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FAX TRANSMISSION

TO: John Fleming, Geological Supervisor ARMC-Faro
FROM: Lee Pigage, L.C. Pigage Consulting
DATE: January 14, 1997 **TIME:**

John:

January 13, 1997 I successfully downloaded the G9110 undiluted models from the Whitehorse office tapes. They were packaged for courier to the Minesite via Lomak. Hopefully you have them already.

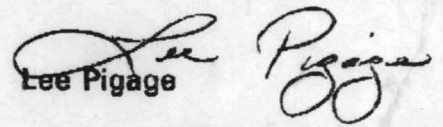
Attached is the documentation concerning my recent visit to Faro. I think it covers the major items that we discussed. If you have any questions or comments, please contact me.

In terms of future use of my expertise during the schedule outlined in the documentation - I think I could contribute most during the actual construction of the G9701 PC-MINE model. I could also help substantially during the creation and data transfer with the new PC-XPLOR Grum drill hole database.

In a general sense I could help fill in if you get bogged down with other duties. This last should only be considered if your schedule is decimated.

Thanks for the chance to help out. Good luck with your modelling. Keep me informed-if you have problems or questions please call me.

Invoice and printed copy of documentation will follow shortly by mail.


Lee Pigage

This transmission consists of 11 page(s), including cover page
If all pages are not received, please contact (403) 633-4742.*

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MEMO

TO: John Fleming, Geological Supervisor
Anvil Range Mining Corporation, Faro Minesite

FROM: Lee C. Pigage, L.C. Pigage Consulting

DATE: January 13, 1997

SUBJECT: GRUM BLOCK MODELLING

INTRODUCTION

The geological group at the Grum/Faro Minesite has been assigned the tasks of evaluating the current Grum G9110 block model and updating it to incorporate blasthole data from the mined benches and recent diamond drill data from the northwest end of the deposit. The work is to be completed before March 20, 1997 (preferably earlier). The existing model and the updated model both utilize Gemcom software to create the model and to generate reports from the model.

During the week of January 06-10, 1997, L.C. Pigage Consulting was contracted to visit the Minesite to review the GEMCOM modelling process and to offer suggestions concerning procedures for successful completion of the block models. This review was to encompass both the work completed to date and the proposed schedule of activities. Part of this review would consist of a historical background on the existing G9110 block model.

At the time of my visit to the Minesite, the initial geological work to generate an interim Grum block model had been partially completed. During the rest of this memo I will be referring to this model as the interim G9110A model. The intent of the interim G9110A model is to provide initial estimates of the revised mineral inventory at the grid north end of the Grum deposit. It would also be used to determine if re-designing the mine plan in this area would allow for more ore extraction. The new drill hole information from 9 drill holes completed in 1996 had been partially entered into the Grum PC-XPLOR database. The Grum GEOMODEL polygons had been revised for

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ASSAYS +
SURVEY DATA

new ore outlines on cross sections 84W, 85W, 86W, 87W, 88W, 89W, and 90W. The revised polygons had been exported to PC-MINE. Initial trial grade interpolations for the existing block model were disconcerting in that the newly calculated values did not duplicate the results from the earlier block model calculations.

Work had not yet been started on the fully revised and updated Grum block model. For the rest of this memo, this model will be referred to as the G9701 model. It would be a more complete update of the G9110, taking into account both the drill results from the 1996 holes and the Grum blastholes in the mined area.

It is hoped that the G9701 model, the Grum PC-XPLOR database, and the Grum GEOMODEL database will be used to create a Grum GS32 solids model for future use. Work on this GS32 model has not been started.

The rest of this memo discusses the results of my visit to the Faro Minesite. It includes recommendations for completing the proposed tasks as outlined above.

INTERIM G9110A MODEL

INTRODUCTION

Inspection of the rock type model currently in the interim G9110A model revealed that it was a mix of the G9110 simple rock model and the G9110 horizon coded detailed rock model. Further, the cross section polygons for sections 84W through 90W did not appear to have been incorporated into the G9110A rock type model being used.

Inspection of the kriging files for the new G9110A model and the interpolation response files for the original G9110 model indicated that the search parameters used for the two models were not the same. To make things even more confusing, the G9110 model documentation (Curragh Report WH9305) also contained errors in the printed search parameters and did not actually correspond to the interpolation passes as completed.

Either of these problems would be enough to explain the problem that the trial interpolations for the revised G9110A did not duplicate the results from the earlier G9110 model calculations. Because of these problems, it was decided to completely re-do the G9110A interim block model during my visit to Faro.

The G9110A block model was created by modifying the G9110 model. Changes to the G9110A model were completed only for rows 26-52 inclusive. The following sections discuss the changes completed during the running of the G9110A model.

ROCK TYPE MODEL REVISION

The detailed rock type model was revised by completely revising the rock type blocks between rows 26-52 inclusive for the model. Air and overburden blocks (codes 82 and 99) were left unchanged. All other block codes were initialized to rock type 77 (general phyllite waste). Cross section ore polygons from the newly interpreted GEOMODEL sections were used to assign ore rock types to the appropriate blocks. Detailed horizon coding was used during this rock type assignment. The rock types for each row between 26-52 were changed using the sectional polygons according to the correspondence indicated in Table 1.

Table 1. Relation between model row and Grum exploration cross section-G9110A

Exploration cross section	G9110A Model Rows
90 W	26, 27, 28
89 W	29, 30, 31, 32
88 W	33, 34, 35, 36
87 W	37, 38, 39, 40
86 W	41, 42, 43, 44
85 W	45, 46, 47, 48
84 W	49, 50, 51, 52

Because G9110A is an interim model designed only for some preliminary results, it was considered acceptable to input only the ore rock types from the cross sectional interpretation. The use of sections meant that the same geology was projected horizontally for 4 rows in the G9110A model. This projection does not fully and smoothly account for the 11 degree structural plunge of the deposit to grid north.

Grum PC-XPLOR DATABASE

Assay data for Pb, Zn, Fe, and Cu was entered into the Grum PC-XPLOR database for the 9 diamond drill holes completed in 1996. The assays were then cut to the 95th percentile using cutting thresholds listed in report WH9305. These thresholds are listed in Table 2. Equal length 2 metre composites were prepared from the assays for the geological intervals corresponding to the ore horizons. The geological composites were labelled as rock type 602 (carbonaceous quartzite in the Gnome's cap horizon). Collar coordinates and downhole surveys were also entered into the appropriate database tables and checked for correctness.

Table 2. 95th percentile cutoff values for G9110A

Rock Code	Pb %	Zn %	SG
2, 3, 12	6.24 %	10.77 %	3.86
4, 5, 7, 8, 15, 18	9.72 %	17.19 %	4.85

The geological composite information from the new 1996 drilling was appended to the appropriate G9110 model extraction files for Pb, Zn, and SG. The revised extraction files were saved as files NEWPB.MEX, NEWZN.MEX, AND NEWSG.MEX.

GRADE and DENSITY MODEL INTERPOLATION

Gemcom module GEMKRIGE was used to interpolate grades into the lead and zinc block models and SG into the density block model in four passes. The interpolations were completed only for rows 26-52 inclusive. Block grades for all other rows were left unmodified from the G9110 model. The ASCII control files used for the grade and density interpolations were edited to closely correspond to the original interpolation as interpreted from the G9110 ASCII response files and the tables included in report WH9305. Table 3 contains the interpolation parameters used for the G9110A model. Table 4 contains the rock type restrictions used with the G9110A model.

After the grade interpolation passes were completed, the detailed rock type model was edited to the simple rock type model by removing the horizon coding from the rock types for each block. This change corresponded only to the ore rock codes in the detailed rock type model. No dilution was completed for the newly interpolated rows 26-52. The model is therefore a mixed model. Rows 26-52 contain undiluted grade blocks. For rows 53-219 the marginal ore blocks are diluted by 20%. This mixing of diluted and undiluted grades should be remembered when reporting the grades for the model. Any report should be divided into diluted and undiluted portions.

The Pb+Zn grade model was completed by adding block values from the Pb grade model and the Zn grade model after the above grade interpolation was completed.

The density model was also modified after the density interpolations were completed. Program RKDENS was used to assign average SG values to uninterpolated blocks for each ore type. Table 5 lists the average SG values used for the different rock codes; these values are the same as those used to infill model G9110.

Table 3. Interpolation parameters for the G9110A Model

	Pass 1	Pass 2	Pass 3	Pass 4
North search	50 m	75 m	75 m	75 m
East search	50 m	50 m	50 m	50 m
Vertical search	10 m	10 m	17 m	50 m
Tilt	-11 north	-11 north	-11 north	-11 north
Weighting	inverse distance	inverse distance	inverse distance	inverse distance
Power	1	1	1	1
Minimum #	2	2	2	2
Maximum #	10	10	10	10

Table 4. Rock type restrictions for the G9110A Model grade interpolations

Target Rock Type*	Composite Rock Type*
2	2, 3, 12, 15
3	2, 3, 12, 15
5	5, 7, 15, 18
7	5, 7, 15, 18
12	2, 3, 12, 15
15	2, 3, 5, 7, 12, 15, 18
18	5, 7, 15, 18

*rock types in table do not include horizon coding. Horizon coding was used in the actual interpolation

Table 5. Average SG of interpolated blocks

Rock type code	Description	Average SG
2	carbonaceous pyritic quartzite	3.06
3	noncarbonaceous pyritic quartzite	3.29
5	pyritic massive sulphides	4.00
7	baritic pyritic massive sulphides	3.89
12	mixed types 2 and 3	3.17
15	mixed types 2, 3, and 5	3.65
18	mixed types 5 and 7	3.96
77	waste phyllite	2.70
82	gravel overburden	2.20

EVALUATION and CHECKING

Plan plots at 1:500 scale of the G9110A model and the G9110 model were completed for bench levels 20 (1216 m), 25 (1186 m), and 30 (1156 m) and compared. Grades between the newly completed G9110A interpolation and the earlier G9110 interpolation were similar. Only a few blocks in the revised area were uninterpolated. Further evaluation of the results was to be completed during the following week by preparing reports of the mineral inventory within and outside of the IH final pit outline.

WH9701 MODEL

PC-XPLOR

1) Data entry (3 days)

Data entry of drill hole data for the 1996 drilling program needs to be completed. For the 9110A model work only the Pb, Zn, and Pb+Zn assays and downhole surveys were systematically entered. The rest of the information needs to be entered and verified. Lithologies will be especially important for the new geological interpretation.

check 1 ~ 2 day

GEOMODEL

* check 1 dayMain horizon
*
Extra ore

1) Review existing GEOMODEL ore outlines and PC-MINE block model grades relative to blastholes (1 week)

The current geology interpretation as captured in the GEOMODEL and PC-MINE polygons and grades should be compared to the blastholes for the area mined. The comparison should exclude those areas of the blasthole database where no ore was expected; this was "bonus" ore and should not be used to determine that the computer models were not appropriate. The comparison should consider both the location and the grades of the ore lenses as determined from the blastholes.

If the blastholes and GEOMODEL/PC-MINE models are reasonably similar, no adjustment will be required for the existing GEOMODEL polygons except in the area of new interpretation (grid North end of the Grum deposit).

The possibility of "bonus" ore at deeper (un-mined) bench levels should be appraised for the new GEOMODEL interpretation. This possibility would be based on the interpretation of the "bonus" ore encountered at higher levels and whether there would be any expectation of similar ore at lower levels.

2) Revise cross sections and plans (2 weeks)

The Grum deposit should be re-interpreted in plan before constructing the new G9701 PC-MINE model. The interpretation would start with the cross sections and then proceed to plans. Adjustments to ore outlines should be made if blastholes indicate major discrepancies between mined ore and modelled ore. This interpretation should include waste rock types as well as ore rock types. The waste rock types potentially provide useful information on volumes of pyritic waste rock which have to be placed in sulphide cells in the dumps.

At this stage no attempt should be made to "pin" the ore horizons to the existing drill holes in preparation for the GS32 Grum solids model. The existing GEOMODEL Grum interpretation has been smoothed at two stages of its construction. It would be a large and unwarranted task to reverse that smoothing process for the G9701 model.

The G9701 rock type model must be constructed from the re-interpreted GEOMODEL plans. The plans properly "smooth" the rock type outlines and incorporate the overall 11 degree grid north plunge of the deposit.

PC-MINE

1) Initialize and construct G9701 undiluted block model (1 week)

The rock type model will be created from polygons transferred from the newly interpreted GEOMODEL plans. The different grade models will be interpolated using the extraction files and *.krg control files created and used with the G9110A block

model. The *.krg files would have to be edited to remove the existing restriction of interpolation to model rows 26-52. The main time sink for the construction of the model is therefore the run time as the computer does the calculations.

The rock type model and the grade models can be visually reviewed during their construction using the GS32 3D viewing module in PC-MINE. This visual inspection is necessary to ensure that the different models appear reasonable before proceeding to the next stage of model construction.

Rock type and density models should be modified in a similar manner to the modifications completed on the G9110 model after the grade and density interpolations are completed.

GENERAL

1) Review and check the new G9701 block model (1 week)

Univariate statistics should be completed on the blastholes, composites, assays, and G9701 blocks for the different ore types. This comparison is necessary to insure that the block model is an unbiased estimate of the information contained in the drill hole and blasthole data. Histograms are useful visual checks as part of this study of grade distribution.

The mineable and in-situ mineral inventories from the G9701 model should be compared to the G9110 and earlier models. Drilling density is dense enough in the core volume of the deposit that the results should not differ significantly from the earlier models.

GS32 GRUM MODEL

PC-XPLOR

1) Combine the existing Primary and Compositing databases into a single database (2 weeks)

The current practice of using two separate databases was based on software restrictions which are no longer relevant. The GS32 software cannot access two PC-XPLOR databases simultaneously. The existing two databases should therefore be amalgamated into a single database.

* "Housekeeping" changes to existing data should be completed during this amalgamation. Existing Gemcom databases do not support the use of -1 for not sampled or not analyzed; the -1 values in the existing databases should be changed to the new Gemcom conventions.

The new PC-XPLOR databases should have explicit variables for complex and simple rock type codes in the compositing source table and the composite table. The compositing source table should be set up as a separate lithology table in the database.

2) Create ASCII "dump" files of data from the newly created PC-XPLOR database and archive them (4 days)

The ASCII files would be an independent backup of all the Grum drill hole data. Creation of the ASCII files should only take two days. The remaining two days should be used to write documentation describing the different variables along with their value ranges for the ASCII files.

GS32

1) Start construction of the GS32 Grum solids model (indefinite)

Existing GEOMODEL horizon outlines will have to be "snapped" to the 3D drill holes. This will require using the lithology, assay, and compositing source tables from the PC-XPLOR database to locate proper downhole intervals for the snapping operation.

GENERAL COMMENTS

1) The Faro/Grum Minesite did not have available the full set of G9110 model files (The detailed rock type model and the undiluted grade models were not at the Minesite). This made it more difficult to quickly and efficiently complete the G9110A model. In the future, the Minesite should have a full set of each of the deposit block models.

2) The G9110 block model was originally set up to use the Gemcom PC-MINE profiles configuration. In that way the alternative models could be readily accessed without having to copy and overwrite individual model files. This profile configuration was subsequently abandoned for a default (the diluted G9110 model) configuration. The geology and engineering groups should determine whether they want to continue with the default configuration or return to the profile configuration. Because the G9701 model has the same block and model dimensions as the G9110 model, both models could be incorporated into a single PC-MINE profile.

3) The geology group at the Minesite has been using a calculated SG as determined from the analyses of Pb, Zn, and total Fe for their blastholes and drill holes. The calculated SG values are reasonable and compare well with tonnes as weighed during the ore haul to the mill. Consideration should be given to whether calculated SG values should be used to infill the absence of pulp SG measurements on many of the

assay samples. Use of calculated SG in this manner would result in many more SG values being interpolated into the PC-MINE density model.

4) The geology group presently has Gemcom software and databases installed on at least three separate computers. The colour, plotting, etc. profiles are different on each of the computers. This makes it confusing to generate consistent output from the different machines. Efforts should be made to standardize the profiles so they are consistent between the computers.

Lee Pigage
January 14, 1997