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Cyprus Anvil Mining Corporation

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28 March 1985

Mr. G. Scott Zimmer
Manager of Projects
Pincock, Allen & Holt Inc.
1750 E. Benson Highway
Tucson, Arizona 85714-1798

Dear Mr. Zimmer:

Re: Methodology to be used for the G-2 model of the Grum deposit, Anvil District, Yukon

The G-2 model of the Grum deposit is intended to rectify major shortcomings perceived in previous computer block models. These are mainly: a) block sizes that are too large or block shapes that are wrongly oriented in cross-sectional aspect and b) inadequate geologic control in the process of grade interpolation. The new model will also incorporate all existing relevant drill hole and assay data for the deposit as well as any revisions to survey control up to the end of 1982. This will be the first model for Grum that will be referenced to the current elevation datum for the Vangorda Plateau. The geologic interpretation to be used is the same as that used for the latest (1982) sectional hand calculation of tonnage and grade. This is the most recent complete interpretation, it uses the most complete information base and is in accord with current nomenclature for the Anvil District.

The model extends from section 62W to 86W which is the limit of most concentrated drilling and the volume for which most reserve figures for Grum are quoted. It does not include the Champ zone (48W to 60W) although this could perhaps be added at a later date since reinterpretation of that area is nearing completion at this time. At this point there is some uncertainty concerning the vertical limit of the model. There are blocks coded to level 91 (of 100 levels) on section 86W, the most northwesterly and deepest part of the deposit. The model may not

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as presently setup consider levels deeper than level 70 at 1000 m elevation (about 300 m below the surface). At any rate the model certainly includes all levels at which open pit mining would be practical.

Geologic control for the G-2 model will be based on the geology interpreted on vertical cross-sections oriented NE-SW and spaced 60.5 m (200 feet) through the deposit. There will be no longitudinal section or bench plan representations of the geology used in this model. Block size used will be 4.5 m high x 8.0 m across the section (NE-SW) x 15.0 m perpendicular to the section (NW-SE). This shape reflects the nature of the deposit well since the deposit is elongate northwesterly perpendicular to the sections following fold plunge and lithologic projection is most reliable in that direction. Geological codes have been assigned to the blocks manually using a gridded overlay on the original section. The geology is assumed to be continuous from a section half way to the adjacent sections. The same codes are applied to four blocks, two sets on each side of the section. This scheme does not account for the 11^{o} northwest plunge of the deposit but this should not create a major error.

Topography has been digitized and elevations assigned to blocks by machine. Overburden likewise has been machine coded from a digitized map of the bedrock surface elevation.

Assays are composited on a 4.5 m bench basis using the same overall limits of the mineralized interval as the existing 1982 sectional calculation. There are many non-vertical drill holes at Grum, these holes are composited on the basis of the intersection with an imaginary 4.5m x 4.5m x 4.5m grid. As a result it is possible to have composites longer than 4.5m with the longest possible being 7.8m; for most holes at Grum the maxiumum possible is 6.4m. Geological codes are assigned to the composited interval by machine using a transposition of the logging codes stored in the assay subfile of Cyprus Anvil's Diamond Drill Hole Data Base. This coding follows the same scheme as the coding of blocks but the logic of machine coding is slightly different from manual block coding condequently all codes will be manually checked by a geologist and edited as required. Assay data available is Cu, Pb, Zn, Ag for nearly all samples and pulp S.G., soluble Fe, insoluble Fe and Au for many.

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The exact method to be used for grade interpolation/extension has not yet been worked out in detail. We anticipate an orientation that takes the fold plunge into account and to make use of geologic coding to restrict the possible source composites. As with models used at Faro we will probalby use inverse square weighting at Grum.

The result of this process is expected to be an interim block model that will be comparable to the Faro F-3 and be adequate for long range planning purposes.

Should you require further information please do not hesitate to contact the undersigned.

Yours very truly,

CYPRUS ANVIL MINING CORPORATION

Gregg Jilson
Senior Geologist

GJ/sm

c.c. R. Visagie
P. Clarke

CYPRUS

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 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 but require a finer grind.

GRUM

The Grum deposit has been extensively drilled both from surface and underground. The deposit is drilled off on a minimum of 100′ x 200′ centers; 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 out to about 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 meters of underground development that provides access to a 700 meter strike length.

The deposit consists of a number of ore horizons that are contorted into a complex polyphase fold structure. This fold defines the elongation of the deposit and plunges about 12° to the northwest from the deposit′s subcrop beneath a thick blanket of glacial till. Most mineralization is thus beneath at least 30 meters of rock or overburden cover but once this cover is removed there will be mineralization exposed at all levels thruout the length of 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 and is the major determinant for slope stability in proposed pits. There are a number of moderately dipping faults that will contribute significantly to local slope stability problems.

The ore horizons are up to 30 meters thick but in much of the deposit average about 15 meters especially in the area of the most significant reserves. Thinner ore layers occur widely and a method of effecient 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 commonly overlain by soft dark colored phyllites. Since the massive ores and especially the baritic ores are considerably higher grade on the average than the quartzose ore 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 in places inverted.

A number of reserve estimates have been made for the Grum deposit. 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. Block based computer models on the other hand have not compared well with the sectional hand calculations. The most recent model is significantly 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 massive sulphide ore blocks.

An improved section based block model (known as G-2) that will use smaller blocks (4.5m.high x 9m.across trend x 15m. along trend vrs. 9m. highx 15m.x 15m.)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 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 within the next three months. At that time there will be available geologic reserve and mine planning data for Grum that will be comparable to the Faro F-3 model

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 data 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.x 5m.x 9m.high) for improved geological detail unfortunately the sub-division was perpendicular to the deposit trend and results in no substantial improvement.

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 overburden and the major faults will be needed at Grum.

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 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.

There is a block model available for the northwest part of Vangorda. It is based on bench plan geology and uses 12m.x 12m.x 6m. 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 in interpolation. This would take about a month and would be finished in about the same timeframe as the Grum model.

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 +4 %	Pb (%)	Zn (%)	Ag (g/t)	Pb+Zn (%)	tonnes	total metal (tonnes)
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	-18.0	-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	-38.6	-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

COMPARISON OF KERR ADDISON AND CYPRUS ANVIL HAND CALCULATED RESERVES FOR THE GRUM DEPOSIT

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	3.37	5.98	59	9.35	3093642	289256
80W	3.31	5.41	56	8.72	3783293	329903
82W	3.00	5.10	52	8.10	3618273	293080
84W	2.86	4.83	48	7.69	2763172	212488
86W	2.88	5.21	49	8.09	3579480	289580
totals	3.48	5.72	59	9.20	32611059	2999662

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	-3.3	5.7	-12.5	-7.9	15.3	-9.5
80W	13.6	19.7	-10.9	-5.5	0.0	-7.6
82W	15.3	39.6	-35.3	-43.1	-31.9	-40.2
84W	42.2	50.2	-16.4	-15.9	-10.4	-16.1
86W	45.6	53.1	-24.7	-11.3	-12.2	-16.1
totals	8.7	20.1	-17.2	-12.4	-4.5	-14.2

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

GRUM DEPOSIT
summary of some comparable reserve estimates

Open Pits at 4% Pb + Zn cutoff (62W - 86W)

	tonnes	Pb %	Zn %	Ag g/t	strip ratio cu. m./t	Pb + Zn	contained metal tonnes	vaviance from average
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	16875000	3	4.9	47	2.72	7.9	1333125	-4.4
						average =	1393821	

Geological Reserves at 4% Pb + Zn cutoff (62W - 86W)

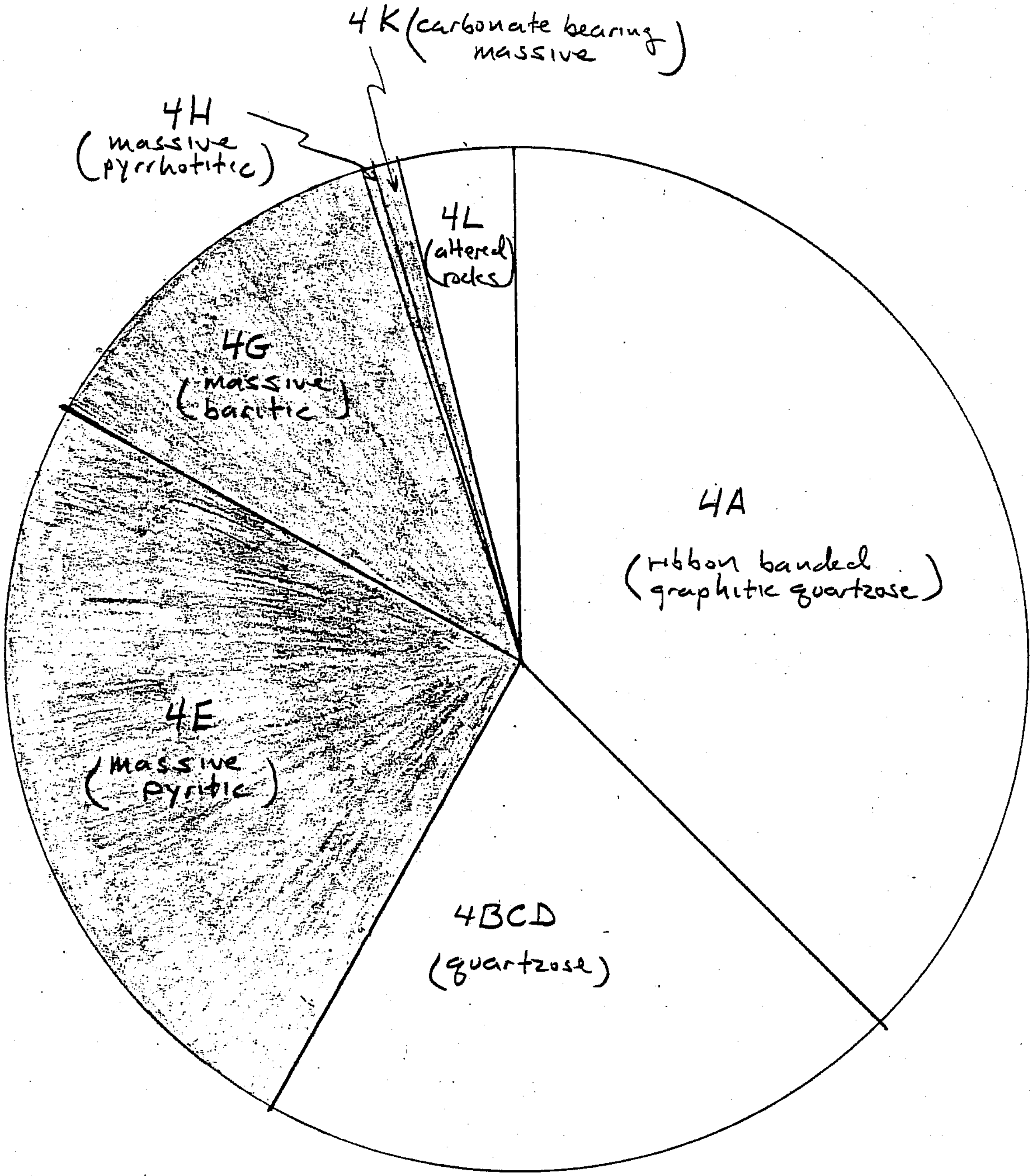
	tonnes	Pb %	Zn %	Ag g/t	strip ratio cu. m./t	Pb + Zn	contained metal tonnes	vaviance from average
Kerr Addison hand calculation	26083000	4.1	6.4	62		10.5	2738715	5.2
Kerr Addison - Noranda computer	27650000	3.1	4.9	48		8.0	2212000	-15.0
Cyprus Anvil G1 computer model	30781000	3.1	4.9	49		8.0	2462480	-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

	tonnes	Pb %	Zn %	Ag g/t	strip ratio cu. m./t	Pb + Zn	contained metal tonnes	vaviance from average
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	

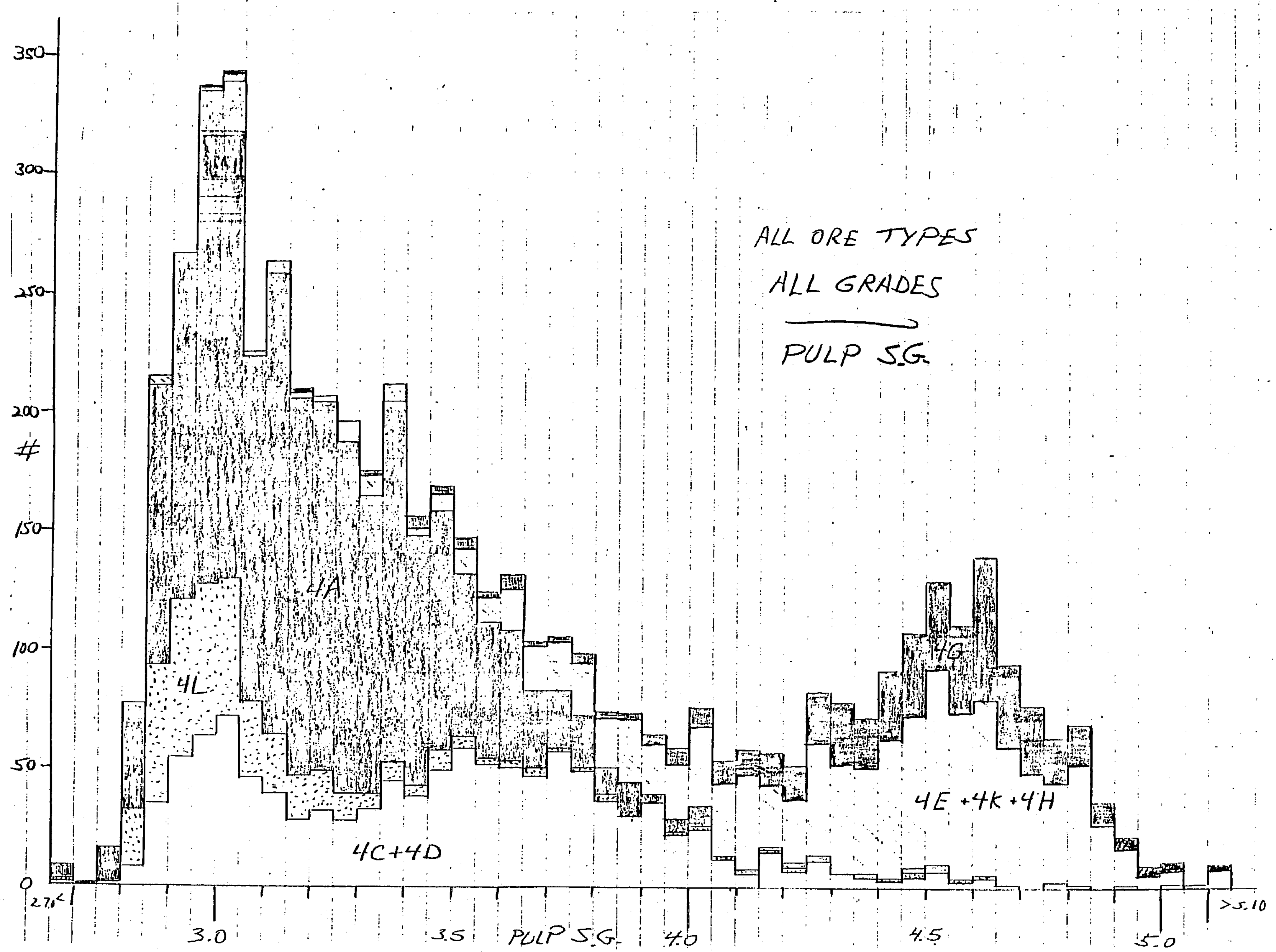
notes:
* includes about 3500000 tonnes drilled off in 1982 after other calculations were done
** more selective choice of ore panels than Kerr Addison
*** too low due to having left an area near Doal Lake out

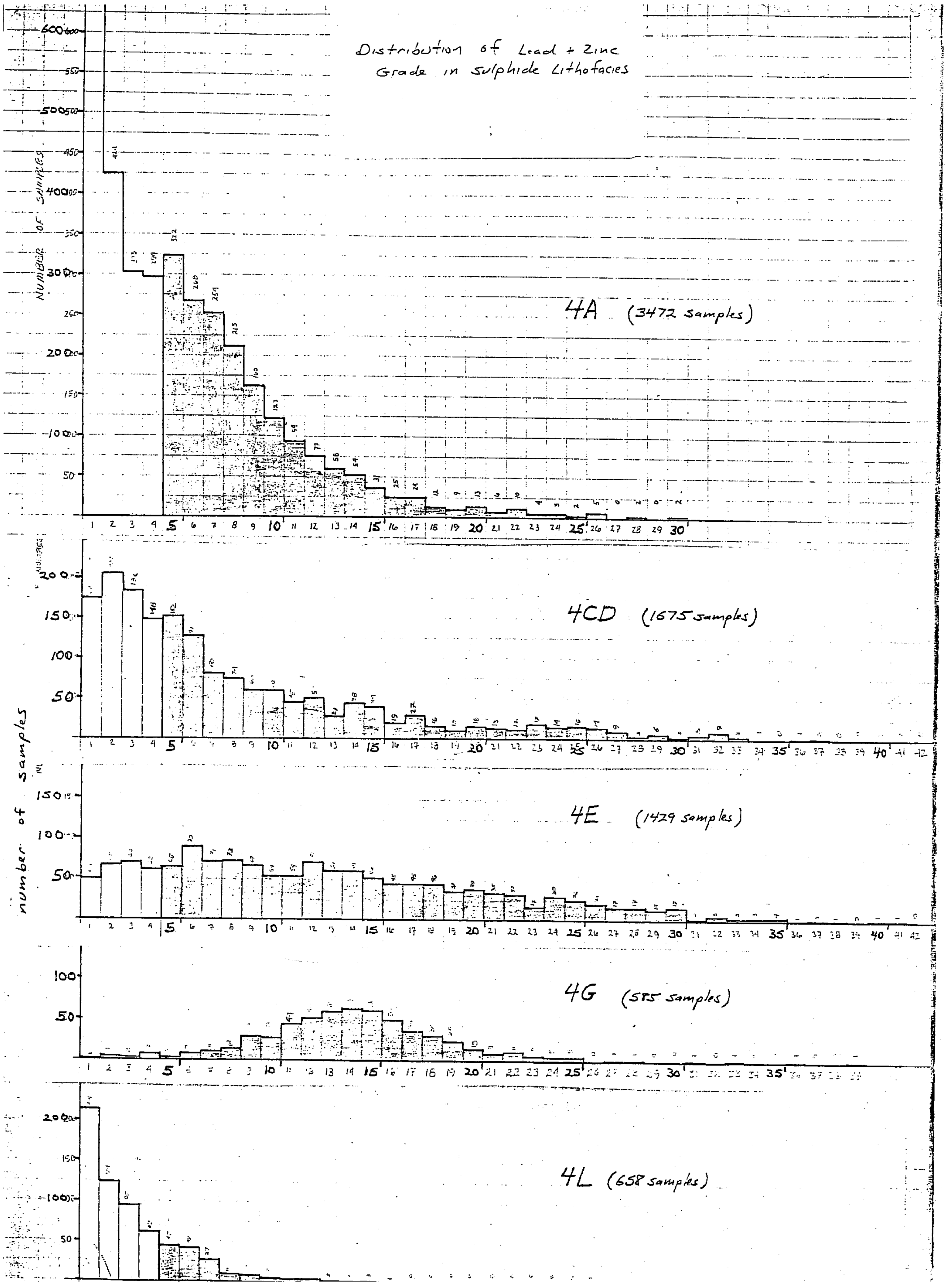
GRUM DEPOSIT



All ore types
with grade > 4% Pb + Zn

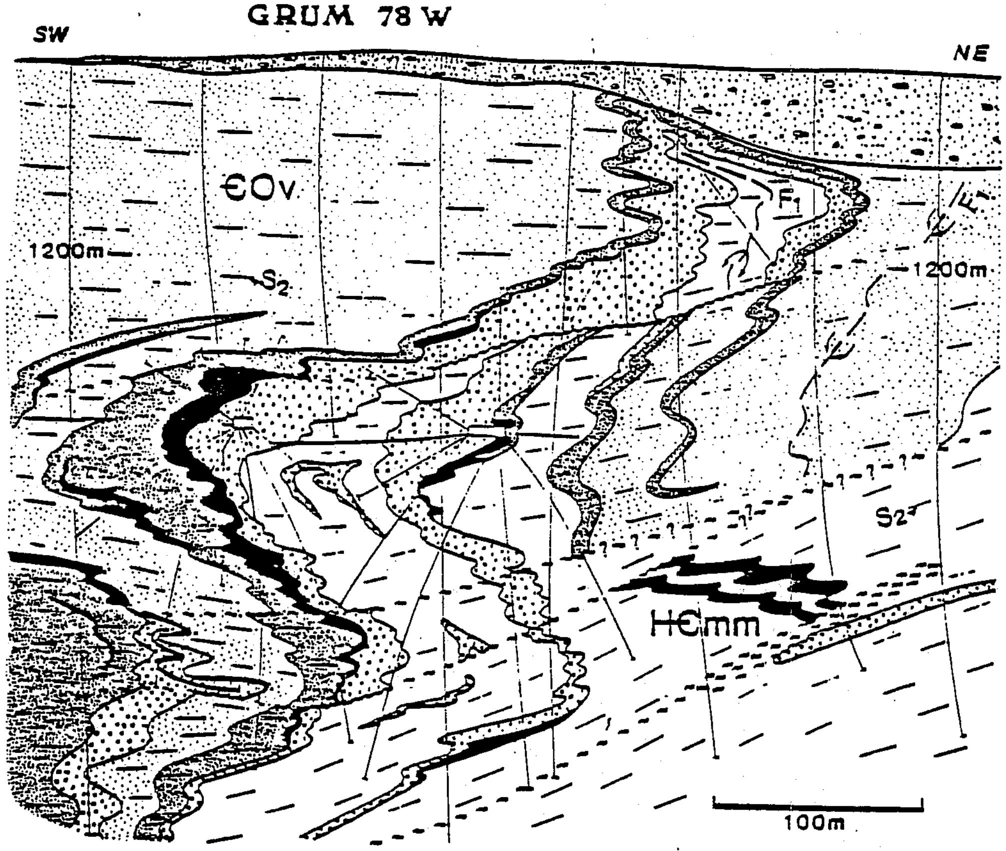
	4A	4CD	4E	4G
Cu(%)	0.08	0.13	0.17	0.12
Pb(%)	2.00	3.05	4.80	5.45
Zn(%)	3.58	5.25	7.65	8.34
Ag(g/t)	36.0	53.0	81.3	91.8
Fe(%) soluble	1.86	3.45	3.39	2.14
Fe(%) insoluble	9.62	12.27	25.85	18.00



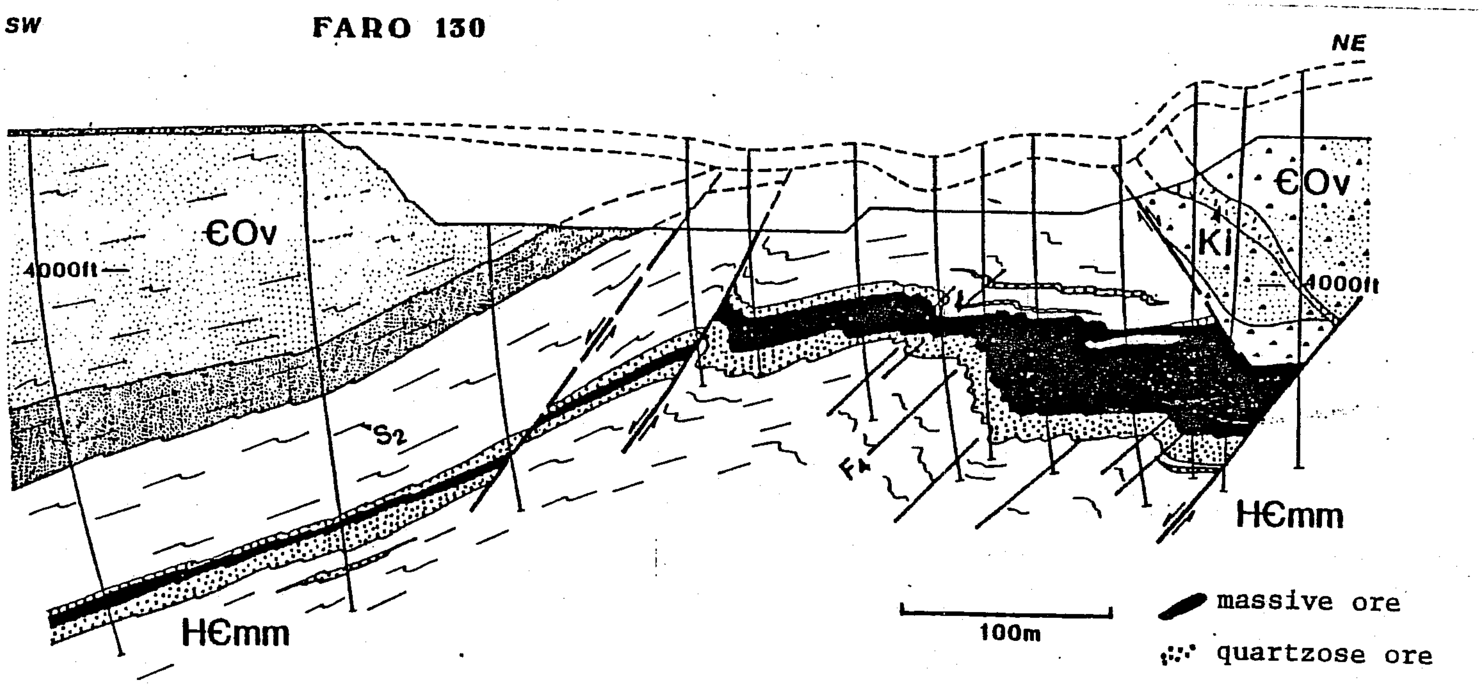


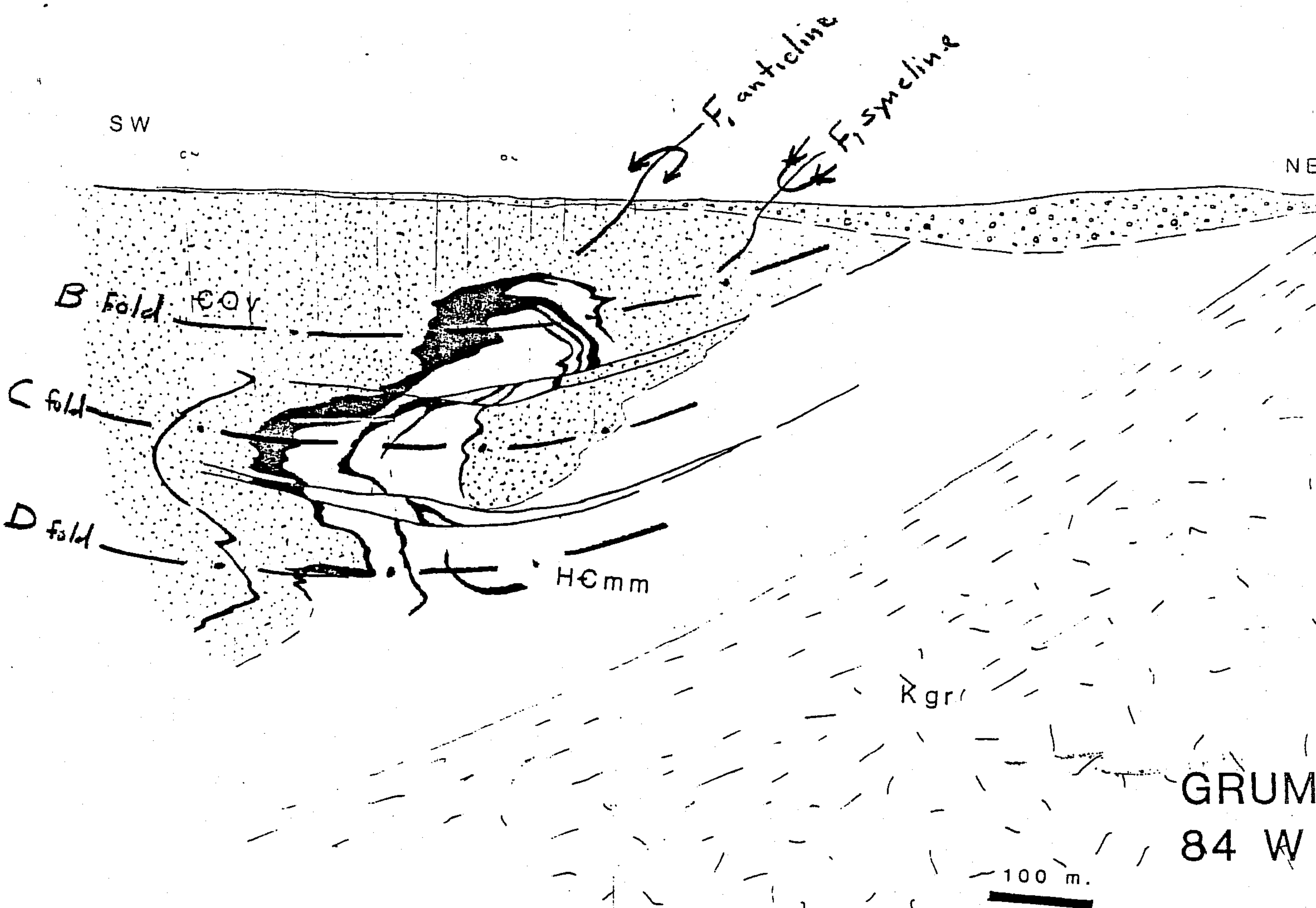
Distribution of Lead + Zinc Grade in sulphide Lithofacies
NUMBER OF SAMPLES
number of samples
4A (3472 samples)
4CD (1675 samples)
4E (1429 samples)
4G (585 samples)
4L (658 samples)

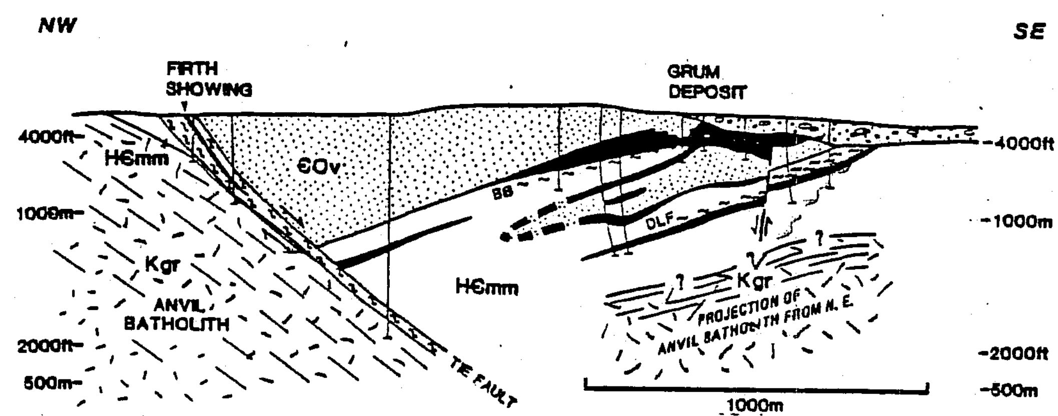
GRUM 78 W



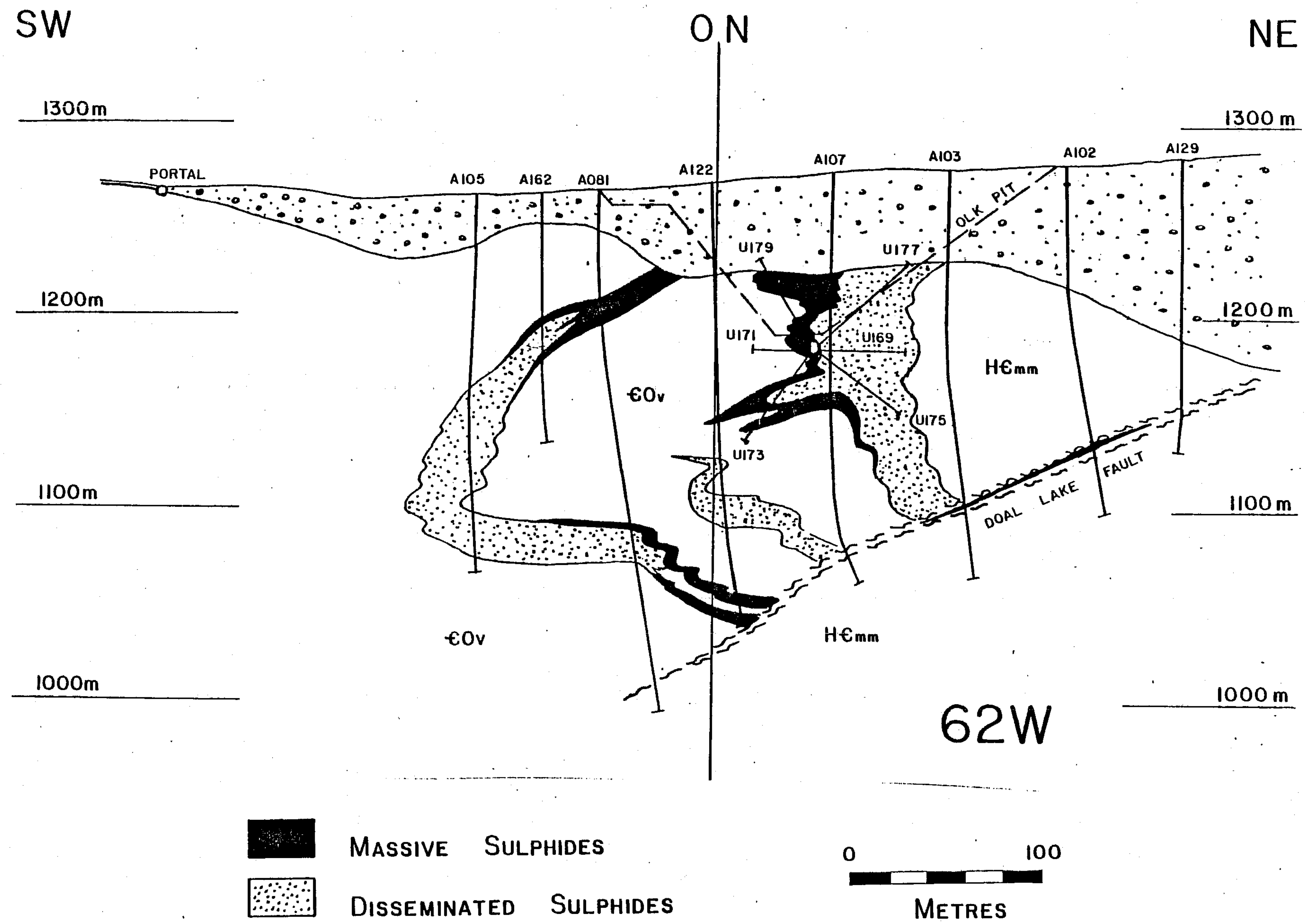
FARO 130







all sulphide lithofacies



SW
0 N
NE
1300m
1300 m
1200m
1200 m
1100m
1100 m
1000m
1000 m
PORTAL
A105
A162
A081
A122
A107
A103
A102
A129
OLK PIT
U179
U177
U171
U169
U175
U173
€Ov
H€mm
DOAL LAKE FAULT
62W
Massive Sulphides
Disseminated Sulphides
0
100
Metres

VANGORDA DEPOSIT

The overall structure of the Vangorda Plateau shows that the Vangorda deposit should be located on the overturned limb of a large S-shaped second phase fold. The deposit is composed of one major and several subordinate ore layers which appear to be hosted by strongly altered Mt. Mye Formation phyllites.

To test the applicability of this hypothesis a quick re-interpretation of the best drilled portion of the deposit was made. The results show that the model seems to work reasonably well. Many problems have been overlooked by focusing on what appears to be the one major ore layer and ignoring the details of the lesser layers. The interpretation that results is essentially a hybrid of the existing C.A.M.C. and Kerr-Addison versions of the deposit. Conceptually it is most like the Kerr sections but geometrically the sections are so close to the C.A.M.C. versions that the difference in tonnage and grade is likely to be small.

While examining the data it became apparent that the bulk of the metal of the deposit would be in one fairly shallow "ore plum" surrounded and underlain by widespread dispersed lower grade mineralization. A quick sectional calculation was made to estimate the size and grade of this "plum". This is not a rigorous reserve calculation since the intent was to focus on one layer of largely massive baritic sulphides. Within this layer a cutoff of about 10% Pb+Zn was used but cutoff was primarily by ore facies. This one layer contains about 1,710,000 tonnes at 11.7% Pb+Zn, 70 g/t Ag and 0.6 g/t Au. between 1W and 11E. This figure amounts to about 50% of the metal contained in the open pit reserves for 2W to 18E. The remaining 50% of the metal is largely in deeper low grade mineralization containing dispersed contorted thin high grade lenses (maintaining mass balance this would amount to about 3.5 MMT @ 5.6 Pb+Zn). Because of these geometric peculiarities a selective high grading of Vangorda should be considered.

The Vangorda deposit has been drilled to the usual company standard of 200' x 100'. This spacing appears to be just adequate to define reserves that are in large bodies of the sort of grade Cyprus Anvil has mined in the past, i.e. 8-10% average with cutoff grade about 4%. The Vangorda deposit however, has a high grade zone that might be worth considering separately for early extraction. This zone is much smaller and of significantly higher expected grade than we have generally depended upon for planning. Because of this it should be better defined than reserves have been in the past. As shown on the accompanying sections the following minimal holes are proposed.

OE	0+50N	325'
2E	0+75N	350'
4E	0+50N	350'
6E	0+50S	350'
8E	0+50S	325'
10E	0+50S	300'

These holes should be large diameter (HQ or larger) so that they could provide additional metallurgical samples as well.

VANGORDA DEPOSIT - PIT VOLUMES TO ACCOMPANY HIGH GRADE ORE CALCULATION
********************THIS IS A PRELIMINARY ESTIMATE ONLY**************

CASE 1
Northeast wall and overburden slopes at 30 deg.
Southwest wall at 45 deg.

SECTION	overburden volume cu. m.	overburden volume cu. yd.	overburden tonnage (S.G.=2.33) tonnes	waste rock volume cu. m.	waste rock volume cu. yd.	waste rock tonnage (S.G.=2.75) tonnes	ore volume cu. m	ore volume cu. yd.	ore tonnage tonnes	average S.G. used for ore	total waste (rock+O.B.) cu. yd	total waste (rock+O.B.) tonnes	STRIPPING RATIOS overall waste/ore by volume	STRIPPING RATIOS overall waste/ore by tonnage
2 EAST	172788	255997	402596	433997	567643	1193492	73628	96301	286300	3.89	823640	1596088	8.55	5.57
4 EAST	271433	355019	632439	250077	327086	687712	120576	157707	443588	3.68	682105	1320151	4.33	2.98
6 EAST	306009	400242	713001	175571	229637	482820	87533	114488	329292	3.76	629879	1195821	5.50	3.63
8 EAST	327698	428611	763536	35635	46608	97996	59827	78250	226790	3.79	475219	861532	6.07	3.80
10 EAST	334807	437909	780100	16880	22077	46420	52075	68111	184935	3.56	459986	826520	6.75	4.47
total 2E-10E	1412735	1877778	3291673	912160	1193051	2508440	393639	514857	1470905		3070829	5800113	5.96	3.94
0 EAST (estimated)	170000	256000	396100	650000	852000	1800000	73950	96722	271619	3.67	1108000	2196100	11.46	8.09
grand total	1582735	2133778	3687773	1562160	2045051	4308440	467589	611579	1742524		4178829	7996213	6.83	4.59

CASE 2
Northeast and Southwest walls in rock with 45 deg. slope
Slopes in overburden at 30 deg.

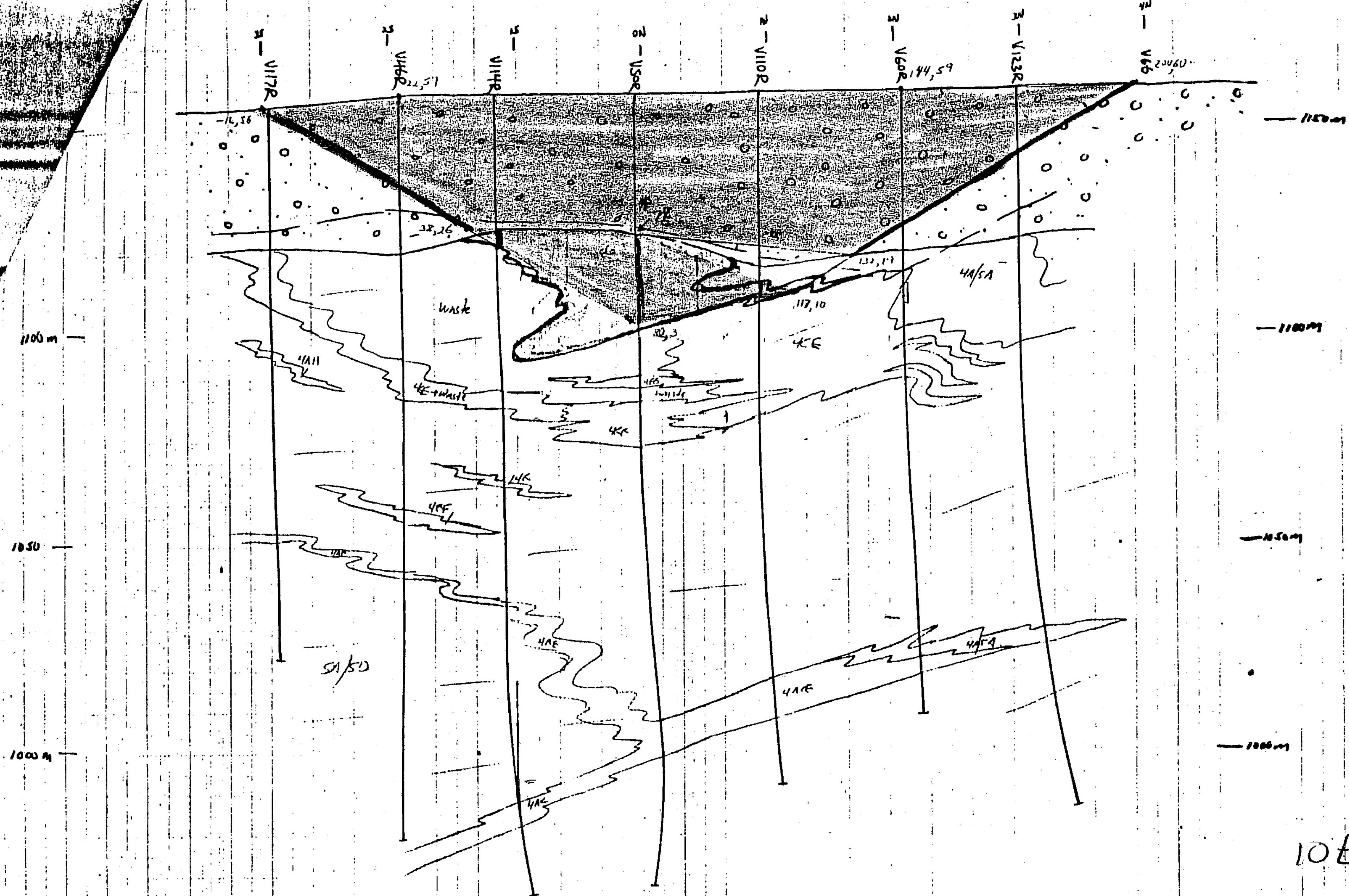
SECTION	overburden volume cu. m.	overburden volume cu. yd.	overburden tonnage (S.G.=2.33) tonnes	waste rock volume cu. m.	waste rock volume cu. yd.	waste rock tonnage (S.G.=2.75) tonnes	ore volume cu. m	ore volume cu. yd.	ore tonnage tonnes	average S.G. used for ore	total waste (rock+O.B.) cu. yd	total waste (rock+O.B.) tonnes	STRIPPING RATIOS overall waste/ore by volume	STRIPPING RATIOS overall waste/ore by tonnage
2 EAST	168507	220397	392620	345308	451643	949596	73628	96301	286300	3.89	672040	1342216	6.98	4.69
4 EAST	223266	292019	520209	188147	246086	517405	120576	157707	443588	3.68	538105	1037614	3.41	2.34
6 EAST	291482	381242	679153	156457	204637	430257	87533	114488	329292	3.76	585879	1109410	5.12	3.37
8 EAST	327698	428611	763537	35635	46608	97995	59827	78250	226790	3.79	475219	861532	6.07	3.80
10 EAST	334807	437909	780101	16879	22077	46418	52075	68111	184935	3.56	459986	826519	6.75	4.47
total 2E-10E	1345760	1760178	3135621	742426	971051	2041671	393639	514857	1470905		2731229	5177292	5.30	3.52
0 EAST (estimated)	172790	226000	402601	422037	552000	1160601	73950	96722	271619	3.67	778000	1563202	8.04	5.76
grand total	1518550	1986178	3538222	1164462	1523051	3202271	467589	611579	1742524		3509229	6740494	5.74	3.87

Notes:
Ore S.G. used is pulp S.G. reduced by 10% in accord with studies on massive ores.
No ramps were specifically allowed for.
Northwest and Southeast ends of pit are simple extrapolation of last sections.
Section 0 East not measured, estimated by comparison to 2E.

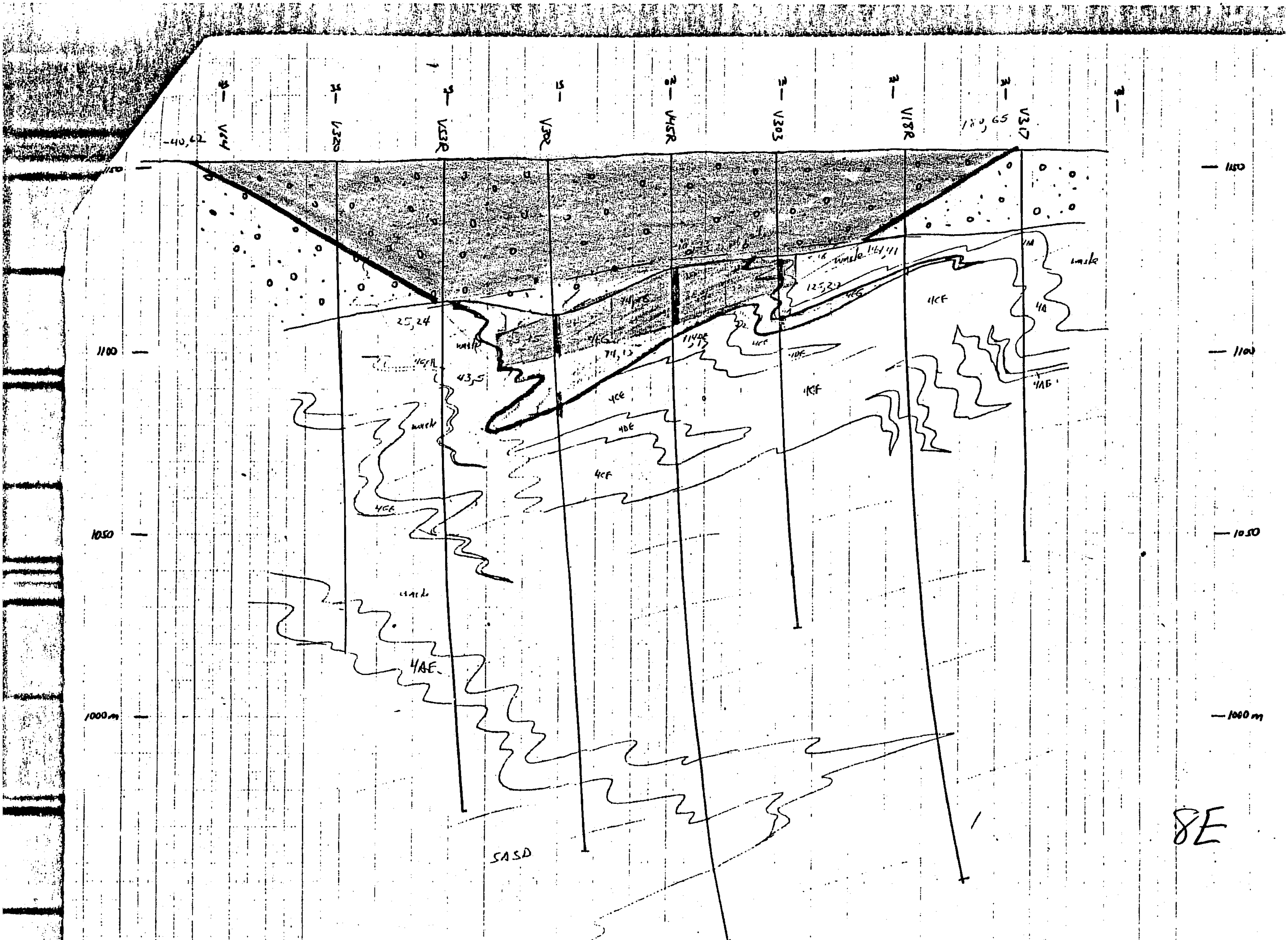
VANGORDA DEPOSIT: summary of sectional reserves , main layer high grade

SECTION	TONNAGE	VOLUME	S.G.	Pb	Zn	Cu	Ag	Au	BaO	Pb + Zn
10E	184935	52075	3.95	5.84	7.34	.08	61.8	.38	17.72	13.17
8E	226790	59827	4.21	4.29	6.77	.11	65.3	.70	20.67	11.06
6E	329292	87533	4.18	5.02	6.24	.06	71.2	.48	15.33	11.26
4E	443588	120576	4.09	4.37	6.54	.08	65.6	.70	20.86	10.91
2E	286300	73628	4.32	5.15	6.11	.13	73.6	.48	15.14	11.25
0E	271619	73950	4.08	5.77	7.45	.15	80.9	.92	11.80	13.21
total	1742524	467589	4.14	4.98	6.67	.10	69.9	.62	17.10	11.65
	tonnes	cu. m.		%	%	%	g/tn	g/tn	%	%

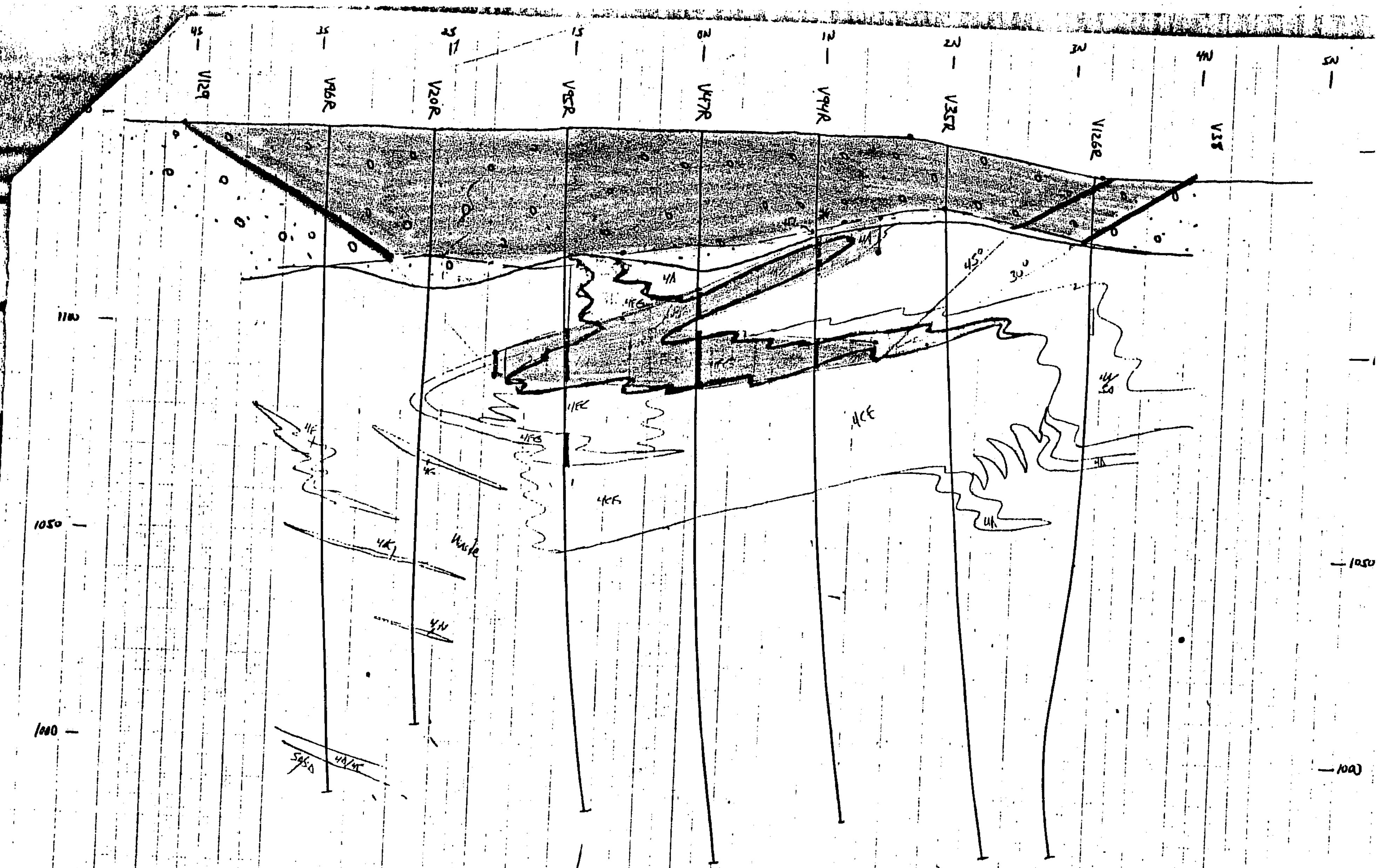
S.G. used for purposes of calculation is pulp S.G. less 10%. i.e. average is = 3.73



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.62	21.19	13.45
74.7	76.0	1.3	4.29	4.67	5.86	.22	47.0	.55	12.86	10.53
92.4	93.6	1.2	4.61	5.66	8.1	.11	98.0	.62	19.73	13.76
93.6	94.9	1.3	4.45	5.75	8.09	.16	80.5	.55	18.67	13.84
92.4	94.9	2.5	4.53	5.71	8.09	.14	88.9	.58	19.18	13.80

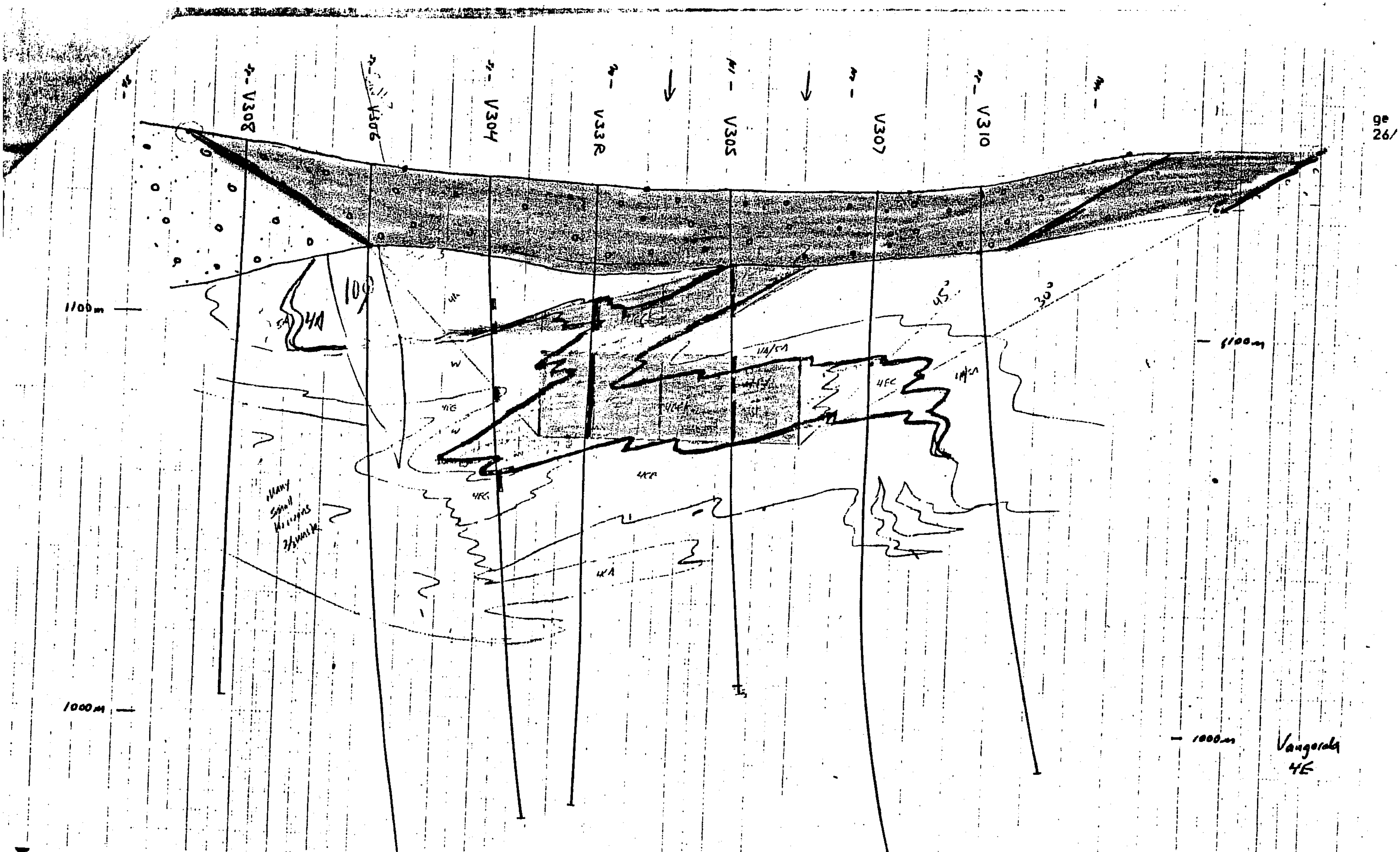


		[illegible]	[illegible]	[illegible]	6.22	.14	64.50	1.91	15.46	11.57
65.6	67.0	1.4	4.60	8.17	9.79	.17	87.50	1.95	9.38	17.96

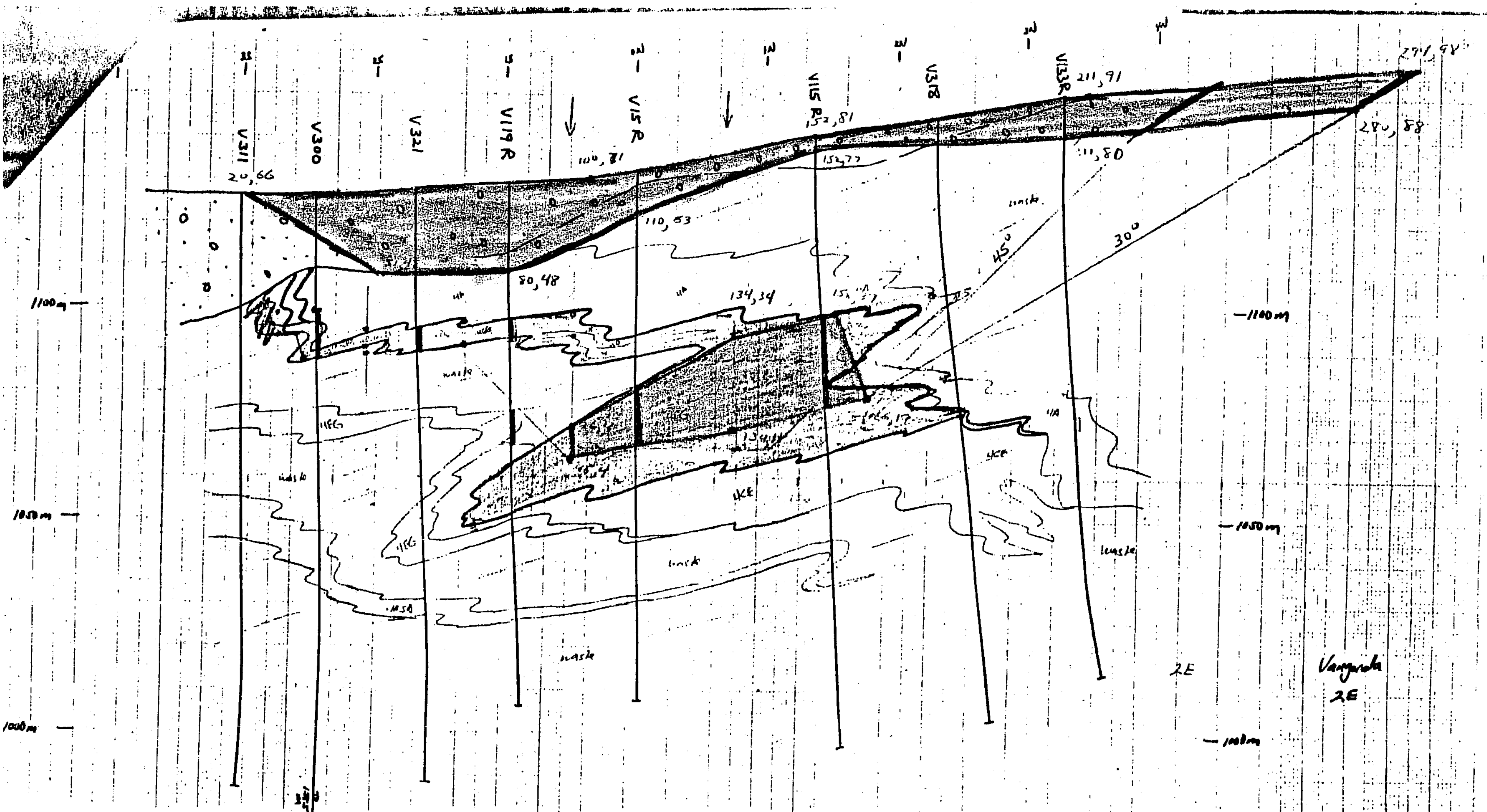


6E

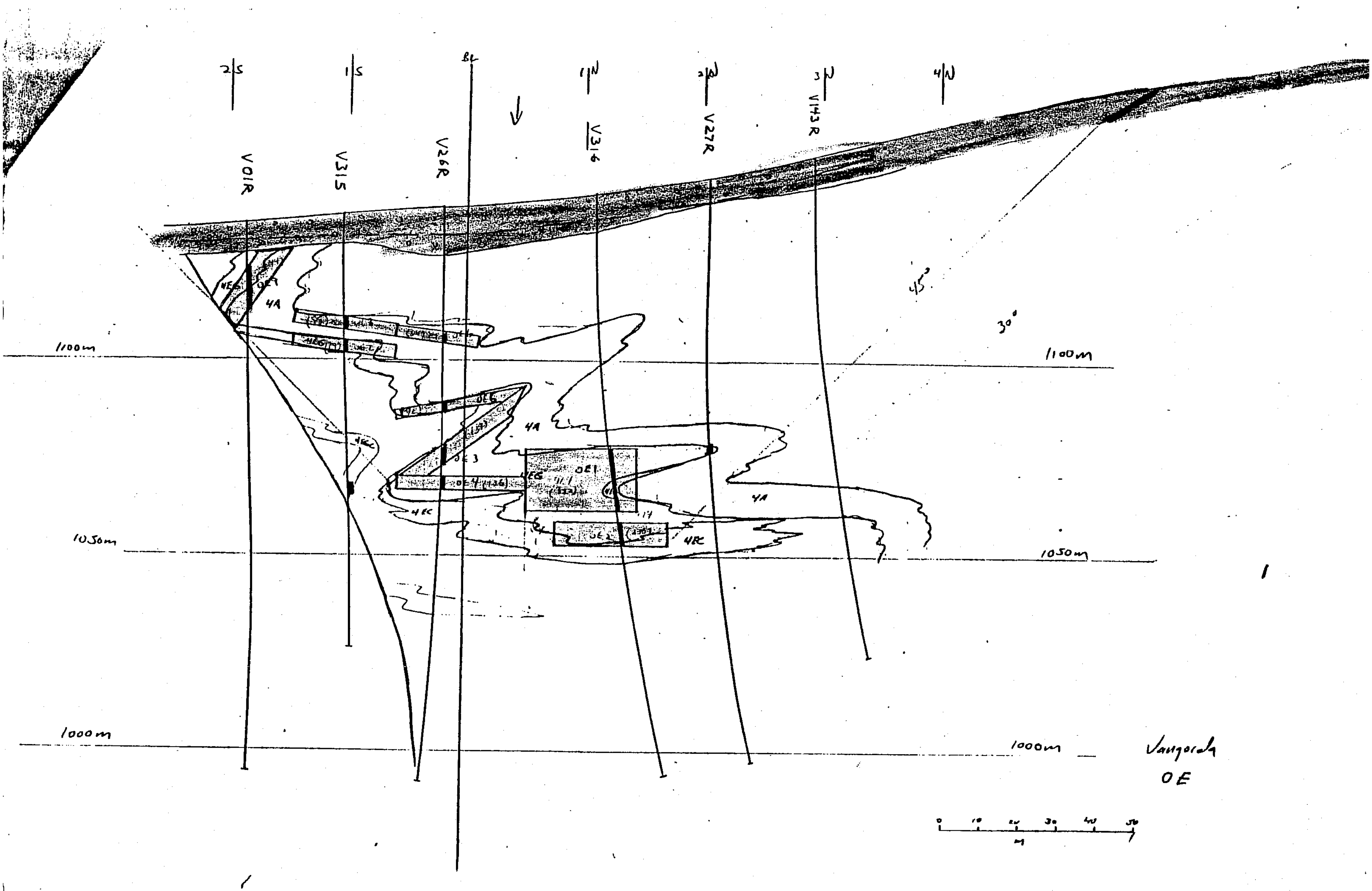
	[illegible]	[illegible]	1.0	3.45	3.3	3.93	.03	55	[illegible]	[illegible]	[illegible]
	50	52	2.0	4.52	2.96	3.78	.04	50.5	.34	9.67	7.23
	52	53.2	1.2	4.75	3.66	7.22	.04	59.5	.86	7	6.74
	53.2	54.4	1.2	4.51	2.88	6.44	.02	53.5	.24	26.98	10.88
	54.4	55.9	1.5	3.94	5.06	7.34	.07	72	.24	30.52	9.32
	55.9	57.5	1.6	4.98	1.43	2.8	.04	31.5	.58	11.08	12.40
	57.5	58.8	1.3	4.83	2.22	4.17	.02	42.5	.45	4.39	4.23
	58.8	60.4	1.6	4.5	5.72	7.42	.06	86	.21	23.16	6.39
	60.4	62.1	1.7	4.2	4.22	6.93	.06	67	.27	24.02	13.14
									.34	24.87	11.15
6-E-2 =	48.2	62.1	13.9	4.46	3.62	5.59	.05	59.62	.44	17.73	9.21
V-95-R	48.1	49.8	1.7	[illegible]							



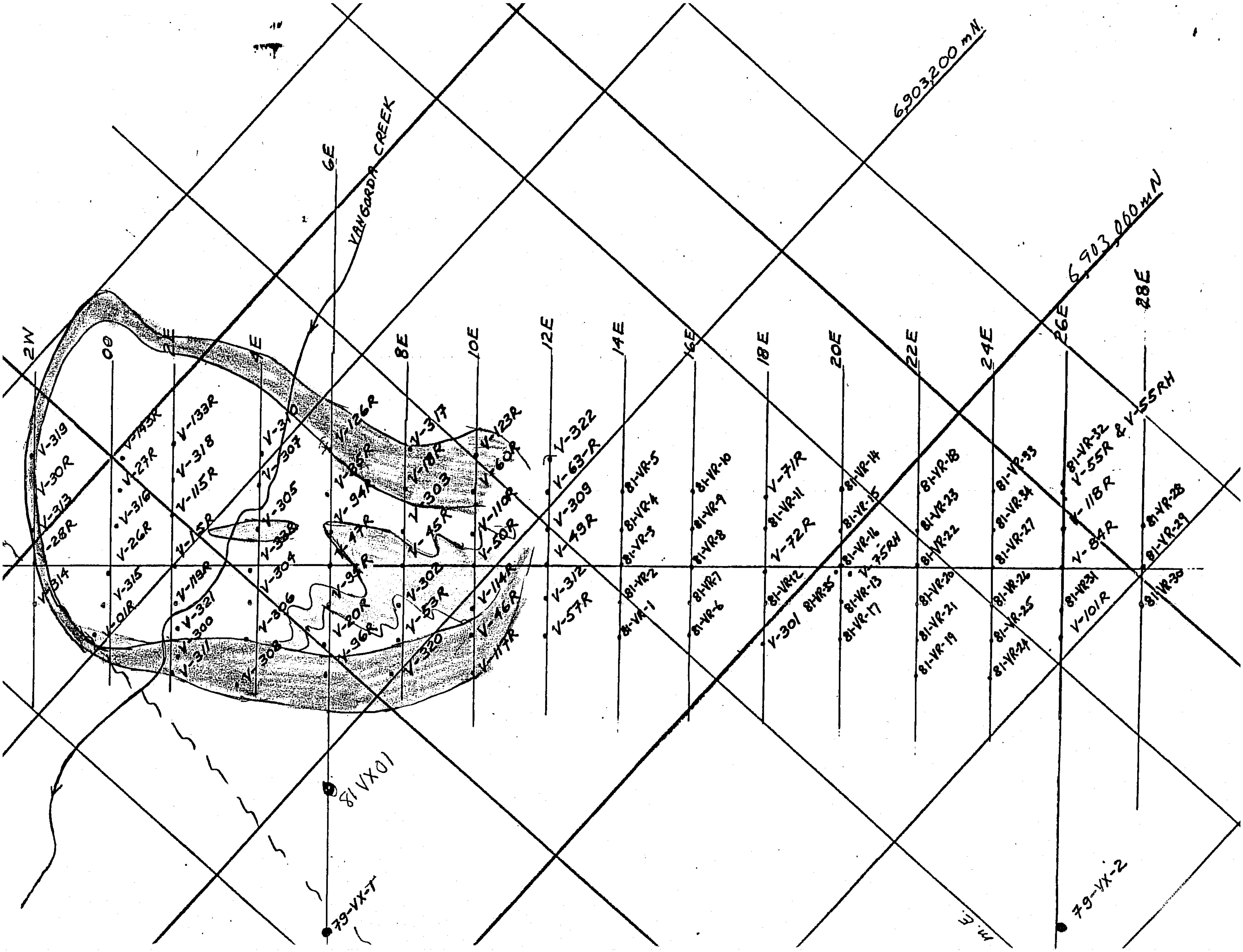
	34.4	35.5	1.1	4.04	4.74	4.6	.48	87.5	3.43	12.96	9.34
	35.5	37.1	1.6	4.5	5.76	6.54	.13	77.5	1.58	11.06	12.30
4-E-4 =	28.5	37.1	8.6	4.39	5.31	6.66	.16	77.4	1.42	18.56	11.97
	42.3	43.5	1.2	4.13	6.21	7.9	.08	87.0	.79	19.01	14.11
	43.5	45	1.5	3.91	3.72	7.29	.01	58.0	.21	30.33	11.01
	45	46.6	1.6	3.98	3.35	8.05	.01	59.5	.17	36.94	11.40
	46.6	48.2	1.6	4.17	6.37	6.94	.02	88.5	.27	27.95	13.31
	48.2	49.7	1.5	3.83	3.59	4.27	.16	49.5	.55	16.02	7.86
	49.7	51.2	1.5	3.87	5.15	4.43	.09	70.0	.58	17.44	9.58
	51.2	52.7	1.5	3.59	3.06	5.18	.06	47.5	.72	20.92	8.24



	[illegible]	[illegible]	[illegible]						[illegible]	[illegible]	[illegible]
	51.8	52.6	.8	2.96	.5	.6	.03	4.0	.21	[illegible]	[illegible]
	52.6	54.7	2.1	4.53	3.75	5.73	.14	59.5	.89	23.31	9.48
	54.7	56.3	1.6	4.48	7.1	7.9	.13	92.5	1.03	4.66	15.00
	56.3	57.9	1.6	4.25	5.45	7.23	.18	82.0	2.26	23.89	12.68
	57.9	59.4	1.5	4.22	.95	1.04	.3	20.5	1.47	1.75	1.99
	59.4	60.4	1.0	4.23	1.34	2.1	.17	21.0	1.03	1.98	3.44
	60.4	61.4	1.0	4.45	4.97	7.23	.07	83.0	.82	26.74	12.20
	61.4	61.8	.4	4.39	7.78	8.73	.05	111.0	.69	21.58	16.51
	61.8	63.6	1.8	4.21	3.93	6.07	.09	64.0	.55	19.82	10.00
	63.6	65.4	1.8	4.18	5.97	5.06	.15	74.5	.62	13.59	11.03
2-E-2 =	50.6	65.4	14.8	4.23	4.33	5.44	.14	64.3	1.00	15.38	9.77
	67.2	69.3	2.1	4.42	5.1	7.65	.05	91.0	.48	27.9	12.75
	70.6	72.1	1.5	4.45	5.62	6.45	.05	82.0	.45	26.46	12.07
						[illegible]	[illegible]	174.5	.01	.32	14.70



0-E-3	61.2	66.2	5	4.29	4.67	5.51	.18	[illegible]	[illegible]	[illegible]	[illegible]
	69.4	70.9	1.5	4.38	3.61	6.18	.14	55.5	.78	22.61	9.79
	70.9	72.4	1.5	4.54	6.82	5.14	.08	84	1.1	23.32	11.96
0-E-4	69.4	72.4	3	4.46	5.21	5.66	.11	69.75	.94	22.96	10.88



6,903,200 mN.
6,903,000 mN
VANGORDA CREEK
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8E
10E
12E
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16E
18E
20E
22E
24E
26E
28E
V-319
V-30R
V-313
V-28R
V-314
V-143R
V-27R
V-316
V-26R
V-315
V-01R
V-133R
V-318
V-115R
V-15R
V-119R
V-321
V-300
V-311
V-310
V-307
V-305
V-304
V-306
V-308
V-126R
V-317
V-123R
V-60R
V-110R
V-50R
V-114R
V-46R
V-117R
V-94R
V-47R
V-45R
V-302
V-53R
V-20R
V-96R
V-320
V-303
V-322
V-63-R
V-309
V-49R
V-312
V-57R
81-VR-5
81-VR-4
81-VR-3
81-VR-2
81-VR-1
81-VR-10
81-VR-9
81-VR-8
81-VR7
81-VR-6
V-71R
81-VR-11
V-72R
81-VR12
V-301
81-VR-14
81-VR-15
81-VR-16
V-75RH
81-VR-13
81-VR-17
81-VR-18
81-VR-23
81-VR-22
81-VR-20
81-VR-21
81-VR-19
81-VR-33
81-VR-34
81-VR-27
81-VR-26
81-VR-25
81-VR-24
81-VR-32
V-55R & V-55RH
V-118R
V-84R
81-VR31
V-101R
81-VR-28
81-VR-29
81-VR-30
81VX01
79-VX-1
79-VX-2

SECTION 0 EAST

block	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb+Zn (%)	DDH	AREA (sq. m)	VOLUME (cu. m)	TONNAGE (tonnes)
0-E-1	65.5	81.1	15.6	4.05	7.67	6.09	.08	99.3	.37	7.87	13.76	V-316	320	19341	70417
0-E-2	84.6	90.6	6.0	4.01	4.10	6.39	.06	59.9	.68	17.84	10.49	V-316	206	12451	44922
0-E-6	32.1	34.9	2.8	3.21	4.08	9.00	.07	72.8	.96	.12	13.09	V-26-R	64	3866	11169
0-E-5	50.3	52.6	2.3	4.61	5.55	8.76	.26	86.6	1.48	15.75	14.31	V-26-R	76	4613	19136
0-E-3	61.2	66.2	5.0	4.29	4.67	5.51	.16	59.4	.99	13.15	10.18	V-26-R	139	8410	32448
0-E-4	69.4	72.4	3.0	4.46	5.21	5.66	.11	69.8	.94	22.96	10.88	V-26-R	106	6413	25742
0-E-8	26.3	29.9	3.6	3.09	4.45	7.19	.09	70.0	1.10	.21	11.64	V-315	88	5351	14904
0-E-7	32.9	35.9	3.0	4.61	5.65	7.70	.20	109.5	1.48	11.15	13.34	V-315	79	4792	19859
0-E-9	11.6	22.3	10.7	4.21	6.85	13.74	.37	87.5	1.61	9.18	20.59	V-01-R	144	8715	33022
				4.08	5.77	7.45	.15	80.9	.92	11.80	13.21			73950	271619

block	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb + Zn (%)	DDH	AREA	VOLUME	TONNAG
SECTION 2 EAST															
2-E-1	42.4	67.7	25.3	4.40	5.89	6.71	.12	82.0	.01	14.95	12.59	V-115-R	628	37994	15049
2-E-2	50.6	65.4	14.8	4.23	4.33	5.44	.14	64.3	1.00	15.38	9.77	V-15-R	589	35634	13581
averages/totals				4.32	5.15	6.11	.13	73.6	.48	15.15	11.25			73628	28630

block	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb + Zn (%)	DDH	AREA (sq. m)	VOLUME (cu. m)	TONNAG (tonnes
SECTION 4 EAST															
4-E-1 =	42.0	63.5	21.5	4.15	4.52	7.77	.05	70.9	.47	23.92	12.30	V-305	746	45103	16849
4-E-4 =	28.5	37.1	8.6	4.39	5.31	6.66	.16	77.4	1.42	18.56	11.97	V-33-R	240	14520	5731
4-E-3 =	18.4	29.8	11.4	3.99	4.05	4.40	.10	56.8	.47	12.94	8.45	V-305	307	18574	6667
4-E-2 =	42.3	63.2	20.9	4.02	3.93	5.91	.08	58.6	.75	23.40	9.83	V-33-R	640	38750	14022
4-E-5 =	36.9	39.2	2.3	3.33	4.68	8.01	.11	63.6	1.02	1.37	12.69	V-304	60	3630	1087
averages/totals				4.09	4.37	6.54	.08	65.6	.70	20.86	10.91			120576	44358

block	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb + Zn (%)	DDH	AREA (sq. m)	VOLUME (cu. m)	TONNAGE (tonnes)
SECTION 6 EAST															
6-E-4	25.1	34.2	9.1	4.13	5.35	6.08	.07	74.1	.28	10.11	11.43	V-94-R	252	15246	56713
6-E-1	50.0	57.3	7.3	4.15	4.72	6.62	.06	70.4	.27	19.30	11.34	V-94-R	221	13386	49980
6-E-5	38.1	45.7	7.6	3.99	4.68	5.69	.11	68.4	.95	7.56	10.37	V-47-R	285	17258	61903
6-E-2	48.2	62.1	13.9	4.46	3.62	5.59	.05	59.6	.44	17.73	9.21	V-47-R	331	20030	80381
6-E-3	48.1	60.7	12.6	4.13	6.64	7.17	.04	83.3	.43	20.15	13.81	V-95-R	357	21614	80315
averages/totals				4.18	5.02	6.24	.06	71.2	.48	15.33	11.26			87533	329292

SECTION 8 EAST

block	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb + Zn (%)	DDH	AREA (sq. m)	VOLUME (cu. m)	TONNAGE (tonnes)
8-E-1	28.8	36.8	8.0	3.30	3.76	5.75	.11	55.5	.29	7.39	9.51	V-303	190	11503	34188
8-E-2	31.7	46.9	15.2	4.40	4.29	7.98	.04	66.6	.35	30.91	12.27	V-45-R	442	26756	106016
8-E-3	41.9	52.6	10.7	4.46	4.50	5.70	.20	67.6	1.28	13.37	10.19	V-302	356	21568	86586
averages/totals				4.21	4.29	6.77	.11	65.3	.70	20.67	11.06			59827	226790

SECTION 10 EAST

block	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb + Zn (%)	DDH	AREA (sq. m)	VOLUME (cu. m)	TONNAGE (tonnes)
10-E-1	46.0	50.8	4.8	3.85	7.05	9.60	.11	59.3	.02	.97	16.65	V-110-R	153	9241	31982
10-E-2	34.1	55.2	21.1	4.23	5.75	7.44	.07	67.1	.54	19.89	13.19	V-50-R	552	33396	127089
10-E-3	32.9	36.9	4.0	3.05	4.76	4.04	.09	39.4	.07	27.74	8.80	V-114-R	156	9438	25865
averages/totals				3.95	5.84	7.34	.08	61.8	.38	17.72	13.17			52075	184935

VANGORDA DEPOSIT- main layer high grade   Nov. 1984

CALUCLATION OF ASSAY COMPOSITES

SECTION 0 EAST

D.D.H.	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb+Zn (%)
V-27-R	68.5	70.0	1.5	4.44	7.35	8.71	.02	119.0	.62	25.13	16.06
	70.0	70.2	.2	3.04	1.53	1.52	.05	23.0	.10	6.78	3.05
	70.2	70.8	.6	4.06	8.44	9.03	.05	138.5	.51	9.16	17.47
	68.5	70.8	2.3	4.22	7.13	8.17	.03	115.7	.55	19.37	15.30
V-316	65.5	66.3	.8	3.21	4.39	5.79	.04	65.5	.15	4.14	10.18
	66.3	67.4	1.1	4.27	4.79	8.39	.04	88.0	.34	19.79	13.18
	67.4	68.9	1.5	4.06	6.63	7.39	.03	94.0	.46	19.32	14.02
	68.9	70.6	1.7	4.35	8.29	7.73	.04	118.0	.46	13.44	16.02
	70.6	71.8	1.2	4.15	12.95	5.94	.06	149.5	.40	.44	18.89
	71.8	73.0	1.2	4.00	13.11	3.98	.05	143.0	1.04	1.61	17.09
	73.0	73.8	.8	4.02	4.04	8.35	.05	78.5	.26	19.38	12.39
	73.8	74.8	1.0	4.29	19.12	8.14	.06	216.5	.22	.82	27.26
	74.8	75.7	.9	3.29	2.12	2.06	.07	22.5	.15	7.55	4.18
	75.7	77.4	1.7	4.07	8.23	6.74	.14	96.5	.22	1.86	14.97
	77.4	79.6	2.2	4.09	4.27	3.39	.24	52.0	.22	.30	7.66
	79.6	81.1	1.5	4.13	5.26	6.30	.04	86.5	.41	11.00	11.56
BLOCK 0-E-1 =>	65.5	81.1	15.6	4.05	7.67	6.09	.08	99.3	.37	7.87	13.76
	84.6	86.3	1.7	4.02	4.59	6.05	.10	65.0	1.22	11.81	10.64
	86.3	87.8	1.5	3.47	2.74	4.60	.04	42.0	.33	15.78	7.34
	87.8	89.3	1.5	4.30	5.44	7.73	.06	68.5	.70	15.76	13.17
	89.3	90.6	1.3	4.28	3.50	7.35	.03	64.0	.37	30.51	10.85
BLOCK 0-E-2 =>	84.6	90.6	6.0	4.01	4.10	6.39	.06	59.9	.68	17.84	10.49
V-26-R	32.1	33.5	1.4	3.08	3.19	8.19	.04	52.5	.65	.14	11.38
	33.5	34.9	1.4	3.34	4.98	9.82	.09	93.0	1.27	.11	14.80
BLOCK 0-E-6 =>	32.1	34.9	2.8	3.21	4.08	9.00	.07	72.8	.96	.12	13.09
	50.3	51.4	1.1	4.63	5.48	8.45	.27	84.0	2.13	16.68	13.93
	51.4	52.6	1.2	4.59	5.61	9.05	.26	89.0	.89	14.90	14.66
BLOCK 0-E-5 =>	50.3	52.6	2.3	4.61	5.55	8.76	.26	86.6	1.48	15.75	14.31
	61.2	62.8	1.6	4.50	4.24	4.98	.14	61.5	.78	14.86	9.22
	62.8	64.3	1.5	4.44	5.05	5.94	.15	66.5	1.57	9.44	10.99
	64.3	65.6	1.3	4.06	5.21	5.67	.22	49.0	.82	11.87	10.88
	65.6	66.2	.6	3.83	3.71	5.53	.13	58.5	.46	20.64	9.24
BLOCK 0-E-3 =>	61.2	66.2	5.0	4.29	4.67	5.51	.16	59.4	.99	13.15	10.18
	69.4	70.9	1.5	4.38	3.61	6.18	.14	55.5	.78	22.61	9.79
	70.9	72.4	1.5	4.54	6.82	5.14	.08	84.0	1.10	23.32	11.96
BLOCK 0-E-4 =>	69.4	72.4	3.0	4.46	5.21	5.66	.11	69.8	.94	22.96	10.88
V-315	26.3	28.1	1.8	3.01	5.70	9.25	.06	88.5	1.27	.12	14.95
	28.1	29.9	1.8	3.18	3.20	5.13	.12	51.5	.93	.30	8.33
BLOCK 0-E-8 =>	26.3	29.9	3.6	3.09	4.45	7.19	.09	70.0	1.10	.21	11.64
	32.9	34.4	1.5	4.63	5.50	7.29	.20	116.5	.93	12.33	12.79
	34.4	35.9	1.5	4.58	5.79	8.11	.20	102.5	2.02	9.97	13.90
BLOCK 0-E-7 =>	32.9	35.9	3.0	4.61	5.65	7.70	.20	109.5	1.48	11.15	13.34
	69.4	70.7	1.3	4.51	5.31	5.60	.14	69.5	.79	10.06	10.91
	70.7	72.2	1.5	4.58	5.64	5.85	.16	62.0	.51	13.94	11.49
	69.4	72.2	2.8	4.55	5.49	5.73	.15	65.5	.64	12.14	11.22
V-01-R	11.6	13.1	1.5	4.34	6.70	13.11	.57	111.5	1.77	18.06	19.81
	13.1	14.6	1.5	4.47	5.14	11.60	.20	105.5	1.27	26.88	16.74
	14.6	16.2	1.6	5.04	9.54	19.20	.50	154.0	1.81	4.51	28.74
	16.2	17.5	1.3	4.29	.67	.81	.04	96.0	.45	6.10	1.48
	17.5	20.4	2.9	3.79	9.40	19.03	.53	16.0	2.30	.39	28.43
	20.4	22.3	1.9	3.79	6.41	12.08	.23	101.5	1.30	7.63	18.49
BLOCK 0-E-9 =>	11.6	22.3	10.7	4.21	6.85	13.74	.37	87.5	1.61	9.18	20.59

VANGORDA DEPOSIT -main layer high grade   Nov. 1984

CALCULATION OF ASSAY COMPOSITES

SECTION 2 EAST

DDH	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb + Zn (%)
V-115-R	42.4	43.9	1.5	4.24	4.96	7.05	.05	87.0	0.00	27.33	12.01
	43.9	45.4	1.5	4.25	6.85	7.62	.08	102.0	0.00	20.02	14.47
	45.4	46.9	1.5	4.24	8.19	6.73	.07	102.0	.01	19.02	14.92
	46.9	48.5	1.6	4.37	6.79	7.65	.04	95.0	.01	19.97	14.44
	48.5	50.0	1.5	4.20	9.65	7.36	.20	112.0	.01	4.71	17.01
	50.0	51.2	1.2	4.41	8.82	6.51	.10	98.5	0.00	11.51	15.33
	51.2	52.7	1.5	4.47	6.05	4.72	.04	89.0	.01	14.14	10.77
	52.7	54.3	1.6	4.37	5.26	5.70	.17	72.0	.01	13.04	10.96
	54.3	55.8	1.5	4.74	1.98	6.07	.03	33.5	0.00	6.54	8.05
	55.8	57.3	1.5	4.35	5.57	9.06	.05	101.5	.01	21.09	14.63
	57.3	58.8	1.5	4.33	8.49	10.60	.10	106.5	.02	11.98	19.09
	58.8	60.4	1.6	4.57	3.64	7.41	.08	59.0	0.00	27.03	11.05
	60.4	61.9	1.5	4.46	3.28	7.63	.09	62.0	0.00	30.51	10.91
	61.9	63.4	1.5	4.46	7.99	6.77	.16	100.5	.02	10.82	14.76
	63.4	64.9	1.5	4.48	3.45	3.79	.30	49.0	.01	4.37	7.24
	64.9	66.4	1.5	4.48	5.05	4.13	.30	67.0	.03	3.78	9.18
	66.4	67.7	1.3	4.39	4.59	4.89	.25	60.0	.01	5.24	9.48
BLOCK 2-E-1 =>	42.4	67.7	25.3	4.40	5.89	6.71	.12	82.0	.01	14.95	12.59
V-15-R	38.5	39.9	1.4	3.08	4.65	9.03	.04	74.5	.45	.33	13.68
	41.8	42.9	1.1	4.13	8.02	5.35	.08	103.5	.65	1.83	13.37
	45.0	45.4	.4	3.49	4.19	9.79	.04	63.5	.24	12.24	13.98
	50.6	51.8	1.2	4.13	5.89	7.80	.09	96.0	.89	22.93	13.69
	51.8	52.6	.8	2.96	.50	.60	.03	4.0	.21	6.73	1.10
	52.6	54.7	2.1	4.53	3.75	5.73	.14	59.5	.89	23.31	9.48
	54.7	56.3	1.6	4.48	7.10	7.90	.13	92.5	1.03	4.66	15.00
	56.3	57.9	1.6	4.25	5.45	7.23	.18	82.0	2.26	23.89	12.68
	57.9	59.4	1.5	4.22	.95	1.04	.30	20.5	1.47	1.75	1.99
	59.4	60.4	1.0	4.23	1.34	2.10	.17	21.0	1.03	1.98	3.44
	60.4	61.4	1.0	4.45	4.97	7.23	.07	83.0	.82	26.74	12.20
	61.4	61.8	.4	4.39	7.78	8.73	.05	111.0	.69	21.58	16.51
	61.8	63.6	1.8	4.21	3.93	6.07	.09	64.0	.55	19.82	10.00
	63.6	65.4	1.8	4.18	5.97	5.06	.15	74.5	.62	13.59	11.03
BLOCK 2-E-2 =>	50.6	65.4	14.8	4.23	4.33	5.44	.14	64.3	1.00	15.38	9.77
	67.2	69.3	2.1	4.42	5.10	7.65	.05	91.0	.48	27.90	12.75
	70.6	72.1	1.5	4.45	5.62	6.45	.05	82.0	.45	26.46	12.07
V-119-R	32.6	34.1	1.5	4.69	6.06	8.64	.22	174.5	.01	.32	14.70
	34.1	36.0	1.9	4.13	10.22	4.87	.04	128.0	.01	5.03	15.09
	36.0	36.6	.6	2.75	0.00	0.00	0.00	0.0	0.00	0.00	0.00
	36.6	37.6	1.0	4.68	5.99	8.04	.22	190.0	.02	.11	14.03
	32.6	37.6	5.0	4.24	6.90	6.05	.13	139.0	.01	2.03	12.95
	53.8	55.4	1.6	3.96	6.85	6.27	.07	87.5	0.00	11.64	13.12
	55.4	56.7	1.3	4.59	7.48	8.86	.06	108.5	.01	31.14	16.34
	56.7	58.2	1.5	4.57	6.55	8.53	.04	94.0	.01	36.44	15.08
	58.2	59.8	1.6	4.53	6.87	7.96	.04	5.0	.01	36.19	14.83
	59.8	61.0	1.2	4.58	3.17	4.49	.20	41.0	.01	8.16	7.66
	61.0	62.3	1.3	4.46	5.41	5.87	.21	68.0	.02	4.43	11.28
	53.8	62.3	8.5	4.44	6.16	7.07	.10	66.8	.01	22.03	13.23

VANGORDA DEPOSIT- main layer high grade Nov. 1984

CALCULATION OF ASSAY COMPOSITES

SECTION 4 EAST

DDH	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb + Zn (%)
V-305	18.4	20.0	1.6	4.41	4.84	3.15	.17	60.0	.80	7.94	7.99
	20.0	21.2	1.2	3.92	6.01	4.65	.11	72.0	.51	7.38	10.66
	21.2	23.0	1.8	3.18	1.74	1.96	.05	26.5	.08	17.90	3.70
	23.0	24.2	1.2	3.88	4.19	5.03	.15	60.0	.10	11.87	9.22
	24.2	25.1	.9	4.45	3.59	6.42	.05	59.5	.42	22.92	10.01
	25.1	25.6	.5	2.75	0.00	0.00	0.00	0.0	0.00	0.00	0.00
	25.6	27.4	1.8	4.22	3.97	4.23	.17	53.5	1.15	3.98	8.20
	27.4	28.7	1.3	4.54	5.89	7.59	.06	85.0	.35	23.08	13.48
	28.7	29.8	1.1	4.05	4.56	6.12	.06	77.0	.31	19.70	10.68
BLOCK 4-E-3 =>	18.4	29.8	11.4	3.99	4.05	4.40	.10	56.8	.47	12.94	8.45
	42.0	43.8	1.8	3.27	4.26	6.61	.05	59.5	.15	3.21	10.87
	43.8	44.7	.9	3.55	4.67	7.37	.12	72.0	.86	5.62	12.04
	44.7	46.0	1.3	4.74	9.04	11.29	.04	160.0	.77	12.57	20.33
	46.0	46.9	.9	3.34	2.09	3.69	.01	33.0	.07	15.59	5.78
	46.9	47.9	1.0	4.10	3.18	7.01	.02	52.0	.14	31.86	10.19
	47.9	48.8	.9	4.25	5.79	4.47	.15	81.5	.76	8.24	10.26
	48.8	50.3	1.5	4.41	4.12	6.81	.05	73.5	.52	31.30	10.93
	50.3	51.8	1.5	4.23	2.84	6.26	.02	40.0	.31	36.07	9.10
	51.8	53.3	1.5	4.00	1.92	5.30	.03	34.5	.39	32.69	7.22
	53.3	54.9	1.6	4.33	3.68	7.13	.03	60.0	.36	33.96	10.81
	54.9	56.4	1.5	4.41	3.77	7.49	.03	70.0	.27	33.47	11.26
	56.4	57.9	1.5	4.32	4.71	8.86	.04	88.5	.31	27.50	13.57
	57.9	59.4	1.5	4.24	4.59	9.61	.03	81.5	.36	25.67	14.20
	59.4	61.0	1.6	4.42	3.18	8.16	.02	59.0	.39	34.30	11.34
	61.0	62.5	1.5	4.33	6.94	11.29	.07	89.0	.93	20.04	18.23
	62.5	63.5	1.0	4.16	9.07	11.66	.08	84.5	1.36	14.39	20.73
BLOCK 4-E-1 =>	42.0	63.5	21.5	4.15	4.52	7.77	.05	70.9	.47	23.92	12.30
V-33-R	28.5	29.0	.5	3.88	10.86	8.87	.03	157.0	.41	7.32	19.73
	29.0	30.1	1.1	4.46	4.39	8.25	.03	72.0	.27	37.04	12.64
	30.1	31.7	1.6	4.69	6.33	7.63	.19	81.5	1.41	7.45	13.96
	31.7	33.2	1.5	4.57	4.69	6.02	.09	67.0	1.10	23.71	10.71
	33.2	34.4	1.2	4.06	3.17	5.82	.15	47.0	1.23	29.78	8.99
	34.4	35.5	1.1	4.04	4.74	4.60	.48	87.5	3.43	12.96	9.34
	35.5	37.1	1.6	4.50	5.76	6.54	.13	77.5	1.58	11.06	12.30.
BLOCK 4-E-4 =>	28.5	37.1	8.6	4.39	5.31	6.66	.16	77.4	1.42	18.56	11.97
	42.3	43.5	1.2	4.13	6.21	7.90	.08	87.0	.79	19.01	14.11
	43.5	45.0	1.5	3.91	3.72	7.29	.01	58.0	.21	30.33	11.01
	45.0	46.6	1.6	3.98	3.35	8.05	.01	59.5	.17	36.94	11.40
	46.6	48.2	1.6	4.17	6.37	6.94	.02	88.5	.27	27.95	13.31
	48.2	49.7	1.5	3.83	3.59	4.27	.16	49.5	.55	16.02	7.86
	49.7	51.2	1.5	3.87	5.15	4.43	.09	70.0	.58	17.44	9.58
	51.2	52.7	1.5	3.59	3.06	5.18	.06	47.5	.72	20.92	8.24
	52.7	54.3	1.6	3.96	2.65	5.09	.05	38.5	.72	22.80	7.74
	54.3	55.8	1.5	4.28	2.47	5.66	.07	41.0	.68	30.84	8.13
	55.8	57.3	1.5	4.45	3.56	5.39	.15	71.5	1.89	23.85	8.95
	57.3	58.8	1.5	4.34	3.47	6.75	.20	60.0	1.17	17.89	10.22
	58.8	60.0	1.2	4.22	4.27	6.75	.04	62.5	.62	32.88	11.02
	60.0	61.3	1.3	3.81	4.92	4.72	.07	64.0	1.17	14.53	9.64
	61.3	63.2	1.9	3.83	3.03	4.83	.13	35.5	1.03	16.67	7.86
BLOCK 4-E-2 =>	42.3	63.2	20.9	4.02	3.93	5.91	.08	58.6	.75	23.40	9.83
V-304	30.8	32.3	1.5	3.21	5.05	7.86	.16	73.5	.99	.14	12.91
	36.9	38.4	1.5	2.87	2.60	5.82	.04	40.5	.78	.19	8.42
	38.4	39.2	.8	4.19	8.58	12.12	.23	107.0	1.47	3.58	20.70
BLOCK 4-E-5 =>	36.9	39.2	2.3	3.33	4.68	8.01	.11	63.6	1.02	1.37	12.69
	53.0	54.5	1.5	4.50	8.14	9.86	.05	123.0	1.12	23.34	18.00
	54.5	56.0	1.5	4.14	4.25	6.86	.17	65.5	1.15	17.24	11.11
	56.0	57.0	1.0	4.01	4.77	6.41	.13	66.0	.63	12.83	11.18
	53.0	57.0	4.0	4.24	5.84	7.87	.12	87.2	1.01	18.43	13.71
	74.6	76.2	1.6	4.10	4.07	3.87	.53	48.5	4.18	1.74	7.94
	76.2	77.7	1.5	4.63	4.94	5.95	.21	68.5	1.41	17.61	10.89
	77.7	79.1	1.4	4.51	5.78	8.50	.07	83.5	2.05	22.56	14.28
	74.6	79.1	4.5	4.40	4.89	6.00	.28	66.1	2.59	13.51	10.90

VANGORDA DEPOSIT -main layer high grade calculation   Nov. 1984

CALCULATION OF ASSAY COMPOSITES

SECTION 6 EAST

DDH	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb + Zn (%)
V-94-R	25.1	26.3	1.2	4.08	6.84	6.03	.08	93.5	.55	10.94	12.87
	26.3	26.5	.2	2.75	0.00	0.00	0.00	0.0	0.00	0.00	0.00
	26.5	28.0	1.5	4.47	5.94	6.12	.09	80.5	.41	15.87	12.06
	28.0	29.0	1.0	4.66	8.54	8.56	.07	105.0	.27	20.37	17.10
	29.0	30.4	1.4	4.81	1.27	4.82	.02	22.0	.21	.19	6.09
	30.4	30.9	.5	4.52	4.68	7.58	.03	71.0	.27	21.21	12.26
	30.9	31.7	.8	3.31	2.38	3.29	.11	38.5	0.00	12.96	5.67
	31.7	32.2	.5	4.04	8.45	15.50	.07	131.0	.34	7.27	23.95
	32.2	32.9	.7	3.03	.51	.57	.03	5.5	0.00	10.81	1.08
	32.9	34.2	1.3	3.86	9.55	6.97	.11	130.5	.34	1.75	16.52
BLOCK 6-E-4 =>	25.1	34.2	9.1	4.13	5.35	6.08	.07	74.1	.28	10.11	11.43
	50.0	50.7	.7	4.47	5.35	9.19	.16	95.0	.34	12.05	14.54
	50.7	51.2	.5	2.75	0.00	0.00	0.00	0.0	0.00	0.00	0.00
	51.2	52.7	1.5	4.52	8.15	5.84	.05	111.5	.55	17.53	13.99
	52.7	54.3	1.6	4.31	5.26	8.55	.04	89.0	.41	28.77	13.81
	54.3	56.0	1.7	4.33	2.40	5.76	.03	39.0	0.00	32.07	8.16
	56.0	57.3	1.3	3.65	4.61	7.45	.11	55.0	.21	4.33	12.06
BLOCK 6-E-1 =>	50.0	57.3	7.3	4.15	4.72	6.62	.06	70.4	.27	19.30	11.34
V-47-R	38.1	39.6	1.5	3.02	4.62	5.40	.06	64.0	.75	.45	10.02
	39.6	40.5	.9	3.22	4.38	6.14	.07	68.0	.58	2.30	10.52
	40.5	42.1	1.6	4.25	5.04	6.77	.13	82.5	.96	12.53	11.81
	42.1	43.6	1.5	4.38	3.98	4.04	.16	52.0	1.47	5.01	8.02
	43.6	45.1	1.5	4.56	3.16	5.21	.12	51.5	.99	14.74	8.37
	45.1	45.7	.6	4.42	9.93	8.18	.05	126.0	.58	8.37	18.11
BLOCK 6-E-5 =>	38.1	45.7	7.6	3.99	4.68	5.69	.11	68.4	.95	7.56	10.37
	48.2	49.0	.8	4.85	5.16	6.61	.09	90.0	.72	24.09	11.77
	49.0	50.0	1.0	3.45	3.30	3.93	.03	55.0	.34	9.67	7.23
	50.0	52.0	2.0	4.52	2.96	3.78	.04	50.5	.86	7.00	6.74
	52.0	53.2	1.2	4.75	3.66	7.22	.04	59.5	.24	26.98	10.88
	53.2	54.4	1.2	4.51	2.88	6.44	.02	53.5	.24	30.52	9.32
	54.4	55.9	1.5	3.94	5.06	7.34	.07	72.0	.58	11.08	12.40
	55.9	57.5	1.6	4.98	1.43	2.80	.04	31.5	.45	4.39	4.23
	57.5	58.8	1.3	4.83	2.22	4.17	.02	42.5	.21	23.16	6.39
	58.8	60.4	1.6	4.50	5.72	7.42	.06	86.0	.27	24.02	13.14
	60.4	62.1	1.7	4.20	4.22	6.93	.06	67.0	.34	24.87	11.15
BLOCK 6-E-2 =>	48.2	62.1	13.9	4.46	3.62	5.59	.05	59.6	.44	17.73	9.21
V-95-R	48.1	49.8	1.7	4.11	4.90	7.24	.02	68.0	.17	29.11	12.14
	49.8	51.1	1.3	3.02	.83	1.66	.01	10.5	0.00	12.95	2.49
	51.1	52.3	1.2	3.87	3.23	6.07	.02	39.0	.07	29.28	9.30
	52.3	53.0	.7	4.25	8.62	8.52	.02	110.0	.34	17.84	17.14
	53.0	54.2	1.2	4.39	13.75	12.40	.04	160.5	.48	2.81	26.15
	54.2	55.5	1.3	4.37	2.75	6.25	.03	35.5	.10	38.90	9.00
	55.5	56.3	.8	4.77	22.30	8.87	.03	244.0	1.65	2.20	31.17
	56.3	57.8	1.5	4.42	6.88	8.83	.03	96.5	.68	21.19	15.71
	57.8	59.4	1.6	4.44	6.88	7.23	.06	94.5	.82	22.77	14.11
	59.4	60.7	1.3	3.84	3.95	5.93	.13	51.0	.34	12.28	9.88
BLOCK 6-E-3 =>	48.1	60.7	12.6	4.13	6.64	7.17	.04	83.3	.43	20.15	13.81
	73.4	75.0	1.6	4.61	4.68	5.82	.29	74.0	1.10	19.87	10.50
	75.0	76.5	1.5	4.66	3.67	4.95	.19	65.5	1.20	11.84	8.62
	76.5	78.0	1.5	4.61	7.90	8.09	.15	103.0	1.65	5.66	15.99
	78.0	79.6	1.6	4.49	5.94	9.54	.15	86.0	0.00	28.83	15.48
	79.6	81.1	1.5	4.34	4.50	6.66	.13	62.0	.07	27.21	11.16
	73.4	81.1	7.7	4.54	5.34	7.03	.18	78.1	.80	18.83	12.37

VANGORDA DEPOSIT- main layer high grade calculation   Nov. 1984

CALCULATION OF ASSAY COMPOSITES

SECTION 8 EAST

DDH	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb + Zn (%)
V-303	28.8	29.9	1.1	3.03	2.10	3.27	.09	30.5	.21	7.37	5.37
	29.9	31.0	1.1	3.33	3.73	5.38	.07	68.5	.37	11.61	9.11
	31.0	32.1	1.1	3.84	7.62	12.60	.06	101.0	.12	2.67	20.22
	32.1	32.8	.7	2.96	1.09	.92	.01	12.0	.15	3.63	2.01
	32.8	34.1	1.3	3.62	5.93	7.79	.12	75.5	.21	12.22	13.72
	34.1	35.4	1.3	2.72	1.34	2.10	.04	15.0	.24	1.66	3.44
	35.4	36.8	1.4	3.49	3.63	6.53	.30	70.0	.61	10.50	10.16
BLOCK 8-E-1 =>	28.8	36.8	8.0	3.30	3.76	5.75	.11	55.5	.29	7.39	9.51
	44.3	45.5	1.2	4.05	2.75	4.25	.06	45.0	.68	12.73	7.00
	45.5	46.7	1.2	4.34	8.60	9.01	.06	110.5	.87	14.59	17.61
	46.7	48.4	1.7	3.99	8.82	12.79	.06	94.5	.78	3.69	21.61
	44.3	48.4	4.1	4.11	6.98	9.18	.06	84.7	.78	9.53	16.16
V-45-R	31.7	33.2	1.5	4.63	5.79	8.80	.07	88.5	.75	30.68	14.59
	33.2	34.7	1.5	4.42	3.70	6.89	.09	60.5	.68	22.49	10.59
	34.7	36.3	1.6	4.34	3.59	8.24	.02	56.0	.25	35.21	11.83
	36.3	37.8	1.5	4.44	3.65	8.88	.01	56.0	.25	36.54	12.53
	37.8	39.3	1.5	4.60	3.91	8.34	.01	59.0	.07	35.07	12.25
	39.3	40.8	1.5	4.33	2.91	7.40	.01	46.0	.11	34.40	10.31
	40.8	42.4	1.6	4.25	3.87	7.65	.05	59.0	.53	28.78	11.52
	42.4	43.9	1.5	4.53	4.61	7.43	.01	89.0	.18	33.11	12.04
	43.9	45.4	1.5	4.44	5.65	8.96	.07	67.0	.36	24.06	14.61
	45.4	46.9	1.5	4.06	5.32	7.18	.05	86.5	.36	28.62	12.50
BLOCK 8-E-2 =>	31.7	46.9	15.2	4.40	4.29	7.98	.04	66.6	.35	30.91	12.27
V-302	41.9	43.4	1.5	4.29	8.70	7.66	.18	122.5	1.60	6.38	16.36
	43.4	44.7	1.3	4.58	4.79	5.41	.23	62.0	.79	14.90	10.20
	44.7	46.3	1.6	4.67	3.42	5.68	.20	57.5	1.59	12.19	9.10
	46.3	47.9	1.6	4.30	2.72	3.42	.37	48.0	1.17	9.75	6.14
	47.9	49.3	1.4	4.28	2.74	5.17	.09	53.5	.75	15.36	7.91
	49.3	50.7	1.4	4.40	3.99	6.26	.18	62.5	.71	18.12	10.25
	50.7	52.6	1.9	4.65	5.04	6.24	.16	67.0	1.98	16.94	11.28
BLOCK 8-E-3 =>	41.9	52.6	10.7	4.46	4.50	5.70	.20	67.6	1.28	13.37	10.19
	62.8	64.4	1.6	4.55	5.24	4.29	.16	68.0	.85	4.92	9.53
	64.4	65.6	1.2	4.36	5.35	6.22	.14	64.5	1.91	15.46	11.57
	65.6	67.0	1.4	4.60	8.17	9.79	.17	87.5	1.95	9.38	17.96
	67.0	68.5	1.5	4.27	3.02	1.88	.22	35.5	1.26	3.13	4.90
	68.5	69.8	1.3	4.30	4.40	5.16	.06	58.5	1.53	10.58	9.56
	62.8	69.8	7.0	4.42	5.21	5.37	.15	62.6	1.47	8.29	10.58

VANGORDA DEPOSIT- main layer high grade calculation   Nov. 1984

CALCULATION OF ASSAY COMPOSITES

SECTON 10 EAST

DDH	from (m)	to (m)	length (m)	S.G.	Pb (%)	Zn (%)	Cu (%)	Ag (g/t)	Au (g/t)	BaO (%)	Pb + Zn (%)
V-110-R	46.0	47.5	1.5	3.97	7.75	8.31	.12	61.0	.01	.19	16.06
	47.5	49.1	1.6	3.84	6.51	9.77	.11	57.0	.02	1.11	16.28
	49.1	50.8	1.7	3.74	6.94	10.58	.10	60.0	.02	1.52	17.52
BLOCK 10-E-1 =>	46.0	50.8	4.8	3.85	7.05	9.60	.11	59.3	.02	.97	16.65
V-50-R	34.1	34.7	.6	4.26	4.09	5.84	.10	43.0	.89	21.65	9.93
	34.7	36.3	1.6	4.39	4.46	4.16	.13	37.0	1.14	1.41	8.62
	36.3	37.9	1.6	4.62	5.42	5.34	.07	55.5	.96	4.21	10.76
	37.9	40.1	2.2	3.81	5.86	8.80	.05	54.0	.39	15.56	14.66
	40.1	41.8	1.7	4.38	7.85	7.31	.07	114.5	.50	25.38	15.16
	41.8	43.3	1.5	4.26	6.54	6.77	.08	83.0	.71	23.50	13.31
	43.3	44.8	1.5	4.15	6.42	7.52	.10	103.0	.68	32.84	13.94
	44.8	46.3	1.5	4.45	6.02	8.49	.05	88.0	.50	29.59	14.51
	46.3	47.9	1.6	4.18	6.63	8.92	.05	90.0	.53	23.30	15.55
	47.9	48.7	.8	2.89	1.13	2.00	.02	12.5	.14	9.04	3.13
	48.7	50.0	1.3	4.26	5.79	8.56	.08	56.5	.14	21.10	14.35
	50.0	51.5	1.5	4.35	6.15	9.47	.07	58.0	.82	25.95	15.62
	51.5	53.0	1.5	4.33	6.96	10.24	.03	73.0	.14	23.55	17.20
	53.0	54.0	1.0	4.47	5.02	8.44	.02	44.0	.17	21.72	13.46
	54.0	55.2	1.2	4.25	3.84	6.05	.15	40.5	.17	19.62	9.89
BLOCK 10-E-2 =>	34.1	55.2	21.1	4.23	5.75	7.44	.07	67.1	.54	19.89	13.19
	67.8	68.9	1.1	4.68	5.00	6.65	.06	41.5	.17	11.93	11.65
	68.9	70.7	1.8	3.73	5.94	7.59	.04	55.0	.14	4.19	13.53
	67.8	70.7	2.9	4.09	5.58	7.23	.05	49.9	.15	7.13	12.82
	73.9	75.3	1.4	4.27	6.08	9.52	.06	94.5	.62	22.14	15.60
	75.3	76.7	1.4	4.46	5.82	7.73	.10	56.0	.27	21.05	13.55
	73.9	76.7	2.8	4.37	5.95	8.62	.08	75.2	.44	21.59	14.57
V-114-R	32.9	33.5	.6	4.49	4.61	7.99	.06	64.5	.07	37.94	12.60
	33.5	36.9	3.4	2.79	4.79	3.34	.09	35.0	.07	25.94	8.13
BLOCK 10-E-3 =>	32.9	36.9	4.0	3.05	4.76	4.04	.09	39.4	.07	27.74	8.80
	70.9	71.8	.9	4.18	5.78	7.67	.02	67.0	.62	21.19	13.45
	74.7	76.0	1.3	4.29	4.67	5.86	.22	47.0	.55	12.86	10.53
	92.4	93.6	1.2	4.61	5.66	8.10	.11	98.0	.62	19.73	13.76
	93.6	94.9	1.3	4.45	5.75	8.09	.16	80.5	.55	18.67	13.84
	92.4	94.9	2.5	4.53	5.71	8.09	.14	88.9	.58	19.18	13.80

To: Rik Visagie

From: Gregg Jilson

Date: March 29, 1985

Subject: Geological observations bearing on geotechnical data for the Grum open pit

INTRODUCTION

For all deposits in the Anvil District one of the major determinants of the stability of excavations in rock is the orientation of the dominant metamorphic clevage or foliation (S_2). At the Grum deposit the orientation of the foliation is locally totally unknown because the bedrock surface is covered by thick overburden. There is however a body of evidence bearing on the orientation available in the underground workings and on surface at the northwest end of the proposed pit. Another line of evidence is found in the structural style of the Anvil District which, though not site specific, provides a general guide to the reasonability of assumptions.

At Grum assumptions must be made in the absence of specific data. It is the impression of the author that the assumptions made, while conceivebly correct, are not consistent with the usual structural style of the district. There are further assumptions made that tend to systematically exaggerate the foliation dip on the order of 5° - 10°.

The purpose of this memo is merely to point out that these troublesome points exist but not to propose a solution. Indeed no solution can presently be provided with the available data because there are simply too many unknowns. Definitive answers to these questions will require more data, this means drilling more holes to retrive oriented core. While the cost of drilling many such holes may seem high it will be small in comparison to the cost of stripping off an unnesessarily large area only to find a more favorable situation than had been predicted or worse, that the overall stripping ratio and mining costs will have to be higher because the situation is less favorable. Additionally the memo presents new data gathered during the 1984 field season and re-examines old surface data in light of new structural interpretations of the Vangorda Plateau. This is a response to and reiteration of section 6.6.1 of the Montreal Engineering Phase Two Geotechnical Report.

REGIONAL FOLIATION DIP

The Vangorda Plateau portion of the Anvil District is characterized by shallow foliation dips that are generally toward the southwest but locally are thrown into gentle warps such that the dip can be shallow in any direction. Near faults and in areas of strong contrasts of ductility steeper dips are found but large domains of steep foliation dip have not been proven to exist. The stereonet of foliation attitudes from the vicinity of Grum presented in the Montreal Engineering phase two geotechnical report (plate c-2 of appendix c) demonstrates this fact. Figure 1 of this memo is a modification of that stereonet which discards all but 58 of the 113 poles ploted on plate c-3 since they are derived from domains that are not relevant to Grum (the mylonitic border of Anvil Batholith and the footwall sequence of the Tie Fault). This modification considerably lessens the prominent peak at 000/20W which is largely due to the schist sequence in the footwall of the Tie Fault. Figure 1 still demonstrates the overall low angle nature of the foliation when only phyllites of the Vangorda Plateau sequence are considered.

FOLIATION IN THE UNDERGROUND WORKINGS

Foliation poles measured underground at Grum were plotted on plate c-3 of the Montreal report. The latter plot is remarkably similar to figure 1 with poles tending to fall on a girdle close to the plane of the Grum cross sections and on a peak corresponding to a strike a little more northwesterly than 000 (160° to 170°). In general the measured dips underground are so low and so variable that it is difficult to think of an average foliation strike for Grum on the basis of a stereonet analysis alone.

A somewhat different analysis of foliation dips underground can be made by attempting to draw highly generalized form lines for foliation dips (note that to do this analysis I have examined the geology of the walls of the cross cuts as portrayed by Kerr Addison and overruled some ploted foliation attitudes as being inconsistent with with the walls or the breast). The results of this analysis (figure2) show that two major domains exist with the domain boundary at about 2N. Southwest of 2N foliation dips are nearly always toward the southwest about 10° to 30° (the average strike is about 140° and dip direction 230°). Northwest of 2N the dips are more variable but there is a strong component dipping gently to the northeast (average strike about 125° and dip direction 035°) and a tendency to reverse back to a southwest dip at about 7N. This gentle warp in the foliation is apparent on all the Grum cross sections and the mapped cross cuts.

1984 WORK ON SURFACE FOLIATIONS

Figure 3 is a map of the area of the proposed Grum pit showing the foliations measured during the 1984 field season. Considerable attention was paid to this area and several new areas of outcrop were found and measured. The results show the foliation defines a fairly smooth arc with a poorly defined change in foliation attitude at about 3N. Southwest of that line dips are to the southwest with an average strike of about 140° (figure 4), this is the surface extension of the domain S.W. of 2N in the subsurface. To the northeast dips are toward the northwest with a slight tendency to dip north (figures 3 and 4), this is presumably the surface expression of the dip reversal in the subsurface. There is a rather remarkable antithetic correlation between foliation dip and the proposed pit walls so that it tends to dip into both the southwest and northwest walls (figure 3). If this situation persists to depth then these walls can be kept steep as presently planned. Indications are that this is the case.

Figure 5 shows the results of measurment of S_2 and L_2 for the area around Grum. It is analogous to Figure 1 but draws data from a smaller area. Note that on this stereonet and the underground map (figure 2) the average foliation strike is close to 000° but that is not a common direction for individual measurements.

STEEP FOLIATION ALONG THE EAST WALLS

The northeast walls are the contentious issue and it is these areas where overburden cover is greatest and data is least. Certainly where the walls are in thick overburden the pit slopes will have to be kept shallow. Dewatering of the overburden must be considered as this will have a substantial effect on stability as the Montreal report points out. In the bedrock it is these areas where the predicted foliation dips look most suspicous to me. Dips of up to 70° are predicted by Montreal Engineering (see plates c-13 to c-15) on the basis of manipulating the foliation angles measured and displayed by Kerr Addison on cross sections.

There are two points to be made here. First the assumption has been made that the foliation angles plotted by Kerr geologists on section were apparent dips. This is not the case. Sirola states on page 11 of the 1977 Mineral Inventory Report that foliation was plotted numerically, while the meaning of this statement is unclear, checking their logs against the sections shows that the measured core angle was simply plotted directly in relation to the apparent drill hole trajectory on section. By assuming a strike of 000° and apparent dips on section one arrives at a dip that is too large. Figure 6 and Table 1 of this memo show that the magnitude of this overestimate 0^{o} to about 10^{o} depending on the local geometry. Consequently the dips plotted on plates c-13 to c-15 should not be accepted uncritically. Of greater importance of course is possibility that the 000^{o} strike is not applicable. Reference to the foliation charts for the northeast and southeast walls shows that this is not necessarally good news since the statement is made that shallower dips will mean less stability (footnote 2 of table V). The extent to which this generalization is valid is uncertain since there must come a point when stability starts to increase as dip decreases. If dips are 20 ^{o} then increased stability may set in especially if there is waviness in the foliation resulting in a lower sheet dip (thus the concern over a small increase to dips thought to be in the 15^{o} to 30^{o} range).

It is at this point where the second issue must be discussed. That is that foliation angles are measured relative to drill holes that are not necessarily vertical nor on section. It is this correction for drill hole deviation that can be most significant at Grum and it is likely that the areas of steep dip predicted in the pit have their origin here. A typical area of suspicious steep dip is at 10 north on section 66W on level plan 1203m (plate c-13). The drill hole that is the source of data here is FAGA139. At the point in question the foliation angle measured is 45^{o}, when ploted on section this translates to a dip of 58^{o} and when "corrected" for apparent dip this becomes the 68^{o} shown on plate c-13. Figure 7 shows the orientation of the drill hole,the cross section and a small circle that represents the cone that is the locus of all possible poles to the foliation. Because this is a special case the small circle also is a close approximation to the locus of all possible dip directions for the foliation. This figure shows that the true dip for the 270^{o} (i.e. the assumed 000^{o} strike) direction is 57^{o}, it also shows that a number of alternate solutions for the foliation dip exist.

Underground mapping shows that northeast dips do occur thus this possibility should be considered, if the generalized dip direction for the domain north of 2N is used here the resultant dip is 32° to the northeast. If this is to cause of the several very speep foliation dips predicted for the northeast and southeast walls then it is possible that there is a fairly well developed component of northeast dips there. Once the slight exaggeration of southwest dip is removed and the possibility of a slight waviness to the northeast is added in the situation could be somewhat more hopeful than we are anticipating.

A FIELD APPROACH TO ORIENTING UNORIENTED DRILL CORE

There are exercises that could be undertaken in the field to attempt to solve the problem of foliation orientation but the likelyhood of success is not great. Phyllites of the Vangorda Plateau contain several linear and planar features in addition to S_2 (figure 8) that can be used to orient the core in an ideal and simple situation. This technique can be powerful provided there is an adequate background of well established information on the usual orientation of the features near Grum and that the problem is not rendered insoluble by ambiguous relationships. Some orientation work has already been done during 1984 at Grum aimed at this possibility, several problems were encountered not the least of which was poor outcrop. This problem can be partly eliminated by trenching to improve the outcrop. About $2500 worth of backhoe time could significantly improve the outcrop situation and about a month of field time would be required to gather data from outcrop and drill core. The problem then is whether there will be a sufficiently distinctive array of structures available to work with and whether observations made in hangingwall Vangorda formation phyllites can be extrapolated to footwall Mt. Mye formation phyllites. Neither of these questions can be satisfactorally answered now but more field work could provide a sufficiently compelling statistical background for further interpretation. The basic problem is that with the additional data provided by the trend of a fine crenulation lineation on the main foliation the dip direction can be narrowed down to two choices (plus or minus about 25°), with the addition of the dip of the crenulation clevage related to the lineation (which acts as the reference fabric element in terms of the field logging manual) the choice is narrowed down to one possibility. The drawback with this approach is that one can never be quite sure that there is one fine crenulation lineation or, more importantly, that the related clevage dips in the assumed direction. During the 1984 field season 31 measurements of the fine crenulation lineation were made near Grum, all are within a azimuthal range of 45° averaging 155° - 335°. Ten related foliations were measured, 8 dipped steeply southwest as expected, one was vertical and one dipped northeast (figure 9). Attempts to use this method to date have proved to be frustrating and ambiguous because evidence was found that there were reference foliations dipping in both directions. Should this method give statistically convincing results it still cannot provide information about areas that have not been drilled yet (it should not be considered a substitute for oriented core) and much of the potential northeast wall has no holes at all. There is a slightly better that even chance that this approach would work.

MODERATE ANGLE FAULTS

Faults with moderate dips are an important component of the overal structural style of the Vangorda Plateau and the Grum deposit. Preliminary indications are that a major gouge marked fault zone will be found in the northeast wall. The fault is expected to be striking north - south and dipping 40° to the west. If the foliation is dipping to the southwest there may be a major problem with 3-D wedge failure. As the structural interpretation of Grum progresses more data on this structure will become available. A larger fault of similar nature (the Doal Lake Fault) and orientation truncates the Grum deposit at its east end. Current pits do not include this area but a large pit intended to take the upright panel will probably encounter stability problems due to this structure. Similarly oriented faults were pointed out to be present in the Montreal report (p. C-6).

Figure 10 shows the results of measurment of close spaced joints to wide spaced fracture clevage in phyllites around the Grum deposit (1984 data). These poles fit well with those measured underground and show that the joints measured in ore do apply to rocks outside the ore. This direction is very widely developed throughout the Vangorda Plateau. Other joint directions occur but they are more local; nonetheless they can be the significant controls on rock breakage.

OVERBURDEN EAST OF THE GRUM DEPOSIT

Figure 3 shows overburden thickness isopachs. As is apparent from that map there is a buried valley to the east of the Grum deposit. The valley runs north - south and appears to be controlled by the soft highly gouged phyllites of the Doal Lake Fault Zone. The east side of this valley, from the available evidence, is quite steep and slopes toward Grum at an angle of 25° . Figure 11 shows this valley in relation to the approximate O1K Pit limit. Incrementally larger pits designed to mine the upright panel and other sulphide horizons will encounter increasing thicknesses of overburden. It does not appear likely that the west sloping sub-overburden surface will ever daylight in the pit but sufficiently large proposed pits may have problems with failure on this plane.

RECOMMENDATIONS

It is recommended that drilling of oriented cores be undertaken to define foliation dips along the northeast portion of the pit. The number of holes required will probably be at least 25 if foliation dip proves to be variable. Since this will represent a large expenditure the possibility that these holes could also be part of a dewatering network should be explored.

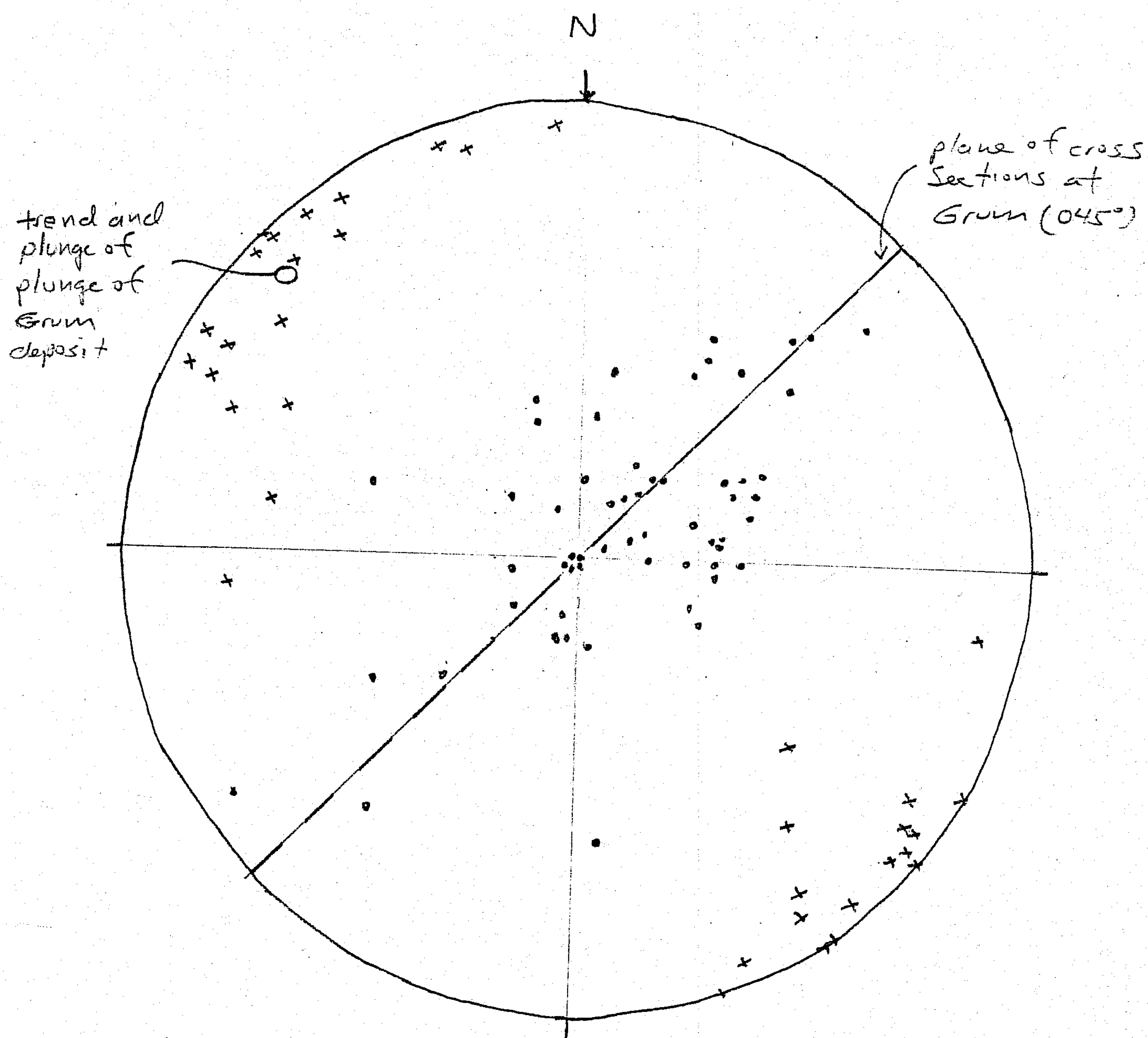
On a shorter term the sorts of analysis of foliation dip undertaken here should be extended. Since shallower dips may be expected than the 34^{o} minimum currently studied, foliation charts for lower dips should be derived for the northeast and southeast walls. Since foliation waviness may occur along these walls, Q-sums analysis of the foliation should be undertaken.

A geotechnical engineer should examine the data for Grum in close co-operation with a project geologist. Most of what is said here was previously mentioned in the recommendations of the phase two geotechnical report. The other recommendations of the Montreal Engineering report should also thus be enacted or examined at the earliest practical date.

In light of the uncertain results of the field approach to orienting core this method is not strongly recommended but should be considered as a possibility. On going structural reinterpretation of the Grum deposit should attempt to isolate areas of known foliation dip or areas where the overall geology can help define the most likely foliation dip.

TABLE 1. Amount of exaggeration of dip that results from the assaumption that the dips on section are apparent dips and the the strike is north - south

apparent dip on a section at 045 degrees	true dip if plane strikes 000 and dips west	exaggeration of dip that results
0	0	0
10	13	3
20	27	7
30	38	8
40	49	9
50	59	9
60	68	8
70	75	5
80	83	3
90	90	0



• S_2 pole
× L_2 lineation

Limits on data are:
a) Vangorda Ck on SE
b) Batholith contact on N&NE
c) Tie Fault on NW
d) a line parallel to and 7000' SW of the centerline of Grum deposit

FIGURE 1

D_2 structural elements from northwest Vangorda Plateau portion of sheet F6 (1979 data)

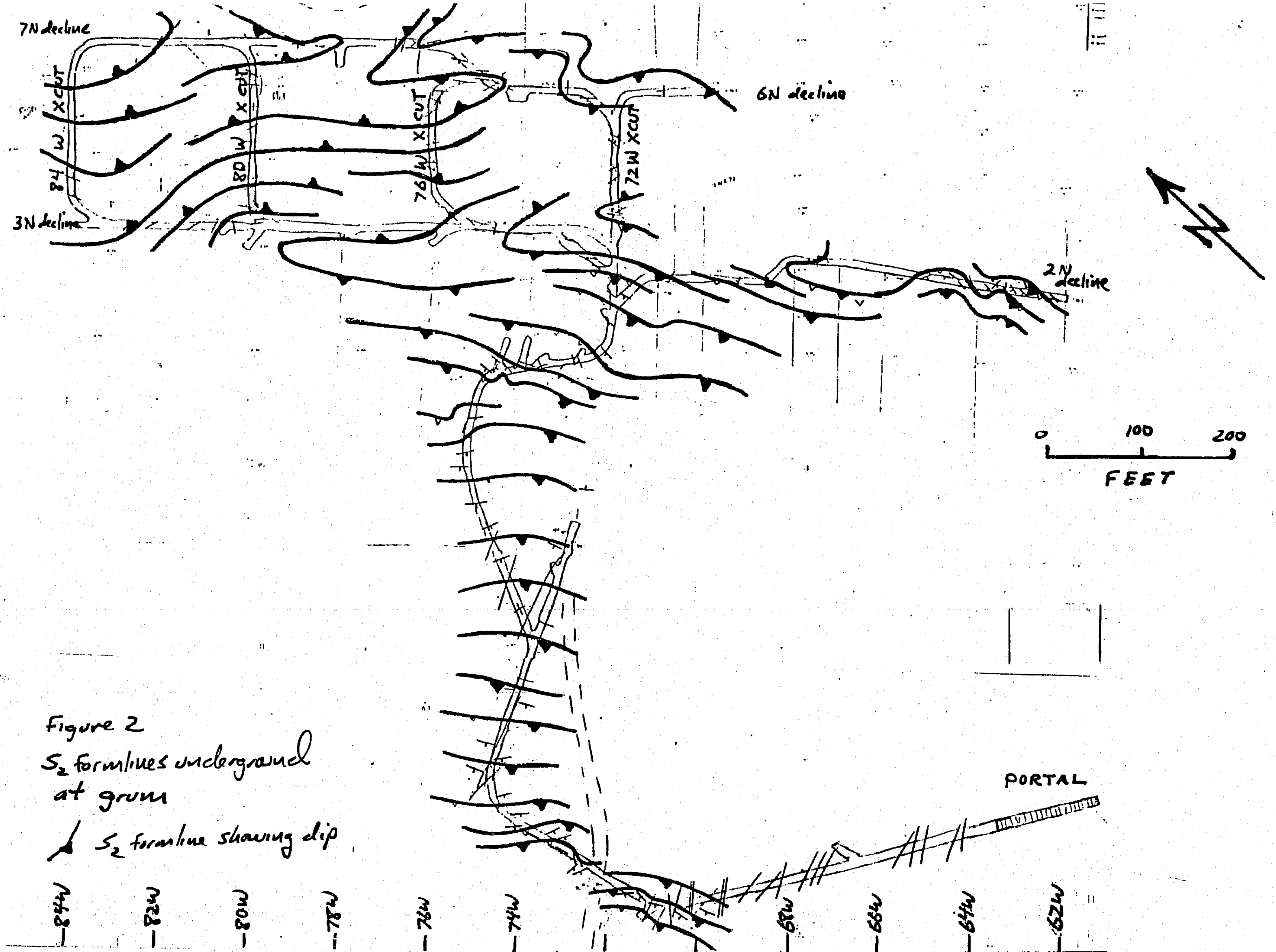


Figure 2
S_2 formlines underground at grum

S_2 formline showing dip

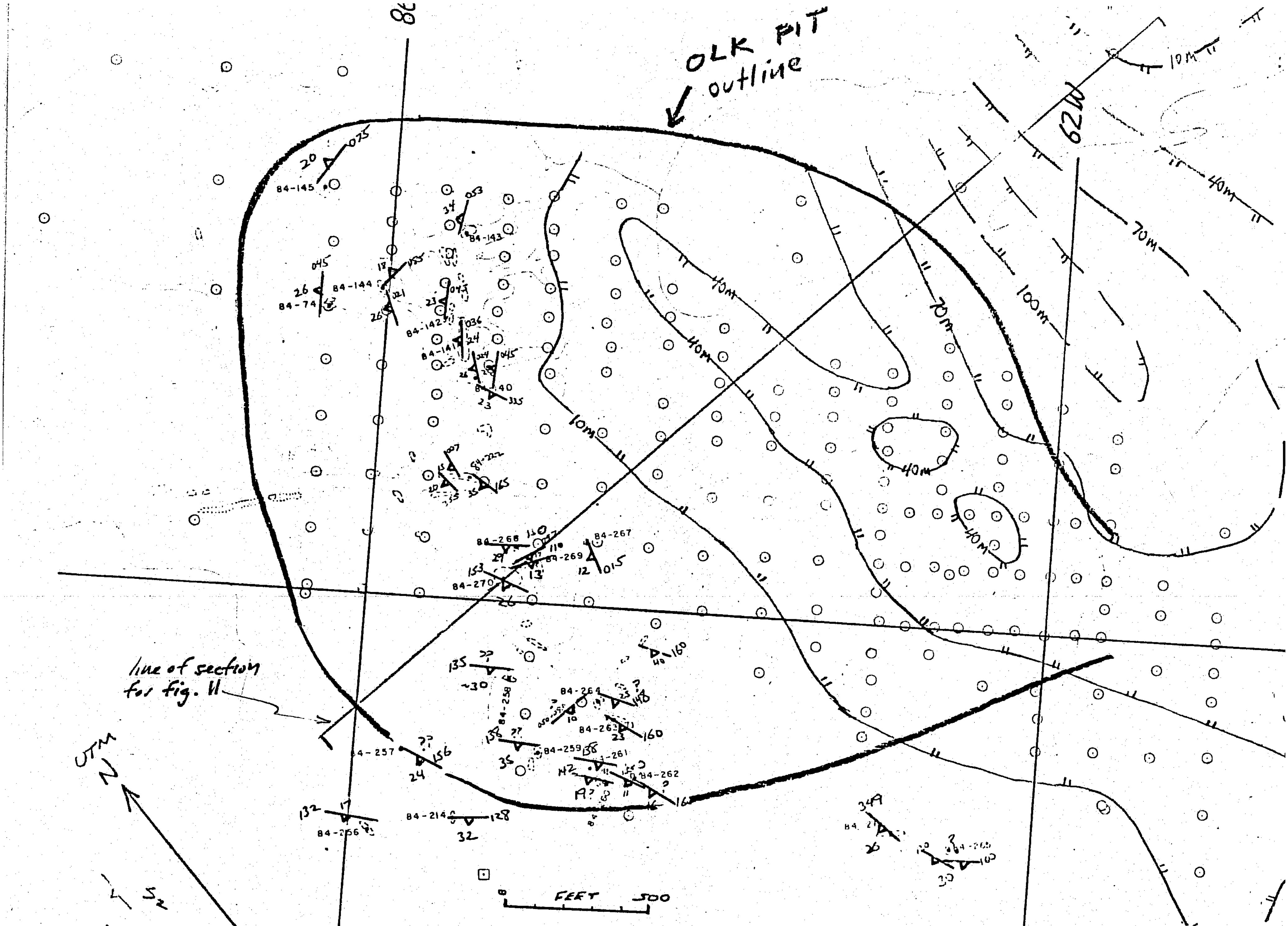
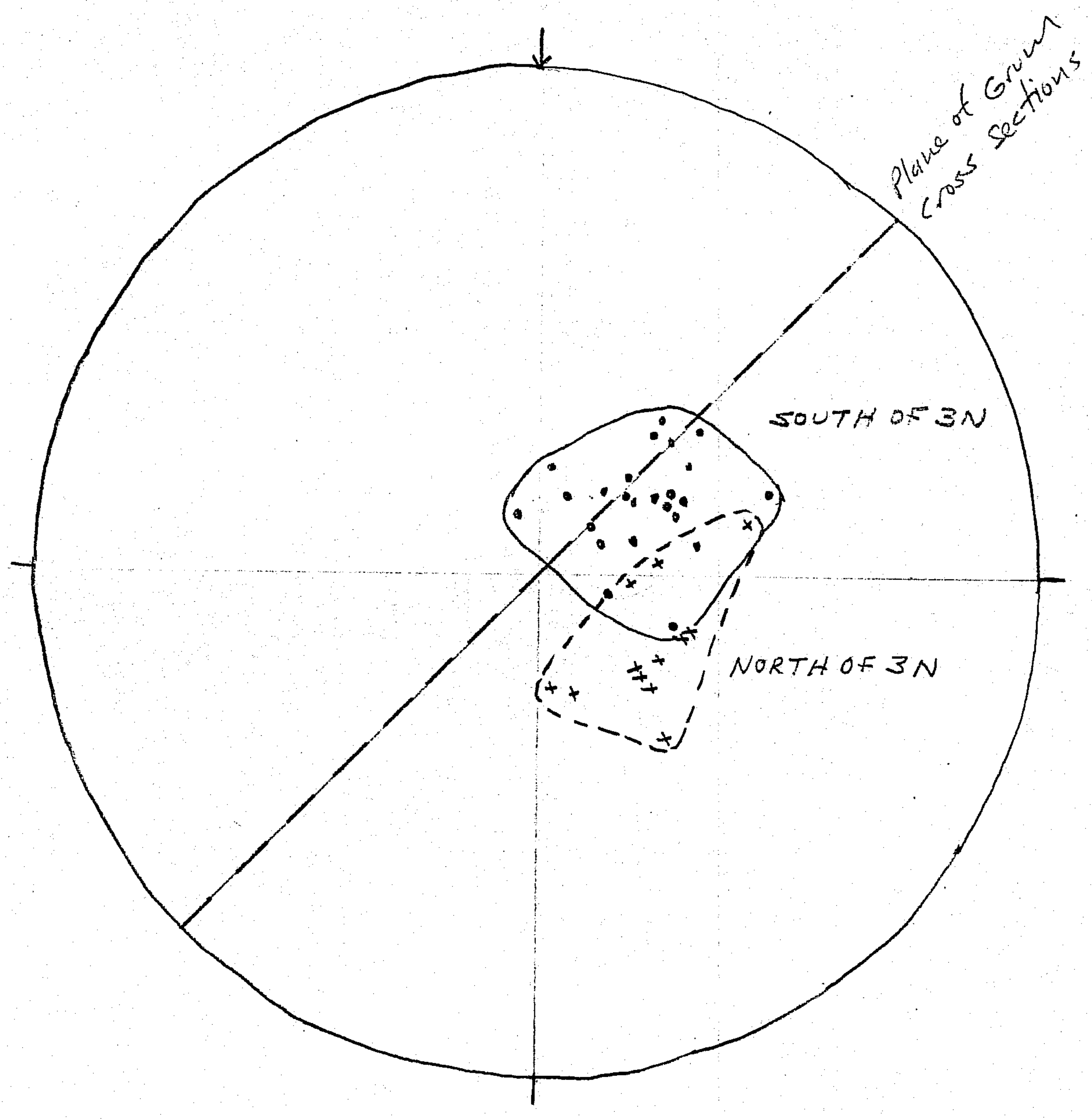


Figure 3 - S_2 orientation and overburden thickness at Grum



• poles to S_2 south of 3N

× poles to S_2 North of 3N

Figure 4
S_2 poles measured in the immediate vicinity of Grum during 1984

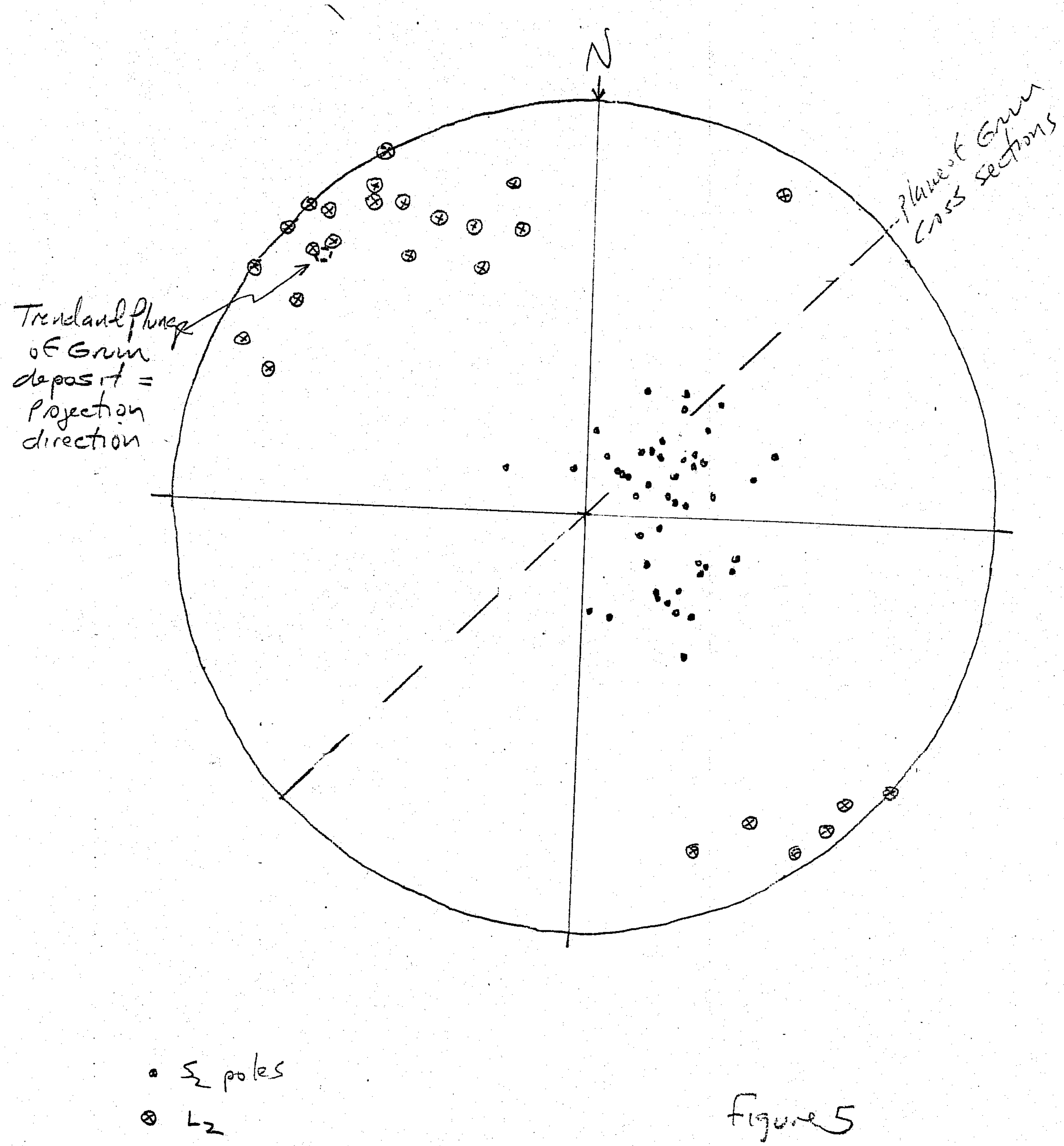


figure 5

Poles to S_2 & L_2 lineations

all diagrams Near the Grum Deposit

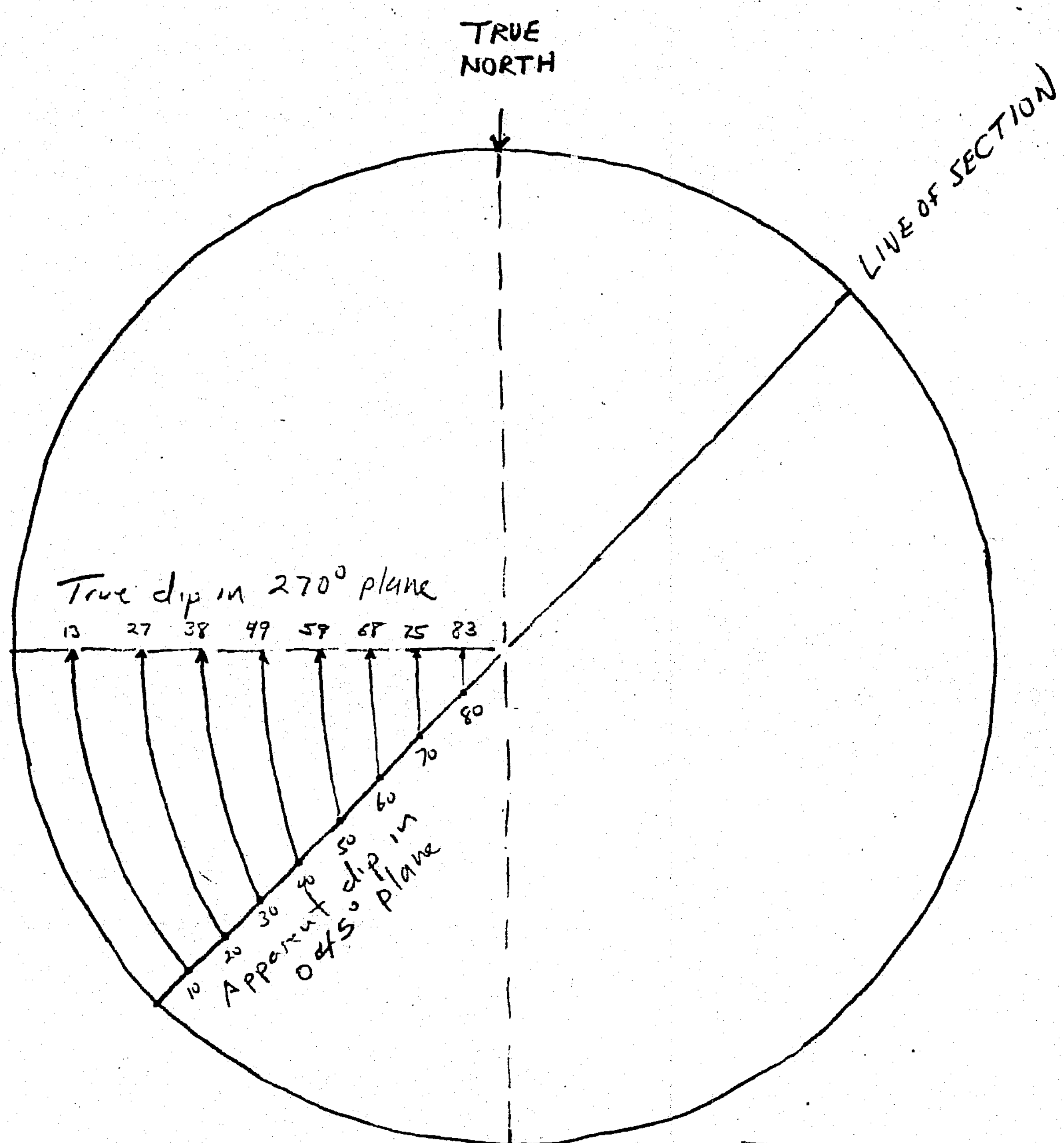
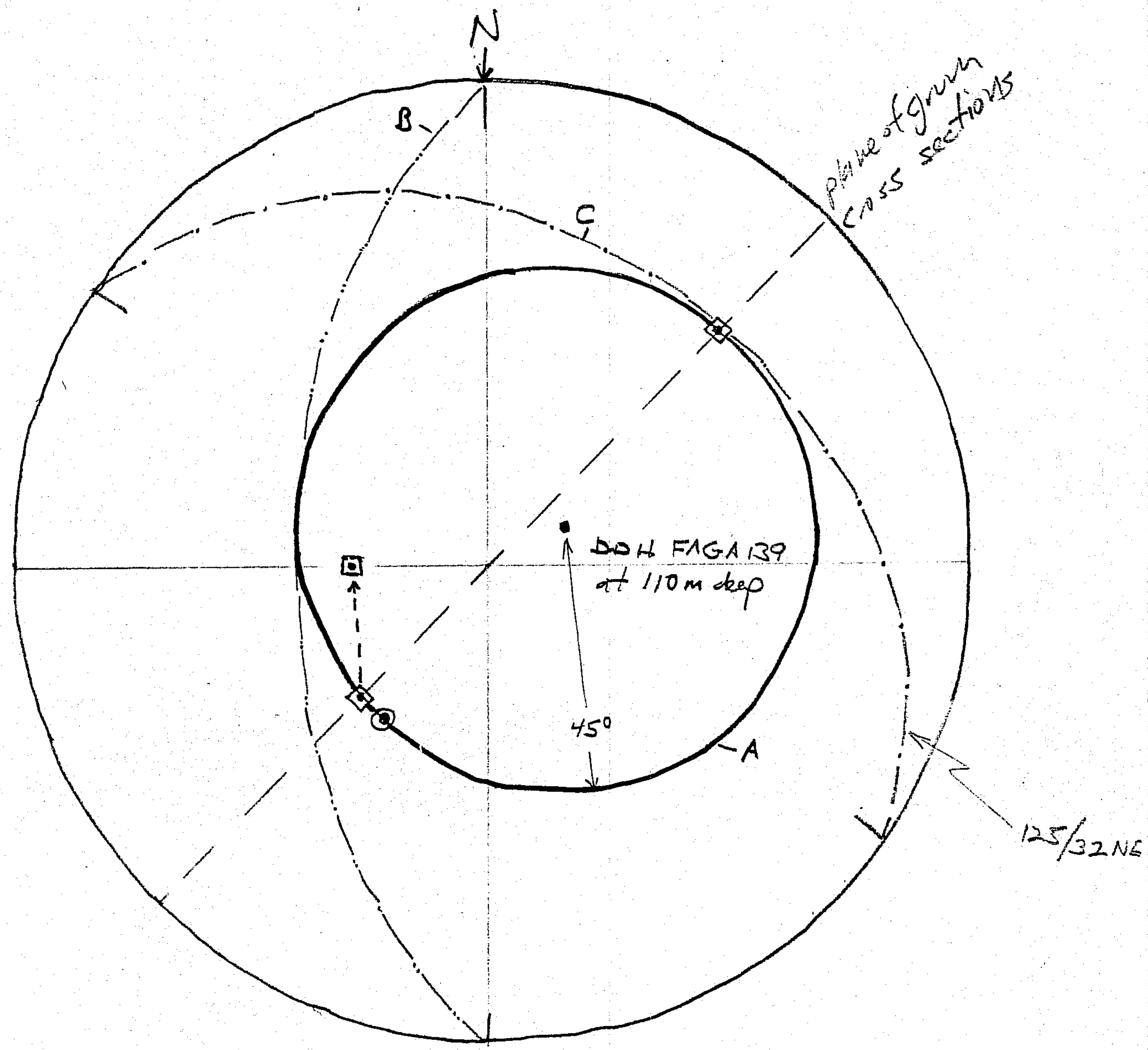


Figure 5.
Stereonet showing the result of assuming plotted S_2 in plane of section is an apparent dip



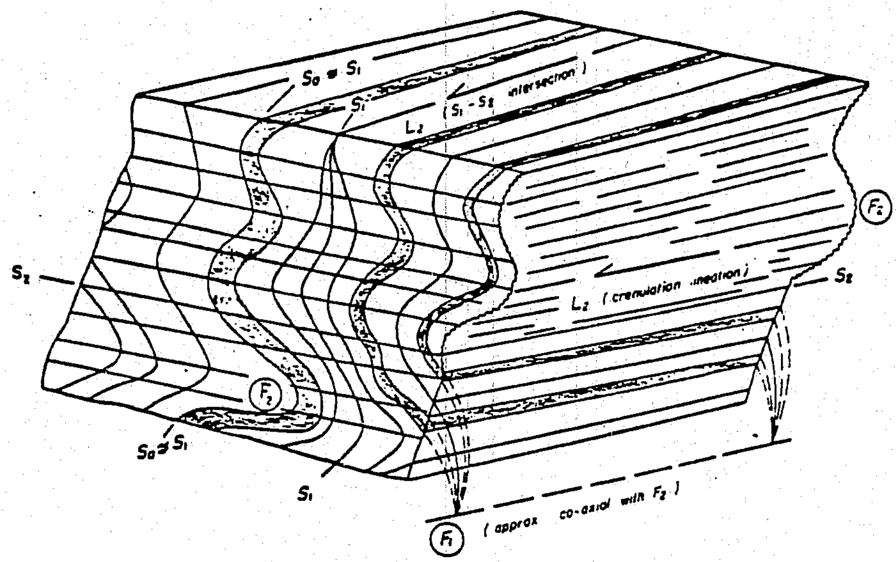
A — small circle representing the cone of all possible poles to S_2 and approximately all possible dip directions

▣ Two possible solutions for S_2 dip direction if dipping in plane of sections - kerr plotted the one with southwest dip - the dotted line shows the exaggeration of the dip if an apparent dip is assumed.

Figure 7

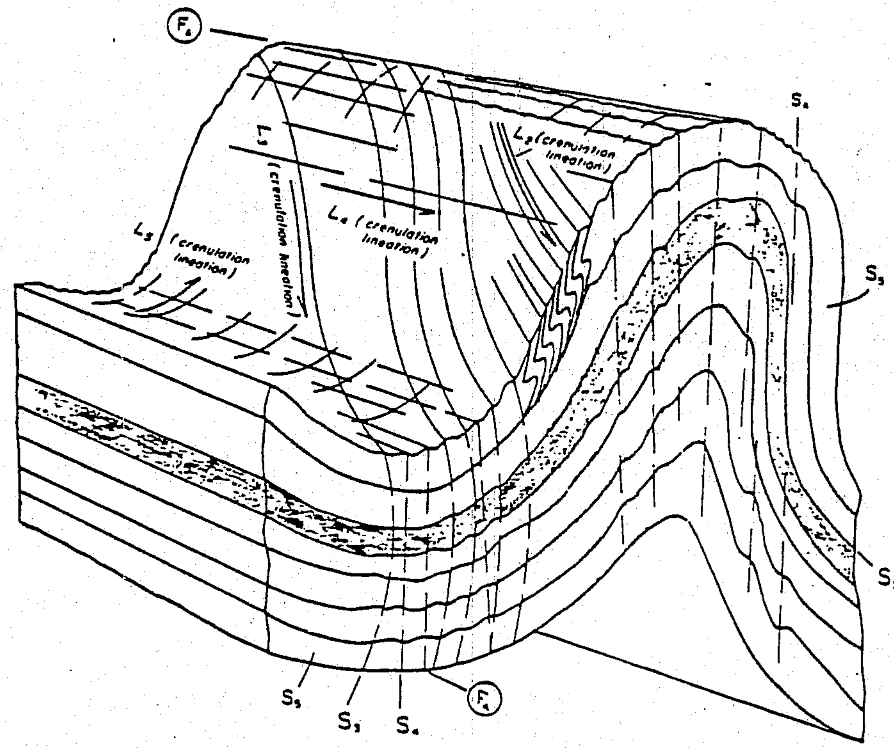
B — great circle showing actual S_2 plane if strike is 000° and dip is to west

C — great circle showing S_2 if average dip direction for S_2 in underground N of ZN is assumed. ⊙ is its pole.



A

Schematic Post-D_2 Geometry



B

Schematic Post D_5 Geometry (F_3 and F_5 omitted)

Figure 7. Summary diagrams showing the fabric elements in rocks of the Anvil District.

D_{1-5} refers to deformations 1-5.

S_{1-5} refers to foliations (surfaces) formed during D_1 through D_5. S_0 is bedding.

L_{1-5} refers to lineations formed during D_1 through D_5.

F_{1-5} refers to folds and fold axes formed during D_1 through D_5.

[A] summarizes the post D_2 geometry and is an idealization of the greenschist facies phyllites. [B] shows the post D_2 deformations superimposed on near pervasive S_2 where parallel to compositional layering and is an idealization of the amphibolite facies schists.

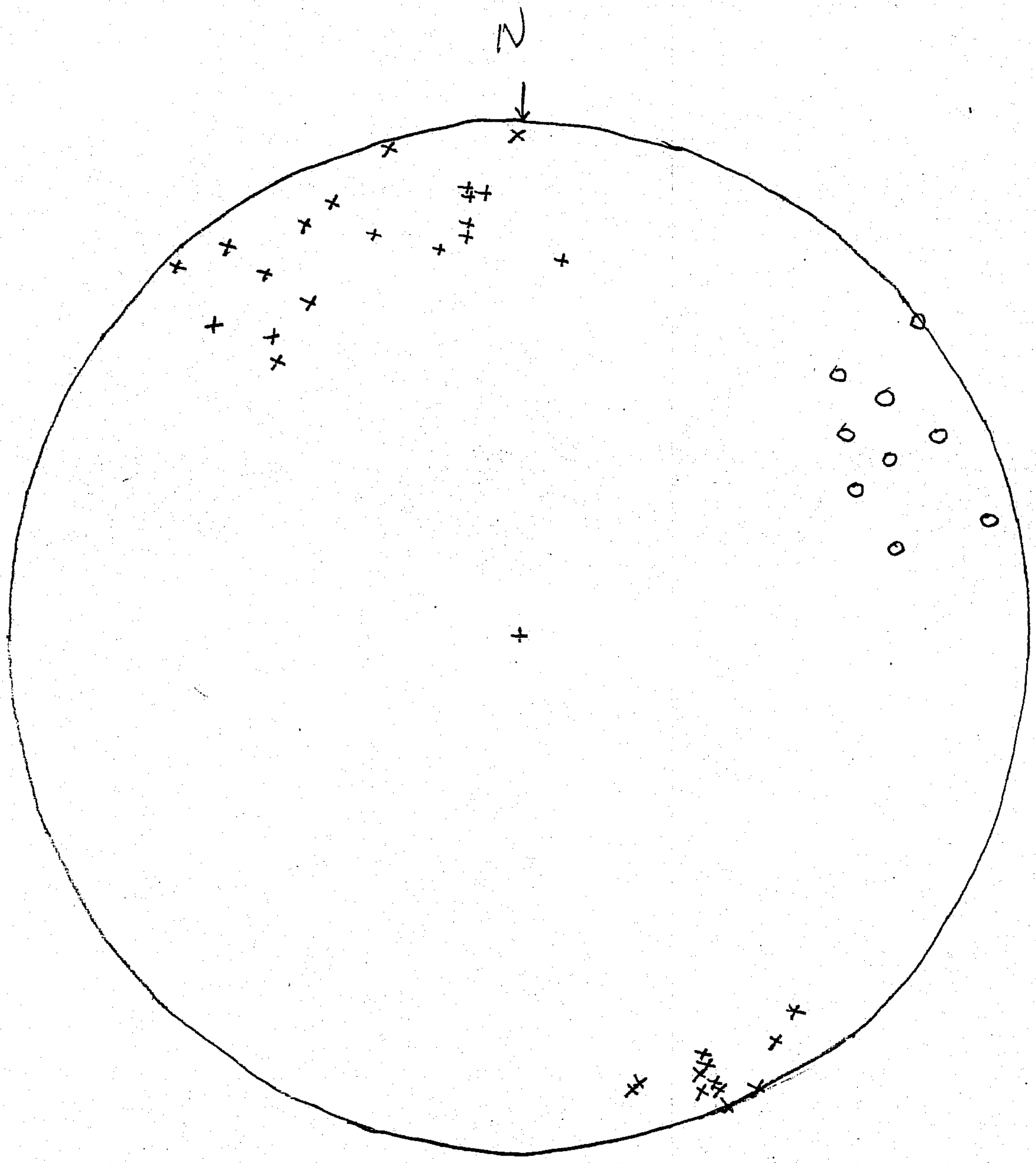
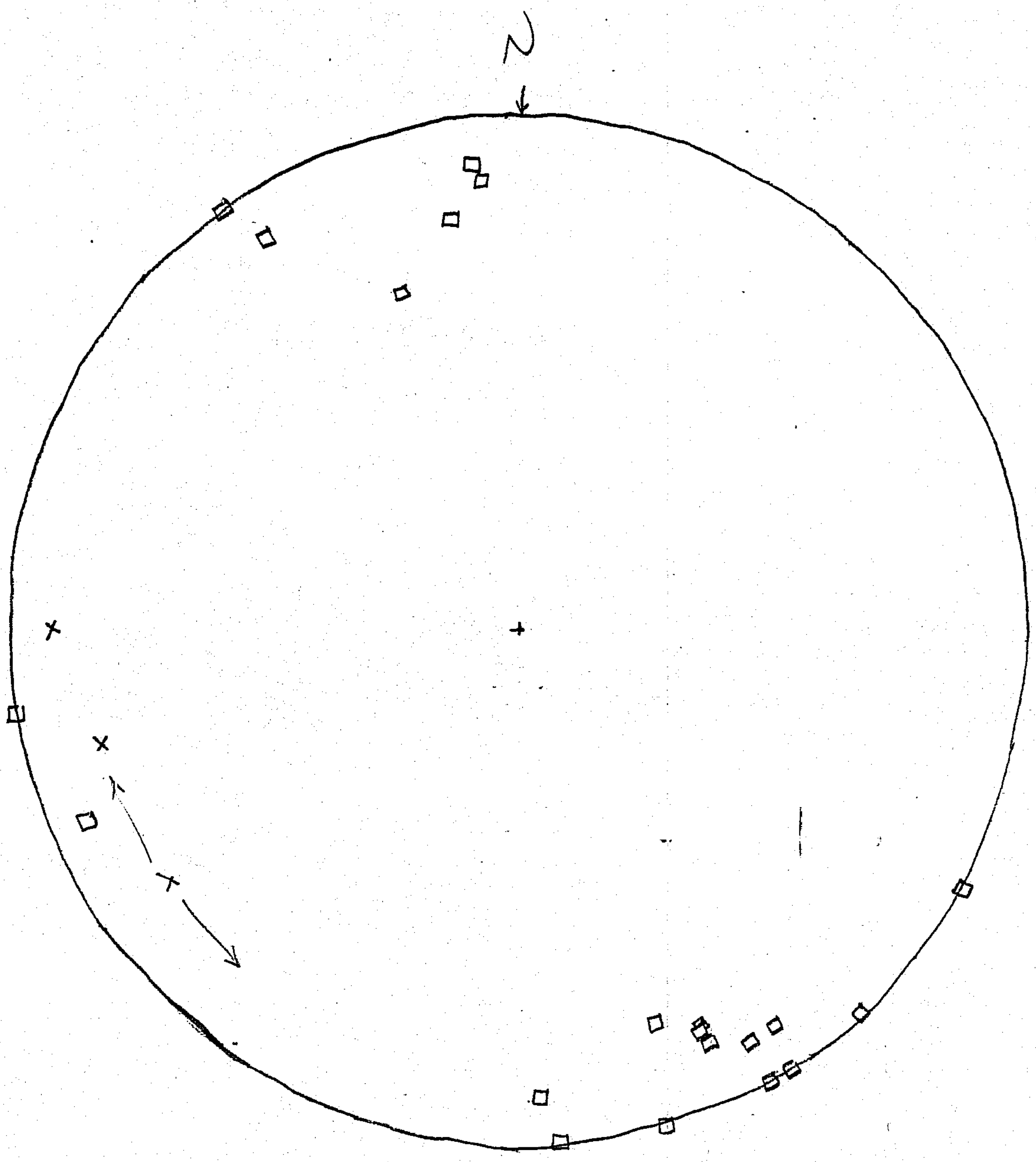


Figure 9

× fine crenulation lineation = L_3 ?
o poles to cleavage related to above = S_3 ?

FINE CRENULATION LINEATION
& poles to Foliation causing it.

GRENA AREA all
domains

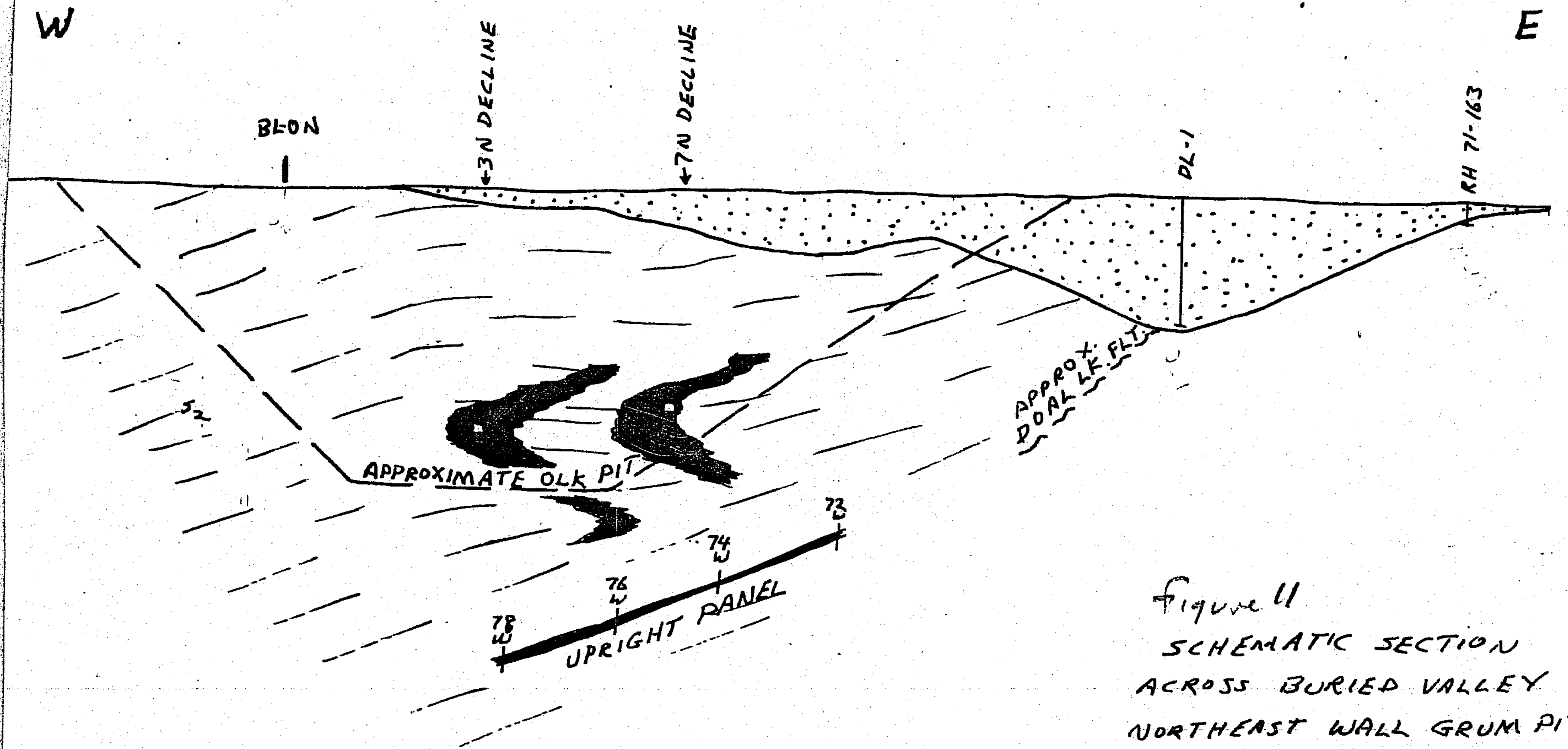


□ poles
× axes

Figure 10

poles to close spaced joints to wide spaced fracture cleavage & axes of kinks related to them

GROUND - all domains



Note : BEDROCK GEOLOGY IS HIGHLY SCHEMATIC

figure 11
SCHEMATIC SECTION
ACROSS BURIED VALLEY
NORTHEAST WALL GRUM PIT
1:5000