CIM Meeting ... June 1973 at Lornex

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GRADE CONTROL

AT

BRENDA MINES

by

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Paper to be presented at

Spring Meeting, South-Central

B.C. Branch C.I.M., June 1973.

MINE GEOLOGY

The Brenda orebody is a copper-molybdenum, fracture-filling deposit containing 145 million tons grading 0.180% copper and 0.048% molybdenum (0.080% molybdenite). Mineralization consists of chalcopyrite and molybdenite with minor pyrite in quart-K feldspar or quartz filled fractures within a quartz diorite host. The ore fractures dip at 80 - 90° and average approximately 3/16" in thickness. As there are essentially no disseminated sulphides, the grade of the orebody is a function of fracture density.

BLASTHOLE (60R) SAMPLING

During the fall of 1968, three methods of sampling the drill cuttings from the 60R drills were compared -- wedge shaped sample cutters, shovel cuts, and pipe cuts. At this time, 25 foot benches were being drilled to level out the pit area. With 6 feet of sub-grade, each 12 1/4" diameter hole yielded 2.1 tons of cuttings.

The sample cutters were positioned opposite one another prior to the hole being drilled. The hole was then drilled to 25 feet, a marker horizon of sawdust was placed on the cone cuttings, and the 6 feet of

sub-grade was drilled. The sub-grade cuttings were removed before sampling was started.

Samples for 2, 4, 8, 12 and 16 pipe cuts were taken. The wedges were removed and the cuttings in each riffled to samples size. Shovel samples in the form of a wedge were then taken at the north and south quadrants, each shovel sample comprising approximately 1/12 the cone of cuttings.

The rejects from the foregoing samples plus the cuttings remaining in the cone were shovel mixed, quartered and two quarters were rejected. After a second mixing, quartering, and rejecting, the remaining cuttings were divided into quarters and each quarter was riffled to sample size. The average of these four samples became the control sample.

The average deviations from the control sample for each of the methods are given in the following table:

		Pipe Cuts					
Method	2 Wedges	2	4	8	12	16	2 Shovel Cuts
% Deviation	5.0	8.0	9.1	5.1	4.7	4.6	3.6

From the table, it can be seen that the sampling by shovel cuts was the most accurate but it is also the most time consuming --

approximately one hour per hole for a 25' hole. The wedges, although acceptable for accuracy, are difficult to place and generally inconvenient to work with.

Our sampling is therefore done with 12 pipe cuts, a method which is economical and within tolerable limits of error. Sampling is done by the drill helper. For the sake of expediency and because the mineralized fractures essentially dip vertically, sub-grade is not removed from the holes prior to sampling. The 12 1/4" holes are drilled on a 28' x 34' pattern to a depth of 58', including 8' of sub-grade. Each sample represents approximately 4000 tons.

GRADE CONTROL

The 60R samples are assayed for Cu and Mo with a Philips PW 1540 X-ray Spectrograph. The precision of this instrument has been determined to be $\pm$ 0.005% for Cu and $\pm$ 0.003% for Mo. All values are reported to the third decimal. The Mo is converted to Cu equivalents and a total Cu equivalent value for each hole is plotted in colour (mill feed - red, low grade stockpile - orange, and waste - blue) on a 1" = 50' plan of the blast. Using Cu equivalent cut-offs of 0.4% for

mill feed, 0.3 - 0.4% for low grade, and less than 0.3% for waste, grade lines are drawn on the plan. It is an accepted fact that the values for individual holes may be completely misleading. Therefore, when establishing grade lines, groups of holes rather than individual holes are considered as shown on the attached blast hole plan. (Note holes 28 and 39 in particular). Erratic highs and lows are primarily due to mode of occurrence of the mineralization. As the sulphides are not uniformly distributed throughout the fractures, it is possible for the drill hole to intersect a relatively barren fracture or fractures within an otherwise well mineralized area. The converse is, of course, also possible.

Wherever possible, the grade lines are drawn at right angles to the face of the blast to facilitate mucking.

Following each blast, the survey crew marks the grade lines with painted stakes at about 12 foot intervals. String is tied between the stakes and coloured ribbons are tied to the string. Prior to the introduction of the string and ribbons, oncoming shovel operators had difficulty in locating grade lines, particularly at night. The ribbon and stake hanging over the face solved this problem. Coloured 50 scale

plans of the digging areas are issued to the shift bosses and shovel operators every second or third day.

The survey crews survey the toes of each working face every morning. The grade of the material removed in the past 24 hours is then calculated from the 60R drill hole values. Initially a "weighting" factor was applied to each drill hole value based on a visual estimate of the amount of ore obtained from that hole. However, it was found that on a monthly basis, the difference between the "weighted" grades and the unweighted mean was insignificant.

Direct comparisons between daily mill heads and blast hole grades are virtually impossible for two reasons. First, an average of 20% of primary crusher discharge is fed directly to the fine ore bins. As the rock readily breaks along the mineralized fractures, the primary crusher fines are enriched with sulphides while the coarse fraction is proportionately deficient in sulphides. Second, the primary crusher coarse discharge is fed to a stockpile where it may remain for up to 56 hours. Due to these operating conditions, pit grades are not ordinarily supplied to the mill on a daily basis. However, if an area containing anomalously high Mo values which would result in unusually

high tailings losses is to be mucked, the mill is advised. With this information, the operators are able to make the necessary adjustments at the first sign of the higher than usual Mo in the circuit.

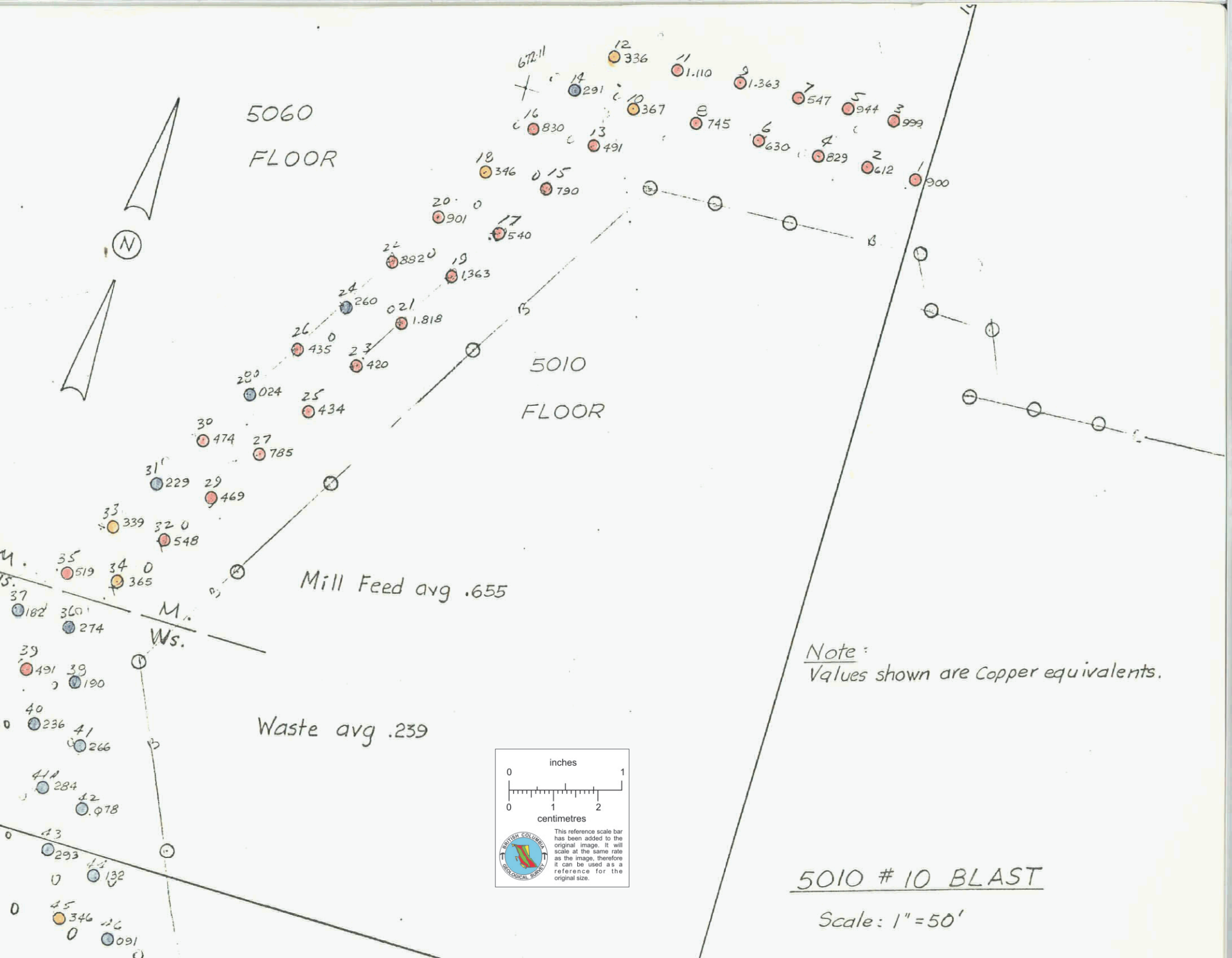
The grade of the ore treated in the mill may range from 0.140% Cu to 0.233% Cu and 0.040% Mo to 0.091% Mo. Unfortunately, due to the large tonnage of rock which must be moved each day (52,000 tons) and the relative immobility of the electric shovels, blending of ore is generally not possible. Some blending may be possible if the two shovels are operating in ore.

At the beginning of each month the mill is given an estimate of the grade of ore to be mucked during the month. This estimate is derived from blast hole assays and, in areas which have not been drilled, from the computer generated grade plans.

Recently, the engineering department has been providing the mill with a weekly grade estimate. This estimate is derived from blast hole assays only. Whether this information will be of use to the mill is yet to be determined.

The mill heads for 1972 were 0.208% Cu and 0.061% Mo. The

average for the year as calculated from the blast holes was 0.216% Cu and 0.066% Mo. Differences of this order of magnitude are considered acceptable.



Note:
Values shown are Copper equivalents.

5010 # 10 BLAST

Scale: 1" = 50'