New Mexico Bureau of Mines and Mineral Resources

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Column Leach Testing of Gold Ore from the Ortiz gold mine: The effect of surfactant additions to the leaching solution.

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Abstract

Five column leaching tests were carried out to determine the effects of adding various surfactants (at a level of 15 ppn) to the cyanide leaching solution, on the extraction of gold from ore taken from the Ortiz gold mine, located near Cerrillos, N.M. Based on this test work the surfactant additions did not have a significant effect on the over all extraction of gold from the ore.

Introduction

This open file report is based on work carried out for the Ortiz gold mine during the period of October 1984 to February 1985. The Ortiz gold mine (owned by Consolidated Gold Fields) provided the materials needed for this study.

Summary

1. The ore as received had been crushed to 100 percent passing 1 inch. The material was moderately damp with an 8.3 percent moisture. Triplicate fire assays yielded a head analysis of 0.02 troy ounces of gold per ton of ore.

2. The cyanide leaching solution contained 1 gram per liter sodium cyanide at a pH of 11.8 with a residual gold concentration of 0.086 ppm (0.0025 oz/ton of solution).

3. Five column leaching tests were carried out to test the effects of various surfactants on the extraction of gold. The surfactants tested and the extraction results are shown below:

Column	Surfactant	Gold Extracted (mg Au/ Kg of ore)
1	None	1.0502
2	Nalco 2DA-375	1.0181
3	Nalco 7811-V1179	1.0320
4	Nalco 3DA-78S	1.0350
5	Nalco 8801-B3159	1.0502

4. The extraction rate of gold as a function of effluent flow rate was determined to be a constant during the initial portion of each of the five column leaching tests. This constant value was 5.00 mg of gold per liter of leaching solution.

5. The quantity of gold dissolved in solution was found to peak early in the test and declined there after. This peak in the concentration of dissolved gold in the leaching solution was found to occur between the 5th and 8th liter of effluent for each of the column tests.

6. In each of the five tests, 90 percent (or better) of the gold was extracted with the first 20 liters of leaching solution.

7. Based on these results the surfactant additions had little if any, effect on the extraction of the gold at a surfactart addition of 15 ppm.

Discussion

Ore Description: The gold ore used in this test work was provided by the Ortiz gold mine. The sample consisted of about 750 pounds of wet material contained in a 55 gallon drum. A head sample was split out from the bulk sample for preliminary

analysis. Tests were carried out on the head sample to determine gold content, percent moisture and particle size distribution. The results are shown below:

Gold Content (triplicate fire assay)	0.02 oz/ton
Percent Moisture (air dry)	8.3

Particle Size Distribution

Tyler Mesh	Cumulative Passing Weight Percent
1 inch	100.0
3/4 inch	99.7
1/2 inch	91.7
4 m	45.6
10 m	30.1
20 m	20.7
28 m	17.2
35 m	13.3
48 m	9.8
65 m	5.0
100 m	0.9

Leaching Solution: The leaching solution as provided by Ortiz consisted of approximately 110 gallons of one gram per liter sodium cyanide solution, pH 11.8, with a residual gold concentration of 0.086 ppm (0.0025 oz/ton of solution). This solution was modified for the test work by the addition of the surfactants, which were also provided by Ortiz. Each surfactant was added at a rate of 15 ppm by weight. The surfactant used in each test is shown below:

Test	Surfactant
1	None (control)
2	Nalco 2DA-375
3	Nalco 7811-V1179
4	Nalco 3DA-785
5	Nalco 8801-B3159

Bulk samples of each leaching solution were prepared by mixing five gallons of the cyanide solution with enough surfactant to make the designated 15 ppm concentration. The bulk solutions were stored in stoppered five gallon containers and used as needed each day.

Column Description: Five columns were used in this test work. Each column consisted of a ten foot long, 6 inch ID, schedule 40 PVC pipe. On the bottom of each column a 6 inch schedule 40 PVC cap was installed to contain the ore in the column. Each cap was drilled and fitted with a short length of 1/2 inch PVC tubing to allow the leaching solution to flow out of the column. Inside the cap a small wad of glass wool was placed over the exit hole. The glass wool was held in place by a section of screen which was laid over the wool and then glued in place with PVC solvent. This arrangement allowed the solution to flow out of the column while retaining the ore particles. The columns were mounted on a wooden frame 14 inches above the floor and the tops of the columns were secured to the second floor tailing with metal straps and screws.

Column Loading Procedure: Ore was taken from the 55 gallon drum by shovelfuls and placed sequentially into one of five numbered buckets (one bucket for each column). After every three rounds a shovelful was placed into a sixth bucket to serve as a head sample. When the ore buckets were filled they were weighed and the contents were loaded into the respective columns. After

loading the ore contained in the columns varied in height between 7.5 and 8 feet.

Leaching procedure: Approximately two liters of leaching solution was introduced into each column each day. The solutions were held in two liter flasks which were suspended above the columns in a rack which was attached to the ceiling. The solution flowed out of the flask through tubing and into the column. The flow rate was regulated by a screw clamp on the tubing. By tightening the clamp the solution flow rate was decreased.

Each day the flasks were filled and the column effluents were collected. Each effluent sample was weighed and portions were taken for cyanide, pH and dissolved gold determinations. The bulk effluent sample was then disposed of after the residual cyanide had been destroyed with sodium hypochlorite.

The columns were leached for 42 days, drained for two days, washed with two liters of water, drained for five days, washed, drained for five days and washed a final time. The columns were then drained for seven days after which the leached residues were removed and air dried for several days. The residues were then split into quarters and a fire assay sample was split out from each quarter, the bulk residues were then stored.

Test Results: The test results are summarized in Table I and

Figures 1-4. A complete listing of the leaching test data for each column is presented in the appendix.

From these results there would seem to be little to differentiate these tests. Figure 1 shows gold extraction (based on percent) as a function of effluent flow. The data are grouped in a narrow band without more than an 8 percent difference at any time.

Figure 2 shows gold extraction (in milligrams) as a function of effluent flow for the initial 15 liters of each test. The most interesting feature of these results is the linear aspect of the extraction between 2 liters and 11 liters. A least squares fit of these results gave an equation of $y = 5.00 (X) - 11.20$ with a coefficient of fit of 0.98. The coefficient of fit is very good, again indicating that there was little difference between the five tests. The slope of the line gives a value for the rate of extraction during the initial stage of the test. The value of 5.00 mg of gold per liter of solution is equivalent to 0.146 oz of gold per ton of solution.

Figure 3 shows the concentration of dissolved gold as a function of effluent flow rate. Of primary interest is that the amount of gold in solution reached a peak very early in the test work and then declined gradually through out the rest of the time. This peak occurred between 5 and 8 liters total effluent flow, which corresponds to between 6.7 and 10.8 gallons effluent per

square foot.

The only real difference in these results is shown in Figure 4 which presents total gold extraction (mg) as a function of effluent flow. Yet even this difference is only a function of the weight of ore placed in the column. Column 4 yielded the lowest overall extraction and had the lowest total weight of ore. Column 5 yielded the highest overall extraction and had the highest total weight. The ratio of gold extracted (mg) to total weight of ore was calculated to overcome the effect of the different weights of ore in each test. The results are shown below:

Column	Surfactant	Gold Extracted (mg Au/ Kg of ore)
1	None	1.0502
2	Nalco 2DA-375	1.0181
3	Nalco 7811-V1179	1.0320
4	Nalco 3DA-78S	1.0350
5	Nalco 8801-B3159	1.0502

These results vary (lowest to highest) by only 3 percent, again indicating very little difference in the test results.

Finally using the total amount of gold dissolved in each test to calculate a head assay gave the following results.

Column	Calculated Head Assay (oz/ton)
1	0.0306
2	0.0297
3	0.0301
4	0.0302
5	0.0306

These results are somewhat higher than the fire assay result of 0.02 oz/ton, but still within experimental limits.

Therefore it is the conclusion of this study that the use of the various surfactants at a level of 15 ppm did not significantly effect the extraction of gold from this sample of the Ortiz ore.

Table 1
Summary of Column Leaching Results

	Column Test Number				
	1	2	3	4	5
Gold Extracted (mg)	62.007	59.185	61.569	58.293	64.038
Effluent flow (liters)	84.2	72.2	80.8	77.7	79.0
Cyanide consumed (gms)	28.598	27.044	28.396	27.941	28.766
Feed Weight (wet, kg)	64.004	62.943	64.601	60.985	66.024
Feed Weight (dry, kg)	59.110	58.130	59.661	56.322	60.975
Gold Extraction					
mg Au/liter	0.7371	0.8197	0.7612	0.7495	0.8103
mg Au/kg of ore	1.0502	1.0181	1.0320	1.0350	1.0502
Calculated Head Assay (oz/ton)	0.0306	0.0297	0.0301	0.0302	0.0306
Leached Residue Assays (oz/ton)					
1	0.00	trace	0.00	trace	trace
2	0.00	trace	trace	trace	trace
3	0.00	trace	0.02	0.00	trace
4	0.00	trace	0.02	trace	trace

trace ≡ less than 0.01 oz/ton

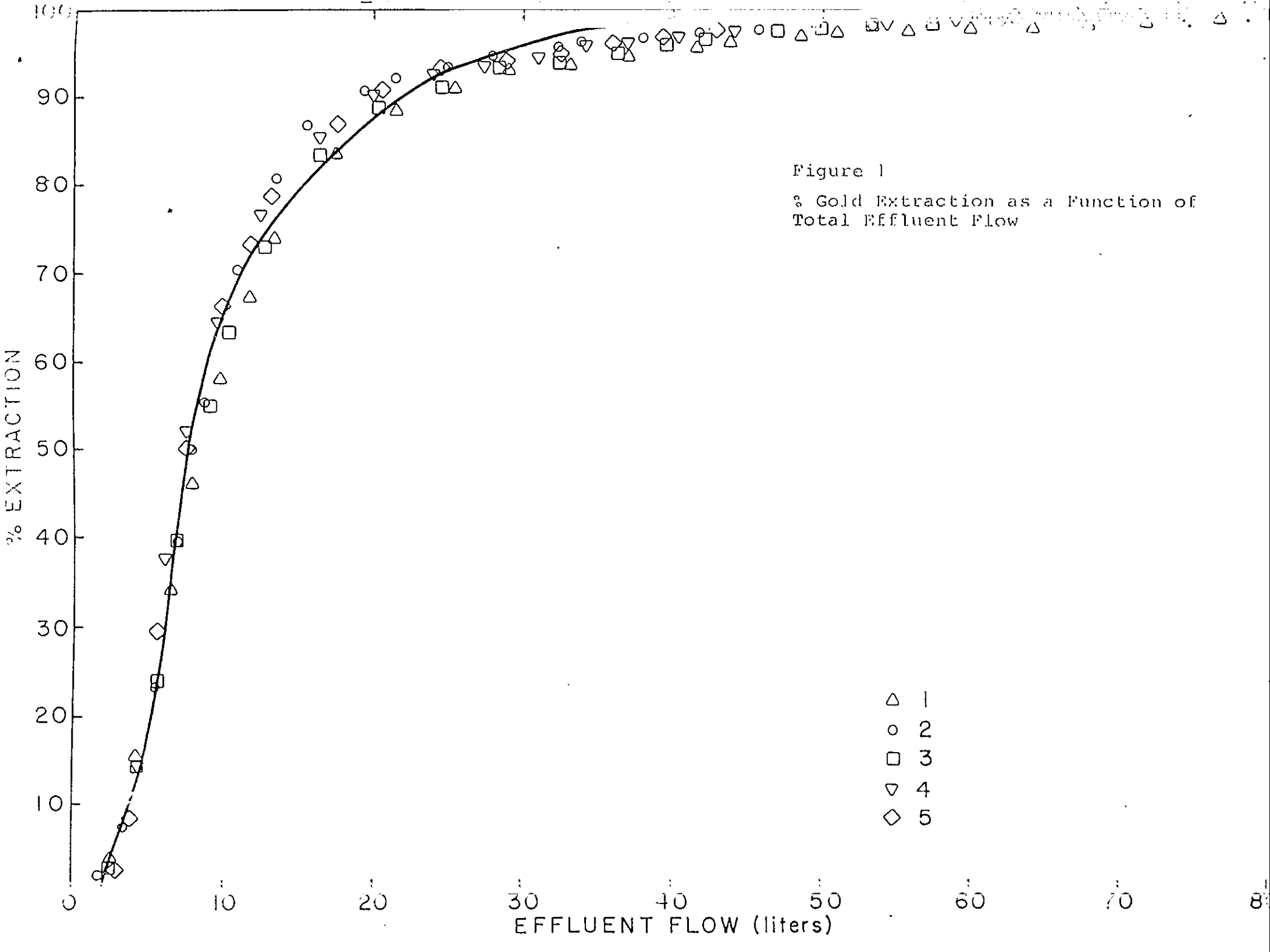


Figure 1

% Gold Extraction as a Function of Total Effluent Flow

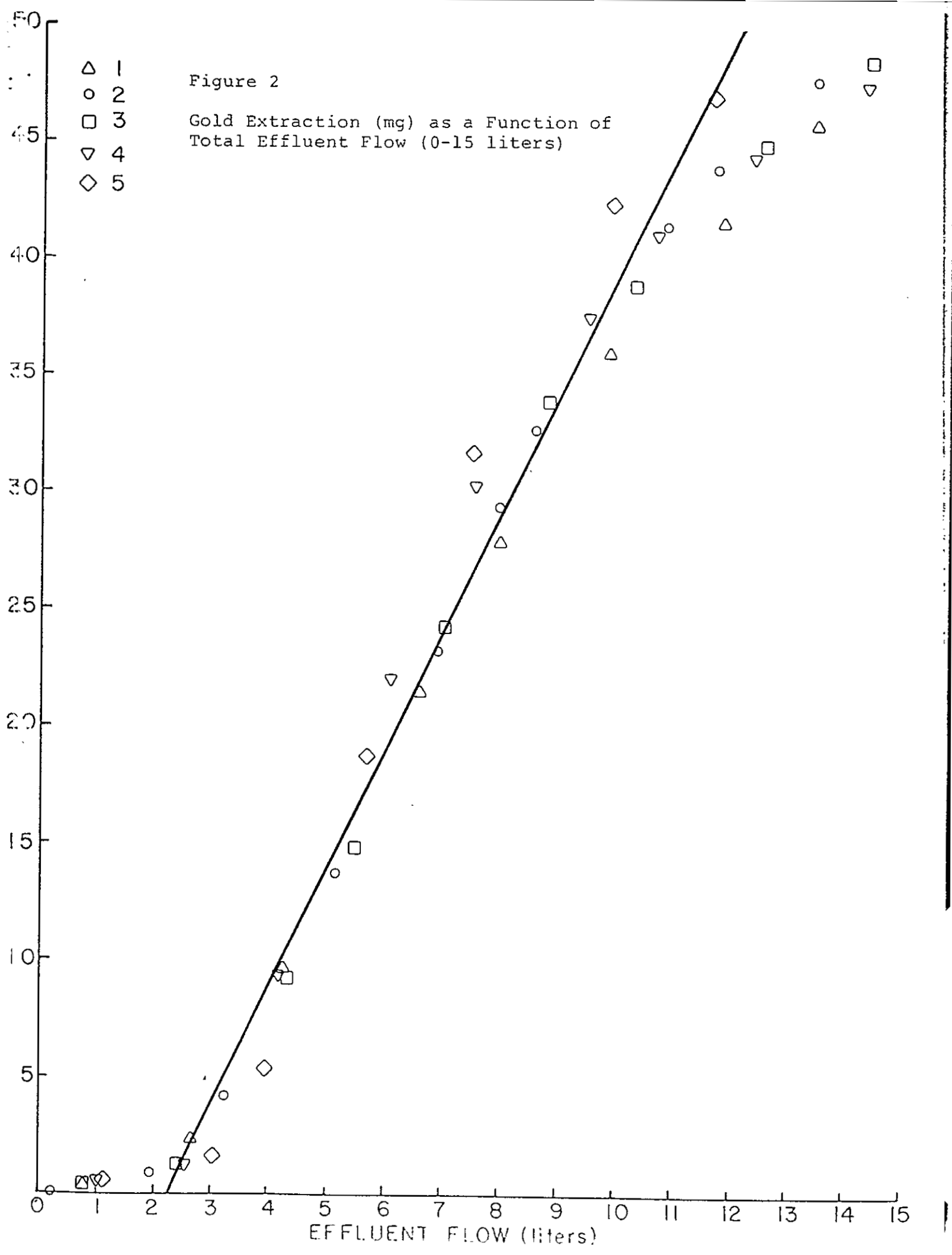
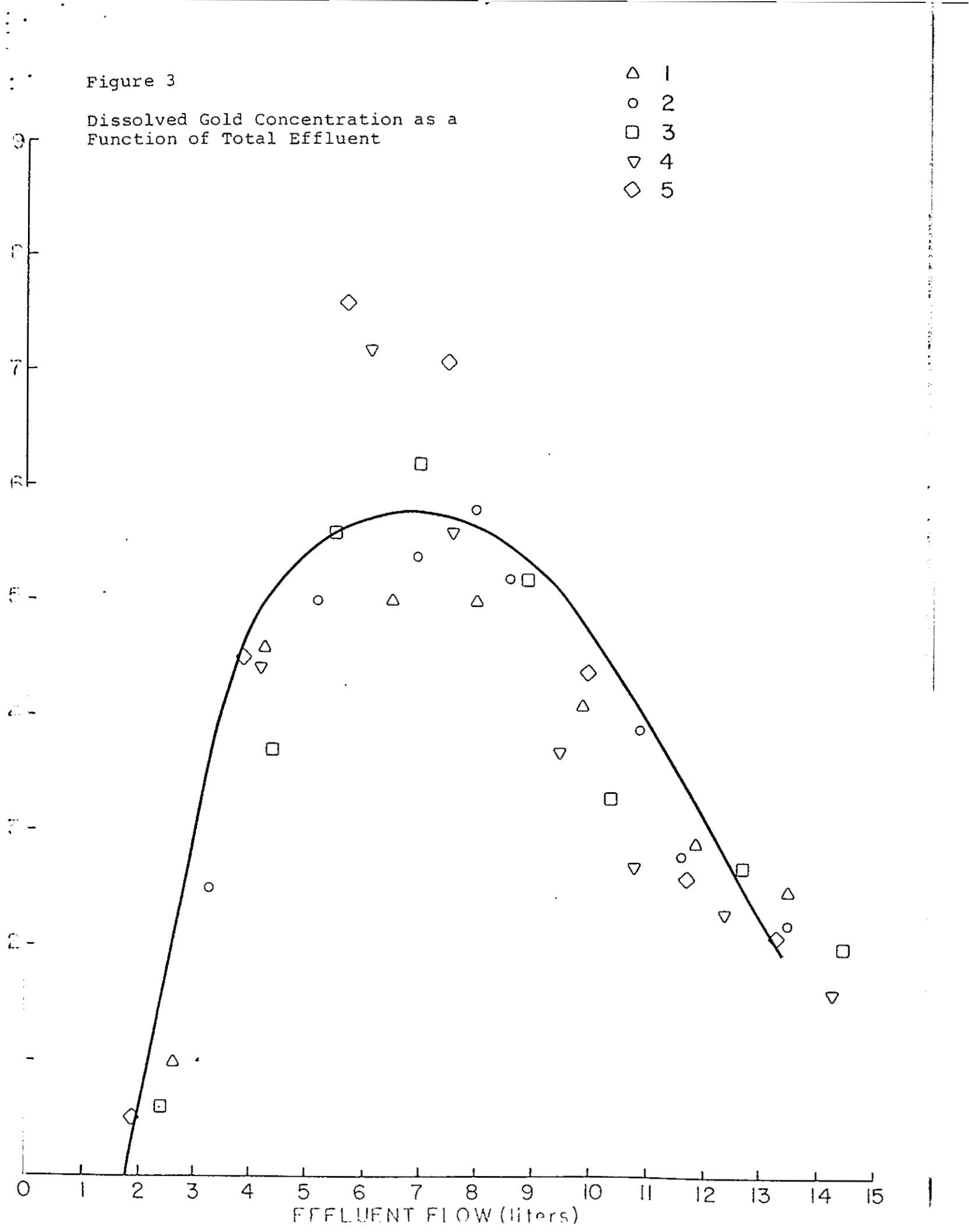

1
2
3
4
5
Figure 2
Gold Extraction (mg) as a Function of
Total Effluent Flow (0-15 liters)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
EFFLUENT FLOW (liters)

Figure 3

Dissolved Gold Concentration as a Function of Total Effluent



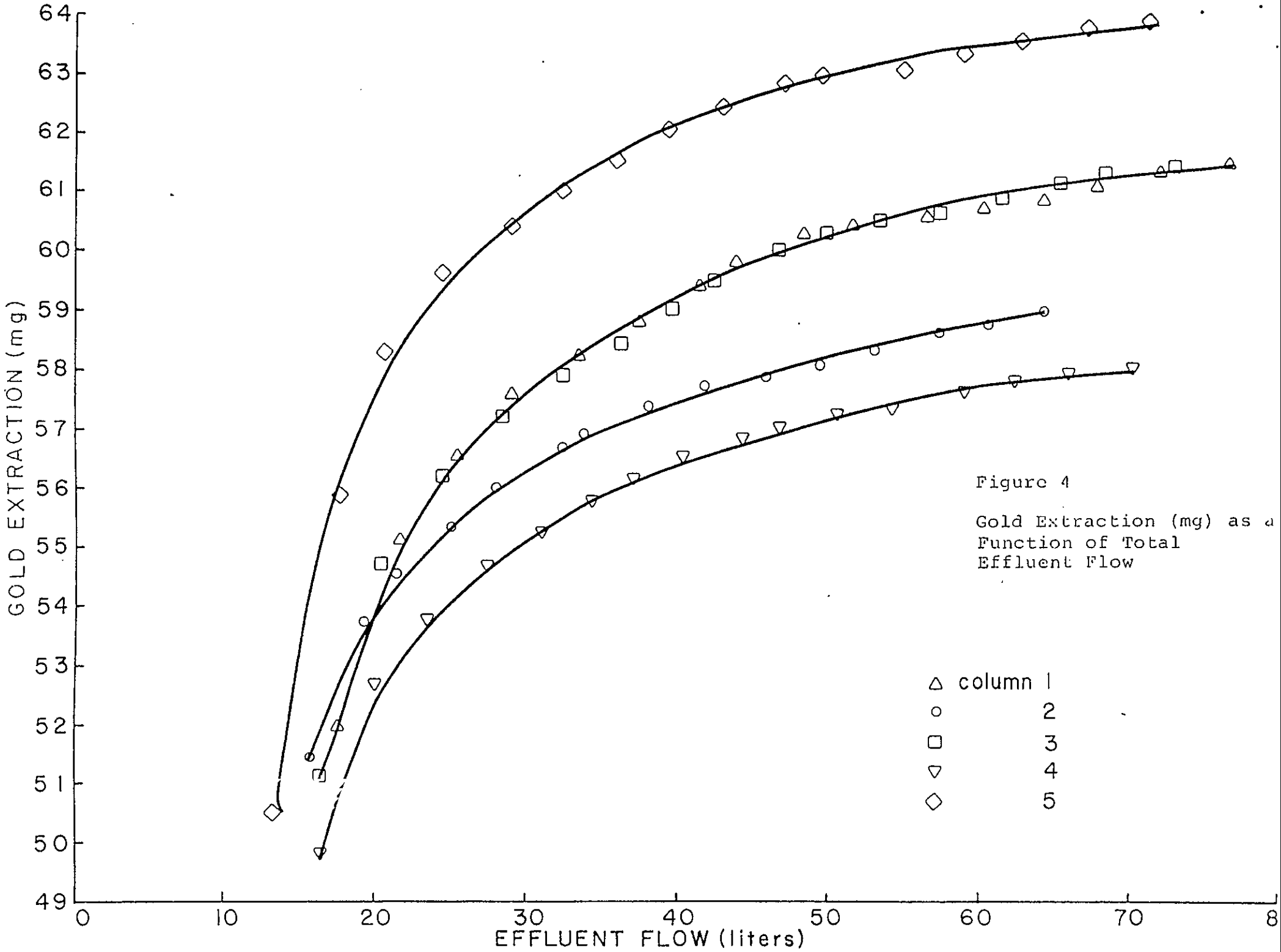


Figure 4

Gold Extraction (mg) as a Function of Total Effluent Flow

APPENDIX

Column 1 - Control
Summary of Leaching Data

Date	Sample No.	Sample Weight (g) Individual	Sample Weight (g) Cumulative	Gold (ppm)	Gold Extraction (ug) Individual	Gold Extraction (ug) Cumulative	Effluent Cyanide (mg) per liter	Effluent Cyanide (mg) Consumed	Effluent Cyanide (mg) Cumulative	pH
11/ 8	101	803	803	<0.5	402	402	20	787	787	8.1
9	102	1815	2618	1.0	1815	2217	20	1779	2566	8.1
10	103	1642	4260	4.6	7553	9770	25	1601	4167	8.2
11	104	2310	6570	5.0	11550	21320	180	1894	6061	8.2
12	105	1436	8006	5.0	7180	28500	200	1149	7210	8.4
13	106	1875	9881	4.1	7688	36188	300	1312	8522	8.9
14	107	1951	11832	2.9	5658	41846	375	1219	9741	9.3
15	108	1650	13482	2.5	4125	45971	425	949	10690	9.5
16	109	2121	15603	1.6	3393	49364	445	1177	11867	9.8
17	110	2047	17650	1.3	2661	52025	475	2046	13913	10.1
18	111	2086	19736	0.8	1169	53694	550	939	14852	10.0
19	112	1816	21552	0.8	1453	55147	625	681	15533	10.1
20	113	1905	23457	0.35	667	55814	690	591	16124	10.3
21	114	1972	25429	0.37	729	56543	665	661	16785	10.4
22	115	2269	27648	0.29	658	57201	670	749	17534	10.5
23	116	1390	29088	0.29	403	57604	700	417	17951	10.5
24	117	2297	31385	0.15	345	57949	750	574	18525	10.5
25	118	2105	33490	0.13	274	58223	725	579	19104	10.8
26	119	1960	35450	0.10	196	58419	760	470	19574	10.6
27	120	1859	37309	0.20	377	58790	700	558	20132	10.5
28	121	2176	39485	0.18	392	59182	800	435	20567	10.7
29	122	1959	41444	0.13	255	59437	775	441	21008	10.7
30	123	1492	42936	0.14	209	59646	770	343	21351	10.5
12/ 1	124	960	43896	0.14	134	59780	705	283	21634	10.5
2	125	2220	46116	0.13	289	60069	725	611	22245	10.4
4	126	2208	48324	0.09	198	60267	660	751	22996	10.3
5	127	1324	49648	0.03	40	60307	750	331	23327	10.4
6	128	1933	51581	0.05	97	60404	810	367	23694	10.5
7	129	2482	54063	0.03	74	60478	795	509	24203	10.4
8	130	1930	55993	0.03	58	60536	805	376	24579	10.5
9	131	2041	58034	0.04	82	60618	850	306	24885	10.6
10	132	2026	60060	0.02	40	60658	800	405	25290	10.6
11	133	2008	62068	0.04	80	60738	825	351	25641	10.6
12	134	2106	64174	0.06	126	60864	800	421	26062	10.6
13	135	2002	66176	0.06	120	60984	800	400	26462	10.7
14	136	1671	67847	.05	84	61068	780	368	26830	10.8
15	137	2328	70175	.05	116	61184	800	466	27296	10.5
16	138	1806	71981	.05	90	61274	860	253	27549	10.5
17	139	2391	74372	.05	120	61394	875	299	27848	10.5
18	140	2070	76442	.04	83	61477	865	279	28127	10.5
19	141	2092	78534	0.05	105	61582	775	471	28598	9.9
21	142	1809	80343	0.05	235	61817	810			10.1
26	143	2166	82509	0.04	260	62077	300			9.7
1/2/85	144	1709	84218	0.00	—	62077	75			9.4

Column 2 - Surfactant 2DA-375
Summary of Leaching Data

Date	Sample No.	Sample Weight (g) Individual	Sample Weight (g) Cumulative	Gold (ppm)	Gold Extraction (ug) Individual	Gold Extraction (ug) Cumulative	Effluent Cyanide (mg) per liter	Effluent Cyanide (mg) Consumed	Effluent Cyanide (mg) Cumulative	pH
11/ 8	201	246	246	<0.5	123	123	15	242	242	8.0
9	202	1704	1950	<0.5	852	975	20	1670	1912	8.1
10	203	1294	3244	2.5	3235	4210	30	1255	3167	8.3
11	204	1921	5165	5.0	9605	13815	90	1748	4915	8.4
12	205	1770	6935	5.4	9558	23373	175	1460	6375	8.4
13	206	1064	7999	5.8	6171	29544	200	851	7226	8.5
14	207	617	8616	5.2	3208	32752	225	479	7705	8.8
15	208	2283	10899	3.9	8904	41656	300	1598	9303	9.1
16	209	853	11752	2.8	2388	44044	280	614	9917	9.6
17	210	1751	13503	2.2	3852	47896	310	1208	11125	9.9
18	211	—	13503	—	—	47896	—	—	11125	—
19	212	2230	15733	1.6	3568	51464	475	1171	12296	9.7
20	213	760	16493	0.87	662	52126	410	448	12744	10.1
21	214	2799	19292	0.57	1595	53721	595	1134	13878	10.3
22	215	1173	20465	0.41	481	54202	550	528	14406	10.3
23	216	845	21310	0.40	338	54540	550	380	14786	10.3
24	217	1715	23025	0.25	429	54969	610	669	15455	10.4
25	218	2080	25105	0.17	354	55323	625	780	16235	10.6
26	219	799	25904	0.25	200	55523	605	316	16551	10.4
27	220	2096	28000	0.24	503	56026	650	734	17285	10.7
28	221	2000	30000	0.21	420	56446	750	500	17785	10.4
29	222	2292	32292	0.12	275	56721	760	550	18335	10.5
30	223	704	32996	0.12	84	56805	650	246	18581	10.3
12/ 1	224	835	33831	0.14	117	56922	575	355	18936	10.5
2	225	2093	35924	0.12	251	57173	675	680	19616	10.4
4	226	2096	38020	0.11	231	57404	650	734	20350	10.3
5	227	1865	39885	0.07	130	57534	720	522	20872	10.4
6	228	1905	41790	0.09	171	57705	800	381	21253	10.4
7	229	1880	43670	0.03	57	57762	780	414	21667	10.3
8	230	2190	45860	0.05	110	57872	775	493	22160	10.4
9	231	1272	47132	0.05	63	57935	750	318	22478	10.4
10	232	2235	49367	0.05	112	58047	725	614	23092	10.5
11	233	2020	51387	0.07	141	58188	790	424	23516	10.5
12	234	1636	53023	0.08	131	58319	760	393	23909	10.5
13	235	2047	55070	0.07	143	58462	725	563	24472	10.6
14	236	2294	57364	0.06	138	58600	780	504	24976	10.7
15	237	614	57978	0.05	31	58631	550	276	25252	10.1
16	238	2629	60607	0.05	131	58762	805	513	25765	10.4
17	239	1968	62575	0.04	79	58841	815	364	26129	10.4
18	240	1833	64408	0.04	73	58914	830	312	26441	10.5
19	241	2363	66771	0.05	118	59032	745	603	27044	10.1
21	242	1846	68617	0.05	92	59124	770			9.9
26	243	2020	70637	0.03	61	59185	325			9.8
1/2/85	244	1559	72196	0.00		59185	70			9.4

Column 3 - Surfactant 7811-V1179
Summary of Leaching Data

Date	Sample No.	Sample Weight (g) Individual	Sample Weight (g) Cumulative	Gold (ppm)	Gold Extraction (ug) Individual	Gold Extraction (ug) Cumulative	Effluent Cyanide (mg) per liter	Effluent Cyanide (mg) Consumed	Effluent Cyanide (mg) Cumulative	pH
11/ 8	301	820	820	<0.5	410	410	20	804	804	8.1
9	302	1592	2412	0.6	955	1365	15	1568	2372	8.1
10	303	1972	4384	3.7	7296	8661	50	1873	4245	8.3
11	304	1089	5473	5.6	6099	14760	75	1007	5252	8.5
12	305	1552	7025	6.2	9622	24382	210	1226	6478	8.5
13	306	1836	8861	5.2	9547	33929	295	1294	7772	8.5
14	307	1511	10372	3.3	4987	38916	305	1050	8822	9.2
15	308	2267	12639	2.7	6121	45037	390	1383	10205	9.4
16	309	1817	14456	2.0	3634	48671	400	1090	11295	9.9
17	310	1896	16352	1.3	2465	51136	435	1072	12367	9.9
18	311	2164	18516	1.1	2380	53516	530	1017	13384	9.9
19	312	1800	20316	0.7	1260	54776	605	711	14095	10.0
20	313	1899	22215	0.40	760	55536	640	684	14779	10.2
21	314	2308	24523	0.29	669	56205	635	842	15621	10.5
22	315	1804	26327	0.29	523	56728	640	650	1627	10.5
23	316	2108	28435	0.25	527	57255	680	675	16946	10.5
24	317	1619	30054	0.22	356	57611	700	486	17432	10.5
25	318	2427	32481	0.12	291	57902	710	704	18136	10.7
26	319	1914	34395	0.10	191	58093	740	497	18632	10.6
27	320	1842	36237	0.19	350	58443	710	534	19166	10.7
28	321	1568	37805	0.20	314	58757	780	345	19511	10.6
29	322	1695	39500	0.17	288	59045	755	415	19926	10.7
30	323	1420	40920	0.13	185	59230	700	426	20352	10.5
12/ 1	324	1423	42343	0.16	228	59458	750	356	20708	10.5
2	325	2201	44544	0.13	286	59744	750	550	21258	10.5
4	326	2191	46735	0.12	263	60007	700	658	21916	10.2
5	327	1919	48654	0.09	173	60180	705	566	22482	10.4
6	328	1168	49822	0.09	105	60285	790	245	22727	10.5
7	329	2398	52220	0.06	144	60429	790	504	23231	10.4
8	330	1103	53323	0.06	66	60495	735	292	23523	10.4
9	331	2092	55415	0.01	21	60516	795	429	23952	10.5
10	332	2088	57503	0.03	63	60579	775	470	24422	10.5
11	333	1688	59191	0.08	135	60714	790	355	24777	10.6
12	334	2346	61537	0.07	164	60878	755	575	25352	10.6
13	335	1727	63264	0.07	121	60999	725	475	25827	10.7
14	336	2091	65355	0.07	146	61145	800	418	26245	10.7
15	337	2088	67443	0.05	104	61249	715	595	26840	10.4
16	338	979	68422	0.05	49	61298	780	215	27055	10.4
17	339	2469	70891	0.02	49	61348	845	383	27438	10.5
18	340	2261	73152	0.02	45	61393	825	396	27834	10.5
19	341	2081	75233	0.03	62	61455	730	562	28396	10.1
21	342	1772	77005	0.04	71	61526	775			10.2
26	343	2167	79172	0.02	43	61569	325			9.7
1/2/85	344	1646	80818	0.00		61569	80			9.5

Column 4 - Surfactant 3DA-785
Summary of Leaching Data

Date	Sample No.	Sample Weight (g) Individual	Sample Weight (g) Cumulative	Gold (ppm)	Gold Extraction (ug) Individual	Gold Extraction (ug) Cumulative	Effluent Cyanide (mg) per liter	Effluent Cyanide (mg) Consumed	Effluent Cyanide (mg) Cumulative	pH
11/ 8	401	1020	1020	<0.5	510	510	20	1000	1000	8.0
9	402	1577	2597	<0.5	788.5	1298	10	1561	2561	8.0
10	403	1582	4179	4.4	6960.8	8259	35	1527	4088	8.1
11	404	1915	6094	7.2	13788	22047	175	1580	5668	8.3
12	405	1485	7579	5.6	8316	30363	190	1203	6871	8.4
13	406	1958	9537	3.7	7244.6	37607	250	1468	8339	8.6
14	407	1246	10783	2.7	3364.2	40972	300	872	9211	9.1
15	408	1576	12359	2.3	3624.8	44597	385	969	10180	9.3
16	409	1916	14275	1.6	3065.6	47662	395	1159	11339	9.7
17	410	2154	16429	1.0	2154	49816	430	1228	12567	9.9
18	411	1889	18318	1.0	1889	51705	535	878	13445	9.9
19	412	1673	19991	0.6	1003.8	52709	615	644	14089	10.0
20	413	2253	22244	0.33	743	53453	625	845	14934	10.3
21	414	1460	23704	0.28	409	53862	600	584	15518	10.4
22	415	2419	26123	0.22	532	54394	670	798	16316	10.5
23	416	1348	27471	0.22	297	54690	725	371	16687	10.5
24	417	2049	29520	0.22	451	55141	750	512	17199	10.6
25	418	1487	31007	0.07	104	55245	625	558	17757	10.7
26	419	1205	32212	0.12	145	55390	700	362	18118	10.6
27	420	2108	34320	0.18	379	55769	715	601	18720	10.7
28	421	1061	35381	0.15	159	55928	710	308	19028	10.5
29	422	1716	37097	0.15	257	56186	730	463	19491	10.5
30	423	1568	38665	0.11	172	56358	700	470	19961	10.5
12/ 1	424	1826	40491	0.10	183	56541	750	457	20418	10.5
2	425	1308	41799	0.10	131	56671	675	425	20843	10.4
4	426	2358	44157	0.08	189	56860	700	707	21550	10.2
5	427	1154	45311	0.06	69	56930	700	346	21896	10.3
6	428	1368	46679	0.07	96	57025	750	342	22238	10.3
7	429	2446	49125	0.08	196	57221	770	563	22801	10.4
8	430	1547	50672	0.04	62	57283	795	317	23118	10.4
9	431	2146	52818	0.03	64	57347	800	429	23547	10.5
10	432	1510	54328	0.01	15	57362	710	438	23985	10.4
11	433	2450	56778	0.05	122	57485	800	490	24475	10.5
12	434	2225	59003	0.07	156	57641	750	556	25031	10.6
13	435	622	59625	0.05	31	57672	700	187	25218	10.5
14	436	2594	62219	0.05	130	57801	800	519	25737	10.7
15	437	1966	64185	0.05	98	57900	730	531	26268	10.4
16	438	1712	65897	0.02	34	57934	800	342	26610	10.5
17	439	2043	67940	0.02	41	57975	830	347	26957	10.5
18	440	2346	70286	0.02	47	58022	815	434	27391	10.5
19	441	2000	72286	0.05	100	58122	725	550	27941	10.1
21	442	1849	74135	0.03	55	58177	760			9.7
26	443	2068	76203	0.03	62	58293	350			9.5
1/2/85	444	1568	77771	0.00	--	58293	70			9.4

Column 5 - Surfactant 8801-B3159
Summary of Leaching Data

Date	Sample No.	Sample Weight (g) Individual	Sample Weight (g) Cumulative	Gold (ppm)	Gold Extraction (ug) Individual	Gold Extraction (ug) Cumulative	Effluent Cyanide (mg) per liter	Effluent Cyanide (mg) Consumed	Effluent Cyanide (mg) Cumulative	pH
11/ 8	501	1158	1158	<0.5	579	579	15	1141	1141	8.0
9	502	1901	3059	0.5	950	1529	25	1853	2994	8.2
10	503	851	3910	4.5	3829	5359	40	817	3811	8.2
11	504	1768	5678	7.6	13437	18796	100	1591	5402	8.2
12	505	1834	7512	7.1	13201	31817	190	1486	6888	8.4
13	506	2423	9935	4.4	10661	42478	255	1805	8693	8.6
14	507	1774	11709	2.6	4612	47091	310	1224	9917	9.0
15	508	1643	13352	2.1	3450	50541	385	1010	10927	9.4
16	509	2104	15456	1.6	3366	53907	435	1189	12116	9.7
17	510	2210	17666	0.9	1989	55896	475	1160	13276	10.0
18	511	1738	19404	0.8	1390	57287	575	739	14015	10.0
19	512	1245	20649	0.8	996	58283	530	585	14600	10.0
20	513	2447	23096	0.39	954	59237	625	918	15618	10.3
21	514	1323	24419	0.25	331	59568	625	496	16014	10.4
22	515	2536	26955	0.21	533	60100	660	862	16876	10.6
23	516	1771	28726	0.17	301	60401	700	531	17407	10.6
24	517	1629	30355	0.11	179	60580	690	505	17912	10.5
25	518	2182	32537	0.19	415	60995	675	709	18621	10.7
26	519	1123	33660	0.17	191	61186	700	337	18958	10.6
27	520	2329	35989	0.16	373	61559	690	722	19680	10.9
28	521	1832	37821	0.17	311	61870	725	504	20184	10.6
29	522	1535	39356	0.13	200	62070	750	384	20568	10.5
30	523	1549	40905	0.11	170	62240	700	465	21033	10.5
12/ 1	524	2110	43015	0.10	211	62451	765	496	21529	10.5
2	525	1688	44703	0.09	152	62603	750	422	21951	10.5
4	526	2342	47045	0.09	211	62814	710	679	22630	10.3
5	527	1624	48669	0.06	97	62911	755	398	23028	10.3
6	528	904	49573	0.06	54	62965	705	267	23295	10.3
7	529	2375	51948	0.01	24	62989	750	594	23889	10.4
8	530	—	51948	—	--	62989	--	--	23889	—
9	531	1262	53210	0.05	63	63052	605	498	24387	10.3
10	532	2270	55480	0.01	23	63075	775	511	24898	10.5
11	533	1948	57428	0.07	136	63211	805	380	25278	10.5
12	534	1521	58949	0.07	107	63318	740	395	25673	10.6
13	535	1946	60895	0.05	97	63415	765	457	26130	10.7
14	536	1940	62835	0.06	116	63531	750	485	26615	10.7
15	537	2344	65179	0.05	117	63649	725	645	27260	10.3
16	538	2135	67314	0.05	107	63756	825	374	27634	10.4
17	539	1582	68896	0.02	32	63788	825	277	27911	10.5
18	540	2517	71413	0.02	50	63838	850	377	28288	10.5
19	541	2036	73449	0.03	61	63899	765	478	28766	10.2
21	542	1891	75340	0.03	57	63956	800			9.8
26	543	2058	77398	0.04	82	64038	325			9.5
1/2/85	544	1634	79032	0.00	--	64038	70			9.4