
55. 3 air blowers
56. 30 hp electric motors
57. Mechanics tools
58. Arc welder
59. Grinders, vise, etc.
60. Misc. nuts & bolts
61. Spare parts
62. Drill press
63. Hose, air fittings

Subtotal

\$ 34,080.58

- | | | |
|-----|---|-----------------|
| 1. | 4 x 4 dump truck | \$ 3,950.00 |
| 2. | 1 1/2 ton Ford Flatbed truck | 1,500.00 |
| 3. | 4 x 4 truck | 950.00 |
| 4. | Shake splitter | 750.00 |
| 5. | Onan diesel power plant | 2,560.75 |
| 6. | Electrical switching | 600.00 |
| 7. | Tires | 2,000.00 |
| 8. | Battery charger | 390.00 |
| 9. | 12 Batteries | 360.00 |
| 10. | Trammer batteries | 500.00 |
| 11. | Miner's lights & hardhats | 285.00 |
| 12. | Denver 185 CFM compressor
(diesel) | 6,450.00 |
| 13. | Cabin furniture & fixtures | 21,165.87 |
| 14. | Fire hose & protection
system water line | <u>4,637.12</u> |

Subtotal

\$ 46,098.74

BUILDINGS

- 9 cabins and wood sheds
- 1 commissary
- 1 office

Operations center
Wood shed
Generator house and garage
Truck shop
Fuel shed
Garage
Cat shed

Subtotal

70,900.15

Fire reel boxes 75.00
Line reels 208.00
Propane storage tank 300.00
Alum. Am. Rib roofing 6,651.75

Subtotal

7,234.75

TOTAL

\$158,314.22

STARVATION

PATENT EXPENDITURES

STARVATION MILLSITE

ORE MILL

1.	Coarse ore bin	
2.	Buzz screen feeder	
3.	4' flume	
4.	60' conveyer	
5.	9 x 28' jaw crusher	
6.	Grizzly	
7.	60' conveyer	
8.	4 x 8 1/4" shaker screen	
9.	30" rolls crusher	
10.	60' conveyer	
11.	Fine ore bin	
12.	60' conveyer	
13.	3 x 4 ball mill	
14.	Cyanide feeder	
15.	Classifier	
16.	Slurry pump	
17.	Conditioner	
18.	Reagent feeder (2)	
19.	Flotation cells pb.	
20.	Conditioner	
21.	Flotation cells 2n	
22.	Concentrating table	
23.	Pan filters (4)	
24.	Bins	
25.	Settling pond	
26.	150 KW Murphy Generator set	
27.	Generator shed	
28.	Electrical controls & boxes	
29.	Wood furnace	
30.	Fine ore pond	
	Subtotal	\$50,516.26
	Mill Building	3,436.85
	Saw Mill Mobile Dimension Saw	<u>4,295.00</u>
	TOTAL	\$58,248.11

EXPENDITURE NOTE

VALUES

Bibliography

1. State of Oregon, Dept. of Labor
2. Prefiled Mining Catalogs 1948
3. Metallic Mining Catalogs 1940
4. J. E. Haseltine & Co. 1935
5. J. E. Haseltine & Co. 1936
6. Ingersol Rand 1947
7. Woodbury & Wheeler Co. 1929
8. Mine & Smelter Supply 1926
9. Marshall Wells 1947
10. Company records - asset sheets - payroll records
 - a. Pacific Smelting & Refining
 - b. Columbia Mine Development
 - c. Amcol Mining & Milling
 - d. Amalgamated Mines
 - e. Santiam Copper
 - f. Santiam Zinc
 - g. Shiny Rock Mining Corp.
11. Reports
 - a. Fred J. Rosenberg 1941
 - b. W. Merrit 1935-1944
 - c. F. W. Libbey 1956
 - d. L. E. Frizell 1966
 - e. War Mineral Report 1943
 - f. Feasibility Study Reconstruction Finance 1943
 - g. Donal A. Hull 1977
 - h. State Dept. of Feology 1945
 - i. Donald Decker August 1978