ORE COMPARISON

BETWEEN MINE MODEL AND BLAST HOLES

FOR THE FIVE UPPER BENCHES

OF THE SMALL FARO DEPOSIT (ZONE 2)

003136

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION:

Since mining started in January, 1980 in Zone 2, numerous discrepancies have been encountered between the Mine Model estimation and the ore distribution established from the blast hole assays. These differences were found in tonnage and grade estimations, but mainly in the ore distribution: Ore/waste contact location has been poorly defined in the Model on the North side of the deposit and this was mainly responsible for not establishing optimum pit limits there.

2.0 PURPOSE:

The purpose of this report is to document, illustrate and summarize the data collected during seven months of mining in the Small Faro Deposit and to try to find an explanation for such differences.

It is hoped that the Zone 2 experience will be used for further evaluation of similar deposits.

3.0 TONNAGE AND GRADE COMPARISONS FOR THE FIVE UPPER BENCHES IN ZONE 2:

Table 1 shows comparisons between tonnages and grades estimated by the Mine Model, the blast holes, and tonnages and grades crushed in the mill.

The tonnage from the Mine Model has been re-evaluated by using a 2.8 overall tonnage factor (TF) (see Appendix 1 - P. Clarke/F. Gay memo). No tonnage adjustment factor was applied.

3.1 Comments on Table 1:

3.1.1 Tonnages and Grades in Model and Blastholes:

As we can see, with a 2.8 tonnage factor, overall tonnages compare very well between Model and blast hole estimations; so does the lead content. Zinc grade shown by the Model is higher than the grade estimated by the blast hole assays and is also higher than the grade obtained in the crusher feed. It appears that the zinc grade has been over-estimated by the Model and this over-estimation is constant through the benches.

TABLE 1

BENCH	BLAST HOLES TF: 2.8				MINE MODEL** TF: 2.8				MONTHLY METALLURGICAL BALANCE					VARIANCES
	000's SDT	Pb %	Zn %	g/mt Ag	000's SDT	Pb	Zn	g/mt Ag	Month	000's SDT	Pb	Zn	g/mt Ag	
									January	229	3.0	4.4	N/A	
3890	273	3.2	4.0		197	2.5	4.6	44.7	February	284	3.2	4.1	48.3	
3870	241	2.9	3.9		268	2.4	4.7	48.1	March	281	2.7	4.4	44.5	
3850*	393	2.7	4.2	49.8	288	2.7	4.6	41.4	April	279	3.8	4.6	53.4	
3830	527	3.0	4.5	46.2	606	3.0	4.4	42.8	May	225	2.9	4.1	42.3	
Sub-Total	1,434	2.9	4.2		1,358	2.8	4.5	43.9	June	253	3.7	5.3	46.8	
3810***	757	3.0	4.4	46.6	778	3.2	4.9	47.6	July	249	3.0	4.6	41.4	
TOTAL	2,191	2.9	4.3		2,136	2.9	4.6	45.3	Up to August 11	111	3.1	5.0	46.0	
									Sub-Total	1,911	3.2	4.5	46.1	
									+ Stockpile	41	3.1	4.8		
									+ Oxi.	108	3.2	3.8		
									+ 3810-J2	20	2.7	4.8		
TOTAL	2,191	2.9	4.3		2,136	2.9	4.6	45.3	TOTAL	2,080	3.2	4.5		

VARIANCES:				
	Blast Holes vs. Model	Tons - +3%	Pb - 0	Zn - -7%
	Met Balance vs. Blast Holes	Tons - -5%	Pb - +10%	Zn - +4%
	Met Balance vs. Model	Tons - -3%	Pb - +10%	Zn - -2%

** Grade is down-graded by 5% for Pb, Zn and Ag.

*** 108,000 SDT (Pb - 3.2, Zn - 3.8) out of 757,000 from 3810 will be stockpiled and will not appear in the met balance.

As of August 11, 41,000 SDT (Pb - 3.1, Zn - 4.8) in stockpile. 20,000 SDT left J2 (Pb - 2.7, Zn - 4.8).

* 13,000 T of 3850-K2 are in the stockpile but included in 3850 tonnage.

3.1.2 Tonnage and Grades Milled:

The tonnage milled and stockpiled is lower than that estimated by the blast holes, but the grade is higher. This is probably related to the way mining was conducted: Less ore but with a higher grade has been hauled to the crusher. Probably some marginal ore has been sent to the dump instead of the crusher.

The lead grade of the mill feed is about 10% higher than what was predicted and this could also be related to a kind of selective mining.

Overall, the grades and tonnages compare well between Model blast holes and metallurgical balance. The only problem is the zinc over-prediction.

Note: The Model, with adjustment factors applied, attempts to predict mill feed, not blast holes as such.

4.0 ORE LIMITS, DIAMOND DRILL HOLES AND BLAST HOLE GRADE COMPARISONS:

4.1 Location of the Ore Boundary on the North:

Since mining started in Zone 2, and for the five benches already mined out, the North boundary of the ore has been found consistently different from what was predicted by the Mine Model.

The ore/waste contact defined by the blast hole assays on the North is consistently south (up to 150 feet) of the contact predicted by the Model (see attached Figures 3, 4, 5, 6 and 7). This is particularly evident for the North central part of the deposit.

However, the Southern boundary of the ore outlined by blast holes is comparable to the ore predicted by the Model for the lower benches.

In order to explain the discrepancies between the Model and what was found in the mine, the following data were reviewed:

- Surveying (drill hole location and elevation)
- Core recoveries
- Grade estimation per hole and per bench

4.1.1 Surveying:

Most of the surveying can be considered as being correct, but nothing can be verified since the original topography does not exist. Therefore, it will be impossible to consider the influence of surveying errors in the major discrepancies.

TABLE 2

GRADE COMPARISON BETWEEN DIAMOND DRILL HOLES AND BLAST HOLES

Hole Number	Benches Involved	Footage** in the Model	Grades Estimated by the Model Per Bench (20 Feet)			Grades Established From Blast Holes*		Core Recovery For 20'	Variances Blast Hole vs. DDH	
			Pb	Zn	Ag	Pb	Zn		Pb	Zn
67-22	3890	*20	1.7	3.3	-	W	W	38%	-	-
	3870	*20	1.3	2.6	-	W	W	62%	-	-
78-10	3890	20	2.5	5.0	28.4	1.1	1.5	30%	-56%	-70%
	3870	20	2.5	5.0	28.4	Waste	Waste	64%	-88%	-88%
67-13	3850	*20	3.4	5.5	54.22	1.6	1.7		-53%	-70%
	3830	* 4	1.2	2.4	22.00	W	W		-90%	-90%
78-09	3850	20	2.9	5.1	40.65	Waste	Waste		-90%	-90%
73-18	3830	*14.4	2.5	3.9	42.3	1.2	1.9	70%	-52%	-51%
73-06	3830	* 8.1	4.4	5.2	60.67 }#			60%		
	3810	*20	3.5	4.5	52.78 }			100%		
78-07	3810		3.1	5.7	30.75	0.7	1.03		-17%	-82%
67-18	3810	*20	2.6	6.3	46.8	1.5	2.7	80%	-42%	-57%
73-26	3810	*12	3.14	5.6	48.8	1.6	1.7		-49%	-70%

* Grades established by using the blast hole grades in a 30 to 50 foot radius.

See attached sketch.

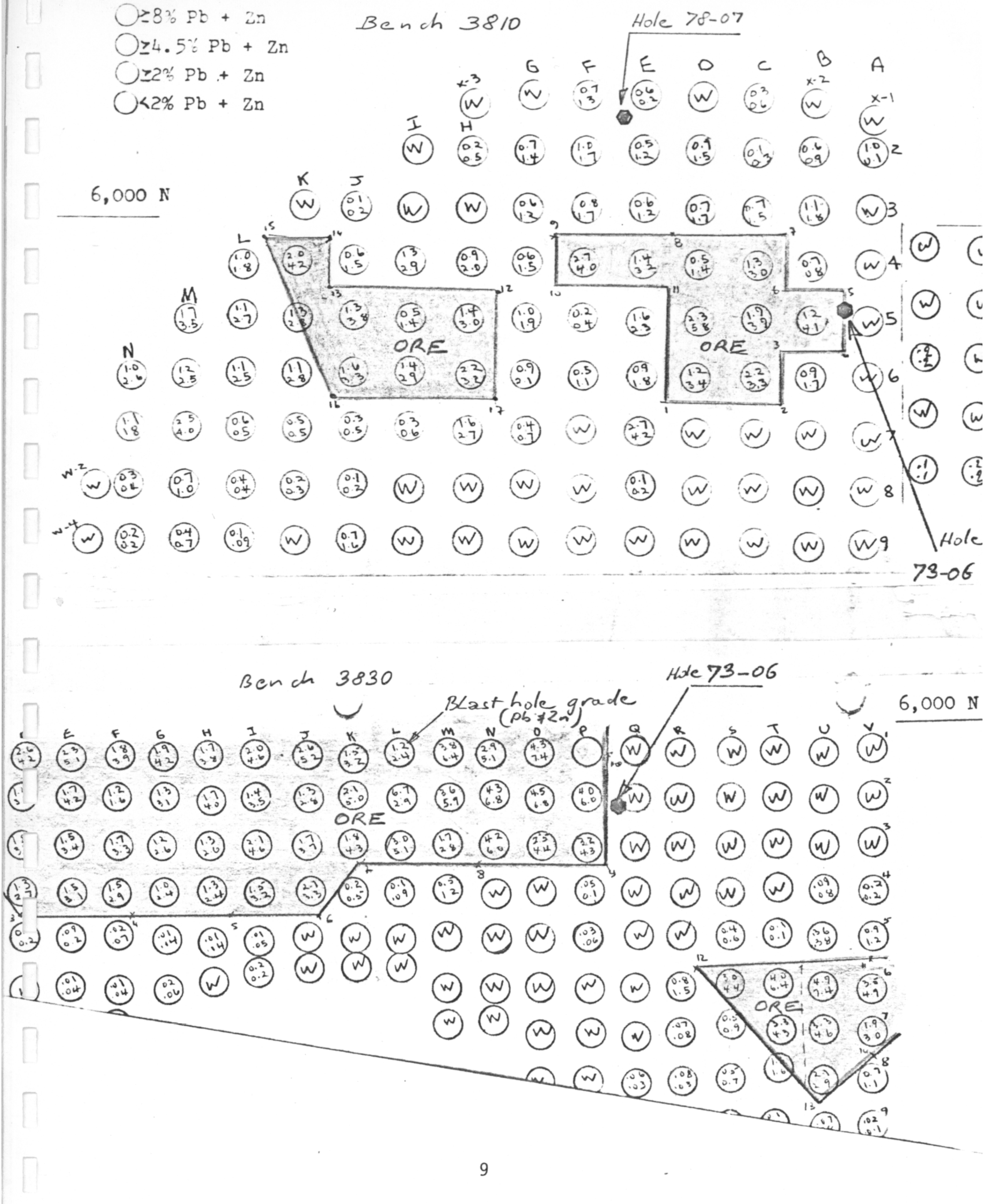
4.1.2 Grade Estimations Per Hole and Per Bench:

Table 2 shows comparisons between blast holes and Mine Model grades for the same area, and holes selected present major discrepancies. Some of the differences are related to bad core recovery but others are not.

Other holes, like 78-07, 73-06 and 67-13 (see Figure 1 and 2) are located near the edge of an ore zone and in those cases mineralization extended in only one direction, but was interpreted to extend in several.

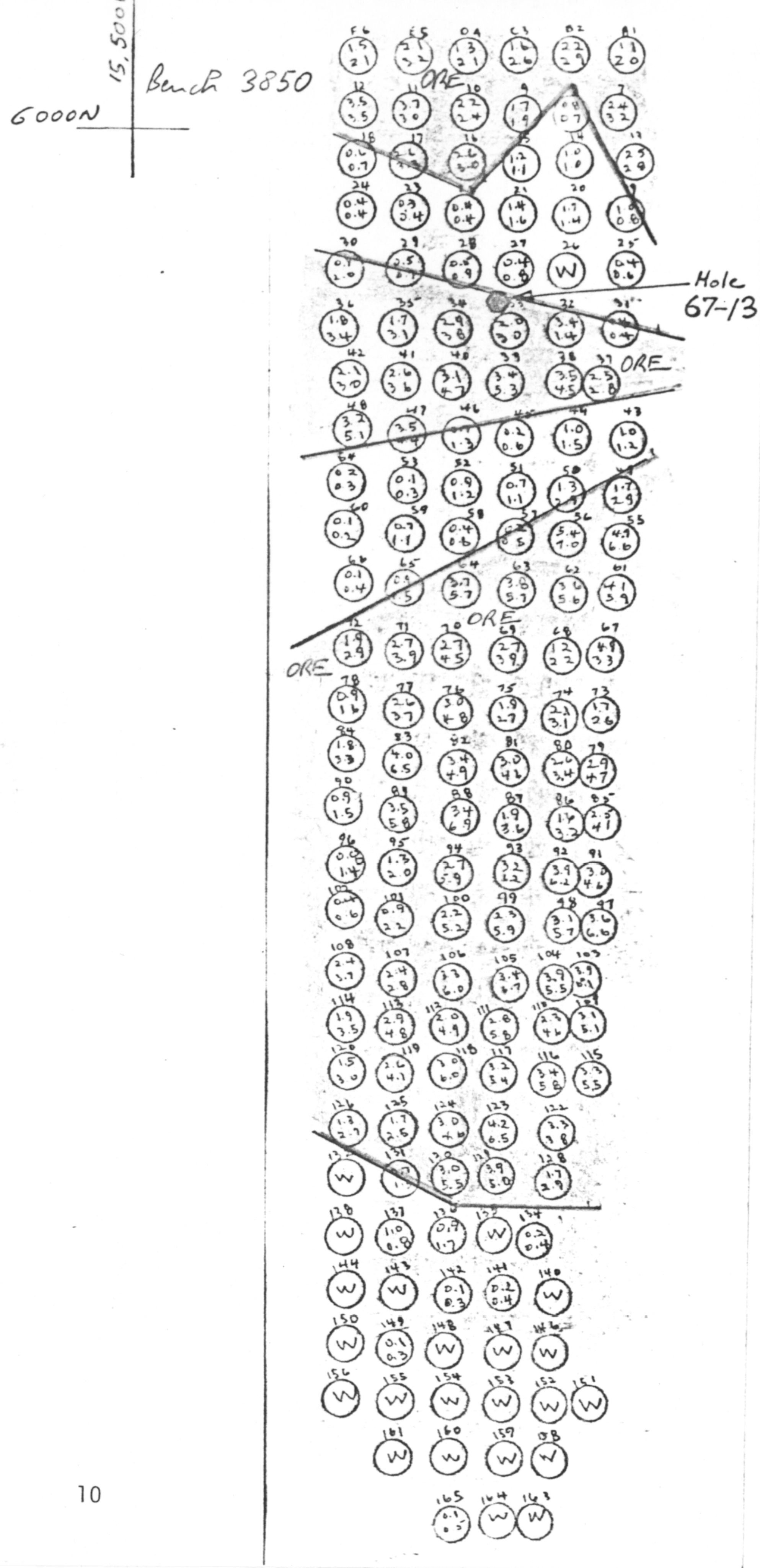
Hole 73-06 illustrates very well the situation: It is just located on the Southeast edge of the North ore zone and a low grade band has been consistently found for three benches on the Southeast side of the hole (see Figure 5, 6 and 7), but this could not be predicted because no other holes picked up this low grade zone and the grade was assumed to be relatively constant within the drilling pattern.

Such cases are extreme, but a few examples like this in one deposit of the size of Zone 2 would change significantly the grade and the tonnage evaluations.


≥8% Pb + Zn
≥4.5% Pb + Zn
≥2% Pb + Zn
<2% Pb + Zn
Bench 3810
Hole 78-07
6,000 N
ORE
ORE
Hole
73-06
Bench 3830
Hole 73-06
Blast hole grade
(Pb + Zn)
6,000 N
ORE
ORE

6,000 N

Figure 2



5.0 MINE MODEL AND BLAST HOLE ORE DISTRIBUTION PER BENCH (SEE FIGURES 3, 4, 5, 6 AND 7:

5.1 Bench 3890, Figure 3:

This bench shows the most significant discrepancy between Mine Model and blast hole ore interpretations, especially between 15,500 E and 16,000 E: Ore limits outlined by blast hole assays are more than 150 feet South of what was predicted. This could be related to a bad recovery in holes 78-10, 73-19 and 67-22 for the upper part of the sulfides.

However, the Northwest ore zone is similar to what was predicted.

5.2 Bench 3870, Figure 4:

As for 3890 bench, the North boundary of the ore is not properly defined by the Model and certain ore blocks from the Model were not found by blast hole drilling.

Section 131: Secondary structure was not picked up between holes 79-19 and 73-06 and also the ore intersected by hole 78-10 was marginal and too diluted with low grade ore.

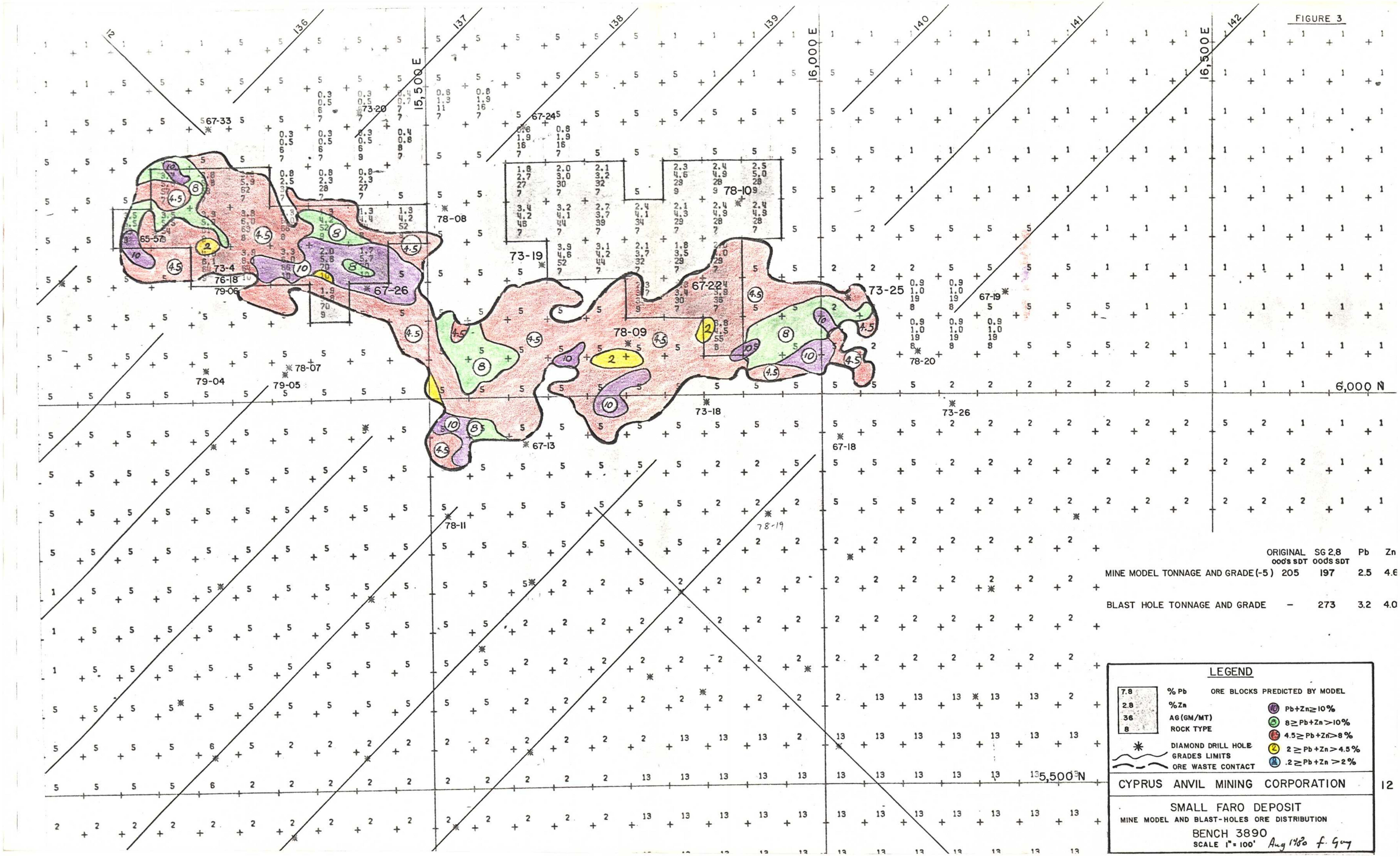
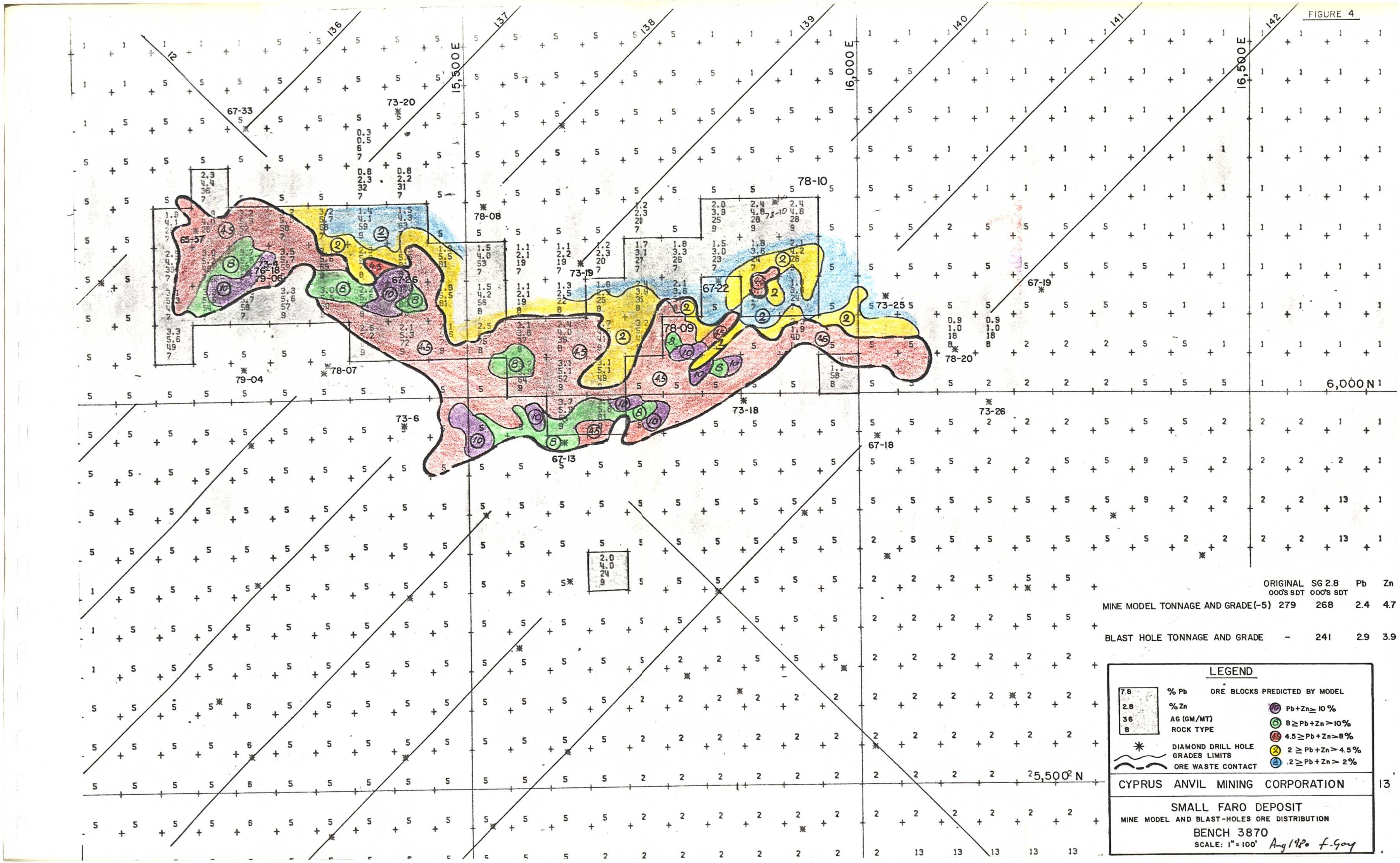


FIGURE 3
15,500 E
16,000 E
16,500 E
6,000 N
5,500 N
67-33
73-20
67-24
78-10
78-08
73-19
65-57
73-4
76-18
79-06
67-26
67-22
73-25
67-19
78-09
78-07
79-04
79-05
78-20
73-18
73-26
67-13
67-18
78-11
78-19
ORIGINAL 000's SDT
SG 2.8 000's SDT
Pb
Zn
MINE MODEL TONNAGE AND GRADE (-5) 205 197 2.5 4.6
BLAST HOLE TONNAGE AND GRADE – 273 3.2 4.0
LEGEND
% Pb
% Zn
AG (GM/MT)
ROCK TYPE
ORE BLOCKS PREDICTED BY MODEL
Pb+Zn≥10%
8≥Pb+Zn>10%
4.5≥Pb+Zn>8%
2≥Pb+Zn>4.5%
.2≥Pb+Zn>2%
DIAMOND DRILL HOLE
GRADES LIMITS
ORE WASTE CONTACT
CYPRUS ANVIL MINING CORPORATION
12
SMALL FARO DEPOSIT
MINE MODEL AND BLAST-HOLES ORE DISTRIBUTION
BENCH 3890
SCALE 1" = 100'
Aug 1980 f. Guy

FIGURE 4



	ORIGINAL 000's SDT	SG 2.8 000's SDT	Pb	Zn
MINE MODEL TONNAGE AND GRADE (-5)	279	268	2.4	4.7
BLAST HOLE TONNAGE AND GRADE	-	241	2.9	3.9

CYPRUS ANVIL MINING CORPORATION

SMALL FARO DEPOSIT

MINE MODEL AND BLAST-HOLES ORE DISTRIBUTION

BENCH 3870

SCALE: 1" = 100'

Aug 1980 f. Gay

5.3 Bench 3850, Figure 5:

The boundaries of the ore have been poorly defined by the Model and several explanations can be brought up:

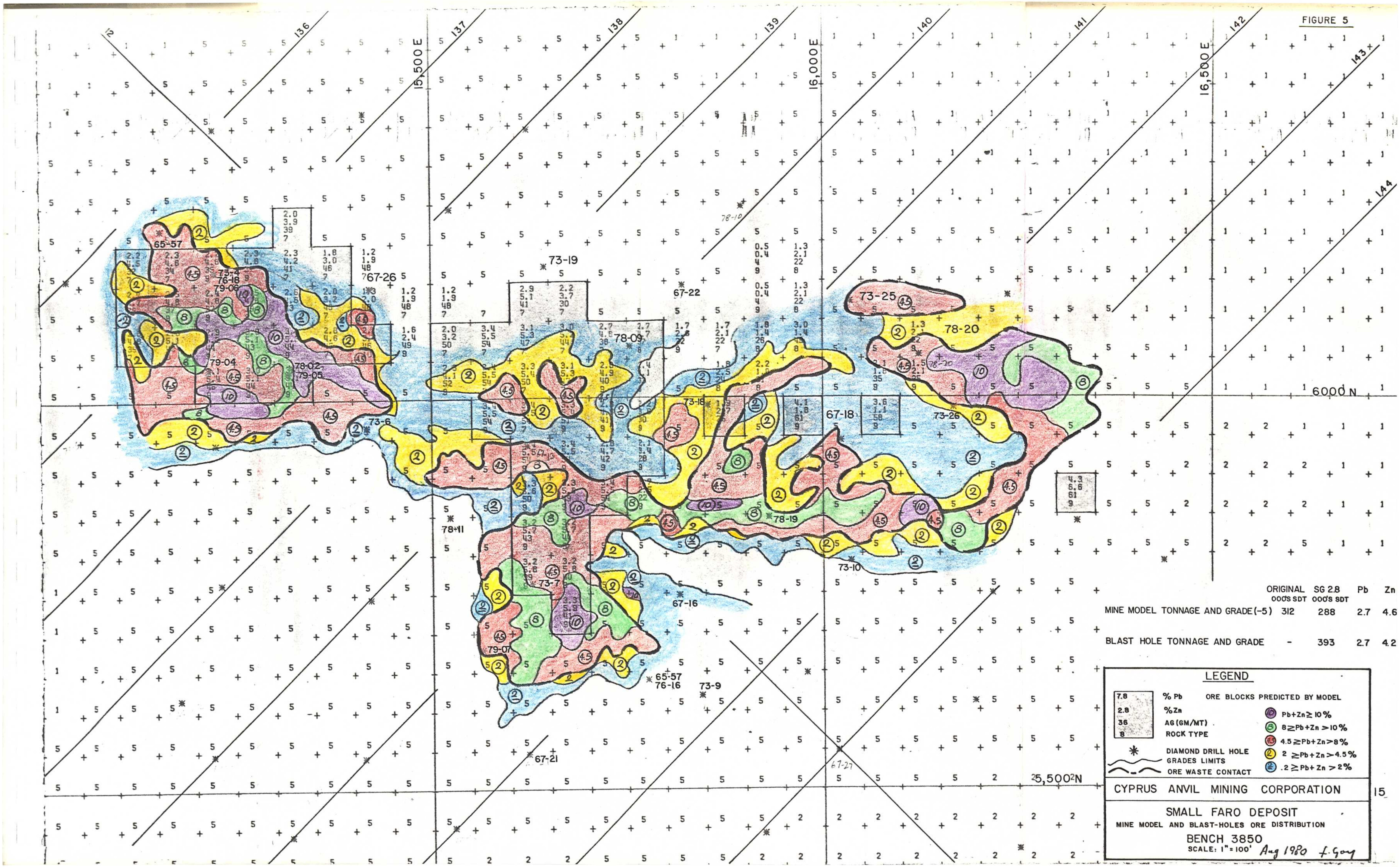
Secondary structures have not been picked up between 78-07 and 67-26 holes and between 73-19 and 73-06 holes. Also, there is a big (not drilled) gap (300') between 73-19 and 73-06 and a minor change in the structure can significantly affect the ore/waste contact of the bench.

A significant amount of unexpected ore was found (over 100,000 SDT) by blast hole drilling on the Northeast side of the bench. Figure 5 shows that this ore has been intersected by only one hole (78-20) and most of the mineralized zone occurs in between holes.

It is also very clear on Figure 5 that on the Eastern part of the bench the ore occurs very sporadically in narrow bands and this type of ore distribution is not easy to pick up with the diamond drilling pattern used in Zone 2.

5.4 Benches 3830 and 3810, Figures 6 and 7:

The same comments made for the upper benches would apply for 3830 and 3810: The North ore boundaries are not well defined by the Model and ore was found where it was not predicted. This can be explained by local variation in the structures and/or changes not intersected by diamond drilling.



	ORIGINAL 000'S SDT	SG 2.8 000'S SDT	Pb	Zn
MINE MODEL TONNAGE AND GRADE (-5)	312	288	2.7	4.6
BLAST HOLE TONNAGE AND GRADE	-	393	2.7	4.2

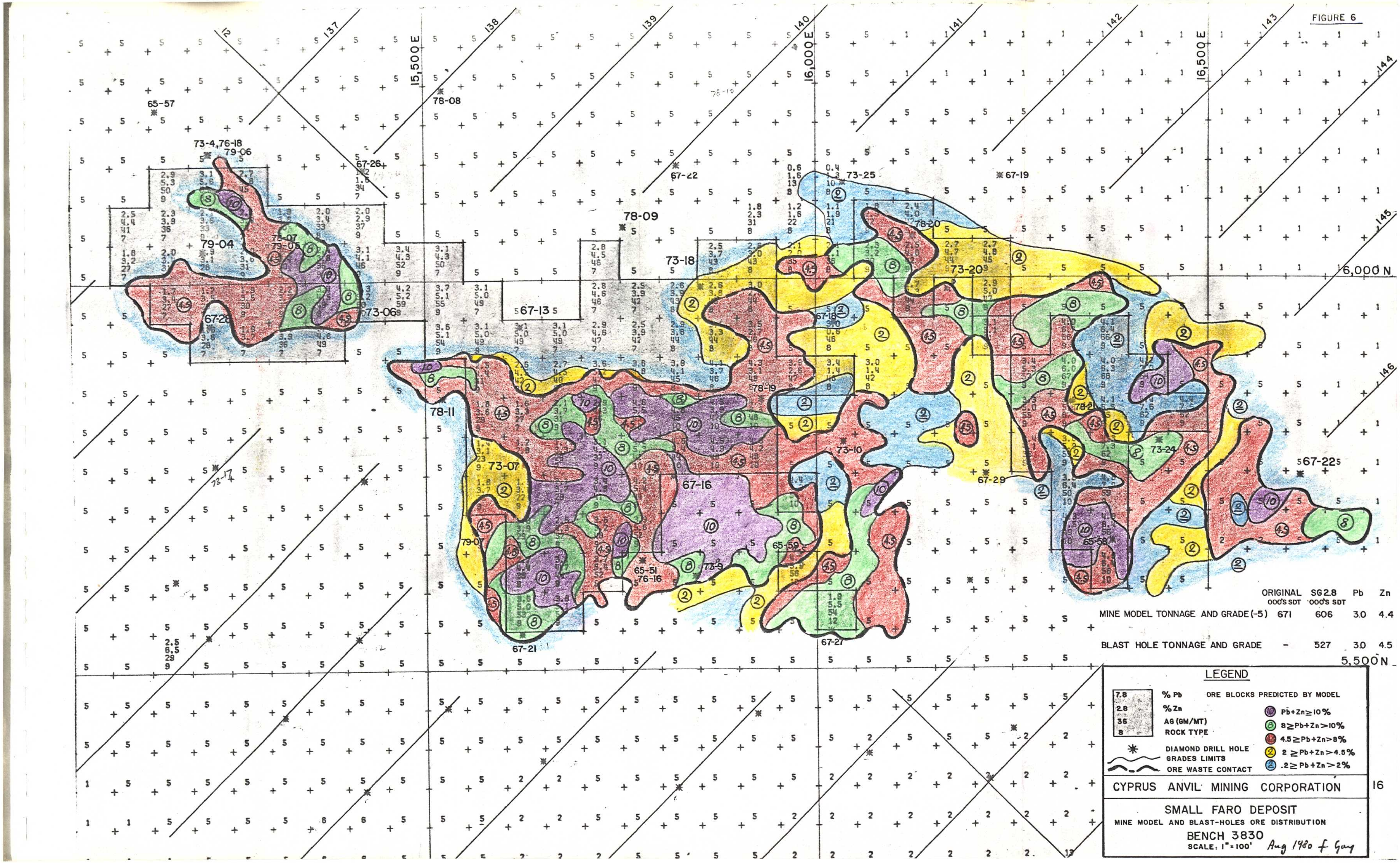


FIGURE 6
15,500 E
16,000 E
16,500 E
6,000 N
5,500 N
ORIGINAL 000'S SDT
SG2.8 000'S SDT
Pb
Zn
MINE MODEL TONNAGE AND GRADE (-5) 671 606 3.0 4.4
BLAST HOLE TONNAGE AND GRADE - 527 3.0 4.5
LEGEND
% Pb
% Zn
AG (GM/MT)
ROCK TYPE
ORE BLOCKS PREDICTED BY MODEL
Pb+Zn≥10%
8≥Pb+Zn>10%
4.5≥Pb+Zn>8%
2≥Pb+Zn>4.5%
.2≥Pb+Zn>2%
DIAMOND DRILL HOLE
GRADES LIMITS
ORE WASTE CONTACT
CYPRUS ANVIL MINING CORPORATION
SMALL FARO DEPOSIT
MINE MODEL AND BLAST-HOLES ORE DISTRIBUTION
BENCH 3830
SCALE: 1" = 100'
Aug 1980 f Gay

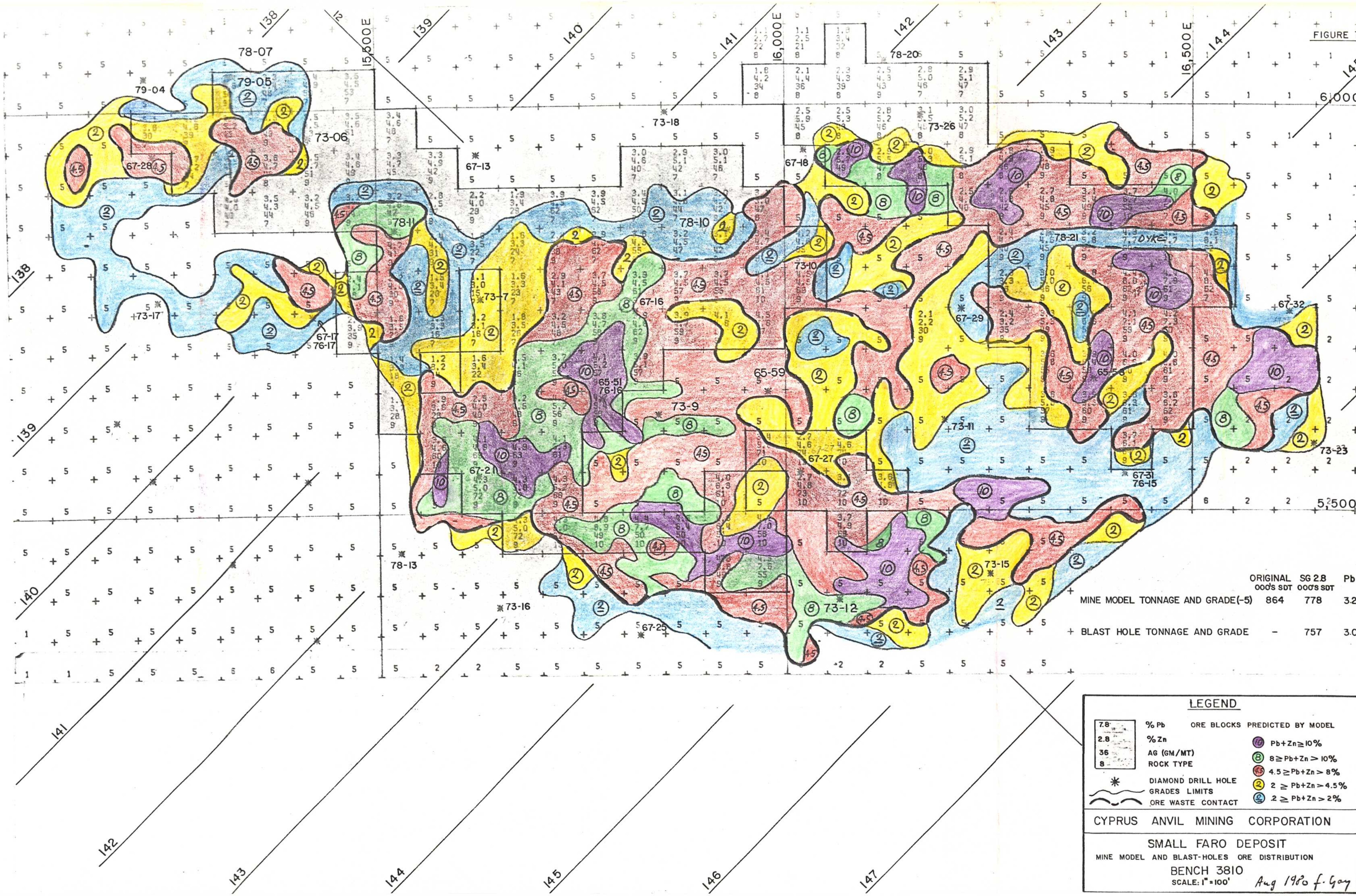


FIGURE 7
ORIGINAL 000'S SDT
SG 2.8 000'S SDT
Pb
Zn
MINE MODEL TONNAGE AND GRADE (-5) 864 778 3.2 4.9
+ BLAST HOLE TONNAGE AND GRADE - 757 3.0 4.4
LEGEND
%Pb
%Zn
AG (GM/MT)
ROCK TYPE
ORE BLOCKS PREDICTED BY MODEL
Pb+Zn≥10%
8≥Pb+Zn>10%
4.5≥Pb+Zn>8%
2≥Pb+Zn>4.5%
.2≥Pb+Zn>2%
DIAMOND DRILL HOLE
GRADES LIMITS
ORE WASTE CONTACT
CYPRUS ANVIL MINING CORPORATION
SMALL FARO DEPOSIT
MINE MODEL AND BLAST-HOLES ORE DISTRIBUTION
BENCH 3810
SCALE: 1" = 100'
Aug 1980 f. Gay
15,500E
16,000E
16,500E
6,000 N
5,500 N

5.5 Comments:

From different observations made above the following problems are common to every bench:

- Secondary structure not picked up by diamond drilling.
- Ore found and/or not found in between holes.
- Large gaps not covered by sufficient diamond drill holes.
- Bad core recoveries.

All these problems seem to be more or less related (except the core recovery) to an inadequate drilling pattern and several large areas were not sufficiently drilled (see Figure 8).

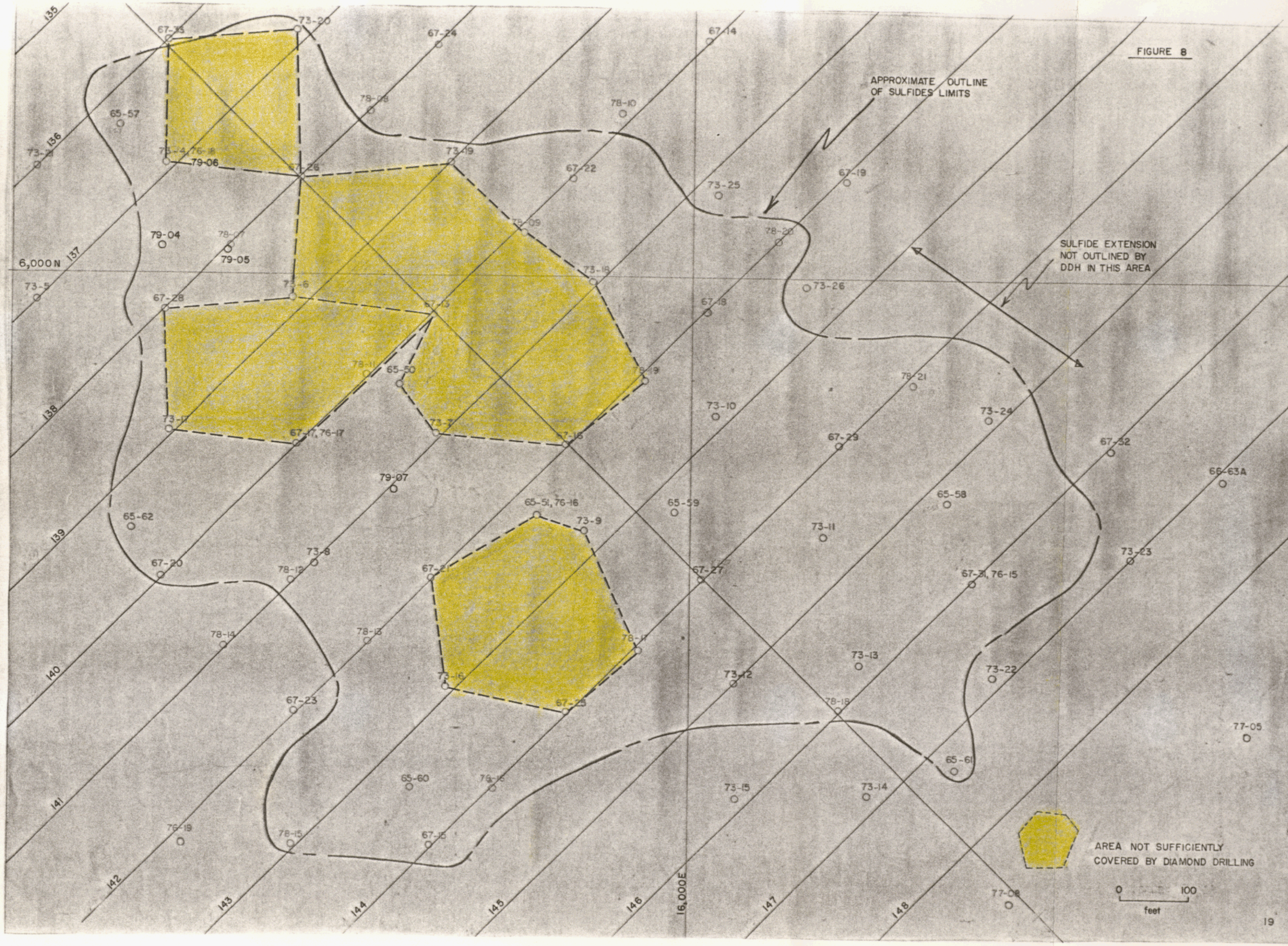

APPROXIMATE OUTLINE
OF SULFIDES LIMITS
SULFIDE EXTENSION
NOT OUTLINED BY
DDH IN THIS AREA
AREA NOT SUFFICIENTLY
COVERED BY DIAMOND DRILLING
6,000 N
16,000E
0
100
feet
135
136
137
138
139
140
141
142
143
144
145
146
147
148
67-33
73-20
67-24
67-14
65-57
78-08
78-10
73-4, 76-18
79-06
73-19
67-26
67-22
73-25
67-19
79-04
78-07
79-05
78-09
78-20
73-18
73-5
67-28
73-6
67-13
67-18
73-26
78-11
65-50
78-19
78-21
73-10
73-24
67-17, 76-17
73-2
67-16
67-29
67-32
79-07
66-63A
65-51, 76-16
73-9
65-59
65-58
65-62
73-11
73-23
73-8
67-20
78-12
67-21
67-27
67-31, 76-15
78-14
78-13
78-17
73-13
73-22
73-16
73-12
67-23
67-25
78-18
77-05
65-61
65-60
78-16
73-15
73-14
76-19
78-15
67-15
77-08

FIGURE 8

6.0 GENERAL COMMENTS:

From observations made for each bench, the following points should be emphasized:

6.1 Drilling Problems:

The drilling pattern must be adjusted to the thickness and the size of the deposit: Secondary structure not picked up is more critical for a deposit averaging 50 feet in thickness than for a deposit averaging 150 to 200 feet and also more variation must be expected in a deposit where different rock units are relatively thin as they are in Zone 2: 10 feet of 2F can thin or disappear within a few feet, whereas 30 to 50 feet will not. Rock units 2E and 2F are relatively thin in Zone 2 and their average thickness does not exceed 10 feet. The situation is completely different in Zone 1 and 3 where 2E and 2F average more than 50 feet in thickness in the main ore zone.

Drilling pattern and development method used in Zone 2 are similar to the one used in Zone 1 and 3, but the two deposits are different, therefore, the methods should have been adapted.

The relatively large gaps not drilled (see Figure 8) turned out to be located in critical areas where ore predicted was not found.

7.0 CONCLUSIONS:

If we look at the overall figures after seven months of mining in Zone 2, tonnages and grades predicted by the Mine Model produced by computer are very close to what was actually found and mined out. However, in a short term point of view, the Model cannot predict either the location or the grade of the ore blocks with accuracy, therefore, the short range forecast cannot be made by using the Mine Model. This affects seriously the short range planning and also the establishment of an accurate pit design: Some unnecessary drilling and stripping were made in the North wall of Zone 2 because the ore limits were not defined on this side and this extra cost could have been used for additional development drilling.

The Mine Model needs certainly a few adjustments, but it appears that problems encountered in Zone 2 are mainly related to an inadequate drilling pattern for this type of deposit.

APPENDIX 1

MINE MODEL AND BLAST HOLE VOLUME COMPARISON

MEMOS REGARDING TONNAGE FACTORS

August 13, 1980

MINE MODEL AND BLAST HOLES

VOLUME COMPARISON

FOR BENCHES 3830 AND 3810

INTRODUCTION:

Benches 3830 and 3810 are now completely drilled and blasted and comparisons can be made between volumes and grades predicted by the "Mine Model" and volumes and grades obtained from the blast holes.

The following table summarizes the results for the two benches:

BENCH 3830

	BCY	Tons	Pb	Zn	Ag g/mt
Blast Holes	188,200	527,000 TF: 2.8	2.99	4.49	50.90
Mine Model (Grades - 5%)	216,369	671,341	3.00	4.43	42.76
Variance Blasthole vs. Model	-13%	-21%	0	+1%	+19%

BENCH 3810

	BCY	Tons	Pb	Zn	Ag g/mt
Blast Holes	270,429	757,200 TF: 2.8	2.96	4.36	46.63
Mine Model (Grades - 5%)	277,975	863,609	3.20	4.85	47.60
Variance Blasthole vs. Model	-3%	-12%	-8%	-10%	-2%

COMMENTS:

3830 Bench:

Volume and tonnage variances are quite high. However, the grades are better than what was predicted by the model. Tonnage variances are probably related to a poor knowledge of the specific gravity, but volume variances are certainly related to an over-estimation by the model.

3810 Bench:

For this bench, volumes are quite comparable and differences in tonnages are certainly related to the specific gravity variations.

The grades defined by the blastholes are about 10% lower than what was expected.

Overall, for Benches 3830 and 3810, it appears that volumes predicted by the model are slightly higher than what is actually found in the pit from blasthole analysis. However, the tonnage estimations are really different and the specific gravity should be adjusted either in the model or in the blasthole tonnage calculation.

From the results obtained after seven months of mining in Zone 2, tonnage crushed in the mill is only 6% lower than tonnage estimated from blast holes. Blasthole tonnage is, therefore, comparable to what is actually weighted.

If the tonnages given by the mill measurement are reliable, the tonnages predicted by the model are too high and the specific gravity should be lowered in the model, and, from a quick calculation, it seems that an overall tonnage factor of 2.8 is realistic.

F. Gay
Mine Geologist

FG/mm

To	J. Purkis/F. Gay	cc.	B. Cron	Assay Lab
From	P. Clarke		B. Voisey	Met Lab
Date	August 19, 1980			
Subject	ZONE 2 TONNAGE FACTORS			

Further to the July 21, 1980 memo on tonnage factors, a recent statistical analysis of rock type densities with grade in Zone 2 has called for a modification to earlier estimates.

As yet figures are available for Zone 2 only. The new tonnage factors for > 4.5% Pb + Zn Zone 2 are:

Rock	Tonnage Factor SDT/Cu. Yd.
2A	2.64
2BCD	2.67
2EC	2.92
2EF, 2G, 2H	3.21

These figures agree quite well with an independent study made from production statistics by F. Gay.

P. Clarke

P. Clarke
Engineering Geologist

PC/mm

To	J. Purkis/F. Gay	cc. B. Cron	Assay Lab
From	P. Clarke	B. Voisey	Met Lab
Date	July 21, 1980		
Subject			

As requested, the following are average tonnage factors by rock type and zone which are currently being used:

ZONE 2:

Rock	Tonnage Factor SDT/cu. yd.
2A	2.64
2BCD	2.82
2EC	3.24
2EF, 2G, 2H	3.60

ZONE 1/3:

Rock	Tonnage Factor SDT/cu. yd.
2A, 2BCD	2.82
2EC	3.24
2EF, 2G, 2H	3.60

CODES:

2A	Graphitic Quartzite
2BCD	Pyritic and other Quartzites
2EC	Quartzite/Massive Pyrite Sulphides
2EF	Massive Sulphides (Massive Pyritic → Buckshot)
2G	Baritic Massive Sulphides
2H	Pyrrhotitic Massive Sulphides

Note: Zone 1 2A is generally not as graphitic as the Zone 2 variety.

The above figures are statistical averages developed from S.G. determinations on individual crushed samples, mathematically combined into bench averages and assigned a particular rock type based on predominant lithology.

Some work on bulk S.G.'s (i.e. uncrushed core) is planned which may give us data to suggest that S.G.'s are slightly lower than the above in some instances.

While there is most definitely a variation from the average corresponding with grade, this has not, as yet, been quantitively defined.

In order to calibrate tonnage factor against daily mill tonnage throughput, we would need to go over some past production figures with someone from one of the mill departments.

Peter Clarke

P. Clarke
Engineering Geologist