GRUM PLANNING MEETING
WHITEHORSE
September 28, 1991
7:00 a.m.

Present

Whitehorse	Faro	Toronto
G. Jilson	J. Hogg	C. Benner
C. Reed	K. Ball	J. Hendry
	G. Wilson	G. McDonald
	B. Dunn	

GEOLOGY

The progress on geological interpretation was outlined and highlights of the geology of Grum were presented with reference to cross sections.

Cross sections have complete first pass interpretation. Long sections have half complete first pass interpretation. Digitizing is on going. Target date for a complete interpretation (cross section, long section and those benches in the first years mining volume) is mid to late October. Target date for a partial reserve calculation using the same bench composites and parameters as the 1992 budget reserve model is end October 1991.

It is recognized that a more specific model using geological composites, as has been done for Vangorda, will be needed however due to the number of drillholes at Grum it will not be possible to provide this until after November 1. It is estimated that an additional 10 days to 2 weeks will be required. Further effort will be needed to complete all benches and provide reserves for the entire deposit.

The following challenges or opportunities offered by Grum were discussed.

- Selective mining at Grum is essential. Much of the high grade massive sulphide at Grum has carbonaceous phyllite (unit 5A) adjacent to it and it will be essential to minimize this type of dilution to reduce addition of carbon to the mill circuit. It was noted that the carbonaceous phyllite is highly fractured and may prove to be free digging at considerable depth. Selectivity can be enhanced by using dozers to clean contacts and arranging blasts so that crossing of ore waste contacts is minimized. Use of specialized loading equipment was discussed however tonnage demands by concentrator mean cable shovels will always be needed for loading, it was recognized that support equipment can allow these shovels to be used for selective mining.

- Contacts at Grum are complex due to folding and considerable faulting will exist. No matter how effective selective mining is there will be some mixing of material types during mining thus test work must examine mixtures of ore and waste. Of particular interest here is carbonaceous phyllite (unit 5A) and talcose altered metabasite (unit 5C4).

- Ores at Grum are unusual in that most massive sulphides are very high grade however pyritic quartzites are considerably low grade. This implies that some conscious effort will be required to level feed grade to the mill and prevent surges of too high grade. A histogram of grade by rock type is attached.

- The question of surface oxidation as experienced at Vangorda, is still an unknown since all test work by Curragh has been on drill core. Recognizing that the drill core logs for Grum will not be as good as those for Vangorda, it will be necessary to review all logs to attempt to establish the depth of oxidation below the glacial till. Where specific data is lacking for Grum assumptions will be made based on Vangorda experience. A surface of oxidation should be created and reserves within the possible oxidized zone calculated by bench.

- As with any pit in the Anvil Range water will be a concern. The possible use of the existing underground workings as a dewatering gallery was discussed. It was agreed that pumping out the underground workings will not likely dewater a significant volume of the rock mass (as it is reasonable that inflows will eventually drop to approximately 100gpm as is rumoured to be the case during CMS's work for Kerr-Addison) however the workings could be of value in conjunction with pit sumps to help control pit water. The location of the underground workings will be shown on each bench plan.

- Drilling has indicated that artesian wells exist where buried valleys exist beneath Grum overburden. This is similar to experience at Vangorda thus there will likely be large flows into the pit when these channel aquifers are breached. The position of such channels will be indicated on bench plans.

- The northeast wall of the Grum Pit will be of concern in that it poses two challenges (i) thick consolidated glacial overburden and (ii) possible 20-30% south west to west dipping foliation of phyllite. The phyllite at Grum will have lower friction along their foliation and will likely be prone to exhibit surficial sliding as seen on the northeast wall of the Faro Pit.

- Low to moderate angle faults (35° to 45° dip) are an important aspect of the structure at Grum. A major west dipping structure marked by major gouge zones will be found beneath the northeast wall, however, it is not likely to daylight in the pit. Other structures of similar orientation may exist thus structural and geotechnical mapping must be carried out as the pit is developed.

  Toward the northwest end of the northeast pit wall another moderately west dipping structure has been tentatively identified. This fault will be exposed in the pit walls and if S_2 dips southwest in the area there is potential for 3D wedge type failures. It would be wise to take cognizance of these structural features now and commit to an ongoing program of structural mapping (including waste) and investigate methods to minimize blast damage to the final wall.

- In addition to surficial oxidation there is abundant evidence that deep moving oxygenated groundwaters have oxidized sulphides along fault zones. Generally it is likely that such oxidized zones will provide only a small portion of mill feed however in unusual circumstances of the mining face versus a fault zone, short periods of an abundance of this type of feed could occur. Pit bench plans will indicate all known faults to attempt to provide advance warning of such situation.

- In the northwest end of the phase I pit the ore feed will consist dominantly of medium grade carbonaceous quartzite ("A type ore"). This material will be intimately mixed with carbonaceous phyllite and visual distinction may be difficult. Due to complex structures physical separation will be difficult even if the ore and waste can be distinguished visually. The points to be made here are:
  - Dilution will be high and difficult to control - more difficult than much of the Grum Pit. It would not be representative of the deeper parts of the pit where massive sulphides are more important and one should not give up hope for the rest of the pit if this area proves difficult at first.

  - The potential problems of carbon in the ore feed will be most prominent in this area since both the ore and the dilution are rich in carbon.

- The waste management program for Grum depends on separating potentially acid generating rocks (below grade sulphides and altered phyllite) from non-acid generating rocks and dumping the acid generating rock in a specifically designed cell. It is important that the separation be maintained throughout the life of the pit and that there not be mixing of these two material types. This is particularly important for the acid generating cell since it has limited capacity.

- There is limited material on the Vangorda Plateau for road surfacing other than sulphides. Sulphides, of course, can only be used below the eventual level of pit flooding. No other rocks suitable for roads are likely to be encountered in the pits. Other materials that may be suitable include: greenstone which crops out on the knobs near the dry-office complex and towards the town of Faro from the Grum pit, granite which crops out along the haul road approximately 1500' east of the west fork of Vangorda Creek crossing and amphibolite which occurs in limited amounts in an old quarry along the old Vangorda Plateau access road approximately 3000' north of the mine dry. No significant sources of gravel other than those currently developed are known (however the Montreal Engineering aggregate inventory should be consulted).

Action items resulting from this discussion were:

- Priority will be completion of the geological interpretation and reserve calculation of the early benches of the Grum Pit by end October. [Reed]

- Logs of holes at Grum will be reviewed for signs of oxidation as was done at Vangorda - the priority will be in the early phase pit - this will occur after completion of the new interpretation. [Reed, Wassel]

- The lead-zinc ratios for grum drillholes will be reviewed. [Reed]

- Using above information and experience at Vangorda a surface representing the depth of oxidation will be derived and reserves above this level will be calculated by bench. This should be done by November 15th. [Reed]

- After the preliminary reserves are calculated a more specific, geologically composited, calculation will be started (similar to Vangorda). This will required the assistance of a geologist from Faro in Whitehorse for two weeks in early/mid November. [Reed, Wassel]

- In light of uncertainty with regard to carbon, samples of this material (5A) will be tested along with massive sulphides - This should also include "talcose" altered metabasites (5C4). [Wilson/Ledwidge/Reed]

- A trenching program will be carried out in the Grum Pit area to acquire bulk samples of carbonaceous quartzite ore and its surrounding carbonaceous phyllite dilution for testing. [Wilson & Ledwidge]

METALLURGY

The test work done on Grum so far was outlined by Godfrey McDonald.

a) Noranda Pilot Plant Testing at Lakefield - 1977
- underground sample
- test results:

	Assays		Recoveries	
	Pb%	Zn%	Pb%	Zn%
Pb conc	60-62	8-10	77-80	
Zn conc	2-2.5	56		81-84

b) Curragh Resources Inc. (1988 - 1989)
- Laboratory Testwork - composites GI, GII and GIII
  - batch and locked cycle testwork

	Assays		Recoveries	
	Pb%	Zn%	Pb%	Zn%
Pb conc*	65-68	5-8	83-90	
Zn conc	0.5-1.5	53-56		83-84

*Pb conc	gold rec	34-68%
	silver rec	69-79%

- Why the metallurgical improvement?
  - finer regrind
  - high intensity conditioning
  - reagent (SD 200)
  - modified flowsheet

- Selected diamond drill holes to identify "cap" rock effect and brecciated massive sulphide occurrence
  - diamond drill holes 89G43 and 91G48
  - composite composition
    - geological increments of each DDH from collar to bottom

  - results:
    - "cap" rock shows reduced metallurgical performance; lower recoveries
    - massive sulphide ore - Pb concentrate contains more zinc (more regrinding for liberation is required).

  - ongoing testwork
    - retest composite of several geological increments from 2 diamond drill holes to determine the effect of reagent type/additions and regrinding selected flotation products
    - assay composite head sample and flotation products for non-sulphide contact.

- General comments
  - grinding work index - 15 kWh/t (similar to Faro Ore)
  - Stronsay flowsheet very applicable to Grum ore processing
  - Pb concentrate regrind possibly to a PK_{80} of 16 microns

The latest test work at Lakefield has identified middlings causing cross contamination of concentrates. Further test work will be done at Lakefield at attempt to deal with this situation. Two drill holes (89G35 and 91G35) will be provided to McDonald for this purpose. Further test work beyond this work will be done at Faro. A need was expressed to examine options to deal with stockpiled "refractory" material at Vangorda however it appears to be too late to do anything on surface involving water this year.

The importance of doing anything reasonable to identify any metallurgical issue that could develop at Grum was stressed since by late '92 Grum will be the only source of mill feed. Testing on bulk samples from trenches in Grum Pit was agreed to be appropriate. It was noted that in general quartzose ore appears less oxidized than massive sulphide ore thus if no oxidation effect is noted by testing quartzose ores a false sense of security should not develop.

Action Items:

- provide core from 89G35 and 91G35 to Lakefield - [Ledwidge, ASAP]

- trench in Grum Pit for shallow carbonaceous quartzite (4A) [Ledwidge, Wilson]

- examine blends of ore and carbonaceous phyllite (5A) and possibly also talcose phyllite (5C4) [Wilson/Ledwidge/Reed]

- examine options for processing Vangorda refractory. To be done over winter so that implementation, if feasible, can be next summer. [McDonald]