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W. Krats

SUGGESTED MODIFICATION TO Pb-GRADE

FOR 1974 PIT

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Introduction:

The most likely pit plan to be followed next year is "Alternate 3." This involves a total of 3,650,000 tons of ore being fed to the mill, the DDH-estimated and rotary drill hole-estimated grades being 3.7% Pb and 5.9% Zn.

On the basis of past experience these grades are not realistic: the Pb is almost certainly underestimated and the Zn overestimated. The present study attempts to correct the Pb. A previous report outlines an approach to Zn-corrections (June 29, 1973).

Historical Approach:

In 1972 the DDH-estimated Pb-grade was 3.7%; in fact, based on reported mill feed for the year and rotary drilling of the LG stockpiles a grade of 4.1% was experienced. During the first five months of 1973, in which emphasis was placed on sub-zone A as a source of feed (see report May 8, 1973), the DDH-estimated vs mill/rotary drill hole-reported grades were 3.4% and 4.5% respectively.

An analysis of 1972 feed reveals a broad mining of sub-zones A and C which explains the less drastic increase in Pb over the DDH-estimated value. 1974 places a similarly weighted emphasis on sub-zones A and C.

Zonal Weighting Approach:

The writer examined the ore scheduled for mill feed in 1974 and increased the Pb/Zn ratio to 1.0 or just under this value in tonnage blocks, which appears to be in sub-zone A (based on past experience and the values reported from 1972 DDH's crossing sub-zone A and C). No 1972 values were altered as they appear to be valid. A maximum value of 7.0% Pb was exercised based on frequency distributions for 1972 and 1973 blast holes. Stockpile values were not changed for a variety of reasons (including the fact that they were tested as recently as 1973 and that low grade/red and yellow ore largely derives from sub-zone C).

This approach coincidentally increased the planned Pb-grade to 4.1% from 3.7% exactly as was experienced in 1972.

1. Blast Hole Data:

1972 ore was examined in terms of the two halves: January to June and July to December. Blast hole assays from each of the half-year periods were classified and frequency curves were drawn up. These are illustrated and discussed below.

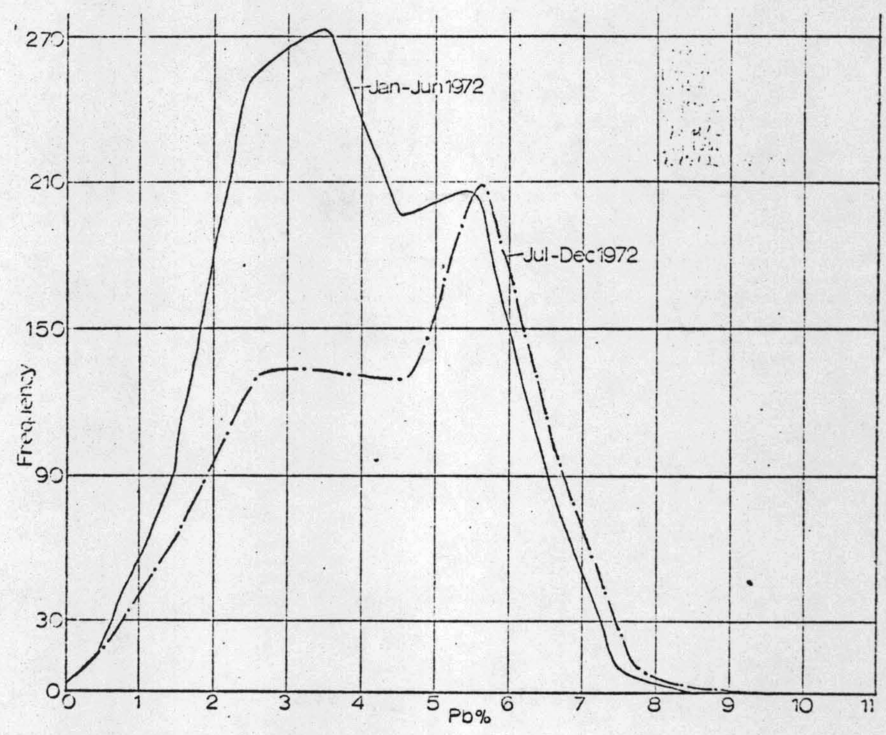
In the first half there were 1149 assays and in the second half 813 assays. This discrepancy is partly explained by the greater degree of LG stockpiling in the first half (780,000 tons vs 400,000 tons in the second half) and by the large number of short hole blasts (ramps being replaced) in the second half. Short hole assays were not included in the study since they would have been given unjustifiable weighting.

a. Pb

Figure I illustrates the Pb frequency distributions for the two half-year periods.

Figure I:

Frequency distributions showing the frequency of Pb assays reported from blast holes drilled Jan. - June, 1972 and July - Dec., 1972.



The curve for the first half very much resembles that for the period January - May, 1973 (Report June 29, 1973; p. 4, Fig. 3). It is bimodal with modal values of 3.5% and 5.4%. The curve for the second half, on the other hand, is quite different. While also being bimodal, and for similar values (3.0% and 5.6%) they are almost mirror images of one another (allowing for the different sample volumes) with 4.5% as the point of rotation.

This is largely explained by the fact that, during 1972, the boundary between sub-zones A and C was very roughly located at 3950 elevation. The former sub-zone is hypothesized as being higher in Pb than the latter. This seems to be represented by the two modal values in each of the curves.

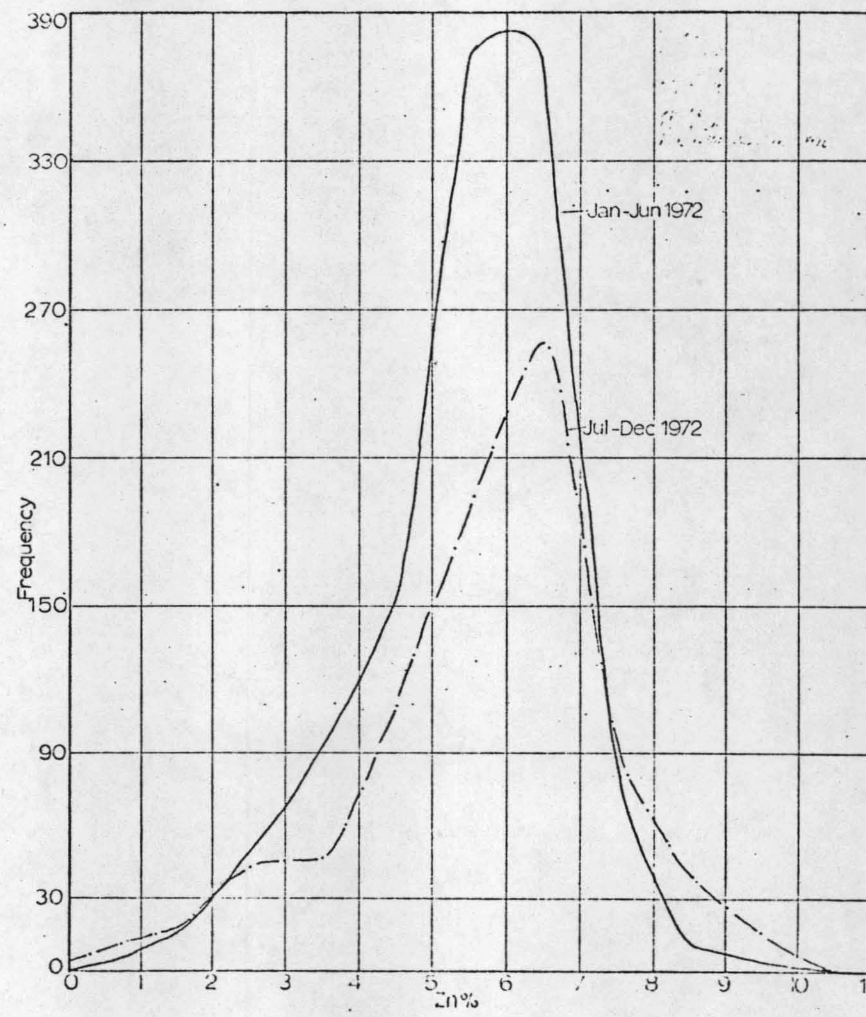
A breakdown of the tonnages of ore (LG and mill feed) sources during the year indicates that during the first half 66% of the feed was derived from benches 3950 up. In the second half, only 18% of ore sources were above 3950 elevation. This appears to tie in with the above remarks on sub-zones A and C and the 3950 elevation cut-off. One, therefore, presumes that the two curves are mirror images of one another because of the very different weighting during each half-year.

b. Zn

Frequency curves for Zn derived in a similar fashion are illustrated in Figure 2.

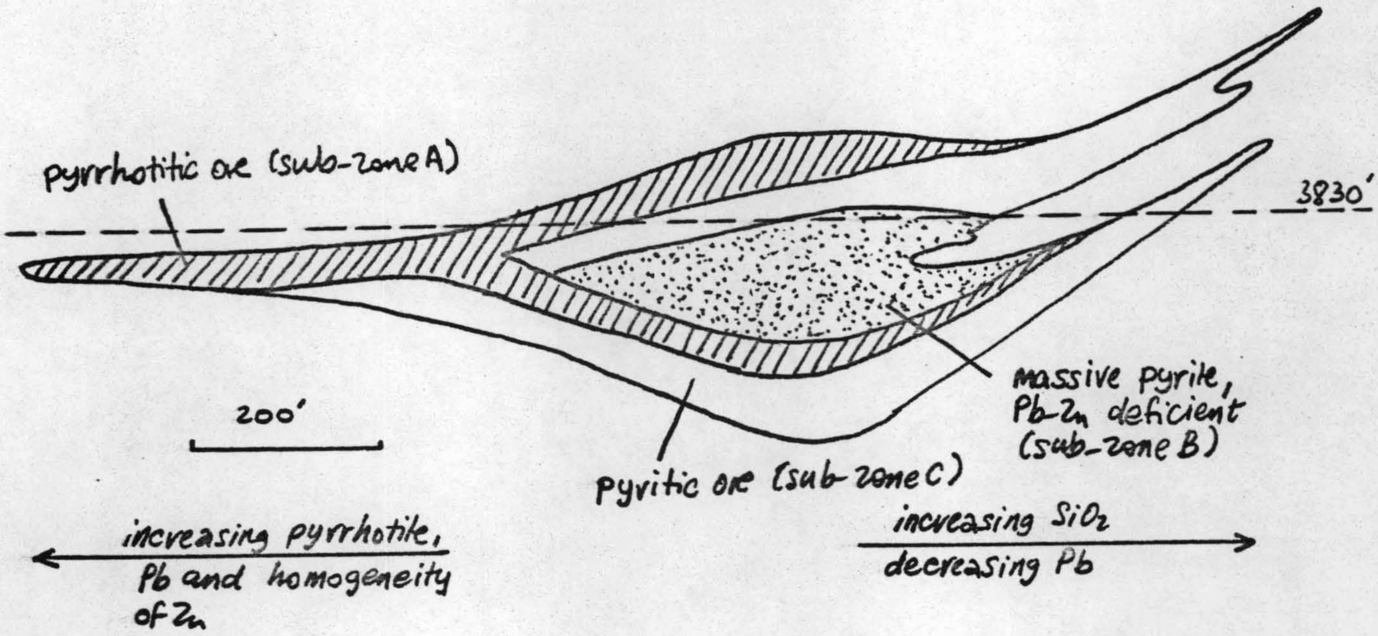
Figure 2:

Frequency distributions showing the frequency of Zn assays reported from blast holes drilled Jan. - June, 1972 and July - Dec., 1972



Both curves are negatively skewed with somewhat similar modal values (6.0% and 6.5%). The January - June curve is more leptokurtic than that for the second half. This is due to the greater inhomogeneity of Zn values in sub-zone C vs the somewhat narrower range of Zn values in sub-zone A. This homogeneity vs inhomogeneity is almost certainly related to remobilization and the pyrrhotite distribution. Figure 3 is an attempt to summarize this concept.

Figure 3: Sketch showing generalized transverse cross-section of ore body approximately at section # 113. Looking NW.



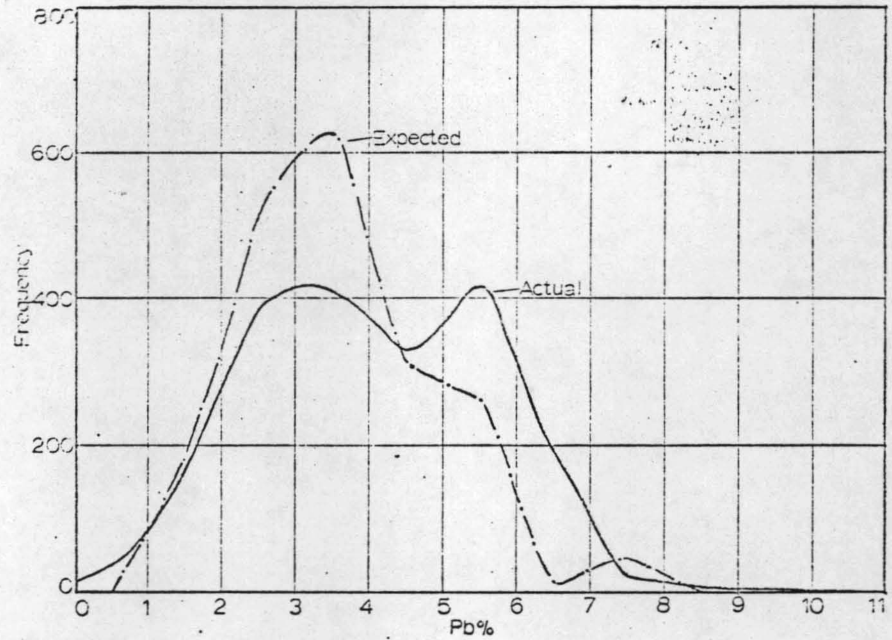
Note: The stated sub-zonation of the Zn values and the implicit (in the sketch) sub-zonation of the SiO_2 content may prove to be oversimplified. The object of the present study is to formulate a model from which to use trial-and-error in a systematic context to correct for known defects in available data. The Pb and py/po sub-zonation appears to be extremely valid having been based on 1972 DDH data and a considerable amount of assay data on grab samples from the pit.

2. DDH vs Blast Hole Data:

Both the half-year blast hole assays were combined (1,962 assays) and composite frequency curves were drawn up for Pb and Zn. As was carried out for the report dated June 29, 1973, the DDH-estimated tonnages and grades were classified and tonnage/frequency conversions made. The resulting frequency curves are termed "expected" and the blast hole-derived curves are termed "actual."

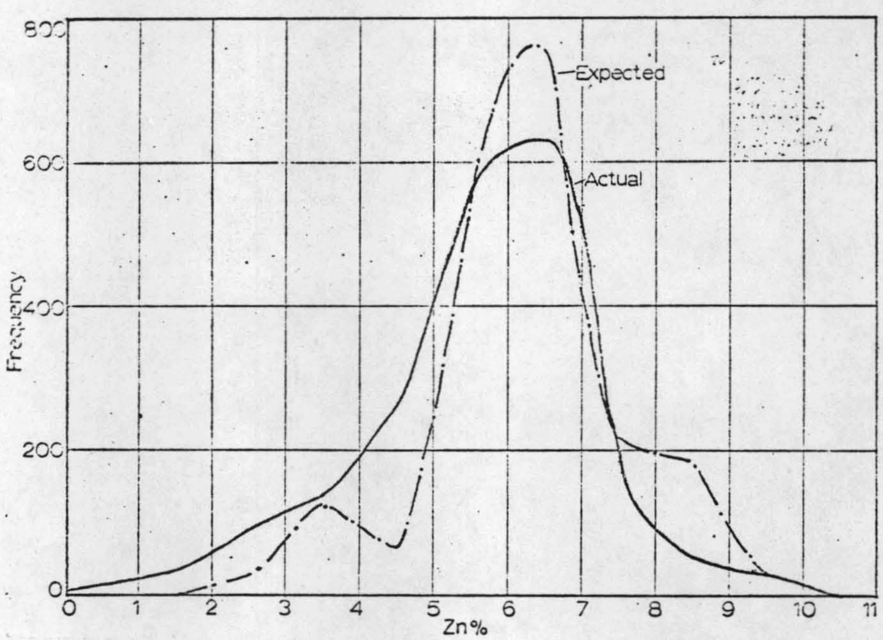
These curves are illustrated in Figures 4 and 5.

Figure 4: "Actual" (blast hole-derived) and "expected" (DDH-derived) frequency distributions showing the frequency of Pb assays reported and expected from ore mined Jan. - Dec., 1972



The curves in Figure 4 appear to convincingly demonstrate the bimodal/zonal nature of the Pb distribution vs the oversimplified view given by the DDH data. Again, the interference of Ba could account for the lack of a second crest at 5.5%.

Figure 5: "Actual" (blast hole-derived) and "expected" (DDH-derived) frequency distributions showing the frequency of Pb assays reported and expected from ore mined Jan. - Dec., 1972



In Figure 5, the "actual" curve is slightly negatively skewed and leptokurtic while the "expected" curve deviates very much further from the normal curve due especially to a "plateau" at 8.5% and a trough at 4.5%.

The "plateau" is a less pronounced expression of the second peak at 9.5% in the January-May, 1973 distribution (report June 29, 1973; p. 3, Fig. 2). The trough, on the other hand, is more pronounced than in the 1973 distribution.

This more drastic leptokurticity seems to suggest that, in the long term, the 7.5% cut-off suggested in the June 29 report may not be sufficient to correct for sampling/assaying errors: Some lower grade blocks will have to be introduced in the 3.0% - 5.0% range.

This is backed up by the fact that the application of a 7.5% maximum Zn results in a down-grading of predicted Zn for 1972 from 6.3% to 6.2% vs an experienced value of 5.8%. A correction using 7.0% as a maximum results in a further down-grading to 6.1%. This is not enough; however, the curves indicate any further lowering of the maximum is unrealistic. Some fattening of the lower grade Zn must be done although the technique to be employed is not yet clear. Perhaps the reassaying programme may result in suitable guidelines.

Conclusions:

1. Sub-zone A is characterized by high Pb % and homogeneity of Zn %. This sub-zone provided the bulk of ore in the first half of 1972.

2. Sub-zone C is characterized by low Pb % and greater inhomogeneity of Zn %. This sub-zone provided the bulk of ore in the second half of 1972.

3. The DDH data does not reflect the above phenomena as clearly as is necessary for short term planning. (Note that the report dated May 8, 1973 indicates that these trends are still validly indicated in the broad overview especially clarified by the 1972 DDH data).

4. Corrections to projected Pb grades will have to be made in terms of sub-zonation based on 1972 DDH data. This has already been done for the 1974 mining plan (see memorandum dated July 31, 1973).

5. Upper limits set for projected Zn grades as instituted recently (see memoranda dated June 29 and July 31, 1973) seem likely to be only part of the answer as it seems to be necessary to increase the number of tonnage blocks projected as being in the range 3.0% - 5.0%.

Recommendations:

1. Await results of DDH resampling programme and follow up as seems appropriate.

2. Tie in as much of the above discussion with a mineragraphic study and some broad ore-typing and metallurgical testing.

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