'71 MINERALS CYANIDE LEACH TESTS

Notice that the projected recoveries were all low(under 50%) for a cyanide leach. Realize further that cyanide was used to determine the dump grade which does not reflect the true total grade(heads).

December 23, 1974

Memo to: R. J. Hewlett

From: R. M. Darrah

Subject: Tombstone Metallurgical Test Results

The results for the second series of cyanide leaching test to evaluate heap leaching are as follows:

Test	Dump	Gold Leached, oz/ton 1 day	Gold Leached, oz/ton 2 days	Silver Leached, oz/ton 1 day	Silver Leached, oz/ton 2 days
10	Tranquility	.016	.023	.35	.45
11	Empire	.015	.022	.23	.32
12	Toughnut	.008	.010	.26	.32
13	Contention 1	.024	.030	.52	.70
14	Little Joe	.006	.008	.34	.53
15	West Side	.013	.018	.44	.60
16	Grand Central	.007	.010	.59	.76
17	Lucky Cuss	.018	.024	.51	.73
18	Emerald	.004	.005	.44	.57
19	Contention	.020	.033	.83	1.18
	Average	.013	.018	.46	.62

Using $4.50 per troy oz. for silver, and $185 per troy oz. for gold, the total leached values in $/ton for 2 days leaching are as follows:

Tranquility.....6.30	West Side.....6.11
Empire.....5.43	Grand Central.. 5.31
Toughnut..... 3.20	Lucky Cuss..... 7.75
Contention 1 ... 8.80	Emerald..... 3.53
Little Joe..... 3.92	Contention 2 ..11.35

The total silver recovery for 2 days is $2.77 per ton and gold recovery is $3.40 per ton, for a total gold and silver average of $6.17/ton.

Cyanide consumption in 2 days has been about one pound per ton with the exception of Contention 1 and Lucky Cuss, which have used about two pounds per ton. Lime consumption for two days is about 1.5 pounds per ton.

The above results are extremely encouraging in regards to the economics and viability of heap leaching.

A recommendation to proceed with the initial 50,000 ton production test will be made when tests 10 - 19 are completed. This will be around Jan. 3, 1975.

Robert M. Darrah
Consulting metallurgist

cc: Jim Kennedy
File (2)

Projected Gold and Silver Production From Heap Leaching the Tombstone Dumps

December 30, 1974

Dump	Estimated Tons	U. S. Dollars/short ton Recovery 1/	Net Profit 2/	$Profit 3/
Contention 1	100,000	7.00	4.00	400,000
Lucky Cuss	55,000	5.90	2.90	159,500
Contention 2	20,000	10.58	7.58	151,600
Tranquility	50,000	5.39	2.39	119,500
Grand Central	50,000	4.61	1.61	80,500
Empire	40,000	4.32	1.32	52,800
West-Side	10,000	5.41	2.41	24,100
Totals/Aver.	325,000			988,000

1/ Based on $4.50/troy oz. silver, $185/troy oz. gold

2/ For $3.00/ton net operating cost

3/ Tonnage x net profit/short ton

Mining and Leaching Sequence, Tombstone Waste Dumps

Leach Period	Tonnage	Dump	Production, $	Net Profit $
April 1975	20,000	Contention 2	211,600	151,600
April 1975	30,000	Contention 1	210,000	120,000
May 1975	50,000	Contention 1	350,000	200,000
June 1975	20,000	Contention 1	140,000	80,000
June 1975	30,000	Lucky Cuss	177,000	87,000
July 1975	25,000	Lucky Cuss	147,500	72,500
July 1975	30,000	Tranquility	161,700	71,700
Aug. 1975	20,000	Tranquility	107,800	47,800
Aug. 1975	10,000	West Side	54,100	24,100
Aug. 1975	20,000	Grand Central	92,200	32,200
Sept. 1975	30,000	Grand Central	138,300	48,300
Sept. 1975	20,000	Empire	86,400	26,400
Oct. 1975	30,000	Empire	86,400	26,400
Totals	325,000		1,963,000	987,800

Month	Production $	Net Profit $	Cum. Net Profit $
April 1975	421,600	271,600	271,600
May 1975	350,000	200,000	471,600
June 1975	317,000	167,000	638,600
July 1975	309,200	144,200	782,800
Aug. 1975	254,100	104,100	886,900
Sept. 1975	224,700	74,700	961,600
Oct. 1975	86,400	26,400	988,000

Summary of Cyanide Leach Tests

Test	Dump	Metal leached, Mg. Silver	Metal leached, Mg. Gold	Metal leached tr oz/ton ore Silver	Metal leached tr oz/ton ore Gold
10	Tranquility	1449	78	0.37	0.0200
11	Empire	1061	65	0.27	0.0167
12	Toughnut	962	27	0.25	0.0070
13	Contention 1	2155	95	0.55	0.0244
14	Little Joe	1711	30	0.44	0.0077
15	West Side	2217	60	0.57	0.0154
16	Grand Central	2345	40	0.60	0.0103
17	Lucky Cuss	2192	71	0.56	0.0182
18	Emerald	1831	18	0.47	0.0046
19	Contention 2	4419	115	1.14	0.0295
	Average			0.52	0.0154

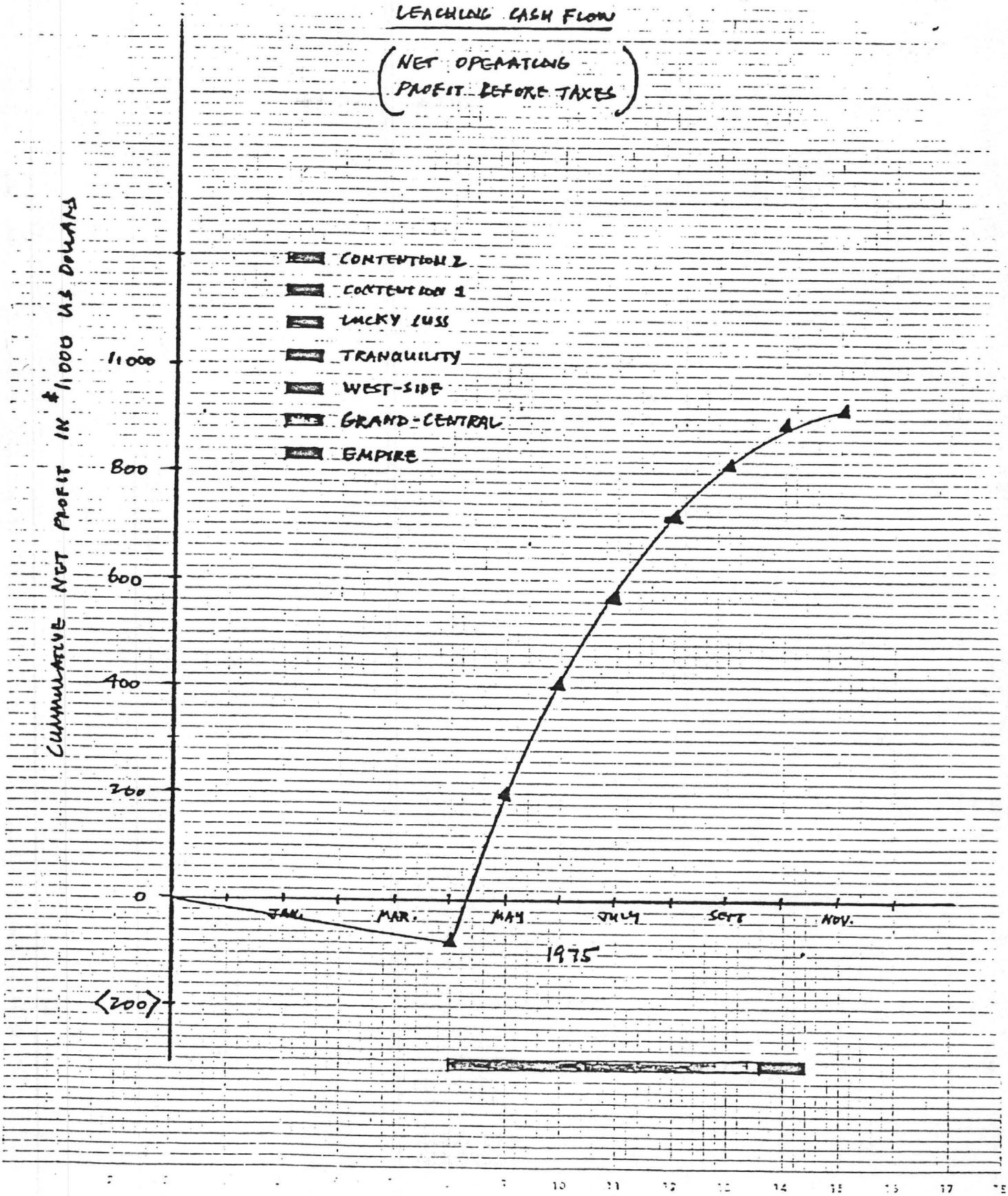
Sample size, pounds..... 250
Leaching time, days..... 2.0
Washing time, days..... 5.0
Average cyanide consumption, lbs/ton... 1.0
Average lime consumption, lbs/ton..... 1.5
Water usage, tons water/tons ore..... 0.6
Application rate, tons water/day/ton ore 0.1

Extrapolated leach time in days for production head, 50,000 tons/month mining rate, 200 gpm sprayrate..... 22

TOMBSTONE HEAP

LEACHING CASH FLOW

(NET OPERATING PROFIT BEFORE TAXES)



Barrel Tests 1-8 - Calc. recovery in 3 days

Test #	Pump	(1) Channel oz/ton Ag	(1) Channel oz/ton Au	(2) Calc. recovery oz/ton Ag	(2) Calc. recovery oz/ton Au	(3) Calc. % recovered Ag	(3) Calc. % recovered Au	(4) Calc. days for 100% R Ag	(4) Calc. days for 100% R Au
1	Tranquility	1.6	.05	.227	.0062	14.3	12.7	273	428
2	Empire	1.4	.04	.129	.0062	9.1	15.9	184	328
3	Tenderfoot	2.8	.03	.124	.0031	4.4	11.5	270	22
4	Contention	1.5	.04	.399	.0134	27.5	31.9	33	13
5	Little Joe	2.2	.05	.184	.0020	8.2	3.9	45	+∞
6	West-side	1.6	.02	.332	.0052	20.5	27.4	64	15
7	Grand Central	1.4	.03	.770	.0041	53.5	13.7	6	-∞
8	Lucky Cuss	3.4	.04	.504	.0102	15	26.2	61	35

(1) Calc. grade using RJH % Recovery & Calc. oz/ton recovered
i.e. grade Ag = oz/ton Ag recovered ÷ % Recovery Ag
" Au " Au " ÷ % " Au

(2) From test data, but may be low due to Ag & Au ppt' onto carbon, zinc dust, pipe & nails.

(3) Calc. by RJH lb/lb

(4) Calc. by RJH lb/lb using first order equation

BECHTEL

183 (0501) 1-6

TOMBSTONE HEAP LEACH TESTS 12/21/74 AMJ

SAMPLE WEIGHT: 250 LBS.
1 TROY OZ/SHORT TON = 3892 MG/250 LBS.

TEST	DUMP	NaCN USED #/TON	MG. LEACHED (17 HRS) SILVER	MG. LEACHED (17 HRS) GOLD	OZ/TON ORE SILVER	OZ/TON ORE GOLD	$/TON ORE 1/ SILVER	$/TON ORE 1/ GOLD
10	TRANQUILITY	0.07	1350.1	61.8	.347	.0159	1.56	2.94
11	EMPIRE	0.34	895.0	58.8	.230	.0151	1.04	2.79
12	TOUGHNUT	0.70	992.5	30.2	.255	.0078	1.15	1.44
13	CONTENTION 1	0.68	2039.3	92.2	.524	.0237	2.35	4.38
14	LITTLE JOE	0.38	1509.1	24.1	.388	.0062	1.74	1.15
15	WEST-SIDE	0.46	1726.0	51.2	.443	.0132	2.00	2.44
16	GRAND CENTRAL	0.08	2289.2	28.0	.588	.0072	2.65	1.33
17	LUCKY CUSS	0.57	1976.1	68.6	.508	.0176	2.28	3.26
18	EMERALD	0.80	1694.4	14.3	.435	.0037	1.96	.68
19	CONTENTION 2	0.32	3218.7	76.0	.827	.0195	3.72	3.61
	AVERAGE	0.44	—	—	.455	.0130	2.05	2.40

1/ BASED ON $4.50/TROY OZ. AG & $185/TR. OZ. AU

HEFLIN

HEFLIN STEEL SUPPLY CO.

HEFLIN - HARRINGTON

INDUSTRIAL PLASTICS INC.

STEEL 252-8941

1111 WEST MARICOPA FRWY.
P. O. BOX 1249
PHOENIX, ARIZONA 85001

PLASTICS 252-7616

#	Doré	Au	Au
1 # 20 1-9-75	17.22	.39	17.33
2 21	8.1	.19	7.91
3 22	17.50	.18	17.32
4 23	37.32	.05	37.27
5 24	5.75	.19	5.56
6 25	41.8	.02	41.78
7 26	23.08	1.1	21.98
8 27	4.83	.97	3.86
9 28	23.31	.36	22.95
10 29	22.34	.83	21.51
11 1-8-74 24	6.12		
12 25	49.12	.020	49.10
13 26	28.03		
14 27	6.24		
15 28	27.97		
16 29	28.15		

1-9-75

Heron Assay

Dump	Silver oz/ton C.S.	Silver oz/ton B.T.	Gold oz/ton C.S.	Gold oz/ton B.T
Tranquility	1.6	1.2	.05	.03
Empire	1.4	2.4	.04	.04
Tomahawk	2.8	1.1	.03	.02
Contention 1	1.5	1.1	.04	.03
Little Joe	2.2	1.4	.05	.02
West-side	1.6	3.7	.02	.04
Grand Central	1.4	1.3	.03	.04
Lucky Cuss	3.4	3.1	.04	.05
~~Contention 2~~		~~1.6~~		~~.03~~
Avg.	2.0	1.9	.044	.034

C.S. Channel sample

BT Bunsel test, Calc. Grad from Gold + Silver.

tests 10-19

CERTIFICATE OF ANALYSIS

Your Sample (S) Were Assayed With The Following Results

Description	Gold Ounces Per. Ton	Silver Ounces Per. Ton	% Lead	% Copper	% Zinc								
1st #30	.078	2.143		Silver thread									
" #31	.002	.485		Contact									
" #32	.017	.761		Prompter									
" #33	.034	5.105		Hershel									
" #34	0.111	16.881		Bob Ingersoll						#35 - Tribute			
" #37	.013	7.659		Vicuna						36 - Sulphuret			
" #38	.015	4.706		Defense									

15 JAN 75
DATE

CHARGES

CHEMIST

Doré	Au	Ag
20: 17.63	.40	17.23
21: 11.13	.25	10.78
22: 23.42	.15	23.27
23: 46.02	.06	45.96
24: 6.24	.19	6.05
25: 45.54	.02	45.34
26: 28.06	1.28	26.78
27: 5.81	1.13	4.68
28: 28.12	.43	27.69
29: 26.12	.90	25.22

1-8-75

12/18/74
[illegible]

TOMBSTONE BARREL
LEACH TEST 1-8

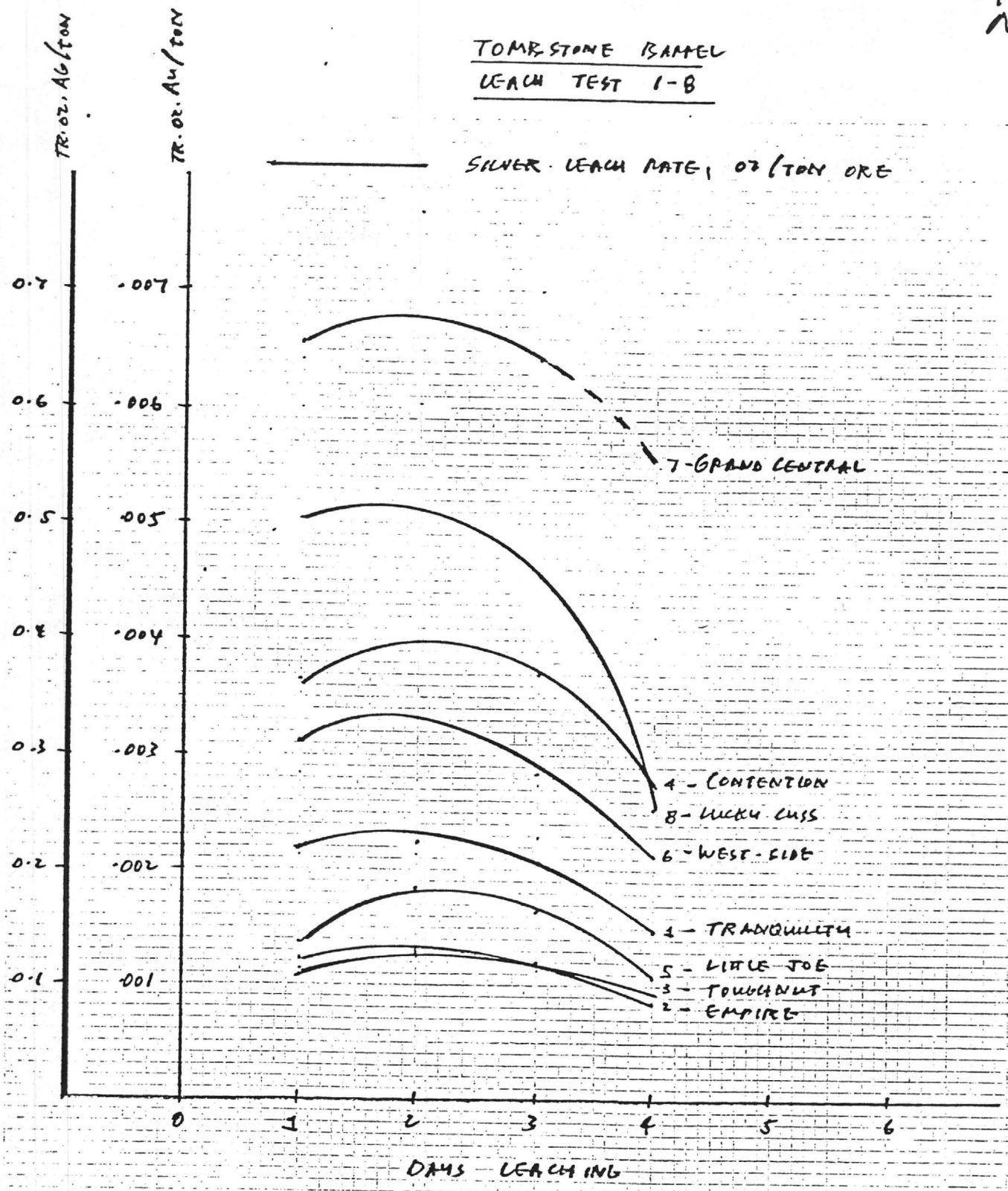


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FIG. 5

TOMBSTONE BARREL TESTS 10-19

BASED ON $4.50/oz. AG, $185/oz. AU

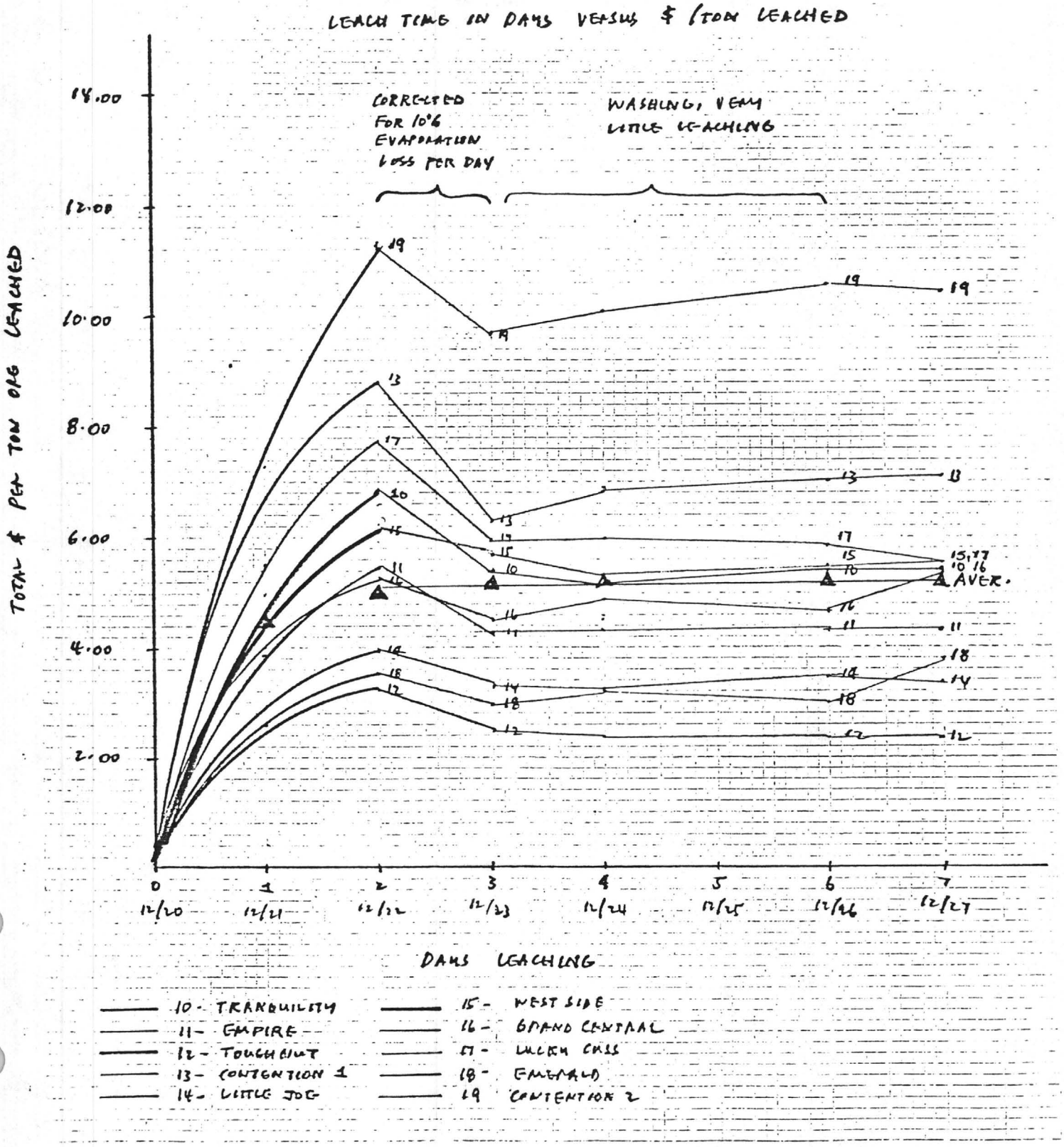
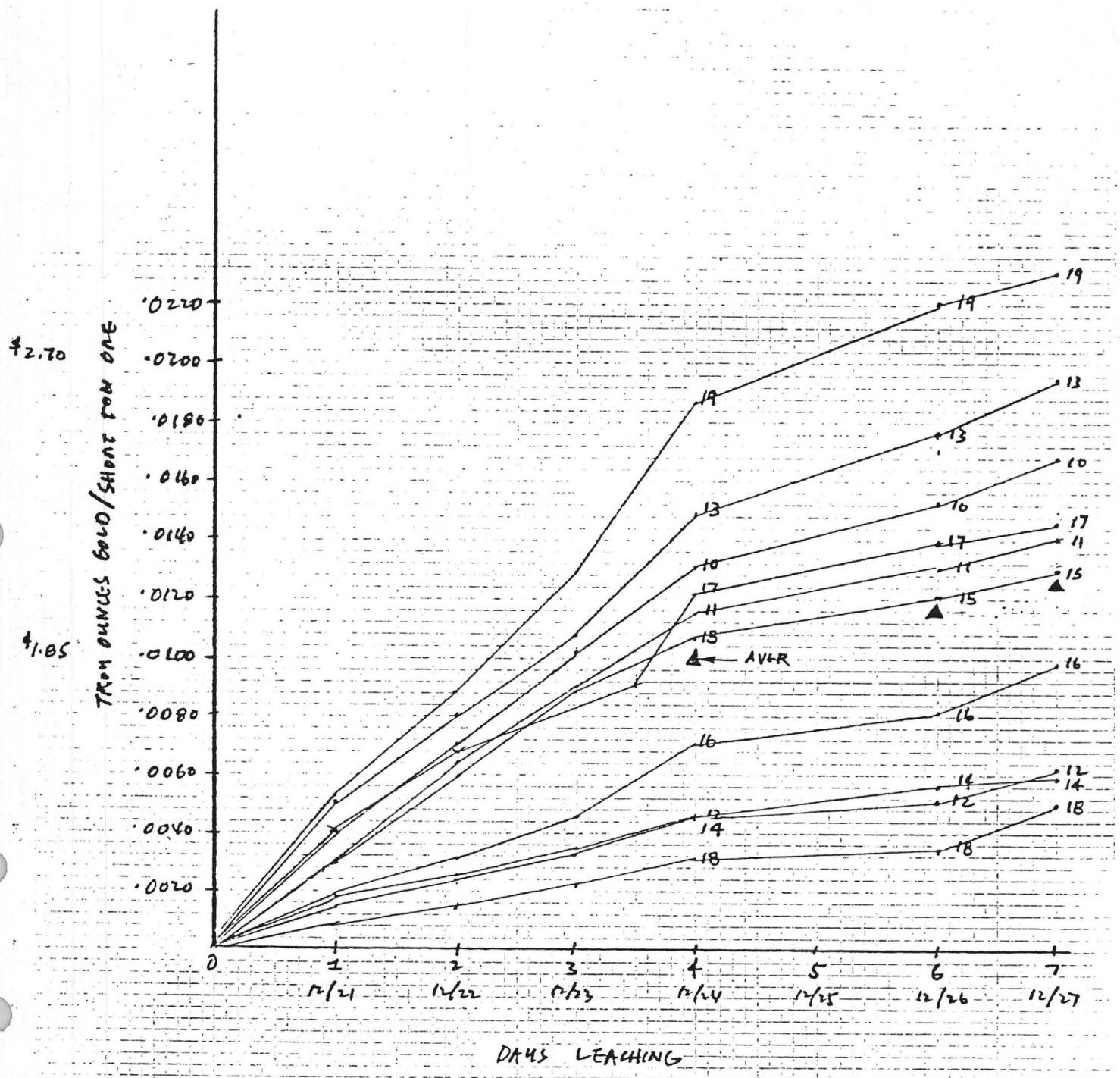


FIG. 1

TOMBSTONE BARREL TESTS 10-19

GOLD LEACHED[1/] IN TROY OUNCES/SHORT TON

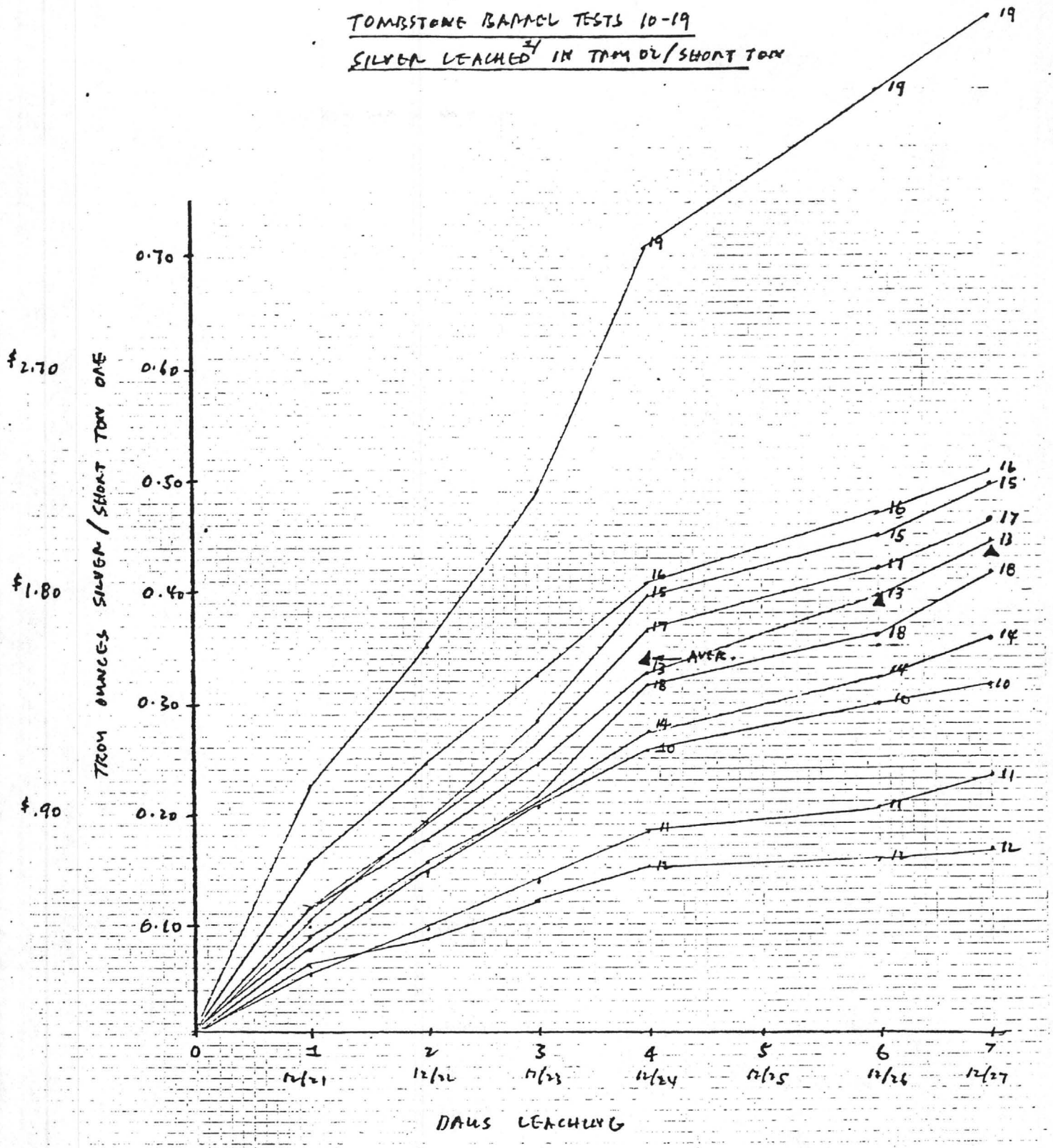


1/ FOR GOLD REMOVED ONLY, SEE FIG. 3, FOR GOLD IN TEST PLUS GOLD REMOVED, i.e. TOTAL GOLD LEACHED.

FIG. 2

TOMBSTONE BARREL TESTS 10-19

SILVER LEACHED 1/ IN TROY OZ/SHORT TON



1/ FOR SILVER REMOVED ONLY, SEE FIG. 4 FOR SILVER IN TEST. PLUS SILVER REMOVED, I.E. TOTAL SILVER LEACHED.

Au & Ag Recovery

Test No.	Sample	Days Leaching	Reagents Consumption Lime/Ton	Reagents Consumption NaCN/Ton	Recovery, Au oz/Ton	Recovery, Au $/Ton	Recovery, Ag oz/Ton	Recovery, Ag $/Ton	Total $/Ton
1									
2									
3									
4									
5									
6									
7									
8									
9									
10	Tranquility	7	1.53	1.504	.0177	3.27	.332	1.33	4.60
11	Empire	7	1.35	1.488	.0150	2.78	.243	.97	3.75
12	Toughnut	7	1.88	1.544	.0066	1.22	.231	.92	2.14
13	Contention 1	7	1.53	2.359	.0212	3.92	.490	1.96	5.88
14	Little Joe	7	1.70	1.504	.0062	1.15	.386	1.54	2.69
15	West Side	7	1.21	1.496	.0135	2.50	.513	2.05	4.55
16	Grand Central	7	1.53	1.504	.0103	1.90	.537	2.15	4.05
17	Lucky Cuss	7	1.70	1.512	.0156	2.89	.499	2.00	4.89
18	Emerald	7	1.70	2.576	.0054	1.00	.454	1.82	2.82
19	Contention 2	7	1.00	1.504	.0247	4.57	.977	3.91	8.48
20	Toughnut	1			.0090	.00	.39		
21	Little Joe	1			.0050		.21		
22	Emerald	1			.0030		.48		
23	Bunker Hill	1			.0015		1.21		
24	Comet	1			.0038		.12		
25	St. of Maine	1			*.0362		.81		
26	Boss	1			.0227		.10		
27	Flora Mou.	1			.0082		.51		
28	Old Guard	1			.0265		.76		
29	Contention 2	1			.0191		.69		

Computations based on:
54 % available CaO
$185/oz Au, $4/oz Ag

For tests 10-19, lime consumption ≃ lime added, no titration data available

Barrel Tests. Summary of Reagents Consumption and Au & Ag Recovery

Test No.	Sample	Days Leaching	Reagents Cons. lb Lime/ton ore	lb NaCN/ton ore	Recovery Au oz/T ore	$/T ore	Recovery Ag oz/T ore	$/T ore	Total $/T ore
30	Silver Thread	6	2.53	.976	.0136	2.52	.351	1.40	3.92
31	Contact	6	1.08	1.08	.0006	0.11	.057	0.23	0.34
32	Prompter	6	3.05	.997	.0020	0.37	.092	0.37	0.74
33	Hershel	6	3.27	1.40	.0050	0.92	.627	2.51	3.43
34	Bob Ingersol	6	3.01	1.35	.0124	2.29	2.141	8.56	10.85
35	Tribute	5	3.86	.944	.0033	0.61	.046	0.18	0.79
36	Sulpheret	5	3.99	.976	.0058	1.07	.026	0.10	1.17
37	Visina	6	3.05	.992	.0013	0.24	.847	3.39	3.63
38	Defense	6	2.52	1.496	.0017	0.31	.650	2.60	2.91
39	Tombstone Ext.	5	2.02	.984	nil	0	.009	0.04	0.04
40	Grand Dipper	5	2.70	.808	.0056	1.04	.141	0.56	1.60
41	Telephone	5	2.71	.837	.0002	0.04	.207	0.83	0.87
42	Silver Plume	5	2.95	.934	.0024	0.44	.261	1.04	1.48
43	Oregon	5	2.86	.998	.0004	0.07	.092	0.37	0.44
44	State of Maine	5	2.91	.978	.0002	0.04	.886	3.54	3.58
45	State of Maine underground	5	1.94	.952	nil	0	1.676	6.70	6.70
46	Tranquility	6	2.90	.968	.0128	2.37	.178	0.71	3.08
47	Tranquility	6	2.97	.968	.0119	2.20	.184	0.74	2.94
48	Contention	6	3.99	.984	.0152	2.81	.368	1.47	4.28
49	Contention	6	3.94	.984	.0150	2.78	.380	1.52	4.30
50	Lucky Cuss	6	3.01	.997	.0135	2.50	.453	1.81	4.31
51	Lucky Cuss	6	2.99	1.03	.0155	2.87	.463	1.85	4.72
52	Toughnut	5	3.94	.976	.0053	0.98	.244	0.98	1.96
53	Toughnut	5	3.94	.904	.0054	1.00	.212	0.85	1.85
54	Tombstone Ext.	5	2.93	.960	.0022	0.41	.123	0.49	0.90
55	Comet	5	2.97	.976	.0027	0.50	.101	0.40	0.90

Computations based on:
54% available CaO
$185/oz Au, $4/oz Ag

Test No.	SAMPLE	Days Leaching	Reagent Consumption			Au Recovery		Ag Recovery		Total
			lb lime per Tons	lb cyanide per ton	lb NaCN per Ton	oz/Tons	$/Tons	oz/Tons	$/Tons	$/Tons
56	Contention 1	8	4.52	0	1.40	.0098	1.81	.159	.64	2.45
57	Contention 1	8	0	2.10	1.42	.0073	1.35	.104	.42	1.77
58	Contention 2	8	3.58	0	1.38	.0190	3.52	.588	2.35	5.87
59	Contention 2	8	0	1.04	1.40	.0195	3.61	.573	2.29	5.90

TEST 10

TOMBSTONE HEAP LEACH

METALLURGICAL TESTS

Dump Location TRANQUILITY

Sample Weight, Lbs. 250

Total Days Leaching

December, 1974

Conducted by:

Approved by:

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	oz % rock Gold Recov.	% Silver Recov.
19	DEC-74	56.8	~~0~~	20,000	~~0~~	1.0							
20	DEC-74	30.0	56.8	2,000	0								
21	DEC-74	0	0	5000	5000		.824	1.792	.082	14.04	306.8	.0036	.079
22	DEC-74	0	0	5,000	5,000		.096 / .920	1.562	.083	14.21	267.5	.0036 / .0072	.069 / .148
23	DEC-74	0	0	7,000	5,000		.037 / .957	1.360	.072	12.33	232.8	.0031 / .0103	.060 / .208
24	DEC-74	0	30.0	10,000	7,242		.008 / .960	.807	.044	10.91	200.1	.0028 / .0131	.051 / .259
26	DEC-74	0	0	10,000	7,752		.416 / 1.376	.567	.035	9.29	150.5	.0024 / .0154	.038 / .297
27	DEC-74	0	0	10,000	7,600		.088 / 1.464	.327	.021	5.46	85.1	.0014 / .0168	.021 / .318
28	DEC-74	0	0	0	8,680		.040 / 1.504	.186	.012	3.567	55.29	.0009 / .0177	.014 / .332
Total Ave.		86.8	86.8	69,000	46,474								

1 / 2

1 - Daily
2 - Cumulative

TEST

TOMBSTONE DUMP LEACH

METALLURGICAL TESTS

Dump Location EMPIRE

Conducted by:

Sample Weight, Lbs. 250

December, 1974

Approved by:

Total Days Leaching

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
19	DEC. 74	56.8	Ø	20,000	Ø								
20	DEC-74	10.Ø	56.8	4000	Ø								
21	DEC-74	Ø	Ø	5000	5,000		.856	1.182	.078	13.356	203.42	.0034	.052
22	DEC-74	Ø	Ø	5,000	4,500		.080 / .936	1.130	.073	11.25	174.14	.0029 / .0063	.047 / .097
23	DEC-74	Ø	Ø	7,000	5,000		.024 / .960	.944	.059	10.10	161.64	.0026 / .0089	.042 / .139
24	DEC-74	10.Ø	30.Ø	10,000	7,242		.008 / .968	.662	.041	10.17	164.2	.0026 / .0115	.042 / .181
26	DEC-74	Ø	Ø	10,000	7,092		.384 / 1.352	.474	.028	6.80	115.1	.0017 / .0132	.029 / .210
27	DEC-74	Ø	Ø	10,000	7,400		.112 / 1.464	.330	.018	4.56	83.63	.0011 / .0143	.021 / [illegible]
28	DEC-74	Ø	Ø	Ø	8,350		.024 / 1.488	.166	.010	2.860	47.47	.0007 / .0150	.012 / .243
Total Ave.		76.8	86.8	69,000	44,784								

1 / 2

1 - Daily
2 - Cumulative

TEST 2

TOMBSTONE HEAP LEACH

METALLURGICAL TESTS

Dump Location TOUGHNUT

Conducted by:

Sample Weight, Lbs. 250

December, 1974

Approved by:

Total Days Leaching

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
19	DEC-74	56.8	~~0~~	20,000	~~0~~								
20	DEC-74	30.0	56.8	1,000	0								
21	DEC-74	0	0	5000	4800		.924	1.38	.042	6.90	236.30	.0018	.061
22	DEC-74	10.0	0	5,000	2,600		.048 / .976	1.127	.033	2.938	100.3	.0008 / .0026	.025 / .087
23	DEC-74	0	0	7,000	4,000		– / .976	.956	.028	3.836	130.9	.0010 / .0036	.034 / .121
24	DEC-74	10.0	30.0	10,000	6,942		– / .976	.689	.020	4.755	163.8	.0012 / .0048	.042 / .163
26	DEC-74	0	0	10,000	6,702		.460 / 1.416	.511	.014	3.213	117.3	.0008 / .0056	.030 / .193
27	DEC-74	0	0	10,000	7,240		.120 / 1.536	.346	.010	2.49	85.78	.0006 / .0062	.022 / .215
28	DEC-74	0	0	0	8,390		.008 / 1.540	.213	.005	1.437	61.20	.0004 / .0066	.016 / .231
Total Ave.		106.8	86.8	68,000	40,874								

1 / 2

1 - Daily
2 - Cumulative

TEST 3

TOMBSTONE DUMP LEACH

METALLURGICAL TESTS

Dump Location CONTENTION 1

Conducted by:

Sample Weight, Lbs. 250

December, 1974

Approved by:

Total Days Leaching

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
19	DEC 74	56.8	Ø	20,000	Ø								
20	DEC-74	30.Ø	56.8	3,000	Ø								
21	DEC-74	Ø	Ø	5,000	4,000		.944	2.59	.117	20.034	443.32	.0051	.114
22	DEC-74	Ø	30.Ø	5,000	3,000		.037 / .976	2.3085	.099	10.17	237.17	.0026 / .0071	.060 / .175
23	DEC-74	Ø	30.Ø	7,000	4,000		.488 / 1.464	1.929	.084	11.51	264.2	.0029 / .0107	.064 / .243
24	DEC-74	Ø	20.Ø	10,000	5,942		.437 / 1.896	1.622	.0715	14.55	330.1	.0037 / .0144	.085 / .328
26	DEC-74	Ø	Ø	10,000	6,952		.304 / 2.200	1.172	.051	12.14	279.0	.0031 / .0175	.072 / .400
27	DEC.-74	Ø	Ø	10,000	6,580		.175 / 2.375	.852	.035	7.88	193.11	.002 / .0195	.049 / .449
28	DEC-74	Ø	Ø	Ø	8,960		.034 / 2.359	.518	.021	6.444	158.9	.0017 / .0212	.041 / .490
Total Ave.		86.8	136.8	70,000	39.634								

1 / 2

1 - Daily
2 - Cumulative

TEST #

TOMBSTONE HEAP LEACH

METALLURGICAL TESTS

Dump Location LITTLE JOE

Conducted by: _____

Sample Weight, Lbs. #250

December, 1974

Total Days Leaching _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
19	DEC. 74	56.8	Ø	20,000	Ø								
20	DEC-74	30.Ø	56.8	2,000	Ø								
21	DEC-74	Ø	Ø	5000	5000		.376	2.003	.032	5.479	342.98	.0014	.085
22	DEC-74	Ø	Ø	5,000	4,000		.160 / .936	1.843	.029	3.973	252.47	.0010 / .0024	.065 / .153
23	DEC-74	Ø	Ø	7,000	4,000		.032 / .968	1.659	.028	3.836	227.3	.0009 / .0034	.058 / .211
24	DEC-74	10.Ø	30.Ø	10,000	5,642		– / .968	1.235	.019	3.671	238.6	.0009 / .0043	.061 / .272
26	DEC-74	Ø	Ø	10,000	6,752		.368 / 1.336	.873	.015	3.468	201.9	.0009 / .0052	.051 / .323
27	DEC-74	Ø	Ø	10,000	6,610		.144 / 1.480	.588	.010	2.264	133.1	.0006 / .0058	.034 / .357
28	DEC-74	Ø	Ø	Ø	8,660		.024 / 1.504	.377	.005	1.483	111.8	.0004 / .0062	.029 / .386
Total Ave.		96.8	86.8	69,000	40,864								

1 / 2

1 - Daily
2 - Cumulative

TEST # 15

TOMBSTONE DUMP LEACH

METALLURGICAL TESTS

Dump Location WEST SIDE

Sample Weight, Lbs. 2.50

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
19	DEC-74	56.8	Ø	20,000	Ø	1.0 / 1.0	~~0~~ / 0						
20	DEC.74	Ø	56.8	2,000	Ø	0 / 1.0	1.0 / 1.0			-			
21	DEC-74	Ø	Ø	5,000	5000	0 / 1.0	.880 / ~~1.0~~	↑	↑	↑	↑		
22	DEC-74	Ø	Ø	5,000	5,000	0 / 1.0	.056 / .936	2.29	.068	11.64	392.29	.003	.101
23	DEC-74	Ø	Ø	7,000	5,000	0 / 1.0	-024 / .960	2.088	.065	11.13	357.5	.0025 / .0059	.0919 / .193
								2.054	.064	10.96	351.7	.0028 / .0087	.090 / .283
24	DEC-74	15.Ø	30.Ø	10,000	7,842		— / .960	1.665	.025	6.71	447.2	.0017 / .0104	.115 / .398
26	DEC-74	Ø	Ø	10,000	6,902		.416 / 1.376	.892	.026	6.15	210.8	.0016 / .0120	.054 / .452
27	DEC-74	Ø	Ø	10,000	7,650		-096 / 1.472	.585	.015	3.93	153.	.0010 / .0130	.03[illegible] / .491
28	DEC-74	Ø	Ø	Ø	8,850		.024 / 1.496	.280	.007	2.122	84.86	.0005 / .0135	.022 / .513
Total Ave.		71.8	86.8	69,000	46,444								

1 / 2

1 - Daily
2 - Cumulative

TEST # 16

TOMBSTONE DUMP LEACH

METALLURGICAL TESTS

Dump Location GRAND CENTRAL

Sample Weight, Lbs. 250

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
19	DEC. 74	56.8	Ø	18,500	Ø	1.0 / 1.0	0 / 0						
20	DEC-74	30.Ø	56.8	1,000	Ø	.53 / 1.53	1.0 / 0						
21	DEC-74	Ø	Ø	5,000	5000		.824	3.428	.042	7.19	586.98	.0018	.1508
22	DEC-74	Ø	Ø	5,000	3,800		.104 / .928	2.819	.040	5.205	366.9	.0013 / .0031	.094 / .245
23	DEC-74	Ø	Ø	7,000	4,000		.032 / .960	2.359	.035	4.794	323.2	.0012 / .0043	.083 / .328
24	DEC-74	Ø	30.Ø	10,000	6,798		.960	1.316	.042	9.778	305.8	.0023 / .0068	.079 / .407
26	DEC-74	Ø	Ø	10,000	6,762		.424 / 1.384	1.022	.017	3.937	236.7	.0010 / .0078	.061 / .468
27	DEC-74	Ø	Ø	10,000	6,470		.104 / 1.488	.643	.035	7.76	153.6	.0020 / .0098	.0395 / .507
28	DEC-74	Ø	Ø	Ø	8,900		.016 / 1.504	.387	.006	1.829	117.9	.0005 / .0103	.0[illegible] / .537
Total Ave.		86.8	86.8	66.5	41,930								

1 / 2

1 - Daily
2 - Cumulative

TEST 17

TOMBSTONE DUMP LEACH

METALLURGICAL TESTS

Dump Location LUCKY CUSS

Sample Weight, Lbs. 250

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
19	DEC. 74	56.8	Ø	20,000	Ø			PRE-CONDITIONAL					
20	DEC-74	30.Ø	56.8	7,000	Ø			PRE-CONDITIONAL					
21	DEC-74	Ø	Ø	5000	5000		.972	2.623	.091	15.58	449.14	.0040	.115
22	DEC-74	Ø	Ø	5,000	3,250		.052 / .968	2.578	.085	9.461	286.9	.0024 / .0064	.074 / .189
23	DEC-74	Ø	Ø	7,000	4000		.068 / .976	2.114	.075	10.27	289.6	.0026 / .0090	.074 / .263
24	DEC-74	10.Ø	30.Ø	10,000	6,848		– / .976	1.483	.052	12.20	347.8	.0031 / .0121	.089 / .352
26	DEC-74	Ø	Ø	10,000	6,412		.424 / 1.000	1.117	.034	7.47	245.3	.0019 / .0140	.063 / .415
27	DEC-74	Ø	Ø	10,000	6,940		.048 / 1.088	.789	.008	1.90	188	.0005 / .0145	.048 / .463
28	DEC-74	Ø	Ø	Ø	8,650		.024 / 1.117	.479	.014	4.147	141.9	.0011 / .0156	.03 / .499
Total Ave.		96.8	86.8	69,000	41.300								

1	2

1 - Daily
2 - Cumulative

TEST # 18

TOMBSTONE DUMP LEACH

METALLURGICAL TESTS

Dump Location EMERALD

Sample Weight, Lbs. 250

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
19	DEC. 74	56.8	Ø	20,000	Ø								
20	DEC-74	30.Ø	56.8	4,000	Ø								
21	DEC-74	Ø	Ø	5,000	5000		.982	2.249	.019	3.25	385.1	.0008	.099
22	DEC-74	10.Ø	30.Ø	5,000	2,606		.040 / .992	2.003	.018	1.603	178.3	.0004 / .0012	.046 / .145
23	DEC-74	Ø	30.Ø	7,000	4,000		.488 / 1.880	1.927	.019	2.603	263.9	.0007 / .0019	.068 / .213
24	DEC-74	Ø	20.Ø	10,000	7,648		.336 / 1.816	1.533	.013	3.405	401.5	.0009 / .0028	.103 / .316
26	DEC-74	Ø	Ø	10,000	6,902		.488 / 1.304	.803	.009	2.127	189.8	.0005 / .0033	.049 / .365
27	DEC-74	Ø	Ø	10,000	8,250		.032 / 1.336	.727	.024	6.781	205.4	.0017 / .0050	.052 / .418
28	DEC-74	Ø	Ø	Ø	8,580		.024 / 1.576	.483	.005	1.469	141.9	.0004 / .0054	.03 / .454
Total Ave.		96.8	136.8	69,000	43.186								

1 / 2

1 - Daily
2 - Cumulative

TEST 19 1.9

TOMBSTONE HEAP LEACH

METALLURGICAL TESTS

Dump Location CONTENTION #II

Conducted by: _____

Sample Weight, Lbs. 250

December, 1974

Total Days Leaching _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
19	DEC. 74	56.8	Ø	18200	Ø								
20	DEC. 74	Ø	56.8	Ø	Ø								
21	DEC. 74	Ø	Ø	5000	5000		.876	5.164	.122	20.89	884.24	.0053	.227
22	DEC-74	Ø	Ø	5,000	3,000		.120 / .936	4.6465	.1325	13.613	477.58	.0034 / .0098	.123 / .350
23	DEC-74	Ø	Ø	7,000	4,000		.018 / .944	3.980	.113	15.48	545.2	.0040 / .0128	.140 / .490
24	DEC-74	Ø	30.Ø	10,000	8,848		— / .944	2.812	.074	22.42	852.1	.0058 / .0186	.219 / .709
26	DEC-74	Ø	Ø	10,000	7,512		.456 / 1.400	2.153	.056	14.41	553.88	.0037 / .0223	.142 / .851
27	DEC. 74	Ø	Ø	10,000	6,390		.088 / 1.488	1.198	.012	2.63	262.2	.0007 / .0230	.067 / .918
28	DEC-74	Ø	Ø	Ø	8,990		.016 / 1.504	.749	.021	6.465	230.6	.0017 / .0247	.05[illegible] / .977
Total Ave.		56.8	86.8	65.200	43,940								

1 / 2

1 - Daily
2 - Cumulative

BECHTEL

Barrel Test 10-19 Assayed Screen Analysis, Tailings

		+1½	+1"	+½	+¼	-¼	Calc. Tailing	oz/ton leached	Calc. head	% Recovery
CONTEMPLATION 1										
	wt %	6	4	13	17	60				
	Au	<.005	<.005	<.005	<.005	<.005	<.005	.0244	<.0244	83
TEST 19	Ag	0.72	2.76	0.62	0.78	1.16	1.063	.550	1.613	34
	wt x Au	—	—	—	—	—	—			
	wt x Ag	.0432	0.1104	.0806	.1326	.696	1.063			
	% Au	4	10	.8	13	65	100			
	% Ag	6	4	13	17	60	100			
CONTEMPLATION 2										
	wt %	8	4	18	28	42				
	Au	<.005	<.005	<.005	<.005	<.005	<.005	0.0245	<.031	95
TEST 19	Ag	.80	.82	1.54	4.58	0.92	2.043	1.140	3.183	36
	wt x Au	—	—	—	—	—	—			
	wt x Ag	.064	.0328	.2772	1.2824	.3864	2.043			
	% Au	8	4	18	28	42	100			
	% Ag	3	2	13	63	19	100			
TRANQUILITY										
	wt %	19	9	20	19	33				
	Au	<.005	<.005	<.005	<.005	<.005	<.005	0.020	.025	80
TEST 10	Ag	.68	.60	.56	1.50	0.74	.8244	0.370	1.1944	31
	wt x Au	—	—	—	—	—				
	wt x Ag	.1292	.054	.112	.285	0.2442	.8244			
	% Au	19	9	20	19	33	100			
	% Ag	16	7	13	34	30	100			
Grand Central										
	wt %	18	5	17	17	43				
TEST 16	Au	<.005	<.005	<.005	.15 *	<.005	.0297	.0103	.0400	25
	Ag	.30	.30	1.54	.35 *	.60	.649	0.60	1.245	48
	wt x Au									
	wt x Ag									
	% Au									
	% Ag									

BECHTEL

183 (0501) 1-

Barrel Tests 10-19, Combined Tailing

	+ 1½"	+ 1"	+ ½	+ ¼	− ¼	Calc. tailing	oz/ton leached	Calc. head	% Recovery
Little Joe									
wt%	11.0	5.0	15	18	51				
Au	<.005*	<.005	<.005	<.005	.030*	.0179	.0077	.0256	30
Ag	2.88*	.50	.54	.150	.30*	.603	0.44	1.043	42
wt x Au	.0006	.0003	.0008	.0009	.0153	.0179			
wt x Ag	.317	.025	.081	.027	.153	.603			
% Au	3	2	4	5	85	100			
% Ag	53	4	13	4	25	100			
West Side									
wt%	23	.9	22	17	29				
Au	<.005	<.005	.056*	<.005*	<.005	.0164	.0154	.0318	48
Ag	1.02	.82	1.14*	12.48*	1.32	3.06	0.57	3.63	16
wt x Au	.0012	.0005	.0123	.0009	.0015	.0164			
wt x Ag	.235	.024	.251	2.120	.383	3.063			
% Au	7	3	75	5	9	100			
% Ag	8	2	8	69	13	100			
Lucky Guss									
wt%	15	6	18	17	44				
Au	<.005	<.005	<.005	<.005	<.005*	<.0057	.0182	.0233	78
Ag	1.18	1.34	1.50	2.12	3.62*	2.480	0.56	3.04	18
wt x Au	.0008	.0003	.0009	.0009	.0022	.0051			
wt x Ag	.177	.080	.270	.360	1.593	2.480			
% Au	15	6	18	17	44				
% Ag	7	3	11	15	64				

* Aver. of duplicate assays

BECHTEL

183 (0501) 1-

Barrel Tests 10-19, Tailings

	+1 1/2	+1"	+1/2"	+1/4	-1/4	Calc. Tailing	Orthon Leached	Calc. Head	% Recovery
Emerald									
wt%	11	6	16	19	48				
Au	.005	.005	<.005	.01	.005	.0060	.0046	.0106	43
Ag	1.70	3.91	1.21	2.45	2.10	2.09	.47	2.56	18
wt x Au	.0006	.0003	.0008	.0019	.0024	.0060			
wt x Ag	.187	.235	.194	.466	1.008	2.09			
% Au	10	5	13	32	40				
% Ag	9	11	9	22	48				
Empire									
wt%	13	5	16	18	48				
Au	<.005	<.005	<.005	.040	.035	.0258	.0167	.0425	61
Ag	1.50	2.04	0.78	3.12	2.45	2.160	.27	2.43	11
wt x Au	.0007	.0003	.0008	.0032	.0168	.0258			
wt x Ag	.195	.102	.125	.562	1.176	2.160			
% Au	3	1	3	28	65	100			
% Ag	9	5	6	26	54	100			
Toughnut									
wt%	11.0	5.0	17.0	18.0	49				
Au	<.005	<.005	<.005	<.005	.010	.0076	.0070	.0146	48
Ag	1.42	1.16	.70	.54	.79	.818	0.25	1.068	23
wt x Au	.0006	.0003	.0009	.0009	.0049	.0076			
wt x Ag	.156	.058	.119	.097	.387	.818			
% Au	8	4	12	12	64	100			
% Ag	19	7	15	12	47	100			

BECHTEL

BARREL TESTS, 0-29
250# each

1/7/75 183.05011.1.6

Started: 11:00 am 1/6/75

1/7/74

TEST	DUMP	ASSAY, SOLN 10 AT Au	Ag	ℓ in test	Mb/each in 1 day Au	Ag	oz/ton in 1 day Au	Ag	% ton Au	Ag
20	Toughnut	.57	24.53	14	35.1	1512	.0090	.39	1.67	1.75
21	Little Joe	.38	17.86	15	19.52	917	.0050	.24	.93	1.06
22	Emerald	.18	28.62	19	11.71	1862	.0030	.48	.56	2.15
23	Bunker Hill	.08	64.00	22	6.03	4822	.0015	1.24	.29	5.58
24	Comet	.23	7.29	19	14.97	474	.0038	.12	.71	.55
25	St. of Maine	1.87	43.32	22	140.9	3264	.0362	.84	6.70	3.77
26	Boss	1.52	6.88	17	88.5	401	.0227	.10	4.21	.46
27	Flora Mow.	0.52	34.37	18	32.1	2119	.0082	.54	1.52	2.45
28	Old Guard	1.31	37.54	23	103.2	2957	.0265	.76	4.90	3.42
29	Cont. 2	1.36	49.12	16	74.5	2692	.0191	.69	3.54	3.11

Recalc.

Salt .002 Actual

#30 .53

TOMBSTONE HEAP LEACH

METALLURGICAL TESTS

Dump Location Silver Thread

Sample Weight, Lbs. _____

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Re[illegible].
13	1-75	113.5	0	15,000	0		.816 / .816						
14	1-75	0	56.75	2000	0		.104 / .920						
15	1-75	0	0	6000	5000	1.78	.040 / .960	2.143	.078	13.3562	366.95	.0034	.094
16	1-75	0	0	6000	5000	.13 / 1.91	.008 / .968	2.150	.083	14.2123	368.15	.0036 / .0070	.095 / .189
17	1-75	30.0	0	6000	5000	— / 1.91	.008 / .976	1.653	.068	11.6438	283.05	.0030 / .0100	.073 / .262
18	1-75	0	0	6000	4300	.57 / 2.46		.978	.044	6.4795	144.02	.0017 / .0087	.037 / .299
19	1-75	0	0	4,000	4,550	.07 / 2.53		.791	.031	4.8305	123.26	.0012 / .0099	.032 / .331
20	1-75	0	0		4220			.565	.019	2.7459	81.654	.0007 / .0106	.02[illegible] / [illegible]2
Total Ave.		143.50	56.75	45,000	28,070	2.86	0.36			53.3680	1367.08	.0137	.351

3.33 lb/T.N

1 / 2

1 - Daily
2 - Cumulative

@ 54% cured time

#31

TOMBSTONE DUMP LEACH

METALLURGICAL TESTS

Dump Location Contact

Sample Weight, Lbs. _____

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
13	1-75	113.5	0	10,000	0								
14	1-75	0	56.75	2000	0								
15	1-75	0	0	5000	2000	1.76	.824 / .824	.485	.020	0.1369	33.219	Nil	.008
16	1-75	0	0	5000	3200	.03 / 1.79	.140 / .964	.539	.010	0.1096	59.068	Nil	.015 / .023
17	1-75	0	0	5000	3800	.09 / 1.88	.056 / 1.02	.431	.010	1.3014	56.09	.0004 / .0004	.014 / .037
18	1-75	0	0	5000	3500	.06 / 1.94	.048 / 1.07	.294	.005	0.5993	35.24	.0002 / .0006	.009 / .046
19	1-75	0	0	4,000	3260	.03 / 1.97	.016 / 1.08	.215	TR	Nil	27.685	Nil / .0006	.007 / .053
20	1-75	—	—	—	3450			.141	TR	Nil	16.659	Nil / .0006	.004 / .057
Total Ave.										2.1478	227.96		

1 / 2

1 - Daily
2 - Cumulative

32

TOMBSTONE [illegible]AP LEACH

METALLURGICAL TESTS

Dump Location Prompter

Sample Weight, Lbs. _____

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Re[illegible]v.
13	1-75	113.5	Ø	13,500	Ø		.952 / .952						
14	1-75	Ø	56.75	2000	Ø		.024 / .976						
15	1-75	Ø	Ø	5000	2500	1.98	.008 / .984	.761	.017	1.4555	65.154	.0004	.017
16	1-75	30.0	Ø	5000	3000	.01 / 1.99	.008 / .992	.740	.017	1.7466	76.027	.0004 / .0008	.020 / .037
17	1-75	30.0	Ø	5000	4000	.53 / 2.52		.658	.014	1.9178	90.137	.0005 / .0013	.023 / .060
18	1-75	Ø	Ø	5000	2600	.46 / 2.98		.442	.009	0.8014	39.356	.0002 / .0015	.010 / .070
19	1-75	Ø	Ø	4,000	3490	.07 / 3.05	.008 / .992	.402	.010	1.1952	48.047	.0003 / .0018	.012 / .082
20	1-75	—	—	—	3750			.309	.006	0.7705	39.683	.0002 / .0020	.019 / [illegible]
		173.5											
Total Ave.										7.8870	358.40		

1 / 2

1 - Daily
2 - Cumulative

33

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location Hershel ~~Stope Fire~~

Conducted by: _____

Sample Weight, Lbs. _____

December, 1974

Approved by: _____

Total Days Leaching _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
13	1-75	113.5	0	15,000	0		.896 / .896						
14	1-75	56.75	56.75	2,000	0		.048 / .944						
15	1-75	0	0	5000	3000	.287	.024 / .968	5.105	.034	3.4932	524.486	.0009	.133
16	1-75	0	0	5000	2900	.07 / 2.94	.016 / .984	4.994	.047	4.6678	495.979	.0012 / .0021	.122 / .260
17	1-75	0	0	5000	3900	.03 / 2.97	.416 / 1.40	4.170	.038	5.0753	556.952	.0013 / .0034	.143 / .403
18	1-75	30.0	30.0	5000	2800	.03 / 3.00		2.845	.025	2.3973	272.808	.0006 / .0040	.070 / .473
19	1-75	0	0	4,000	3170	.27 / 3.27		2.819	.027	2.9312	306.035	.0007 / .0047	.079 / .552
20	1-75	—	—	—	3770			2.270	.012	1.5493	293.079	.0003 / .0050	.075 / [illegible]
Total Ave.		200.25	86.75							20.1141	449.357	.0052	.124

1 / 2

1 - Daily
2 - Cumulative

34

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location Bob. Ingersol

Conducted by: _____

Sample Weight, Lbs. _____

December, 1974

Approved by: _____

Total Days Leaching _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
13	1-75	113.5	0	14,500	0								
14	1-75	56.75	56.75	2,000	0								
15	1-75	0	0	6000	4600	2.96	.936 / .936	16.881	.111	17.4863	2659.336	.0045	.623
16	1-75	30.0	0	4000	3100	.03 / 2.99	.040 / .974	13.057	.086	9.1301	1386.188	.0023 / .0068	.356 / 1.039
17	1-75	30.0	0	6000	3900	.53 / 3.57	0 / .974	11.827	.030	4.0068	1579.634	.0010 / .0078	.406 / 1.445
18	1-75	0	30.0	5000	3800	.46 / 3.98	.008 / .984	7.834	.052	6.7671	1019.493	.0017 / .0095	.262 / 1.707
19	1-75	0	0	4000	3550	.03 / 4.01	.368 / 1.352	7.603	.050	6.0788	924.337	.0016 / .0111	.237 / 1.944
20	1-75	—	—	—	3760			5.956	.038	4.8932	766.937	.0013 / .0124	.197 / 2.141
Total Ave.		230.25								48.3623	8335.925		2.142

1 / 2

1 - Daily
2 - Cumulative

#35

Tribute

~~Tribute~~

TOMBSTONE ... LEACH

METALLURGICAL TESTS

Dump Location ~~Sylvester~~

Conducted by: _____

Sample Weight, Lbs. _____

December, 1974

Total Days Leaching _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption: Lime #/Ton Ore	Reagent Consumption: NaCN #/Ton Ore	Solution Assays: Silver Oz/Ton	Solution Assays: Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
13	1-75	113.5	-0-	15,000	-0-								
14	1-75	56.75	-0-	2,000	-0-								
15	1-75	56.75	56.75	2,000	-0-								
16	1-75	-0-	-0-	5000	4350	3.70	.792	.322	.030	4.464	47.969	.0011	.012
17	1-75	-0-	-0-	6000	3800	.06 / 3.76	.072 / .864	.325	.027	3.5137	42.2945	.0009 / .0020	.011 / .023
18	1-75	-0-	-0-	5000	4050	.04 / 3.80	.040 / .904	.268	.018	2.4966	37.171	.0006 / .0026	.009 / .032
19	1-75	-0-	-0-	4000	3250	.06 / 3.86	.040 / .944	.242	.015	1.9264	31.721	.0005 / .0031	.008 / .040
20	1-75	—	—	—	3350			.207	.009	1.0325	23.748	.0002 / .0033	.006 / [illegible]
Total Cum.		127.0								13.4382	182.903	.0033	.047

1 / 2

1 - Daily
2 - Cumulative

#36

TOMBSTONE LEACH

METALLURGICAL TESTS

Dump Location Sulphuret

Conducted by:

December, 1974

Sample Weight, Lbs.

Approved by:

Total Days Leaching

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
13	1-75	113.5	0	15,000	0								
14	1-75	56.75	0	3,000	0								
15	1-75	56.75	56.75	2,000	0								
16	1-75	0	0	5000	2,000	3.89	.896	.227	.056	3.8356	15.548	.0010	.004
17	1-75	0	0	6000	4100	– / 3.87	0 / .896	.217	.055	7.7226	30.469	.0020 / .0030	.008 / .012
18	1-75	0	0	5000	3850	.06 / 3.95	.048 / .944	.153	.036	4.7466	20.173	.0012 / .0042	.005 / .017
19	1-75	0	0	4000	3680	.04 / 3.99	.032 / .976	.142	.033	4.1589	17.896	.0010 / .0052	.005 / .022
20	1-75	—	—	—	3600			.111	.021	2.5890	13.685	.0006 / .0058	.004 / .026
Total Ave.										23.0527	97.771	.0059	.025

1 / 2

1 - Daily
2 - Cumulative

#37

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location Visina

Conducted by:

Sample Weight, Lbs.

December, 1974

Approved by:

Total Days Leaching

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
13	1-75	113.5	0	15,000	0								
14	1-75	0	56.75	2,000	0								
15	1-75	0	0	5,000	3500	1.85	.904 / .904	7.659	.013	1.5582	918.03	.0004	.236
16	1-75	30.0	0	5000	2350	.13 / 1.98	.044 / .968	6.524	.011	0.8853	525.05	.0002 / .0006	.135 / .371
17	1-75	30.0	0	6000	4700	.52 / 2.50	— / .968	5.233	.009	1.4486	842.298	.0004 / .0010	.216 / .587
18	1-75	0	0	5000	2900	.40 / 2.90	.024 / .992	3.475	.006	0.5959	345.120	.0001 / .0011	.088 / .676
19	1-75	0	0	4000	3350	.15 / 3.05	— / .992	2.802	.004	0.4589	321.462	.0001 / .0012	.083 / .759
20	1-75	—	—	—	4672			2.142	.002	0.3200	342.72	.0001 / .0013	.088 / [illegible]
Total Ave.										5.2669	3294.68	.0014	

1 / 2

1 - Daily
2 - Cumulative

38

TOMBSTONE ... LEACH

METALLURGICAL TESTS

Dump Location Defense

Conducted by:

Sample Weight, Lbs.

December, 1974

Approved by:

Total Days Leaching

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Reco
13	1-75	113.5	0	13,000	0								
14	1-75	0	56.75	2,000	0								
15	1-75	0	0	6,000	5,000	1.79	.808	4.706	.015	2.5685	805.82	.0006	.207
16	1-75	30.0	30.0	5000	4350	.15 / 1.94	.120 / .928	3.917	.012	1.7877	583.53	.0004 / .0010	.150 / .357
17	1-75	0	0	6000	4350	.40 / 2.34	.360 / 1.288	3.207	.011	1.6387	477.76	.0004 / .0014	.123 / .480
18	1-75	0	0	5000	4500	.12 / 2.46	.112 / 1.40	1.959	.006	0.9247	301.90	.0002 / .0016	.078 / .558
19	1-75	0	0	4000	4,000	.06 / 2.52	.096 / 1.496	1.511	.004	0.5479	206.986	.0001 / .0017	.053 / .611
20	1-75	—	—	—	4042			1.105	.001	0.1384	152.959	Nil / .0017	.039 / [illegible]
Total Ave.										7.6059	2528.955	.0020	.650

1 / 2

1 - Daily
2 - Cumulative

#39 Tomb. Extension

TOMBSTONE LEACH

METALLURGICAL TESTS

Dump Location Tombstone Extension

Conducted by: _____

Sample Weight, Lbs. 250 Dry

December, 1974

Approved by: _____

Total Days Leaching _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
20	1-75	113.5	Ø	29,000	Ø								
21	1-75	Ø	1400 Hrs 56.75	10,000	Ø								
22	1-75	Ø	Ø	Ø	3670		–	.062	TR	Nil	7.792	Nil	.002
23	1-75	Ø	Ø	3000	2590	1.76	.848 / .848	.118	.001	.0887	10.466	Nil	.003 / .005
24	1-75	Ø	Ø	3000	3270	.24 / 2.00	.136 / .984	.048	.001	.1120	5.735	Nil	.001 / .006
25	1-75	Ø	Ø	7700	1760			.074	.001	.0602	4.460	Nil	.001 / .007
26	1-75	—	—	—	2900			.092	.001	.0993	9.137	Nil	.002 / .009
Total Ave.										.3602	37.590	nil	.010

1 / 2

1 - Daily
2 - Cumulative

#40 Ground Dipper

TOMBSTONE ... LEACH

METALLURGICAL TESTS

Dump Location _____

Conducted by: _____

Sample Weight, Lbs. 250 Dry

December, 1974

Total Days Leaching _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Rec
20	1-75	113.5	~~0~~	15,000	~~0~~								
21	1-75	56.75	1400 56.75	~~0~~	~~0~~								
22	1-75	~~0~~	~~0~~	7000	6760		–	.695	.034	7.8712	160.434	.0020	.041
23	1-75	~~0~~	~~0~~	6000	5790	2.67 / 2.67	.688 / .688	.705	.026	5.1555	139.793	.0013 / .0033	.036 / .077
24	1-75	~~0~~	~~0~~	5,000	4730	.07 / 2.70	.120 / .808	.507	.017	5.6647	168.942	.0014 / .0047	.043 / .120
25	1-75	~~0~~	~~0~~	6000	3840			.345	.014	1.8411	45.370	.0005 / .0052	.011 / .131
26	1-75	—	—	—	5500			.211	.008	1.5069	39.743	.0004 / .0056	.010 / .141
Total Ave.										22.0394	554.282	.0057	.142

1 / 2

1 - Daily
2 - Cumulative

41 Telephone

TOMBSTONE HEAP LEACH

METALLURGICAL TESTS

Conducted by: _____

Dump Location _____

December, 1974

Approved by: _____

Sample Weight, Lbs. 250 Dry

Total Days Leaching _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
20	1-75	113.5	Ø	15,000	Ø								
21	1-75	56.75	1400 56.75	Ø	Ø								
22	1-75	Ø	Ø	6000	3440	—	.816 .816	1.527	.002	0.2356	179.893	.00006	.046
23	1-75	Ø	Ø	5000	5,000	2.68	.016 .832	1.142	.001	0.1712	195.548	.00004 .0001	.050 .096
24	1-75	Ø	Ø	5.000	8000	.03 2.71	— .832	.911	.001	0.2740	249.589	.00007 .00017	.064 .160
25	1-75	Ø	Ø	6000	3950			.725	.001	0.1353	98.074	.00003 .0002	.025 .185
26	1-75	—	—	—	4850			.509	TR	—	84.543	Nil .0002	.022 .207
Total Ave.										.8161	807.647	.0002	.208

1 - Daily
2 - Cumulative

42 Silver Plume

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location _____

Conducted by: _____

Sample Weight, Lbs. 250 Dry

December, 1974

Approved by: _____

Total Days Leaching _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
20	1-75	113.5	0	16,000	0								
21	1-75	56.75	56.75	3,000	0								
22	1-75	0	0	6000	5150	– / –	– / –	1.393	.016	2.8219	245.683	.0007	.063
23	1-75	0	0	6,000	5700	2.9 / 2.9	90 / 90	1.223	.010	1.9521	238.736	.0005 / .0012	.061 / .124
24	1-75	30	0	5.000	9700	.03 / .95	.03 / .936	1.064	.010	3.3219	353.452	.0008 / .0020	.091 / .215
25	1-75	0	0	6000	3310			.770	.008	0.9068	87.284	.0002 / .0022	.022 / .237
26	1-75	—	—	—	4200			.655	.006	0.8630	94.212	.0002 / .0024	.024 / .261
Total Ave.										9.8657	1019.367	0025	262

1	2

1 - Daily
2 - Cumulative

43 MCE66Q

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location _____

Sample Weight, Lbs. 250 Dry

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
20	1-75	113.5	-0-	15,000	-0-								
21	1-75	56.75	1400 56.75	-0-	-0-								
22	1-75	-0-	-0-	6000	3200	—	.9w / .9w	.503	.003	0.3288	55.123	.0001	.014
23	1-75	∅	∅	7000	6946	2.70	— / .9w	.449	.003	0.7136	106.807	.0002 / .0003	.027 / .041
24	1-75	∅	∅	5000	11860	.16 / 2.86	.008 / .9w	.330	.001	0.4062	134.034	.0001 / .0004	.034 / .075
25	1-75	-0-	-0-	6000	4150			.249	Tr	Nil	35.388	Nil / .0004	.009 / .084
26	1-75	—	—	—	4856			.197	.001	0.1661	32.721	Nil / .0004	.008 / .092
Total Ave.										1.6147	364.074	/	.094

1	2

1 - Daily
2 - Cumulative

44 Tate of Maine Run

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location _____

Sample Weight, Lbs. 250 DRY

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
20	1-75	113.5	Ø	16,000	Ø								
21	1-75	56.75	1400 56.75	7,000	Ø								
22	1-75	Ø	Ø	7000	7150	2.52	.597	4.096	.001	0.2449	1002.959	.0001	.258
23	1-75	Ø	Ø	8000	5,800	.10 / 2.66	.786 / .872	3.710	.001	0.1986	736.918	.0001 / .0002	.189 / .447
24	1-75	Ø	Ø	5000	7680	.75 / 2.91	.052 / .927	3.1695	.0005	0.1315	833.622	Nil / .0002	.214 / .661
25	1-75	Ø	Ø	14,000	3480			2.236	Tr	Nil	266.482	Nil / .0002	.068 / .729
26	1-75	—	—	—	12,600			1.412	Tr	Nil	609.288	Nil / .0002	.157 / .886
Total Ave.										.5750	3449.269	.0001	/

1 / 2

1 - Daily
2 - Cumulative

#45 State of Maine underground

TOMBSTONE ... LEACH

METALLURGICAL TESTS

Dump Location _____

Sample Weight, Lbs. 250 Dry

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
20	1-75	113.5	ø	21,000	ø								
21	1-75	ø	1400 56.75	8,000	ø								
22	1-75	ø	ø	8000	8460	1.90	.872	7.474	TR	Nil	2165.412	Nil	.556
23	1-75	ø	ø	8000	7300	.03 / 1.93	.072 / .944	6.3715	.0005	0.1250	1592.875	Nil	.409 / .965
24	1-75	30	ø	5000	12710	.01 / 1.94	.008 / .952	3.392	TR	Nil	1476.449	Nil	.379 / 1.344
25	1-75	ø	ø	15,000	3820			3.598	TR	Nil	470.70	Nil	.121 / 1.465
26	1-75	—	—	—	11,000			2.181	TR	Nil	821.610	Nil	.211 / 1.676
Total Ave.										.1250	6527.045	nil	1.677

1 / 2

1 - Daily
2 - Cumulative

TOMBSTONE ... LEACH

METALLURGICAL TESTS

Dump Location *Tranquility*

Sample Weight, Lbs. *250 Dry*

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
29	1-75	113.5	~~0~~	16,000	~~0~~								
30	1-75	56.75	56.75	1000	~~0~~								
31	1-75	~~0~~	~~0~~	7000	5260	2.61	.720	1.527	.089	16.0319	275.07	.0041	.070
1	2-75	~~0~~	~~0~~	6000	5772	.10 / 2.71	.136 / .856	.949	.068	13.4416	187.59	.0035 / .0076	.050 / .120
2	2-75	~~0~~	~~0~~	6000	5210	.14 / 2.89	.088 / .944	.559	.043	7.6722	99.382	.0020 / .0096	.026 / .146
3	2-75	~~0~~	~~0~~	7000	4675	.01 / 2.90	.004 / .968	.376	.032	5.1233	60.1986	.0013 / .0109	.015 / .161
4	2-75	~~0~~	~~0~~	6000	10,270	— / 2.90	— / .968	.148	.015	5.2757	52.054	.0014 / .0123	.013 / .174
5	2-75	~~0~~	~~0~~	~~0~~	5410			.104	.012	2.2232	19.268	.0005 / .0128	.004 / .1[illegible]
Total Ave.										49.7679	693.543	/	/

1 / 2

1 - Daily
2 - Cumulative

TOMBSTONE LEACH

METALLURGICAL TESTS

Dump Location Contention

Sample Weight, Lbs. 250 Dry

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
29	1-75	113.5	Ø	21,000	Ø								
30	1-75	56.75	56.75	4,000	Ø								
31	1-75	Ø	Ø	11,000	9760	– / –	.808	1.961	.071	23.7315	655.458	.0061	.168
1	2-75	Ø	Ø	9000	8220	2.67	.088 / .896	1.143	.050	14.0753	321.762	.0036 / .0097	.083 / .251
2	2-75	56.75	Ø	6000	5850	.33 / 3.00	.080 / .976	.882	.040	8.0136	176.702	.0021 / .0118	.045 / .296
3	2-75	Ø	Ø	5000	5000	.98 / 3.98	– / .976	.231	.035	5.9932	125.171	.0015 / .0133	.032 / .328
4	2-75	Ø	Ø	6000	4100	.01 / 3.99	.008 / .984	.569	.028	3.9315	79.894	.0010 / .0143	.021 / .349
5	2-75	Ø	Ø	–	5000			.439	.022	3.7671	75.171	.0009 / .0152	.019 / .368
Total Ave.										59.5177	1434.158	.0153	1

1	2

1 - Daily
2 - Cumulative

49

TOMBSTONE ... LEACH

METALLURGICAL TESTS

Dump Location Contention

Sample Weight, Lbs. 250 DRY

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
29	1-75	113.5	ø	21,000	ø								
30	1-75	56.75	56.75	2,000	ø								
31	1-75	ø	ø	8000	6550	2.47	.872	2.013	.076	17.0479	451.546	.0044	.116
1	2-75	ø	ø	8000	7150	.42 / 2.89	.056 / .928	1.610	.065	15.9161	394.229	.0041 / .0085	.101 / .217
2	2-75	56.75	ø	6000	6250	.10 / 2.99	.056 / .984	1.195	.047	10.0599	255.779	.0026 / .0133	.066 / .283
3	2-75	ø	ø	6000	5170	.94 / 3.93	– / .984	1.007	.041	7.2592	178.294	.0019 / .0130	.046 / .329
4	2-75	ø	ø	6000	4580	.01 / 3.94	– / .984	.729	.029	4.5486	114.343	.0011 / .0141	.029 / .358
5	2-75	ø	ø	–	4220			.585	.023	3.3323	84.544	.0009 / .0150	.022 / [illegible]
Total Ave.										58.1140	1478.735	.0149	

1 / 2

1 - Daily
2 - Cumulative

50

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location Lucky Cuss

Sample Weight, Lbs. 250 Dry

Total Days Leaching

December, 1974

Conducted by:

Approved by:

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
29	1-75	113.5	ø	17,000	ø								
30	1-75	56.75	56.75	2,000	ø								
31	1-75	ø	ø	6,000	4400	2.73	.840	3.368	0.101	15.2192	507.507	.0039	.130
1	2-75	ø	ø	6000	4470	.21 / 2.94	.117 / .957	2.687	.082	12.5527	411.332	.0032 / .0071	.106 / .236
2	2-75	ø	ø	6000	4250	.01 / 2.95	.008 / .960	1.960	.058	8.4417	285.273	.0021 / .0092	.073 / .309
3	2-75	ø	ø	6000	5530	.06 / 3.01	.037 / .997	1.553	.047	8.9010	294.113	.0023 / .0115	.076 / .385
4	2-75	ø	ø	6000	4710	— / 3.01	— / .997	1.023	.030	4.8390	165.011	.0012 / .0127	.042 / .427
5	2-75	ø	ø	—	4350			.927	.023	3.4263	100.830	.0008 / .0135	.026 / [illegible]
Total Ave.										53.3799	1764.066	.0137	1

1 / 2

1 - Daily
2 - Cumulative

51

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location Lucky Cuss

Sample Weight, Lbs. 250 Dry

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
29	1-75	113.5	ø	17,000	ø								
30	1-75	56.75	56.75	1,000	ø								
31	1-75	ø	ø	10,000	8620	2.80	.776	2.205	.073	21.5500	650.928	.0055	.167
1	2-75	ø	ø	10,000	9050	.06 / 2.86	.144 / .920	1.548	.052	16.1164	479.774	.0041 / .0096	.123 / .290
2	2-75	ø	ø	6000	8350	.01 / 2.87	— / .920	1.093	.035	10.0085	312.553	.0026 / .0122	.080 / .370
3	2-75	ø	ø	6000	4400	.117 / 2.99	.117 / 1.03	.946	.031	4.6712	142.548	.0012 / .0134	.037 / .407
4	2-75	ø	ø	6000	6360	— / 2.99	— / 1.03	.610	.021	4.5740	132.863	.0012 / .0146	.034 / .441
5	2-75	ø	ø	—	5250			.431	.013	3.3476	84.821	.0009 / .0155	.022 / [illegible]
Total Ave.										60.2677	1803.533	/	/

1 / 2

1 - Daily
2 - Cumulative

52

TOMBSTONE ... LEACH

METALLURGICAL TESTS

Dump Location Toughnut

Sample Weight, Lbs. 250 Dry

Total Days Leaching

December, 1974

Conducted by:

Approved by:

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
29	1-75	113.5	-0-	15,000	-0-								
30	1-75	56.75	56.75	-0-	-0-								
31	1-75	-0-	-0-	6000	4780	2.72	.760	2.088	.044	7.2027	341.803	.0018	.088
1	2-75	-0-	-0-	6000	4580	.10 / 2.82	.096 / .856	1.575	.034	5.3329	247.038	.0014 / .0032	.063 / .151
2	2-75	56.75	-0-	5000	4500	.169 / 2.99	.120 / .976	1.182	.030	4.6232	182.152	.0012 / .0044	.047 / .198
3	2-75	-0-	-0-	6000	3000	.95 / 3.94	— / .976	.831	.017	1.7466	85.377	.0004 / .0048	.022 / .220
4	2-75	-0-	-0-	6000	5250	— / 3.94	— / .976	.520	.011	1.9777	93.493	.0005 / .0053	.024 / .244
Total Ave.										20.8831	949.868	0.054	—

1 / 2

1 - Daily
2 - Cumulative

37

TOMBSTONE LEACH

METALLURGICAL TESTS

Dump Location Contention 2-B

Sample Weight, Lbs. 250 lbs

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS ~~CaO~~ Caustic Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
20	3/75	pH 10-11	~~0~~	15,000	~~0~~								
21	3/75	30.0	~~0~~	1,000	~~0~~								
24	3/75	30.0	56.75	8000	6152			2.90	.069	14.5372	610.99	.0037	.157
		~~0~~	~~0~~	↓	↓	.418	.656	↓	↓	↓	↓		
		~~0~~	~~0~~	7500	6510	.53 / 1.02	.184 / .840	2.468	.083	18.5044	550.23	.0047 / .0085	.141 / .298
		~~0~~	~~0~~	7000	5710	– / 1.04	.076 / .916	1.804	.067	13.1017	352.77	.0034 / .0119	.091 / .389
		~~0~~	~~0~~	8000	5620	– / 1.04	.024 / .940	1.229	.049	9.4308	236.54	.0024 / .0143	.061 / .449
1	4/75	~~0~~	~~0~~	8000	6770	– / 1.04	.016 / .956	.882	.033	7.6510	197.54	.0020 / .0163	.051 / 1.500
2		~~0~~	~~0~~	7000	6460	– / 1.04	.008 / .964	.571	.028	6.1945	126.32	.0016 / .0179	.032 / .532
3		~~0~~	30	8000	5810	.02 / 1.04	– / .964	.368	.018	3.5815	73.22	.0009 / .0188	.019 / .551
4					6810	– / 1.04	.432 / 1.396	.373	.013	3.0319	86.99	.0008 / .0196	.022 / .573
Total Ave.		60 +	86.75	6950	49,842					76.0379	2234.60	.0195	.574

1 / 2

1 - Daily
2 - Cumulative

02 = 3.60
.6 = 2.40
6.00

53

TOMBSTONE LEACH

METALLURGICAL TESTS

Dump Location Tenaburt

Sample Weight, Lbs. 250 Dry

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
29	1-75	113.5	0	15000	0								
30	1-75	56.75	56.75	0	0								
31	1-75	0	0	7000	4940	2.73	.752	1.753	.046	7.7822	296.569	.0020	.076
1	2-75	0	0	6000	4670	.11 / 2.84	.032 / .784	1.326	.035	5.5976	212.069	.0014 / .0034	.054 / .130
2	2-75	56.75	0	5000	4650	.16 / 3.00	.120 / .904	.964	.024	3.8219	153.513	.0010 / .0044	.039 / .169
3	2-75	0	0	6000	3000	.94 / 3.94	— / .904	.798	.018	1.8493	81.986	.0005 / .0049	.021 / .190
4	2-75	0	0	5000	4830	— / 3.94	— / .904	.510	.012	1.9850	84.360	.0005 / .0054	.022 / .212
Total Ave.										21.036	828.497	/	.213

1 / 2

1 - Daily
2 - Cumulative

Test 78

39

TOMBSTONE LEACH

METALLURGICAL TESTS

Dump Location Tombstone Ext.

Sample Weight, Lbs. 250 Dry

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Rec
29	1-75	113.5	0	19,000	0								
30	1-75	0	56.75	1000	0		~~.84~~						
31	1-75	0	0	6000	3600	1.90	.896	.831	.016	1.9726	102.452	.0005	.026
1	2-75	0	0	6000	3120	.07 / 1.97	.056 / .952	.9015	.0185	1.9767	96.325	.0005 / .0010	.025 / .051
2	2-75	56.75	0	5000	4650	.060 / 1.98	— / .952	.716	.012	1.9109	114.020	.0004 / .0014	.029 / .080
3	2-75	0	0	6000	3700	.95 / 2.93	.014 / .960	.620	.011	1.3938	84.897	.0004 / .0018	.022 / .102
4	2-75	0	0	5000	4720	— / 2.97	— / .961	.496	.010	1.6164	80.175	.0004 / .0022	.021 / .123
Total Ave.										8.8704	477.869	.0023	-

1 / 2

1 - Daily
2 - Cumulative

55

TOMBSTONE LEACH

METALLURGICAL TESTS

Dump Location Comet

Sample Weight, Lbs. 250 Dry

Total Days Leaching

Conducted by:

December, 1974

Approved by:

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
29	1-75	113.5	Ø	17,000	Ø								
30	1-75	56.75	56.75	1,000	Removed overflow 2000								
31	1-75	Ø	Ø	6000	3525	2.92	.912	0.800	.021	2.5351	96.575	.0007	.025
1	2-75	Ø	Ø	6000	3640	.04 / 2.96	.032 / .944	0.700	.021	2.6178	87.260	.0007 / .0014	.022 / .047
2	2-75	Ø	Ø	5000	4250	— / 2.94	.016 / .960	.577	.015	2.193	81.070	.0005 / .0019	.021 / .068
3	2-75	Ø	Ø	5000	4800	.01 / 2.97	.008 / .968	.493	.013	2.1370	81.041	.0005 / .0024	.021 / .089
4	2-75	Ø	Ø	5000	3870	— / 2.97	.008 / .976	.362	.009	1.1928	47.977	.0003 / .0027	.012 / .101
Total Ave.										10.4659	393.923		

1 / 2

1 - Daily
2 - Cumulative

36

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location Contention 1-A

Sample Weight, Lbs. 250

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
20	3/75	113.5	0	15,000	0								
21	3/75	60.0	0	3,000	0								
24	3/75	30.0	56.75	6000	3177			.883	.0575	6.2560	96.07	.0016	.025
25	3/75	0	0	↓	↓	3.07	.936	↓	↓	↓	↓	↓	↓
26		0	0	6500	4260	.47 / 3.54	– / .936	.872	.055	8.0240	127.22	.0021 / .0037	.033 / .058
27		0	0	7000	5130	.06 / 4.00	– / .936	.625	.044	7.7301	109.45	.0020 / .0057	.028 / .086
28		0	0	7000	5750	– / 4.00	.016 / .952	.433	.028	5.5137	85.26	.0014 / .0071	.022 / .108
1	4/75	30.0	0	8000	6250	– / 4.00	.040 / .992	.374	.022	4.3774	80.05	.0011 / .0082	.021 / .129
2		0	0	6000	5810	.52 / 4.52	– / .992	.278	.016	3.1836	55.31	.0008 / .0090	.014 / .143
3		0	30	7000	5130	– / 4.52	.008 / 1.00	.217	.012	2.1082	38.12	.0005 / .0095	.010 / .153
4					5180	– / 4.52	.40 / 1.40	.144	.007	1.2417	25.54	.0003 / .0098	.006 / .159
Total Ave.		233.5	86.75	65500	40,687					38.4347	617.02	.0099	.158

1	2

1 - Daily
2 - Cumulative

57

TOMBSTONE . LEACH

METALLURGICAL TESTS

Dump Location Contention 1-B

Sample Weight, Lbs. 250

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date: Day	Date: Month/Yr	GMS ~~CaO~~ Caustic Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption: Lime #/Ton Ore	Reagent Consumption: NaCN #/Ton Ore	Solution Assays: Silver Oz/Ton	Solution Assays: Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
20	3/75	to 1st 10-11	0	15,000	0								
21	3/75	60.0	0	1,000	0								
24	3/75	30.0	56.75	4000	2292			.688	.049	3.8461	54.00	.0010	.014
		0	0	↓	↓	1.57	.616	↓	↓	↓	↓	↓	↓
		0	0	5000	2650	– / 1.57	.304 / .920	.730	.057	5.1730	66.25	.0013 / .0023	.017 / .031
31		0	0	5000	3560	– / 1.57	.008 / .928	.605	.046	5.6082	73.76	.0014 / .0037	.019 / .050
4/1		0	0	5000	3670	– / 1.57	.024 / .952	.472	.035	4.399	59.32	.0011 / .0048	.015 / .065
1	4/75	30.0	0	6000	3970	– / 1.57	.032 / .984	.432	.0295	4.0108	58.76	.0010 / .0058	.015
2	"	0	0	5000	3890	.53 / 2.10	– / .984	.295	.020	2.6644	39.30	.0007 / .0065	.010 / .090
3		0	30	6000	3650	– / 2.10	.018 / .952	.242	.016	2.0000	30.25	.0005 / .0070	.008 / .098
4					3890	– / 2.10	.032 / 1.024	.172	.010	1.3082	22.50	.0003 / .0073	.006 / .104
Total		1.20 +	86.75	52000	27502					29.0097	404.14	.0074	–

1 - Daily
2 - Cumulative

58

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location Contention 2-A

Sample Weight, Lbs. 250

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS CaO Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Lime #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
20	3/75	113.5	0	15,000	0								
21	3/75	60.0	0	0	0								
24	3/75	30.0	56.75	6000	5052			3.586	.081	14.0141	620.43	.0036	.159
		0	0	↓	↓	3.06	.736	↓	↓	↓	↓	↓	↓
		0	0	5000	4350	.37 / 3.43	.104 / .840	3.088	.090	13.0849	460.03	.0034 / .0070	.118 / .277
		0	0	5000	3560	.15 / 3.58	.072 / .912	2.451	.086	10.4849	298.82	.0023 / .0096	.077 / .354
75		0	0	6000	3950	– / 3.58	.024 / .936	1.858	.068	9.1986	251.34	.0024 / .0120	.064 / .418
1	4/75	0	0	7000	5290	– / 3.58	.048 / .984	1.428	.051	9.2394	258.70	.0024 / .0144	.066 / [illegible]
2	"	0	0	5000	4700	– / 3.58	– / .984	1.067	.048	7.7260	171.74	.0019 / .0163	.044 / .528
3		0	30	8000	4090	– / 3.58	.008 / .992	.811	.038	5.3226	113.60	.0014 / .0177	.029 / .557
4					6300	– / 3.58	.384 / 1.376	.562	.023	4.9623	121.25	.0013 / .0190	.031 / .588
Total Ave.		203.5	86.75	57000	37,265					74.0328	2295.91		.590

1	2

1 - Daily
2 - Cumulative

65

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location Contention II

Sample Weight, Lbs. _____

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS ~~CaO~~ NaOH Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption ~~Lime~~ NaOH #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
9	4-75	60.0	~~0~~	15,000	~~0~~								
10	4-75		56.37		—			—	—	—	—		
11		30 0		5000	3750	1.06	.742	4.631	.147	18.878 ~~[illegible]~~	594.73	.0048	.153
[illegible]				5000	3400	.34 / 1.40	.112 / .904	3.822	.132	15.3699	445.03	.0039 / .0087	.114 / .267
15				5000	3440	.15 / 1.55	.032 / .936	3.114	.108	12.7233	366.85	.0033 / .0120	.094 / .361
16				5000	3590	— / 1.55	.024 / .960	2.328	.081	9.9586	286.77	.0026 / .0146	.074 / .435
18				0	3500	— / 1.55	.024 / .984	1.843	.061	7.3116	221.03	.0019 / .0165	.057 / .492
Total Ave.													

1 / 2

1 - Daily
2 - Cumulative

61

TOMBSTONE [illegible] LEACH

METALLURGICAL TESTS

Dump Location Contention II

Sample Weight, Lbs. _____

Total Days Leaching _____

December, 1974

Conducted by: _____

Approved by: _____

Date Day	Date Month/Yr	GMS ~~CaO~~ NaOH Added	GMS NaCN Added	cc Water Added	cc Water Removed	Reagent Consumption Na2O4 ~~Lime~~ #/Ton Ore	Reagent Consumption NaCN #/Ton Ore	Solution Assays Silver Oz/Ton	Solution Assays Gold Oz/Ton	MG. Gold Leached	MG. Silver Leached	% Gold Recov.	% Silver Recov.
9	4-75	60.0	56.75	15,000	~~0~~								
10	4-75			–	4940	.784	.672	3.510	0.142	24.0233	593.82	.0062	.153
11				5000	3240	.274 / 1.04	.216 / .888	3.230	.136	15.0904	358.40	.0038 / .0100	.092 / .245
14				5000	3330	– / 1.04	.052 / .944	2.770	.113	12.8866	315.89	.0033 / .0133	.081 / .326
15				5000	2840	– / 1.04	.032 / .976	2.204	.092	8.9479	214.36	.0023 / .0156	.055 / .381
16				5000	2990	– / 1.04	.016 / .992	1.713	.071	7.2702	175.41	.0019 / .0195	.045 / .426
18					3120	.02 / 1.06	– / .992	1.333	.053	5.7175	143.80	.0015 / .0190	.037 / .463
Total Ave.													

1 / 2

1 - Daily
2 - Cumulative

GEOLOGIC DESCRIPTION OF THE PRINCIPAL

DUMPS, TOMBSTONE DISTRICT, ARIZONA

Mine - Dump	Principal* Rock Types		CU Oxides	Mn Oxides	Sulfates	Sulfides	Remarks
Lucky Cuss	Arg., Ls., Monz.		xxx	xxxx	xx	xx	Some trash & carbon on
Oregon	Ls.	Not sampled	-	xxxx	-	-	Not samp.-produced Mn o
Prompter	Ls.	Not sampled	-	xxxx	-	-	Not samp.-produced Mn o
Telephone	Ls.	Not sampled	-	xxxx	-	-	Not samp.-produced Mn o
Bunker Hill	Ls.	Not sampled	-	xxxx	-	-	Not samp.-produced Mn o
Rattlesnake	Ls.	Not sampled	-	xxxx	-	-	Not samp.-produced Mn o
Comet	Ls., Monz.	Not sampled	-	xxxx	-	-	Not samp.-produced Mn o
Black Eagle	Ls. Monz.	Not sampled	-	xxxx	-	-	Not samp.-produced Mn o
Emerald	Ls., qtzt.		xxxx	xxx	xxx	xxx	Copper oxides and wulfe ite abundant
Silver Plume	Ls., qtzt.		xx	xxx	xx	xx	
Luck Sure	Ls.	Not sampled	-	xxx	-	-	
State of Maine	Latite porph.		x	xxx	x	-0-	Contains some trash & t

Abbreviations: Ls=limestone, Arg=argillaceous quartzite, Monz=intermediate igneous intrusive rock, Novac=fine grained quartzite, qtzt=quartzite

* Rock types listed in order of decreasing amounts generally present in dump

(x = very rare) (xx = rare) (xxx = common) (xxxx = abundant)

GEOLOGIC DESCRIPTION OF THE PRINCIPAL

DUMPS, TOMBSTONE DISTRICT, ARIZONA

Mine - Dump	Principal* Rock Types		CU Oxides	Mn Oxides	Sulfates	Sulfides	Remarks
Empire	Arg., Ls., Monz		xxx	x	x	xx	
Tranquility	Arg., Monz., Ls.		xxx	x	x	x	Fluorite & wulfenite, some rotted timber
Toughnut	Arg., Ls., Novac.		xxx	xx	xx	xx	Some timber expected
Visina	Novac., Ls.	Not sampled	-	-	-	-	Very siliceous
Westside	Arg., Ls., Novac.		xxx	xx	x	xx	East ½ only is ours
Silver Thread	Arg., Ls., Novac.	Not sampled	-	-	-	-	Probably similar to the Westside
Boss	Arg., Monz.	Not sampled	-	-	-	-	Probably similar to the Westside
Defence	Novac., Arg., Monz.	Not sampled	-	-	-	-	Probably similar to the Westside
Tribute	Arg., Ls., Monz.	Not sampled	-	-	-	-	Probably similar to the Westside
Contention	Arg., Monz.		xxx	x	xxx	xxx	Lots of carbon and tr[illegible] in and on the dumps
Grand Central	Arg., Monz.		xxx	x	xxx	x	
Little Joe	Arg., Monz.		xxx	x	xxx	x	
Arizona Queen	Arg.	Not sampled	-	-	-	-	Probably similar to Tranq.
Sulphuret	Arg., Monz.	Not sampled	-	-	-	-	Probably similar to Tranq.

COMPILATION

PAST SAMPLING PROGRAMS (Austral Oil)

Mine Dumps	Tons		Au oz/ton		Ag oz/ton	
Boss #1	3,400	0.030	0.037	.001	2.39	.072
Bunker Hill #1	15,300	0.134	0.030	.004	3.59	.481
Bunker Hill #2	10,500	0.091	0.007	.001	3.10	.282
Emerald #2	1,600	0.014	0.020	-	2.10	.029
Empire #1	41,000	0.358	0.080	.029	1.90	.680
Herschedl #1	6,800	0.059	0.015	.001	3.47	.205
Lucky Cuss #1	18,200	0.159	0.040	.006	2.98	.474
Oregon #1	1,000	0.009	0.005	-	5.52	.050
Oregon #2	1,500	0.013	0.002	-	3.27	.043
Prompter #1	1,600	0.014	0.005	-	3.65	.051
Rattlesnake	3,000	0.026	0.005	-	2.33	.061
San Pedro	1,500	0.013	0.005	-	4.48	.058
Tranquility #1	9,200	0.080	0.060	.005	3.22	.258
	114,600	1.001		0.047		2.74

Weighted averages

Au 0.047 oz/ton	@ $100.00	-	$ 4.70
Ag 2.47 oz/ton	@ $3.00	-	7.41
	Value per ton		$12.11

EFFECT OF CRUSHING

Note that the values (Au & Ag) are generally evenly distributed between the coarse and the fines. Therefore, crushing of the coarse would be economical.

EFFECT OF SCREENING
TOMBSTONE DUMPS

Dump No.	Unscreened		Screened					
			-3/4 inch			-1/4 inch		
	Au	Ag	Wgt.%	Au	Ag	Wgt.%	Au	Ag
Empire								
41-1	.046	.68	85	.050	.72	60	.055	.64
41-2	.026	1.27	78	.022	1.29	55	.020	1.35
41-3	.057	1.29	72	.060	1.23	40	.070	1.31
41-4	.010	.24	84	.015	.28	58	-	.30
41-5	.025	1.66	84	.027	1.52	59	.030	1.80
41-6	.065	3.58	76	.091	3.34	50	.045	4.80
41-7	.063	.94	73	.078	0.83	48	.055	.87
41-8	.047	.93	74	.054	1.07	46	.035	1.16
41-9	.031	.50	59	.040	.60	32	.060	.62
41-10	.029	2.10	74	.030	2.42	50	.030	2.95
41-11	.026	.68	78	.031	0.72	52	.040	.76
41-12	.051	.62	74	.063	0.64	48	.040	.74
41-13	.018	.45	75	.016	0.39	50	.020	.41
41-14	.039	1.61	75	.029	1.30	46	.025	.44
41-15	.027	.83	62	.033	0.90	36	.045	1.16

EMPIRE

Sample	Total Tons	Unscreened Tons	Unscreened Au	Unscreened Ag	Screened Tons	Screened Au	Screened Ag
41-1	4,500	4,500	.046	.678	3,915	.049	.715
2	3,500	3,500	.026	1.267	595	.039	1.302
3	2,500	2,500	.067	1.290	2,500	.067	1.290
4	Waste	-	-	-	-	-	-
5	6,800	6,800	.025	1.66	6,800	.025	1.66
6	3,600	3,600	.065	3.58	3,600	.065	3.58
7	1,835	1,835	.063	.940	1,835	.063	.940
8	3,420	3,420	.047	.930	2,770	.052	0.979
9	2,000	2,000	.031	.497	640	.060	.62
10	5,000	5,000	.029	2.098	4,050	.030	2.34
11	4,000	4,000	.026	.685	3,320	.030	.73
12	1,000	1,000	.051	.621	810	.059	.61
13	Waste	-	-	-	-	-	-
14	1,500	1,500	.039	1.611	810	.051	2.61
15	1,500	1,500	.027	0.826	540	.045	1.16
		41,155	.039	1.416	32,185	.044	1,582

EFFECT OF SCREENING
TOMBSTONE DUMPS

Dump No.	Unscreened		Screened					
			-3/4 inch			-1/4 inch		
	Au	Ag	Wgt.%	Au	Ag	Wgt.%	Au	Ag
Contention								
38-1	.035	.93						
38-2	.009	.73	75	.006	.92	49	.005	1.06
38-3	.010	.21						
38-4	.023	.56	66	.025	.58	40	.040	.64
38-5	.041	1.92	64	.048	2.31	40	.050	1.61
38-6	.010	.23						
38-7	.027	1.21	76	.031	1.34	48	.045	1.76
38-8	.014	.86	66	.017	.97	40	.015	1.09
38-9	.027	.96	67	.038	1.37	39	.055	1.88
38-10	.005	.80	68	.006	.49	41	.010	.81
38-11	.030	1.89	46	.015	1.18	41	.030	1.89
38-12	.015	1.37	67	.019	1.02	41	.020	1.14
38-13	.002	.30	59	.002	.25	33	.005	.46
38-14	.016	.68	85	.025	1.03	33	.040	1.30

EFFECT OF SCREENING
TOMBSTONE DUMPS

Dump No.	Unscreened		Screened					
			-3/4 inch			-1/4 inch		
	Au	Ag	Wgt.%	Au	Ag	Wgt.%	Au	Ag
Toughnut								
39-1	.050	5.90	78	.058	6.89	51	.085	8.64
39-2	.018	1.85	75	.019	2.13	46	.025	2.80
39-3	.015	1.36	76	.015	1.46	47	.020	1.64
39-4	.003	1.36	64	-	1.00	38	.007	1.01
39-5	.003	1.31	69	-	1.39	39	.008	1.58
39-6	.040	2.10						
39-7	.017	2.69	71	.024	3.18	33	.030	2.18
39-8	.015	1.92	74	.019	2.17	34	.035	3.99
39-9	.010	.63						
39-10	.006	.94	49	.014	2.00	24	.025	3.54
39-11	.009	1.13	80	.011	1.29	55	.015	1.70
39-12	.015	1.38	53	.023	1.32	33	.030	1.71
39-13	.022	1.93	64	.030	2.42	38	.035	3.20
39-14	.002	.26	42	.006	.37	22	.005	.61
39-15	-	.62	46	-	.75	32	-	.84
39-16	-	.43	21	-	.38	9.5	-	.34

TRANQUILITY

Sample	Total Tons	Unscreened Tons	Unscreened Au	Unscreened Ag	Screened Tons	Screened Au	Screened Ag
40-1	2,000	2,000	.045	1.83	1,240	.055	2.53
2	2,000	2,000	.023	.564	Waste	-	-
3	2,500	2,500	.045	1.687	1,525	.060	2.19
4	1,500	1,500	.011	1.702	1,100	.010	2.13
5	4,000	4,000	.061	1.420	4,000	.061	1.42
6	1,500	1,500	.028	.898	2,120	.090	1.64
7	3,000	3,000	.005	.680	Waste	-	-
8	Waste	-	-	-	Waste	-	-
9	3,000	3,000	.064	2.91	1,290	.108	5.85
10	1,500	1,500	.021	.954	525	.050	1.75
11	2,000	2,000	.017	2.197	1,180	.010	2.18
12	2,000	2,000	.070	0.40	1,316	.088	.458
13	6,500	6,500	.087	2.17	6,500	.087	2.166
		31,500	.049	1.590	20,796	.070	2.101

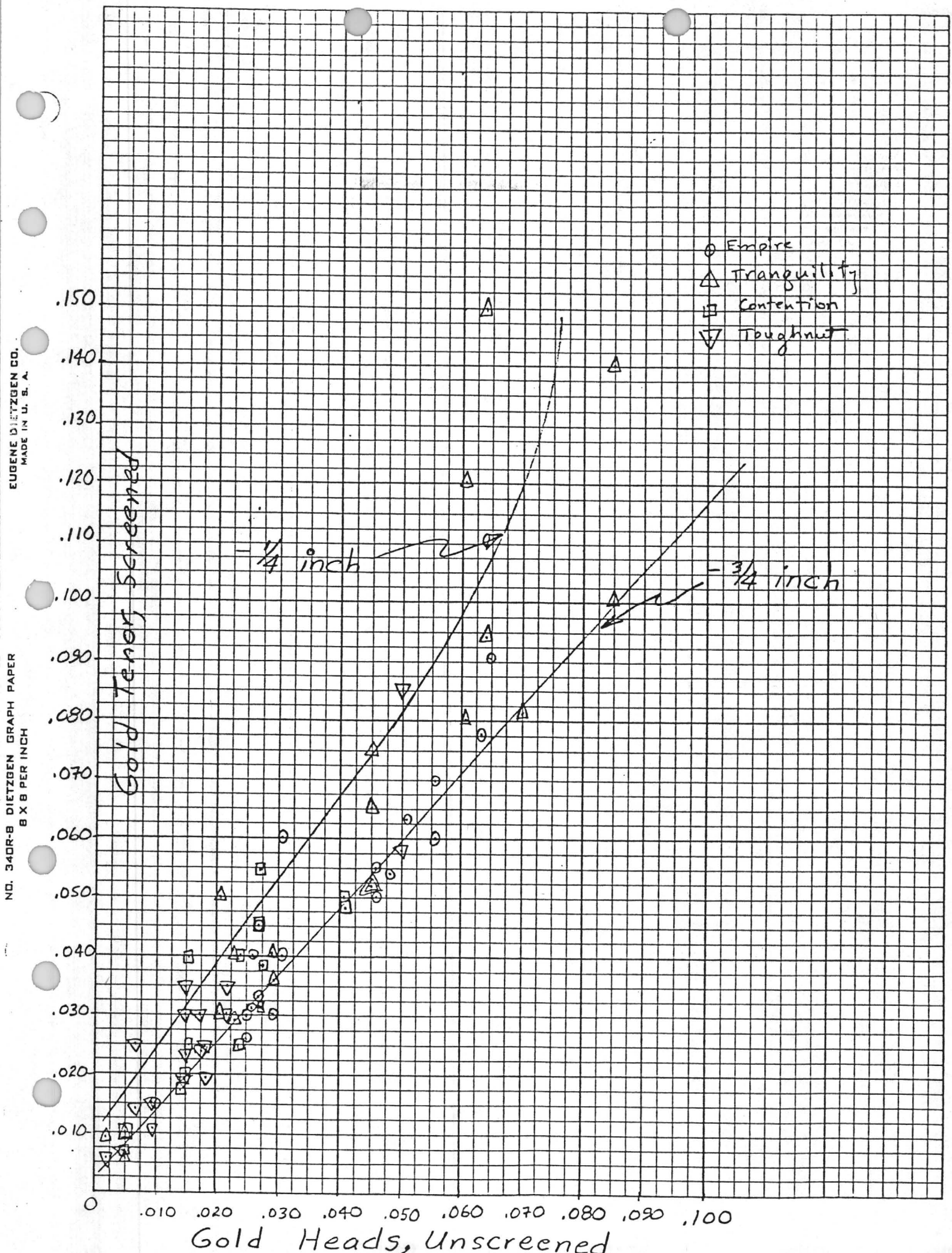
SIERRA MINERAL MANAGEMENT

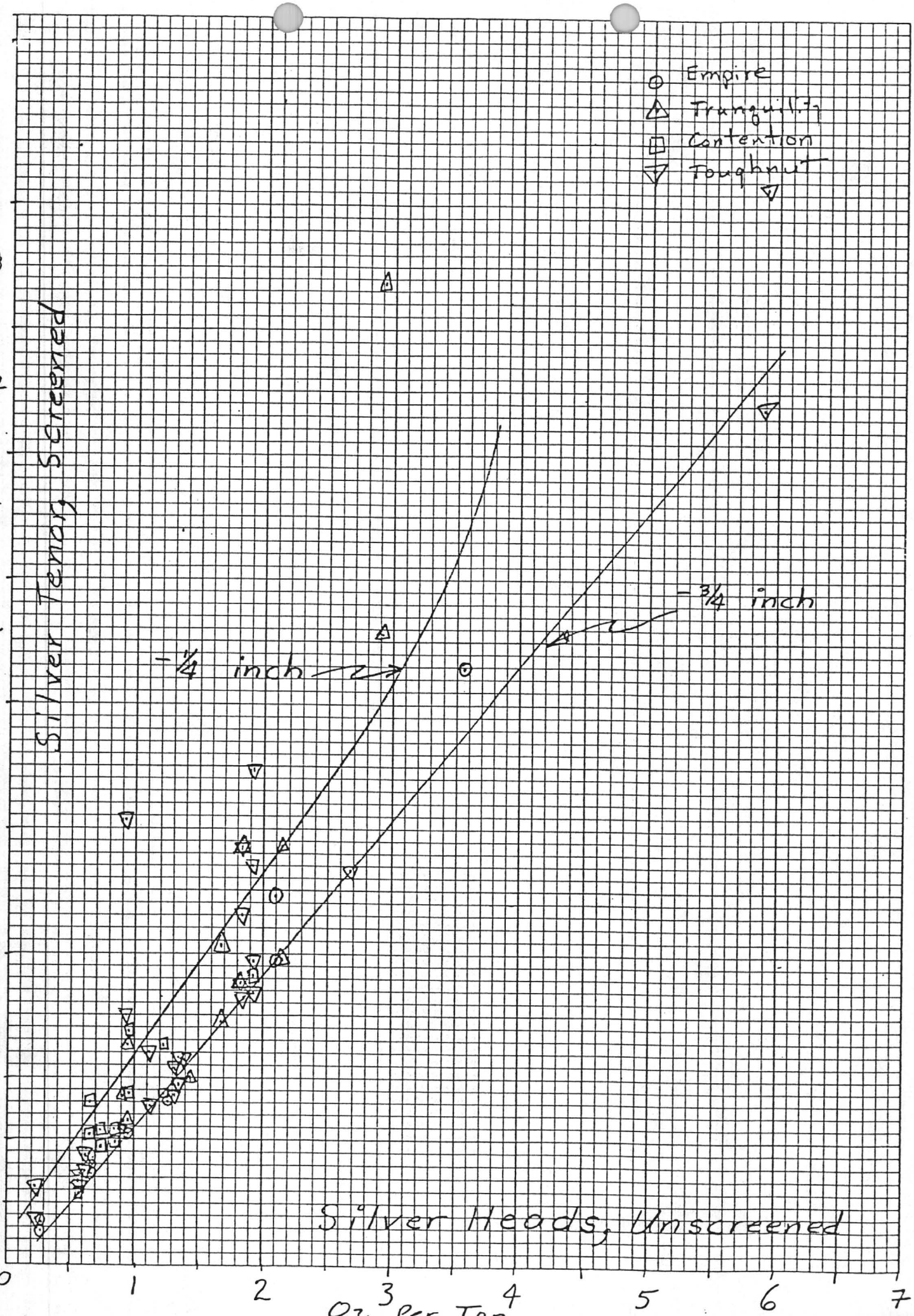
R. F. HEWLETT
President

4741 EAST SUNRISE DRIVE
SKYLINE BEL AIRE PLAZA
TUCSON, ARIZONA 85718
602 / 299-9736

State of Maine- Brother Jonathan Dump

Sample No.	Tons	Au	Ag
J-1	2500	0.0138	2.6271
M-1	1700	0.0130	2.9867
M-2	1600	0.0090	3.9579
M-3	1500	0.0051	2.0187
M-4	500	---	2.7862
M-5	500	0.0072	3.0912
M-6	1000	---	3.6436
M-7	1000	0.0032	3.5445
M-8	1000	---	2.55
M-9	1000	---	3.57
M-10	1000	---	1.96
	13,300	.006	2.95


Empire
Tranquility
Contention
Toughnut
-1/4 inch
-3/4 inch
Gold Tenor, Screened
Gold Heads, Unscreened
0
.010
.020
.030
.040
.050
.060
.070
.080
.090
.100
.110
.120
.130
.140
.150
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340R-8 DIETZGEN GRAPH PAPER
8 X 8 PER INCH



EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340R-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

TOMBSTONE
PRODUCTION SCHEDULE
(450 tons per day)

Time	Dump	Grade		Recovered Value 95% Au, 75% Ag: $130/$3.50	
		Au	Ag	Per Ton	Per Month
March '74	Lucky Cuss	.039	2.91	$12.46	$155,750
April	Lucky Cuss	.039	2.91	12.46	155,750
May	Lucky Cuss	.039	2.91	12.46	155,750
June	Lucky Cuss	.039	2.91	12.46	155,750
July	Herschel	.015	3.47	10.96	137,000
Aug.	Oregon, Prompt., Boss	.018	3.25	10.75	134,375
Sept.	Tranquility	.049	1.59	10.23	127,875
Oct.	Tranquility	.049	1.59	10.23	127,875
Nov.	Tranquility	.049	1.59	10.23	127,875
Dec. '76	Tranq./Empire	.046	1.53	9.70	121,250
Jan. '75	Empire	.039	1.42	8.54	106,750
Feb.	Empire	.039	1.42	8.54	106,750
March	Empire	.039	1.42	8.54	106,750
April	Emp./Toughnut	.033	2.65	11.03	137,875
May	Toughnut	.027	2.82	10.74	134,250
June	Contention	.042	1.45	9.00	112,500
July	Contention	.042	1.45	9.00	112,500
Aug.	Contention	.042	1.45	9.00	112,500
Sept.	Contention	.042	1.45	9.00	112,500
Oct.	Cotention	.042	1.45	9.00	112,500
Nov.	Little Joe	.050	2.20	11.95	149,375
Dec. '75	Little Joe	.051	2.23	12.15	151,875
Jan. '76	Silver Thread	.030	2.22	9.53	119,125
Feb.	Bunker Hill	.021	3.39	11.49	143,625
March	Bunker Hill	.021	3.39	11.49	143,625
April	BH/San Pedro/St. M.	.008	3.53	10.25	128,125
May	St. Maine/Ingersol	.011	2.43	7.74	96,750
June	Comet/Defence	.028	1.78	8.13	101,625
July	Defence/Emerald	.025	1.93	8.15	101,875
Aug.	Emerald	.025	1.75	7.68	96,000
Sept.	Emerald	.025	1.75	7.68	96,000

PRODUCTION SCHEDULE

Dump	Total Tonnage	Segregated or Screened Au	Ag	Tonnage
Lucky Cuss	50,000	.039	2.91	50,000
Herschel	10,000	.015	3.47	10,000
Oregon	5,000	.003	4.17	5,000
Prompter	4,000	.005	3.63	4,000
Boss	5,000	.037	2.39	5,000
Tranquility	45,000	.049	1.59	45,000
Empire	45,000	.039	1.42	45,000
Toughnut	50,000	.027	2.82	20,000
Contention	127,800	.042	1.45	65,000
Little Joe	20,000	.051	2.23	20,000
Silver Tread	16,000	.030	2.22	16,000
Bunker Hill	25,800	.021	3.39	25,800
San Pedro	2,000	.005	4.48	2,000
State of Maine	15,000	.006	2.95	15,000
Ingersol	12,000	.017	1.71	5,000
Comet	15,000	.030	1.56	6,000
Defence	26,000	.025	2.01	11,000
Emerald	55,000	.025	1.75	38,000
Old Guard	20,000	.020	1.49	14,000
Rattlesnake	5,000	.010	2.80	3,000
Silver Plume	25,000	.014	1.03	11,000
Sulphuret	6,000	.043	1.05	3,000
West Side	60,000	.019	1.62	42,000
	644,600	.032	2.07	460.800

SIERRA METALS

R. F. HEWLETT
President

4741 EAST SUNRISE DRIVE
SKYLINE BEL AIRE PLAZA
TUCSON, ARIZONA 85718
602/299-9736

TOMBSTONE

METAL PRICE SENSITIVITY ANALYSIS

FOR HEAP LEACHING VS. MILLING

Assume:

1. Rate of mining for heap leaching is 45,000 tons-per-month
2. Heap leaching extraction percentages are 60% Au and 50% Ag
3. Heap leaching cost of production = $3 per ton
4. Rate of milling is 12,500 tons-per-month
5. Milling extraction percentages are 75% for Au and Ag
6. Milling cost of production = $7.50 per ton
7. Base prices are $170 Au and $4 Ag

Extraction Method	Recv. Au	Ext. Time	Au Month	Recv. Ag	Ext. Time	Ag Month
Heap Leach	11,239	12.6 ms.	892	550,602	12.6 ms.	43,699
Mill (H.L.)	3,938	16.8 ms.	234	505,439	16.8 ms.	30,086
H.L. & Mill	15,177	13.$\bar{5}$ ms.	1126	1,056,041	14.$\bar{3}$ ms.	73,785
Mill Only	14,999	64 ms.	234	1,313,901	64 ms.	20,530

Gold Price Change

$4 Ag - Monthly Net Profit Before Tax

Ext. Method	Gross Value Ag/Mo	Production Costs/Mo	Monthly Net	Au Gross Value		Au NPBT	
				$150	$200	$150	$200
Heap Leach	$174,796	$135,150	$39,646	$133,800	$178,400	$173,446	$218,046
Mill (H.L.)	120,344	93,754	26,590	35,100	46,800	61,690	73,390
H.L. & Mill	295,140	228,904	66,236	168,900	225,200	235,136	291,436
Mill Only	82,120	93,743	−11,623	35,100	46,800	23,477	35,177

SIERRA METALS

R. F. HEWLETT
President

4741 EAST SUNRISE DRIVE
SKYLINE BEL AIRE PLAZA
TUCSON, ARIZONA 85718
602/299-9736

From the above, notice the advantage of both heap leaching and milling. Comparisons of heap leaching and milling vs. milling follows:

	Heap Leaching & Milling	Milling Only
Tons Processed	567,631 + 210,009 = 799,940	799,940
Extraction Time	Less than 2 years	Over 5 years
Recovered Au	15,702 t. ounces	16,999 t. oz.
Recovered Ag	1,056,041 t. ounces	1,313,902 t. oz.
Gross Sales	$7,331,868	$8,668,641
Production Costs	$3,256,960	$5,919,556
Net Profit B. Tax	$4,074,908	$2,749,085
Av.Mon. Net Profit B.T.	$ 169,788 (2 yrs.)	$ 45,818 (5 yrs.)
Depletion, Total	$1,022,795	$1,209,275
Depletion, Yearly	$ 511,398 (2 yrs.)	$ 241,855

Utilization of the heap leaching method of gold-silver extraction in combination with the milling of the high-grade manganese ores minimizes the risks involved with using only ore extraction method, such as milling.

Evaluating the variables (risks) results as follows:

	Heap Leaching	Mill
Break-even Extraction Rate (Dec. 5)	23%	53%
Break-even Precious Metal Prices		
Gold (H.L. %=60/50; Mill %=85/75)	$54	$193
Silver (Same; Gold=60 & 85, Silver=50 & 75)	$ 2	$ 2

The graphical presentation is shown on the following page.

SIERRA METALS

R. F. HEWLETT
President

4741 EAST SUNRISE DRIVE
SKYLINE BEL AIRE PLAZA
TUCSON, ARIZONA 85718
602/299-9736

SUMMARY COMPARISON OF

MILLING AND HEAP LEACHING

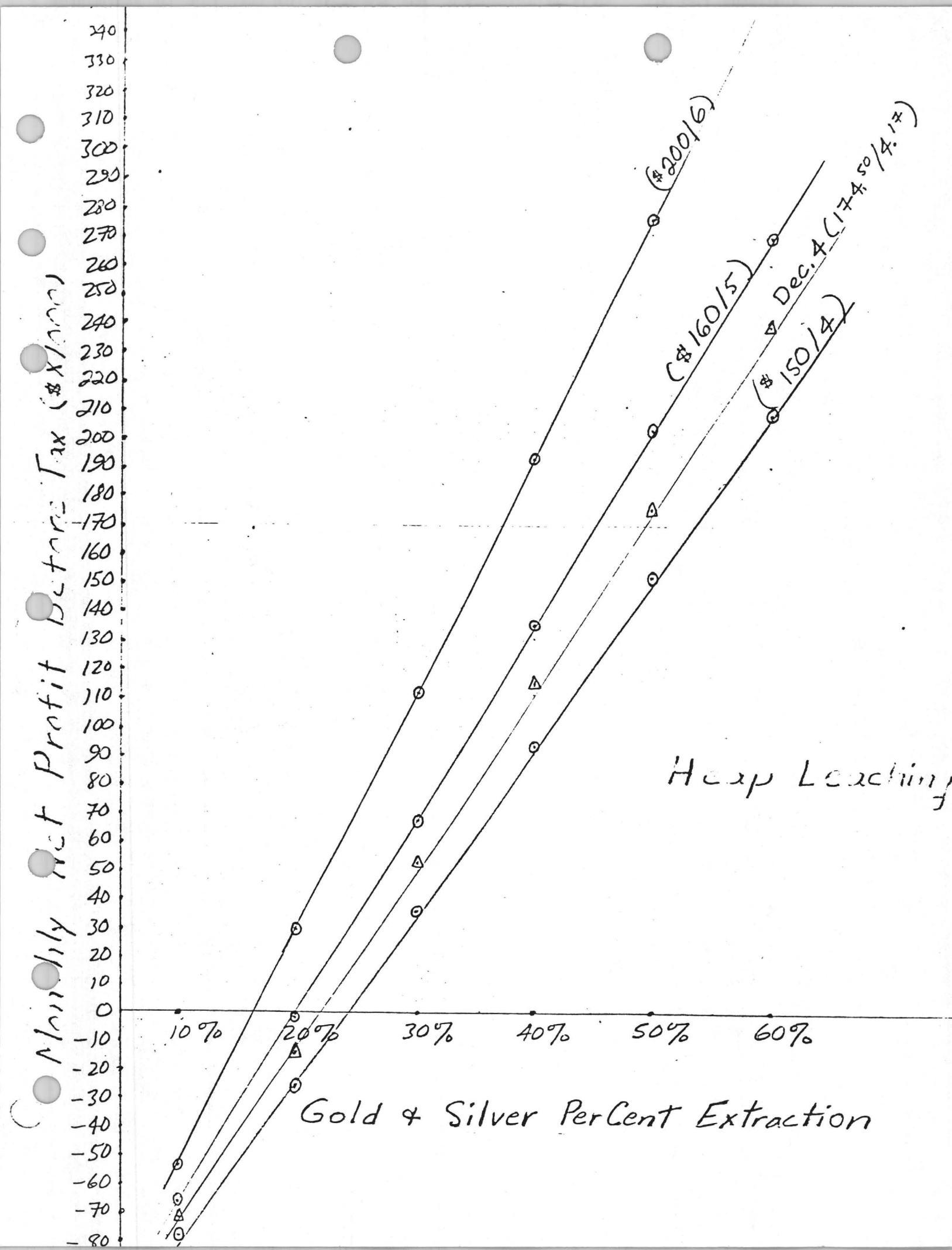
Constants:

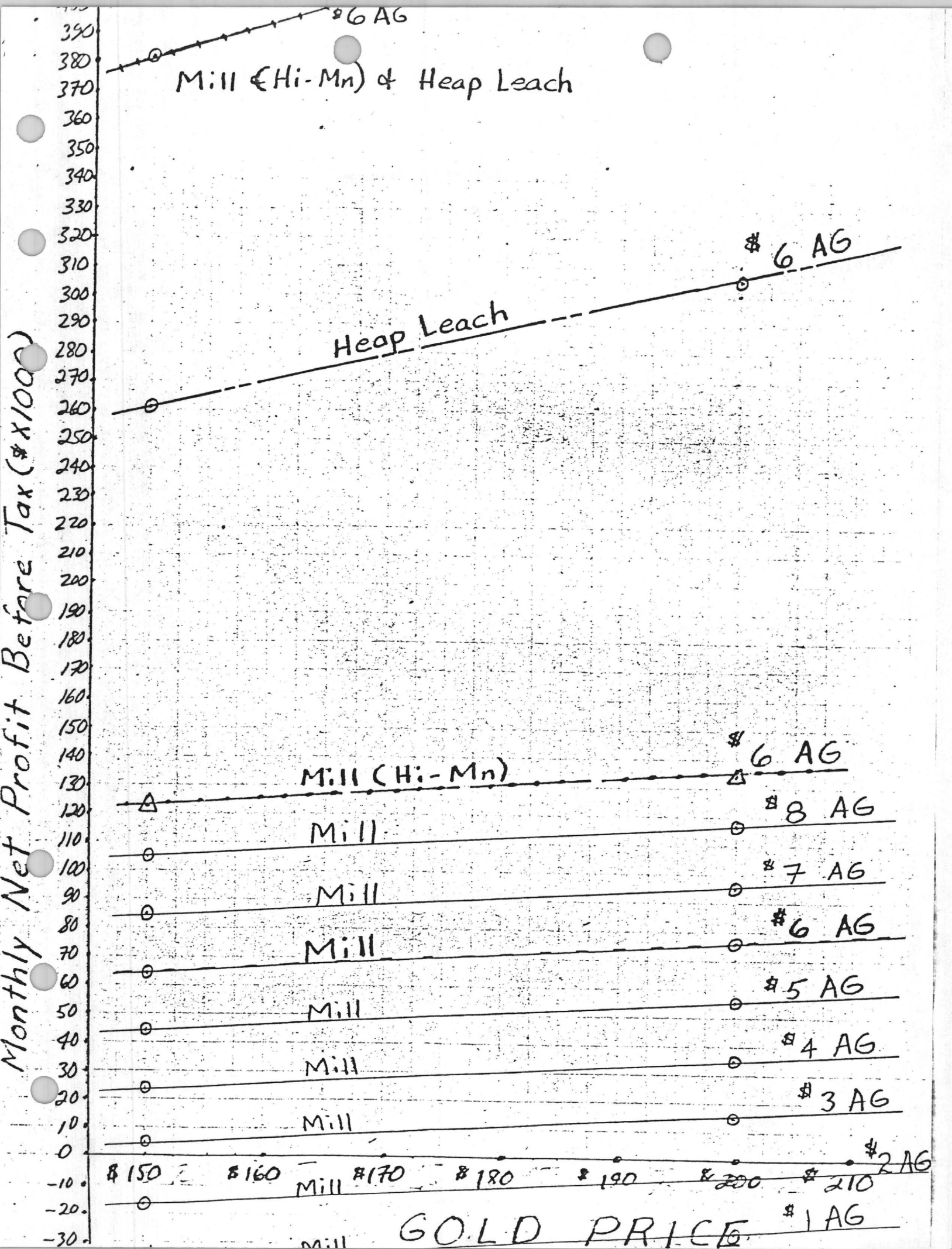
1. Gross Au = 19,999 t. ounces
2. Gross Ag = 1,751,869 T. ounces
3. Total tonnage = 799,940
4. Mill costs are $7.40 per ton
5. Heap leaching costs are $3.00 per ton

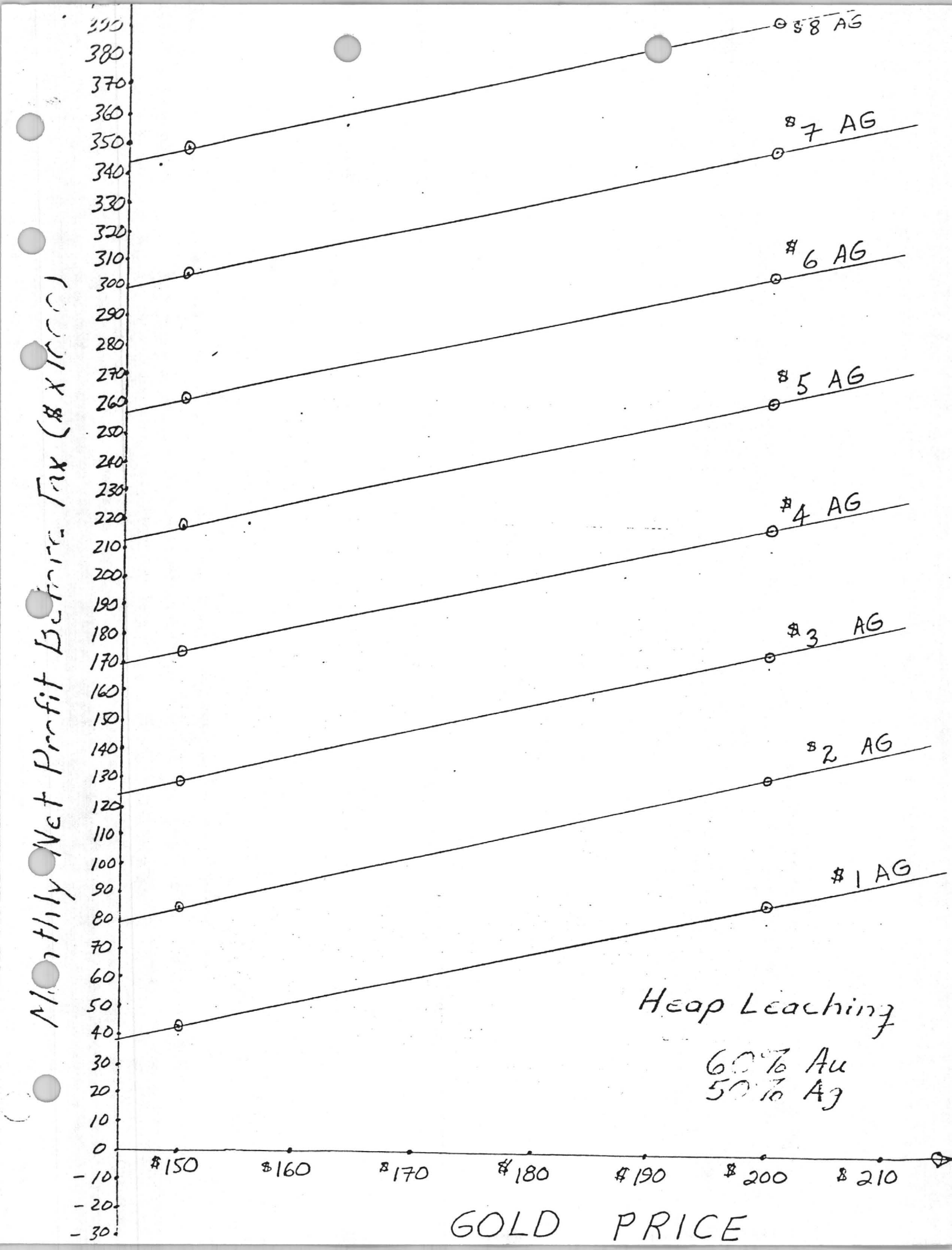
Variables:

1. Precious metal prices (Dec. 5; Au=$178.75, Ag=$4.285
2. Recovery - Mill: assumed 85% Au and 75% Ag
3. Recovery - Heap leach: assumed 60% Au and 50% Ag
4. Heap leaching rate: assumed 1500 tons-per-day

	Heap Leaching & Milling		Milling Only
	Heap Leach	Mill High-Manganese	Mill All Ore
Tons Processed	567,631	210,009	799,940
Extraction Rate	45,000 t.p.m.	12,500 t.p.m.	12,500 t.p.m.
Total Ext. Time	12.6 months	16.8 months	64 months
Recoverable Au	11,239	4,463	16,999
Recoverable Ag	550,602	505,439	1,313,902
Gross Sales	$4,368,301	$2,963,567	$8,668,641
Production Costs	1,702,893	1,554,067	5,919,556
Net Profit B. Tax	2,665,408	1,409,500	2,749,085
Av. Monthly NPBT	211,540	83,899	42,954
Depletion	$609,378	$413,417	$1,209,275


Monthly Net Profit Before Tax ($X/1000)
340
330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
10%
20%
30%
40%
50%
60%
($200/6)
($160/5)
Dec. 4 (174.50/4.17)
($150/4)
Heap Leaching
Gold & Silver PerCent Extraction


Monthly Net Profit Before Tax ($X100)
390
380
370
360
350
340
330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
$6 AG
Mill (Hi-Mn) & Heap Leach
$6 AG
Heap Leach
$6 AG
Mill (Hi-Mn)
$8 AG
Mill
$7 AG
Mill
$6 AG
Mill
$5 AG
Mill
$4 AG
Mill
$3 AG
Mill
$2 AG
Mill
$1 AG
Mill
$150
$160
$170
$180
$190
$200
$210
GOLD PRICE


Monthly Net Profit Before Tax ($ x 1000)
390
380
370
360
350
340
330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
$8 AG
$7 AG
$6 AG
$5 AG
$4 AG
$3 AG
$2 AG
$1 AG
Heap Leaching
60% Au
50% Ag
$150
$160
$170
$180
$190
$200
$210
GOLD PRICE

SIERRA METALS

R. F. HEWLETT
President

4741 EAST SUNRISE DRIVE
SKYLINE BEL AIRE PLAZA
TUCSON, ARIZONA 85718
602/299-9736

SUMMARY OF TOMBSTONE HEAP LEACHING TESTS

Dump	Gold, T.oz. per ton			Silver, t.oz. per ton		
	1st Day	3rd	6th	1st Day	3rd	6th
Tranquility	.0133	.0190	.0200	.287	.37	.37
Empire	.0110	.0160	.0167	.193	.27	.27
Toughnut	.0056	.007	.007	.195	.24	.25
Contention #1	.0192	.024	.0244	.40	.54	.55
Little Joe	.0053	.007	.0077	.282	.44	.44
West Side	.0100	.0139	.0154	.453	.57	.57
Grand Central	.00882	.0103	.0103	.448	.58	.60
Lucky Cuss	.01422	.0182	.0182	.383	.55	.56
Emerald	.004	.0046	.0046	.40	.47	.47
Contention #2	.0170	.028	.0295	.764	1.08	1.14

SIX DAY RECOVERY DATA

Dump	Au	Ag	Gross Value ($185/4.50)	NPBT
Tranquility	.0200	.37	$ 5.37	$ 106,650
Empire	.0167	.27	4.30	58,500
Toughnut	.007	.25	2.43	--
Contention #1	.0244	.55	6.99	598,500
Little Joe	.0077	.44	3.40	--
West Side	.0154	.57	5.42	72,600
Grand Central	.0103	.60	4.61	80,500
Lucky Cuss	.0182	.56	5.89	158,950
Emerald	.0046	.47	2.97	--
Contention #2	.0295	1.14	10.59	151,800
				$1,227,500

NOTE: 395,000 tons at an average of $3.11 net profit per ton (not leaching Toughnut, Little Joe & Emerald)

HEAP LEACHING VS. MILLING

Dump	Mill Recvry. (Au/Ag)	H.L. Recovery Troy Ounces		Mill Recovery Troy Ounces		Tons
		Au	Ag	Au	Ag	
Tranquility	75/75	900	16,650	1,654	53,663	45,000
Empire	75/75	752	12,150	1,316	47,925	45,000
Contention # 1	75/75	3,660	82,500	4,725	163,125	150,000
West Side	81/75	462	17,100	462	36,450	30,000
Grand Central	75/75	515	30,000	1,125	54,000	50,000
Lucky Cuss	75/60	1,001	30,800	1,609	110,550	55,000

Dump	Heap Leaching Gross Value ($185/4.5)			Prod. Cost (3)	Net Profit Before Tax
	Au	Ag	Total		
Tranquility	$166,500	$ 74,925	$ 241,425	$135,000	$106,425
Empire	139,120	54,675	193,795	135,000	58,795
Contention # 1	677,100	371,250	1,048,350	450,000	598,350
West Side	85,470	76,950	162,420	90,000	72,420
Grand Central	95,275	135,000	230,275	150,000	80,275
Lucky Cuss	185,185	138,600	323,785	165,000	158,785

Dump	Milling Gross Value ($185/4.5)			Prod. Cost (7.5)	Net Profit Before Tax
	Au	Ag	Total		
Tranquility	$305,990	$241,484	$ 547,474	$ 337,500	$209,974
Empire	243,460	215,663	459,123	337,500	121,623
Contention # 1	874,125	734,063	1,608,188	1,125,000	483,188
West Side	85,470	164,025	249,495	225,000	24,495
Grand Central	208,125	243,000	451,125	375,000	76,125
Lucky Cuss	297,665	497,475	795,140	412,500	382,640

Dump	Net Profit Before Tax		Net Profit Before Tax Monthly	
	H.L.	Milling	H.L.	Milling
Tranquility	$ 106,425	$ 209,974	$106,425	$58,326
Empire	58,795	121,623	58,795	33,784
Contention # 1	598,350	483,188	179,685	40,266
West Side	72,420	24,495	108,090	10,206
Grand Central	80,275	76,125	72,320	19,031
Lucky Cuss	158,785	382,640	130,152	86,964
	$1,075,050	$1,298,045		

From the above, perhaps an economic criteria for the heap leach vs. mill decision might be:

2. Monthly profit rate
1. Net profit difference

This could be shown as:

Dump	Net Profit Difference		
	Total	Ratio (Milling)/(H.L.)	Monthly (H.L.)/(Milling)
Tranquility	$103,549 (M)	1.97	1.82
Empire	62,828 (M)	2.07	1.74
Contention # 1	115,162 (H.L.)	0.81	4.46
West Side	47,925 (H.L.)	0.34	10.59
Grand Central	4,150 (H.L.)	0.95	3.80
Lucky Cuss	223,855 (M)	2.41	1.50

Therefore, from the net profit difference, the following are obvious:

1. Heap leach; Contention #1, West Side, and Grand Central

From the net profit ratio, the following are shown:

1. Two clusters of values, obvious heap leach (below unity) and about twice the net profit by milling

The monthly net profit ratio (H.L./Milling) shows:

1. A trade-off on the monthly cash flow and net profit difference on the Tranquility, Empire and Lucky Cuss

A present worth analysis of heap leaching the six economic dumps (375,000 tons) follows:

Month	PW (12%)	Income		Discounted Income	
		H.L.	Mill	Heap Leach	Mill
3	.974	$ 387,407	$ 148,500	$ 377,334	$ 144,639
6	.947	387,407	148,500	366,874	140,630
9	.920	300,886	148,500	276,815	136,620
12	.893	--	148,500	--	132,611
15	.869	--	148,500	--	129,047
18	.845	--	148,500	--	125,483
21	.821	--	148,500	--	121,919
24	.797	--	148,500	--	118,355
27	.776	--	148,500	--	115,236
30	.755	--	69,300	--	52,322
		$1,075,700	$1,405,800	$1,021,023	$1,216,862

Therefore, the discounted income is very nearly the same, without considering the differential in capital investment.

DUMP SAMPLING COMPARISONS

Dump Name		Austral Oil Au	Austral Oil Ag	Duval Au	Duval Ag	Sierra Au	Sierra Ag
Empire	us	-	-	-	-	.039	1.42
	s	.080	1.90	.085	1.39	.044	1.58
Tranquility	us	.031	1.42	-	-	.049	1.59
	s	-	-	.082	1.50	.070	2.10
Contention	us	.013	.87	-	-	.016	.90
	s	-	-	.058	1.02	.042	1.45
Little Joe (Grand Central)	us	.010	.60	-	-		
	s	-	-	.051	2.23		
Sulphuret	us	.022	.66	.030	.80		
	s	-	-	-	-		
Silver Thread	us	.025	1.33	-	-		
	s	-	-	.030	2.22		
Lucky Cuss	us	.040	2.98			.039	2.91
	s	-	-			.065	5.01
Toughnut	us	.009	.54			.013	1.52
	s	-	-			.027	2.82
Bonanza		-	6.00			-	5.74
State of Maine		-	4.50			-	3.90
Soltice		.004	2.80			-	3.4
N. Bonanza		.003	1.84			-	4.4
Joseph		-	1.02			-	1.30
Br. Jonathan		-	1.94			-	3.0

NOTE: us = unscreened
s = screened

New Pueblo CONSTRUCTORS Inc.
P. O. BOX 27566
TUCSON, ARIZONA 85726
4115 EAST ILLINOIS STREET — PHONE 748-8000
GENERAL CONTRACTORS AND HEAVY ENGINEERING

KARL G. RONSTADT
PRESIDENT

February 27, 1979

Mr. James Briscoe
S.E.A. Hydromet
4500 East Speedway Blvd.
Tucson, Arizona 85712

Dear Jim:

Confirming the conversation Dick Yaeger, you and I had yesterday I am enclosing copies of estimates for your precious metals project at Tombstone.

To summarize: Estimated costs for varying quantities with a Commander III crusher (16 X 48 jaw, 6' X 20' triple deck screen, triple 30" rolls, 700 hp engine and necessary support equipment), product crushed to 1/2" minus and stockpiled by stacking conveyor only. Excluded are facilities for blending in chemicals or additives

Minimum	150/Ton/Hour	200/Tons/Hour
30,000 Tons	$4.96/Ton	$4.39/Ton
100,000 Tons	3.45/Ton	2.91/Ton
1,000,000 Tons	2.70/Ton	2.14/Ton

Included in the preceding cost is amoritization of the crushing plant and associated conveyors to a maximum of $300,000, an allowance for an increase of 7% in wages over current wage schedules and one month's standby costs on crushing equipment of approximately $15,000.

As an alternative (on behalf of commencing the project and creating current cash flow for minimum expenditure) we have provided a second estimate which includes crushing approximately 30,000 tons to a maximum of 1 1/4". This would be done by a combination of a jaw crusher and an 855 Cedarapids Commander crusher. This equipment would be moved in sometime after March 15, crushing for approximately two weeks, stockpiling 30,000 tons by stacking conveyor and thereupon be removed. It is anticipated this 30,000 tons would be of the highest grade ore available and thereby accelerate cash flow on the project. The remaining course rock above 1/2" could be crushed to a finer dimension (1/2") at a later date. The estimated cost per ton for 30,000 tons would be $2.44/ton or $73,260.00.

Payment for costs incurred would be due 30 days after invoicing. These costs would include all direct costs plus 11% overhead and administration as contained and accounted for in New Pueblo's standard job cost accounting system. Method of defining costs would be in accordance with attached "Schedule of Project Costs".

We propose to take no profit on the project until such time as the cash flow of the project exceeds expenditures and necessary reserves at which time we would receive 10% of the net profit on the project as our share of the profits. Thus we are hereby offering to manage the costs of processing and stockpiling for minimum cost and overhead and participating in the net results as a 10% partner entitled to 10% of the net revenues or benefits. All expenditures concerning the processing and crushing would be subject to review by management of the project and accounting by both parties would be subject to audit as appropriate.

Your acceptance of this proposal by signature below and return of one copy will constitute agreement.

Very truly yours,

NEW PUEBLO CONSTRUCTORS, INC.

Karl G. Ronstadt, President

KGR/kb

Attachments: Two Cost Estimates (copies)
NPC Schedule of Project Costs

ACCEPTED BY:

_____

Date: _____

NEW PUEBLO CONSTRUCTORS, INC.
SCHEDULE OF PROJECT COSTS

Description	I Items Reimbursable At Cost, Including Direct Costs on Salaries & Wages	II Non-reimbursable Items Covered By Administrative & Overhead Charges
1. HOME OFFICE COSTS		
A. Executive Salaries & Expenses		X
B. Engineering		
1. Chief Engineer		X
2. Project Engineer	X	
3. Design Engineer	X	
4. Detail Draftsman	X	
5. Material Take-Off	X	
6. Estimating Engineer	X	
7. Specifications Engineer	X	
8. Critical Path Scheduling	X	
9. Engineering Clerk	X	
10. Secretarial Service	X	
11. O.A.B., Social Security and Other Payroll Tax	X	
12. Compensation Insurance, Public Liability and Similar Insurance	X	
13. Payroll and Accounting Expense		X
14. Sick Leave and Absence for Cause		X
15. Standby Salaries		X
16. Pensions		X
17. Proportional Cost of Light, Heat, Rent, etc.		X
18. General Supplies and Equipment		X
19. Personnel Procurement		X
20. Actual Cost of Copy Work	X	
21. Computer Service	X	
22. Overtime As Necessary		
22.1 Straight time portion of cost	X	
22.2 Premium portion of cost	X	
C. Project Management		
1. Project Manager	X	
2. Project Engineers	X	
3. Cost Engineers	X	
4. Stenographic and Clerical	X	
5. Expediters & Purchasing Clerk	X	
D. Central Accounting		
1. Chief Accountant and Staff		X
2. Field Auditor		X

Description	I Items Reimbursable At Cost, Including Direct Costs on Salaries & Wages	II Non-reimbursable Items Covered By Administrative & Overhead Charges
1. HOME OFFICE COSTS - cont'd		
E. Labor Relations Personnel		X
F. Construction Manager and Staff		X
G. Chief Purchasing Agent		X
H. General Office Expenses		
1. Traveling Expenses of above employees when on trips authorized by you	X	
2. Long Distance Telephone, Telegraph and Teletype	X	
3. Local Telephone Service		X
4. Rental on Business Machines		X
5. Group Insurance, Hospitalization		X
6. Parcel Post and Express	X	
7. Postage	X	
8. Depreciation, Repairs & Maintenance		X
9. Rent, Light, Heat, Taxes and Insurance		X
10. Office Supplies and Stationery		X
11. Forms required specially for a particular Customer	X	
12. Miscellaneous Items, such as Want Ads, Subscriptions, Dues, Catalogs, Bulletins		X
13. For monthly field service which includes project ledgers, cost report work sheets, cost reports, field payroll earnings records, quarterly reports, workmens compensation for field personnel.		X
2. MATERIALS, SUBCONTRACTS, AND CONSTRUCTION SUPPLIES COSTS		
A. Actual cost of all material and equipment, including transportation and unloading of same, whether purchased by you or by ourselves. All discounts and commissions are passed on to the Customer.	X	
B. Actual Manufacturing cost of any Equipment made in our shops. Equipment can be furnished at fixed prices.	X	

Description	I Items Reimbursable At Cost, Including Direct Costs on Salaries & Wages	II Non-reimbursable Items Covered By Administrative & Overhead Charges
MATERIALS, SUBCONTRACTS, AND CONSTRUCTION SUPPLIES COSTS - cont'd		
C. All Subcontracts	X	
D. All expendable materials and construction supplies, also water & electricity	X	
3. FIELD LABOR AND RELATED COSTS		
A. Salaries and Wages		
1. Field Superintendent of Construction	X	
2. Assistant Superintendent	X	
3. General Foreman	X	
4. Resident Engineer	X	
5. Chief Surveyor	X	
6. Instrument Men, Stakers & Rodmen	X	
7. Field Accountant and Staff	X	
8. Cost Analysis Engineer	X	
9. Timekeepers	X	
10. Field Purchasing Agent	X	
11. Warehousemen and Helpers	X	
12. Safety Engineer, Doctor & Nurses	X	
13. Watchmen and Guards	X	
14. Other necessary Non-Manual Field Employees	X	
15. Overtime pay for 3-A (1 to 14) above, in accordance with Established Policy and with your prior approval	X	
15.1 When Overtime is Worked, the overtime premium payroll will be a job cost.		
16. Vacation and Holiday allowances, in accordance with NPC policy	X	
17. Sick leave for monthly salary employees		X
B. Travel and living expense and subsistence for personnel 3-A (1 to 14) above, in accordance with NPC policy	X	
C. Social Security, Unemployment Insurance and Payroll Taxes applicable to Employees, 3-A (1 to 15) above.	X	
D. All Job Site Craft and common labor salaries, wages and fringe benefits as required by working rules of Unions having jurisdiction, including travel and premium pay allowances for field manual employees.	X	

Description	I Items Reimbursable At Cost, Including Direct Costs on Salaries & Wages	II Non-reimbursable Items Covered By Administrative & Overhead Charges
FIELD LABOR AND RELATED COSTS - cont'd		
D(a) When overtime is worked, the premium overtime payroll will be a job cost with no addition for Contractors burden or fee.		
(1) Labor for tie in of subcontract installations	X	
(1.1) Material for tie in of subcontract installations	X	
(2) Labor to install changes after start-up	X	
(2.1) Material needed to install changes after start-up	X	
E. Social Security, Unemployment Insurance and Payroll Taxes applicable to employees in 3-D.	X	
F. Workmen's Compensation; Liability, Property Damage, Builders Risk and other insurance as required.	X	
G. Cost of labor recruitment, testing and transportation to the Job Site.	X	
H. Cost of labor negotiations, specifically for this work as required.	X	
I. Cost of Engineers, Technicians, or Manufacturer's Specialists for installation and start-up.	X	
4. CONSTRUCTION EQUIPMENT AND TOOL COST		
A. Transportation and handling costs to move tools and equipment to and from the job.	X	
B. Purchase of major construction equipment.	X	
Rental of major construction equipment from others, at cost (outside rented equipment).	X	
D. Rental and transportation of any construction equipment, whether furnished by contractor or others. Rental rates for contractor owned equipment, if available, will be negotiated.	X	

Description	I Items Reimbursable At Cost, Including Direct Costs on Salaries & Wages	II Non-reimbursable Items Covered By Administrative & Overhead Charges
CONSTRUCTION EQUIPMENT AND TOOL COST - cont'd		
D(a) Normally NPC equipment "Use" rate will be charged. This rate includes all costs of ownership, and operation except operator labor. These rates are fueled & maintained, and are based on A.E.D. Rates. 50% of this rate will be charged for stand-by time. No charge will be made if equipment is stored or inoperative.		
E. Small Tools and Rigging	X	
F. Maintenance of outside rented equipment and tools, including renovating at end of job.	X	
G. Gas, Oil and other maintenance supplies on outside rented equipment only.	X	
5. MISCELLANEOUS JOB COSTS		
A. Temporary Construction Facilities	X	
B. Field Office, Furniture, Office Equipment	X	
C. Building Permits and Licenses	X	
D. Field Telephone & Telegraph	X	
E. Premium of Compensation Insurance, Public Liability and Property Damage, Automobile Public Liability and Property Damage, and any other insurance required for Field Payroll or Plant, job incurred only.	X	
F. Losses or Expenses not compensated by Insurance.	X	
G. Rental cars at cost.	X	
H. Sales, Use and Privilege Taxes (if any).	X	
I. All other direct cash outlays for job costs not specifically excluded.	X	
J. Outside consultants.	X	

Description	I Items Reimbursable At Cost, Including Direct Costs on Salaries & Wages	II Non-reimbursable Items Covered By Administrative & Overhead Charges
5. MISCELLANEOUS JOB COSTS - cont'd		
K. Inspection in Suppliers Shop or in Field. Includes travel time and travel and living expense.	X	
L. Cost of legal fees and expenses caused by Force Majeure.	X	
M. Cost of Performance Bond (if required).	X	

Xerox - 2 copies
Please keep pages in order

APPENDIX 4.3

HTH AND HYPO AT LOW pH

VENTURE MINING COMPANY, LTD.
P.O. BOX S
COOL, CALIFORNIA 95614
TELEPHONE (916) 885-2201

November 11, 1976

J. Bruce Stevenson
Caithness Corporation
7110 Oracle Road
Suite 213
Tucson, Az. 85704

Dear Bruce:

Enclosed is Rudy Amiscaray's preliminary test results on HTH/acid and Hypo/acid leach tests conducted at various pH and compared to a cyanide leach.

Gold extraction using HTH and silver extraction with Hypo increases considerably with lower pH. The sample for Tests 1-2A is Wall Street tailings from Nelson, which should be fairly uniform between sample splits (see Table 1). Additional tests were run on the Portland, Cripple Creek tailings and showed the following results:

Portland Tailings

Solvent	pH	Oz Au/Ton	% of NaCN
Cyanide	11.00	.006	100
HTH	6.35	.008	133
HTH	3.40	.012	200
HTH	1.85	.018	300
HTH	1.20	.022	367
I_2 + KI/Acid	----	.016	267
I_2 + KI	----	.012	200

APPENDIX 4.5

HALIDES TO LEACH GOLD

These results represent a major breakthrough in our search for non-toxic gold and silver solvents. The behavior pattern of Hypo, HTH, and even cyanide may explain some current operational data; for instance:

...Silver salts, particularly AgCl, precipitate to AgO, with a strong base, which may explain the Toughnut silver precipitation for the in-situ. Future hypo in-place or in-situ should be controlled at lower pH levels with acid.

...Is the recent Tombstone increase in silver extraction a result of lower pH? Rod Williams switched from liquid caustic to soda ash a few months ago and is maintaining a much lower alkalinity.

...Barrel tests at Cripple Creek indicated soda ash might improve gold recovery as much as 30% over liquid caustic, and this may be due to pH.

We will continue this evaluation as time and personnel permit.

Sincerely,

R. M. Darrah

cc: R. F. Hewlett
J. L. Kennedy
R. R. Williams
R. B. Amiscaray

TABLE 1

COMPARATIVE LEACH RATES

CYANIDE VS. HTH AND HYPO

(Reference: R. B. Amiscaray report dated Nov. 3, 1976)

TEST 1 24 HOUR AGITATION

Solvent	pH	Au Oz/Ton	% of NaCN
Cyanide	11.05	.042	100
HTH	.90	.040	95
HTH	.65	.037	88
HTH	.65	.043	102
HTH	.55	.042	100

TEST 1A 24 HOUR AGITATION

Solvent	pH	Au Oz/Ton	% of NaCN
Cyanide	11.05	.042	100
HTH	6.90	.012	26
HTH	1.10	.018	43
HTH	.90	.024	57
HTH	.35	.032	76

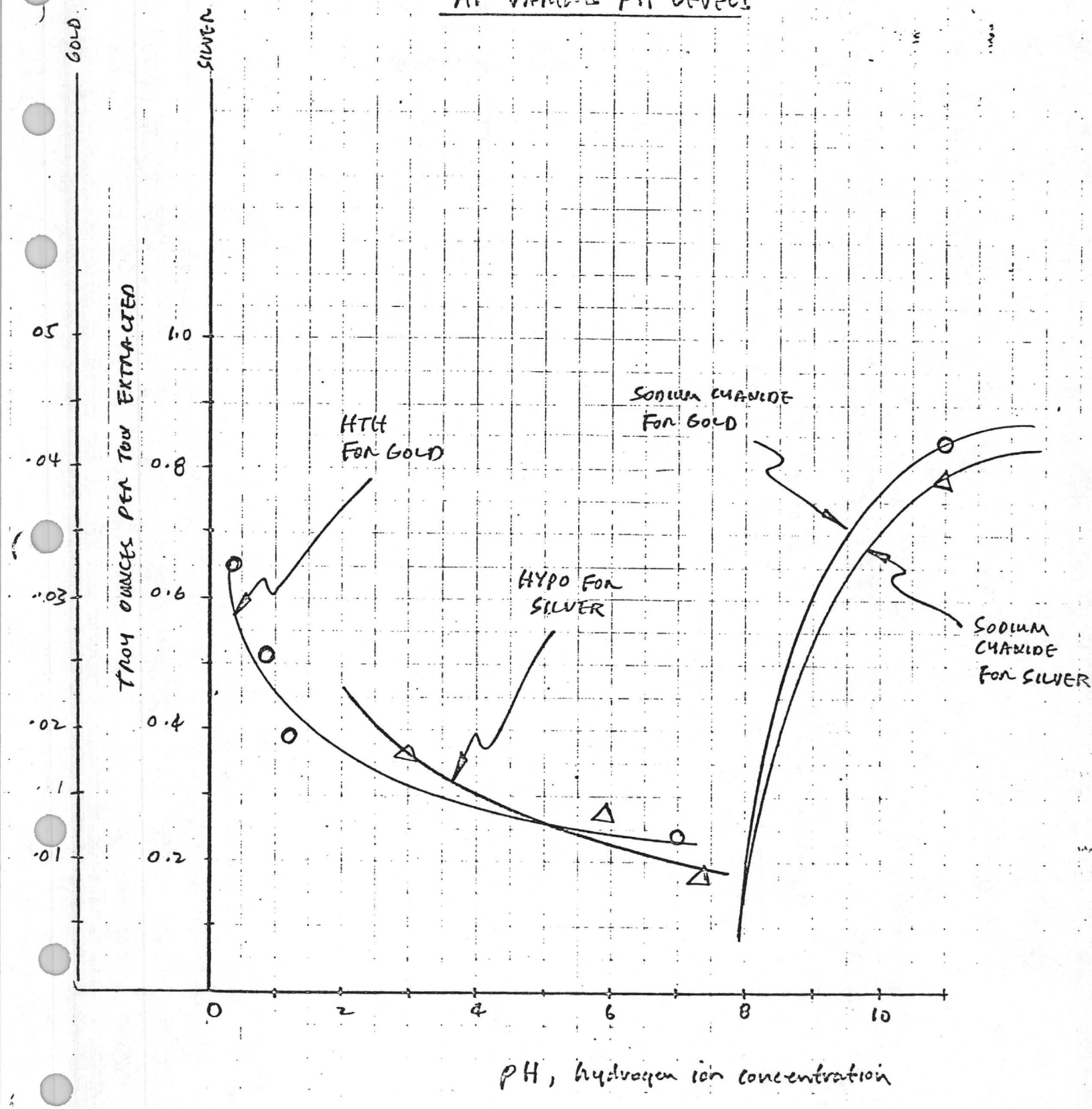
TEST 2A 19 HOURS

Solvent	pH	Ag Oz/Ton	% of NaCN
Cyanide	11.05	.790	100
Hypo	7.25	.156	20
Hypo	5.90	.232	29
Hypo	2.90	.360	46

COMPARATIVE LEACH RATES

CYANIDE VS. HTH VS. HYPO

AT VARIOUS pH LEVELS



November 3, 1976

To: R. M. Darrah
From: R. B. Amiscaray
Subject: HTH & Hypo Test

Per your instruction about discontinuing barrel test for HTH, should we obtain low results on previous barrel test, I would suggest that we have to continue conducting an extensive test on "HTH" including "Hypo" at lower pH. In addition to that, some of the barrel test which we lowered down the pH to 1.5 like the Crystal Butte samples (#121 & 123) showed an increase on the Au leached.

Following is the summary of the shaker test conducted on Nelson tails:

(A) HTH Test

1. At very low pH the Au recovered by HTH is almost the same as that on the standard NaCN/NaOH test.
2. The Au leached increases slightly as pH increases. See Fig. 1, and 1-A.

(B) Hypo Test

1. Au leached increases at lower pH.
2. Ag increases as pH decreased to a certain extent when Ag dropped off at pH lower than 2.9. Below this pH, all the Ag is precipitated as AgS. This can be attributed to the decomposition of Hypo to sulfur, hence Ag reacts with sulfur to form AgS. See Fig. 2, 2-A.

SHAKER TEST RESULTS (Nelson Tails)

TEST 1 HTH TEST -- 24 HOURS

Sample #	pH	Ozs. Leached Au	Ozs. Leached Ag	
1	11.05	.042	.79	NaCN/NaOH
2	.90	.040	.006	HTH w/ H_2SO_4
3	.65	.037	.004	HTH w/ H_2SO_4
4	.65	.043	.005	HTH w/ H_2SO_4
5	.55	.042	.005	HTH w/ H_2SO_4

TEST 1-A HTH TEST -- 24 HOURS

Sample #	pH	Ozs. Leached Au	Ozs. Leached Ag	
1	6.90	.012	.002	HTH w/ H_2SO_4
2	6.85	.012	0	HTH w/ H_2SO_4
3	5.75	.018	.002	HTH w/ H_2SO_4
4	1.78	.014	0	HTH w/ H_2SO_4
5	1.40	.012	0	HTH w/ H_2SO_4
6	1.10	.018	.002	HTH w/ H_2SO_4
7	.90	.024	.004	HTH w/ H_2SO_4
8	.75	.022	.004	HTH w/ H_2SO_4
9	.55	.026	.004	HTH w/ H_2SO_4
10	.35	.032	.006	HTH w/ H_2SO_4

TEST 2 HYPO TEST -- 44 HOURS

Sample #	pH	Ozs. Leached Au	Ozs. Leached Ag	
1	11.60	.066	.940	NaCN/NaOH
2	8.10	.008	.132	Hypo w/ H_2SO_4
3	7.95	.006	.084	
4	7.94	.008	.090	
5	7.85	.010	.140	
6	6.65	.010	.204	
7	1.40	.012	0	
8	0.80	.026	0	

TEST 2-A HYPO TEST -- 19 HOURS

Sample #	pH	Ozs. Leached Au	Ozs. Leached Ag	
A	7.25	.010	.156	Hypo w/ H_2SO_4
B	6.90	.010	.152	
C	5.90	.008	.232	
D	2.90	.008	.360	
E	2.05	.006	.002	
F	1.60	.008	0	

R. Amiscaray

cc: J. Kennedy
File

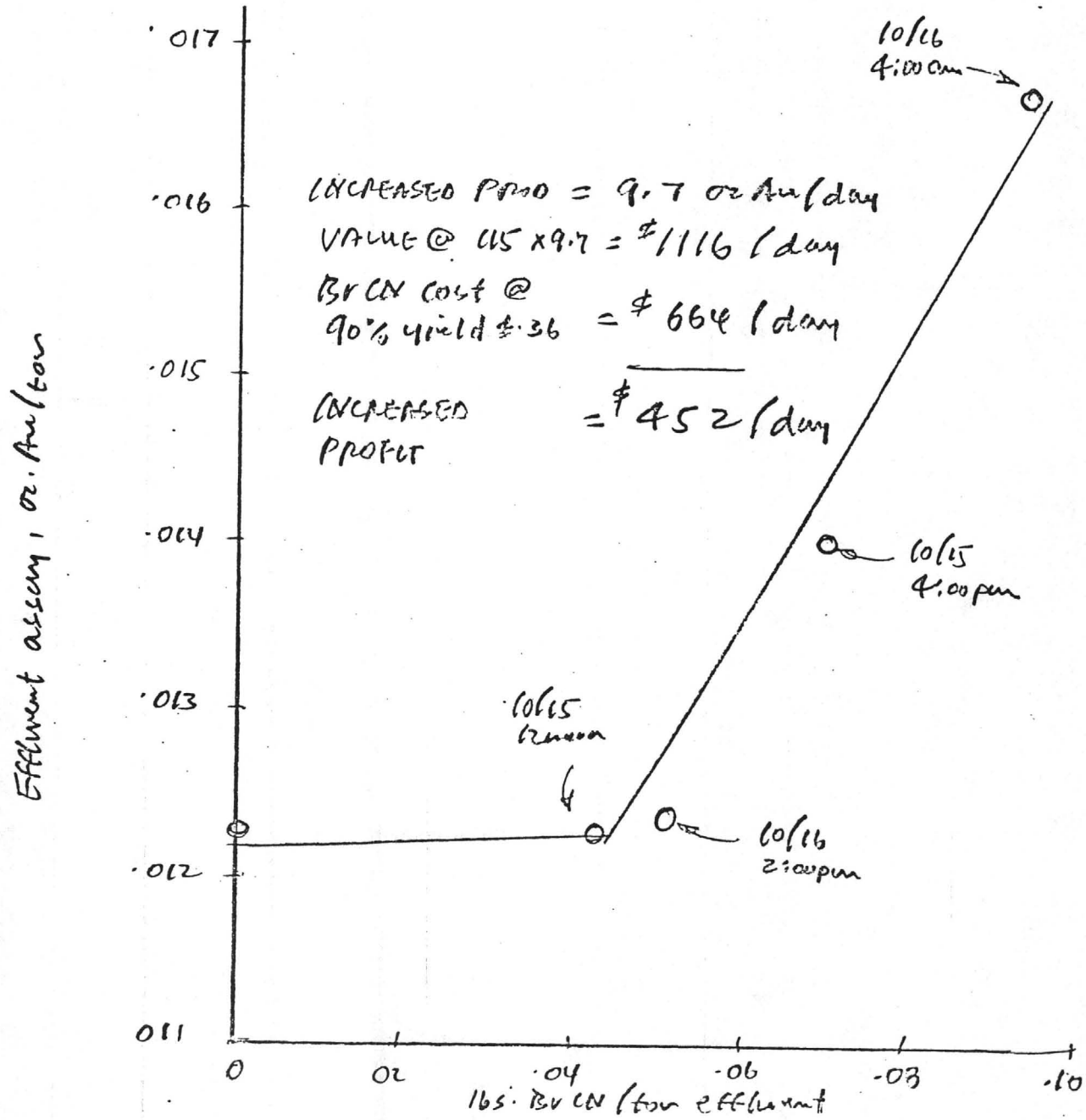
APPENDIX 4.4

BROMINE TEST AT CRIPPLE CREEK

10/16/76
Rmgt.

CRIPPLE CREEK BROMOCYANIDE TEST RESULTS

Effluent	10/14 1:00 AM BrCN	Au	10/15 12 Noon BrCN	Au	10/15 4:00 PM BrCN	Au	10/16 4:00 AM BrCN	Au	10/16 2:00 AM BrCN	Au
1	0	.014	.042	.015	084	.016	.10	.016		
2	0	.013	.042	.011	084	.013	.10	.016		
3	0	.010	.042	011	.042	.013	.084	.018		
Total	0	.037	0126	.037	.210	.042	.284	.050		
Avg	0	.0123	.042	.0123	.070	.014	.095	.0167		

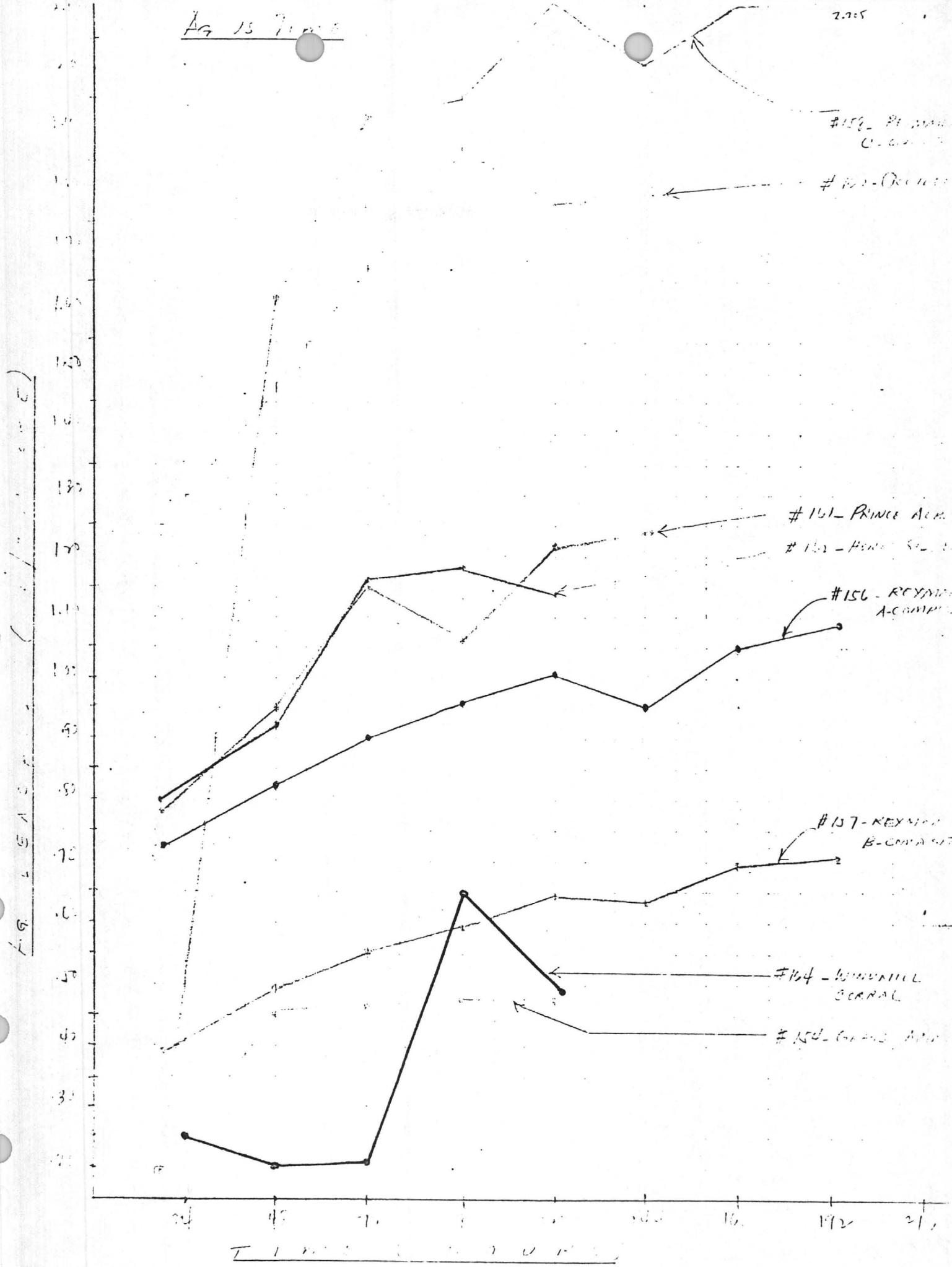


BASIS: SPRAYING 1/2 lb BrCN, 2200 TONS/DAY

Δ INCREASE @ .10 BrCN IS .0167 − .0123 = .0044 x 2200 = 9.68 oz Au/day

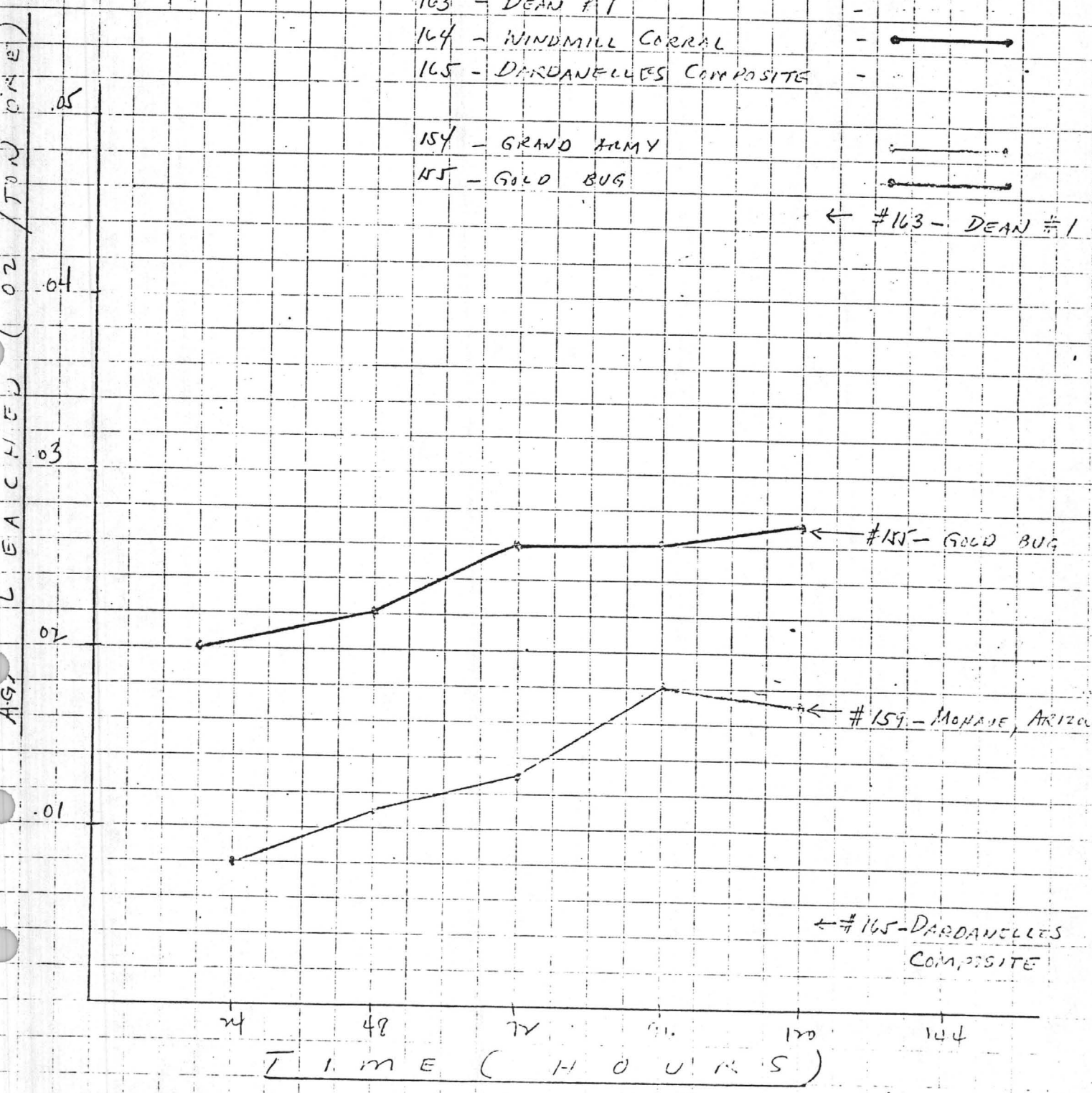
APPENDIX 4.6

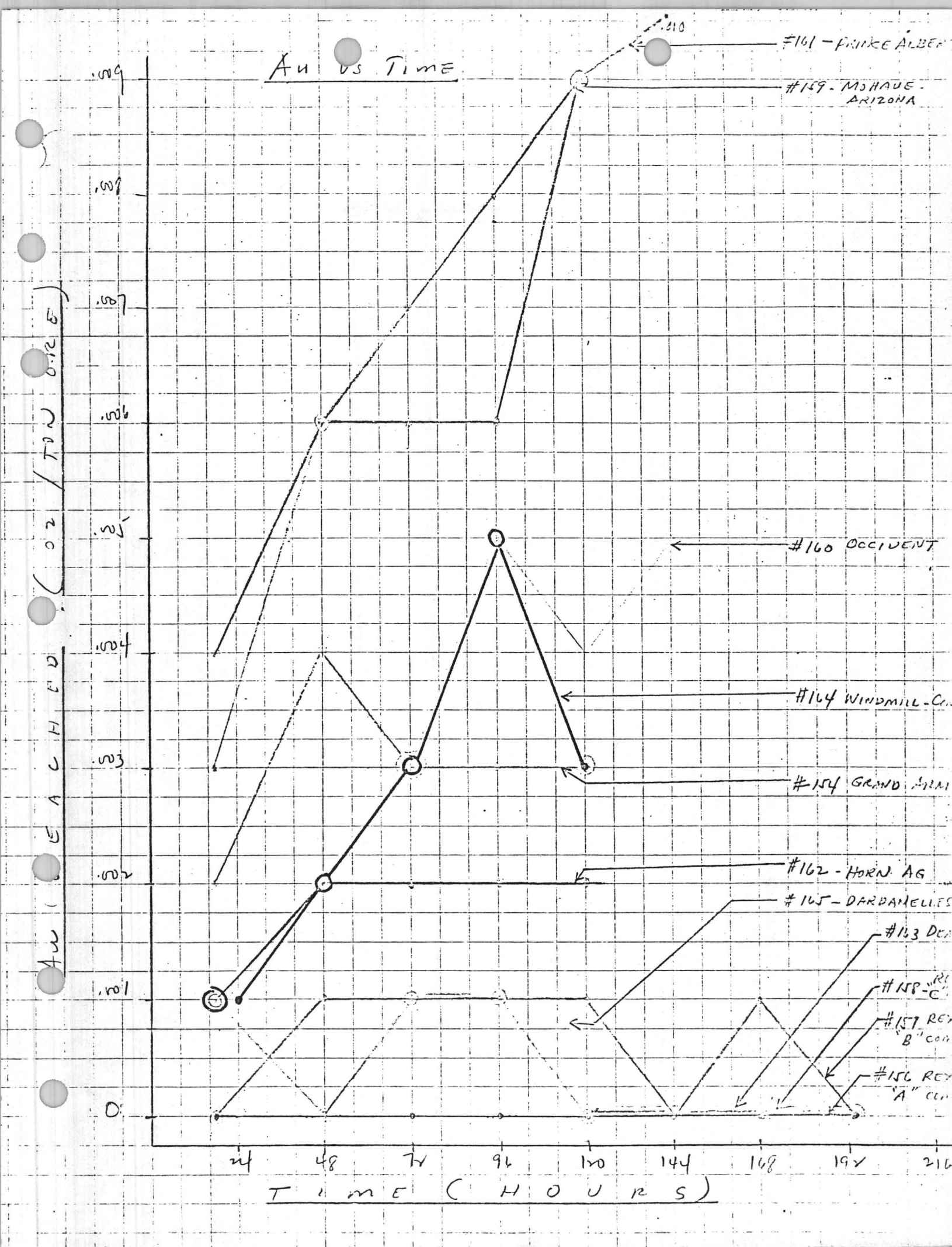
OCT.-NOV. LAB TEST RESULTS


#161_ PRINCE
#156 - REYNO
A-COMP
#157 - REYNO
B-COMP
#164 - WINNEMUCCA
CORRAL

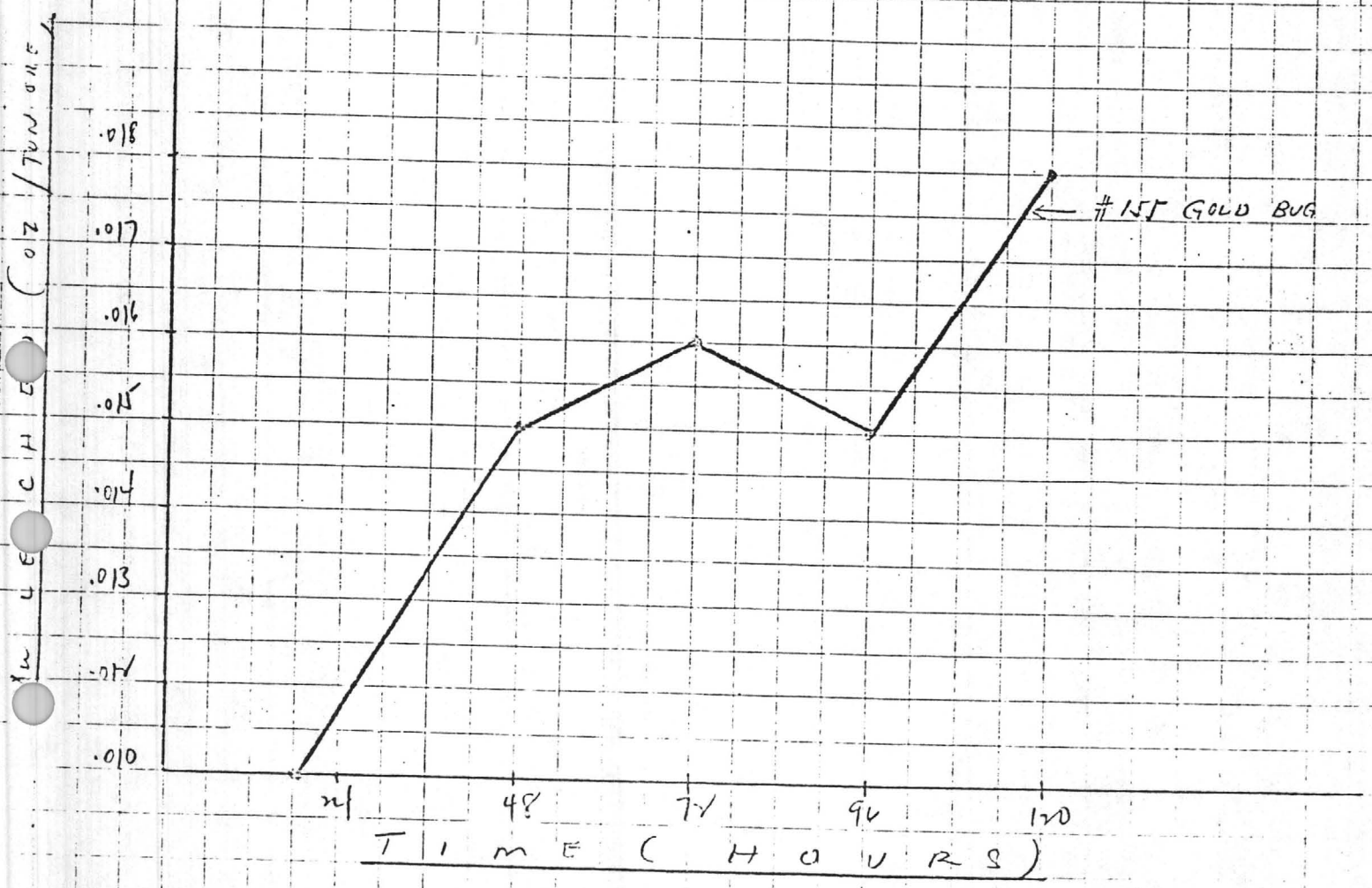
R. M. Minah

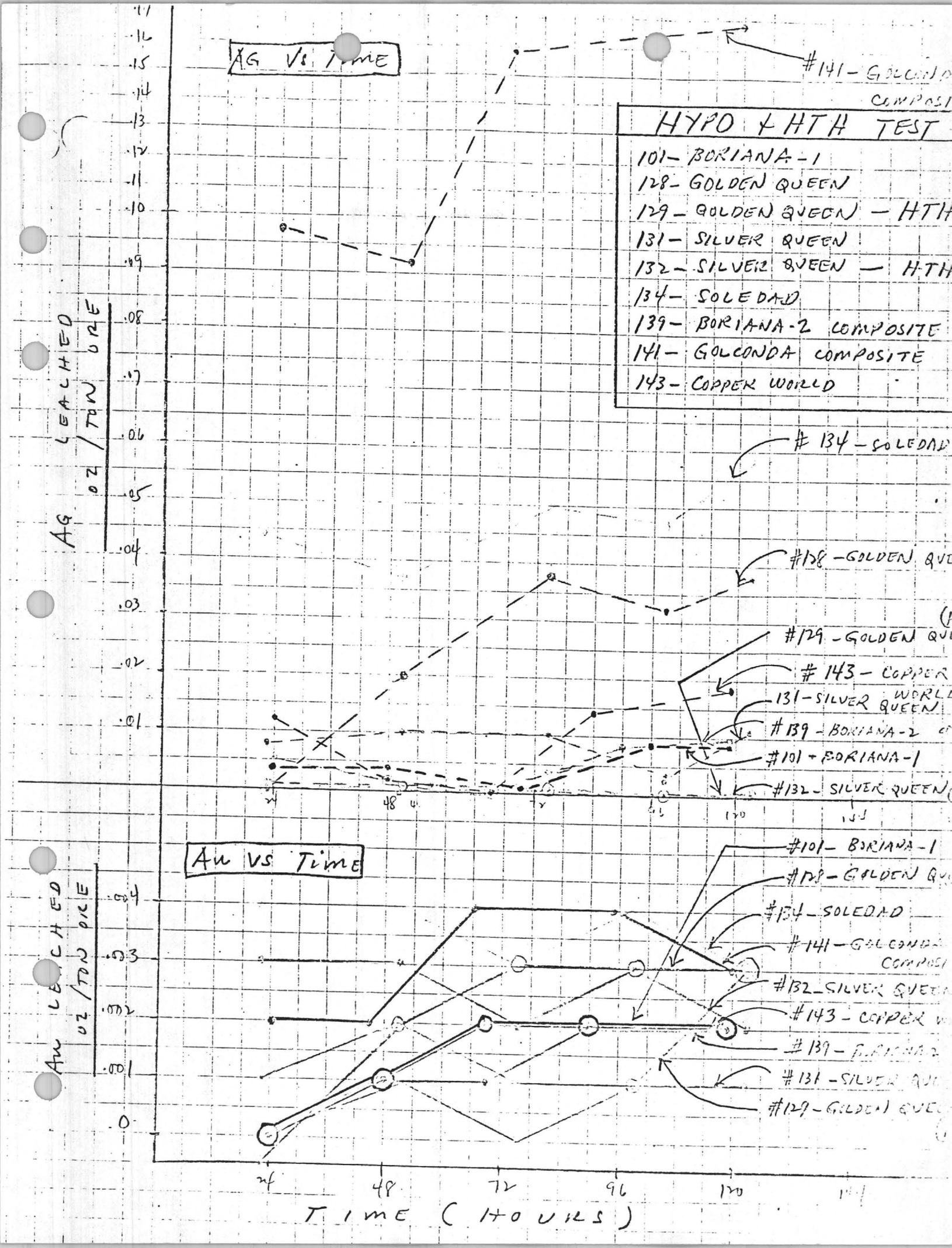
AG VS TIME

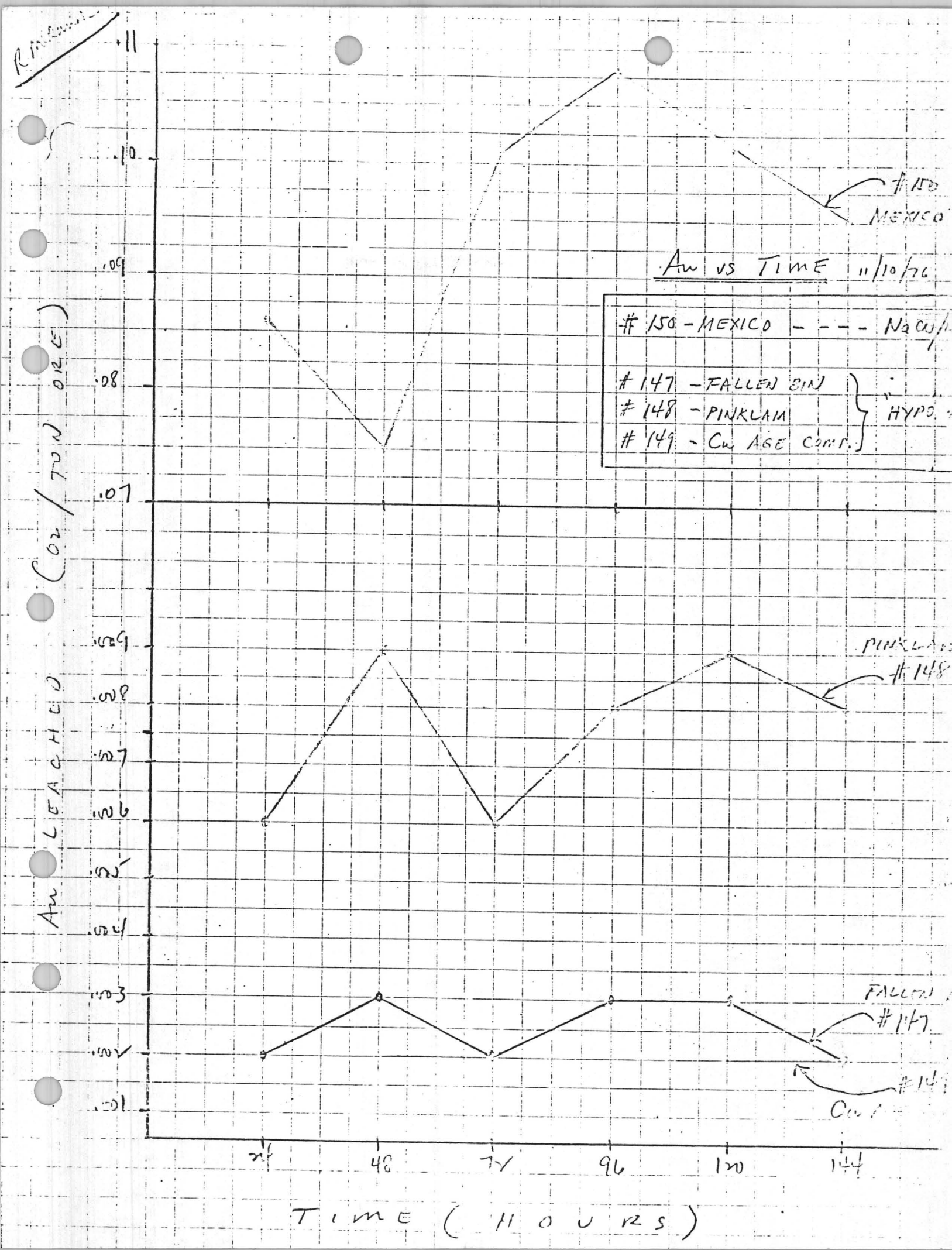


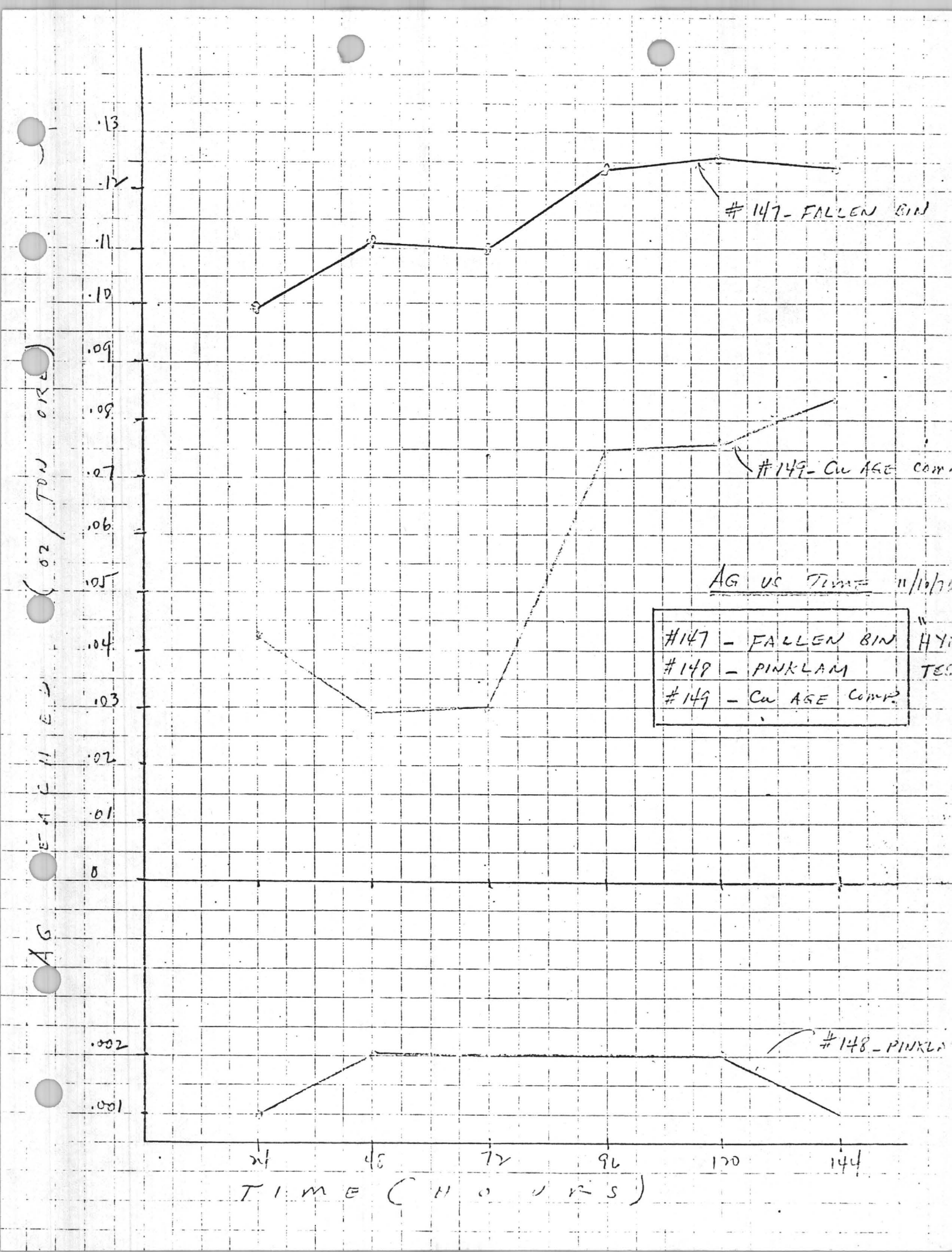

Au vs Time
Au (OZ / TON OF ORE)
.009
.008
.007
.006
.005
.004
.003
.002
.001
0
24
48
72
96
120
144
168
192
216
TIME (HOURS)
#161 - PRINCE ALBERT
#159 - MOHAVE - ARIZONA
#160 OCCIDENT
#164 WINDMILL - C
#154 GRAND ARM
#162 - HORN AG
#165 - DARDANELLES
#163 DE
#158 - "C"
#157 REX "B" CON
#156 REX "A" CON

Au VS TIME


Au LEACHED (OZ / TON ORE)
.018
.017
.016
.015
.014
.013
.012
.010
24
48
72
96
120
TIME (HOURS)
#1ST GOLD BUG

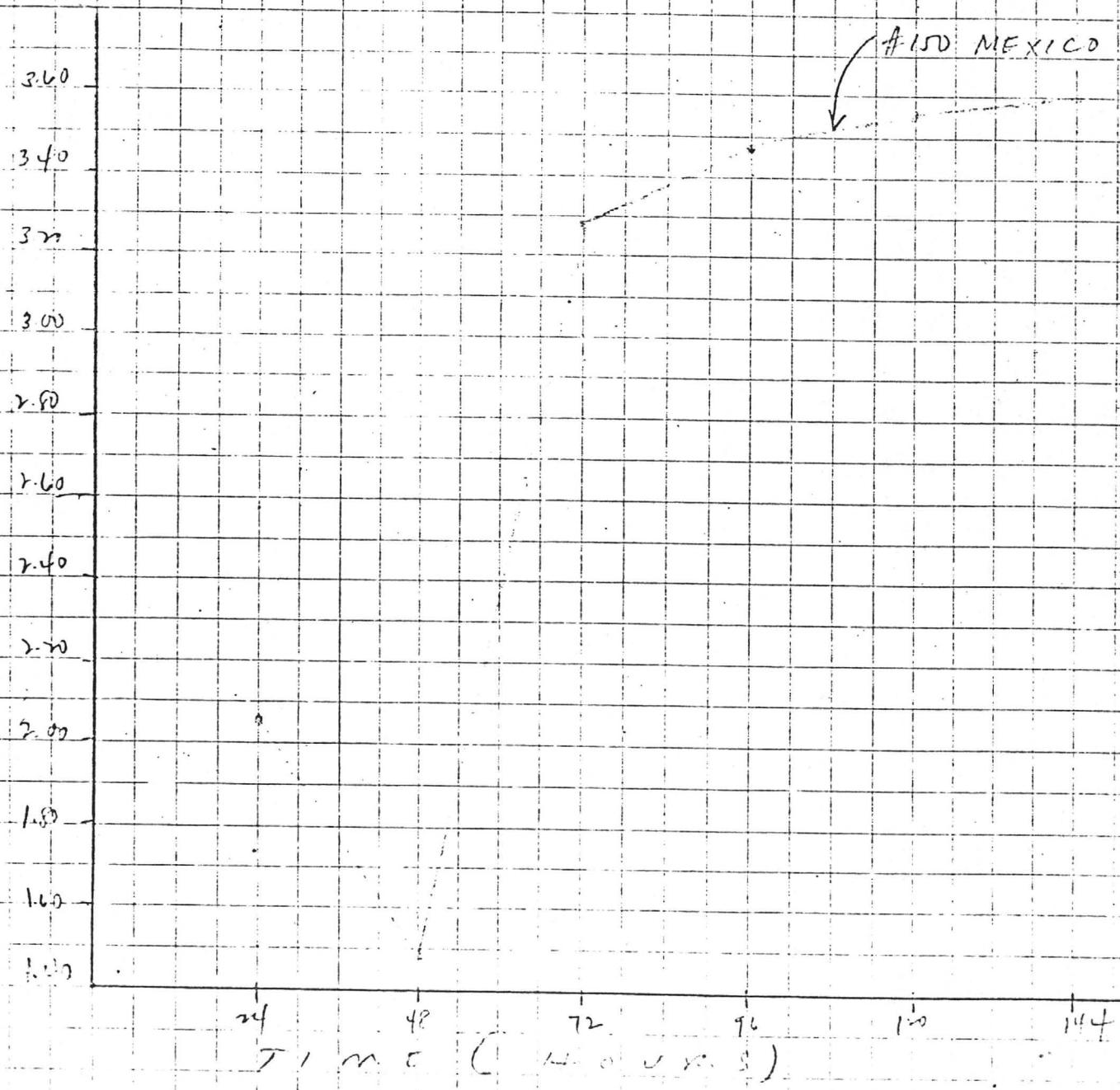

AG VS TIME
#141 - GOLCONDA COMPOSI
HYPO + HTH TEST
101 - BORIANA-1
128 - GOLDEN QUEEN
129 - GOLDEN QUEEN - HTH
131 - SILVER QUEEN
132 - SILVER QUEEN - HTH
134 - SOLEDAD
139 - BORIANA-2 COMPOSITE
141 - GOLCONDA COMPOSITE
143 - COPPER WORLD
AG LEACHED OZ / TON ORE
.17
.16
.15
.14
.13
.12
.11
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
#134 - SOLEDAD
#128 - GOLDEN QUE
#129 - GOLDEN QUE
#143 - COPPER WORLD
131 - SILVER QUEEN
#139 - BORIANA-2
#101 - BORIANA-1
#132 - SILVER QUEEN
24
48
72
96
120
144
Au VS Time
Au LEACHED OZ / TON ORE
.004
.003
.002
.001
0
#101 - BORIANA-1
#128 - GOLDEN QUE
#134 - SOLEDAD
#141 - GOLCONDA COMPOSI
#132 - SILVER QUEEN
#143 - COPPER W
#139 - BORIANA-2
#131 - SILVER QUE
#129 - GOLDEN QUE
24
48
72
96
120
144
TIME (HOURS)


Au vs TIME 11/10/76
150 - MEXICO - - - - Na w/
147 - FALLEN BIN
148 - PINKLAM
149 - Cu AGE COMP.
HYPS
150 MEXICO
PINKLAM # 148
FALLEN # 147
149 Cu
Au LEACHED (OZ / TON ORE)
TIME (HOURS)
24
48
72
96
120
144

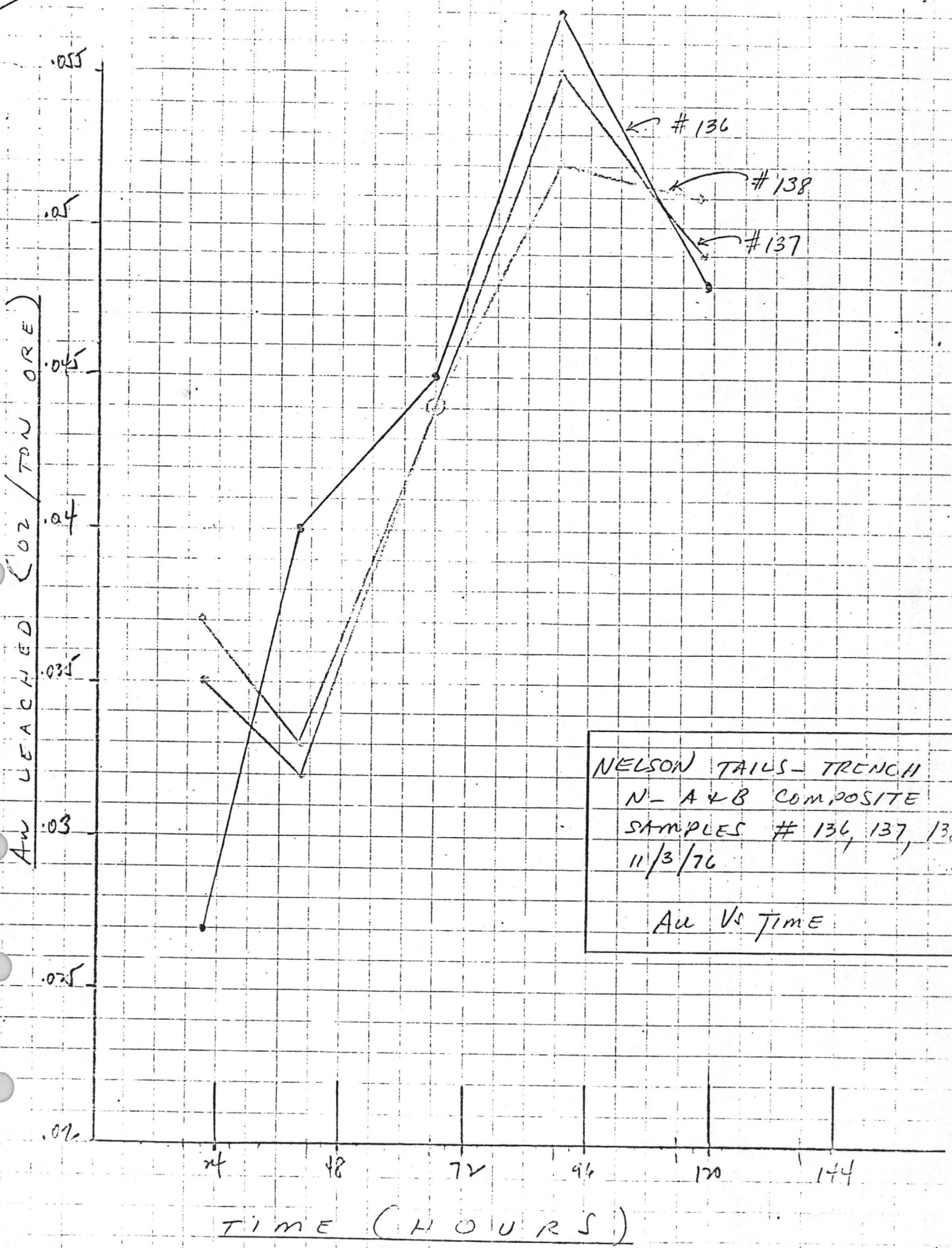

AG VS TIME 11/10/7
#147 - FALLEN BIN
#148 - PINKLAM
#149 - Cu AGE COMP
#147 - FALLEN BIN
#149 - Cu AGE COMP
#148 - PINKLA
AG (OZ / TON ORE)
.13
.12
.11
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
0
.002
.001
24
48
72
96
120
144
TIME (HOURS)

AG VS TIME 11/10/76

#150 - MEXICO SAMPLE - NaCN/NaOH

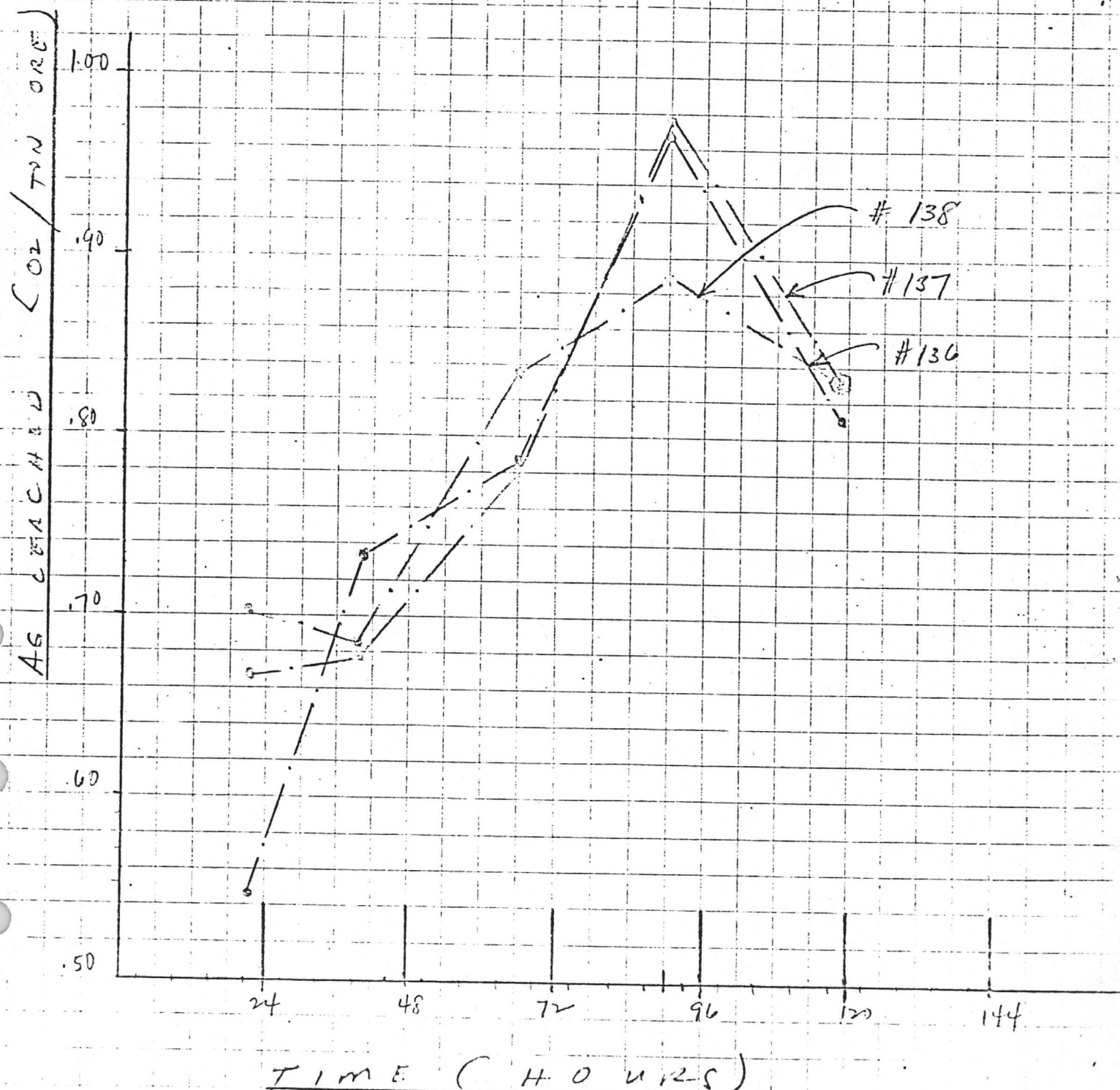


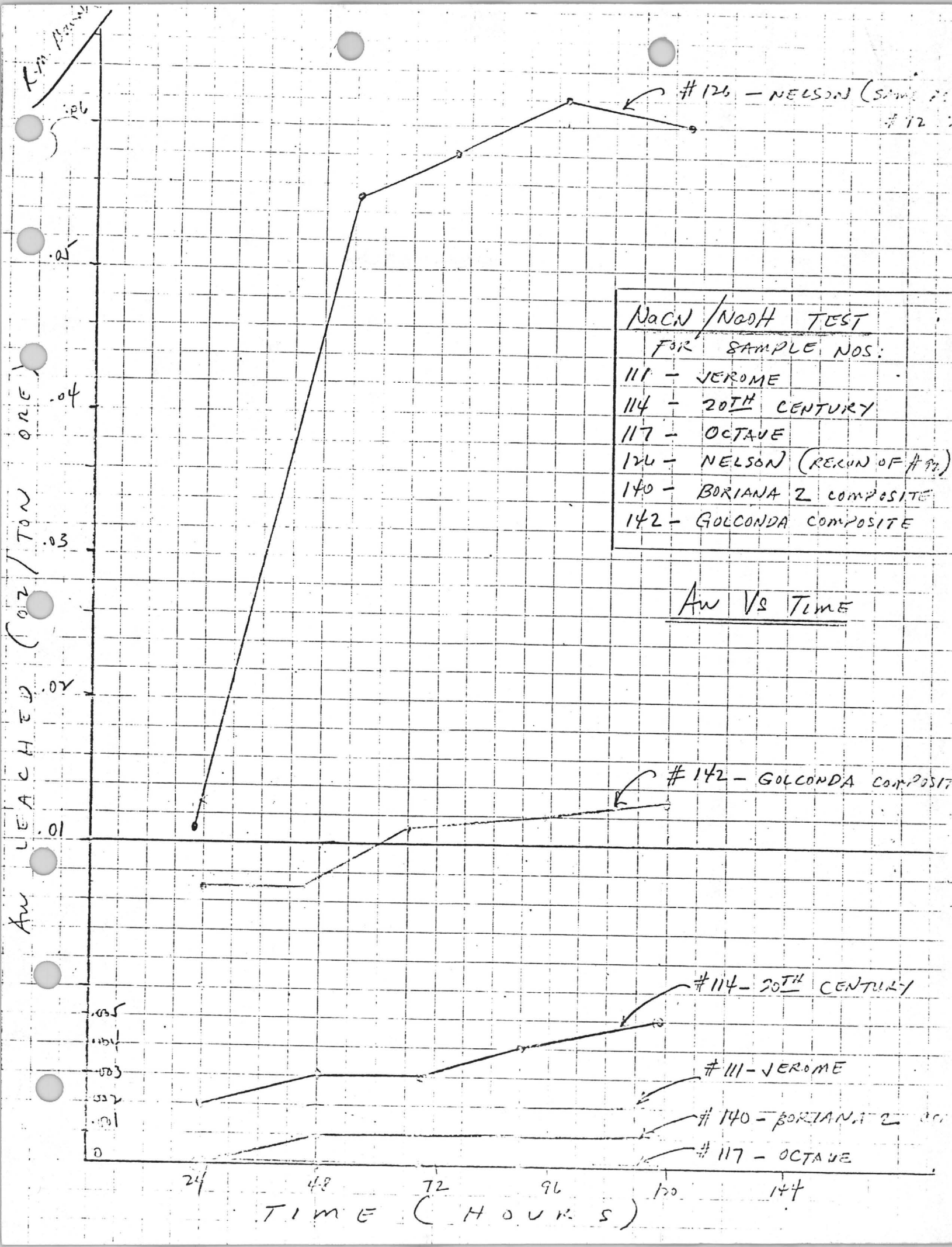
R.W. Kenah

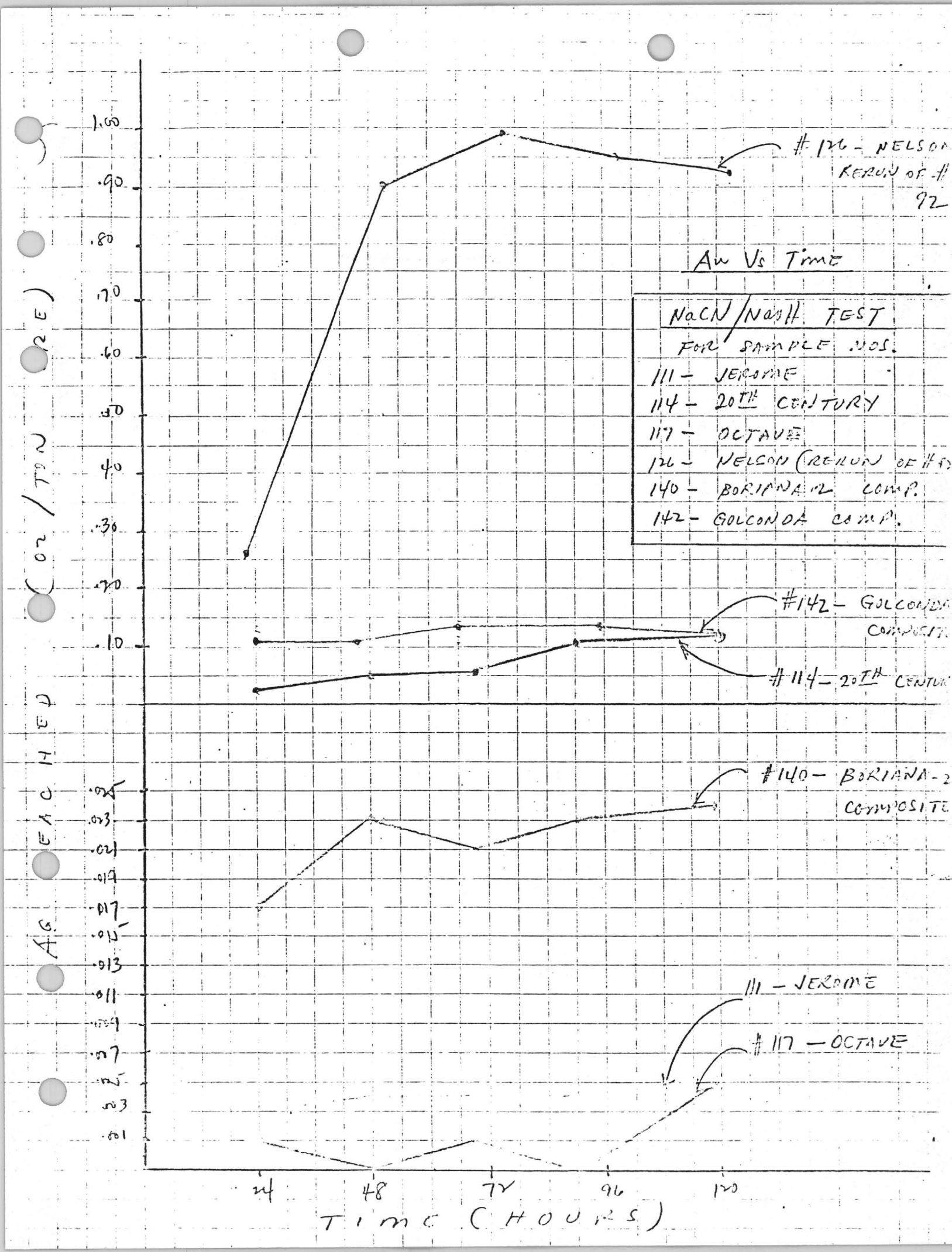

.055
.05
.045
.04
.035
.03
.025
.02
Au LEACHED (OZ / TON ORE)
#136
#138
#137
NELSON TAILS - TRENCH
N - A & B COMPOSITE
SAMPLES # 136, 137, 138
11/3/76
Au Vs TIME
24
48
72
96
120
144
TIME (HOURS)

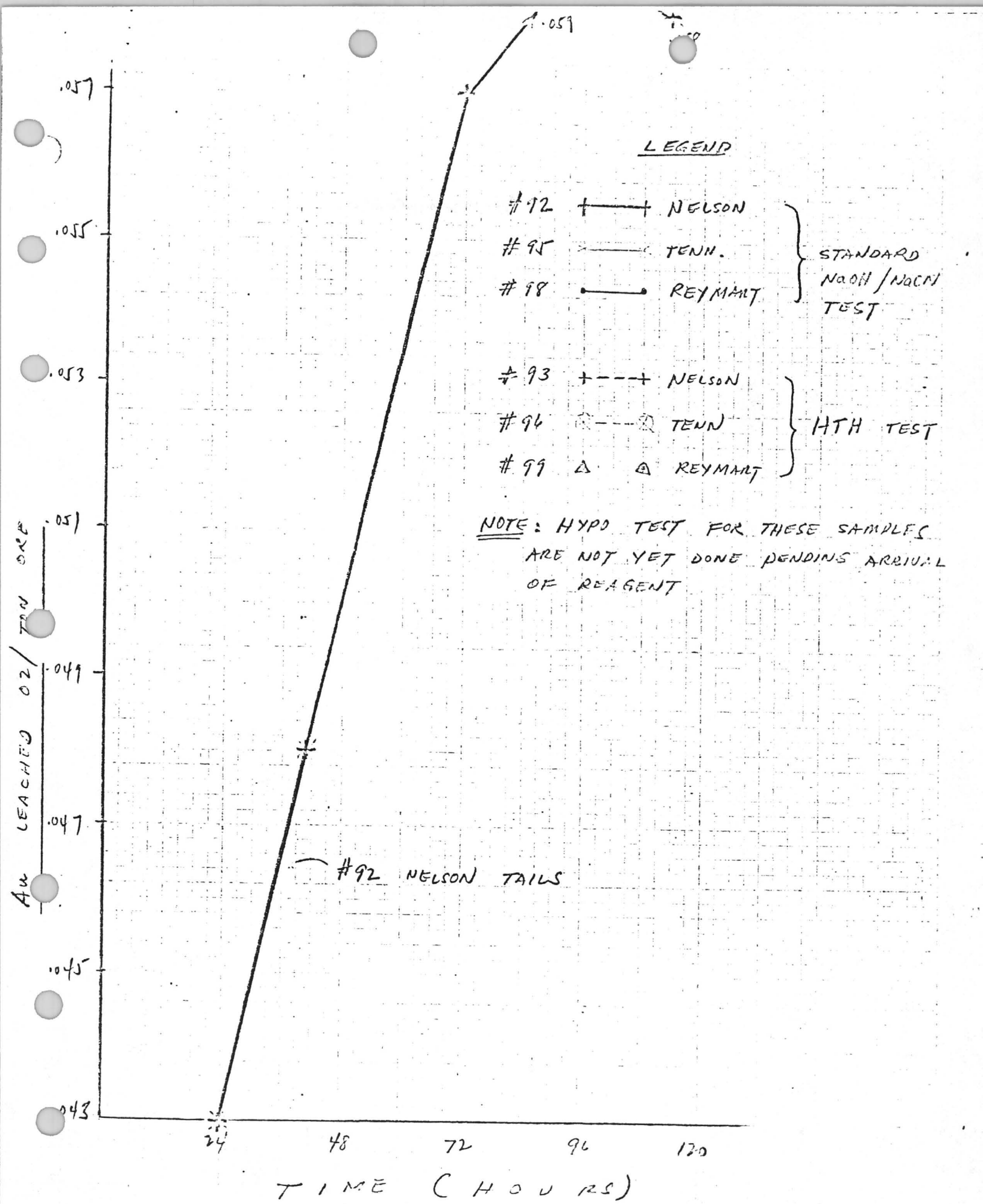
NELSON TAILS – TRENCH
N-A+B COMPOSITE.
SAMPLE # 136, 137, 138
11/3/76

AG VS TIME

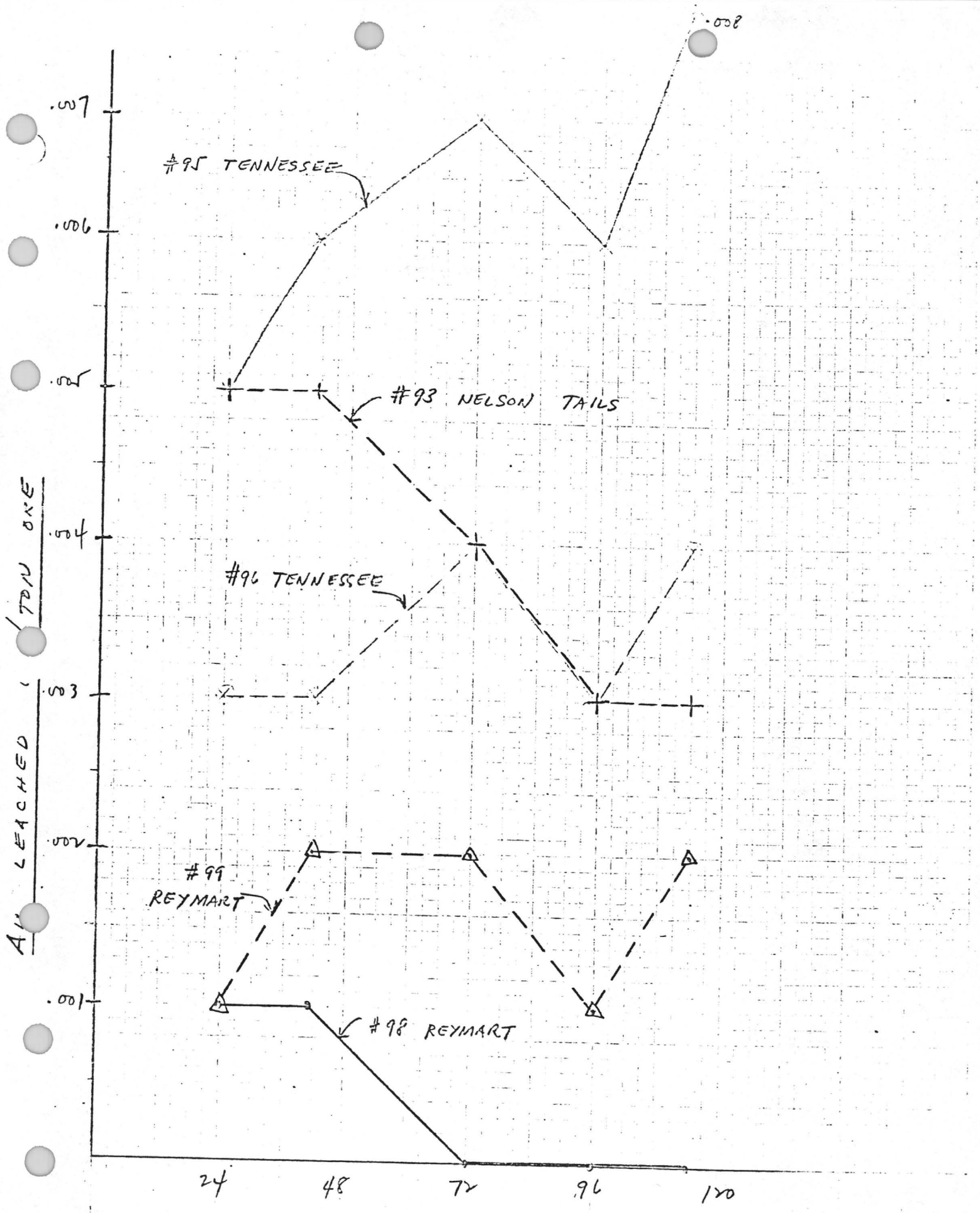



NaCN / NaOH TEST
FOR SAMPLE NOS:
111 - JEROME
114 - 20TH CENTURY
117 - OCTAVE
126 - NELSON (RERUN OF #12)
140 - BORIANA 2 COMPOSITE
142 - GOLCONDA COMPOSITE
Au VS TIME
#126 - NELSON
#142 - GOLCONDA COMPOSITE
#114 - 20TH CENTURY
#111 - JEROME
#140 - BORIANA 2
#117 - OCTAVE
Au LEACHED (OZ / TON ORE)
.06
.05
.04
.03
.02
.01
.035
.031
.003
.002
.001
0
24
48
72
96
120
144
TIME (HOURS)

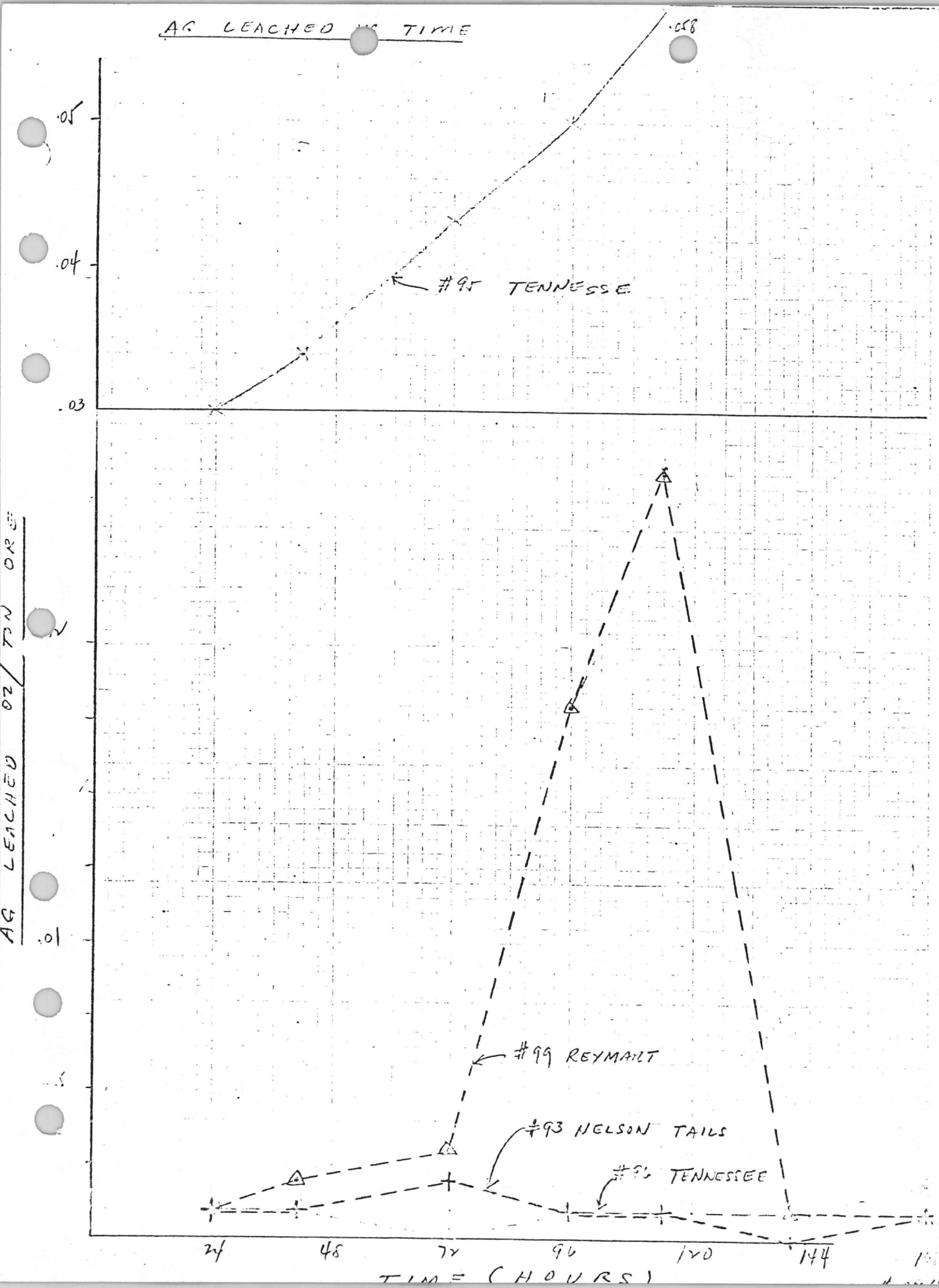

Au Vs Time
NaCN/NaOH TEST
FOR SAMPLE NOS.
111 - JEROME
114 - 20TH CENTURY
117 - OCTAVE
126 - NELSON (RERUN OF #92
140 - BORIANA COMP.
142 - GOLCONDA COMP.
#126 - NELSON
RERUN OF #92
#142 - GOLCONDA
COMPOSITE
#114 - 20TH CENTURY
#140 - BORIANA-2
COMPOSITE
111 - JEROME
#117 - OCTAVE
AG. ENCHED (OZ/TON)
TIME (HOURS)
24
48
72
96
120

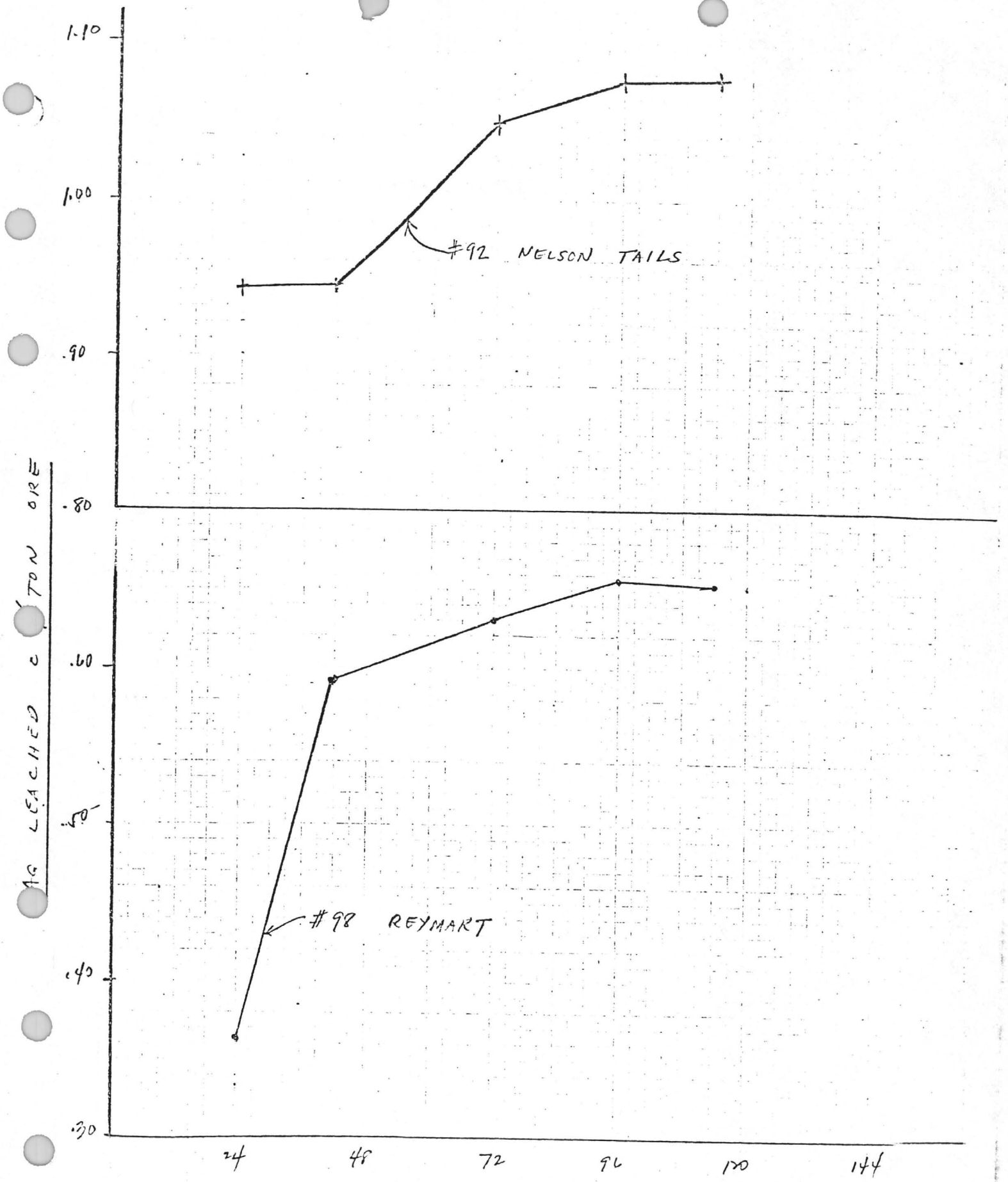


Au LEACHED VS TIME



AU LEACHED VS TIME


AG LEACHED VS TIME
.058
.05
.04
.03
#95 TENNESSE
AG LEACHED OZ/TON ORE
.01
#99 REYMART
#93 NELSON TAILS
#95 TENNESSEE
24
48
72
96
120
144
TIME (HOURS)



AG LEACHING VS TIME

FIG. 1 AU OZS LEACHED VS TIME

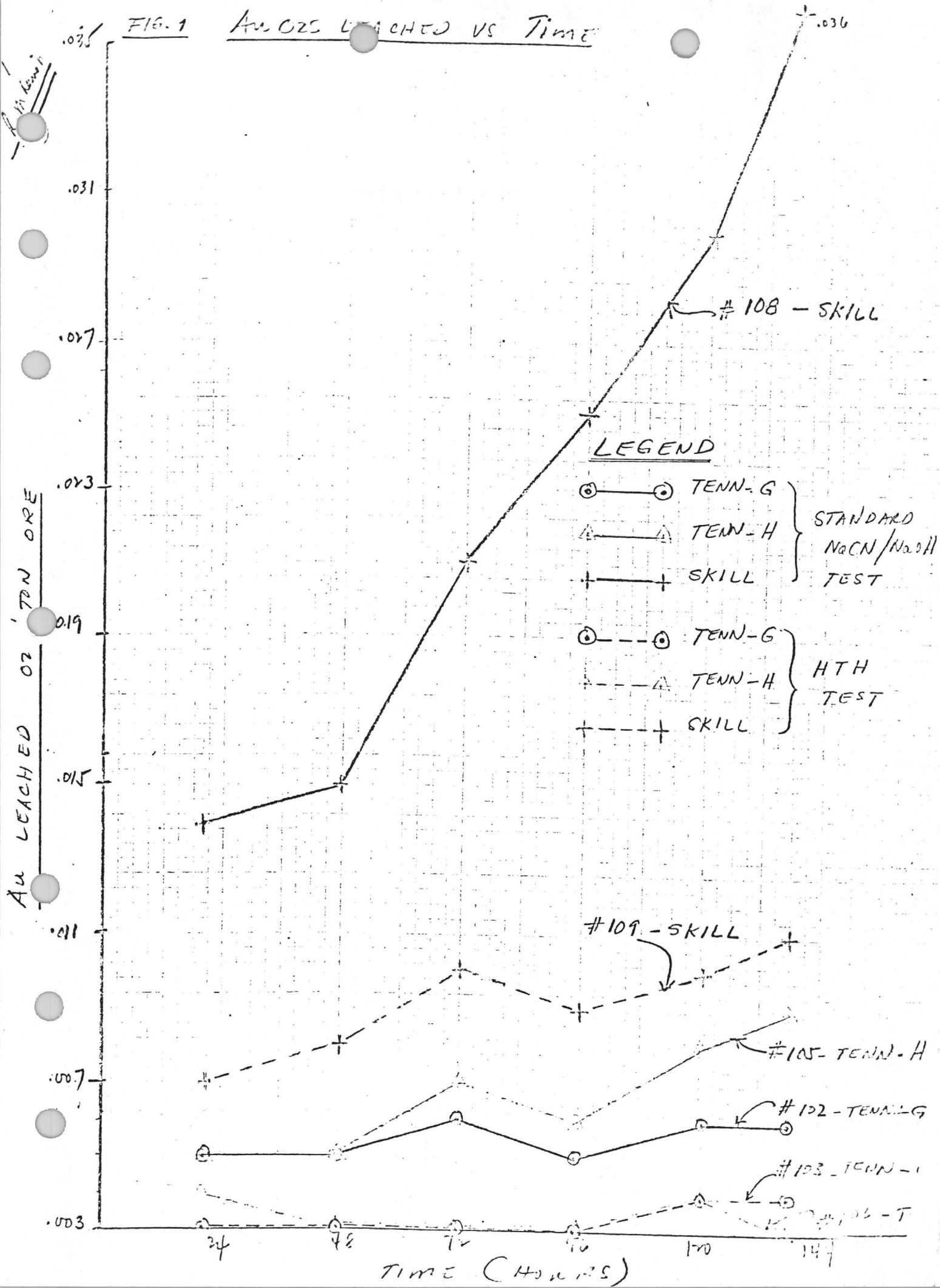
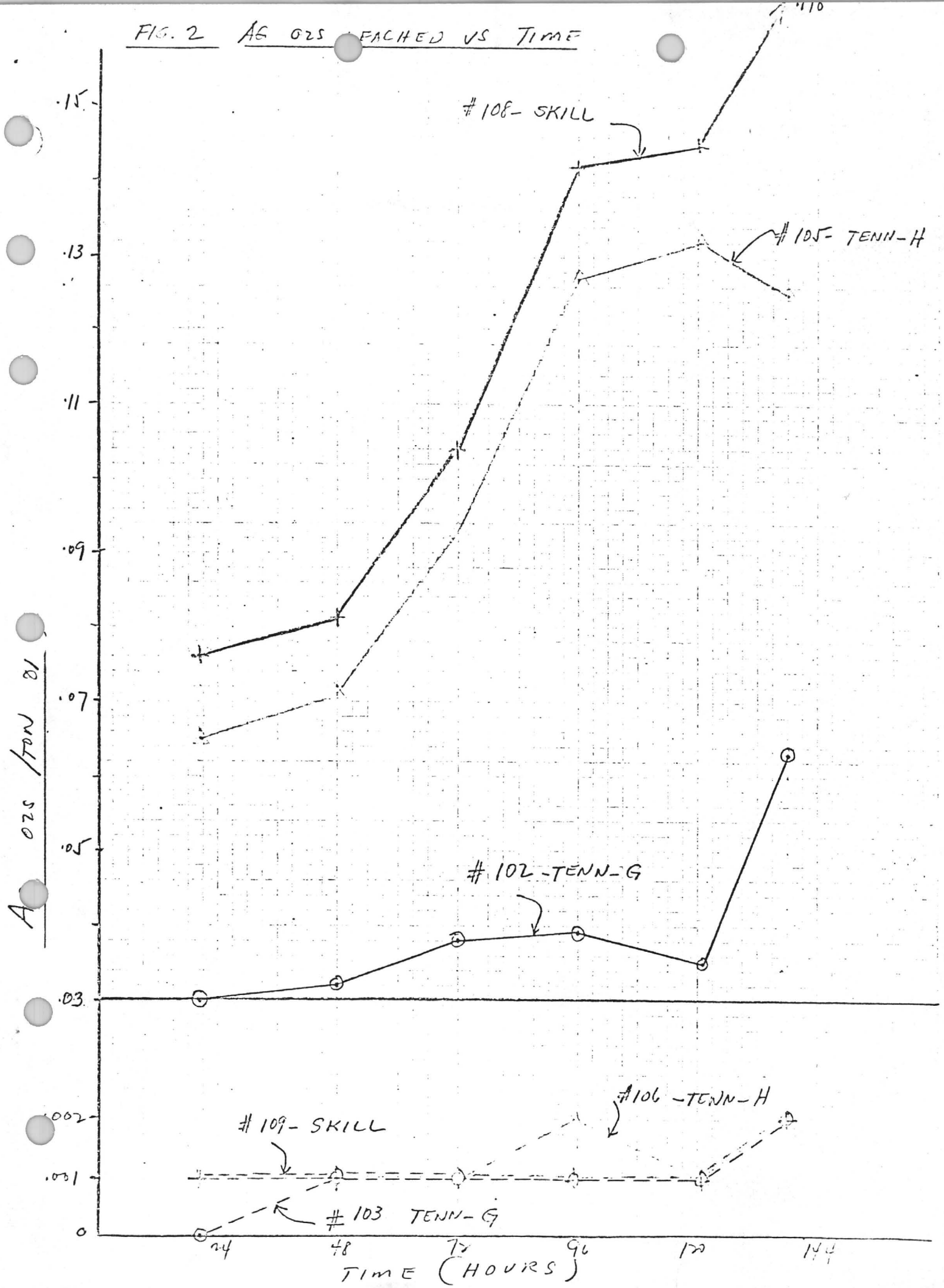


FIG. 2 AG OZS LEACHED VS TIME

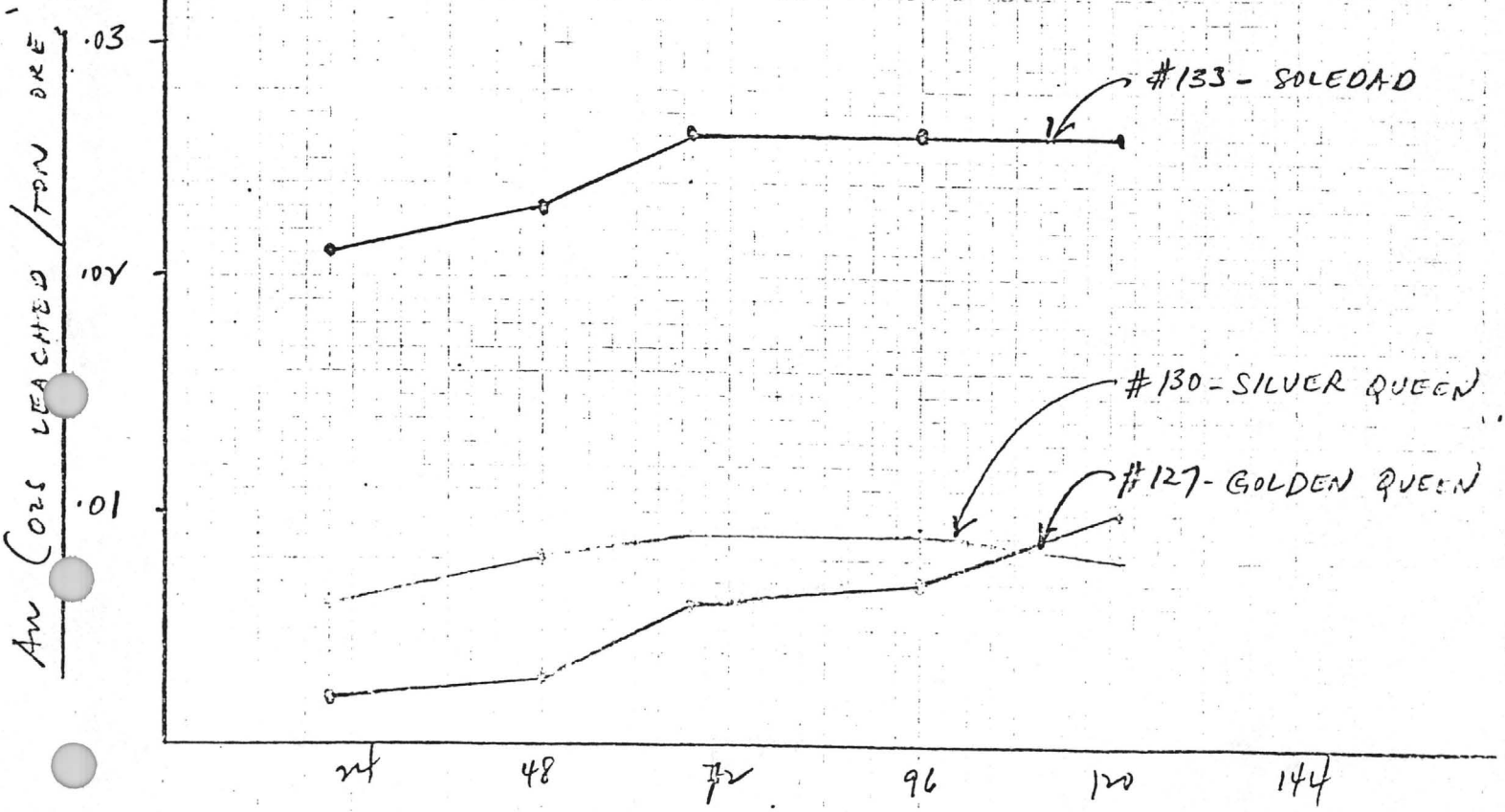


MOJAVE — (NaCN / NaOH TEST)

127 - GOLDEN QUEEN

130 - SILVER QUEEN

133 - SOLEDAD



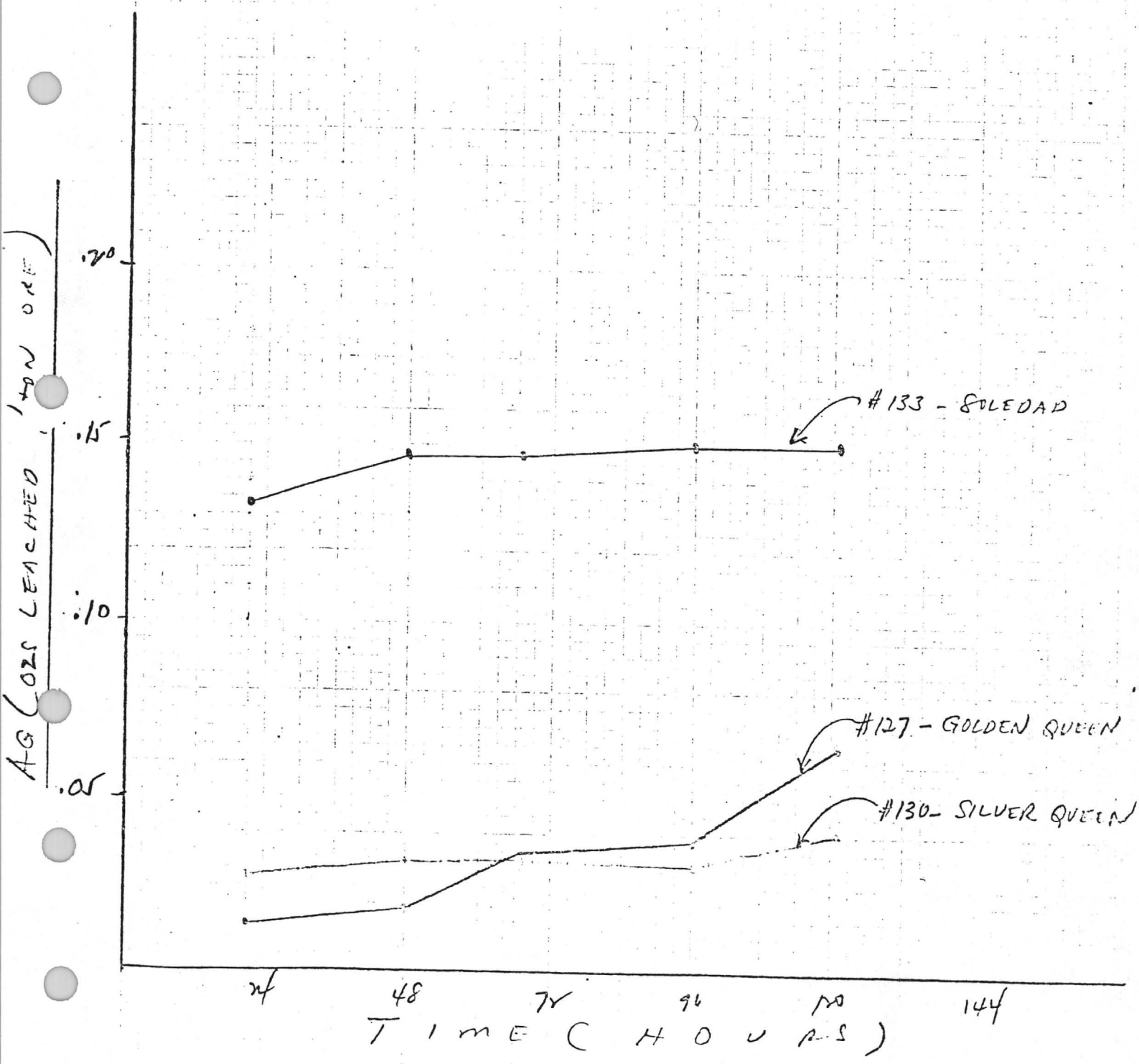
Au Vs Time

MOJAVE — (NaCN / NaOH TEST)

127 — GOLDEN QUEEN

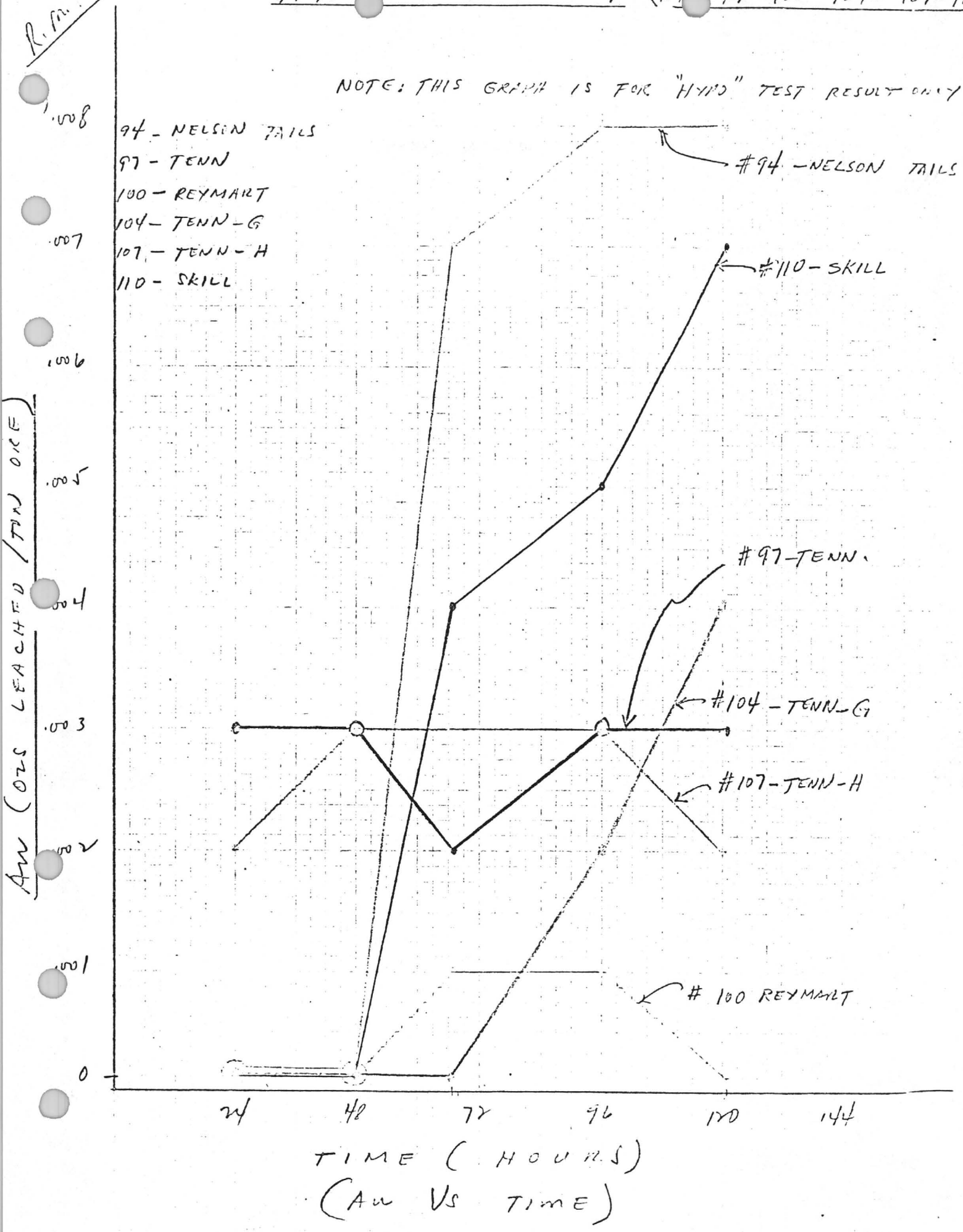
130 — SILVER QUEEN

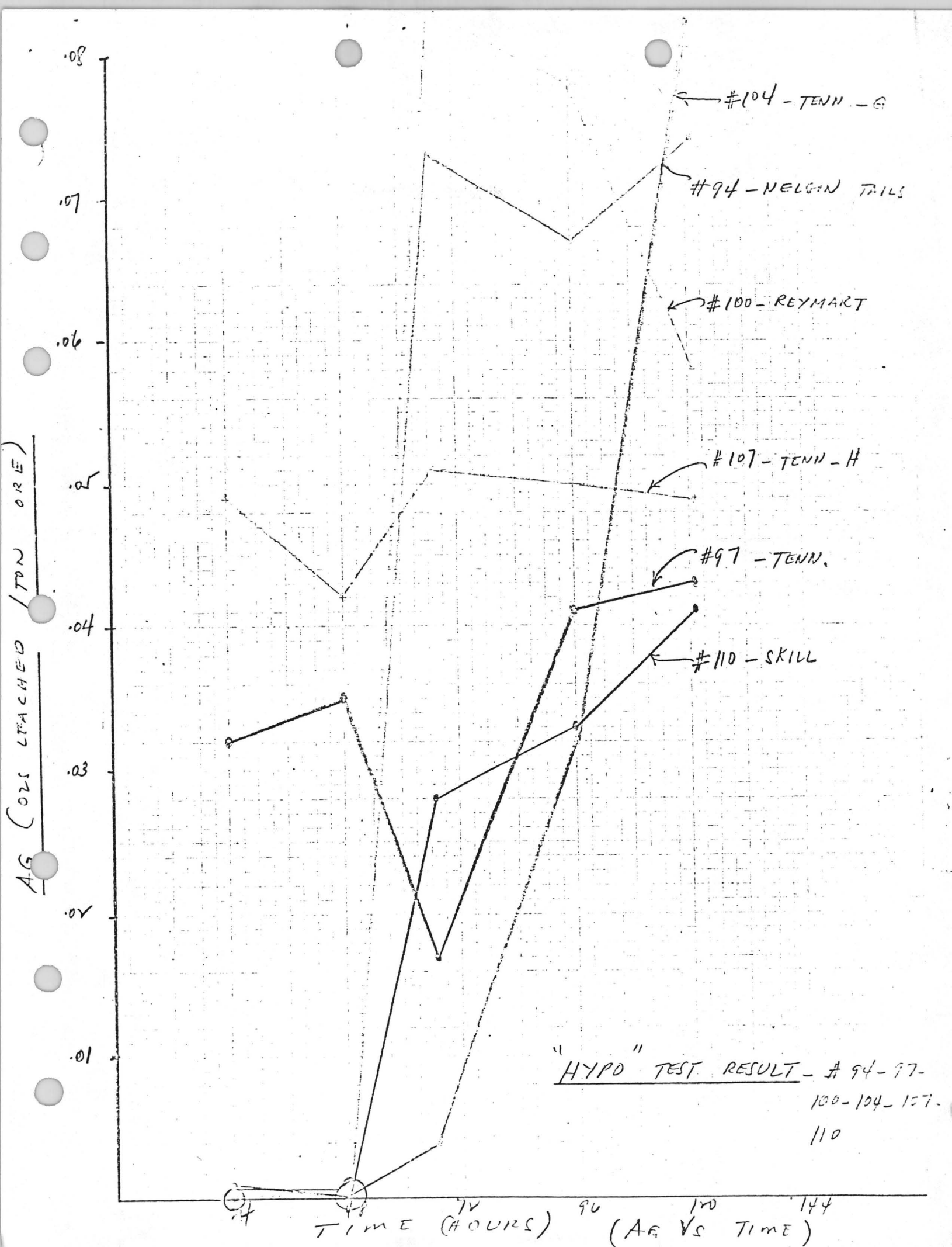
133 — SOLEDAD



AG VS TIME

"HYPO" TEST RESULT (#94-97-100-104-107-110)




.08
.07
.06
.05
.04
.03
.02
.01
AG (OZS LEACHED / TON ORE)
#104 - TENN - G
#94 - NELGIN TAILS
#100 - REYMART
#107 - TENN - H
#97 - TENN.
#110 - SKILL
"HYPO" TEST RESULT - #94-97-100-104-107-110
24
48
72
96
120
144
TIME (HOURS)
(AG VS TIME)

CAITHNESS CORPORATION

ICHARD F. HEWLETT
30 ROYAL CREST CIRCLE, APT. 438
AS VEGAS, NEVADA 89109
733-9260

7110 NORTH ORACLE ROAD
SUITE 213
TUCSON, ARIZONA 85704
(602) 297-2566

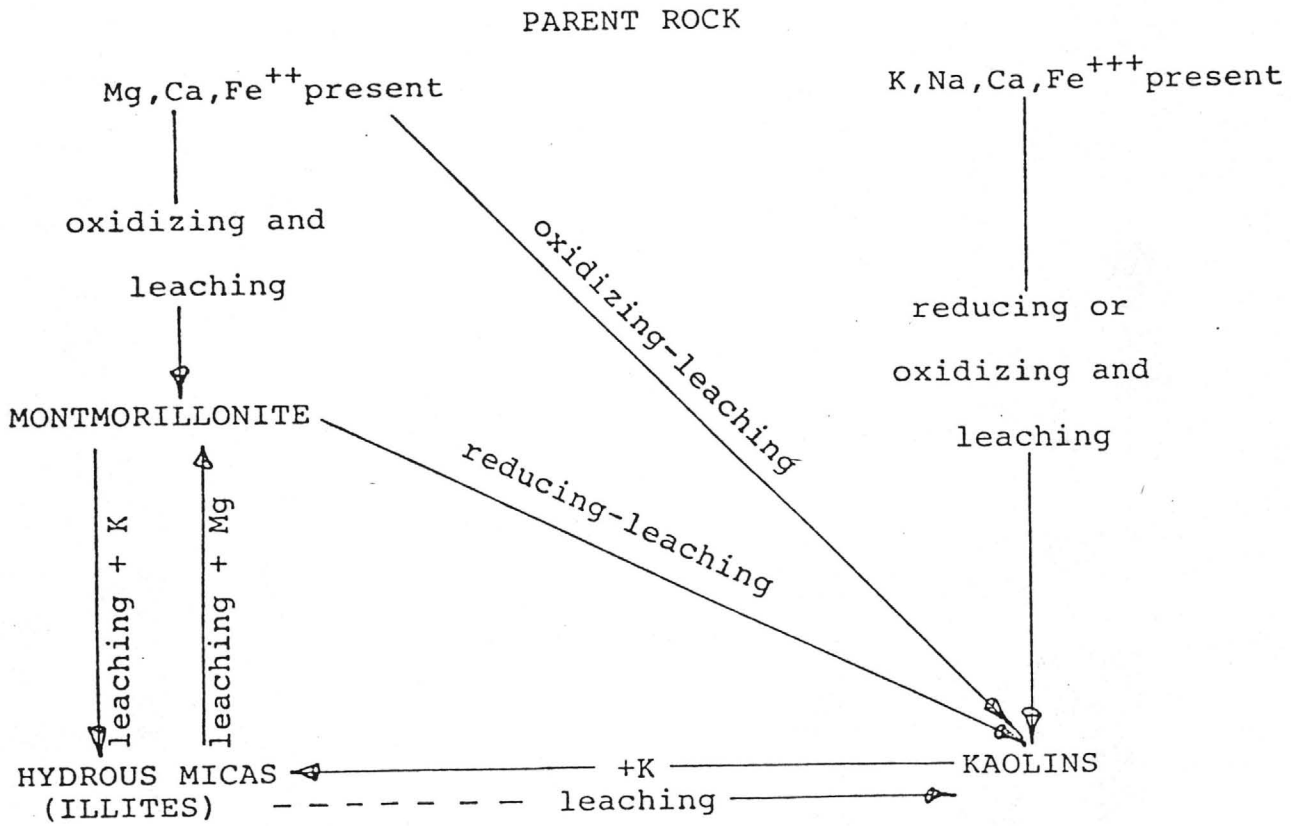
CLAY TECHNOLOGY

R.F.Hewlett
June 28, 1977

Clay minerals commonly formed are:

1. Kaolins
2. Montmorillonites
3. Illites(Hydrous Micas).

Starting from any parent rock, the clay minerals develop under specific environmental conditions as shown below:



The previous diagram illustrates the following:

1. Clay minerals are very sensitive to small changes in the composition, temperature, and pH of their surroundings(excellent indicator minerals)
2. Clay minerals are not stable end products of weathering but are part of a system existing in dynamic equilibrium with its components. The rate at which many of the clay minerals react to environmental changes is often very rapid.
3. Kaolinite characteristically develops in an acid environment often produced by organic acids or the oxidation of sulphide minerals. Also, strong leaching under neutral conditions where the bases have been removed from the rocks develops kaolinite.
4. Montmorillonite minerals develop under a wide range of conditions.
5. Illites are the dominant clay minerals in marine sediments, but they also occur in certain soils derived from marine shales.

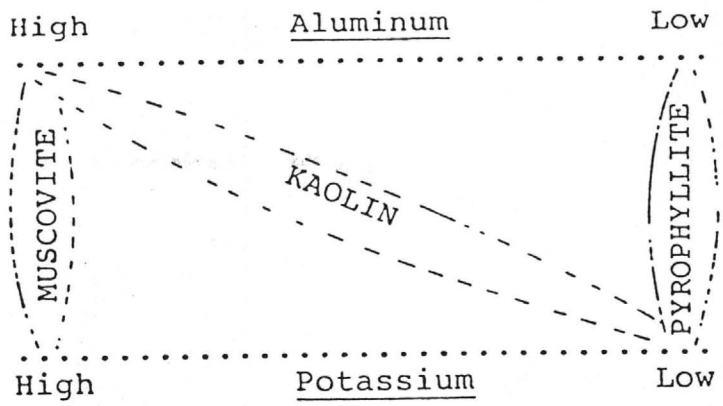
<u>Kaolinite</u> ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$)

Synthetic modes of formation:

Temp.	Time	Solvent	Substance
320°C	24 hrs.	o.5N HCl	Orthoclase($KAlSi_3O_8$)
16	96 "	dil. HF	"
300	250 "	o.5-1.oN HCl/H_2SO_4	"

The pH ranges of formation are:

ACID	NEUTRAL	BASIC
Kaolin ********	Kaolin ******	Montmorillonite **********
Ions with alkali metals(Li,Na,K,Rb,Cs)	'Free of 'Alkali 'Metals	Alkali:Al_2O_3:SiO_2
(4.5-5.2 pH with opt. range 4.8-5.0)		.o2-1: 1 : 4
		Alkali's can be;
High Al/SiO_2 ratio & Potassium Conc.		NaOH, KOH, $Ca(OH)_2$



CLAY MINERAL SPECIES

1. Micaceous Clay Minerals

   a. Kaolinite Group

      Dioctahedral
      - Kaolite
      - Halloysite, $2H_2O$
      - Hydrated halloysite, $4H_2O$
      - Nacrite
      - Dickite

   b. Montmorillonite Group

      Dioctahedral
      - Montmorillonite
      - Beidellite
      - Nontronite

   c. Hydrous Mica Group

      Dioctahedral
      - Illite
      - Pinite
      - Glauconite
      - Celadonite
      - Brammalite

   d. Mixed Layer Group

      - Anauxite
      - Bravaisite
      - Vermiculite-chlorite
      - Kaolinite-nontronite
      - Montmorillonite-illite

Synthetic Formation

MONTMORILLONITE:

Montmorillonite + $KHCO_3$(10%) + H_2O ---> Orthoclase

(KAcid Carbonate)

Add heat in gold-lined pressure bomb

ALUNITE:

A. $H_2SO_4 + K_2SO_4 + Na_2SO_4))_{.01M} + NH_4SO_4$ --> Alunite

60-90% Alunite in 7 days at 200°C

B. 50g $AlSO_4$ + $((H_2SO_4 + K_2SO_4 + Na_2SO_4))_{.05M}$ ---> Alunite

50-99% Alunite in 100 days at 100°C

HALLOYSITE:

Kaolinitic clay + $SO_4^{--}))$ ---> Halloysite

Within carbonate rocks;
therefore a pH change

KAOLIN:

Solfataric Action: ((Alkali)) + SO_2 + S_2 + HCl ---> Kaolinte
Metal
Soln.

Solubilities

A. Mullite ($3Al_2O_3 \cdot 2SiO_2$) is slightly soluble in cold H_2O

B. Montmorillonite Groups disolve in a weak acid soln. (0.01 - .04% H^+)

Decompositions

A. Kaolin

$$\text{Kaolin} + H_2SO_4 \text{))}_{\text{strong}} \longrightarrow SiO_2 + AlSO_4$$

Properties of $Al_2(SO_4)_3$;

A. White powder
B. Soluble in cold H_2O - 31.3 gr/100 ml (o)
C. Soluble in hot H_2O - 98.1 gr/100 ml (100)
D. Slightly sol. in dil. acid and alcohol

Ionization

Calcium from soil colloids*

Clay + NaOH + $Ca(OH)_2$ ---> change in clay lattice;

Therefore, kaolinite + NaOH + $Ca(OH)_2$ ---> Montmorillinite

(Gives up ionized "salts")

Permeability

Calcium - saturated clays tend to be granular & comparatively pervious with Ca; Na clays are highly dispersed and impervious

Base Exchange

Influences pH:

A. Ca clays if free from $CaCO_3$ are 7
B. Na clays are highly alk. - +10
C. Rain with dis. CO_2 is acid(H^+) and H ions replace Na and form dil. soln.s of $NaHCO_3$-Na_2CO_3 or NaOH; resulting in increased alkalinity of Na clays
D. Mix; Na clay + $CaCO_3$ ---> alkiline upon leaching

(Ca^{++} replaces Na^{++} + Na_2CO_3
Also, Mg replaces Na...

Ion Exchange

Clays can be considered as multivalent polyelectrolytes in ion exchange reactions. The key for each of the major crystal structure groups are the distribution of charges in the lattice.

Members of the kaolin group have as a site of exchange reactivity the structural hydroxyl ions along the lateral surfaces and those formed by the hydration of silica at the broken edges of the crystals.

Montmorillonite clay groups are the most active in terms of ion exchange reactivity per unit weight. Either magnesium substitutes for aluminum or aluminum for silicon.

Illite group of clay minerals fix potassium irreversibly.

Processes that occur in an aqueous clay-electolyte interaction:

A. Ion exchange
B. Work of swelling
C. Water transfer
D. Donnan exclusion of anions
E. Complex ion formation
F. Incomplete dissociation
G. Ion pair formation
H. Molecular adsorption
I. Change in solution volume.

Clay Strucure Stabilization

Polar organic compounds play two important roles in soil structure:

1. Weakening the potentially strong cohesive bonds between clay particles(thus permitting formation into aggregates)
2. Linking clay particles together through mutual adsorption of such compounds by two or more clay particles.

Compounds very important in soil structures are polyuronides and polysaccharides. They are readilly adsorbed by clay molecules.

To produce a permeable clay, Na^+ must be replaced with Ca^{++} (to produce flocculation). Colloids in non-alkali soils tend to flocculate. Both Ca^{++} and H^+ ions produce flocculation and absorption of most polar organic molecules causes complete flocculation. (Soil structure changes are in degree of expression of cohesive forces between already flocculated clay particles).

Organic matter modifies the plasticity of clays by utilizing its bulk and adsorptive capacity to adsorb water and insulate or coat clay particles, and by direct adsortion the polar organic compounds modify cohesive forces and bind clay particles together so they are not free to move and thus are less plastic.

Impermeable Soil Conditioning

Polmethracrylates and other correctives for impermeable clays include amino compounds and Krilium-like compounds(polymers).

In general, Krilium-like molecules are large anions and polyanions adsorb on Kaolinites. Amino compounds are large cations and polycations adsorb on Montmorillonite and Beidellic clays.

The Krilium-like molecules are adsorbed by hydrogen bonding. Some of these made by Monsanto Chemical are:

A. CRD 186; a Ca-saturated Krilium
B. CRD 189; a Na-saturated Krilium.

One observation made is that 0.1% of a Krilium-type compound is equivalent to a 2% calcium hydroxide solution in reducing swelling pressure and increased stability. However, higher percentages of calcium hydroxide produced more significant results.

Ammonium ion and phosphate fixation are commonly utilized for soil fixation. Kaolinite and halloysite can adsorb phosphate ions by replacement of hydroxyl groups on the surface of the clay.

The adsorbed phosphate ions on kaolinite could be replaced by arsenate ions. The anion exchange capacity is about equal to the cation exchange capacity. Both the phosphate and arsenate ions are tetrahedral in form like silica, and evidently can attach themselves to the broken edge of the silica sheet and act as an electrically unbalanced silica tetrahedron. A negative anion adsorption is developed for chloride, sulfate, and ferrocyanide in montmorillonite minerals. Formate ions are also adsorbed by H-montmorillonite by treating with formic acid.

DESIGNED TESTING PROCEEDURE

Pre-Treatment

A. Basic

1. CaO (lime)

   Add 1,2,3,4,&5 #lime/ton ore and note effect on perculation.

2. $Ca(OH)_2$

   Add 1,2,3,4,&5 # calcium hydroxide/ton ore and note the effect on perculation

B. Acid

1. H_2SO_4

   Add 1,2,3,4,&5 # H_2SO_4/ton ore and note effect on perculation.

Leaching

A. Basic

1. Pretreatment with lime
2. CaCN

B. Basic

1. Pretreatment with lime
2. NaCN

C. Acidic

1. Pretreatment with H_2SO_4 (1-5#/ton ore)
2. HTH

D. Acidic-Basic

1. Pretreatment with H_2SO_4
2. HTH

* After no more Au/Ag leaches

3. Neutralize with lime to 10.5
4. CaCN

E. Basic-Acidic

1,2 Lime & CaCN or NaCN

* After no more Au/Ag leaches

3,4 H_2SO_4 & HTH

R.F. NEWLETT
1979 Report

HEWLETT MANAGEMENT

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

TOMBSTONE

Tombstone represents an opportunity to produce precious metals with a minimum capital investment. This is due to the following:

1. Extensive previous sampling;

   A. Surface drilling
   B. Underground drilling
   C. Underground sampling

2. An existing heap of one-million tons that can be re-processed utilizing recent "heap leaching innovations"

3. Proven open-pit ore targets for development of open-pit ore reserves.

Potentials are estimated as follows:

Activity	Net Operating Profit
Heap re-processing	$ 3,250,000
Open Pit;	
Gob	18,821,000
"New Ore"	133,480,000
Underground	100,000,000

The most important fact to recognize is that due to the authors knowledge of the Tombstone District and heap leaching, the following activity sequence is possible:

A. Initiate re-processing of heap
B. Heap leaching profit finances;
   1. Continued heap leaching to net over $3,000,000 in one year
   2. Exploration/development of open pit ore-for heap leaching over three years (based on results-feasibility)
   3. Exploration of underground.

R. F. HEWLETT
PHONE (702) 359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

The budget for Tombstone is as follows:

	EXPENDITURES Phase	Total
A. Leases (Tombstone Development, Tombstone Extension, TMR, etc.)	$ 3,000	
B. Data Compilation	3,000	
C. Surface Sampling/Metallurgy	4,000	$ 10,000
D. Heap Re-Processing;		
Water (sub. pump and lines PVC)	$15,000	
Power	12,000	
Pumps (spray, precep, etc.)	20,000	
Building & Laboratory	35,000	
Plant	50,000	
Chemicals	5,000	
Management	8,000	
Operators	5,000	
	150,000	$160,000
E. Drilling	$10,000	
E. Crushing-Dozing	$30,000	$200,000

A time schedule for the above follows:

Time Period	Activity	Expenditure
January	Leases-Organization	$ 3,000
February	Leases-Data Compilation Sampling-Metallurgy	7,000
** March	Heap Processing Development	75,000
April	Construction; Pre-Production	115,000
May	Production	

**Completion of lease

HEWLETT MANAGEMENT

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

TOMBSTONE

Tombstone, Arizona is in south-east Arizona in Cochise County, about 75 miles from Tucson. Following are a summary of past production and a discussion concerning the potential of the Tombstone Mining District.

DISCOVERY

In 1877, Ed Schieffelin left Camp Huachuca and went prospecting in the area east of the San Pedro River. He was warned against the Apaches by "All you'll ever find in those hills, Ed, is going to be your tombstone." An unusual rock formation attracted his attention, and he took some samples to his brother, Al, at the Signal Mine. Dick Gird assayed his samples, and the three formed a partnership. The town was named after the warning made to Ed Schieffelin. The initial discovery by Schieffelin is unknown, but he latter discovered and staked the Lucky Cuss. Soon the discovery was known and prospectors poured into Tombstone.

EARLY MINING

Outcropping ledges and fissures of high-grade ore made early mining easy, because the development could basically be done in ore. All original mines were developed by sinking on outcropping ore; the Goodenough Incline is an excellent example of early mining. Large tonnages of high-grade ore was mined on the surface from the apexes of anticlinal structures that predominate in the vicinity of the Toughnut Mine. Also, the "Million Dollar Stope" is on the south side of town, which has caved and remains as a "Glory Hole".

Subsequent mining was concentrated on the anticline structures which generally plunge easterly, fissures, replacement beds and veins, and along the contacts of the near vertical dikes that strike north-south through the district. These structures were pursued down to the water table and laterally for considerable distances. Many unknown structures were disclosed as a result, and blind ore bodies discovered and mined.

Photo on the next page shows underground mining in the Tombstone District in 1904. Notice that the mining is in a preferential limestone horizon; this is typical of the Goodenough and Toughnut mines.

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

PRODUCTION

Early production is difficult to determine because of the following:

1. Mines that shipped directly to the numerous custom mills that operated in the Tombstone District kept no records.

2. High-grade ore was not milled locally but sent directly to the smelter(common of the plus 80 ounce silver).

3. Early mines with their own mills kept poor records.

4. Portions of mines were leased and very poor records were kept by the leasors.

5. Price fluctuations made production records kept in dollars difficult to relate back to the ore grades.

6. Smelters would cheat the miners by reporting lower grades and commonly not pay(or report) for the gold content.

7. "High-grading" was practiced which reduced the grade.

It is reported that 1,635,639 tons of ore was mined. The computed grades were as follows:

Average Silver grade = 20.67 t.oz./ton

Average Gold grade = .133 t.oz./ton

The yearly production is shown on the following page(table 1).

The actual value of the Tombstone production at today's prices are:

Actual Tombstone Production = $ 38 million

Present Value of Production = $225 million

Dr. C. J. Sarle reports the Tombstone production as $ 79 million. In any event, the production was significant at that period of time.

— GRAND CENTRAL MILL(1884) —

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

Table 1.
TOMBSTONE PRODUCTION

Year(s)	Tonnage	Au Heads	Ag Heads
1879-1880	55,567	.094	34.00
81	128,452	.072	43.00
82	131,296	.075	34.00
83	75,249	.125	34.00
84	33,582	.262	34.00
85	31,736	.286	34.00
86	25,885	.333	34.00
87	14,500	.383	34.12
88	14,511	.453	34.00
89	5,512	.548	34.00
90	13,537	.416	34.00
91	15,362	.479	34.00
92	13,573	.315	34.00
93	14,127	.258	34.00
94	11,213	.258	34.00
95	11,213	.258	34.00
96	11,213	.258	34.00
1897-1901	135,608	.114	15.00
1902-1906	224,602	.114	15.00
07	48,444	.114	15.00
08	51,266	.080	6.97
09	27,123	.084	7.44
1910-1920	232,219	.090	12.11
1921-1930	266,330	.090	10.32
1931-1936	53,619	.269	17.47
	1,635,639	.133	20.67

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

Following are the production by mine:

Mine	Date	Tons	Au	Ag
Northwest	July '89 to '90	274	.141	87.1
"	June '90 to '91	458	.215	67.1
"	June '91 to '92	1,413	.35	87.8
"	June '92 to '93	1,427	.18	87.1
Toughnut	June '91 to '92	1,102	.55	88.5
"	June '92 to '93	2,096	.61	55.5
"	Apr. '20 to '25	5,203	.17	27.45
Empire	Apr. '20 to '23	159	.240	13.48
Tranquility	Apr. '20 to '23	1,978	.320	22.46
Silver Thread	Apr. '20 to '23	4,738	.270	25.47
"				
West Side	Apr. '88 to '89	632	1.794	84.40
"	Apr. '20 to '25	1,238	.560	38.58
West Side-	June '90 to '91	1,105	1.380	73.30
Sulphuret	June '91 to '92	1,490	1.130	66.50
"	June '92 to '93	1,184	.82	48.60
Sulphuret	Apr. '89 to '90	500	1.931	84.80
Contention	Apr. '20 to '23	3,639	.198	13.57
Head Center	Apr. '20 to '23	1,738	.200	14.50
Grand Central	Apr. '20 to '23	1,438	.140	13.75
Lucky Cuss	Apr. '88 to '89	3,253	.576	41.10
"	Apr. '89 to '90	2,488	.466	44.60
"	June '90 to '91	2,271	.740	54.90
"	June '91 to '92	2,684	.460	43.60
"	June '92 to '93	3,729	.110	25.20
"	Apr. '20 to '21	5,560	.056	16.92
Oregon	Apr. '20 to '21	3,866	.013	23.00
Promter	Apr. '20 to '21	9,688	.017	16.50
Emerald	Apr. '20 to '21	119	.010	8.00
Bunker Hill	Apr. '20 to '21	100	.035	15.45

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

CLOSING OF THE MINES

It was generally assumed that the water encountered in the mines was the reason for the closing of the Tombstone mining operations. However, the mines controlled the water level in the Pump Shaft; the mines are all interconnected with the Pump Shaft. In fact, I have talked to miners that went as far as Gleason to warn the miners there when the pumps were shut down after the fire in the pump house.

In general, the development of new ore was overlooked when the Bonanza ores were being mined. Also, leasers would "rob pillars" and in general leave the workings in an unsafe condition.

When development costs were then related with lower-grade ores, uncertainty would exist concerning the economics of further underground development away from the main workings and this was further complicated by lower gold and silver prices;silver was under $1.25/t.ounce.

Financing of the operations contributed to the complexity;when no working capital was available from an operation, it would take time to make additional financial arrangements.

When the pump house burnt down and new Cornish pumps were required (see opposite page), it would have to take over one year to bring them "around the Horn". Then, when the mines flooded and the price of noble metals was still very low, all groups gave up and the mines remained closed.

GEOLOGICAL HISTORY

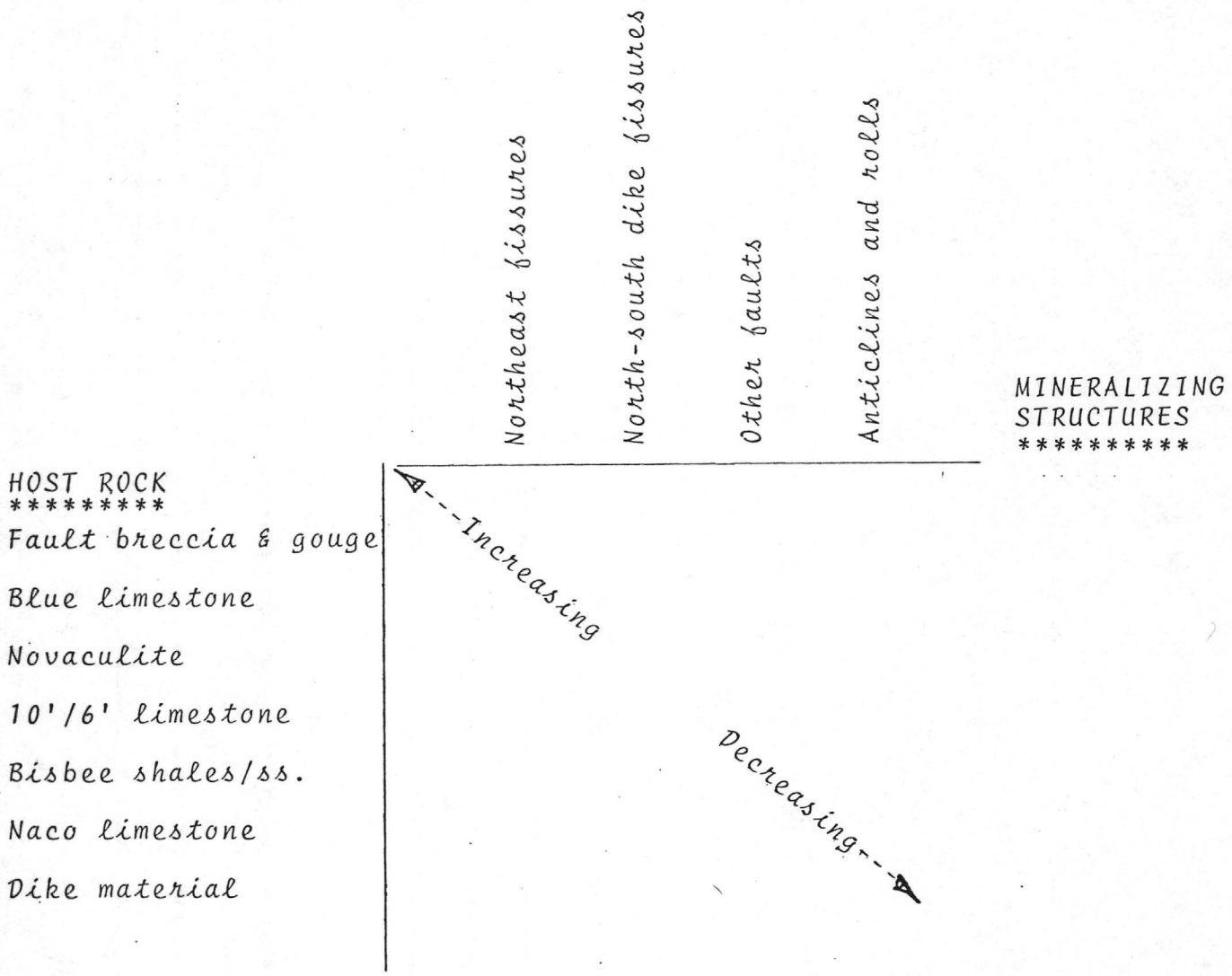
Quartz latite porphyryr(Uncle Sam Porphyry) intruded the Naco and Bisbee limestone, shale, chert, sandstone, and quartzite formations. These sedimentary formations had previously been folded and faulted by tectonic activity, causing some doming. Along these zones of weakness the intrusives followed, including andesite porphyry and rhyolite porphyry dikes. Then a series of steeply dipping north-northeast fissures developed, perhaps due to the final intrusion of Schieffelin granodiorite. Subsequent to this episode and related to magmatic segregation of gold, silver, copper, manganese, lead, zinc, and other minerals was the migration of the mineralizing solutions along the various faults, fissures, joints, breccia zones, and open bedding planes until exsolution occured producing the mineralized structures observed in the district. Every structure occuring within the strucurally induced syncline is mineralized at some point and some throughout their entire extent.

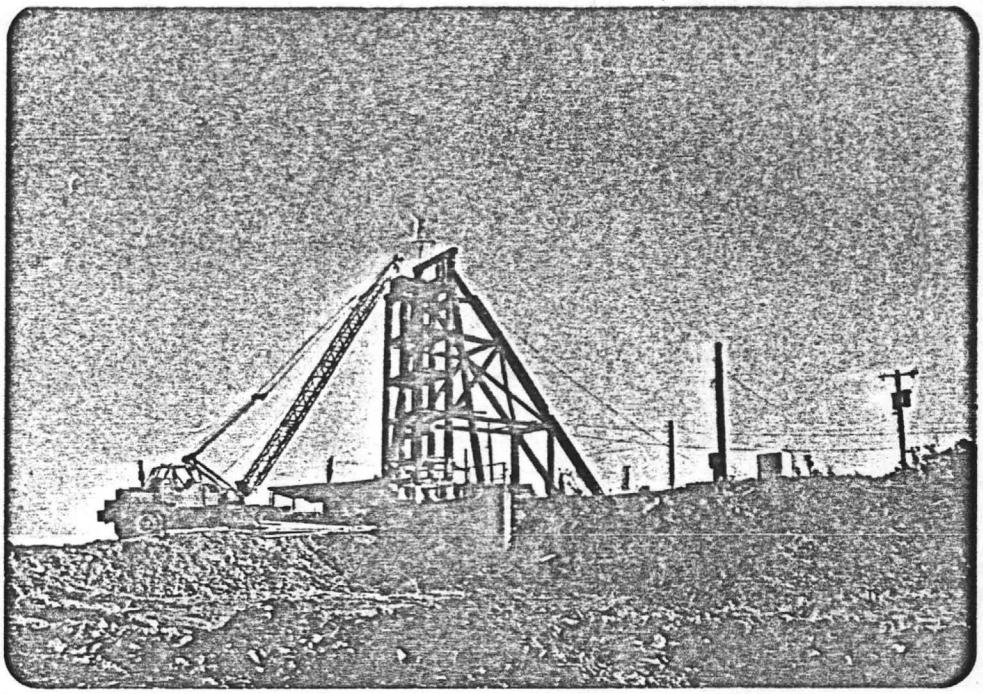
R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

STRUCTURES AND HOST ROCKS

The most productive ore deposits in the Tombstone District exhibit a preferential order of priority to structures and host rocks. Of highest priority are the porous or broken limestone capped by shale or other impermeable units.
Following are the relationships of structures and host rocks in order of their importance on productive mineralization:





WEST SIDE MINE: Source of water for 5 year heap leaching operation. Crane being used to lower submersible pump after repairs to the lagging in the shaft. When problems would come up, the City was very nice and would always allow us to use City water.

The author and others were underground a great deal, especially when we were leaching underground, and noted over the years that the water level changed only about 5-10 feet(lowered) by pumping at about 100 GPM.

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

WATER TABLE

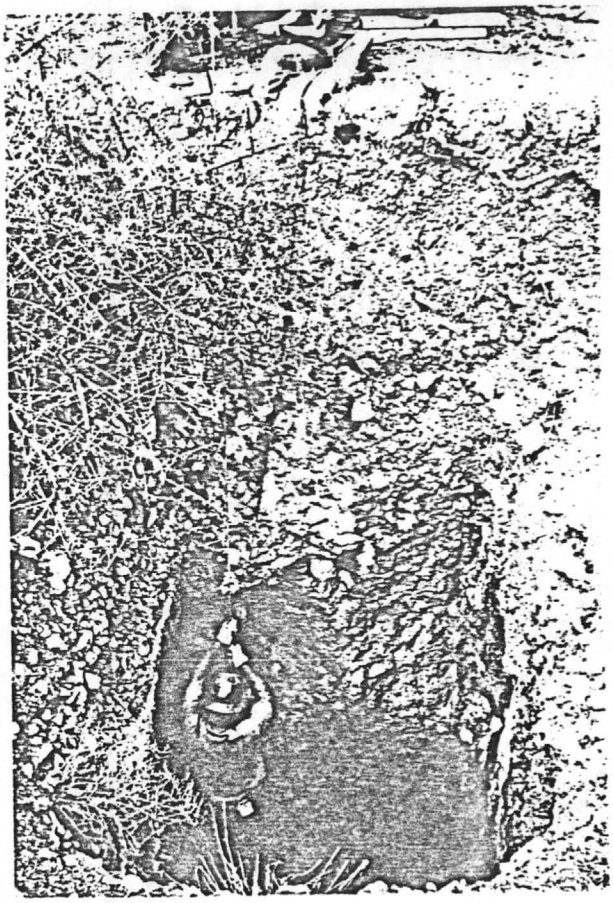
The water table at present is approximately 4115 feet above sea level or about 500 feet below the surface. It was known that the gold-silver values continued undiminished for short distances below the water table and there is good evidence that the values continue into the sulfide zone many hundreds of feet in depth below the water table. In general, the water table has not changed very much from the level during mineralization.

In an effort to exploit the ore under the water table, numerous attempts were made to dewater the Tombstone mines. All attempts seemed destined for failure because only temporary success resulted due to political hassles, carelessness, mechanical failures and caving ground forced the suspension of pumping. As was mentioned previously, the Pump shaft was sank to the 1,000 foot level and the water level was controlled for a short period of time.

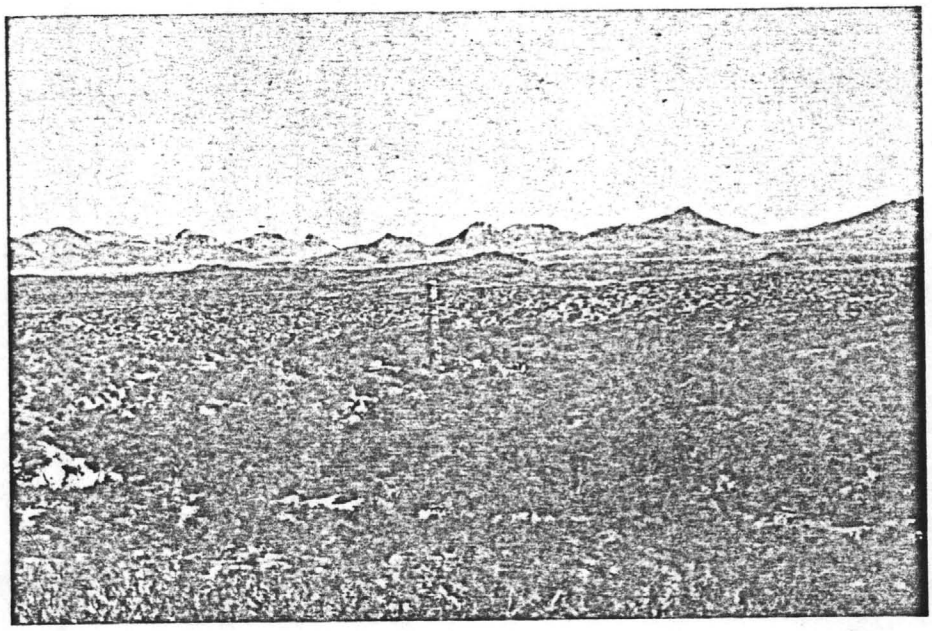
During the period of de-watering, it was proven that the ore continues downward wherever it has been pursued. In the Contention, Grand Central, Luck Sure, Emerald, West Side, and Silver Thread mines it was found that the ore not only continues below the water table, but that the gold and silver increases in grade, especially the gold. In addition, good values in lead, zinc, and mangnaese sulfides are increasing in value. This is also shown by deep diamond drill-holes.

The initial de-watering was accomplished at a rate of 4500 GPM to keep the 1000 foot level dry, and a steady gain was made to de-water the Tombstone Basin. About 2100 GPM would de-water to the 800 foot level. With modern pumps, the cost of de-watering would not be very expensive.

The water underground is not fit to drink due to the town of Tombstone dumping their sewage into old mine shafts. This was an advantage when the author needed water for a recent heap-leaching operation and leached underground because the author pointed out that the water was already contaminated. However, if water would be sold, as to Tucson, a treatment plant would be neccessary; a treatment plant would be required for Tombstone water for consumption at Tucson. The author has looked into the possibility of selling underground Tombstone water to Tucson, and it is now possible with the twp-year old decision that water can be transported from one basin to another basin. The City of Tucson have said they were interested in the water, and would buy it at Tombstone;Tucson would pay for transporting the water and a treatment plant.



Famous underground team of Spear and Walker investigating the Ground Hog shaft. This team has been in most of the underground workings in the District.



ASARCO drilling near Robbers Roost for porphyry copper mineralization.

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

PREVIOUS EXPLORATION

Maps made during the early mining period may still be available to some extent. The author has seen a number of them, and it would be easy to acquire(or copy) any available maps if a project were initiated. The author has been offered the opportunity to copy numerous maps, but at the time it was not necessary.

The earlest exploration was conducted by Eagle Pitcher(in the 30's). The author has been told that the data can be copied, but also (by Eagle Pitcher) that they got very poor core recovery due to their drilling method, and if they wanted drill-data from Tombstone. they would re-drill the same locations.

Newmont spent a great deal of money on surface drilling(core) and underground development. Much of their data is in Appendix A. Also, their core is in the core shed by the Empire mine. The author had it re-boxed where necessary and stacked in sequence; the roof was also patched and made water tight. The most interesting drill holes were #7 and #9. Data not included in this report could possibly be obtained from one of the Nebraska "farmer" owners. Bill Hight's address is as follows:

Mr. William Hight
1824 North Broadwell
Grand Island,
Nebraska(68801)

When Newmont began exploration/development in Tombstone, they formed a company, the Tombstone Development Company. After Fred Searles died, Newmont dropped their precious metal projects (Tombstone and Goldfield) and sold the company to Bill Hight and various other friends of Bill's(Frank Gallup, John Nefelt, etc.). They leased it to 71 Minerals. Height, et. al., paid $160,000 for the 90 odd claims, most of which are patented. They would have taken an end-price of $250,000 at the time of the 71 Mineral lease, but I could not convience my two partners to add that to the lease. As it turned out, Hight, et. al., were paid more than $250,000 in royalties.

Duval spent a short time in Tombstone. Their data is included in the Appendix.

ASARCO drilled at least three deep holes in the breccia pipe area north of the Charlston Lead Mine. The holes were between 4-5,000 feet deep and intersected weak copper mineralization.

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

RECENT ACTIVITIES

71 Minerals was formed by the author to process the dumps at Tombstone. A recent discussion of the operation is found in the back "pocket". Also, the author was very interested to conduct exploration in the whole District, but this activity was restricted by the author's other partners who were only in the limited partnership business and not familiar with mining. However, as a result, considerable knowledge was gleaned with the limited exploration conducted by the author and some very prestigious geologists.

Important exploration conducted by 71 Minerals were as follows:

1. Detailed lithologic, alteration, and structural mapping of the Missy and Fox claims.

2. Underground examination of a large number of workings in the District.

3. Drilling in the Toughnut-Empire-Skip Shaft-Tranquility area(shallow reverse-circulation).

4. Mapping and drilling in the Robbers Roost breccia pipe area on the Charlston road.

5. Mapping and sampling(back-hoe and dozer) of the District as a whole.

6. Drilling and sampling on TMR claims.

Perhaps the greatest advantage of the above exploration is the intimate knowledge gained about the District by Messrs. Briscoe, Spear, and Hewlett. This is to say that "District knowledge" is an exlporation factor that is a requisite for successful discovery.

The results of the 71 Minerals exploration will be discussed on an individual mine basis in the future potential section.

Therefore, another asset will be discussed in detail-the heap at Tombstone which can be re-processed.

R. F. HEWLETT
PHONE (702)359-1069

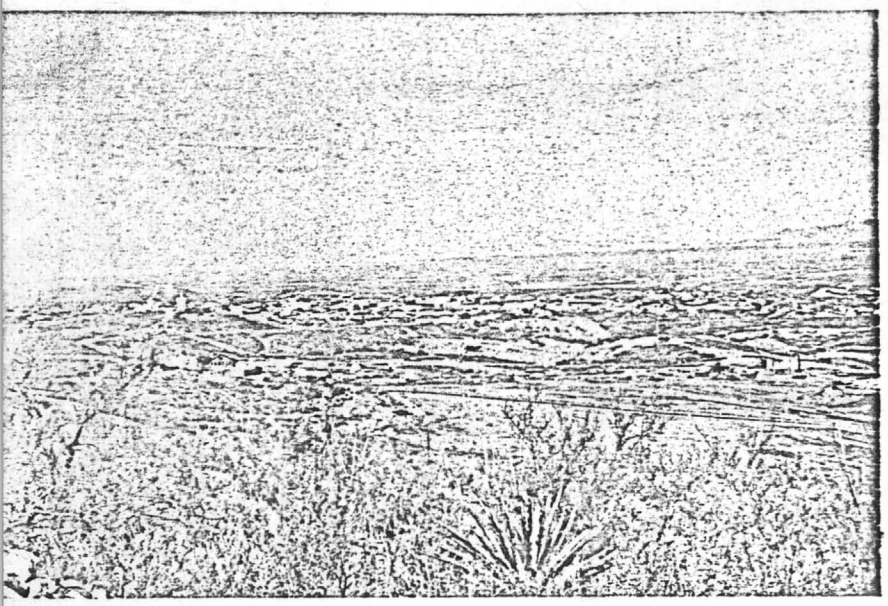
2602 Monte Verde Way
Sparks, Nevada 89431

Extensive sampling was conducted on every dump in the District. This was done with back-hoe trenches. Channel samples were taken in intervals not to exceed 20 feet; sample intervals conformed with changes in the nature of the dump material. Screen analyses were made and it was found that even though screening up-graded the ore, it was still economic to take the entire dump with out screening. An analysis of crushing was conducted by the author at the same time, and it was concluded that crushing would about break-even at those lower precious metal prices (compared with present prices), especially because "IPS" had not been developed by the author at that time. Therefore, at that time, crushing liberated a great deal of values, but the fines created reduced the precolation and hence the recovery, loosing everything gained by crushing.

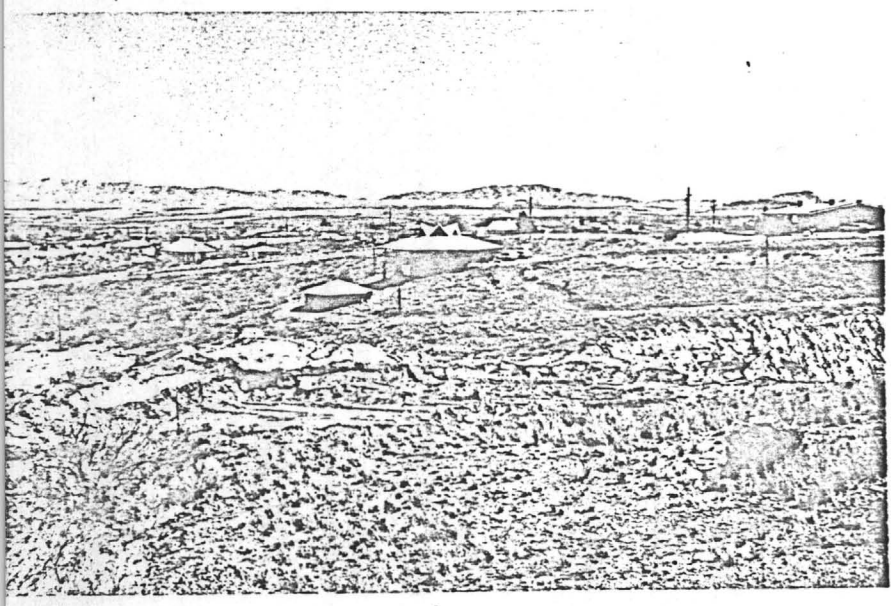
TOMBSTONE DUMP ASSAYS

*=t.oz./ton
**=%/ton

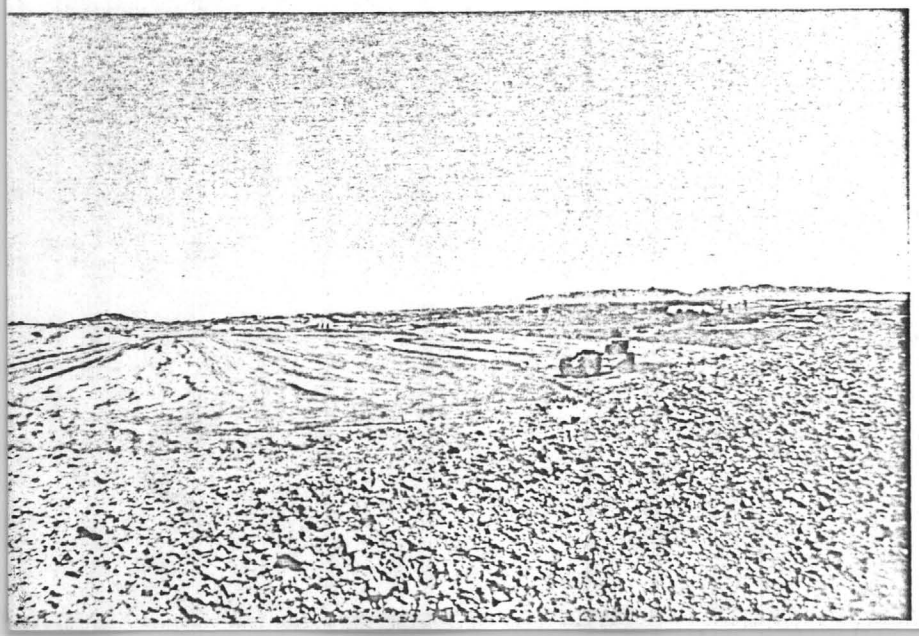
Dump	Tonnage	Au*	Ag*	Pb**	Cu**	Zn**	Mo**	Mn**
Empire	45,000	.044	1.67	.78	.07	-	.015	-
Tranquility	45,000	.058	1.92	.99	.09	-	.008	-
Toughnut	50,000	.029	2.82	.50	.05	-	.009	-
St. of Maine	15,000	.006	3.35	-	-	-	-	-
Contention	230,000	.051	1.60	.50	.03	.40	.001	-
Lucky Cuss	55,000	.039	3.35	1.04	.07	.76	.001	-
Emerald	70,000	.015	3.61	1.12	.28	-	.015	-
Herschel	13,185	.025	3.17	.30	.07	-	-	-
Ingersol	14,646	.041	4.01	.32	.04	1.44	.001	-
Old Guard	11,413	.021	2.68	.30	.04	.54	-	.58
Little Joe	20,000	.051	2.23	.03	.01	.01	.001	-
Sulphuret	6,000	.043	1.05	.31	.03	.18	.005	-
Silver Thread	16,000	.030	2.22	.65	.03	-	.006	-
Bunker Hill	38,000	.021	3.39	1.25	.19	2.00	.005	-
Boss	5,000	.037	2.39	.46	.09	.45	-	-
Comet	30,000	.030	1.56	.19	.03	-	.001	-
Defence	26,000	.025	2.01	.39	.03	1.21	-	-
Oregon	15,000	.003	4.17	.71	.14	-	-	7.95
Promter	4,000	.005	3.63	.80	-	-	-	6.90
Rattlesnake	5,000	.010	2.80	.58	.07	-	-	-
Silver Plume	25,000	.014	1.03	.21	.03	-	.006	-
West Side	60,000	.019	1.62	.59	.05	-	.006	-
Grand Central	100,000	.050	2.05	1.19	.01	.16	.001	-
Telephone	5,000	.027	1.98	-	-	-	-	-
Northwest	6,000	.037	1.75	-	-	-	-	-
	910,244	.037	2.26					



Heap leaching site south of the town of TOMBSTONE;notice the town in the middle background. Photo taken from Contention Mine area.



Tailings site;Girard tailings. Tombstone is just north. Hatcher home in far right.



Pad site;tailings are being layed down with the blade leveling into lifts of about 3 inches and then the leveled tailings are watered for obtaining the maximum compacted density. This impermeable pad was approved by the Bureau of Mines and used for about five years without problem.

R. F. HEWLETT
PHONE (702)359-1069

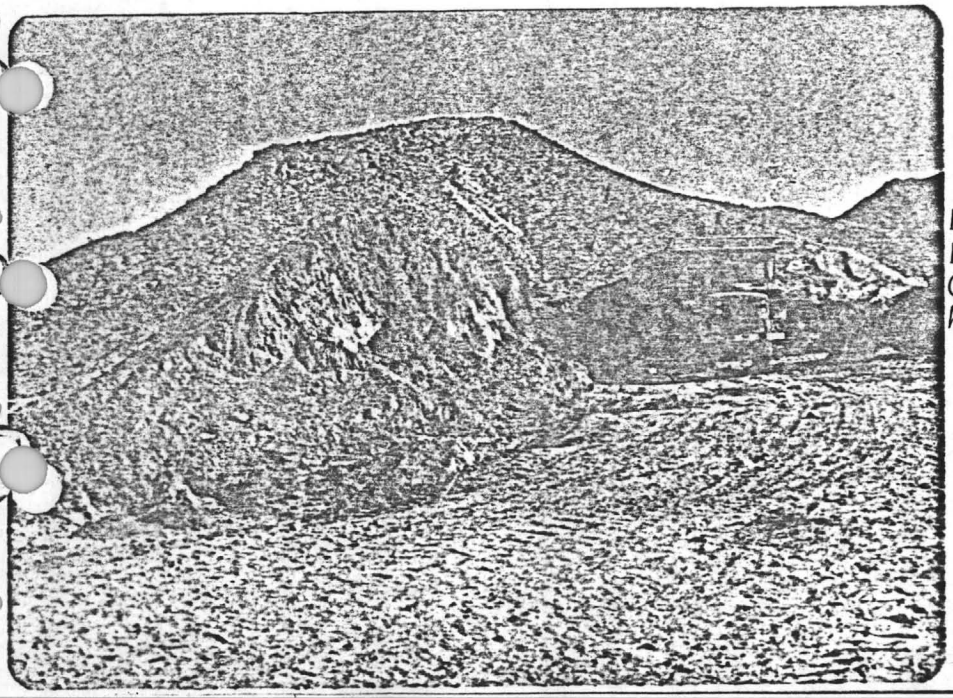
2602 Monte Verde Way
Sparks, Nevada 89431

Having determined the feasibility of heap-leaching the Tombstone dumps, a site was selected south of town that was not in view of the town, but still close enough for power and city water (see photos on opposite page).

Tailings from the old Girard mill were used for pad material, as well as tailings from the West Side area. As is mentioned on the opposite page(last photo), the pad is still in good condition.

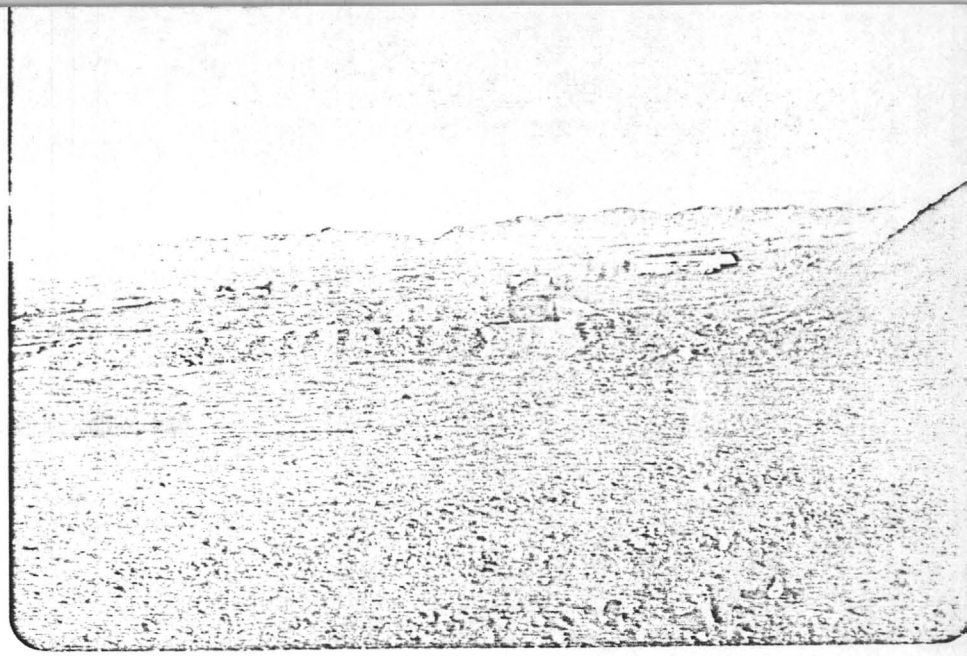
Following are the sequential development of the heap leaching operation.

Dozer pushing and ripping on the Contention dump. This facilitates the loading operation.

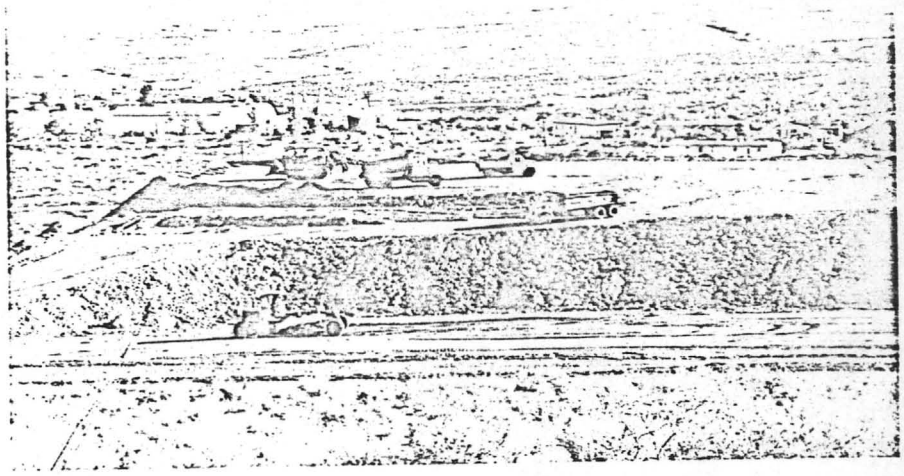


Loading at the Boss dump; Loader is a Cat 988 and Cat 35-ton trucks for haulage.

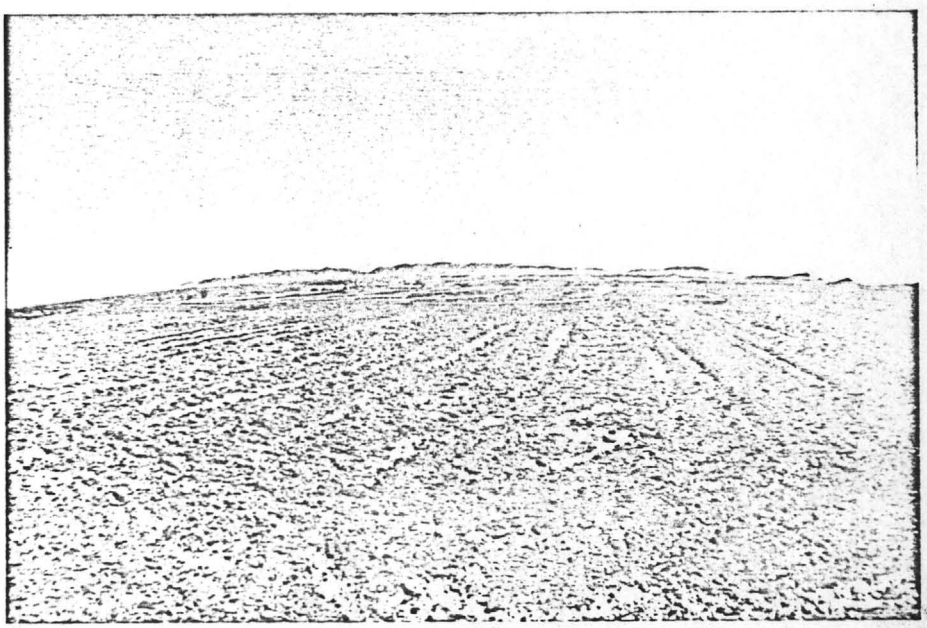
Early loading of the heap from the Contention dump. Notice in the following photos that the heap will become 100 feet high.



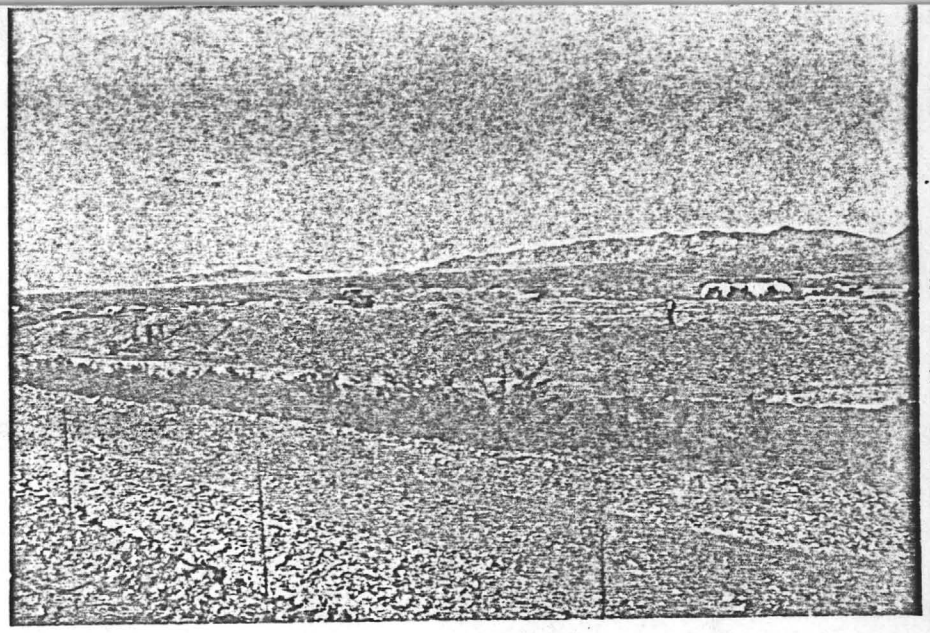
First lift on the north end of the heap;above is the south end. Notice that the first lift is about 25-feet high. The grader is preparing additional pad area.



Top of leveled heap looking north. Notice that the north end is being leached. Then the spray lines will be moved to the south end and new ore will then be heaped on the north end;so goes the leaching cycle.

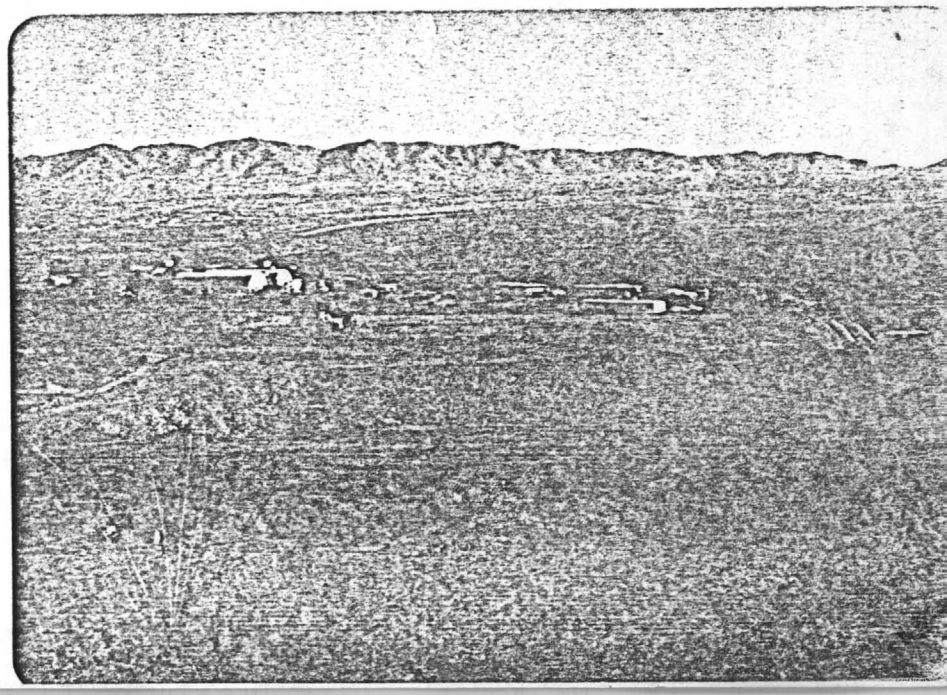


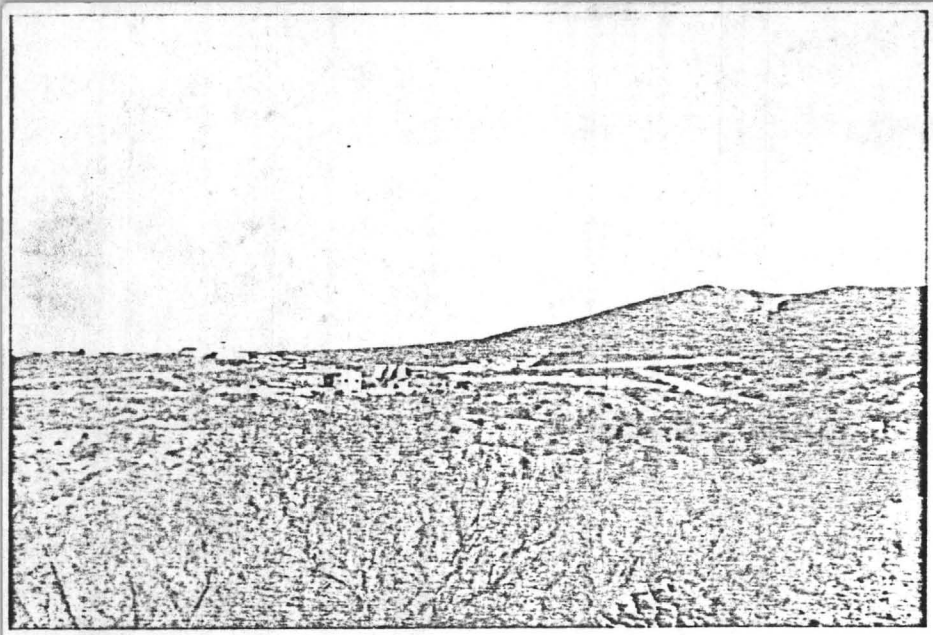
First lift increment being prepared for leaching. Notice beyond and right of the pick-up are the heaps of ore dumped by the trucks.



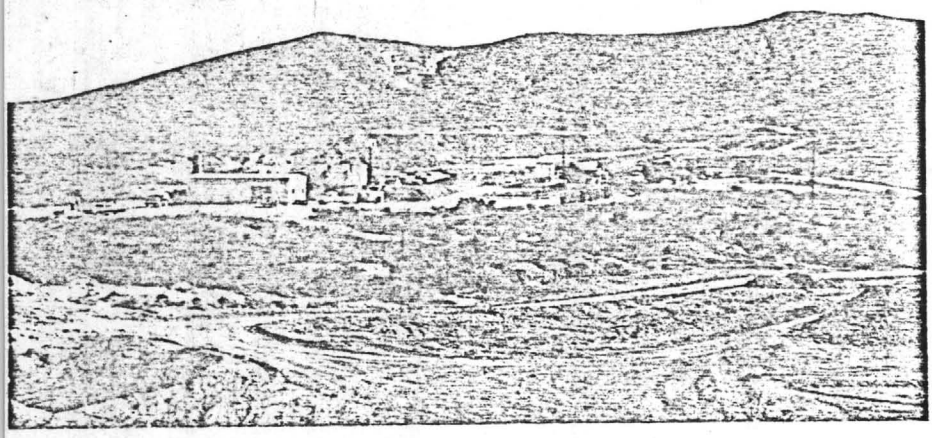
South area being leached while the ore is being heaped on the north end. Contention dump site in foreground.

Completion of second lift on the north end.

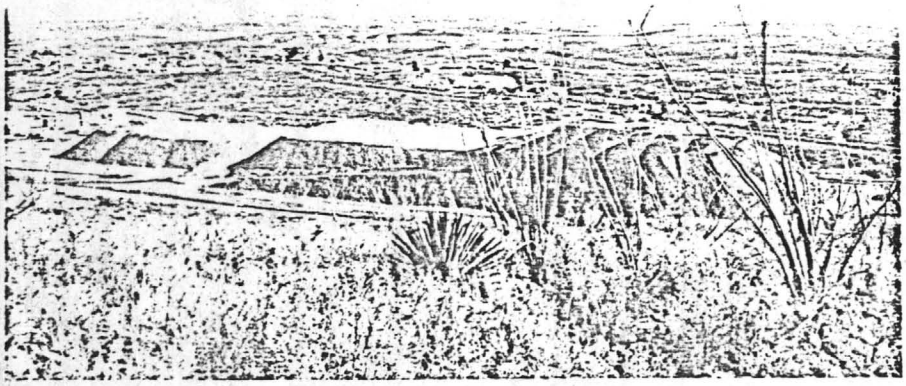




Leach plant and heap; early stage phase of the leaching operation. Photo taken from Empire dump area; looking over Tranquility mine area. Contention mine to the far right-center.

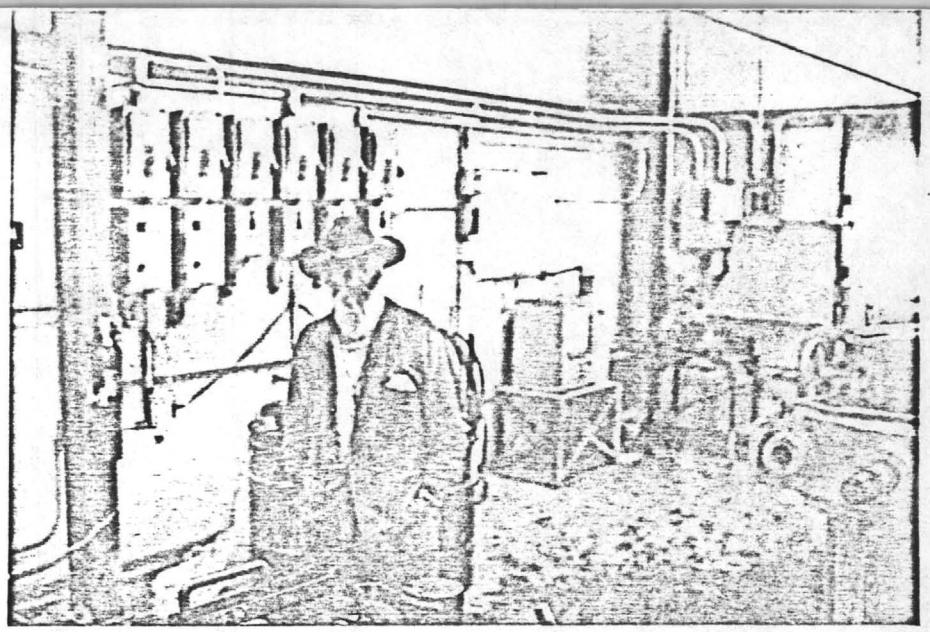


Leach plant and heap after completion of second lift on the north side. Photo taken from Tranquility dump and mine area.

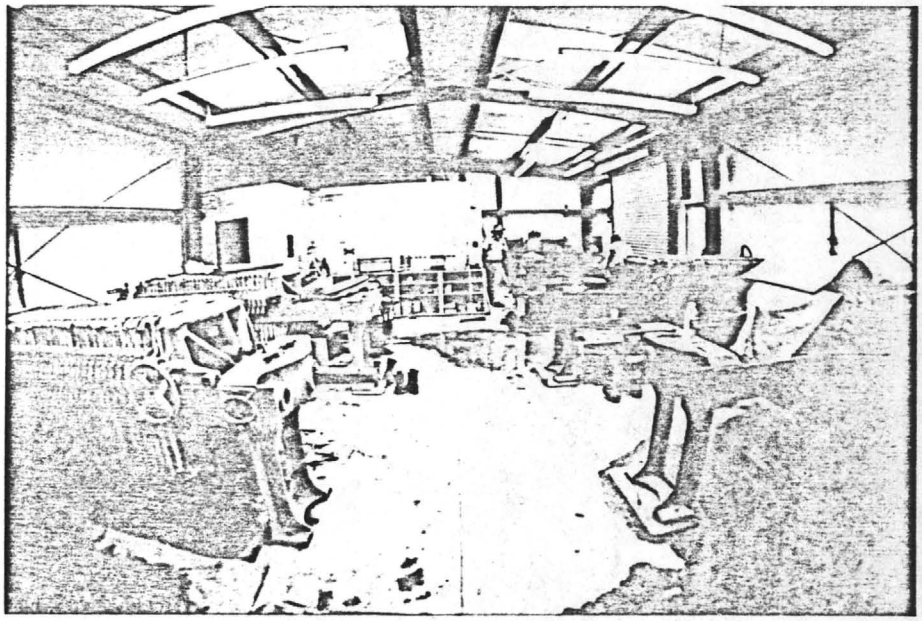


Spraying of third lift on the far south end; area on north being loaded with ore-"heaped". White crust on middle section is dryed caustic and soluble calcite ppt.

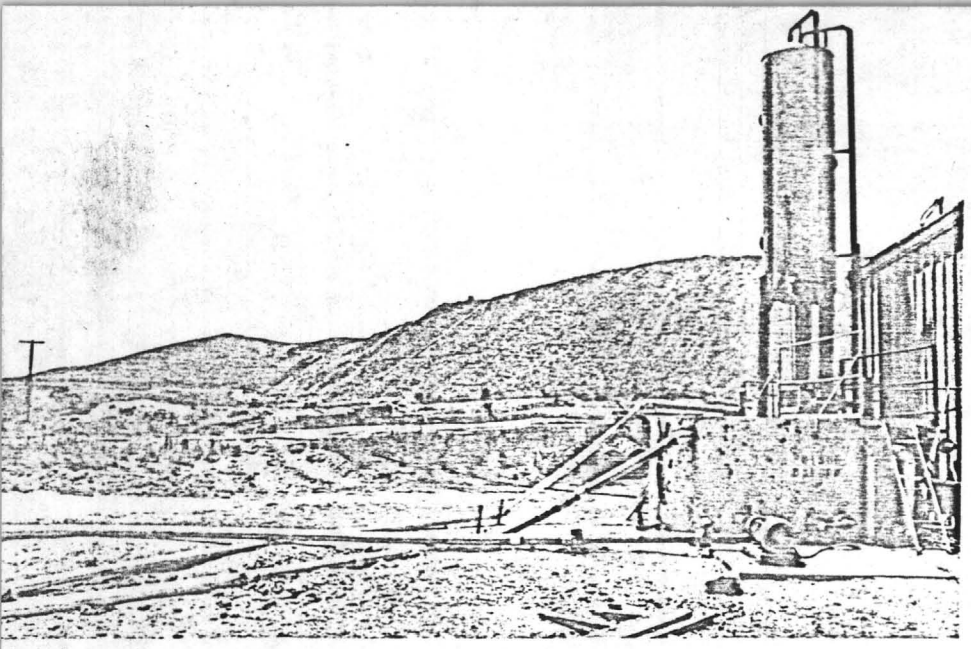
Chief metallurgist; 71 Minerals leach plant. Plant was a Merrill-Crowe zinc precipitation precious metal recovery system.



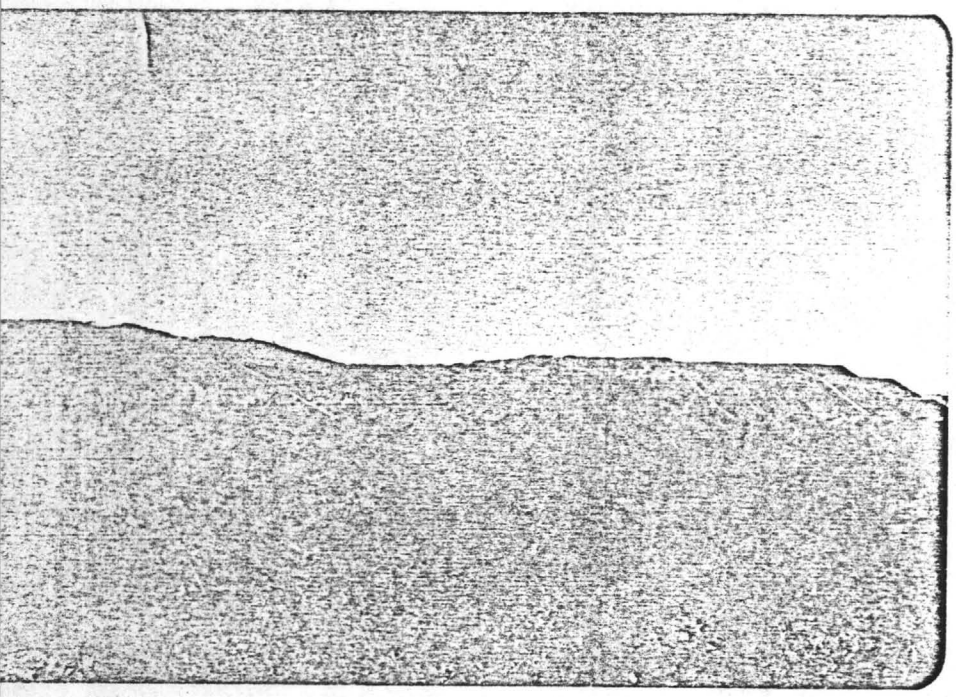
Leach plant; Schriver presses on right are for clarification and the yellow presses are for the precious metal precipitates. Each press held about $100,000 worth of gold-silver precips.



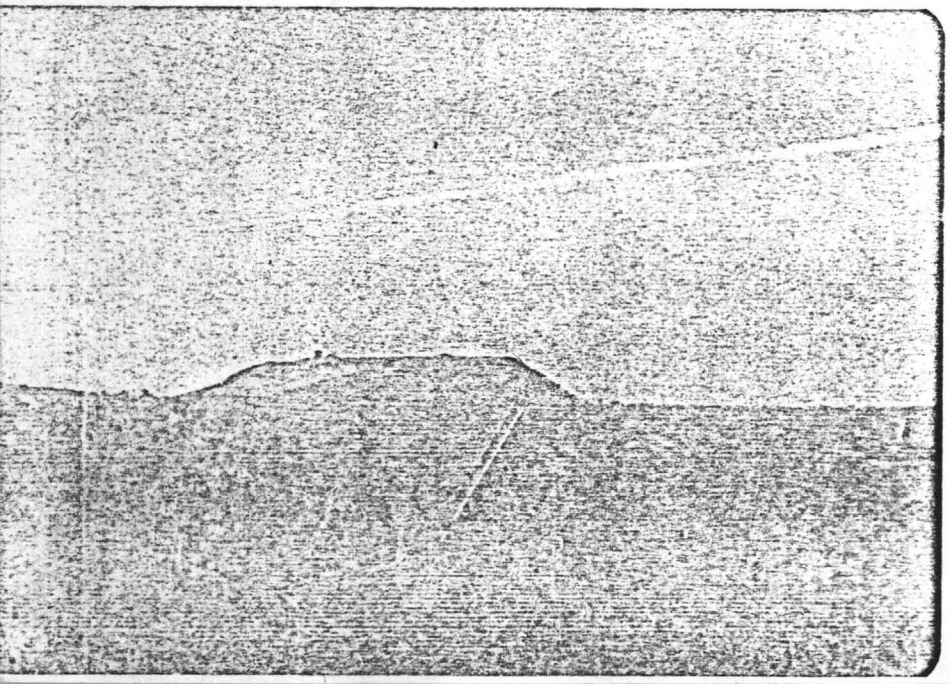
Precious metal precip press clean-up. Black color is unused zinc. Precip's are sealed in the black cyanide barrel's and shipped to the refinery.



Present heap at Tombstone; The heap is about 100 feet high. Compare this photo with previous when 25-50 feet high. Hauling new ore to the heap was stopped over two years ago. Production continued by secondary recovery methods.

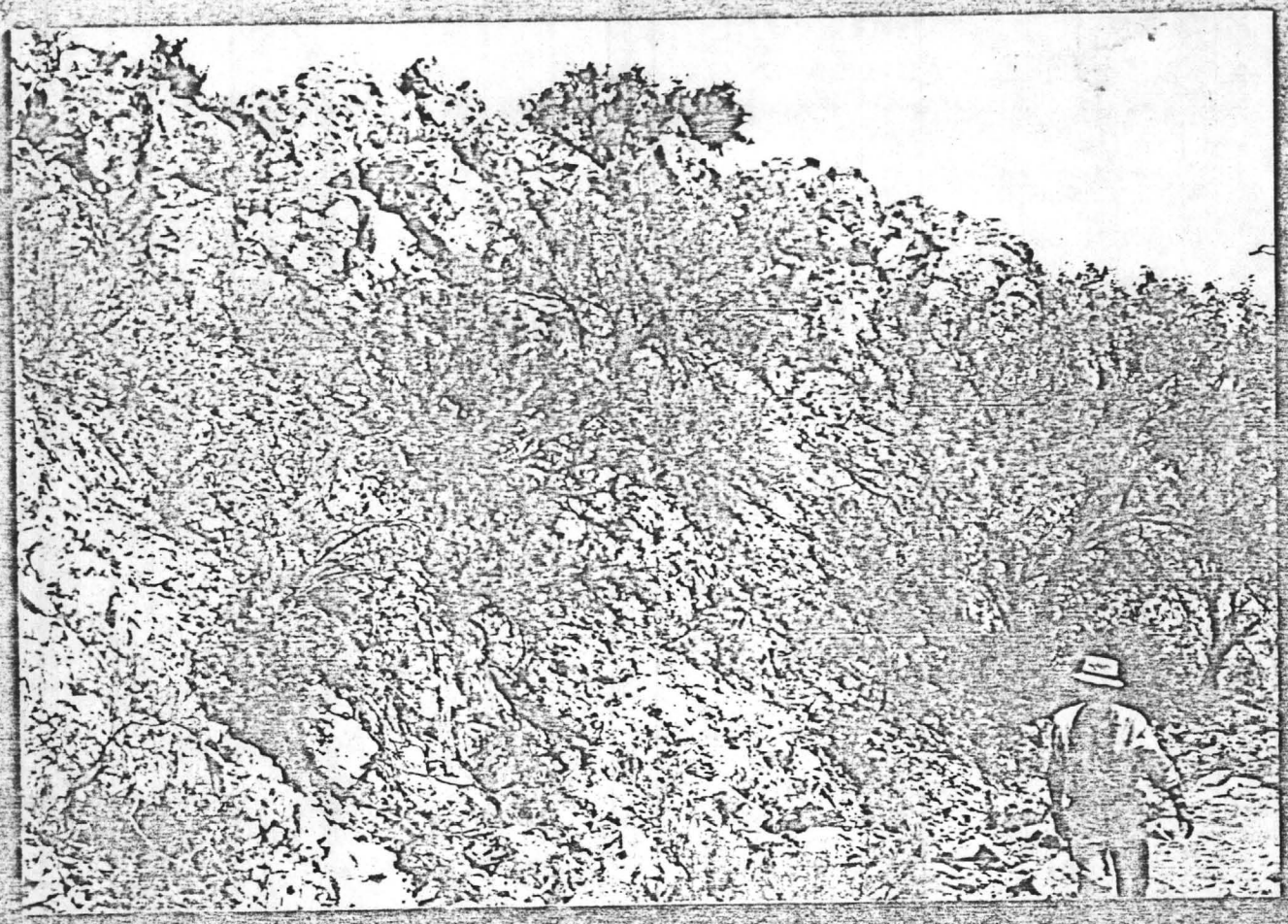


Final stages of leaching heap; south end was Emerald and Bunker Hill ore. Notice that the south end is becoming saturated.

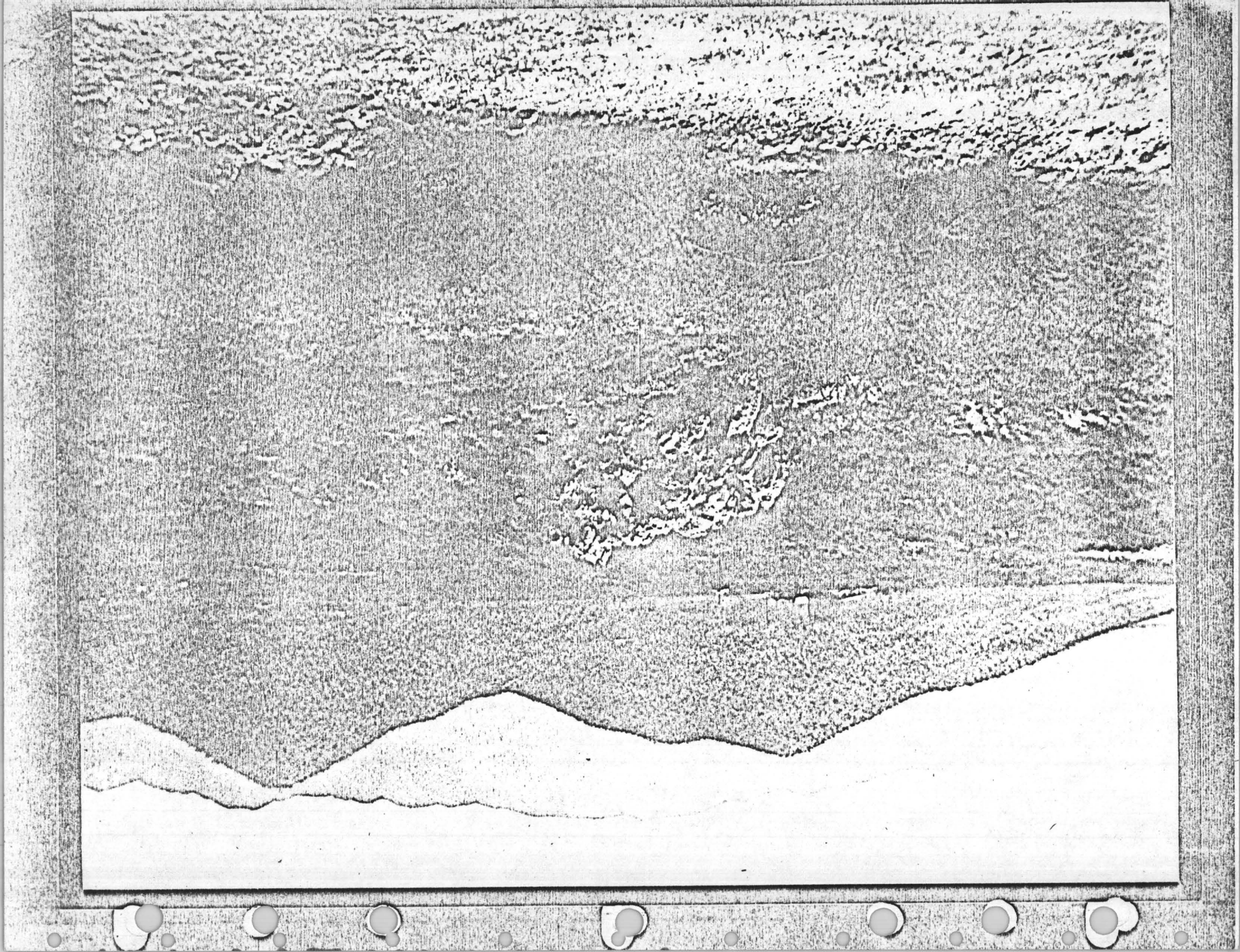


Present heap viewed from the south. Notice dozer on top pushing ore and ripping to increase percolation.

Exposed fracturing on Seth Horne/TMR property. This type of fracturing is one requirement for the occurrence of a porphyry copper deposit.



ABOVE: Kenyon Richard examining breccia pipes.
BELOW: Drill site on TMR property to test for sulphides.



R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

FUTURE POTENTIAL

Tombstone represents three potential economic assets:

1. Heap; for re-processing.
2. Open-pit and underground ore.
3. Water; for possible sale to Tucson and locally for irrigation.

These will be discussed, but the water potential was mentioned in the section called WATER TABLE. Little can be added concerning the water potential without further discussions with the City of Tucson.

Heap Re-Processing

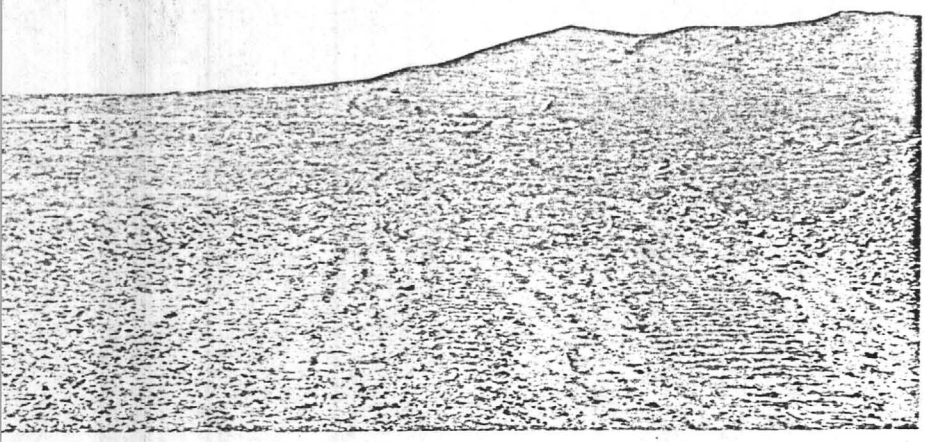
Gross value of the heap is known by the dump samples taken and the samples taken from the heap during truck-dumping and the heap leveling. Also, samples were taken after an area was leached to estimate percent recovery. In all, good sampling was done as an important phase of production monitoring.

The gross amounts and values in the heap are:

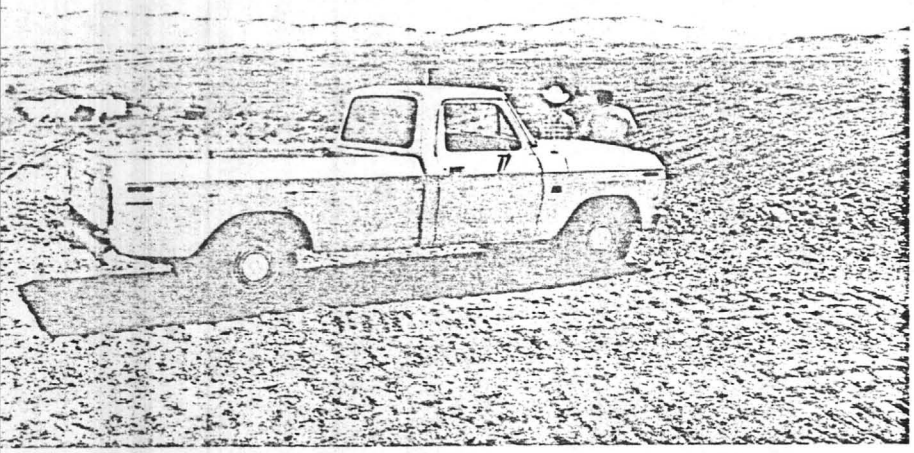
Precious Metal	Troy Oz.	Present $ Value
Gold	33,679	$ 6,735,806
Silver	2,057,151	$ 11,314,333

From the refinery receipts and the computed recoveries:

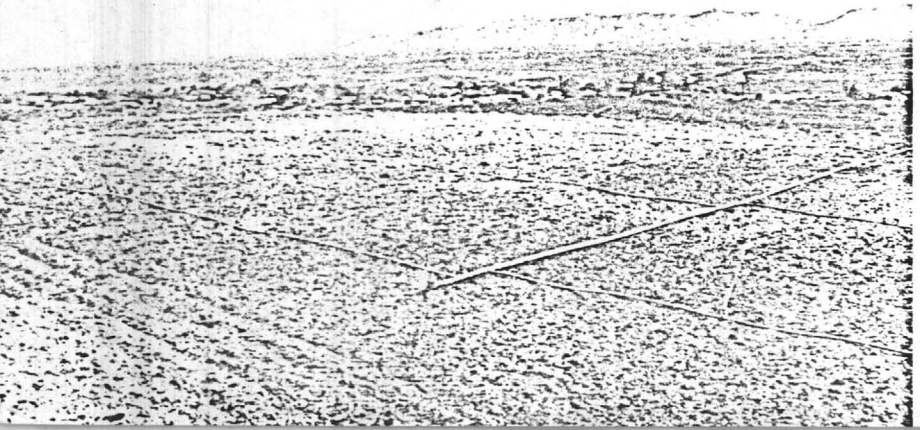
	Quantity Remaining in Heap	
Precious Metal	Troy Ounces	Present $ Value
Gold	20,207	$ 4,041,483
Silver	1,337,148	$ 7,354,316
		$ 11,395,799



Recent dozer activity; pushing and ripping increases percolation. Clay and fines cause channeling and blinding in the heap, reducing the recovery to about 35-40 percent.



Area east(behind) pick-up was dozed down 15 feet and ripped, producing additional values in the preg which lasted for 6 monthes;the heap represents a real asset that simple re-working can produce a significant cash flow.



Above area being leached. Notice the caustic crust which indicates this section of the heap has de-watered for about two weeks.

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

A financial analysis of the Tombstone heap follows:

Gross Value Remaining in Heap; $ 11.40/ton(for 1 mm tons)

Minimum recovery with crushing and "IPS" treatment; 50 %

Minimum recoverable value; $ 5.70/ton.....

Processing Costs;	Operating Cost/Ton
Crushing	$ 0.25
Dozing	.50
Leaching	.50
"IPS"	.50
Plant	.30
Admin.&Overhead	.25
Shipping&Refining	.15
	$ 2.45.....

Minimum net profit;

Gross Value	$ 5.70/ton
Operating Cost	2.45/ton
Net Operating Profit	$ 3.25/ton
Net Operating Profit from Re-Processing Heap	$ 3,250,000 .....

Required Capital Investment = $ 200,000

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

Open Pit Potential

At the present prices of precious metals and by utilizing new innovations in heap-leaching technology, relatively small open pit tonnages are required to be developed to produce a very significant cash flow.

It has been observed in the underground workings that at least the same tonnage(in the form of gob)is still underground as was hoisted to the surface and placed in the "waste dumps". In most(if not all) cases, the gob is higher-grade than the waste dumps;Goodenough gob averaged .15 Au and 10 ounces Ag. Old miners tell me that the gob is the lower-grade material(ore) that was expected to be milled at a later date. The waste was assumed to be to to low grade to ever be processed. Because it was economic to process the "waste dumps", it will be shown that if we assume to discover the same gob tonnage as was dumped on the surface("waste dumps") that an open pit operation would make money if no additional ore would be discovered. That really reduces the risk.

Following are the assumptions and factual data used to make ore reserve estimates:

Deposit Name	Last Production		Waste Dump			Gob Assumed		
	Au	Ag	Tons (X1000)	Au	Ag	Tons (X1000)	Au	Ag
Contention "Dike"	.207	15.22	381	.051	1.75	500	.050	2.10
Tranquillity Skip-Ag Thd.	.307	23.25	61	.051	1.99	100	.058	1.92
Lucky Cuss-Old Guard	.056	16.92	66.4	.036	3.23	70	.039	3.50
Emerald	.010	8.00	70	.015	3.61	70	.015	3.50
Bunker Hill	.035	15.45	38	.021	3.39	40	.021	3.40
Tombstone Extension	.071	11.88	6	.031	6.50	15	.025	5.00

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

Present open-pit mining and heap-leaching costs have been used for the computation of gross value, net operating profit before tax(NOPBT), and total open-pit mining cost. Costs used are:

Ore operating cost/ton = $2.25
Waste haulage/ton = .50

For example, for a stripping ratio of 5.5:1 = $5.00/ton ore.

Preliminary open pits were designed for the six open-pit targets previously defined as having good potential. Criteria used were:

A. 45° pit slopes
B. 50-foot minimum width at bottom bench
C. Pit depth does not exceed ore body width.

The above criteria allows comparison of the various "target" ore bodies on an equitable basis.

After an analysis of the underground maps and personal knowledge, the following resulted from the "mineable open-pit-ore-reserves":

Deposit Name	Pit Total Tonnage	% Ore Tonnage	Ore Value/Ton
Contention Dike	9,100,000	12.6 %	$ 80.00
Tranq-Ag Thread	4,220,000	5.9 %	80.00
Lucky Cuss	1,580,000	8.0 %	68.00
Emerald	1,340,000	9.4 %	36.94
Bunker Hill	1,150,000	6.3 %	65.00
Tomb. Extension	650,000	9.2 %	58.00

Notice that the dumps had an ore value of $ 20.96/ton and that the past ore production had an ore value of $ 150.62/ton. The estimated ore values above from underground samples falls about half way between the previously mined ore and the dump values.

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

As will be presented on the following page, with a realistic projection of deposit ore reserves, a very significant cash flow results. Howvever, it is very interesting to evaluate the individual "target deposits" from the following minimum risk point-of-view:

A. For the designed pits, it is assumed that no ore will be discovered or developed.

B. For the designed pits, it is assumed that only gob exists; the gob has been observed and sampled.

Using the previously mentioned open-pit mining costs, the net operating cost before taxes was computed mining only gob. Also, the "break-even" gob tonnage was computed to relate to the minimum gob tonnage required to develop and not loose any money. It is easy to relate to this approach, because it is quickly seen that relatively small tonnages are required to break even. For example, tonnages smaller than the "waste dump" tonnages are required. Following are these computations:

OPEN PIT RISK ANALYSIS
(Only Gob-No Ore)

Deposit Name	Total OP Mining Cost-Gob & Waste	Gross Value Gob	NOPBT Gob-MM	Break Even Gob Tonnage
Contention	$ 5,425,000	$ 11,300,000	$ 5.875	240,044
Tranq.-Ag Th.	2,285,000	2,312,000	.027	98,832
Lucky Cuss	912,500	2,016,000	1.104	31,684
Emerald	792,500	1,680,000	.888	33,021
Bunker Hill	645,000	984,000	.339	26,220
Tomb. Extens.	328,750	525,000	.196	9,393

Following are the computed economics for the projected ore and the gob within each designed open pit.

R. F. HEWLETT
PHONE (702)359-1069

2602 Monte Verde Way
Sparks, Nevada 89431

OPEN PIT POTENTIAL

Deposit Name	Open Pit Dimensions			Estimated Ore Reserves				Economics	
	Length	Width	Depth	Type	Au	Ag	Tons	Gross Value	Net Op. Profit
"Contention Dike"-Grand Central-Contention-Tranquillity	2,000'	350'	300'	Ore	.100	10.0	1.15MM	$92.MM	
				Gob	.050	2.10	.50MM	11.3	$95.93MM
Tranquillity-Skip Shaft-Silver Thread	900'	300'	300'	Ore	.100	10.0	.250MM	$20.MM	
				Gob	.058	1.92	.100MM	2.312	$19.59MM
Lucky Cuss-Old Guard	700'	200'	200'	Ore	.040	10.0	.126MM	$8.6MM	
				Gob	.039	3.50	.070MM	2.0	$ 9.451MM
Emerald	600'	250'	200'	Ore	.005	6.0	.126MM	$4.7MM	
				Gob	.015	3.5	.070MM	1.7	$ 5.321MM
Bunker Hill	500'	200'	200'	Ore	.025	10.	.072MM	$4.7MM	
				Gob	.021	3.4	.040MM	.984	$ 4.893MM
Tombstone Extension	300'	250'	200'	Ore	.050	8.	.060MM	$3.48MM	
				Gob	.025	5.	.015MM	.525	$ 3.55MM