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KERR ADDISON MINES LIMITED

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To: FILE From: J. K. Carrington

Subject: Notes re Grum Pit Design Date: September 20, 1978

The open pit design for the Grum deposit is based on the Noranda Mines Ltd. General Pit System (GPS) set of computer programs. Input for the GPS programs is the basic assay data from drill logs. From this an ore reserve is estimated and an open pit designed using different economic constraints. This pit is a good approximation of the ultimate pit outline for the given economic parameters. It is not a final engineered outline nor does it indicate the best sequence of mining throughout the pit life to ultimately arrive at this configuration. However, the CPA programs can be used to determine the best mining sequence within the ultimate outline. The word "best" is used here advisedly as any answer is very dependent upon a host of input parameters which are often uncertain. These notes will outline the steps taken in the Grum pit design.

1) Creation of the Mineralized Inventory File (MIF)

The first step in GPS is to arrive at a mineralized inventory which is nothing else than an estimate of the total tonnage and grade of the deposit with no economic or mining constraints applied.

All assay data was compiled into a drill log file. (Note: Everything in this design is on a metric basis.) The Grum coordinate grid is essentially north/south, east/west. However, the geological grid runs approximately N45°W with cross sections running N48°E. This means that the pit is essentially oriented N45°W as well. For the computer system, a rotation of grid coordinates was required. On file is a summary of the new (computer) coordinates for each hole (surface holes are designated A-; underground holes, U-) as well as the "computer" coordinates of each section line. The drill log file (DLF) lists all holes with the Grum system coordinates. All property surveying, etc. is done on the Grum system. The computer system is only necessary for the computer design of the pit, etc.

After the DLF is made, an actual value file (AVF) is created. A three-dimensional block system is superimposed over the orebody. Bench height was selected at 9m and lateral dimensions at 15m x 15m. Each block is thus 15 x 15 x 9m. Any block which has a drill hole(s) intersecting it is given the weighted grade of the intersection(s) and is considered to be an actual value block. All such blocks form the actual value file (AVF). All other blocks will be interpolated from the AVF.

At the same time as the creation of the AVF, the entire orebody is rock coded. This rock coding serves to identify overburden, waste, quartz sulphides and massive sulphides. For instance, any block identified as waste through rock coding will not have an ore value interpolated into it regardless whether it has any drill hole intersections or not. The highly contorted shapes of the Grum sulphide zones required very careful rock coding. Ultimately, rock coding was done on a 5 x 5 x 9m grid basis for the entire deposit. To each block one rock code type is assigned.

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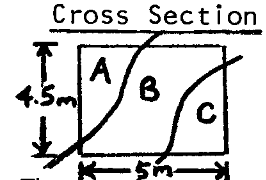
Next, the mineralized inventory file (MIF)was created. This was based on the AVF, the rock coding and a set of interpolation rules. Ideally, the MIF would have been created on the 5 x 5 x 9 block size dictated by the rock coding. However, the computer cost would have been prohibative. To overcome this, a two stage procedure was adopted. Initially, all non-AVF 15 x 15 x 9m blocks were checked to see if they contained any 5 x 5 x 9m sulphide rock coded blocks. (A large block could contain anything from 0 to 9 small 5 x 5 x 9m blocks.) If any were present, then the large 15 x 15 x 9m block was retained for MIF interpolation. The interpolation was done on the 15 x 15 x 9m blocks assigning a grade to each based on the interpolation rules. Next each large interpolated block was checked for the number of smaller 5 x 5 x 9m sulphide blocks actually present. The interpolated grade of the large block was assigned to each small sulphide block present in the large block. Ultimate reserves were then compiled on the small sulphide blocks. Briefly, grade interpolation is done on a 15 x 15 x 9 block basis, but ultimate tonnage and weighted grades are based on the 5 x 5 x 9 block system.

At this stage, it was hoped that the MIF would agree with the manually computed mineral inventory. Agreement on tonnage was good, but grade estimates from the GPS MIF were consistently 20 - 25% lower than the manual reserves. Ultimately, it was determined that the difference lay with how the initial assay data was treated. In the manual system the high grade material was identified and classified just strictly on the assays present using a minimum width of 3m. In the GPS approach the weighted assays of the drill hole intersections were lumped together in the creation of the AVF. Here the "minimum" width was 9m, the bench height. Geologically, the high grade material is much less than 9m in thickness and the result was a downgrading in the AVF (compared to the manual reserves). This downgrading naturally carried into the MIF as the MIF is based on the AVF. To verify this effect more quantitatively a check was done on two typical sections, 74W and 68W. On these cross sections an overlay grid of blocks 5 x 4.5m was superimposed. Each block is one half a bench height and one third of the lateral dimension of the large 15m blocks. To simplify the problem, the thickness was taken as 1.0m and the problem became a 2 dimensional one working on the cross sections as opposed to a 3 dimensional one. To each 5 x 4.5m block was assigned a weighted grade based on the assay cross section. eg.

Cross Section



Grade of block = (A x .25) + (B x .5) + (C x .25) where A, B and C are different assay zones based on manual reserves.

The entire cross section was coded in this manner. A small computer program then compiled these blocks and estimated the tonnage and grade. A feature of the program was that it could combine adjacent blocks into larger blocks up to a 15 x 9m block, i.e. reserves based on 5 x 4.5 blocks, 5 x 9 blocks, 10 x 9 blocks and 15 x 9 blocks were compiled. The results were plotted on a tonnage/grade curve. Both sections show a progressive drop in grade from

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the manual results as the block size is increased (i.e. the high grade is mixed with more lower grade material). Remember that the basis for this comparison is the manual reserve estimate, the only variable being the superimposed block size. Both sections show good agreement between the 9 x 15 size blocks, either from the GPS MIF estimate or the manual estimated with the 9 x 15m block size superimposed. In both cases, the MIF estimate is slightly lower than the modified manual estimate. The conclusions drawn are that the original manual mineralized inventory reports tonnages and grades which have no direct bearing on the expected mining grade. These estimates are more aptly defined as "geological in-situ." The magnitude of the dilution effect simply was not recognized at the time the parameters were set for doing the manual reserves. Also, the GPS MIF grade can be taken as a diluted grade. However, because of the complexity of this deposit and the lack of detail currently available additional dilution is likely adviseable in arriving at a mine grade estimate.

When the MIF was completed, this became the basis for doing an ultimate pit design. Input for this were metal net smelter returns, cut-off grade, mining costs, and slopes. When this was outlined the reserves inside the pit were defined. This outline was smoothed manually to eliminate abrupt contours. From these a manual/computer approach was taken to define the "best" mining sequence within the ultimate pit. The guideline here was to maximize the grade in the early years. The final step was to take the proposed sequence and smooth the stripping requirements. This work has not been completed.

/ces J. K. Carrington

Attachment