NEWMONT MINES LIMITED
SIMILKAMEEN DIVISION

PRECIOUS METAL STUDY

Recently some 2000 gold assays were done to assess the gold-copper relationship of Similkameen ores. Ingerbelle samples were from the North zone 2970, 2930 benches, Pit 2 samples were from the 4020 bench. The Ingerbelle gold-copper may not represent the whole pit.

1. Conclusions

1.1 The Ingerbelle study shows that there is a fairly consistent relationship between the copper grade and the ounces of gold per ton, confirming previous assumptions.

1.2 About 600 gold assays with the copper grade below 0.20% Cu show that there were no areas in the pit portion tested that would be ore on the basis of precious metals alone (silver values were included on the basis of available gold:silver proportions).

1.3 Microscopic studies done by Newmont Exploration in Danbury suggest that the recovered gold occurs free in micron sizes and most of the unrecovered gold occurs as micron sized particles locked in pyrite grains. They indicate that significant additional recovery of gold would not be economic. Recovery appears to be in the 65 to 70% range.

1.4 Assays done for Pit 2 were confined to low grade copper areas and in the surface oxidized zone where leaching or enrichment could have taken place so are most likely not representative of the

main Pit 2 ore body. The gold content of the area tested is much more erratic relative to copper than Ingerbelle and for the ore grade range has only 54% of the Ingerbelle gold content. Using the whole range of copper assays, Pit 2 has 78% of the Ingerbelle gold but this is probably not a good comparison either. In the feasibility reports done, 61% was used in concentrate comparisons.

2. Historical Studies

Numerous brief studies were done in the past commencing in the exploration stage. These were usually limited to small numbers of samples and resulted in various inconclusive reports. Because of the relatively low gold and silver content in the ore, routine precious metal assays were not done during the exploration or production stages, particularly as the gold and silver values, until recently, did not contribute significantly to income.

3. Historical Data

There is a considerable amount of concentrate assay data for copper, gold, and silver that can be used to establish precious metal ratios to copper as recovered in the concentrates. These ratios are probably distorted somewhat by different recoveries of copper, gold, and silver.

Throughout this report, the precious metal contents are shown related to 1% copper to give an equitable ratio for all the varying copper grades.

3.1 Ingerbelle Concentrates

Table 1 gives the concentrate data for Ingerbelle since the commencement of operations and includes adjustments for inventories

and final accepted grades for concentrates. It can be noted that for silver the accepted final assay can be considerably more than the property assays. Because of the apparent change in concentrate grade, and gold and silver values, the 1980 (5 months) data is not included in the totals. There is some suggestion of change in the 1979 precious metal content also. It is not known whether this is a change in the ore, or a reflection of variations in the recovery method.

During 1972-1979 there seems to be a slight progressive drop in the gold and silver content although the gold:silver ratio is fairly consistent.

The three month period in 1980 during which large numbers of gold assays were done is separated out for comparison with head values. These concentrate values could change when final accepted concentrate assays are available.

3.2 Copper Mountain Concentrates and Ore

Table 2 summarizes the available data, with the Ingerbelle summary included for comparison.

3.2.1 Period 1947-1952

For 1947-1952 the ore was all from underground so the concentrate values probably represent ore from the lower areas of Pit 3. Concentrate grade was about 2% less than Ingerbelle, recovered gold less than half Ingerbelle, and recovered silver nearly three times Ingerbelle.

Precious metal ore assays are less than the recovered

values per 1% copper possibly suggesting an ore assay error due to the low values.

3.2.2 Period 1953-1957

The addition of ore mainly from Pits 1 and 2 seems to have lowered the concentrate grade by 3% copper but there is little change in the gold and silver content per % copper in this period. Precious metal content in the concentrates is a little higher for gold and a little less for silver per % copper.

This Copper Mountain data is probably of historical interest only as the Similkameen concentrating process is expected to be more efficient.

3.2.3 Solely on the basis of this data, the Ingerbelle shows twice the gold and one-third the silver relative to that recovered from Copper Mountain (mostly Pit 3 ore).

4. Ingerbelle Gold Assays

1,586 gold assays have been used in a study of gold-copper relationship. The assays are reported to be at an accuracy of $\pm$0.001 ounces per ton.

The procedure used was to tabulate all the assays in increasing increments of 0.01% copper, and determine weighted averages in increments of 0.10% copper with results tabulated to show average copper grade, average gold ounces per ton, and average gold ounces associated with each 1% copper. The latter figure would be constant if there was a direct correlation between the copper and gold assays. The data is shown in Table 3.

The average gold assay per % copper starts high then becomes fairly consistent until the higher copper grades are reached. The results suggest that below the normal cut-off grade of 0.20% Cu, there is a little more gold present. It is noted that there were very few trace gold assays in the very low copper range. The higher percent gold in the second last two grade groups may be a function of the number of assays as the highest grade group with 26 copper assays ranging from 1.55 to 2.52% Cu average in the central range of the gold-copper ratio.

The relationship in the individual 0.01% Cu increments can be quite erratic but averaging in groups of 0.10% Cu certainly suggests a general linear relationship which is expressed by the three linear regression line equations given based on different combinations of the data. The data is plotted on the accompanying graph.

Considerable statistical work could be done on the data but the general relationships have been established. All the detailed data is available if more sophisticated statistical work is desired.

5. Pit 2 Gold Assays

406 gold assays have been used in the study of gold-copper relationships in Pit 2. As these assays were all from the oxidized zone, the original copper and gold present in the fresh rock is unknown so that any relationships only represent the existing values. Enrichment or leaching could have occurred. Any conclusions made are suspect and this must be kept in mind for any comments on the Pit 2 results.

There seems to be a similar relative concentration of gold below 0.20% Cu as with the Ingerbelle results. The ratios of gold to copper are much more erratic than Ingerbelle above the 0.20% Cu range. For what it is

worth, Ingerbelle has 1.3 times as much gold as Pit 2 using all the assay data, and has 1.9 times as much gold above 0.20% Cu.

The data suggests a multiple curvilinear correlation but is too limited for a meaningful correlation and would only be applicable to the oxidized zone.

6. Recommendations

6.1 To complete the Ingerbelle study it would be interesting to have some work done on the silver, say limited to composites for a silver grade for each 0.10% Cu increment. However, at this late stage it would be of academic interest only.

6.2 A similar study on Pits 1, 2, and 3 when they are in unoxidized ore zones would show the copper, gold, and silver ratios in each and verify or adjust the values that have been used to date. Recoveries from each pit would have to be mathematically proportioned as it is unlikely the ore from a single source at Copper Mountain will be processed by itself for many years.

If recoveries turn out to be low, additional work may be justified to increase recoveries.

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JMc/dg

TABLE 1

Ingerbelle Gold and Silver Values in Concentrates

Year:	1972	1973	1974	1975	1976	1977	1978	1979	72-79	1980	Test Period
% Copper	25.26	27.31	26.69	27.60	27.19	27.43	27.79	28.15	27.32	29.42	29.14
Gold oz/ton	0.354	0.394	0.370	0.383	0.373	0.370	0.378	0.369	0.374	0.351	0.339
Gold oz/1% Cu	0.0140	0.0144	0.0139	0.0139	0.0137	0.0135	0.0136	0.0131	0.0137	0.0119	0.0116
Silver oz/ton	1.530	1.510	1.490	1.450	1.460	1.520	1.430	1.410	1.476	1.420	1.481
Silver oz/1% Cu	0.0606	0.0553	0.0558	0.0525	0.0537	0.0554	0.0515	0.0501	0.0504	0.0483	0.0508
Gold:Silver	1:4.3	1:3.8	1:4.0	1:3.8	1:3.9	1:4.1	1:3.8	1:3.8	1:3.9	1:4.0	1:4.4

Source of data: Year-to-date adjusted figures in December.

TABLE 2

Copper Mountain Gold and Silver Data

Period	% Cu	Gold oz/ton	Gold oz/1% Cu	Silver oz/ton	Silver oz/1% Cu	Au:Ag
			ORE			
1947-1952	0.989	0.00596	0.00603	0.1452	0.1468	1:24.3
1953-1957	0.787	0.00481	0.00611	0.1152	0.1464	1:23.4
1947-1957	0.907	0.00549	0.00606	0.1329	0.1466	1:24.2
			CONCENTRATES			
1947-1952	25.146	0.1584	0.00630	3.7078	0.1475	1:23.4
1953-1957	22.070	0.1383	0.00626	3.1058	0.1407	1:22.5
1947-1957	23.884	0.1501	0.00629	3.4611	0.1449	1:23.0
			INGERBELLE CONCENTRATES			
1972-1979	27.316	0.3743	0.01370	1.4763	0.05405	1:39.1

Note: 1947-1952 Underground from Pit 3 only
1953-1957 Open pit and underground production.

TABLE 3

INGERBELLE GOLD AND COPPER ASSAYS

Grade Range % Copper	No. of Samples	Average % Cu	Average Au oz/ton	Average Au for 1% Cu
0-0.09	237	0.059	0.0018	0.0311
0.10-0.19	374	0.144	0.0031	0.0212
0.20-0.29	247	0.244	0.0046	0.0191
0.30-0.39	195	0.342	0.0062	0.0182
0.40-0.49	123	0.438	0.0077	0.0176
0.50-0.59	104	0.541	0.0094	0.0174
0.60-0.69	80	0.642	0.0115	0.0179
0.70-0.79	51	0.737	0.0127	0.0172
0.80-0.89	48	0.844	0.0158	0.0188
0.90-0.99	25	0.943	0.0176	0.0186
1.00-1.09	31	1.049	0.0193	0.0184
1.10-1.19	17	1.148	0.0189	0.0165
1.20-1.29	11	1.254	0.0234	0.0186
1.30-1.39	7	1.346	0.0326	0.0242
1.40-1.49	10	1.452	0.0304	0.0209
1.50+	26	1.921	0.0350	0.0182
Average	1586	0.377	0.0071	0.0188
0-0.19	611	0.111	0.0026	0.0234
0.20+	975	0.544	0.0099	0.0182

Linear regression equations

Using 1586 items $Y = +0.00011 + 0.01856X$

Using the 16 averages $Y = -0.00013 + 0.01925X$

Using 11 averages 0.20-1.29 $Y = 0.000002 + 0.01798X$

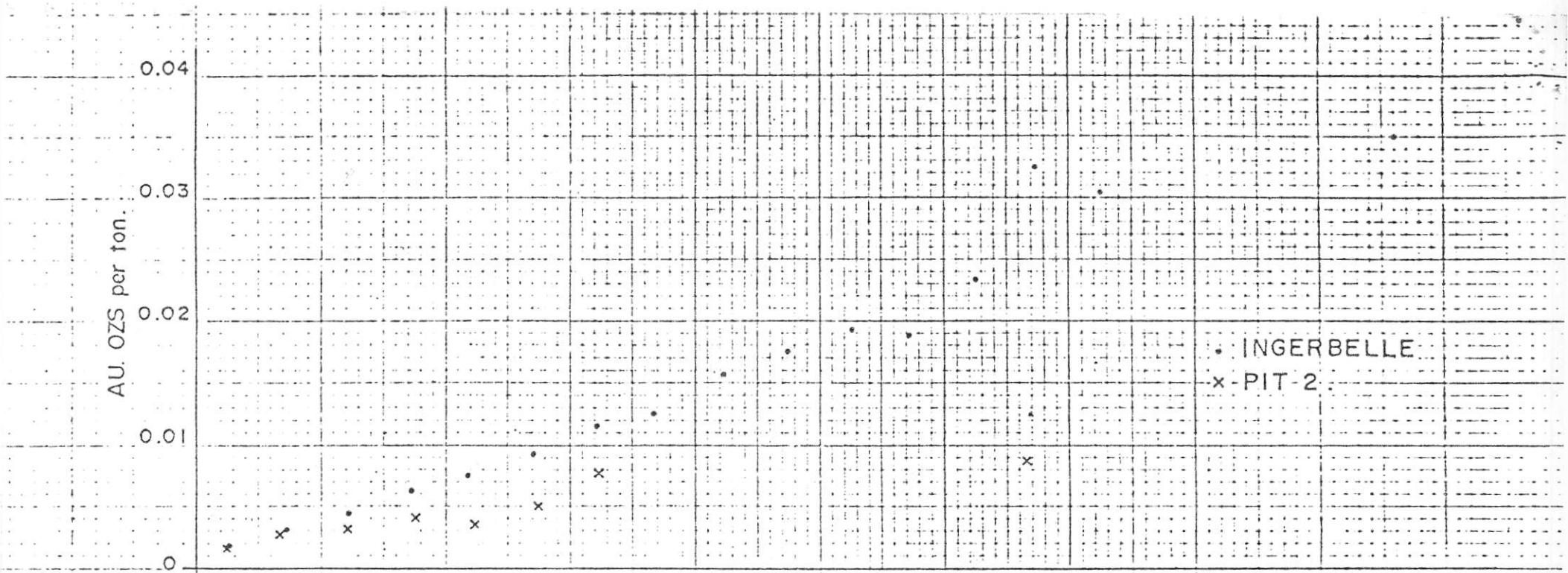
Y is ounces per ton of gold

X is the percent copper

TABLE 4

PIT 2 GOLD AND COPPER ASSAYS

Grade Range % Copper	No. of Samples	Average % Copper	Average Au oz./ton	Average Au for 1% Cu
0-0.09	182	0.055	0.0016	0.0280
0.10-0.19	124	0.138	0.0027	0.0194
0.20-0.29	39	0.240	0.0030	0.0124
0.30-0.39	25	0.352	0.0040	0.0114
0.40-0.49	13	0.445	0.0035	0.0078
0.50-0.59	5	0.548	0.0050	0.0091
0.60-0.69	9	0.646	0.0077	0.0119
0.70+	9	1.332	0.0088	0.0066
Average	406	0.177	0.0026	0.0146
0.-0.19	306	0.089	0.0020	0.0226
0.20+	100	0.445	0.0043	0.0098



NUMBER OF SAMPLES FOR EACH POINT

INGERBELLE	237	374	247	195	123	104	80	51	48	25	31	17	11	7	10	26	= 1586
PIT 2	182	124	39	25	13	5	9							9			= 406

COPPER - GOLD DATA

JUNE 1980