CONSTRUCTION OF THE F8805 MODEL 000888

Contents

INTRODUCTION

Purpose of the New Model

To date, the mine engineering department has been utilizing the FI and the F8701a Models to forecast and reconcile reserves of the Faro Deposit. The intention of the new model (F8805) is to incorporate all data gathered to date and apply this data to predict reserves. The data used to complete the F8805 Model included all DDH information in the subject volume, pit mapping and blast hole data. At the interpretation stage of the project much structural information was gained from pit mapping and blast holes in the area of the JB Phase (southern Zone 3). The F8805 Model includes interpreted sections from 125+035 to 135+000, unlike the F8701a Model. It also includes reserves in the underground area southwest of long-section 14+000.

DRILLING PROGRAM - 1987

In the fall and winter of 1987, in-pit drilling commenced to better define the reserves of the Faro Deposit. A total of twelve diamond drill holes were drilled primarily along cross-sections in the Zone 3 area of the deposit to obtain a better understanding of the structure of the deposit, lithology and the distribution of grade in areas where previous drill hole information was weak. The 1987 drill holes were logged with ore lithologies assayed for %Pb, %Zn, Ag g/T and Au g/T.

Most of the 1986 drill hole information was utilized in the construction of the F8701a model. The remaining drill holes reside outside the limits of the F8701a Model. It should be noted that the F8701a Model does not include reserves in the southeast half of Zone 3. The Model was produced to provide an up-to-date reserve estimate for the northeast half of Zone 3 (AY and BZ mining Phases) only. The F8805 Model limits include the entire Zone 3 and thus all 1986 drill hole information was used.

The 1987 drill holes were logged according to the most rcent standards set by Curragh Resources Inc. with emphasis on full lithologic descriptions. All drill holes were surveyed for down hole deviations.

PLOTTING AND TABULATION OF DRILL HOLE INFORMATION

All logged and surveyed data was entered into the Diamond Drill Hole Database resident on the HP3000 mainframe. Each hole was orthogonally projected on to its respective section using a corridor of 40 feet on both sides of the section line. Sectional paper plots of each individual drill hole were then produced. Each mylar section master was updated by underlaying the respective paper plot and hand drafting on mylar, each drill hole trace, lithologies and assay code bars. Once completed, blueprints of each +000 and +070 sections (panels 1, 2 and 3) were produced. Sectional geologic interpretations were constructed on these blueprints.

INTERPRETATION

The interpretive process involved close analysis of every diamond drill hole in the subject volume. This volume may be expressed as an area bounded by cross-section 116+070 to the north and 135+000 to the south (assuming model north as opposed to true north). The western boundary coincides with long-section 29+000. The eastern boundary is represented by long-section 14+000 extending from cross-sections 116+070 to 125+000 and long-section 9+000 extending from cross-sections 125+035 through 135+000. The irregular eastern boundary is a function of drill hole information but is far enough east to encompass the Faro Underground reserves.

Because recent interpretation was completed between sections 116+070 and 125+000 (F8701a Model), greater emphasis was placed on interpreting the geology between sections 125+035 and 135+000. Only minor modifications were made to sections 116+070 through 125+000 which was based on 1987 diamond drill hole and blasthole data.

To facilitate the interpretive process, lithologic boundaries were delineated by identifying apparent lithofacies. Because of the repetitive nature of the ore lithologies (repetitive Anvil Cycles?), it was found that common lithofacies boundaries could be delineated. The identification of these lithofacies boundaries is not new; it is perceived as the best way to delineate ore horizons, based on metallurgical response and the process by which the computer block rock model is generated. As a result, continuous ore units (lithofacies) were interpreted with definite correlation between drill holes. This convention is consistent with that emphasized in the construction of the F8701a Model. A listing of the ore and waste units is provided in Table 1.

The interpretive process involved a careful examination of the drill hole logs: assays, lithiologic units, structural information and fault data for each hole on section. Fault projection from section to section was difficult especially in the thinner regions of the ore body (JB Phase). Here, long-section interpretation was instrumental in solving such projection problems. Other problems encountered were, insufficient drill hole logged data and suspicious drill hole collar surveys. Hole offsets or actual deviations from a vertical section also presented problems when interpreting contacts and the correct placement of faults. Some sectional interpretations shows obvious displacement or non-coincident interpreted contacts with contacts shown on drill holes. This 'non-matching' of contacts with lithofacies boundaries or gouge in drill holes with interpreted faults, is a result of hole offset from the vertical section.

In previously mined areas (JB and AY Phases), blasthole sections were overlayed on +070 and +000 sections to accurately outline lithofacies boundaries. Once these sections were completed, fill-in sections +035 and +105 were then interpolated by simply drawing in the corresponding lithofacies contacts on both +000 & +070 sections. This was completed to provide better resolution from block to block, such that there would be one section cutting through the center of every row in the block rock model. In all, 75 cross-sections were constructed for the F8805 Model. A schematic diagram shows the position of each cross-section in relation to the block model (Figure 2).

DIGITIZING OF SECTIONS IN GEO-MODEL

Once the interpretive stage was complete, each cross-section was digitized into polygons. The software package, GEO-MODEL, was used to create such polygons whereby, each polygon could be assigned a rock code (corresponding to lithofacies type). The on-screen editor simplified correction of improperly digitized polygons, but more importantly, will allow for less time to update sections if a new model was desired.

Although sectional reserves may be calculated in GEO-MODEL, this package was used primarily as a medium for creating polygons for import to PC-MINE. GEO-MODEL has a facility to export polygons by section into an ASCII file compatable for importation to PC-MINE.

Program Nuproj was executed to produce a new project in PCMINE. Project name, description, parameters etc. for the F8805 model are identical to that used in the F8701a Model. Program Nuproj creates skeleton files necessary for access to PCMINE.

It should be noted that a discrepancy was encountered between coordinate systems used in GEO-MODEL and PC-MINE. It appears that the lower-left-hand corner of a section in GEO-MODEL has local coordinates (0,0). The (x,y) coordinate on section corresponds to an easting and elevation respectively. But, in PC-MINE this coordinate corresponds to an easting of 20,000 and elevation of 2900 feet. So that polygons digitized in GEO-MODEL would not be correctly located in PC-MINE. The geological coordinates were established in PC-MINE for the creation of the F8701a Model. These coordinates were arbitrary, but the convention must be continued for comparative purposes. To correct for the discrepancy, a fortran program (POLYGON) was written to convert coordinates from extracted ASCII files from GEO-MODEL to geological coordinates. The new polygon files were then imported into PC-MINE for construction of the block rock model.

CREATION OF THE ROCK BLOCK MODEL IN PC-MINE

Once created in GEO-MODEL and adjusted by fortran programming, polygons were loaded into PC-MINE in the utility module. Some polygons, however, were not accepted due to irregular shapes. GEO-MODEL may be able to handle such irregular shapes, but PC-MINE cannot. Thus, these 'problem' polygons had to be segmented in GEO-MODEL to reduce irregularity. In some cases 'problem' polygons were identified, deleted and redigitized in PC-MINE. Upon successful loading of sectional polygons, a printer map of each section was produced and overlain on a section block grid. Here minor discrepancies were noted. Such discrepancies were rectified using the block model editor. To re-check final results, a subsequent run of module 3.2 (construct rock model) was completed once again and a new printer map was produced.

This process was lengthy and tedious and could have been avoided by realizing the limitations of PC-MINE to accept irregularly shaped polygons from GEO-MODEL. In summary these limitations are:

(1) PC-MINE will not accept a polygon that contains over 256 coordinate data points. GEO-MODEL is more robust and can handle data points in excess of this number.

(2) PC-MINE will not accept irregularly shaped polygons (polygons with multiple convex and concave boundaries). Thus, when digitizing polygons in GEO-MODEL it is advisable to place XP's (cross-points) in strategic locations along a line that undulates such that segmentation of the polygon into a smaller, more regularly shaped polygon is easily accomplished.

(3) Finally, the problem of local versus world coordinates between software packages (PC-MINE and GEO-MODEL) is an item that must be worked out by GEMCOM.

DATA TRANSFER FROM HP3000 TO A MICROCOMPUTER

All DDH data is resident in a data base on the HP3000 in a Geology account. This data was downloaded from the HP3000 onto a microcomputer with the use of Reflections software.

Of importance are two Fortran programs also resident on the HP3000:

DH205PR.OBJECT.GEOLOGY
DH206PR.OBJECT.GEOLOGY

Program DH205PR accesses the diamond drill hole data base and writes an ASCII file, (named PCMINEDH) containing DDH header, downhole survey, lithology and assay information sequentially ordered for each drill hole. Program DH206PR also writes an ASCII file (named PCMINEDS) containing DDH header, downhole survey, structure, and fault information for each drill hole. After running DH205PR and DH206PR, both PCMINEDH and PCMINEDS were transfered to the microcomputer into drive D:\ in the 'HP' directory.

To segment these two files into distinct header, survey, lithology, structure, fault, and assay data files, program FARODDH.EXE was executed. Such ASCII data files were then ready for importing into PC-XPLOR. Most files are straight forward; note that data manipulation is applied to collar coordinates of each hole such that geological, mine and UTM coordinates are written to the header ASCII file.

CREATION OF A DATABASE STRUCTURE IN PC-XPLOR

With a working knowledge of PC-XPLOR, creating a database structure may appear second nature. In reality this is not true. Careful planning of tables and fields is required before attempting to create a database. Once created, and data inputed, a data base structure may not be modified.

Diamond drill hole information was imported into two data bases in PC-XPLOR. Both data bases have 8 tables with the second data base designed for storing different compositing information. A listing of the data base structure is given in Appendix I.

Upon creation of the data bases, each ASCII data file was imported to its respective table. The files created from program FARODDH.EXE are as follows:

D:\HP\LITH.DAT	All lithology information
ASSAY.DAT	All assay information
HEADER.DAT	DDH heater data
SURVEY.DAT	All downhole survey information
STRUCT.DAT	All structural information
FAULT.DAT	All fault information

The last two data files were NOT imported to data base A because they require further manipulation. Another file not mentioned here is LITHCOMP.DAT. This ASCII file was originally created in Symphony and represents the geological composite intervals selected for each drill hole. This file was imported to data base B, Table 3 (Lithology table).

It may occur that some records (drill holes) were not imported (rejected by PC-XPLOR). Such problems may be overcome by listing the FARO.ERR file in the data base directory. Here, an analysis of why the rejection occurred is given. On occasion max/min limits are too small for rejected data. These problems may be overcome by utilizing VEDIT to modify the structure of the data base file FARO.G5A or FARO.G5B (for both data bases).

COMPOSITING IN PC-XPLOR

The compositing process for the F8805 Model differs from that of the F8701a model in that the use of geological over bench composites was preferred. The geological composite interval would be calculated at intervals set in Table 3 (data base B). These intervals were hand selected for each hole. An effort was made to separate each interval at lithofacies contacts such that each composite interval would have a representative rock code. Special attention was given to the selection of intervals that approximated bench mining height (20 feet). On average, most composite lengths were 15-20 feet, some were shorter due to thin lithofacies. The rationale behind geologic over bench compositing, is that during the interpolation process, grades from one rock type will only be interpolated into a block that has the same rock type. This is important because of the anisotropy associated with the distribution of grade from one rock type to another.

Another deviation from the F8701a Model is the use of non-reduced densities and the use of these densities as a weighting factor during compositing. All densities are reported in mt/bcf and are calculated from the S.G.'s (pulp S.G.'s). Some data did not have measured S.G. values, so following the convention of the F8701a Model, missing S.G. values were replaced with average S.G. values for respective ore types. The following table lists the average S.G.'s for all ore types at Faro and the DDH's that had missing measured S.G. values:

Drill-Hole	Interval (feet)	Number of Assays
66-10	638.0 - 639.0	1
70-10	527.0 - 562.0	8
71-02	532.0 - 573.0	7
71-03	583.0 - 638.0	11
71-04	504.0 - 548.0	9
75456-15		
75456-18	720.0 - 771.5	11
80-01	423.0 - 448.0	11
86F-16	228.2 - 234.0	1
87F-01	275.0 - 277.4	1
	328.5 - 330.3	1
87F-02	207.0 - 211.0	1
87F-11	148.5 - 152.0	1
87F-12	246.0 - 249.1	1

were completed for each variable, with the search volume increased for each successive pass. For each succeeding pass only those blocks still containing 0.0 grade values (un-interpolated) were interpolated. A strict matching of rock-types between composites and the geology rock model was maintained for all three passes.

In consideration of the above, the search volume ellipsoid was constructed to have axes as follows:

SEARCH VOLUME ELLIPSOID

	NW-SE	NE-SW	VERTICAL
Pass 1	225 ft.	150 ft.	14 ft.
Pass 2	225 ft.	150 ft.	37.5 ft.
Pass 3	300 ft.	200 ft.	37.5 ft.

PCMINE SEARCH VOLUME PARAMETERS

	Horizontal Factor	Vertical Factor	Maximum Distance
PASS 1	0.6667	10.7	150 feet
PASS 2	0.6667	4.0	150 feet
PASS 3	0.6667	5.3	200 feet

The flattened nature of the ellipsoid allowed minimum vertical search for composites. The number of composites used to interpolate a block varied, but lower and upper limits of 3 and 20 (respectively) were used. Composite values were interpolated by inverse squared distance between the center of the block and center of the composite. Unfortunately length weighting of composites is not possible in PC-MINE.

Before commencement of MODELRUN.BAT the entire model, for all variables (PCMINE.BL1 to PCMINE.BL5) was initialized to grade values of 0.00. Uninterpolated blocks maintained these 0.00 values and were considered to be unproven reserves.

Waste blocks were assigned a density of 0.076 t/bcf, and uninterpolated ore blocks were assigned a density of 0.096 t/bcf, representative of massive sulphide waste.

Upon completion of the interpolative process, block file PCMINE.BL1 was created by executing ADD.EXE. This program adds the % Zn and % Pb values in block files PCMINE.BL3 and PCMINE.BL2 respectively, and writes to PCMINE.BL1 representing the combined % Pb + Zn block file.

AVERAGE S.G.

Ore Type	Mean S.G.
2ACD - all types	3.15
2BCD - middle	3.05
2BCD - upper	3.42
2EC	4.10
2EF	4.40
2EFG	4.42
2H	4.13
1H & Ore	3.51
Waste Phyllite	2.70

Missing assay data were given background values during compositing of 0.0001%.

INTERPOLATION (PC-MINE)

Composite data was written to extract files. In all, five variables were extracted. These consisted of % Pb, % Zn, Ag g/t (AA), Au g/t and density (mt/bcf). Each extraction file was given a representative name; (eg) LEAD6.MEX represents all % Pb composted data in an extraction file format (compatable to PC-MINE standards). The numeral '6' represents the composite table from which the data was extracted. The extracted data is then copied into PCMINE.MEX for each variable interpolation run. To facilitate this rather lengthy process, a batch file named MODELRUN.BAT was created to interpolate the complete model for all 5 variables.

The block size of the F8805 Model is identical to that of the F8701a Model. The width of a block is 25 feet across the deposit with a length of 35.36 feet along the deposit. Model north is parallel to the structural grain of the deposit (this direction corresponds to the longer edge of the blocks).

Because of the structural grain and dip, the deposit was divided up into sectors that are geometrically unique.

These sectors were interpolated separately because of deposit geometry. The following is a list of rows and columns by sector:

	Row Start	Row End	Col. Start	Col. End	Bench Start	Bench End	Deposit Dip
NESECTOR	39	73	78	128	1	50	12 deg. SW
NCSECTOR	39	73	49	77	1	50	0 deg. (flat)
NWSECTOR	39	76	1	48	1	50	12 deg. SW
SWSECTOR	77	113	1	48	1	50	20 deg. SW
SCSECTOR	74	113	49	128	1	50	0 deg. (flat)

Following the convention of the F8701a Model, three passes