VANGORDA PLATEAU DEPOSITS

005149

INTRODUCTION

In the Anvil Range there are four Pb-Zn-Ag deposits in addition to the Faro deposit. Two of these, Vangorda and Grum, are relatively close to the Faro deposit concentrator and shallow enough to make open pit mining feasible. These deposits contain higher grade ore than the remaining portion of the Faro deposit and could contribute significantly to the economics of mining in the Anvil District when considered in conjunction with the Faro operation.

These deposits are located in an area known locally as the Vangorda Plateau. This area is at lower metamorphic grade than the Faro deposit area. While the other deposits are essentially identical in origin to the Faro deposit they are different in appearance due to the less intense metamorphic overprint and different structural history. The deposits are finer grained and occur in more complex structures involving several distinct mineralized horizons. Despite the finer grain size the Vangorda Plateau ores are metallurgically compatible with Faro ore, given a finer grind.

Grum

The Grum deposit has been extensively drilled both from the surface and underground. The deposit is drilled on a minimum of 100' x 200' centres; the core of the deposit, where the bulk of the high grade reserves are found, is drilled on a closer but variable spacing that averages 100' x 50'. Grum is thus the best drill defined deposit in the district. In addition to the approximately 400 drillholes in the deposit there is about 2900 metres of underground development that provides access to a 700 metre strike length of the deposit (now flooded).

The deposit consists of a number of ore horizons that are contorted into a complex polyphase fold structure (Fig 1A & 2A). This fold defines the elongation of the deposit and plunges about 12^{o} to the northwest from the deposit's subcrop beneath a thick blanket of glacial till (Fig 2B). Most mineralization is thus beneath at least 30 metres of rock or overburden cover but once this cover is removed there will be mineralization exposed at all levels in the pit.

The host rock for the deposit is a soft highly fissile phyllite. The clevage of these phyllites dips shallowly parallel to the axial planes of folds in the deposit (Fig 2A) and is the major determinant for slope stability in rock for proposed pits. There are a number of moderately dipping faults that will contribute significantly to local slope stability problems.

FIG. 1A

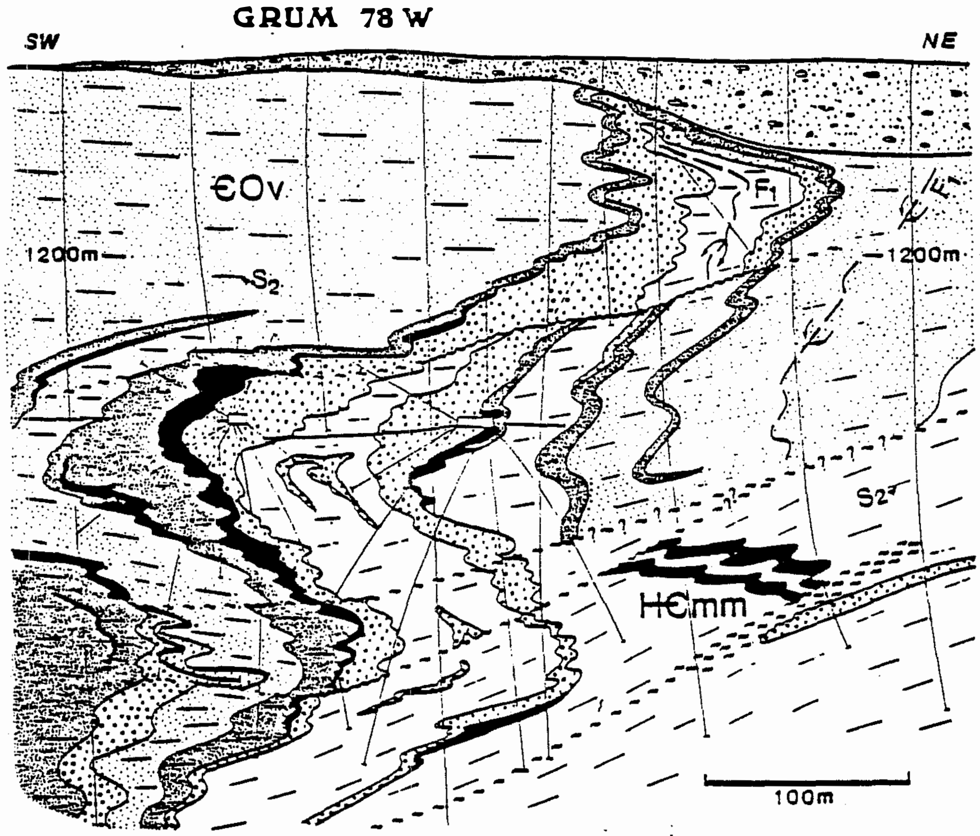


FIG. 1B

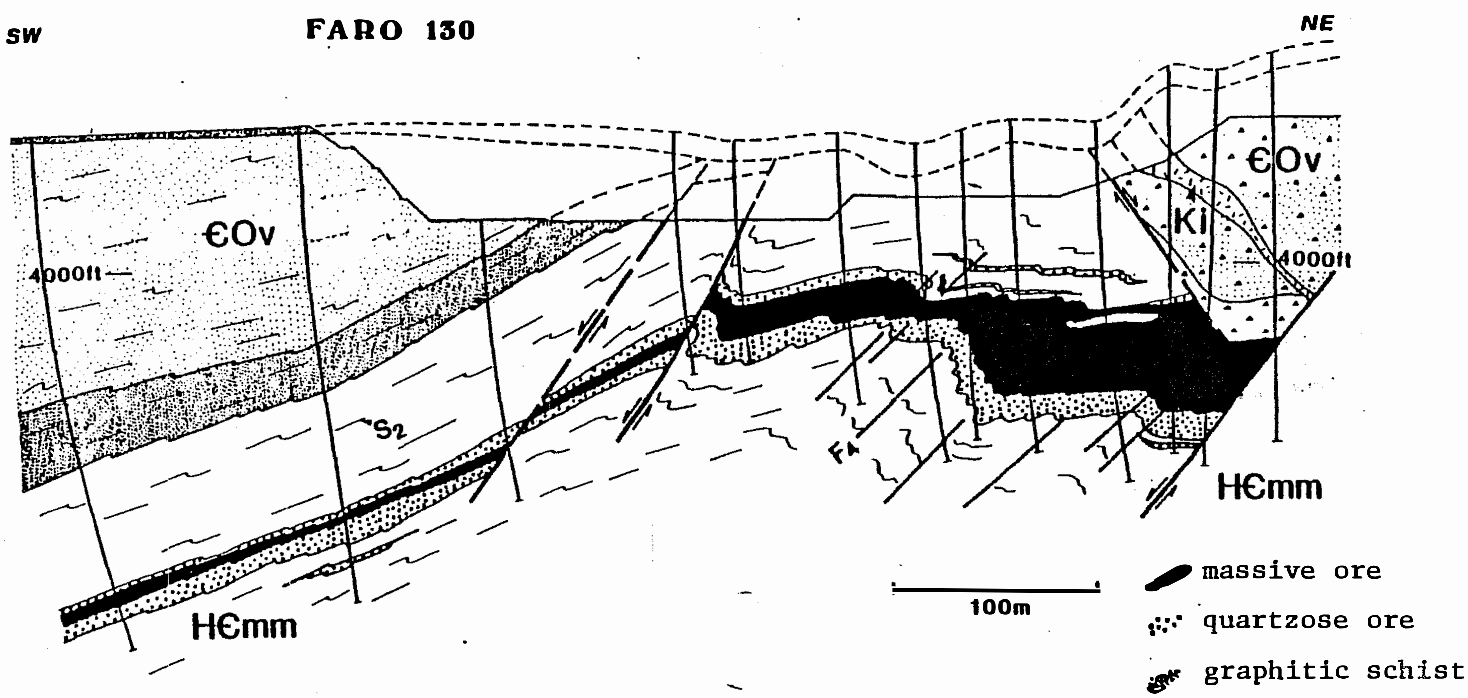


Figure 1

Comparative sections through Grum and Faro. Section 130 at Faro is through the southeast end of zone 3 and is one of the thinner parts of the deposit. Section 78W at Grum is fairly typical of the deposit

FIG. 2A

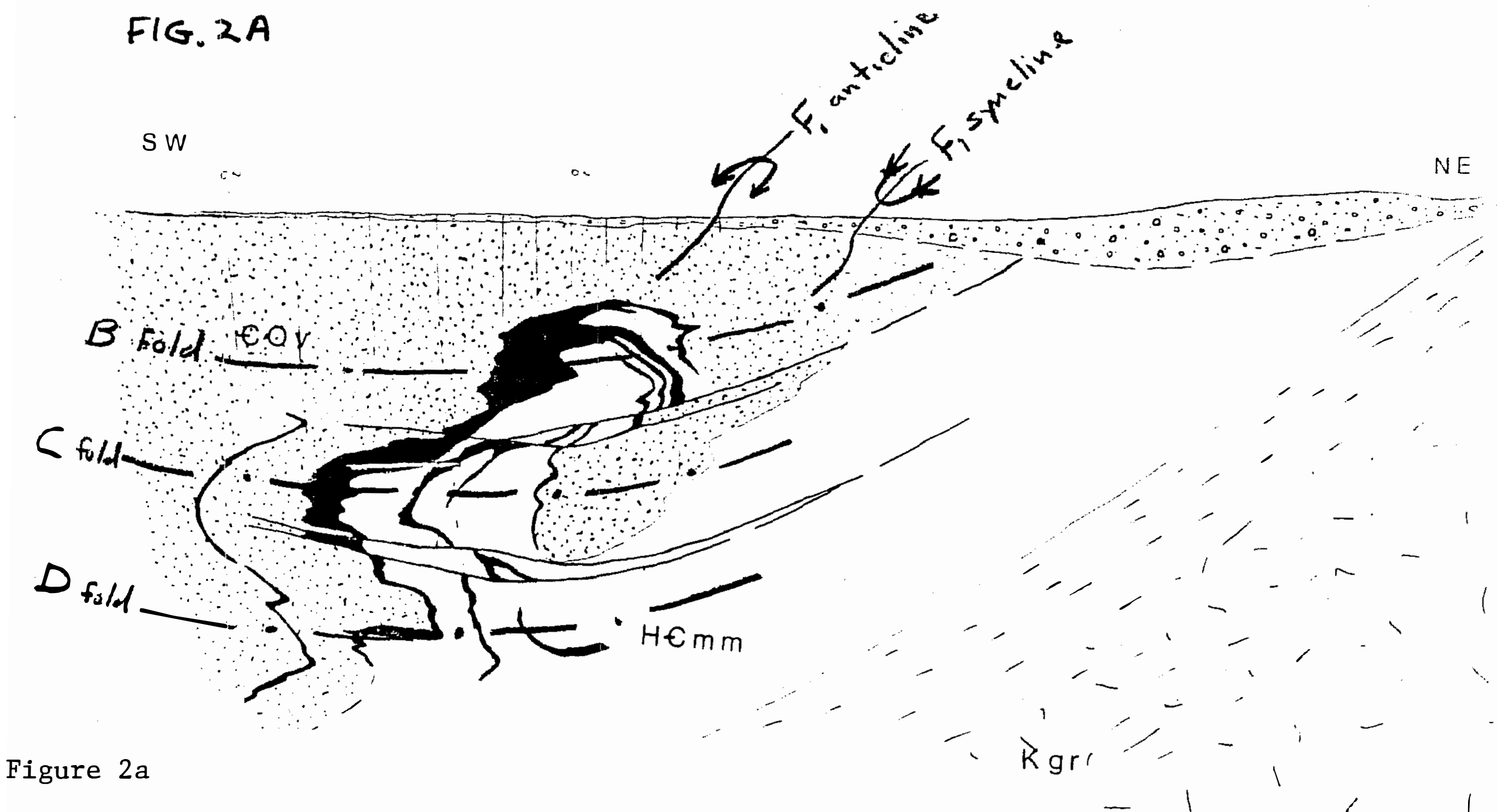
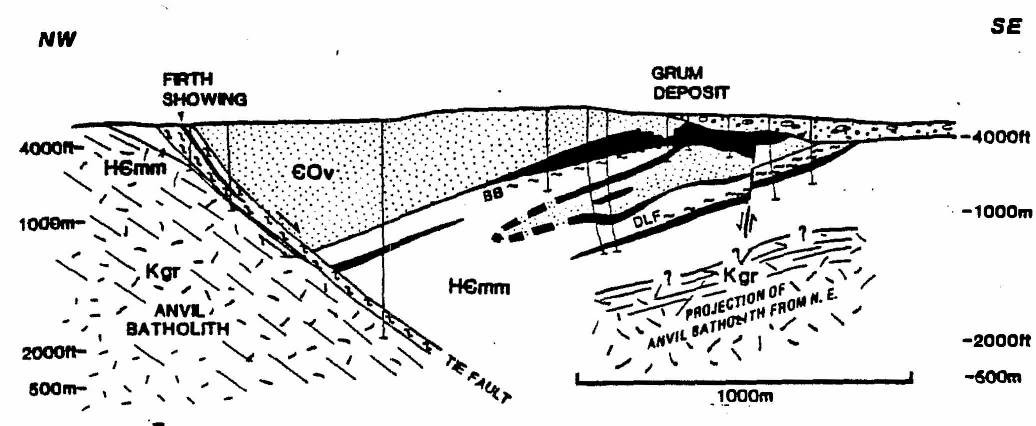


Figure 2a

Schematic cross-section through the northwest end of the portion of Grum where reserves are defined. Terminology used to refer to position in the fold structure is indicated. The S_2 foliation, the most prominent plane of fissility in the phyllites at Grum, is parallel to the axial planes of the B,C and D folds. The Gnomes Cap (see Table III) is the crest of the F_1 anticline. It consists largely of ore type 4A.

FIG. 2B



all sulphide lithofacies

Figure 2b

Schematic longitudinal section through the Grum deposit showing the northwest plunge of the deposit. A large normal fault has truncated the northwest end of the deposit. Such large faults are a newly recognized aspect of the structure of the Anvil District. Related structures occur beneath both the Dy and Swim deposits.

The ore horizons are up to 30 metres thick but in much of the deposit average about 15 metres especially in the area of the most significant reserves. Thinner ore layers occur widely and a method of efficient extraction will be of major importance to the economics of the Grum pit. the ore layers are characteristically strongly zoned both in ore type and grade. The stratigraphic top of a given ore layer is generally massive sulphide, commonly with a baritic upper portion. The massive ore is underlain by thicker zone of disseminated mineralization in a quartzose, variably carbonaceous, gangue. The ore layers, particularly the "main" layer that accounts for the bulk of the reserves, are comonly overlin by soft, dark coloured phyllites. Since the massive ores and especially the baritic ores are considerably higher grade on the average than the quartzose types this geometry results in the strong grade zonation which has important implications both for reserve estimation and mining. Since the folds at Grum have overturned limbs locally this sequence is inverted.

The Grum deposit is less well endowed with massive ore types than the Faro deposit, thus a significantly higher proportion of the mill feed with be quartzose ore types (Fig 3). Despite this, the deposit is significantly higher grade than the remaining portion of Faro, especially in Zn, Ag and Au (Tablel). Preliminary data also shows Grum ores to be higher in As and Hg. By comparison to Faro, Grum will have higher dilution and somewhat higher mining costs in order to be more selective. Table 1 shows however that there are higher grades to counter these negatives.

A number of reserve estimates have been made for the Grum deposit (Table II). Two hand calculations done independently based on different geologic models and using different compositing methods show good agreement in contained metal content where the deposit is most densely drilled (Table III). Block based computer models on the other hand have not compared well with the sectional hand calculations. The most recent model is lower both in tonnage and grade. The decrease in tonnage may be largely due to the inherent inability of a block model to adequately portray thin folded ore bands. The lower grade may be partly due to the lack of geologic control on grade interpolation which in combination with the highly zoned ore bands and overall plunge on the deposit results in assignment of inappropriately low quartzose ore type grades to the less numerous massive sulphide ore blocks.

An improved section based block model (known as G-2) that will use smaller blocks and extensive geologic control on grade interpolation was started in 1982. This model uses the latest in drill control and assay information and is based on the same geologic interpretation as the latest sectional hand calculation. Due to staff shortages and

GRUM DEPOSIT

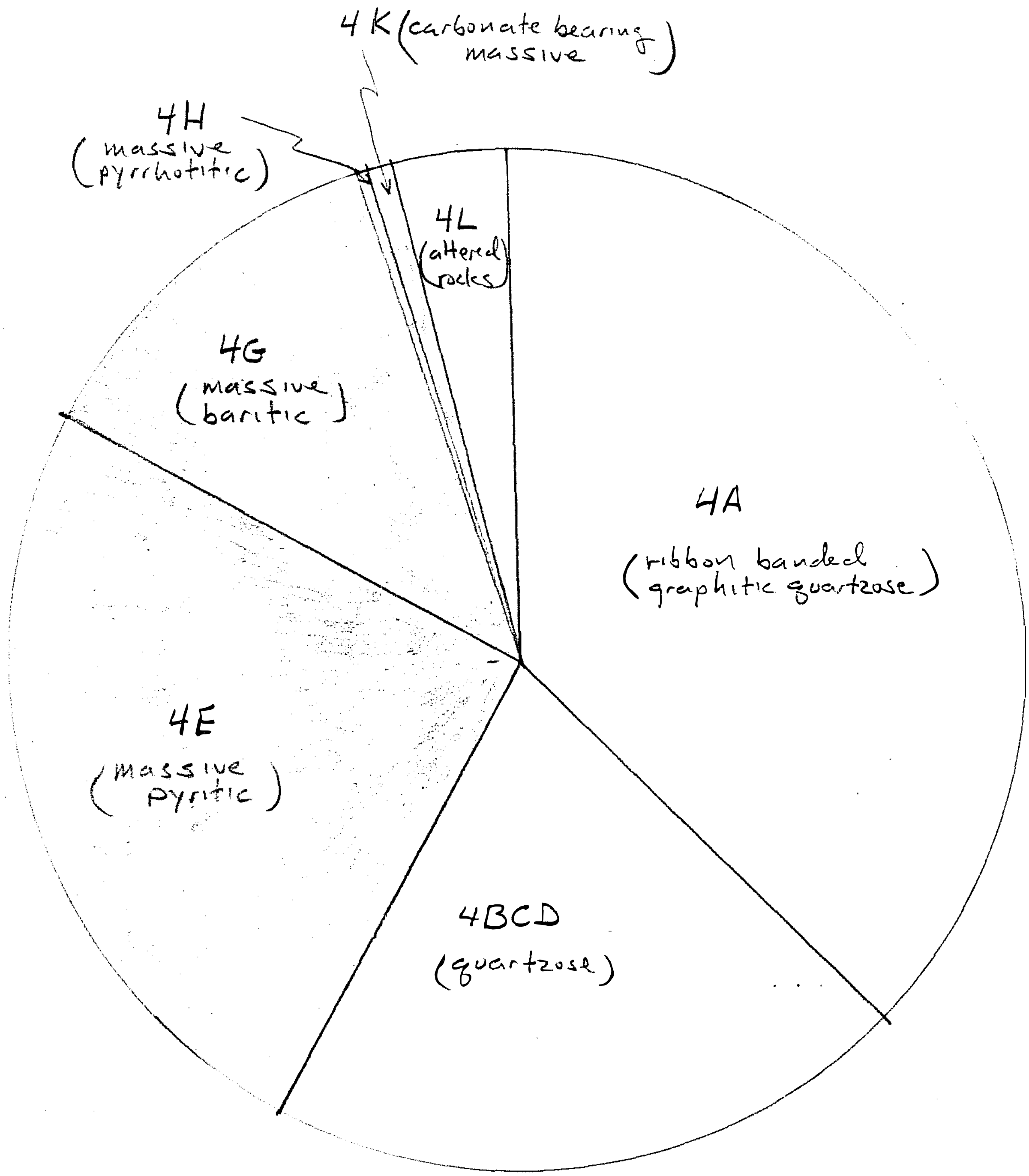


Figure 3

The relative proportions of the different ore types in the Grum deposit based on the number of samples in the Grum database. The Grum deposit is unusually rich in quartzose ore types compared to other Anvil District deposits. Despite this the deposit is one of the highest grade orebodies in the district. Only those samples with greater than 4% Pb + Zn were counted

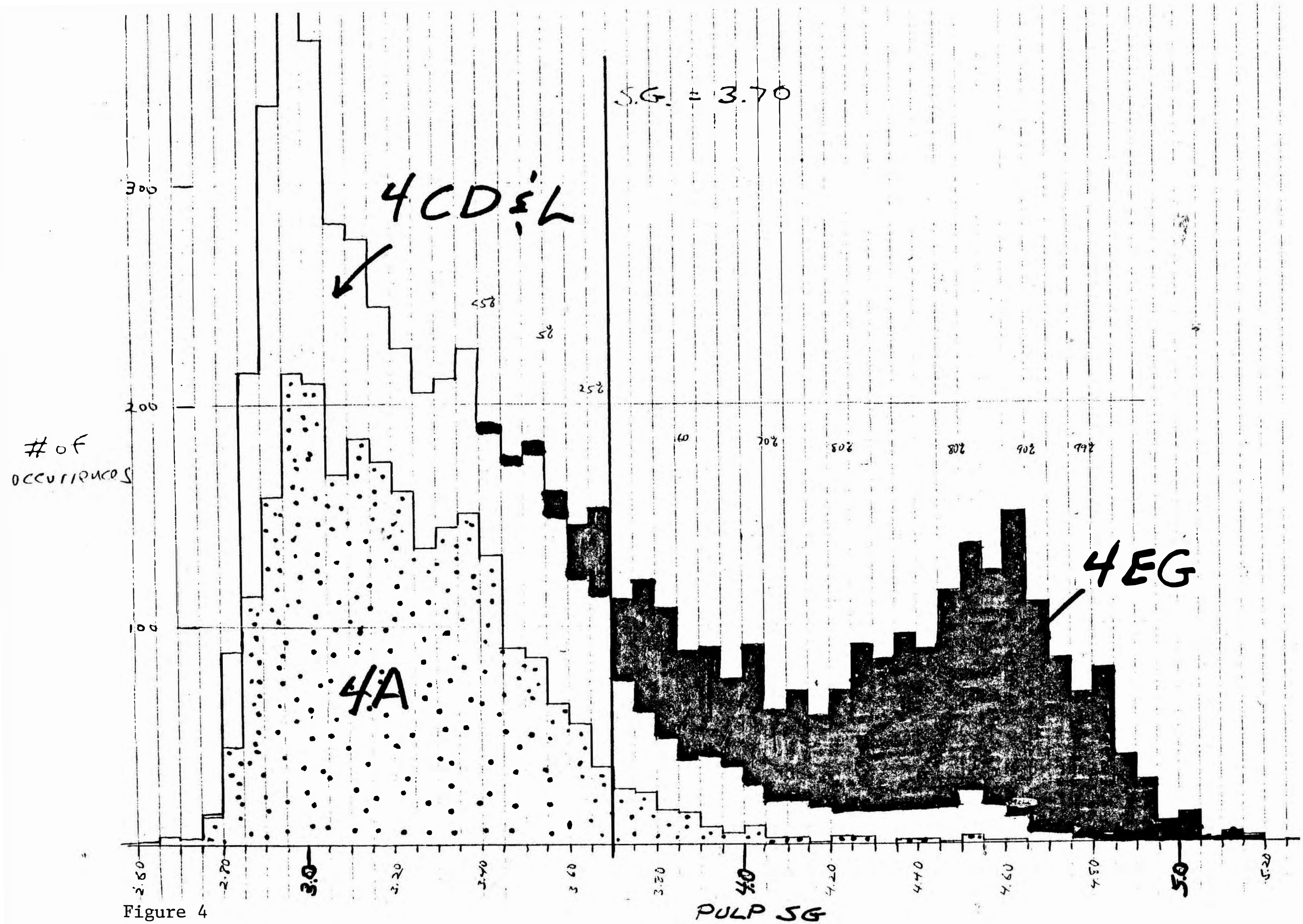


Figure 4

A histogram of pulp S.G. for samples of Grum ore. Based on the number of samples in the Grum database. The bimodal nature of the distribution is due to the massive (4EG) and quartzose (4ACDL) ore type subpopulations. As figure 5 indicates there is a fairly strong differentiation of grade with ore type thus a crude separation of Grum ore types and grade could possibly be made by dense media or other density driven separation.

Figure 5

Histograms of the Pb+Zn content of Grum ore types based on the number of samples in the Grum database. There is a fairly strong tendency for the more massive ore types to be higher grade. As the cutoff grade rises the proportion of quartzose ores falls.

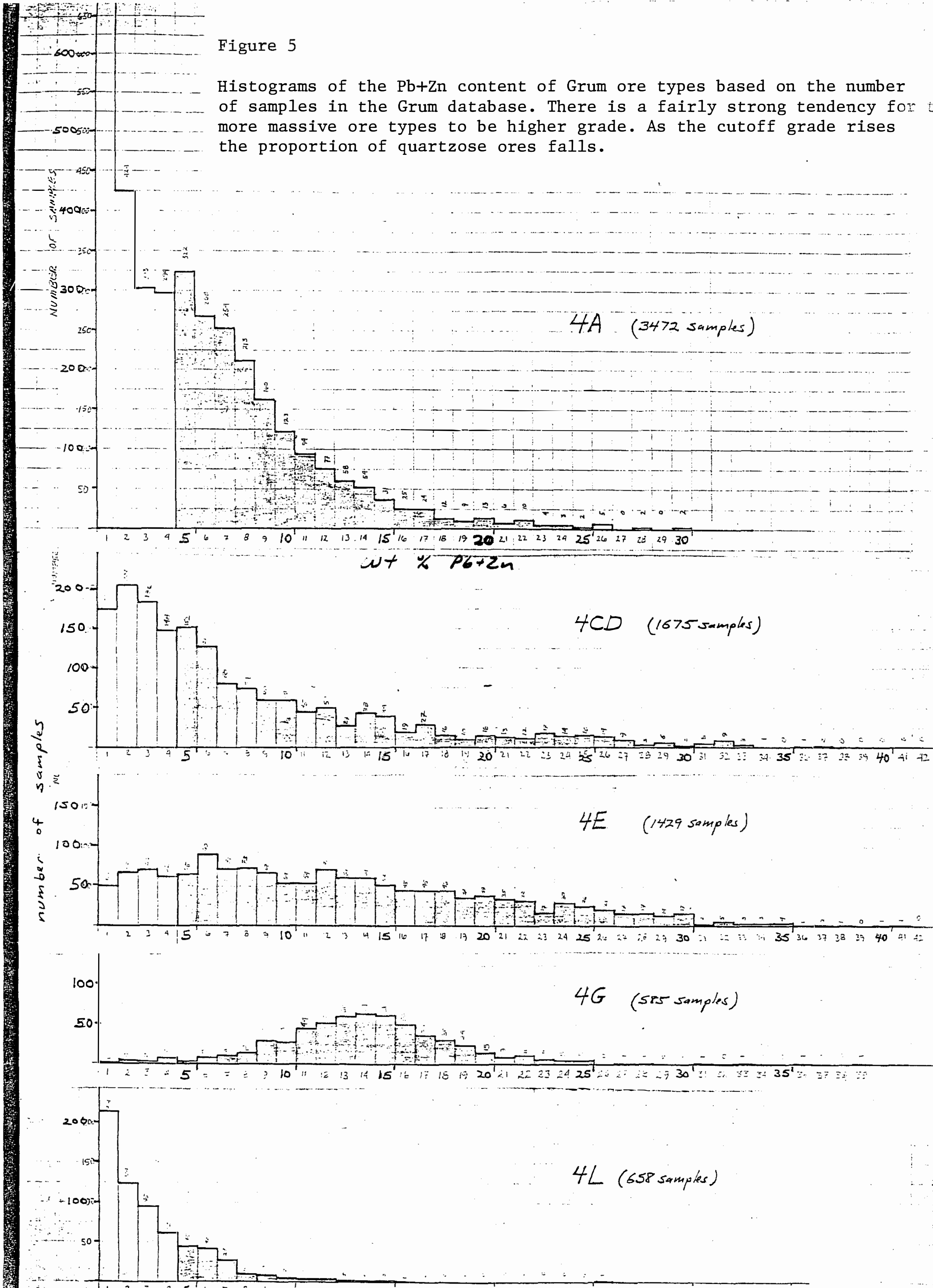


TABLE I

Comparison of Grum and Faro deposit average grades using the most comparable data available

Sectional hand calculated grades at a 4% Pb+Zn cutoff, no dilution

Open pit mineable mineralization:

		Pb (%)	Zn (%)	Ag (g/t)	Pb+Zn	
	FARO Zone 3 (Dome)	3.2	4.9	41	8.1	***
*	GRUM Olk Pit (CAMC)	3.4	5.9	59	9.3	***
		Grum is 6 % higher	Grum is 20 % higher	Grum is 44 % higher		

Sectional hand calculated grades at 4% cutoff, no dilution

All mineralization:

	FARO Zone 3 (Dome)	3.1	5	41	8.1
*	GRUM (CAMC/Dome)	3.5	5.7	59	9.2
**	GRUM (Kerr-Addison)	4.1	6.4	62	10.5

* CAMC and CAMC/Dome calculations of Grum use a loose interpretation of cutoff grade that tends to lower the average grade. The methodology of the Kerr-Addison Grum and the Dome Faro calculations are actually closer.

** Does not include some large volumes of low grade ore defined by CAMC in 1982, see Table III

*** If Faro is diluted by 5% and Grum by 15%, the diluted Pb+Zn grades are:

Faro= 7.69 Grum= 7.91

TABLE II

GRUM DEPOSIT
summary of some comparable reserve estimates

	tonnes	Pb %	Zn %	Ag g/t	strip ratio cu. m./t	Pb + Zn	contained metal tonnes	vaviance from average
Open Pits at 4% Pb + Zn cutoff (62W - 86W)								
Olk Pit 1983 hand calculation	17055000	3.4	5.9	59	2.91	9.3	1586115	13.8
Kerr Addison - Noranda computer model	15583000	3.1	5.0	47	2.9	8.1	1262223	-9.4
Cyprus Anvil G1 computer model grade reduced by 6%	16875000	3.0	4.9	47	2.72	7.9	1333125	-4.4
(no grade reduction)		(3.25)	(5.25)	(49.9)		(8.50)		
						average =	1393821	
Geological Reserves at 4% Pb + Zn cutoff (62W - 86W)								
Kerr Addison hand calculation	26083000	4.1	6.4	62		10.5	2738715	5.2
Kerr Addison - Noranda computer	27650000	3.1	4.9	48		8.0	2212000	-15.0
Cyprus Anvil G1 computer model	30781000	3.1	4.9	49		8.0	2462480	-5.4
Cyprus Anvil/Dome hand calculation *	32611000	3.5	5.7	59		9.2	3000212	15.2
						average =	2603351	
High grade Reserves - Underground - 8 % Pb + Zn cutoff								
Kerr Addison hand calculation	15784000	5.2	8.3	78		13.5	2130840	
Cyprus Anvil hand calculation**	10960000	4.5	7.8	78		12.3	1348080	

notes:
- * includes about 3500000 tonnes drilled off in 1982 after other calculations were done
- ** more selective choice of ore panels than Kerr Addison
- *** too low due to having left an area near Doal Lake out

TABLE III

COMPARISON OF KERR ADDISON AND CYPRUS ANVIL HAND CALCULATED RESERVES FOR THE GRUM DEPOSIT
WITH 1982 DRILLING RESULTS IN THE AREA OF THE "GNOMES CAP" REMOVED

CYPRUS ANVIL RESULTS

SECTION	Pb (%)	Zn (%)	Ag (g/t)	Pb+Zn (%)	tonnes	total metal (tonnes)
+4 %						
62W	3.32	5.66	63	8.98	632340	56784
64W	3.84	5.75	62	9.59	1028545	98637
66W	4.41	5.95	71	10.36	1613702	167180
68W	4.54	6.88	73	11.42	1440349	164488
70W	4.06	6.62	68	10.68	2425119	259003
72W	3.80	6.11	65	9.91	2389111	236761
74W	3.66	5.97	61	9.63	3237299	311752
76W	3.61	6.06	62	9.67	3006734	290751
78W	3.51	6.18	62	9.69	2800662	271384
80W	3.46	5.53	58	8.99	3138505	282152
82W	3.21	5.29	55	8.50	2780499	236342
84W	3.02	4.92	50	7.94	1942527	154237
86W	3.17	5.37	52	8.54	2672070	228195
totals	3.62	5.86	61	9.47	29107462	2757665

PERCENT VARIANCE ((CA - KA) / CA)

SECTION	total metal	tonnes	Pb	Zn	Ag	Pb + Zn
62W	-10.4	.3	-18.8	-6.2	12.3	-10.8
64W	-30.9	-13.2	-13.0	-17.2	-7.9	-15.6
66W	6.4	14.6	-9.0	-10.1	5.6	-9.6
68W	-15.4	-20.6	-.2	7.3	.5	4.3
70W	-5.0	8.2	-17.5	-12.5	1.5	-14.4
72W	.8	6.9	-7.9	-5.7	3.1	-6.6
74W	3.9	14.2	-13.4	-11.1	-8.2	-11.9
76W	3.0	9.1	-13.0	-3.0	1.6	-6.7
78W	-10.1	-4.2	-8.0	-4.4	19.4	-5.7
80W	-1.0	3.2	-6.1	-3.3	3.4	-4.3
82W	-5.0	21.4	-26.5	-38.0	-24.7	-33.6
84W	20.4	29.2	-10.3	-13.8	-6.0	-12.5
86W	30.9	37.2	-13.2	-8.0	-5.8	-10.0
totals	.7	10.4	-12.6	-9.9	-.9	-10.9

KERR ADDISON RESULTS

SECTION	total metal (tonnes)	tonnes	Pb+Zn (%)	Pb (%)	Zn (%)	Ag (g/t)
62W	62718	630266	9.95	3.94	6.01	55
64W	129078	1164762	11.08	4.34	6.74	67
66W	156510	1377821	11.36	4.81	6.55	67
68W	189785	1736341	10.93	4.55	6.38	73
70W	272077	2226492	12.22	4.77	7.45	67
72W	234825	2223718	10.56	4.10	6.46	63
74W	299517	2778449	10.78	4.15	6.63	66
76W	282026	2732810	10.32	4.08	6.24	61
78W	298854	2918497	10.24	3.79	6.45	50
80W	285093	3039373	9.38	3.67	5.71	56
82W	248267	2185447	11.36	4.06	7.30	69
84W	122798	1375120	8.93	3.33	5.60	53
86W	157634	1678746	9.39	3.59	5.80	55
totals	2739181	26067842	10.51	4.07	6.43	61

the cost of outside computer agencies this model was not finished. Now that the Mintec system will be in house, we propose to finish this model. This will provide geologic reserve and mine planning data for Grum that will be comparable to the Faro F-3 model. This model is only considered good enough for peliminary planning and evaluation, a totally new model is planned based on geological reinterpretation currently in progress. this model would be the basis of detailed mine planning.

Other block models that have been made are not adequate for one reason or another. The Kerr-Addison-Noranda model uses only part of the available drill control, old and erroneous (in part) assays and out of date geologic interpretations and ore typing. The interim Cyprus Anvil model (G-1) uses the same geological interpretation but new assay data, incorporates more recent drill control (but still not complete to 1982) and corrected survey data. As with the Noranda model the blocks used in this model were subdivided into smaller sub-blocks (5m.x5.x9m. high) for improved geological detail; unfortunately the sub-division was perpendicular to the deposit trend and results in no substantial improvement. Only the G-2 model will have sufficient geologic control input to allow a reasonable interpolation of grade.

There is considerable background geotechnical information available for the Grum deposit. During the analysis of the orientation of the clevage at Grum an assumption was made that appears to have exaggerated the dip in at least part of the proposed open pit. The impact of these assumptions will have to be examined in some detail since lower clevage dips may bring the overall dip into the range where steeper pit walls may be reasonable. During ongoing reinterpretation of the structure of Grum the impact of this assumption will be examined and alternatives will be put forward. De-watering of overbruden and the major faults will be needed at Grum.

The Grum deposit is open in most directions. To the northwest (down fold plunge) there is potential for addition of 5-10 x 10^6 tonnes of underground reserves. The Champ zone at the southeast end of the deposit requires further definition in order to be considered proven reserves. Mining this low grade zone could impact the economics of the rest of the Grum favorably because of it's topographic setting.

There are currently two activities involving Grum being carried out at the Vancouver office. The first is completion of the G-2 model.

The schedule for this is dependent essentially on the installation of Mintec's system. The data is edited and ready for entry now. Geologic reserves could be ready by the end of August.

The second activity is a detailed reinterpretation of the geometry of the deposit. Both cross and long sections are being generated. This is the only Cyprus Anvil interpretation that has involved longitudinal sections and what has been learned of the deposit thus far proves long sections are essential. The most recent estimate of a completion date for this effort was August 1986, but since that estimate was made, considerable time has been spent on the G-2 model and one of the two geologists has resigned. Thus, with the available personnel, the end of 1986 would be the earliest possible completion date. Successful mining at Grum will require careful attention to the geology and geometry of the deposit, this detailed interpretation is considered an essential first step in getting the geological data for Grum in order to provide a foundation for later work.

Vangorda

Vangorda is a much smaller deposit than Grum and overall is much lower grade. Within the overall deposit there is a lens of high grade baritic massive sulphides that is very shallow and covered mainly by glacial till rather than bedrock. Within this lens there is at least 1.5 to 2.0 Mt of ore at about 11.5% Pb+Zn. Extraction of this high grade ore at an early date could have significant impact on overall cash flow and must be seriously considered.

Several hand calculations based on Prospector Airways/Kerr-Addison drill results also show that the deposit can be best veiwed as a shallow, higher grade deposit with a low stripping ratio rather than a larger tonnage, lower grade deposit, (Table IV).

There is a computer based block model available for the northwest part of Vangorda. It is based on bench plan geology and uses 12m.x12mx6m. high blocks with composites based on benches rather than geology. This model uses no geologic control to guide the interpolation of grade thus like the G-1 model, will tend to assign unreasonable grades to some blocks. Since rock codes have been loaded into the model it could be revised to use geologic control interpolation. This would take about a month and would be finished in about the same time frame as the Grum model.

TABLE IV

Comparison of some open pit reserve figures for the Vangorda deposit to illustrate the result of deeper versus shallower pits.

	Tonnes x 1000	Pb (%)	Zn (%)	Ag (g/t)	Cu (%)	Au (g/t)	strip ratio t/t
CYPRUS ANVIL OPEN PIT 4% Pb+Zn cutoff 2W-14E Mintec block model Tonnage and grade reduced by 5% 14E-18E Sectional hand calculation grade reduced by 5%							
	5189	3.4	4.2	47			approx 4.7
2W-18E recalculated to original results							
	5415	3.6	4.4	50		.78	approx 4.7
GECO OPEN PIT 4% Pb+Zn cutoff 0E-24E Sectional hand calculation, no dilution							
	5076	3.26	5.34	60.8	.28	.89	3.22
ROSWELL-WILTON OPEN PIT 4% Pb+Zn cutoff 0E-26E Sectional hand calculation, no dilution							
	3060	3.64	6.42	68.6	.21		1.21

A section based hand calculation is currently being done in Calgary using the most current and reliable data. Previous Cyprus Anvil reserve estimates have focused on parts of the deposit, this will be the only recent global estimate.

If the Vangorda deposit is viewed as a small high grade deposit then more drill holes will be required in a few areas to better define reserves and reduce risk. At least 5 short holes are called for. There are several areas around Vangorda where there is still exploration potential based on recent structural analyses.

Dy

The Dy deposit is a very deeply buried deposit at the extreme southeast edge of the Vangorda Plateau. Dy is one of the largest deposits in the Anvil Range, but has only 57 drill holes defining it. Considering the size of the target, Dy should be thought of as 2-3 times the problem of Grum. Consequently, Dy is many years and many millions of dollars behind the Grum in terms of its stage of development.

The current reserve figures for Dy are based on a polygonal calculation derived from a simple yet conservative geologic interpretation. These reserves should not be considered proven.

Geologically the Dy is very similar to Grum or Vangorda. Massive sulphides appear to comprise a larger percentage of the mineralization at Dy but the deposit grades are comparable (Table V).

TABLE V

Comparison of the GRUM and DY high grade zones

12% Pb+Zn cutoff

	tonnes x 1000	Pb %	Zn %	Ag %
DY	11630	6.74	8.00	100
GRUM (KA)	9249	5.94	9.88	89

9% Pb+Zn cutoff

DY	21334	5.68	6.95	82
GRUM (KA)				
+10%	12775	5.48	8.97	83
+8%	15768	5.20	8.32	78

notes:

Dy is at a 3.5m. minimun width

Dy results from: Hall(1982) Dy Deposit-Ore Reserve Calculations, Appendix III in Review of 1981 Fieldwork for Pelly River Mines

Grum results from: Sirola (1977) Grum Joint Venture - Mineral Inventory (recalculated to include both AEX and Vangorda Mines ground)

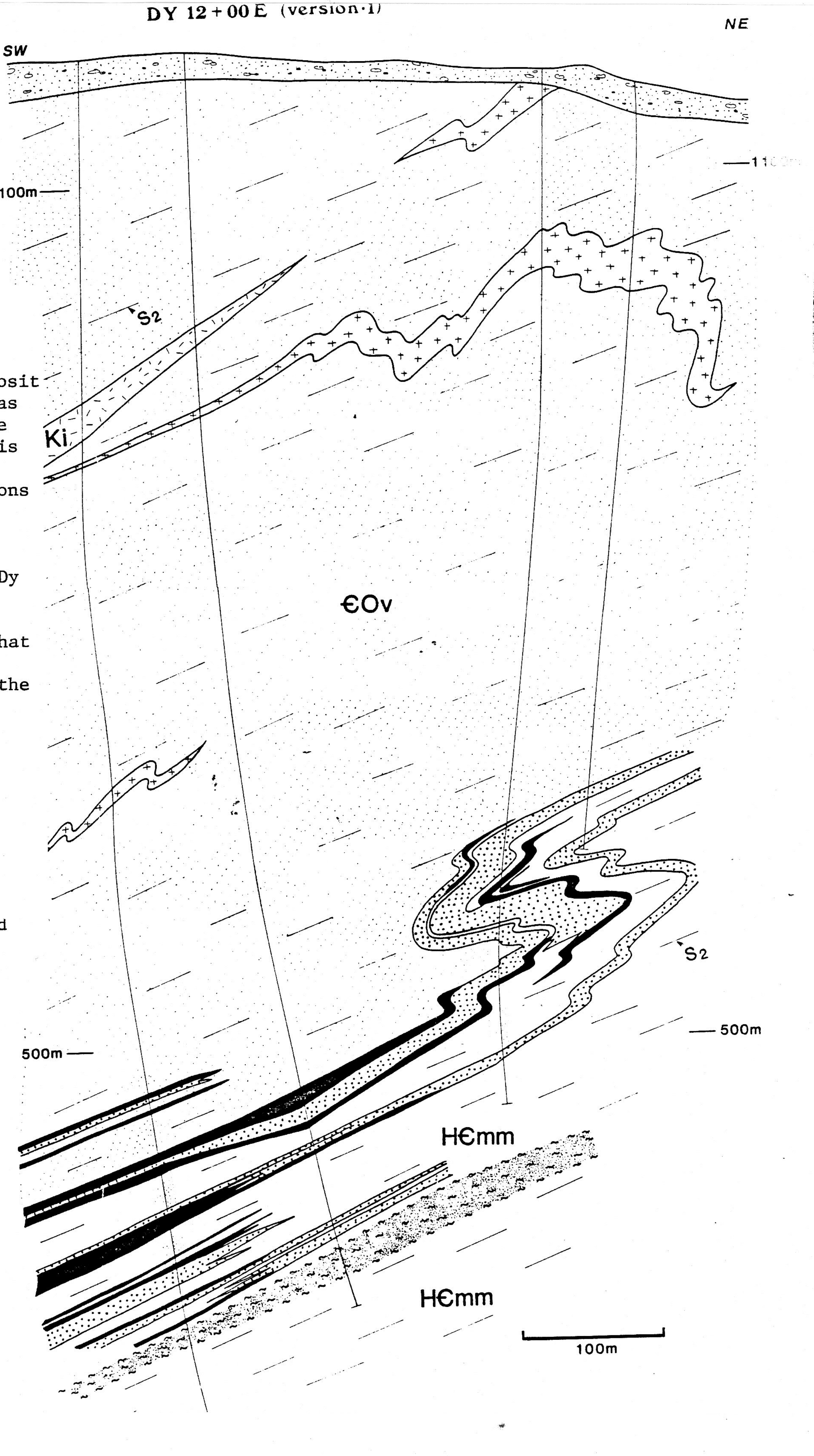


Figure 6

Schematic section through the DY deposit at the same scale as the sections of the other deposits. This is not one of the best drilled sections of the deposit but it illustrates the relative paucity of information at Dy and the difficulty of obtaining more. It is not likely that this is a faithful representation of the structure of the deposit but the gross correlations are reasonable. The shear zone at the base of the deposit is a fault like that at Grum (fig 2a). This is essentially the interpretetion used in the ore reserve calculation.