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E.L. 9/69

ASSESSMENT OF DRILLING AT COWPER POINT

(E.L. 9/69)

Kibuka Mines Pty Ltd
D. Johnson, December
1976

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Unnumbered Sections of High Dune Deposit:

Hand Auger Results 1975 600N, 700N, 800N, 900N

Gemco Auger Results 1976 550N, 600N, 650N, 750N, 850N, 900N, 950N.

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* NOT RELIEVED WITH REPORT.

Summary and Introduction

To test the reliability of ore reserve estimates in the Cowper point area particularly in the High Dune Deposit, redrilling of a selected area of the deposit was undertaken in September 1976.

The area chosen for the drilling program was shown by both the 1967 McMahon and Partners and 1975 Kibuka drilling to be typical of the deposit. The Kibuka grid was used, holes were drilled on a 50 x 100 metre grid between lines drilled in 1975. In addition, two lines were designed to coincide with the lines of the previous programs (see plate 1).

The samples obtained were assayed for heavy mineral content and selected samples were grain counted for rutile concentration. Size analyses were carried out on check samples and compared with primary plant head feed samples from the Naracoopa deposit. Check assaying was carried out to determine reproducibility of results, dummy samples were included to test the reliability of the laboratory technique. Samples from the Back Beach deposit and High Dune deposit were assayed for tin.

The drilling method, using a Gemco auger drill gives samples which suffer from a degree of sample dilution as the holes were not cased. Care was taken to minimise this problem by standardising the sample collection and processing method, which was similar to that used at Kibuka in the past.

Hand augering by Kibuka in 1975 was shown to be an unreliable indicator of real heavy mineral grade although trends in grade distribution could be identified. McMahon and Partners drilling results compared favourably with the recent Gemco survey and are considered to be of a high level of accuracy.

Reserve estimates, based on the 1967 drilling using a higher cut off grade, were calculated by Gibson in 1973. These are considered reliable. Tin assays while being obtained from a limited number of samples provide little encouragement for the presence of significant tonnages of tin in the Cowper Point Deposits.

Size analyses show the High Dune Deposit to have a grainsize distribution different from the Naracoopa deposit. This aspect will require further study as will the very low grade of mineral present in the deposit if mining is contemplated.

Description of the Deposit

The High Dune system consists of a series of dunes up to 30 metres high, the average height being in the order of 10-15 metres above the surrounding flats. Vegetation cover is moderate to light being made up of low scrub and grasses, these are densest in the troughs between the dunes and towards the western side of the deposit. A maximum of one metre of light sandy soil comprises the soil cover.

The deposit is composed of a fine grained wind blown sand overlying a coarser beach deposit which in turn is underlain by clay. The clay is similar to that found at Naracoopa being composed of coarse quartz grains in a white clay matrix. The Gemco drill was not able to penetrate this horizon. The basement did not occur at a uniform level being instead a series of troughs and ridges. Bedrock was not located in any hole.

The coarse grained sand immediately above the basement contains numerous shell fragments and appears to be a beach deposit composed of a number of parallel

and subparallel strand lines similar to those found along the east coast of King Island. The troughs and ridges also tend to follow the basement contours. Thickness of this horizon varies between 2 - 5 metres.

Fine wind blown sand, free of clay and organic material, forms the dune system which also follows the basement contours. The troughs and ridges in the strand lines acted as traps for the wind borne material which is believed to have been blown from the vicinity of the Back Beach deposit. The thickness of the mineral bearing sand varies from less than a metre on the flats within the dune system to 20 metres in the dunes to the eastern side of the deposit (see plate 2).

Heavy mineral is confined mainly to the finer wind blown deposit extending to the coarse water borne sands below (this may be due to a degree of mixing from above). Values in the coarse sand may also be inflated by the presence of shell fragments having densities greater than that of bromoform (SG 2.9). Distribution of heavy mineral in the wind blown sand is patchy with no apparent uniform vertical distribution.

The highest heavy mineral concentrations occur in the dunes towards the centre of the system (see plate 3). Some shallow concentrations occur on the flats between the dunes, being either remnants of older dunes or material blown from adjacent dunes. The steeper (and higher) dunes to the east, in the system fronting the beach, contain very low mineral concentrations. These dunes were largely inaccessible to the gemco drill, but the trend is readily identified from the earlier McMahon and Kibuka drilling.

Analysis of the sands from the High Dune Deposit shows that the size range of both the gross sample and heavy mineral fractions differ in their

distributions to the sands at Naracoopa. This is consistent with the wind borne nature of the deposit. The findings are based on selected samples from the fine heavy mineral bearing dune sands. Table 1 and Plate 4 illustrate the trends in grainsize distribution and give a comparison with the sands at Naracoopa. Further testwork is required to examine the distribution of grainsize within the deposit which may be important for future plant planning.

Arith. average = 0.21 ?
Weighted " " = 0.264 ?

Grain counts of selected holes show the average rutile content of the sands in the area tested is approximately 0.3% with average heavy mineral concentration being in the order of 3.5%. Table 2 shows the results of comparison tests with heavy mineral fractions from three holes. Experience with grain counting indicates that errors of up to 20% are probable, due to different methods of slide preparation; difficulties with grain counting are compounded by the fine grain size and coatings on the grains. It is considered however, that the grain counts listed in Table 2 and those shown in the sections are within acceptable limits of accuracy.

Grain counts for zircon were not undertaken, however, results from McMahon and Partners' survey indicate that rutile and zircon occur in roughly equal proportions.

Comparison with Results of Earlier Surveys

The recently completed program was carried out over an area shown by earlier drilling to be typical of the deposit.

Comparison with Kibuka's 1975 hand auger program (see sections 600N and 900N) shows hand auger heavy mineral values approximately 50% below those obtained in the recent program. The hand auger method suffers from a high degree of

(Arith. ave = 3.43)
Weighted average = 3.119

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sample dilution due to repeated removal of the auger from the uncased hole. The hand auger results are therefore of low accuracy and, while they are capable of showing the trend of heavy mineral concentration, they could not be used to detail the deposit or be used as a basis for ore reserve determinations. While a correction factor may be developed, further check drilling over the entire deposit would be required. Hand augering did not penetrate below the water table, this limits its usefulness for supplying geological information.

It was not possible to identify the McMahon and Partners drill lines in the field, however general comparisons can be drawn between lines 550N, 600N, 650N (Kibuka) and 120NB (McMahon) and 850N, 900N, 950N (K) and 120NC (McM).

It appears that the McMahon drilling used a hand boring and sludging method utilising casing, thus the problems associated with sample contamination were not encountered.

McMahon's results are therefore of a higher order of accuracy than the most recent Kibuka program. Final reserve estimates are limited by the wide spacing of the lines (1000ft apart) and problems associated with the water table at which most penetration stopped. Hard ground originally identified as coffee rock has been shown by recent drilling to be the coarser water borne sand which is considerably harder than the finer sands above. The most recent drilling is therefore able to supply additional geological detail due to greater penetration and the closer spaced drill pattern.

Comparison of the results between the recent Kibuka drilling and McMahon's drilling shows that both give similar heavy mineral trends with a general agreement in values (see Table 3). The average rutile content in the deposit is, however, far below that of other deposits currently being mined on King Island.

The reserves estimated by McMahon "appears to have been dictated by a need to impress by quantity at the expense of quality (grade)" Gibson 1973. This is illustrated by a cut-off grade of 1.5% HM which allows inclusion of the steep low grade dunes on the eastern side of the deposit and shallow low grade deposits in the flats to the west. Gibson in his study of McMahon's results in 1973 used a higher cut-off which correspondingly reduced the reserves of the deposit (see Plate 5).

Conclusions and Recommendations

The recent drill program has verified the reliability of the results obtained by McMahon in their work of 1967. The grade and tonnage estimates presented by them must be modified in the light of higher cut-off grades.

Gibson's estimates of ore reserves based on the McMahon drilling using a higher cut-off of 2.5% heavy mineral is considered to be a reliable indicator of reserves. These are shown in the table below which also gives the original estimates and results of work carried out by Neale and Salway (1975) based on Gibson's work on the High Dune Deposit and Gemco drilling of the Back Beach Deposit.

<u>RESERVES AT COWPER POINT</u>					
<u>Area</u>	<u>Tonnes of Sand</u>	<u>%HM</u>	<u>%Rutile</u>	<u>%Zircon</u>	
Cowper Point		✓	0-264	✓	McMahon and Partners 1967
High Dune and Back Beach	15688194	3.11	0.27	0.24	
Cowper Point including Back Beach	11885500	3.24	0.28	0.25	Gibson 1973
High Dunes	8925000	--	0.33	0.29	Neale and Salway 1975
Back Beach	1195440	7.48	0.55	1.18	

Gibson recommended "deeper drilling which could possibly alter the (reserve) estimates upwards both in volume and grade". The recent drilling has shown this not to be the case.

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It appears that the possibility of large reserves of tin in the deposit is small from the evidence of

- 1) the low heavy mineral content of the overall deposit;
- 2) the low tin content of the highest heavy mineral bearing samples;
- 3) the low values obtained from assays of tin from the Back Beach deposit - the apparent source of the mineral bearing sands in the High Dune Deposit (see Table 4).

This report has not dealt with the Back Beach Deposit which has been shown by Neale and Salway to be a proven reserve. Check drilling has verified the reliability of the drilling carried out in this area.

Further drilling is required to delineate the higher grade areas of the High Dune Deposit, this is not possible with the results obtained from the McMahon and Partners drilling - due to the wide line spacing, or from the 1975 Kibuka drilling due to the unreliability of the data, Gibson's work provides a basis for delineating high grade areas and he states "there appears to be scope for picking out the best portions of this dune deposit and mining it profitably."

NOTES1. Sections and Grid Plan

Relative levels determined from a topographic plan map prepared by Geospectrum for Kibuka Mines in 1972. Datum used was 30 metres RL = High Water Mark.

Drill lines were located on the Geospectrum map by checking line 1400E and spot checking other grid positions using survey pegs and prominent landmarks as controls.

2. Check Samples

Specially prepared samples were used to check the reproduceability of results, samples used were:

CP-1 600N 1300E 0-28' Sample nos 240-244

CP-2 900N 875E 0-34' Sample nos 095-100

CP-3 750N 1250E 0-34' Sample nos 357-362

Samples were composited from individual drill samples using 8 grams of sample for each foot in the interval chosen.

3. Sizing

Samples were washed before sieving to remove organic material and fines (-75 μ m) then dried and sieved to remove +1680 μ m material. Sieve analysis was carried out on the remainder which constituted approximately 90% of the original sample.

Primary plant head feed samples used for size comparison were taken from daily mill samples from material mined at Sea and Milford Beaches Naracoopa.

4. Grain Counts

A minimum of two counts per sample were made using fields containing a minimum of 600 grains. The final values are averages of the counts. Check samples

were counted by different people and the results obtained by each were compared (see Table 2). The main sources of error involved were:

- 1) errors in counting fields;
- 2) misidentification due to coatings on grains and the small grain size;
- 3) problems with slide preparation due to the small size of the sample.

The grain counts shown in the sections were prepared using a single standard procedure.

SIZE ANALYSES
GROSS SAMPLES

Size		CP-1		CP-2		CP-3		PPH*	
Um	Mesh No. (ASTM)	%Retained	%Cum	%Retained	%Cum	%Retained	%Cum	%Retained	%Cum
355	45	8.46		4.69		5.06		15.96	
250	60	20.16	28.62	15.58	20.27	20.43	25.49	43.93	59.89
150	100	48.03	76.65	56.52	76.79	49.9	74.48	31.66	91.55
106	140	20.16	96.81	21.62	98.41	22.1	96.59	6.76	98.31
75	200	2.79	99.6	1.28	99.59	2.33	98.92	0.99	99.3
-75	-200	0.4	100	0.2	100	1.07	100	0.7	100

HEAVY MINERAL FRACTION-NON MAGS.

Size		CP-1		CP-2		CP-3		PPH*	
Um	Mesh No. (ASTM)	%Retained	%Cum	%Retained	%Cum	%Retained	%Cum	%Retained	%Cum
355	45	1.8		2		1.23		7.4	
250	60	8.8	10.6	9.9	11.9	7.12	9.35	31.3	38.7
105	100	22.4	33	24.7	36.6	20.76	29.11	43.8	82.5
106	140	36	69	37.5	74.1	34.4	63.51	15.3	97.8
75	200	28.7	97.7	24	98.1	31.34	94.82	2.2	100
-75	-200	2.3	100	1.9	100	5.18	100		

PPH = Primary Plant Headfeed.

TABLE 2

GRAIN COUNT COMPARISONS

Sample No.	CP-1		CP-2		CP-3	
	Count 1	Count 2	Count 1	Count 2	Count 1	Count 2
%HM	8.07	8.38	4.11	4.03	5.04	5.68
%-60#	89.4	90.14	90.1	88.21	90.42	91.42
%Non mags	31.92	30.19	24.93	25.88	29.63	27.58
%Rutile in HM	5.51	7.65	3.79	6.73	4.23	5.25
%Rutile Overall	0.45	0.64	0.15	0.27	0.22	0.3

Count 1 samples prepared by compositing before heavy mineral sink/float using bromoform (SG 2.9)

Count 2 samples prepared by compositing heavy mineral fraction after sink/float. This method was used for samples shown on sections.

RESULTS OF McMAHON AND PARTNERS DRILLING
(refer to Plate 1)

1. ASSAYS

Area	%HM	%Mags	%Non Mags		%Rutile overall	%Leucoxene in Heavy Mineral	%Zircon overall
			in Heavy Mineral				
A	2.27	77.82	22.18	8.13	0.18	0.97	6.58
B	2.91	75.48	24.52	8.88	0.26	1.57	7.92
C	3.55	75.8	24.2	8.8	0.31	1.24	8.06
D	3.23	73.83	26.17	9.98	0.32	1.55	8.37
E	2.33	81.31	18.69	6.77	0.16	1.23	4.39
F	3.00	85.57	14.43	1.75	0.05	4.65	5.57
G	2.38	67.27	32.73	4.12	0.1	12.27	10.6
H	7.77	71.08	28.92	4.21	0.33	10.05	10.2
Average	3.43	76.02	23.98	6.58	0.21	4.19	7.71

Weighted Averages }

3.44 %

8.52 %

0.2640 %

1.75 %

7.68 0.24

2. RESERVE ESTIMATES

Area	Sand Tons	HM %	Heavy Mineral Tons	Rutile Tons	Zircon Tons	Leucoxene Tons
A	939,999	2.27	21,338	1,735	1,404	207
B	2,675,020	2.91	77,843	6,912	6,165	1,222
C	4,970,217	3.55	176,443	15,527	14,221	2,188
D	4,146,606	3.23	133,897	13,363	11,207	2,075
E	2,020,798	2.33	47,085	3,188	2,067	579
F	613,332	3.00	18,400	322	1,025	856
G	222,222	2.38	5,289	218	561	649
H	100,000	7.77	7,770	327	824	781
Total	15,688,194		488,065	41,592	37,474	8,557

From McMahon and Partners, 1967.

TABLE 4

TIN ASSAYS

Assays for tin were undertaken on a number of samples which contained heavy mineral concentrations of approximately 10%.

1. High Dune Deposit

<u>Location</u>	<u>Sample No.</u>	<u>Depth (feet)</u>	<u>%HM</u>	<u>Sn ppm</u>
900N 1275E	141	4-10	13.88	43
	142	10-16	10.34	43
600N 1300E	241	4-10	8.33	38
	242	10-16	11.67	32
550N 1275E	296	10-16	8.98	BLD

2. Back Beach Deposit

<u>Location</u>	<u>Sample No.</u>	<u>Depth (feet)</u>	<u>%HM</u>	<u>Sn ppm</u>
00 125W	001	4-10	16.6	12
100N 150W	002	10-16	3.6	BLD
800S 125W	003	10-16	8	50
100N 150W	BB-1	0-16	7	BLD
150S 162 $\frac{1}{2}$ W	BB-2	0-16	10.7	21
250S 125W	BB-3	0-22	18.18	15
450S 137 $\frac{1}{2}$ W	BB-4	0-22	10.43	14
750S 125W	BB-5	0-10	13.91	48

BLD= Below Limit of Detection.

REFERENCES:

Kenneth McMahon and Partners 1967:

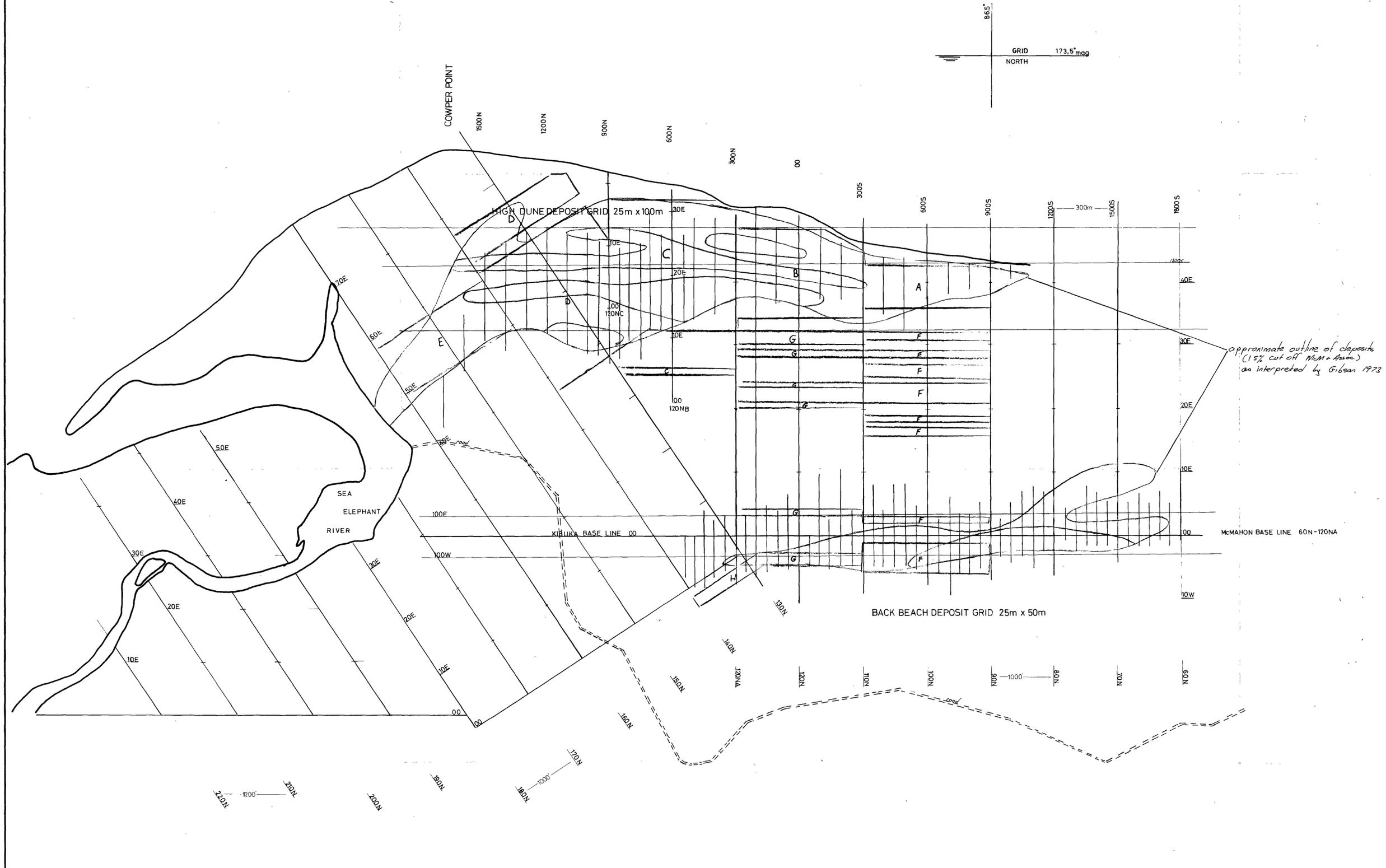
Plan Map and Sections of Drilling Program carried out for Mt Costigan Mines (No Report Available).

Gibson C.R. 1973:

An Exploration Program for Kibuka Mines Pty Ltd

Neale T.I., Salway I.J.U. 1975:

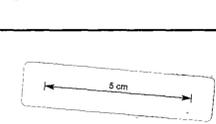
An Evaluation of the Kibuka Mines Properties, King Island Tasmania.



approximate outline of deposits
(15% cut-off McMah & Assoc.)
as interpreted by Gibson 1973

ORE RESERVES BASED ON A 15% CUT-OFF
(McMahon)

McMAHON GRID ———
KIBUKA GRID ———
Hand Auger
Gemco Drill ———
+2% Cut-off (McMahon & C) ○



SCALE 1:8,000

(McM. imperial; K. metric)
1000ft. ≈ 300m

KIBUKA MINES PTY. LTD.
DRILLING GRID PLAN - COWPER POINT
McMAHON & ASSOCIATES 1967
KIBUKA 1974, 75, 76

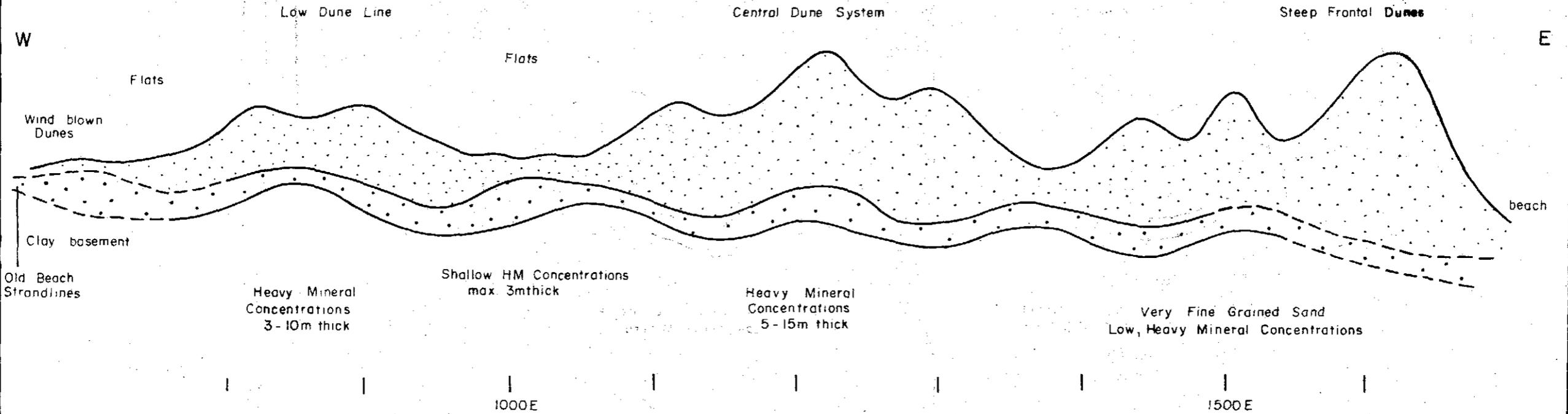
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PLATE 1

76-1189

DIAGRAMATIC CROSS SECTION OF THE HIGH DUNE DEPOSIT

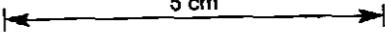
810



 Fine sand
 Coarse sand

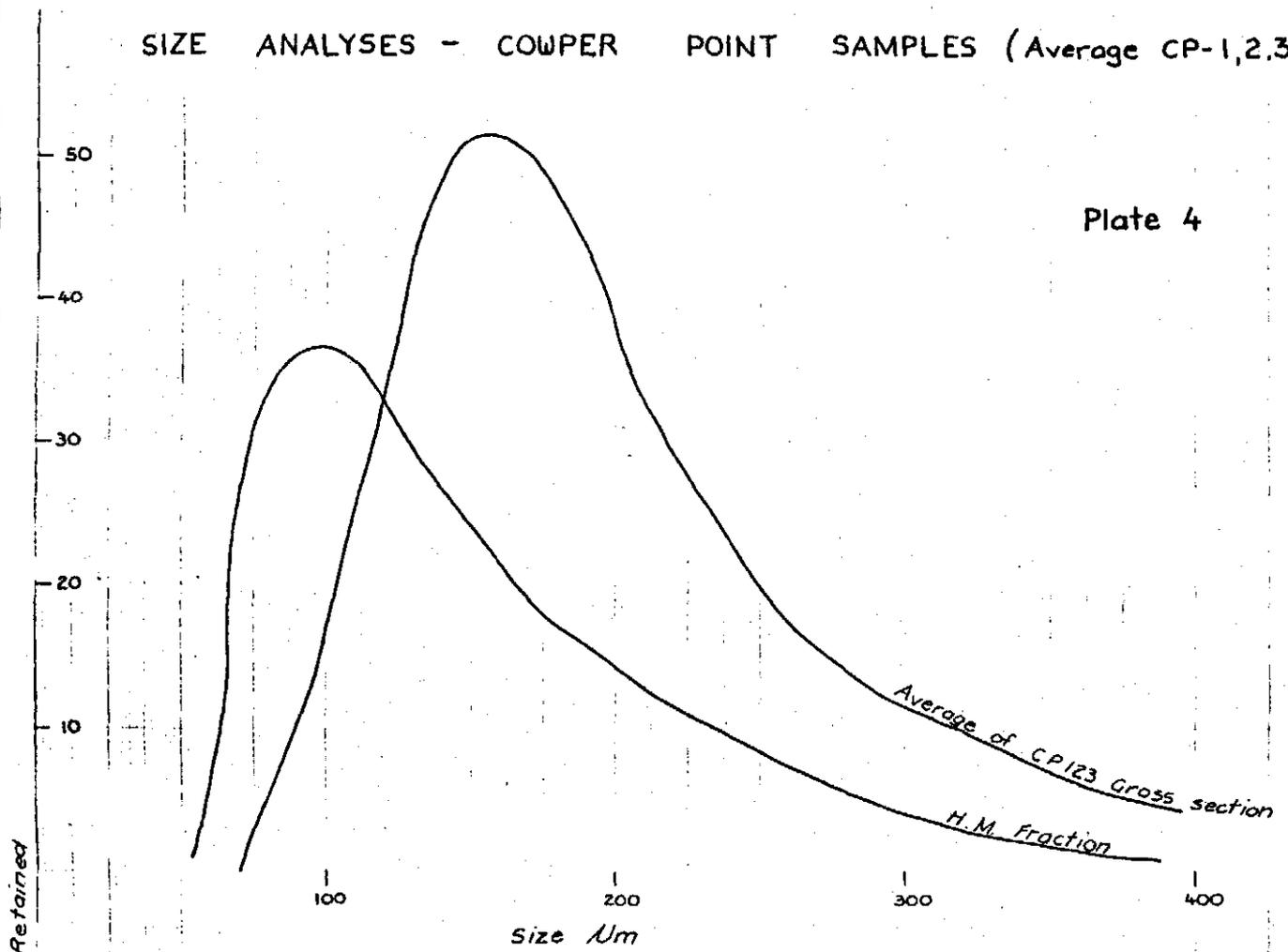
SCALE : 1 cm = 30m Horizontal
 1 cm = 5m Vertical

5 cm

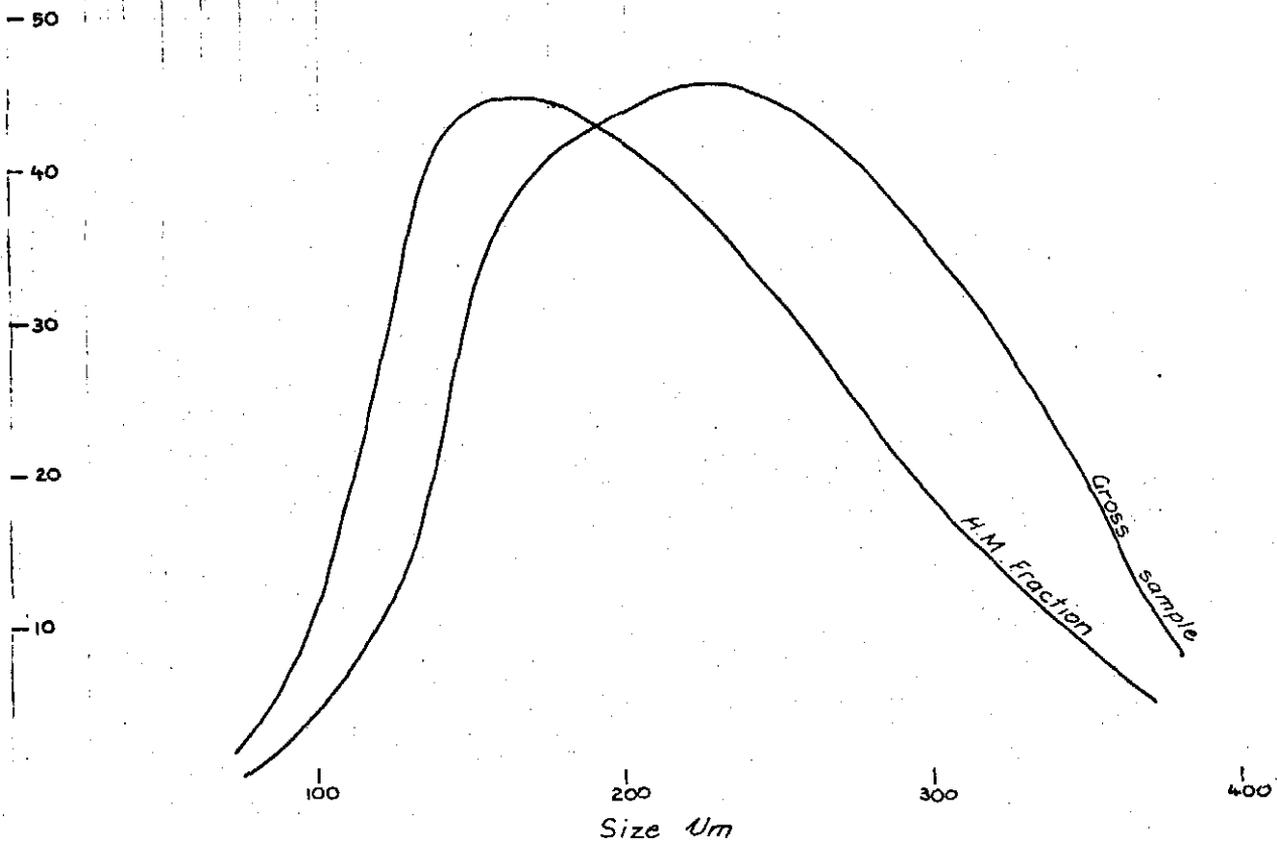


SIZE ANALYSES - COWPER POINT SAMPLES (Average CP-1,2,3)

Plate 4

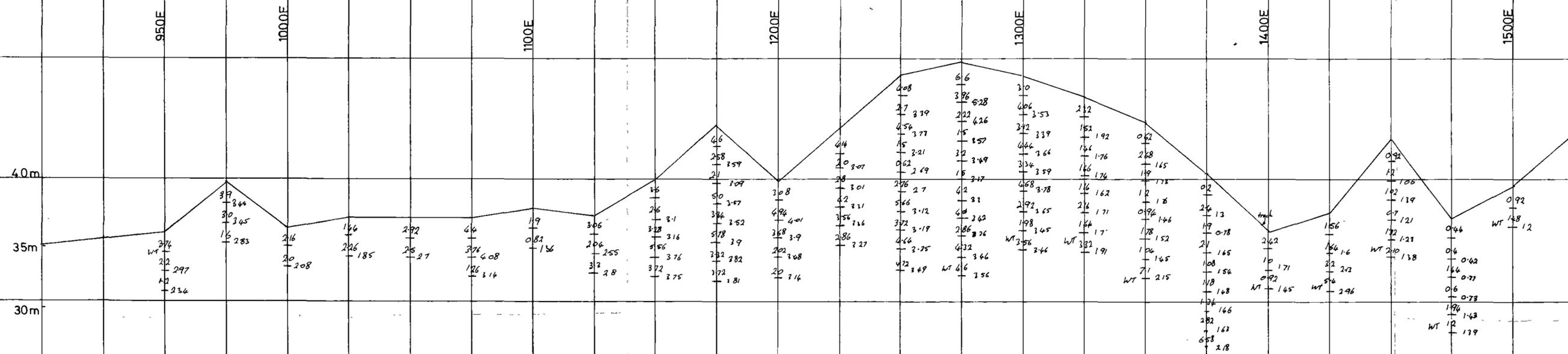


PRIMARY PLANT HEADFEED



COWPER POINT-HIGH DUNES
SECTION 800N

Hand Augering April '75



Collar Height (m)	35.8	39.8	36	37	37	37	38.8	37.2	40	44.2	39.8	44	48.2	49.2	48	46.5	44.5	40.5	35	37.5	43	37	39.5
Hole Depth (m)	4.6	4.6	3	3	3	4.6	3	4.6	7.6	12.2	7.6	9.1	15.2	16.8	13.7	12.2	12.2	13.7	4.6	6.1	9.1	9.1	3

Sample interval 5feet(1.5m)

KEY

%HM <2
2-2.5
2.5-3
3-5
5-10
>10

335024 76-1189

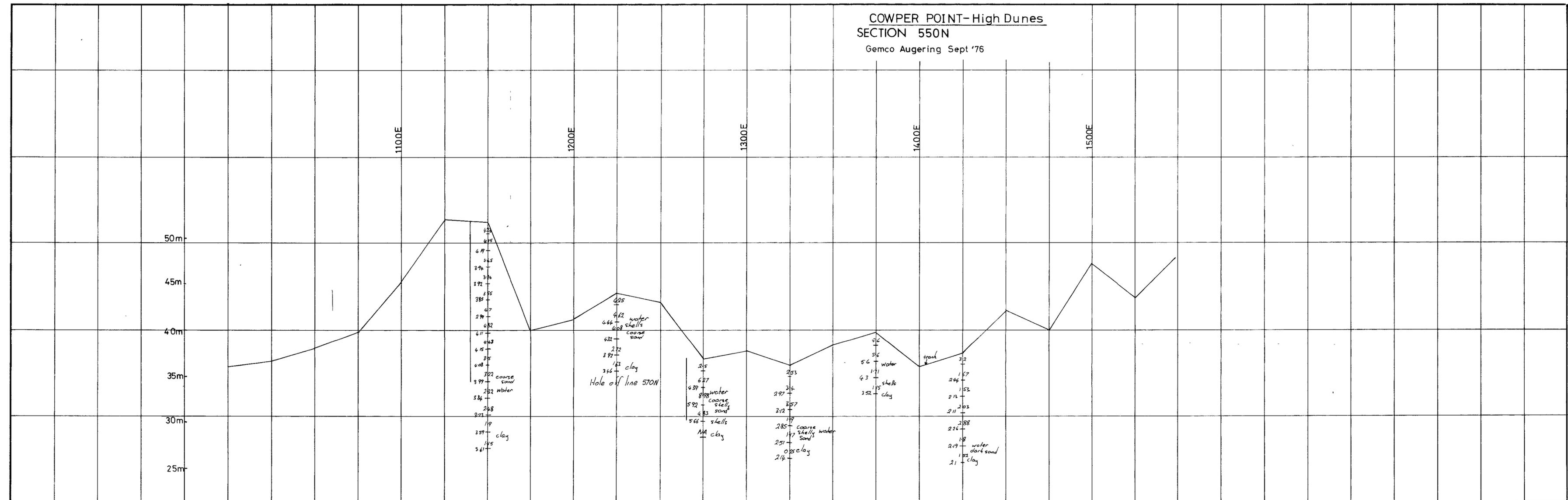
**KIBUKA MINES
PTY, LTD.**

SECTION 800N Hand Auger

DRAWN: _____ CHECKED: _____

Date: SEPT '76 Scale: Hor: 1:250
Vert: 1:240

COWPER POINT-High Dunes
SECTION 550N
Gemco Augering Sept '76



Collar Height m
Depth "

% HM
% Non Mags
% Rutile (in HM)
(overall)

51.5	44	37	36.2	39.8	37.5
25	9.1	9.1	11	7.3	12.8
3.99		5.66			
26.76		26.18			
6.23		5.58			
0.25		0.31			

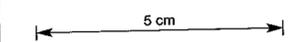
335026 76-1189

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SECTION 550N GEMCO AUGER

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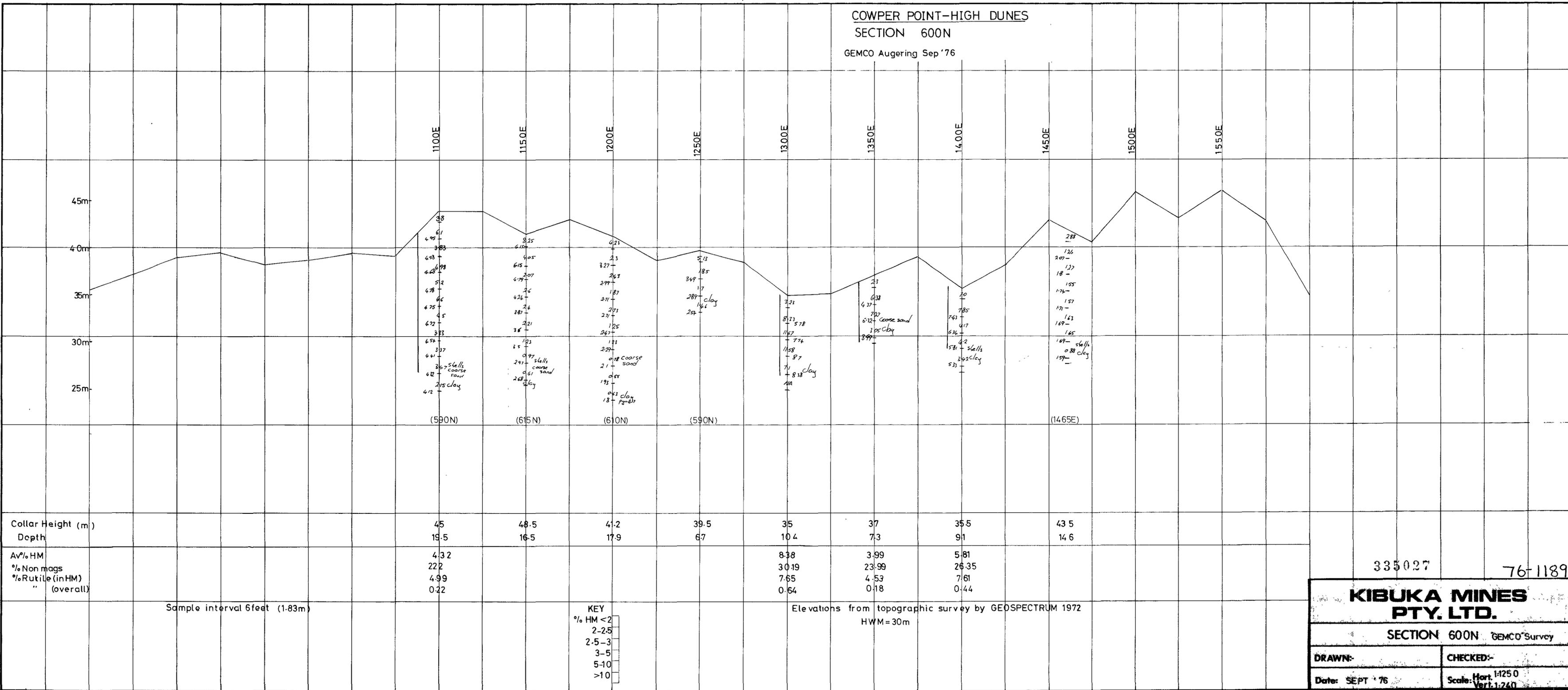
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Vert. 1:240



COWPER POINT-HIGH DUNES

SECTION 600N

GEMCO Augering Sep '76



Sample interval 6feet (1.83m)

KEY
% HM < 2
2-2.5
2.5-3
3-5
5-10
>10

Elevations from topographic survey by GEOSPECTRUM 1972
HWM=30m

335027 76-1189

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SECTION 600N GEMCO Survey

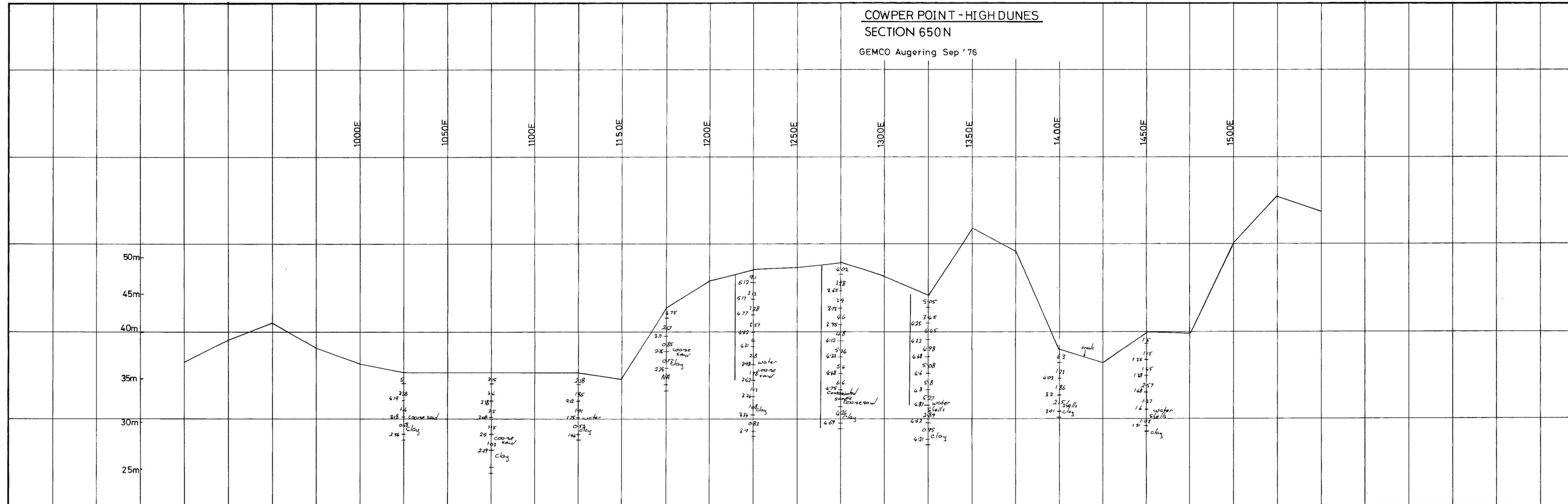
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COWPER POINT - HIGH DUNES

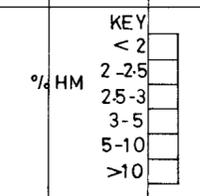
SECTION 650N

GEMCO Augering Sep '76



Collar Height (m)	39.2	41	38.2	35.5	35.6	35.6	35.6	35.6	35.6	35.2	42.5	45.5	46.8	47	47.5	46	44	51.2	48.8	38	36.5	40	39.9	49.8	54.5	53	
Depth "				7.3		9.1		7.3		9.1	18.3	18.3	16.5	7.3	11												
Av% HM											3.98	4.69	4.87														
% non mags											23.04	24.72	24.53														
% Rutile (in HM)											3.71	5.07	4.91														
" (overall)											0.15	0.24	0.24														

Sample interval 6 Feet (1.83metres)



Elevations from GEOSPECTRUM topographic survey 1972
HWM=30metres RL

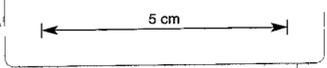
335028 76-1189

KIBUKA MINES PTY. LTD.

SECTION 650N [GEMCO SURVEY]

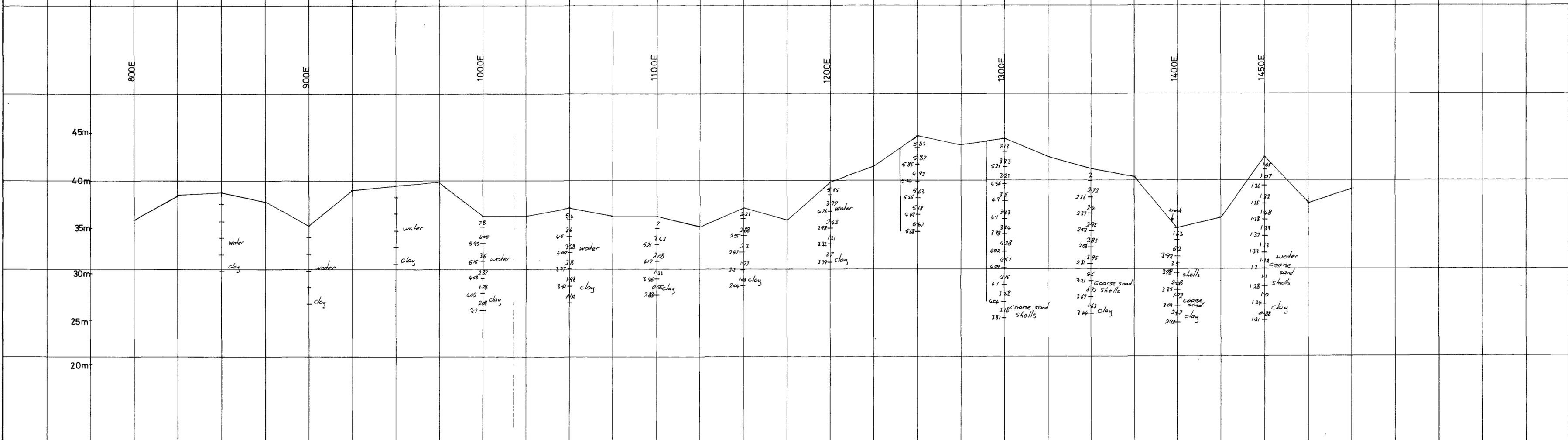
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Date: SEPT '76 Scale: Hor: 1:1250 Vert: 1:240



COWPER POINT - High Dunes
SECTION 750N

Gemco Augering Sept '76



Collar Height m	38.8	35.2	39.5	36.2	37.1	36.2	37	39.7	44.8	44.5	41.4	35	42.5
Depth	8.5	8.5	8.5	10.4	10.4	8.5	8.5	8.5	10.4	19.4	15.9	10.4	17.6
Av% HM									5.68	4.04			
% Non Mags									27.58	24.55			
% Rutile (in HM)									5.25	4.98			
(overall)									0.3	0.2			

- KEY
- 2
 - 2-2.5
 - 2.5-3
 - 3-5
 - 5-10
 - 10

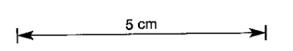
335029 76-1189

**KIBUKA MINES
PTY. LTD.**

SECTION 750N GEMCO Survey

DRAWN: _____ CHECKED: _____

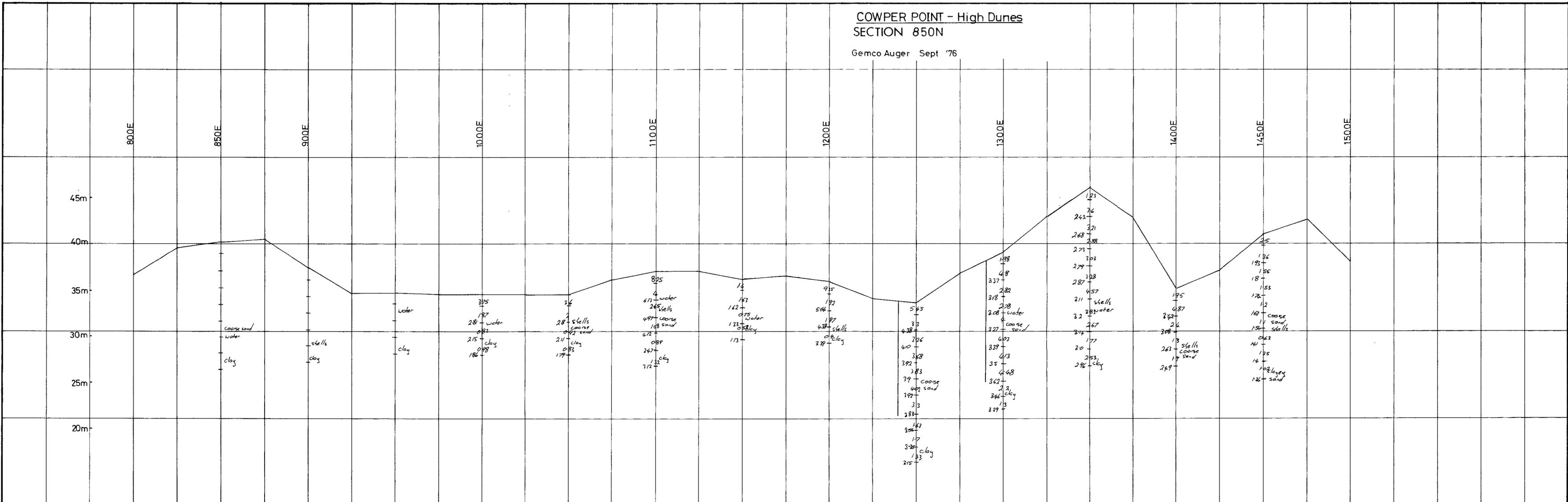
Date: OCT. '76 Scale: Hor: 1:250
Vert: 1:240



COWPER POINT - High Dunes

SECTION 850N

Gemco Auger Sept '76



Collar Height (metres)																			
Depth		40.2	37.4	34.7	34.6	34.5	37	36	36.1	33.5	39	46	35	41					
Av% HM										3.83	3.62								
% Non Mags										24.55	25.6								
% Rutile (in HM) (overall)										5.16	5.33								
										0.2	0.19								

335030 76-1189

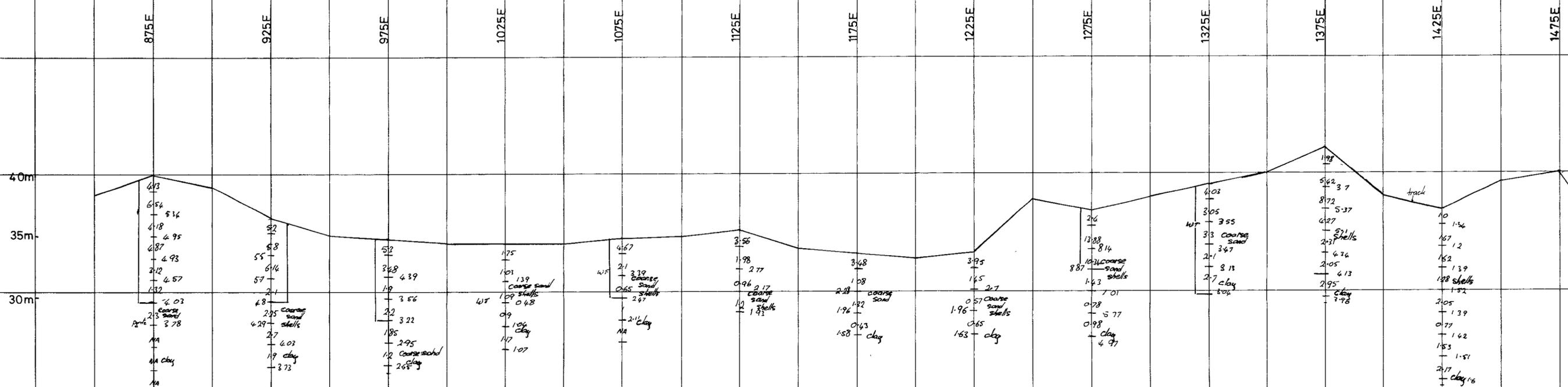
KIBUKA MINES
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SECTION 850N GEMCO Survey

DRAWN: _____ CHECKED: _____

Date: OCT '76 Scale: Hor. 1:250
Vert. 1:250

COWPER POINT - High Dunes
SECTION 900N
 "Gemco" Augering Sept '76



Collar Height (Metres)	40	36.5	34.7	34.5	34.7	35.4	33.5	38.5	37	39	42	37
Hole Depth "	18.3	12.8	11	8.5	8.5	6.7	6.7	6.7	10.4	8.5	13	14.6
%HM	4.03	4.81	3.22		2.47				8.87	3.04	4.54	
%Non Mags	25.88	26.07	22.24		23.58				32.08	19.34	28.51	
%Rutile (in HM) (overall)	6.73 0.27	5.05 0.24	3.92 0.13		4.66 0.12				7.73 0.69	2.33 0.07	5.36 0.24	

Sample interval 6 feet (1.8m)

KEY:
 %HM
 < 2
 2-2.5
 2.5-3
 3-5
 5-10
 >10

Intervals grain counted

Elevations from topographic map prepared by GEOSPECTRUM
 (HWM = 30m)

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**KIBUKA MINES
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SECTION 900N GEMCO Survey

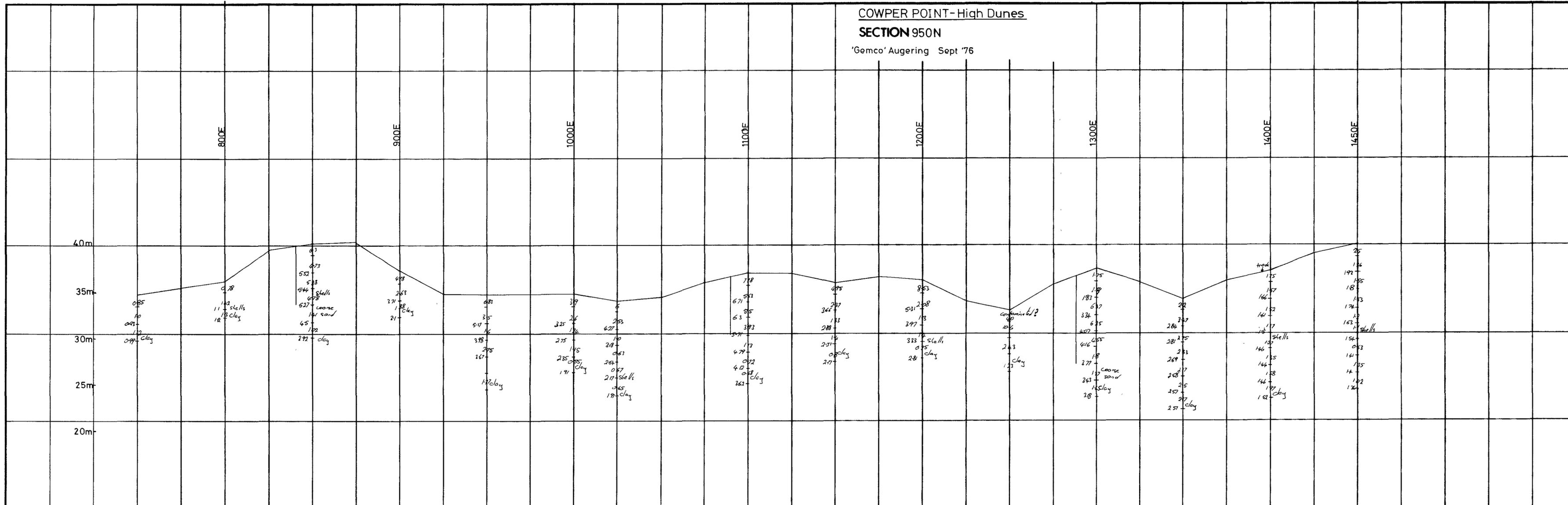
DRAWN: _____ CHECKED: _____

Date: September '76 Scale: Hor. 1:250 Vert. 1:240 (1"=20')

COWPER POINT - High Dunes

SECTION 950N

'Gemco' Augering Sept '76



Collar	Height (metres)	34.8	36.2	40.2	37.4	34.7	34.7	34.6	37	36	36.2	33	37.5	34.2	37.2	40
	Depth	4.9	4	10.4	6.7	10.4	8.5	10.4	12.2	8.5	8.5	6.7	14	12.2	14	15.9
	AV% HM			5.27					5.71				3.77			
	% Non Mags			24.93					23.14				23.83			
	% Rutile (in HM)			4.92					2.98				5.56			
	(overall)			0.26					0.17				0.21			

335032 76-1189

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SECTION 950N 'GEMCO' Survey

DRAWN: _____ CHECKED: _____

Date: OCT '76 Scale: Hor: 1:250 Vert: 1:240