

# **Open File Envelope**

## **No. 1943**

**SML 642**

**CUMMINS**

### **PROGRESS REPORTS TO LICENCE EXPIRY/RENEWAL, FOR THE PERIOD 11/11/1971 TO 10/11/1972**

Submitted by  
Endeavour Oil Co. NL and Le Nickel (Australia) Exploration Pty Ltd  
1972

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**Government of South Australia**

Department for Manufacturing,  
Innovation, Trade, Resources and Energy







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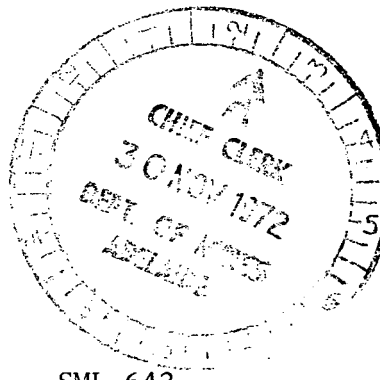
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## Endeavour Oil Company N.L.

DLW/chb

15th November, 1972.

The Director of Mines,  
 Department of Mines,  
 Box 38,  
 Rundle Street Post Office,  
ADELAIDE, S.A. 5001.



Dear Sir,

SML 642

Quarterly Report for the Period  
Ended 11th November, 1972

During the period under review, Endeavour Oil Company N.L. continued exploration on SML 642 for sedimentary uranium and for kaolin. Le Nickel (Australia) Exploration Pty. Ltd. have conducted an extensive reconnaissance geophysical and drilling programme. Their report on this work is enclosed and indicates the most likely continuation of exploration programme during 1973. Expenditures of over \$53,000 on this programme exceed considerably the annual total required by the Mines Department.

Two holes were drilled in the Kapinnie kaolin area. R1, located near the western boundary of the SML 642, was shown to contain little kaolin and is of no economic importance. R2, however, intersected kaolin clays between 24 ft. and 50 ft. 6 in., in which some impurities were noted. Samples have been despatched to overseas companies, and results are awaited. Costs of this drilling programme are:-

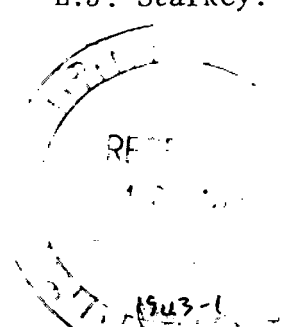
Further decisions on the sedimentary uranium and the kaolin exploration programmes will be made after a careful examination of reports prepared by Le Nickel (Australia) Exploration Pty. Ltd. and the overseas company respectively.

- |            |   |
|------------|---|
| Appendix 1 | Report by Le Nickel (Australia) Exploration Pty. Ltd. dated November, 1972. |
| " 2        | Drill Logs and Map Kapinnie Kaolin.   |
| " 3        | Geophysical Report -<br>L.J. Starkey.                                       |

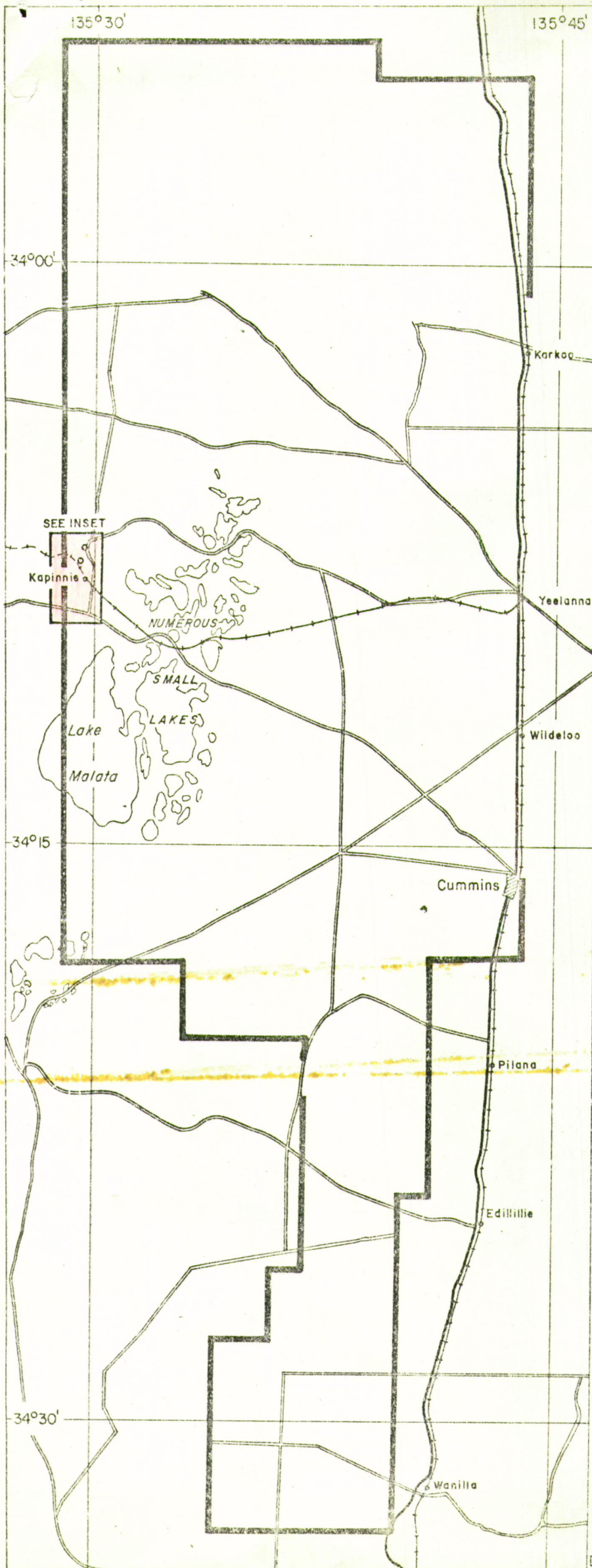
Yours faithfully,

*D.L. Woolf*

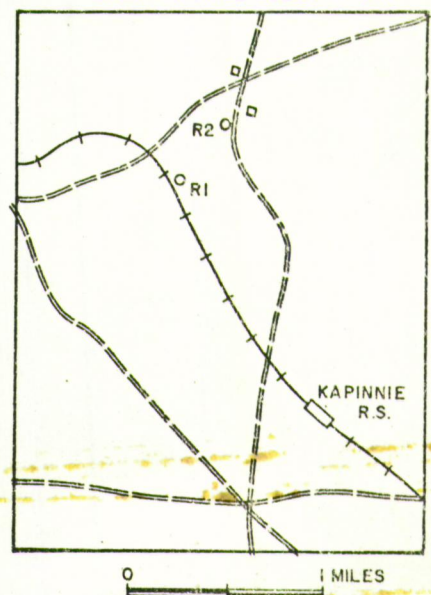
D.L. WOOLF.  
Chief Geologist (Mining).







**INSET**  
LOCATION DRILL HOLES R1 & R2



BOUNDARY OF S.M.L.

ENDEAVOUR OIL COMPANY N.L.  
SOUTH AUSTRALIA  
SML 642 - CUMMINS AREA  
**LOCATION MAP**



DATE: November, 1972

DRG. NO. FO449/1



- 005  
**Endeavour Oil Company NL**

**ROTARY/PERCUSSION SAMPLE LOG**

Area SML 642 - KAPINNIE BIG MAYHEW 1000  
 Hole No. KAPINNIE R1. ~~Claim No.~~ Co-ordinates  
 Total Depth 55' Date 2/10/1972  
 Logged by R.C. DONALDSON Drillers W.L. SIDES & SON

Sample Depth	Assay No.	Rock Type	DESCRIPTION
			Hole collar: situated approx one mile N.N.W.
			along road following disused railway line
			from Kapinnie Post Office.
			Vertical hole
			Bit: 5 1/8" blade
0'-5		Kunkar	Brown coloured sample interval comprising
			mostly brown calcareous clays acting as a
			matrix for small chips of quartz.
			Cream to light brown kunkar or calcrete.
			Also present are numerous chips of ferruginous
			material composing of subangular to subrounded
			quartz particles cemented in a red ferruginous
			clay.
5'-10'		"	Similar to above with an increase in the percen-
			tage of cream coloured calcrete or kunkar chips.
10'-15'		"	Sample interval comprised mostly (80 percent)
			offwhite limestone chips with angular to subangular
			quartz (clean) particles within the calcareous base.
			The remainder of the sample comprises ferruginous
			clays with associated quartz fragments.
15'-20'		Kunkar	Similar to above - offwhite to brown calcrete
		& Kaolin	material.
			20': Change bit to 4 3/4" blade.
			NOTE: Angular clean quartz fragments present
			with up to 20 percent ? offwhite to light grey
			kaolinitic material.
20'-25'		Kunkar	Sample interval comprises up to 10 percent
		and weath	ironstone (quartz cemented by ferruginous clays)
		feldspar	up to 30 percent limestone or calcrete, the
			remainder being offwhite to grey weathered feldspar
			chips.
			Some chips contain small amounts of mica-poor
			quality.
25'-30'		"	Very similar to above interval.
30'-35'		Weathered	Change - Sample interval comprises weathered
		basement	biotite granite or gneiss with up to 30 percent.

# ROTARY/PERCUSSION SAMPLE LOG

Area	SML 642 - KAPINNIE	RIG	MAYHEW 1000
Hole No.	KAPINNIE - R1.	Co-ordinates	
Total Depth	55'	Date	2/10/1972
Logged by	R. C. DONALDSON	Drillers	W. L. SIDES & SON

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# Endeavour Oil Company NL

## ROTARY/PERCUSSION SAMPLE LOG

Area SML 642 - KAPINNIE RIG CRANKS MAYHEW 1000  
 Hole No. KAPINNIE R2 Co-ordinates \_\_\_\_\_  
 Total Depth 100' Date 2/10/72  
 Logged by R.C. DONALDSON Drillers W.L. SIDES & SON

Sample Depth	Assay No.	Rock Type	DESCRIPTION
			Hole collar: situated 180 ft bearing 270°
			magnetic from Mitchel 8B well, approx 1 1/3
			miles north of Kapinnie Post Office.
			Vertical Hole:
			Bit: 5 1/8" blade
0'-5'		Clay	Mottled red, brown and cream coloured clays
		zone	containing a small percentage of subrounded
			quartz chips.
5'-7'6"		Clay	Very similar to above -
			mottled ochre clays. At 7'6" : Change as seen
			from colour of water return. A small percentage
			of returns (up to 20 percent) comprise white
			friable kaolin clay. Commence coring with
			Traefair 3c core barrel at 7'6".
7'6'-13'		Clayey	Recovery = 56 percent. Core comprises of white
		sandstone	sample consisting of sub-rounded quartz particles
			(> 75 percent) in a white clay (kaolin?)
			matrix. Limonitic weathering present on fracture
			planes.
13'-18'6"		Clayey	Recovery 90 percent.
		sandstone	13'-17'" Similar to above - offwhite Kaolinitic
			quartz clays with tiny muscovite flakes
			17'-18'6" Colour change - pale yellow brown
			core comprising of weathered clayey
			(Kaolinite?) sandstone.
18'6"-24'			Recovery 90 percent.
			18'6"-19': As above.
		Kaolinite	19'-24': Core comprises weathered yellow brown
		Quartz	and white kaolinite clay forming a matrix for
		clay	sub-angular to subrounded clean quartz particles
			plus muscovite.
24'-26'		White	25 percent core recovery. Sudden change to a
		Kaolinite	white kaolinite clay with associated quartz and
		clays	mica sections of the core are weathered to brown
			limonitic colouration.
26'-31'6"		"	100 percent Recovery. Core comprises white
			kaolinitic



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**Endeavour Oil Company N.L.**

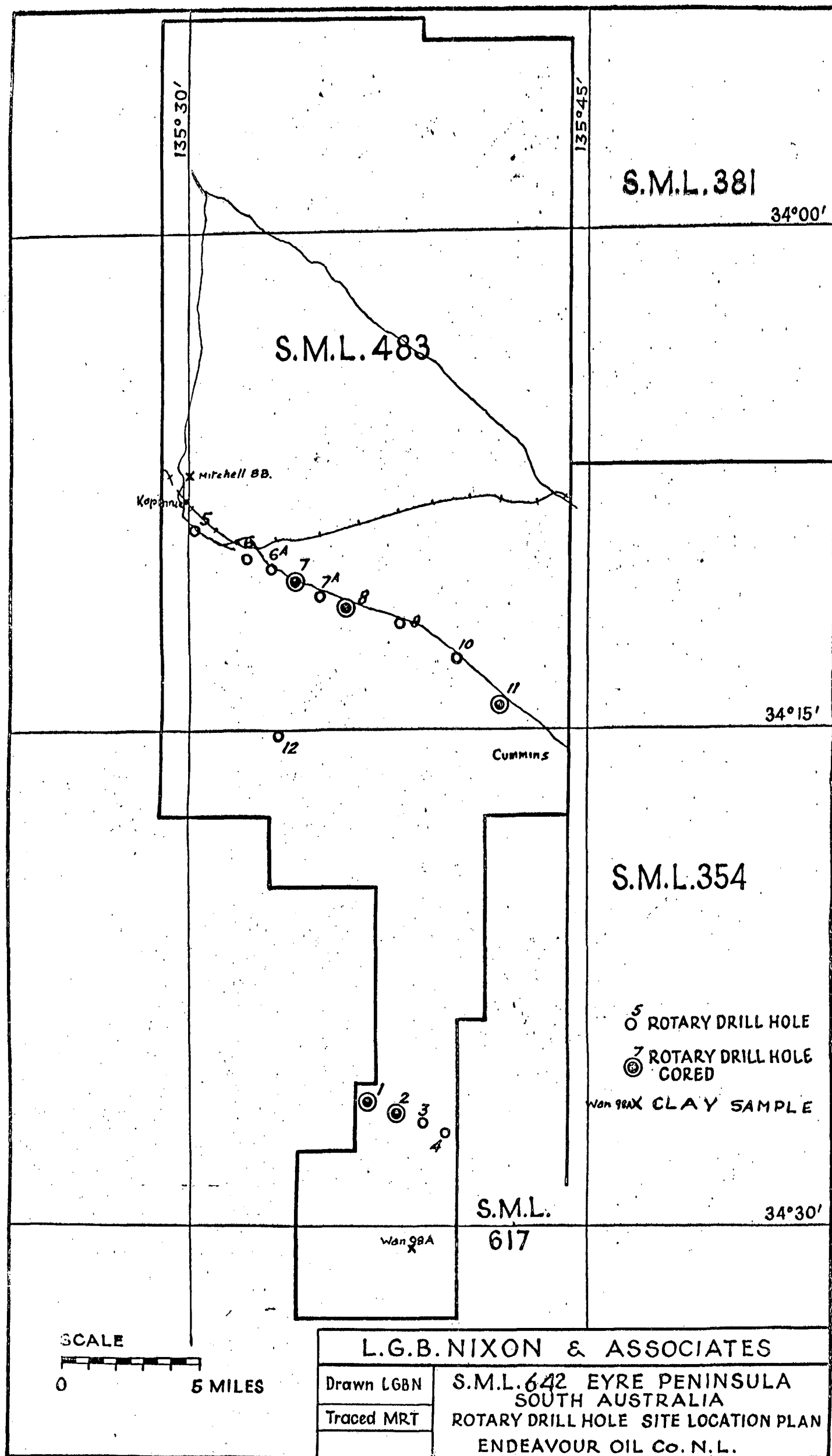
**ROTARY/PERCUSSION SAMPLE LOG**

Area..... SML 642 - KAPINNIE..... Claim No.....  
Hole No..... KAPINNIE R2..... Co-ordinates.....  
Total Depth..... 100'..... Date..... 2/10/1972 - 3/10/72.....  
Logged by..... R. C. DONALDSON..... Drillers..... W.L. SIDES & SON.....

Sample Depth	Assay No.	Rock Type	DESCRIPTION
			clays with associated clear subangular quartz and muscovite flakes. Occassional thin seams (up to 1/2" in thickness) of yellow, brown and red material (weathered sections) are noted throughout.
31'6"-37'		"	100 percent core recovery. Very similar to above except for a generally whiter appearance and containing occasional thin seams of large (up to 1/2" across) clean angular quartz fragments. Ferruginous brown and red thin seams still present.
37'-42'6"		"	Similar to above in general appearance. 100 percent recovery.
42'6"-46'		"	100 percent core recovery-similar to above
46'-51'6"			100 percent core recovery
			46'-50'6" : Similar to above.
			50'6"-51'6" - Colour change
			Fawn to grey core comprising angular clean quartz crystals, introduction of black mica, muscovite present but discoloured to a yellow brown, and offwhite clay (Kaolin)
51'6"-62'6"			Approx 65 percent recovery.
			Core very similar to 50'6" -51'6" interval-fawn to grey mottled core comprising quartz, muscovite, biotite and weathered feldspar.
57'-62'6"			78 percent core recovery
			57'-61': Very similar to above interval
			61'-62'6" : Slight colour change to brown grey. Core is finer grained, with a more even texture, comprising essentially of the same minerals as noted above 62'6": Stop Coreing -
			Change to 4 1/2" blade bit.
62'6"-65'		Granitic sands	Fawn coloured sample interval comprising 60-70 percent subangular clean quartz fragments, muscovite, biotite and feldspar.

Area	SML 642 - KAPINNIE	Claim No.	
Hole No.	KAPINNIE R2	Co-ordinates	
Total Depth	100'	Date	2/10/72 - 3/10/72
Logged by	R.C. DONALDSON	Drillers	W.L. SIDES & SON

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LE NICKEL (AUSTRALIA) EXPLORATION PTY. LTD.

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J/V ENDEAVOUR OIL COMPANY N.L.

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REPORT ON URANIUM EXPLORATION 1972

IN S.M.L. 642

(EYRE PENINSULA - S.A.)

0530/1

R. Carrie  
November 1972

Diffusion:	Endeavour Oil:	2
	L.N.E.	: 2
	S.L.N.	: 1
	Mokta	: 1

1943-1

I N D E X

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ATTACHMENTS

Appendix one :	Drilling data
Appendix two :	Results of analyses
Appendix three:	Location of bench-marks along profiles

FIGURES ACCOMPANYING THIS REPORT

	<u>Scale</u>
Fig. 1 Locality map	
Fig. 2 Seismic and drilling section	1/50,000 <sup>e</sup>
Fig. 3 Drilling sections	( 1/50,000 <sup>e</sup> ( 1/1,000 <sup>e</sup>
Fig. 4 Isobaths of top of weathered basement	1/100,000 <sup>e</sup>
Fig. 5 Test profile: seismic and drilling results	( 1/10,000 <sup>e</sup> ( 1/1,000 <sup>e</sup>
Fig. 6 Profile B:       "       "       "       "	"
Fig. 7 Profile E:       "       "       "       "	"
Fig. 8a Geological logs of all drill holes 13 to 33 to 8w	1/200 <sup>e</sup>



S U M M A R Y

S.M.L. 642 covers part of a shallow continental tertiary basin with proterozoic basement where maximum anomalies up to 110 ppm  $U_3O_8$  were intersected by drilling last year.

The 1972 exploration programme, designed to cover as much as possible of the area not yet explored by 5 E.W. seismic profiles, was aimed at defining the sedimentological and structural environment and test its suitability for uranium mineralisations.

An environment favourable to the trapping and concentration of mobile uranium appears to develop in the upper part of the sedimentary sequence (unit III and top of unit II), inside a fairly small confined basin between line 1 and profile A.

The volume of syngenetic uranium possibly introduced within the sediments and the scale of the leaching process acting as a preliminary factor of concentration remains to be ascertained; the intersection of up to 153 ppm  $U_3O_8$  below the oxydation level is considered as an encouraging result in this respect.

## 1.00 INTRODUCTION

1.1 S.M.L. 642 covers 472 sq. miles of the Central basin of southern Eyre Peninsula, filled in by tertiary continental sediments, and bordered by two precambrian basement ridges, the Lincoln Uplands to the East and the Western Highlands (Fig. 1).

The lease's eastern boundary runs along the sealed road between Port Lincoln and Lock from 40 kms north to 32 kms south of the town of Cummins, the only place in the area providing supplies and accommodation; its width varies between 4.5 kms in the south and 22.5 kms from Cummins northwards.

The country is mildly undulating with altitudes averaging 60 m and ranging from 36 m in the south to a maximum of 125 m SSW of Yeelanna; actual drainages are mainly westwards, towards the Lake Malaka depression, north of Cummins, and in a southerly direction through the Salt Creek, south of this town.

All of the area is extensively farmed, with wheat and sheep being the main activities, and is covered by a fairly dense network of earth roads.

The best period of the year to work the area is during the usually dry months of March and April before sowing.

1.2 The lease was obtained by Endeavour Oil Company in 1970 in the course of a search for sedimentary uranium in South Australia.

Uranium minerals exist in basement rocks of the Lincoln Uplands, the main occurrence being near Port Lincoln, and thorium anomalies have been found

in the Marble Range to the south-west of the lease.

Preliminary investigations in 1970, essentially water sampling and radiometric logging of existing bores and wells, provided a cluster of values up to 20 ppb U in or close to the southern end of the lease.

In 1971, 14 holes, totalling approximately 690 m, were drilled one or two miles apart along two lines across the central and southern parts.

This drilling intersected, over a granitic and gneissic basement with marked relief, up to 130 m of loose, coarse to fine-grained, kaolinitic and/or frequently carbonaceous quartz sand with some peat and clay interbeds.

Radioactive anomalies in excess of 10 times local background were found in 11 holes, in sediments or weathered material in contact with fresh basement, in the peat bearing horizons and, to a smaller extent, in the sand section below the peat.

The best intersections were in holes 8, 10 and 11. A subsequent coring programme in holes 1, 2, 7, 8, and 11, provided values of up to 110 ppm  $U_3O_8$  from side wall samples in hole 8 in a kaolinitic quartz mica sand; uranium mineral, found in close association with iron sulphides, was tentatively identified as autunite or meta-autunite.

In addition, some kaolin indications with potential at paper filling and coating grades were found in water bores near Kapinnie on the western side of the prospect.



1.3 L.N.E. was approached by Endeavour Oil Company in the first half of 1972 and a joint venture agreement was eventually signed and approved by the South Australian Minister of Mines on 18th July 1972.

Under the agreement's terms, L.N.E. may acquire a 50% interest in S.M.L. 642 by:

- spending \$50,000 in exploration (at least \$35,000 prior to 31st December, 1972.)
- paying \$15,000 cash to Endeavour not later than 1st January 1973.

The agreement covers all minerals, except kaolin.

## 2.00 PROGRAMME OF WORKS

### 2.1 Purposes

The ultimate target of our exploration in S.M.L. 642 is the proving of a minimum of 15,000 s.t.  $U_3O_8$  in one or several lenses of Colorado Plateau and/or Wyoming type; the actual potential of the area, from the 1971 results, justified the expenditure of about \$50,000 in the first stage.

The 1972 programme, approved during a technical joint committee on 24th July, was essentially reconnaissance in nature.

Its aims were:-

- a) to outline, as accurately as possible, the actual shape and depth of the basement paleo surface in order to detect buried sedimentary channels.

Seismic was considered as the best method of investigation.

Low level aeromagnetism, proposed in last year's report, was not retained, despite its much lower cost, owing to:

- the expected shallow depth of the basement and limited amplitude of its variations.
- the lack of enough subsurface information for a fair

interpretation of the airborne data.

b) to test, by drilling the main and most interesting of the seismic channels, the suitability of the sedimentary environment for uranium concentration.

With the perspective of having to decide on a possible reduction of the lease surface prior to its renewal date on 11th November, the programme was designed to cover as much of the area not yet explored as possible by 5 E.W. profiles located 6.5 to 8 kms apart, totalling 96.5 kms.; this spacing proved actually too large to enable any correlation between profiles but good enough to determine the most prospective areas.

## 2.2 Methods

### 2.2.1 Seismic

a) The survey, contracted to L.J. Starkey and Associates of Perth, with L.N.E. providing unskilled labour and vehicles, was satisfactorily performed; however, a certain deficiency in field organisation required a tight supervision.

b) The method used was the hammer reflexion with stations at 100 ft intervals and photographic recordings on a Bison 1570 B signal enhancement seismograph.

This method, tried first along an 8.4 km section of line 2, drilled last year, between holes 6A and 9, proved fully able to pick up the basement surface. Field technique for each station consists of summing the signals from hammer point at distances between 1.50 m and 9.15 m from a geophone. Travel times for reflexion waves are the same for all points, hence signals add, whereas times for other waves (such as direct or refracted) are different, hence tend to cancel.

To supply direct velocity measurement, 360 m refraction spreads were done at an average spacing of about 2 kms.

Field technique consists of two shots of 1-1/2 lbs of dynamite, off ends (30 m to 90 m), using geophones 1 and 12 as reciprocals and recorded on an Electro-tech E.R. 75A-12 seismograph. The seismic survey was completed in 33-1/2 working days between August 12th and September 17th, by a field crew of three (one operator and two field assistants) under the supervision of a geophysicist carrying out a day by day field interpretation; average turnover was 2.8 kms/day both in reflexion and refraction.

The initial programme was somewhat altered in the course of the survey; profile B was shortened and profile C deviated owing to flooded areas, and profile E was shortened on the consideration of the general basement rise observed along profiles C and D.

Actual total surveyed was 77.9 kms, split as follows:

Profile	No. of pegs (200' intervals)	Reflexion Kms	Refraction		Ratio refraction spread
			No.	Kms	
Test	139	8.38	6	2.19	1 per 2.10 km
A	132	7.98	6	2.19	1 per 1.33 "
B	286	17.53	9	3.29	1 per 1.95 "
C	200	12.13	4	1.46	1 per 3.03 "
D	370	22.49	10	3.66	1 per 2.25 "
E	154	9.39	4	1.46	1 per 2.35 "
TOTAL	1281	77.90	39	14.25	1 per 2.0 Km

### 2.2.2 Topographic survey

As variations in surface relief elevation were expected to be of a comparable order of magnitude to the expected variations in basement depths, each profile was levelled with an average accuracy of

approximately 0.1 m per mile.

This was completed in 27 working days between July 30th and August 27th by a crew of three (one surveyor and two field assistants); average turnover was 3.90 kms/day in traversing and 3.6 kms/day in levelling.

### 2.2.3 Drilling Programme

The programme, contracted to W.L. Sides and Sons of Melbourne, was carried out using a Mayhew 1000 air-water rig and was completed in 13 working days between September 18th and October 1st.

A total of 24 holes were drilled, including:

- 13 scout holes<sup>(1)</sup> investigating the main channels defined by the seismic field interpretation; some of these channels proved actually non-existent as along profile C and the eastern part of profile D.
- 11 holes to test, at an average 500 m spacing, the extension of the four best anomalous inter-sections:
  - last year's RA 1 and RA 3: 4 holes
  - this year's RA 4/RA 5 (4 holes) and RA 6 (3 holes)

Most holes, drilled in 4-3/4" diameter with a blade bit, were stopped after penetrating at least a few inches in relatively fresh basement, usually hard enough to stop any drilling progress.

Total meterage broke up into:

- 1520 m of mud rotary drilling, of which 1450 m only were chargeable, completed in 125 working hours with an average turnover of about 12 m/h.

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(1) 2 holes (kapi 18A and 23A) are in fact double drilled at W.L. Sides' expense following collapse of the pilot hole.

- 6.10 m of side wall sampling in kapi 26A on anomaly RA 5, carried out after an unsuccessful trial of conventional coring with a Traephus triple tube core barrel.

Unfortunately, the side wall method provides samples which are neither sufficient in volume nor representative and a more satisfactory method, suitable for very loose, water saturated sediments, would have to be selected should further exploration take place in the area.

Each hole was:

- sampled per 3 feet runs and geologically logged (Fig 8a to 8w)
- logged, with the exception of kapi 18 and 23, collapsed, for radioactivity, self potential and single point resistivity with a Neltronic porta logger of the South Australian Department of Mines.

Each gamma ray log was systematically run on the 20 c/sec/cm scale over the total depth, then rerun at higher scales where required; average cable speed was 3m/minute.

Electric logs proved most helpful in the determination of some facies boundaries, specially the top of the weathered basement.

#### 2.2.4 Termination of Survey

After completion of the drilling programme and in compliance with the mining regulations, six days were spent filling in all drill holes and removing all seismic pegs located on private land.



Nevertheless, after agreement with landowners, a certain number of bench-marks were left along fences and in bushy areas, to be used if further work is required along the profiles (refer to Appendix three). L.N.E. field crew left Cummins on 7th October.

### 3.00 RESULTS

This chapter deals only with results of the drilling programme.

Date and results of the seismic survey are discussed in "Report on seismic survey, Cummins, South Australia" by L.J. Starkey.

#### 3.1 Stratigraphy

##### 3.1.1 Basement

A survey of the basement outcrops within or just outside the boundaries of the lease, carried out last year, revealed three main facies:

- coarse grained, red and white quartzite associated with (and probably interbedded in) garnet biotite-hornblende banded gneiss, with pods of red coarse grained biotite granite, in the south.
- an even medium grained biotite granite in the eastern central part of the lease.

These facies are part of the Cleve Metamorphics formation, giving ages around 1700 m.y. for its last metamorphism.

Accurate identification of basement rocks in drill holes is somewhat hazardous, due to insufficient penetration in the typical unweathered formation.

Most intersections can be related to either a muscovite, biotite gneiss or a biotite adamellite; according to Johns (1961), both facies belong to the Flinders Group, lower part of the Cleve Metamorphics.

However, a well layered micaschist, with major biotite and minor muscovite, encountered in holes 15, 26, 27 and 28, might represent part of the overlying Hutchison group.

In each hole, the relatively fresh material is overlain by a sheet of completely weathered rock, ranging in thickness from 3.30 m in kapi 13 to 17.80 m in kapi 14 with an average of 8 m to 10 m.

It occurs as an "agglomerate" of angular to subangular, often milky, coarse to gravelly quartz in an abundant kaolinitic matrix.

Micas (muscovite largely predominant over biotite), kaolinised fragments of feldspars and fine to medium grained pyrite aggregates are common minor elements.

Occasional predominantly kaolinitic layers, about one metre thick, are also interbedded as clearly shown on resistivity logs in holes 13, 14 and 27 for example.

As its components and texture are the same as those of the overlying sediments, it is fairly difficult to determine precisely the top boundary of the weathered basement; the best approach to this is based upon a careful comparison of the quartz grains features, especially degree of attrition and hue, and of the respective resistivity and S.P. curves.

### 3.1.2 Sediments

The sedimentary sequence intersected above the weathered basement ranges from 13.80 m in kapi 39 to a maximum of 123.30 m in kapi 27.

It consists of loose terrestrial kaolinitic and/or carbonaceous quartz sand, with peat and clay interbeds,

Eocene to Pliocene in age according to Johns (1961), overlain by up to 10.40 m of Pliocene to Pleistocene superficial formations, mainly laterite, clay, aeolian sand and kunkar.

The sandy section is quite clearly organised in three units, each representing a different period of deposition, although there might be some inter-fingering, especially between units I and II.

Owing to a locally strong pollution in cuttings, some boundaries are still doubtful but, at this stage, this does not affect the general value of our interpretation.

From bottom upwards:

- a) Unit I is present in every hole, except kapi 15 and 30 where the basement is at its shallowest. Variations in thickness ranging from 6.80 m in kapi 25 to 58 m in kapi 27, are closely related to the variations in basement depths, with thickest sections occurring over the deepest channels.

The facies, fairly constant over all the area explored so far, is a poorly sorted coarse grained to microconglomeratic, kaolinitic and frequently pyritic quartz sand.

Quartz, up to 8 mm in cuttings, often broken, are subangular to angular, mostly transparent and shiny, with some milky or smoky among the coarsest grains.

Kaolinite, as matrix, is a major component of the sand and represents up to 30% in volume of cuttings collected.

Pyrite, another major element especially abundant in holes 17, 22, 26 and 28 with up to 4% of total amount of cuttings, occurs mainly as fine to medium grained centimetric aggregates joining the quartz grains and at least partly diagenetic in origin.

Kaolinised feldspars, hard to differentiate off-hand from calcrete cuttings, and white micas up to 4 mm in size, are frequent minor components.

Carbonaceous material is rare, but can occur down to the weathered basement, in holes 20 and 22 for example.

On the whole, this unit shows a remarkably poor sorting, very little attrition and much similarity with the underlying material. Its deposition apparently results from a moderate reworking of the nearby weathered basement following a mild tilting rather than a major structural outburst.

- b) Unit II is, on the average, better differentiated, better sorted and finer grained than the first one and is characterised by the abundance of carbonaceous materials and peat lenses. The unit is present in every hole, except kapi 30, with thickness ranging from 7 m in kapi 23 and 25 to 45.20 m in kapi 13. The variations in thickness follow two trends:
- general increase with increasing depth of basement as in unit I. However, detailed investigation of deep channels along profiles B and E shows that the thickest section of unit II is notably offset compared with the thickest section of unit I. This may result from either a certain

wandering of the stream channels in course of time or a discriminating erosion of the top of unit I before deposition of unit II.

- general decrease from the southern part of the lease, with a maximum of about 50m in kapi 2, towards the north with only 14 m in hole 22. This variation is associated with a major change in facies resulting in a finer grain, almost complete disappearance of peat lenses and important decrease in carbonaceous content north of the line 2.

The main facies is a loose quartz sand with abundant kaolinitic and commonly carbonaceous matrix, common millimetric white micas and kaolinised feldspars. Quartz are subangular to subrounded, mostly transparent and shiny.

The sand is mainly coarse grained, with occasional gravelly (with quartz up to 1 cm long) and medium grained lenses, along line 1, profiles A and B; it is predominantly coarse to medium grained, with some fine grained layers, north of Cummins. Pyrite, although abundant in holes 21, 22, 24 and 26, is, on the whole, far less common than in unit I.

Peat was intersected in almost every hole south of profile C, with major development in the deep channels of line 1 and profile B. From profile C northwards, it was encountered only in two holes over 1.50 m in kapi 22 and as patches in kapi 20. As a matter of fact, the sediment is, in most cases, a soft silty micaceous, highly carbonaceous, clay, either dark brown or black coloured, with occasionally abundant wood and leaves fragments (kapi 21).

The peat lenses, up to 9 m thick in kapi 13 and apparently fairly limited in extent, occur at any level in the unit, although they are more frequent and important in the top section.

The deposition in local swamps, during unit II of such a large amount of carbonaceous matter, most likely of vegetal origin, may indicate either a major change in climatic conditions, hence in vegetation, at the end of unit I or a major alteration in the drainage system and erosion areas.

- c) Unit III, intersected in every hole, except in kapi 19 and probably kapi 18A on profile C, ranges in thickness from 3 m in kapi 17 to 29 m in kapi 22. Its boundary with the overlying superficial formations is sometimes difficult to determine, owing to major secondary alterations occurred in the weathered zone such as silicification and ferruginisation.

This unit shows, on the whole, better differentiation, better sorting and higher degree of attrition than the underlying ones; it was deposited over an area fairly well levelled and located far away from the major erosion areas.

The facies is a loose micaceous kaolinitic quartz sand, ranging in size from coarse grained to fine grained; the latter seems to develop mainly in the thickest sections. Some kaolin layers, more or less red coloured by iron hydroxides, may also occur at the top of unit (kapi 26, 27, 28 and 29).

Carbonaceous matter, either new or resulting from the erosion of the top peat lenses of unit II, is fairly common and especially abundant near the bottom;



scattered pyrite aggregates have been found very high in the oxydised zone (kapi 27 and 29).

d) Superficial formations

This group of facies, up to 10.4 m thick in kapi 13, presents, when complete, the following succession from bottom upwards:

- lateritic duricrusts, gravels and fossil clayey soils formed under humid pluvial conditions during the Pliocene, according to Johns (1961).
- aeolian sand, Pleistocene in age, fairly well sorted, with fine to medium grained, blunt quartz; this facies may occur only in holes 22 and 26.
- kunkar, mainly porous and soft except for a thin cemented cover where it outcrops, occur typically in two successive layers up to 3 m thick each, with a sticky ferruginous clay in between. Kunkar reaches its main development in the western part of the lease, north of Cummins and has apparently been more or less completely eroded elsewhere.
- clays, sand and gravels of the present erosion cycle with sometimes abundant resorted lateritic gravels.

3.2 Present structures

The pattern of basement ridges, which condition the present relief of the basin floor, follows two major trends:

- the main one, between N.S. and N.E.-S.W., delimits the regional extension of the basin on its western (Western Highlands) and eastern (Lincoln Uplands) sides
- the other, regionally of minor importance, lies between W.E. and W.S.W.-E.N.E.

The combination of both trends defines four major structural units in the lease area:

- a) a basement high, trending W.E., partly followed by profile C. Buried on its western side, with up to 40 m of overlying sediments, it widens and eventually outcrops to the east, north and south of the Minganna

railway siding.

- b) a southern subbasin barred to the south by a north-eastern subsurface spur from the North Block (followed by profile A). Two major sedimentary channels, trending SSE to SE, with depths to the top of the weathered basement ranging from 110 m to 130 m, were intersected on profile B by kapi 13 and kapi 26, 27 and 28; these most likely connect in some way with the shallowest depressions found on line 2. Both channels are characterized by fairly sharp variations in depth across and along their course. Both most likely merge south of Cummins with:
- c) a well defined, steep, SSW to SW paleo channel crossing the lease in its southeastern part. This channel, intersected by kapi 2 and the Cummins school bore with depths up to 130 m might follow a major basement lineament shown intermittently on the B.M.R. aeromagnetic map.
- d) a northern subbasin, shallower and less rugged than its southern counterpart, opens widely north of profile C.

One shallow, fairly open channel runs in a northeasterly direction between profile D and E; its maximum depth below surface is 65 m in kapi 31.

At this stage, little evidence of faulting is available. Apart from the possibility mentioned in c) above, a fault of same trend (NNE-SSW) with east downthrow might account for a sudden drop in basement depths from one station to another observed on the eastern parts of profile A and B; moreover, these occurrences appear to be in line with the paleo channel developing west of kapi 29 on line 2.

### 3.3 Geological history

The region, subjected since the Proterozoic to a long period of subaerial erosion and weathering under cool climate, should have been fairly well levelled when, at the beginning of the Tertiary, tectonic movements re-started active erosion.

Since these events shaped the Central Basin, the main structural features appear to have remained unchanged up until now; this is most clearly revealed by the permanence of the same drainage pattern during the whole sedimentation period (as shown in Fig. 3).

There are, nevertheless, several evidences that local changes, which might have had a predominant influence on concentration or leaching of sedimentary uranium, took place during and after the sedimentation.

The basal sedimentary unit, in its features bears a sometimes striking resemblance to the underlying weathered basement. It is inferred that the tectonic changes which originated its deposition were fairly mild and the erosion process limited to a quite gentle reworking and distribution nearby of part of the weathered material accumulated.

Later on, and before levelling of the residual relief, further tilting resulted in a renewal of the erosion-sedimentation cycle with deposition of unit II.

In the southern basin sediments are better differentiated and periodically coarser than in unit I indicating a stronger erosion and that new source areas further away were being eroded. This went with massive destruction

of a dense vegetation of the rain forest type, swept along and deposited with coarse sediments in temporary swamps developing on intermediate shelves along the watercourses.

This process was most likely preceded by a discriminating erosion of the top of unit I.

In the northern subbasin, unit II is, on the average, finer grained, comparatively thinner and much poorer in carbonaceous matter, indicating less erosion, thus less tilting at the end of unit I than further south.

Unit III was deposited over an area fairly well levelled already and may be under an increasingly warm and dry climate. The result was a marked drop in erosion activity, although some renewals apparently occurred following local minor tilting. The unit, medium grained on an average and relatively thin compared to the lower ones, seem to have developed mostly on or close to the main paleo-channels.

Active sedimentation probably stopped during the Pliocene and laterisation of the top of the sequence took place during the same period.

Later on, different superficial formations deposited during the Pleistocene and subsequent sub-aerial erosion, developed mostly at the expense of this over burden, has given rise to the present relief.

Presence of pyrite aggregates high in the actual oxidized zone indicate a fairly recent change in the physical-chemical equilibrium of the area which may result from some limited tectonic readjustments.

### 3.4 Mineralisation

#### 3.4.1 Radioactive minerals

Local radioactive background of the sedimentary sequence, estimated from the gamma ray logging, varies quite broadly between 15 c/sec up to 100 c/sec.<sup>(1)</sup>

In most holes a fairly sharp increase, from an average of 20 c/sec up to 80 c/sec, is observed below a depth increasing with the thickness of the sedimentary sequence, usually between 20 m and 40 m. This change, particularly noticeable in holes 14, 17, 18A and 21, is most likely related to an increase in potash content, i.e. in kaolinitic matrix, of the sediment.

Of the 23 holes logged:

- all, except 18A and 19 or profile C, gave at least one peak equal or superior to 3 times the local background.
- eight (kapi 22, 25, 26, 26A, 28, 29, 32 and 33) intersected at least one horizon of radioactivity equal or superior to ten times the local background; moreover, all readings, except one, are above 400 c/sec.

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(1) As already mentioned, logging was carried out with a Neltronic porta-logger; approximate equivalence is 1200 c/sec for 875 ppm U for an ore in equilibrium.

Hole No.	Profile No.	Depth(m)	Peak (c/sec)	Background (c/sec)	Unit
Kapi 22	E	70.0	460	40	Weathered basement
Kapi 25	D	29.60	100	10	"
Kapi 26	B	21.80	840	50	III
		116.40	640	60	Weathered basement
Kapi 26A	B	21.40	990	20	III
Kapi 28	B	114.80	600	60	I
Kapi 29	Line 2	44.0	410	40	I
		45.0	410	40	"
Kapi 32	B	26.20	490	30	III
Kapi 33	B	22.60	620	30	III

Complete radiometric results are shown in appendix one.

Three new anomalous zones, numbered RA4, RA5 and RA6, were discovered this year and investigated by complementary drilling:

- RA and RA5, occurring in the same channel of profile B at different levels of the sedimentary sequence, were followed by 3 holes (kapi 26, 27, 28) over a total length of about 1200 m across the channel; two more holes (kapi 32 and 33) were drilled 150 m E and W of kapi 26 for further testing of the top anomaly RA5.
- RA6, intersected by kapi 22 on profile E, was investigated by three more holes (kapi 23, 24 and 31) over a total E.W. length of 2.600 kms.

Two of the last year's best intersections, in kapi 8 (anomaly RA1) and in kapi 11 (anomaly RA3), were also each flanked, with little success, by two holes



at an approximate 400 m spacing. (1)

All the significant radioactive increases (say at least three times background) discovered so far can be divided in four major groups, depending on their level of occurrence in the sequence; from bottom upwards:

a) anomalies located in the weathered basement (which is to be considered as a "sediment" as far as its potential for uranium concentrations is concerned) and/or the bottom of the sedimentary section (unit I).

Four anomalies belong to this group:

- RA1 gave up to 975 c/sec in kapi 7.
- RA3, intersected last year in kapi 11 with a maximum radioactivity of 800 c/sec, extended in kapi 29, 400 m to the NW, with maximum 400 c/sec.
- RA4 gave maximum readings of 640 c/sec at 116.40 m in kapi 26 and 600 c/sec in kapi 28, 550 m to the west; assays on cuttings gave a maximum of 8 ppm U against 50 ppm Th and a ratio  $\frac{\text{Th}}{\text{U}}$  ranging from 2.5 to 6.
- RA6 provided maximum radioactivity of 460 c/sec in kapi 22 at 70 m deep in weathered basement; results of cuttings assays were a maximum of 8 ppm U and 13 ppm Th.

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(1) It is important to appreciate that, due to extensive crops already well grown, it has sometimes been impossible, for lack of time to reach an agreement with the landowner, to drill at the desired site.

This type of radioactive anomaly is by far the most common and best developed in the area. The increase in radioactivity at this level appears to be closely related to an increase in the kaolinitic content of the rock. Most peaks are located within thin (usually not more than a metre) predominantly clayey layers interbedded in highly kaolinitic sands: such sands have radioactivity averaging 300 to 350 c/sec over up to 10 m (see kapi 27 and 28 for example).

Radioactivity is mostly due to either thorium or potassium or both; for such reasons these anomalies are considered of little interest, if any.

- b) Anomalies associated with peat lenses or highly carbonaceous sand.

Most of these anomalies occur in unit II and are of little importance, their increase in radioactivity not exceeding what one can normally expect in this kind of environment.

The only exception is RA1, discovered last year in hole 8 with a maximum reading of 800 c/sec. As already mentioned, assays of side wall samples gave a maximum value of 110 ppm  $U_3O_8$ .

The excess of radioactivity can be either related to the poor representativeness of the side wall sample or due to thorium or potassium, the latter being, again, the most likely explanation, as a high content in kaolin was observed.

- c) Anomalies close to the oxydation-reduction surface inside unit III.

This type bears a certain resemblance to the second type as it also is usually associated with carbonaceous material.

RA5 is the only anomaly of this kind investigated; it has been followed by 3 holes (kapi 26, 32, 33) over a total length of 300 m across the channel, with kapi 27 and 28 showing increases of up to eight times background at the same level further afield.

The anomaly is located between 2 m and 5 m below the bottom of the totally oxydized zone, at an average depth of 23 m, and developed as a sharp double headed peak at the interface between a fine to medium grained micaceous and slightly carbonaceous sand and a clayey peat horizon; thickness above the 400 c/sec mark varies between 0.20 m and 1 m in kapi 26A with a maximum reading of 990 c/sec, theoretically equivalent to 790 ppm U or 930 ppm  $U_3O_8$ . Maximum value on side wall samples was 130 ppm U. (= 153 ppm  $U_3O_8$ ).

In this case, we consider the disequilibrium to be mainly due to the poor representativeness of the side wall samples: as a matter of fact, thorium values are less than 10 ppm; there is very little kaolinitic matrix and no feldspars visible and little evidence of radon.

Anomaly RA7, intersected last year in hole no. 2 as a double peak layer, with up to 620 c/sec, in a mixture of peat and medium to very coarse sand, at the boundary between units II and III, might belong to the same type.

d) Anomalies inside the totally oxydized zone.

These are of minor importance with increases up to 5 times background; they occur mainly in kaolin layers (as in holes 26, 27, 28, 32 33) or, to a lesser extent, in calcrete horizons.

#### 3.4.2 Kaolin

Layers of kaolinitic clay were intersected on top of unit III in the following holes

Hole No.	Profile No.	Depth top(m)	Thickness (m)
Kapi 14	B	10.5	1.0
Kapi 15	D	3.0	4.0
Kapi 26	B	7.0	1.0
Kapi 27	B	1.0	0.5
		4.0	3.0
Kapi 28	B	4.0	0.5
Kapi 32	B	6.0	1.6
Kapi 33	B	6.0	1.6

## 4.00 COMMENTS

### 4.1 Methods

4.1.1 The hammer reflexion method, used this year on a trial basis, has proved satisfactory in being able to mark the top of the basement as deep as 150 m, thus answering our requirements.

However, due to its lack of direct velocity measurements, the method is unable to provide a satisfactory depth interpretation without:

- surface refraction spreads: an average of one per 2.5 kms was considered as optimum for this survey.
- up hole velocity survey: an average of one hole per 5 to 10 kms of profile, depending on the complexity of the sedimentary sequence, should be regarded as a fairly good average.

Cost is another element in favour of this method; it averaged \$200 per km for reflexion only and \$310 per km for the complete survey against about \$500 per km for a conventional refraction survey which is believed not to provide better results.

### 4.2 Results

The process of uranium concentration in such sedimentary environment usually involve three successive stages:

- deposition of scattered syngenetic uranium.
- leaching away by oxydising solutions.
- concentration, under more or less reducing conditions, at the contact with a trap, either lithological or structural.

We will successively discuss the results gathered relating to the sedimentology, structure, possible sources of mineralisation and existing anomalies.

#### 4.2.1 Sedimentology

The three main characteristics of a favourable host-rock are:

- a permeability allowing the circulation of important volumes of solutions.
- lateral and vertical lithological changes inducing sudden drops in permeability; as a result solutions will be slowed down, thus allowing uranium time to precipitate.

Such changes are realized by a lens of pelite in a sandy environment, or the opposite, or by a paleochannel, filled in by coarse sediments, eroding the top of an underlying silt.

- "precipitating" agents. such as carbonaceous matter, hydrocarbon, SH<sub>2</sub>, clay.

For lack of coring, our knowledge of the sedimentary sequence is notably insufficient; it appears to present features both favourable and unfavourable:

- the abundance of pyrite and carbonaceous matter of vegetable origin indicates that reducing conditions have prevailed since the beginning of the sedimentation over most of the sequence.
- the lower part of the sequence (weathered basement, unit I and lower part of unit II) represents a most immature, unorganised and non porous sediment unfavourable to uranium concentrations owing to its low permeability and lack of necessary oxydizing process,

It is interesting to remember that the abundant clay associated with the mineralized districts of the Lakota and Wasatch Formations, respectively Cretaceous and Eocene in age, is not kaolinite but montmorillonite and/or bentonite derived from volcanic tuff.

- the higher we rise in the sequence, the more marked are the lithological changes; the top of unit II and the unit III offer a fairly good differentiation

both laterally and vertically, in grain size as well as in nature and percentage of matrix, thus providing an interesting target for further exploration.

#### 4.2.2 Structure

The following features are considered as interesting:

- permanence of the same drainage pattern during all the sedimentation.
- probable merging south of Cummins of three main paleochannels.
- definition of a confined basin most likely to retain the uranium available and favour its concentration. Most eocene districts of the Wyoming area appear to be localised near the border of such basins.

#### 4.2.3 Sources of uranium

The most common sources of syngenetic uranium in sedimentary basins are either the metamorphic basement or some volcanic material.

As the structural pattern of the area is understood, the sources area of the sediments for the two sub-basins defined so far, were essentially to the west where present basement outcrops show only thorium surface indications. Sediments from the eastern Lincoln Highlands\* were collected by the main S.S.W.-N.N.E. eastern paleochannel; this would attract interest on the section of this channel located inside S.M.L. 642, if it did not appear so "open" downstream.

Although it is quite certain that even an unanomalous basement (containing say about 4 ppm U) can provide, when eroded or leached over a sufficient thickness, enough disseminated uranium to ultimately produce an economical concentration, the collector

\* where uranium minerals occur



basin downstream has to be large enough to accumulate and retain the corresponding sediments: this may not be so in the case of the southern subbasin.

#### 4.2.4 Interest of existing anomalies

Most of the anomalous radioactivities intersected so far appear to be related:

- either to thorium or potassium, locally concentrated in the weathered basement and in the lower section of the sediments.
- or to syngenetic uranium trapped in peat lenses. Radioactivities and values obtained are within what one can normally expect in this kind of environment and even the 110 ppm  $U_3O_8$  (0.01%) found in kapi 8 compare with the grade existing over large areas of bituminous shales either in the S.W. of the United States (up to 0.08%) or in Sweden (average 0.02%). The possibilities of further notable concentrations inside such sediments are remote, due to their low permeability preventing the development of the necessary oxidation process.

At this stage, anomalies such as RA5 and possibly RA7 appear to represent the only type susceptible of any interesting development as it combines the three necessary factors of concentration:

- lithological differentiation with associated variations in permeability: horizon of fine grained sand in a medium to coarse grained environment, overlying a waterproof peat horizon.
- "precipitating" agents, as scattered carbonaceous matter and possibly microcrystalline pyrite in the sand and top interface of the peaty horizon.

- oxydation process in progress above, with subsequent leaching downwards and laterally, towards the favourable area, of all uranium available in the oxydized zone.

4.2.5 To sum up, the 1972 survey has notably, and more than expected, narrowed the range of potential targets for further exploration. An apparently favourable environment develops at the top of the sedimentary sequence within a fairly confined continental basin of limited extent susceptible of retaining and concentrating the syngenetic uranium available. The probability of such a uranium being made available at some stage in enough quantity can not be ascertained at this stage; the information collected would be rather against such probability.

#### 4.3 Recommendations

Should further exploration be carried out, a minimum programme of \$55,000 should aim at:

- in the southern basin:
  - further exploration between line 2 and profile A by intermediate seismic profiles, with subsequent drilling, to define its sedimentological and structural features.
  - drilling at a 400 m to 800 m pattern across the channel in the vicinity of anomaly RA5 or any better anomaly intersected.
  - pattern drilling of the two main channels as close as possible to their expected junction with the main eastern channel south of Cummins.
- in the northern basin, completing the exploration by a seismic profile across the whole width, about 4 to 5 kms north of profile E.
- probing the main eastern channel by one or two drilling lines, with 800 m to 1200 m spacing between holes, between Lake Baird and line 1.

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LE NICKEL (AUSTRALIA) EXPLORATION PTY. LTD.

J/V ENDEAVOUR OIL COMPANY N.L.

S.M.L. 642

(EYRE PENINSULA - S.A.)

REPORT ON URANIUM EXPLORATION 1972

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APPENDIX ONE  
DRILLING DATA

Remarks: all depths are in metres

basement: bottom depth = top fresh basement

top depth = top weathered basement

URANIUM PROJECT			045/30 J V ENDEAVOUR OIL N.L. S.M.L. 642												1
HOLE NUMBER	CO-ORDINATES		DEPTHS(m)		GEOLOGY (m)				NELTRONIC logger		RADIOMETRY 1200 c/sec = 875 ppm U				
	Profile	Peg	Drilled	Logged	Top Basement	Top Unit I	Top Unit II	Top Unit III	(m) Depth peak	(m) Thickness >400c/sec	c/sec RA maxi.	RA average	Accu.	Back-ground c/sec	
KAPI 1	Line 1		67.05	67.05	57.91 60.96?	41.15	25.91	?	25.30?	0.61?	590?	-	-	60?	
KAPI 2	Line 1	~ 1600m ESE k.1	134.10	129.54	?	71.63	21.34	12.19?	20.17	1.52	505	-	-	25	
									24.99	1.07	620			"	
KAPI 3	Line 1	~ 1600m ESE k.2	76.80	76.80	76.20	43.89	13.11	?		-	-	-	-	-	
KAPI 4	Line 1	~ 1600m ESE k.3	27.43	27.30	27.43	-	13.72?	?	11.58	0.61	410	-	-	30	
KAPI 5	Line 2		16.75	16.75	1.50 16.40	-	-	-	-	-	-	-	-	-	
KAPI 6	Line 2	~ 3220m ESE k.5	25.00	25.00	21.34 24.38	-	10.67	3.05	-	-	-	-	-	-	
KAPI 6A	Line 2	~ 1610m ESE k.6	22.86	22.25	16.76 21.34	-	13.72	4.57	-	-	-	-	-	-	
KAPI 7	Line 2	~ 1400m ESE k.6A	83.82	81.38	64.00 80.77	30.48	10.67	?	21.03	-	175	-	-	25	
									76.50	0.91	975	-	-	70	
KAPI 7A	Line 2	~ 1800m ESE k.7	22.86	21.95	20.42 21.95	16.76	7.62	3.05	18.26	-	390	-	-	30	
									20.12	-	540	-	-	30	
KAPI 8	Line 2	~ 1900m ESE k.7A	47.24	47.24	33.52? 45.72	28.96	15.24	6.09	15.24	-	300	-	-	20	
									34.75	0.75	800	-	-	70	
KAPI 9	Line 2	~ 3350m ESE k.8	19.81	19.81	13.72 -	-	-	7.62	15.85	0.30	550	-	-	60	
									19.81	6.09	600	-	-	?	
KAPI 10	Line 2	~ 4125m ESE k.9	47.24	43.89	36.57? 45.72?	24.38?	12.19	4.57	40.23	1.22	590	-	-	80	

HOLE NUMBER	CO-ORDINATES		DEPTHS(m)		GEOLOGY (m)				NELTRONIC logger		RADIOMETRY		1200 c/sec = 875 ppm U	
	Profile	Peg	Drilled	Logged	Top Basement	Top Unit I	Top Unit II	Top Unit III	(m) Depth peak	(m) Thickness >400c/sec	c/sec RA maxi.	RA average	Accu.	Back-ground c/sec
KAPI 11	Line 2	~ 2750m ESE k.10	32.61	32.31	?	22.86?	13.72	3.05	10.97	-	200	-	-	15
									26.21	0.91	800	-	-	70
									31.70	0.61	460	-	-	90
KAPI 12	-	-	65.63	65.23	54.86 -	42.67?	12.19	3.05	26.21	-	250	-	-	40
KAPI 13	B	38	133.40	133.40	120.00 133.30	84.00	38.80	10.40	112.6	-	180	-	-	20 c/sec
KAPI 14	"	(25mSE) 200	86.00	85.20	76.80 84.60	52.00	16.80	9.20	51.90	-	185	-	-	60
KAPI 15	A	(10m E) 107	31.40	30.80	23.00 30.60	-	14.00	5.60	12.20	-	150	-	-	20
									18.80	-	275	-	-	40
									26.20	-	270	-	-	40
KAPI 16	Test	92	71.22	69.60	52.00 68.40	43.80	12.00	8.40	35.40	-	240	-	-	60
									43.10	-	165	-	-	40
KAPI 17	"	(400mS) 88	62.17	61.40	50.90 -	33.20	13.20	10.00?	35.40	-	170	-	-	70
									43.00	-	275	-	-	80
									49.20	-	285	-	-	"
KAPI 18	C	60	23.77	Abandoned following successive collapses: not logged										
KAPI 18A	31m W of Kapi 18		42.97	42.00	37.00 42.00	28.00?	14.80	5.20	-	-	-	-	-	15/60
KAPI 19	C	130	43.00	42.80	37.00 -	13.80	4.40?	-	33.60	-	210	-	-	80
									40.00	-	180	-	-	"

HOLE NUMBER	CO-ORDINATES		DEPTHS(m)		GEOLOGY (m)				NELTRONIC logger		RADIOMETRY		1200 c/sec = 875 ppm U	
	Profile	Peg	Drilled	Logged	Top Basement	Top Unit I	Top Unit II	Top Unit III	(m) Depth peak	(m) Thickness >400c/sec	c/sec RA maxi.	RA average	Accu.	Back- ground c/sec
KAPI 20	D	(10m E) 242	60.95	60.40	55.20 60.00	30.00	13.00	5.80	54.00	-	135	-	-	15
									56.20	-	135	-	-	15
KAPI 21	D	76	65.95	65.80	54.80 -	42.80	25.40	5.60	23.80	-	240	-	-	80
									42.20	-	300	-	-	"
									44.10	-	300	-	-	"
									49.00	-	200	-	-	"
KAPI 22	E	(16m W) 119	74.05	73.20	61.20 -	35.40	21.40	4.00	30.60	-	100	-	-	10
									61.50	-	365	-	-	40
									70.00	-	460	-	-	40
KAPI 23	E	(11m N) 163	45.72	43.40	37.00 43.90	19.00	12.00	0.00	43.40	-	380	-	-	40
KAPI 23A*	E	(16m E) Kapi 23	56.38	55.60	50.20 55.20	?	21.60?	?	35.80	-	210	-	-	80
(*drilled following collapse bottom Kapi 23)									50.20	0.10	430	-	-	80
KAPI 24	E	(35m W) 130	78.00	78.00	60.00 77.80	40.40	27.20	2.80	27.80	-	100	-	-	15
									72.50	-	330	-	-	100
KAPI 25	D	(3m W) 22	33.83	33.00	26.80 32.60	20.00	13.00	0.00	29.60	-	100	-	-	10
KAPI 26	B	(10m E) 149	125.27	125.60	113.60 125.20	67.60	30.80	1.60	21.80	0.60 0.40 1.00 1.40 0.80	840	-	-	50
									116.40		640	-	-	60

HOLE NUMBER	CO-ORDINATES		DEPTHS(m)		GEOLOGY (m)				NELTRONIC logger		RADIOMETRY		1200 c/sec = 875 ppm U	
	Profile	Peg	Drilled	Logged	Top Basement	Top Unit I	Top Unit II	Top Unit III	(m) Depth peak	(m) Thickness >400 c/sec	c/sec RA maxi.	RA average	Accu.	Back- ground c/sec
KAPI 27	B	(1m E) 138	130.00	130.40	123.20 129.80	65.20	27.60	3.00	22.20	-	135	-	-	15
									121.60	-	380	-	-	70
									125.20	0.40	430	-	-	60
KAPI 28	B	158	124.35	124.00	115.00 123.80	73.20	31.20	3.20	8.80	-	130	-	-	15
									26.70	-	160	-	-	20
									114.80	4.80	600	-	-	100
KAPI 29	Line 2	400m NW Kapi 11	57.00	56.80	52.60 56.00	36.80	23.40	4.00	10.00	-	140	-	-	20
									37.60	-	400	-	-	100
									44.00	0.10	410	-	-	40
									45.00	0.10	410	-	-	"
KAPI 30	Line 2	400m SSE Kapi 11	20.70	20.00	13.80 18.40	-	-	4.40	17.40	-	120	-	-	30
KAPI 26A	B	2m SW Kapi 26	D: 31.0 C: from	27.20	- -	-	-	?	6.60	-	105	-	-	15
			19.81 to 25.91						21.40	0.60 0.40	990	-	-	20
KAPI 31	E	111	71.50	71.30	64.80 70.80	39.00	23.00	8.20	36.40	-	140	-	-	20
KAPI 32	B	150m N 235° Kapi 26	30.48	30.80	-	-	-	3.20	7.00	-	115	-	-	15
									26.20	0.20	490	-	-	30
KAPI 33	B	150m N 55° Kapi 26	30.48	30.60	-	-	-	?	7.00	-	120	-	-	15
									22.60	0.40	620	-	-	30

:048

LE NICKEL (AUSTRALIA) EXPLORATION PTY. LTD.

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J/V ENDEAVOUR OIL COMPANY N.L.

S.M.L. 642  
(EYRE PENINSULA - S.A.)  
REPORT ON URANIUM EXPLORATION 1972

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APPENDIX TWO  
RESULTS OF ANALYSES



Sample No.	Nature	Hole No.	Depths (M)		R e s u l t s				
			From	To	U ppm	Th ppm	CaO %	MgO %	P <sub>2</sub> O <sub>5</sub> %
3031/SG	cuttings	Kapi 22	67.67	68.58	6	-	-	-	-
3033/SG	"	"	69.49	70.41	8	13	-	-	-
3034/SG	"	"	70.41	71.32	6	X	-	-	-
3035/SG	"	"	71.32	72.24	7	-	-	-	-
3060/SG	"	Kapi 26	115.21	116.17	6	-	-	-	-
3061/SG	"	"	116.17	117.04	8	53	-	-	-
3062/SG	"	"	117.04	117.96	10	34	-	-	-
3063/SG	"	"	117.96	118.87	8	20	-	-	-
3070/SG	"	Kapi 27	123.44	124.36	3.8	-	-	-	-
3071/SG	"	"	124.36	125.27	3.3	-	-	-	-
3072/SG	"	"	125.27	126.19	3.3	-	-	-	-
3073/SG	"	"	126.19	127.10	4.3	10	-	-	-
3074/SG	"	"	127.10	128.02	3.8	37	-	-	-
3087/SG	Core	Kapi 26A	19.81	20.12	8.6	-	-	-	-
3088/SG	"	"	20.12	20.42	8.7	-	-	-	-
3089/SG	"	"	20.42	20.73	21	-	-	-	-
3090/SG	"	"	20.73	21.03	78	-	-	-	-
3091/SG	"	"	21.03	21.34	17	-	-	-	-
3092/SG	"	"	21.34	21.64	78	X	0.5	0.7	+
3093/SG	"	"	21.64	21.95	130	X	0.5	0.8	+
3094/SG	"	"	21.95	22.25	87	X	0.5	0.9	+
3095/SG	"	"	22.25	22.55	100	X	0.20	0.12	+

+ = less than 0.05% P<sub>2</sub>O<sub>5</sub>

X = less than 10 ppm Th

- = analysis not required

050

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### APPENDIX THREE

Location of Bench-marks along  
profiles

Profile	Bench-mark no.	Nearest seismic peg	Dist. from start of profile		Profile	Bench-mark no.	Nearest seismic peg	Dist. from start of profile
A	1	3(+18)*	140		B	15	46	3,780
"	2	10	549		"	16	54(+25)	4,292
"	3	16(+18)	932		"	17	62	4,755
"	4	27(+45)	1630		"	18	74(-6)	5,480
"	5	43(-6)	2554		"	19	74(+62)	5,548
"	6	45(+17)	2699		"	20	107(-43)	7,455
"	7	55(+45)	3337		"	21	109(-5)	7,615
"	8	57(+10)	3424		"	22	120(+1)	8,292
"	9	65(+16)	3917		"	23	135(-8)	9,197
"	10	68(+3)	4087		"	24	138(-13)	9,375
"	11	80(-26)	4790		"	25	148(+6)	10,003
"	12	91(+16)	5502		"	26	154(-8)	10,359
"	13	107(+7)	6469		"	27	-	-
"	14	110(+24)	6669		"	28	171	11,399
"	15	125(+22)	7581		"	29	177	11,765
					"	30	183(+4)	12,135
B	1	-16	0		"	31	201(-2)	13,226
"	2	-14(+2)	124		"	32	211(+5)	13,843
"	3	-13	183		"	33	215(+45)	14,127
"	4	-9(+55)	482		"	34	221(-8)	14,439
"	5	-6(+15)	625		"	35	227(+45)	14,858
"	6	-4(+22)	752		"	36	224(+6)	15,798
"	7	3(-16)	1142					
"	8	10(+13)	1598					
"	9	17	2012					
"	10	24(+26)	2464					
"	11	29	2743					
"	12	33(-17)*	2970					
"	13	38	3292					
"	14	41(+17)	3492					

\* Profiles A and B were traversed from east westwards:

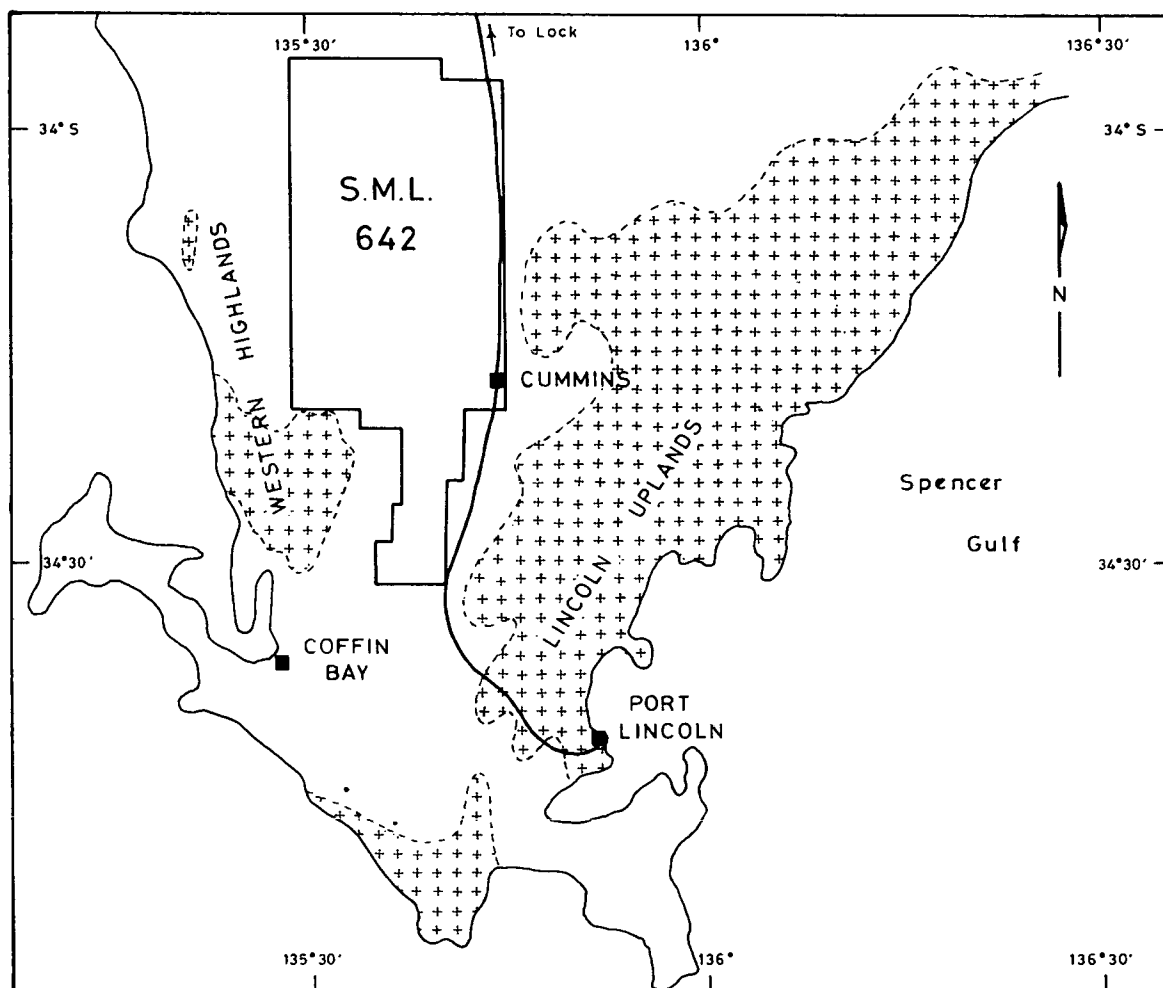
3(+18) means 18 metres west of seismic peg no. 3 33(-17) = 17m east of seismic peg no. 33.

Bench-marks: Profiles Test - C

[illegible]

Profile	Bench-mark no.	Nearest seismic peg	Dist. from start of profile		Profile	Bench-mark no.	Nearest seismic peg	Dist. from start of profile
D	1	—	—		E	1	1	0
"	2	5	244		"	2	30(-24)*	1,744
"	3	10	549		"	3	37(+36)*	2,230
"	4	15	853		"	4	47(-27)	2,777
"	5	20	1,158		"		50(+2)	2,989
"	6	25	1,463		"		59(+4)	3,540
"	7	30	1,768		"	5	64(+30)	3,870
"	8	35	2,073		"		77(-2)	4,631
"	9	40	2,377		"		79(+4)	4,759
"	10	44	2,621		"	6	91(+16)	5,502
"	11	50(+2)	2,989		"	7	92(+30)	5,577
"	12	55	3,292		"	8	97(+28)	5,880
"	13	60(+9)	3,606		"	9	120(-37)	7,227
"	14	65(-2)	3,899		"	10	130(+35)	7,899
"	15	70	4,206		"	11	136(+5)	8,235
"	16	75	4,511		"	12	148	8,961
"	17	80	4,816		"	13	165(-42)	9,955
"	18	85	5,121		"	14	174(+47)	10,593
"	19	—	—		"	15	183(+34)	11,128
"	20	232(-40)	14,042		"	16	201(+48)	12,240
"	21	242(-10)	14,681		"	17	215(-5)	13,040
"	22	258(+10)	15,677		"	18	231(-7)	14,014
"	23	265(-15)	16,078		"	19	234(+8)	14,212
"	24	271(+20)	16,479		"	20	246(-16)	14,919
Seismic pegs, between 90 and 230 inclusive, have been left on the bank of the road					Seismic pegs, between 1 and 30 inclusive, have been left in the field			

Profiles D and E were traversed from east westwards; 30(-24) means 24 metres east of seismic peg 30 and 37(+36) means 36 metres west of seismic peg 37.



## LEGEND



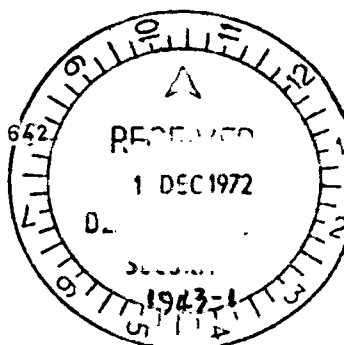
Major areas of basement outcropping



Road



Boundaries of S.M.L. 642



0 4 8 12 16 MILES



JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

URANIUM PROJECT 05/30

## LOCALITY MAP

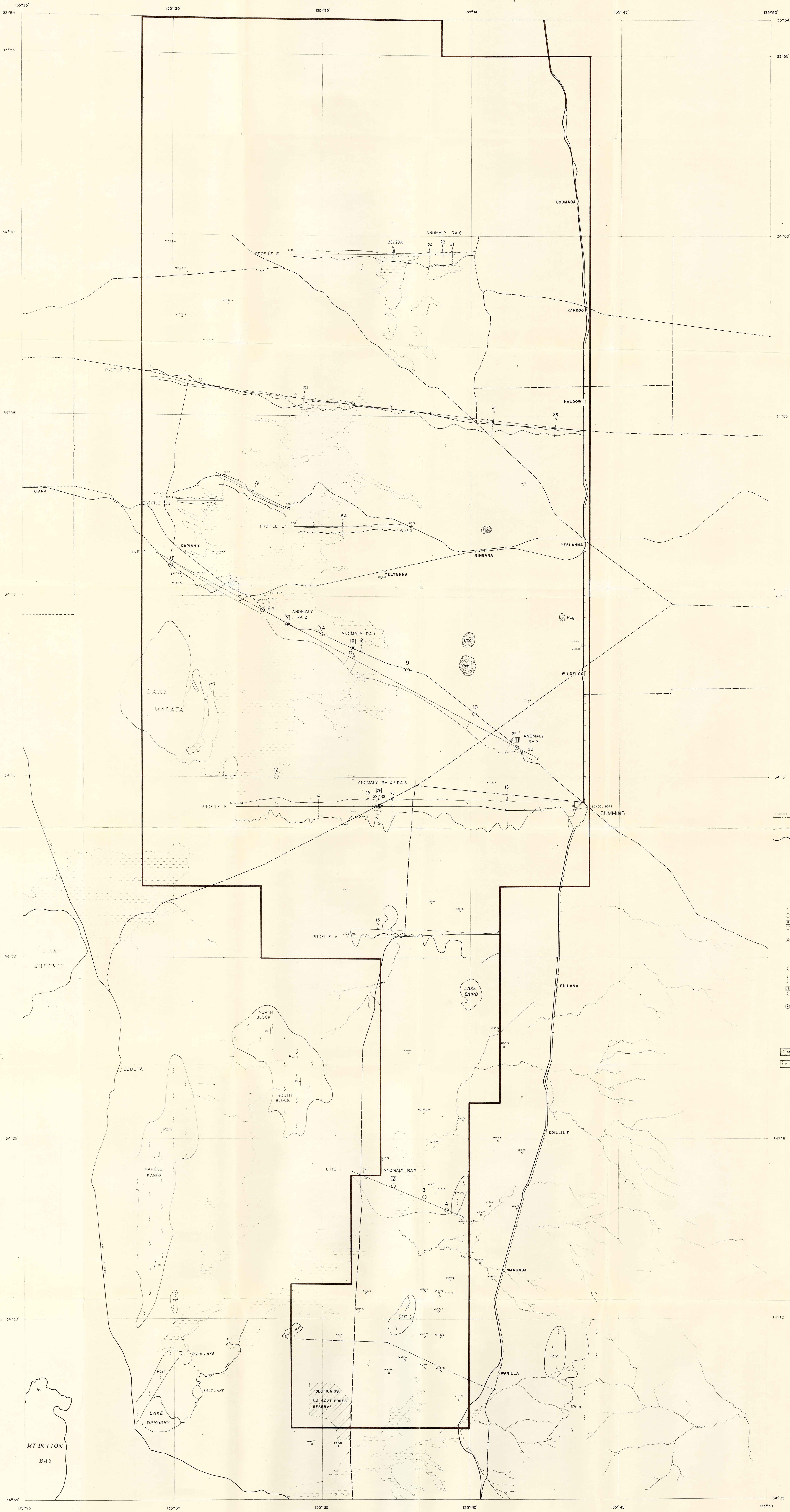
To accompany final report by R. CARRIE, Nov., '72

DRAWN: J. McL.

REF NO 0530/1

Fig. 1





**1972 SEISMIC PROGRAMME**

Seismic profile location

Topographic surface

Basement surface

**1971 DRILLING PROGRAMME**

Rotary drill hole

Rotary drill hole - side wall sampled

Rotary drill hole with radiactivity  $\geq 655 \text{ c/s} \pm 0.5\% \text{ equiv. U}$

**1972 DRILLING PROGRAMME**

Rotary drill hole

Hole with up-hole velocity survey

Rotary drill hole - side wall sampled

Rotary drill hole with radiactivity  $\geq 655 \text{ c/s} \pm 0.5\% \text{ equiv. U}$

**GEOLOGY**

Precambrian granite outcrop

Precambrian metamorphic outcrop

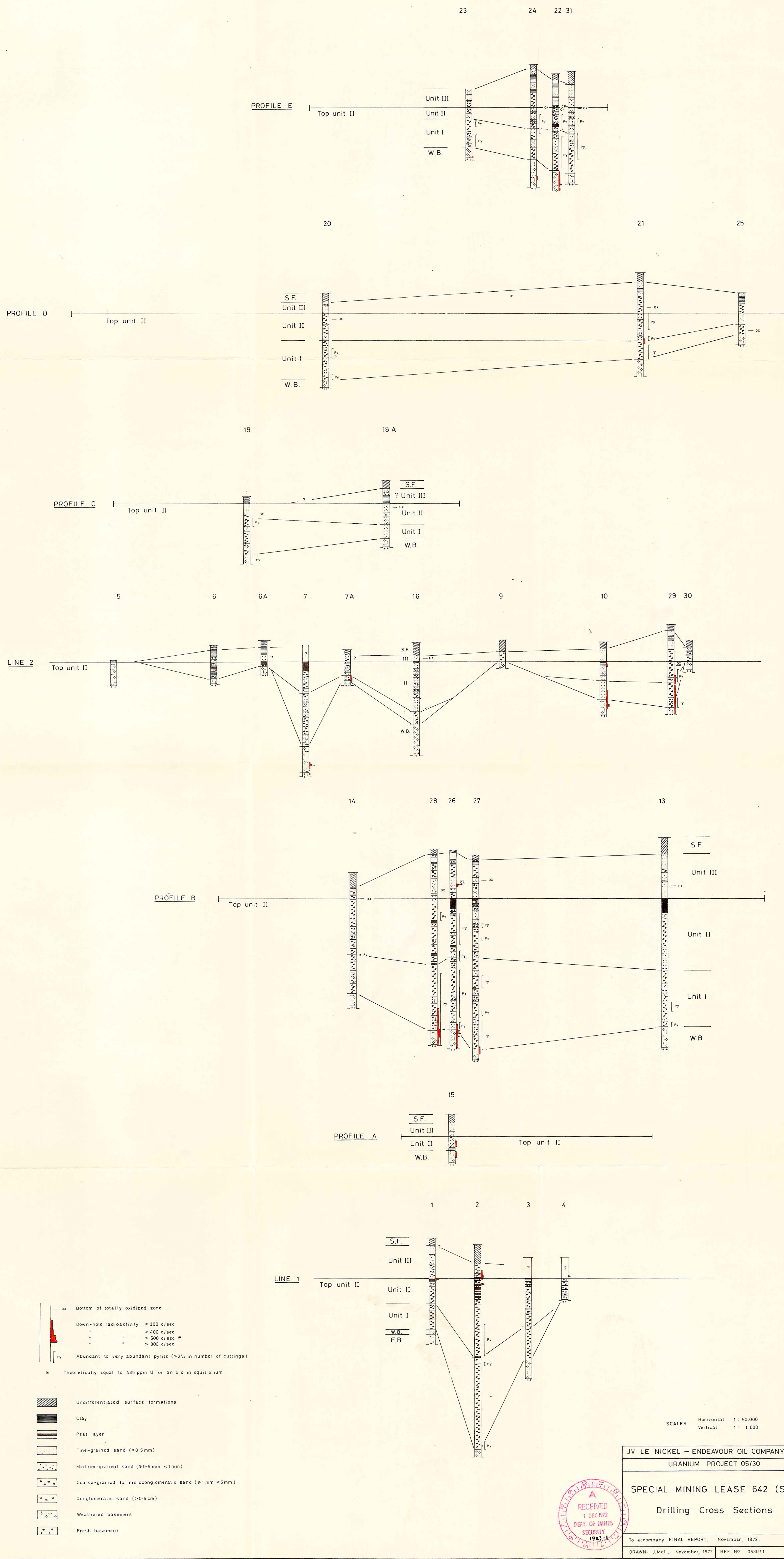
Horizontal Scale 1:50,000

Vertical Scale 1:5,000

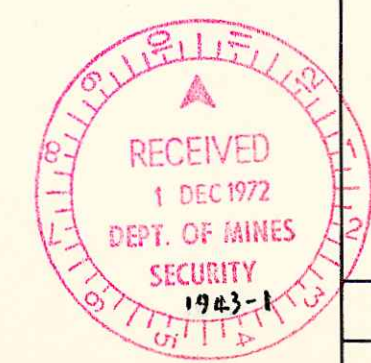
INDEX TO PLANS OF THE HUNDREDS

INDEX TO 1:250,000 SERIES MAPS

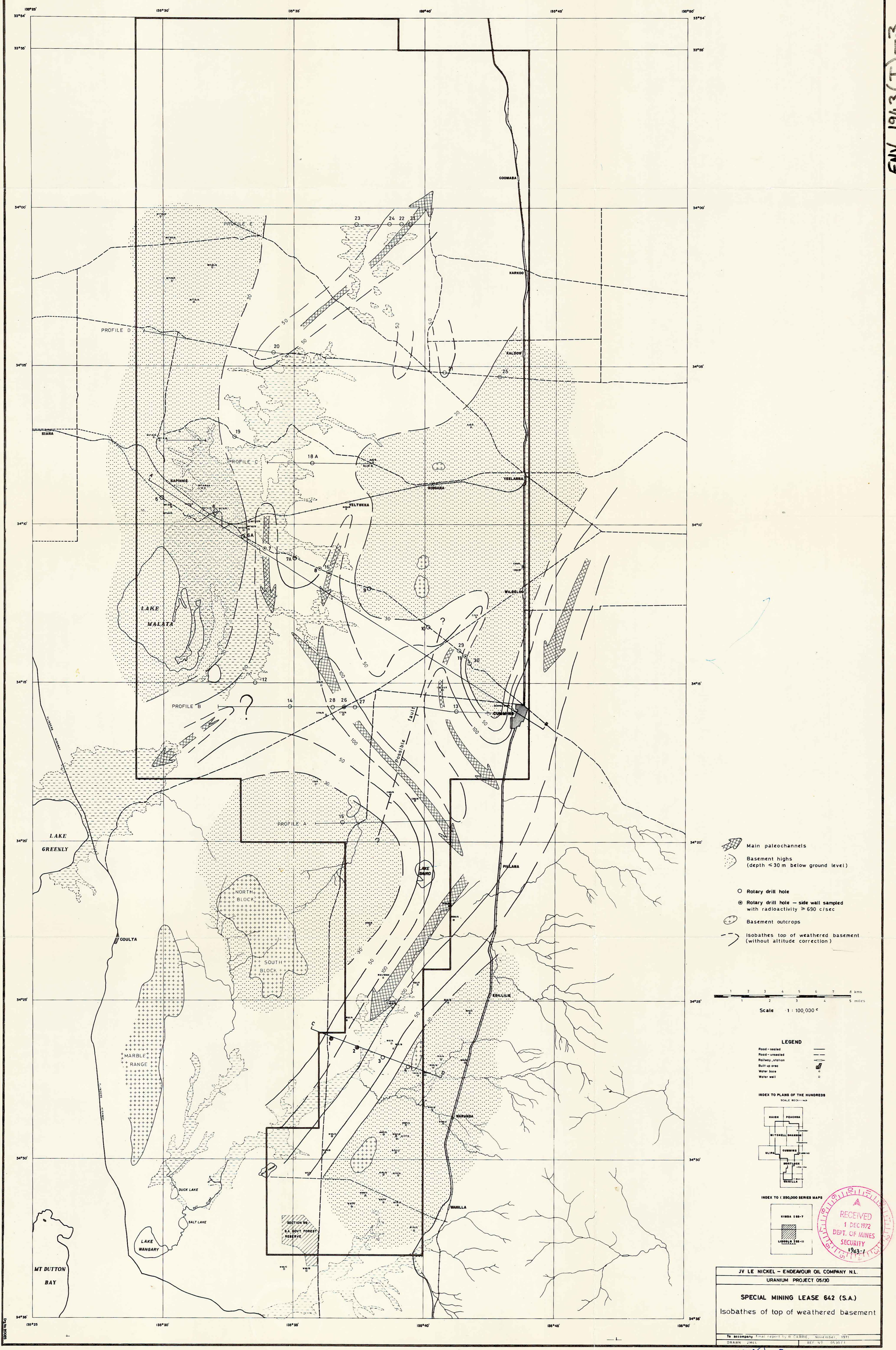




JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.  
URANIUM PROJECT 05/30  
SPECIAL MINING LEASE 642 (S.A.)  
Drilling Cross Sections  
To accompany FINAL REPORT, November, 1972.  
DRAWN: J.M.C., November, 1972 REF. NO. 0530/1

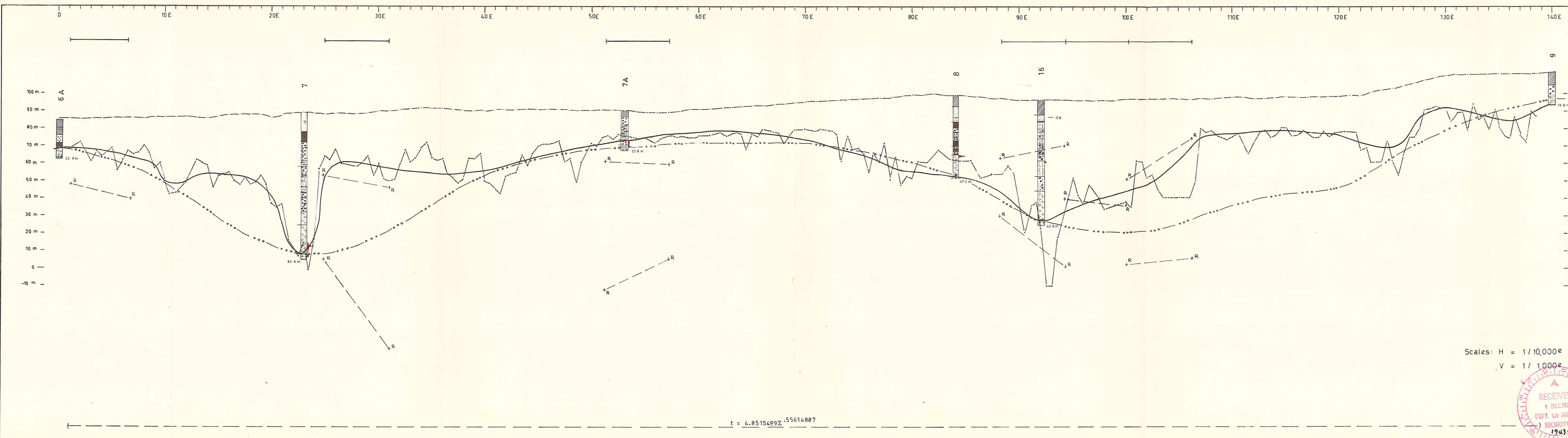






JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.  
URANIUM PROJECT 05/30  
SPECIAL MINING LEASE 642 (S.A.)  
Isobathes of top of weathered basement  
To accompany final report by R. FARRIE, November, 1971  
DRAWN: JMCs REF: 65 05/30/1





ox

Bottom of totally oxidized zone

Py

Abundant to very abundant pyrite (>3% in number of cuttings)

> 200 c/sec

> 400 c/sec

> 600 c/sec \*

> 800 c/sec

Down-hole radioactivity

\* Theoretically equal to 435 ppm U for an ore in equilibrium

Undifferentiated surface formations

Clay

Peat layer

Fine-grained sand (<0.5mm)

Medium-grained sand (>0.5mm <1mm)

Coarse-grained to microconglomeratic sand (>1mm <5mm)

Conglomeratic sand (>0.5cm)

Weathered basement

Fresh basement

Location of control refraction spreads

Location and N° of survey peg at 200ft interval

Drill holes

Fresh basement surface - geological interpretation

Basement surface - smoothed seismic interpretation

Basement surface - raw reflexion results

Depth conversion equation

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

URANIUM PROJECT 05/30

SPECIAL MINING LEASE 642 (S.A.)

Test Profile

SEISMIC and DRILLING RESULTS

To accompany final report by R CARRIE, November, 1972

DRAWN: J McL Nov. 1972

REF N° 0530 / 1

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1 DEC 1972

DEPT. OF MINES

SECURITY

1943-1

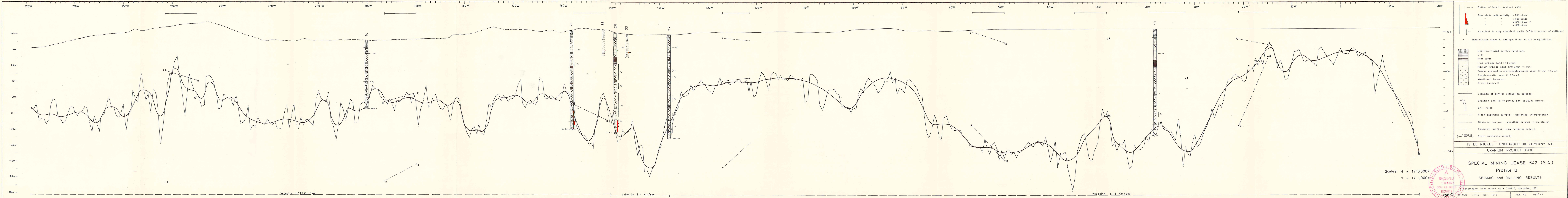
ENV 1943(I)-4

Fig. 5

Scales: H = 1/10,000e  
V = 1/1,000e

t = 4.85154992 .55614887





JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.  
URANIUM PROJECT 05/30

SPECIAL MINING LEASE 642 (S.A.)  
Profile B  
SEISMIC and DRILLING RESULTS

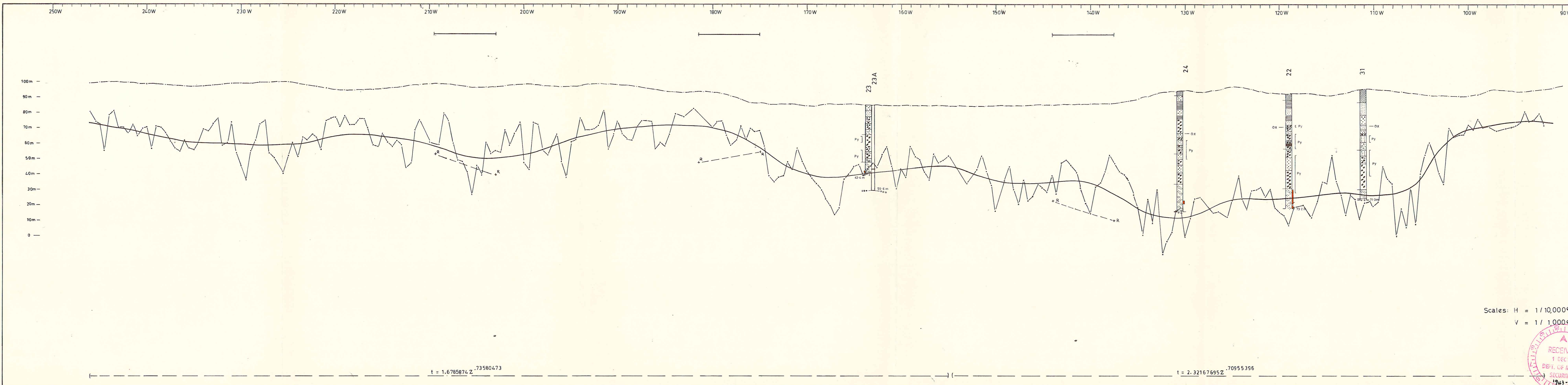
Scale: H = 1/10,000  
V = 1/1,000

Accompany final report by R. CARRIE, November, 1972

DRAWN J.M.C. Nov. 1972 REF. NO. 0530/1

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SECURITY  
1943-1





— ox Bottom of totally oxidized zone

Down-hole radioactivity > 200 c/sec  
" " > 400 c/sec  
" " > 600 c/sec \*  
" " > 800 c/sec

[ Py ] Abundant to very abundant pyrite (>3% in number of cuttings)

\* Theoretically equal to 435 ppm U for an ore in equilibrium

Undifferentiated surface formations  
Clay  
Peat layer  
Fine-grained sand (<0.5 mm)  
Medium-grained sand (>0.5 mm <1 mm)  
Coarse-grained to microconglomeratic sand (>1 mm <5 mm)  
Conglomeratic sand (>0.5 cm)  
Weathered basement  
Fresh basement

Location of control refraction spreads

Location and No of survey peg at 200 ft. interval

Drill holes

Fresh basement surface — geological interpretation

Basement surface — smoothed seismic interpretation

Basement surface — raw reflexion results

( — — — ) Depth conversion equation

JV LE NICKEL — ENDEAVOUR OIL COMPANY N.L.

URANIUM PROJECT 05/30

SPECIAL MINING LEASE 642 (S.A.)

Line E

SEISMIC and DRILLING RESULTS

To accompany final report by R. CARRIE, November, 1972

DRAWN: J. McL. Nov. 1972 REF. No. 0530 / 1

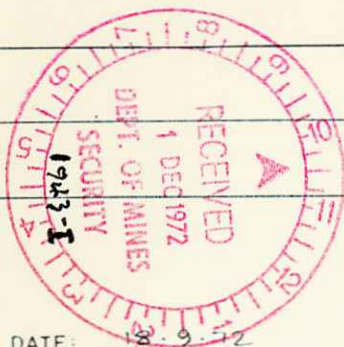
Scale: H = 1/10,000  
V = 1/1,000

RECEIVED  
1 DEC 1972  
DEPT. OF MINES  
SECURITY

ENV 1943(E)-6

Fig. 7





DRILL HOLE NO Kapi 13

DATE: 18.9.72

SITE { X: Peg 38  
Y: Profile B  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	134.40	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 134.40 m  
Logged: 133.40 m

ELECTRIC LOGGING

GAMMA RAY LOGGING

GEOLOGICAL LOGGING Date: 18-19.9.72 geol. R. Carrie  
SAMPLING Date: 21.9.72 geol.

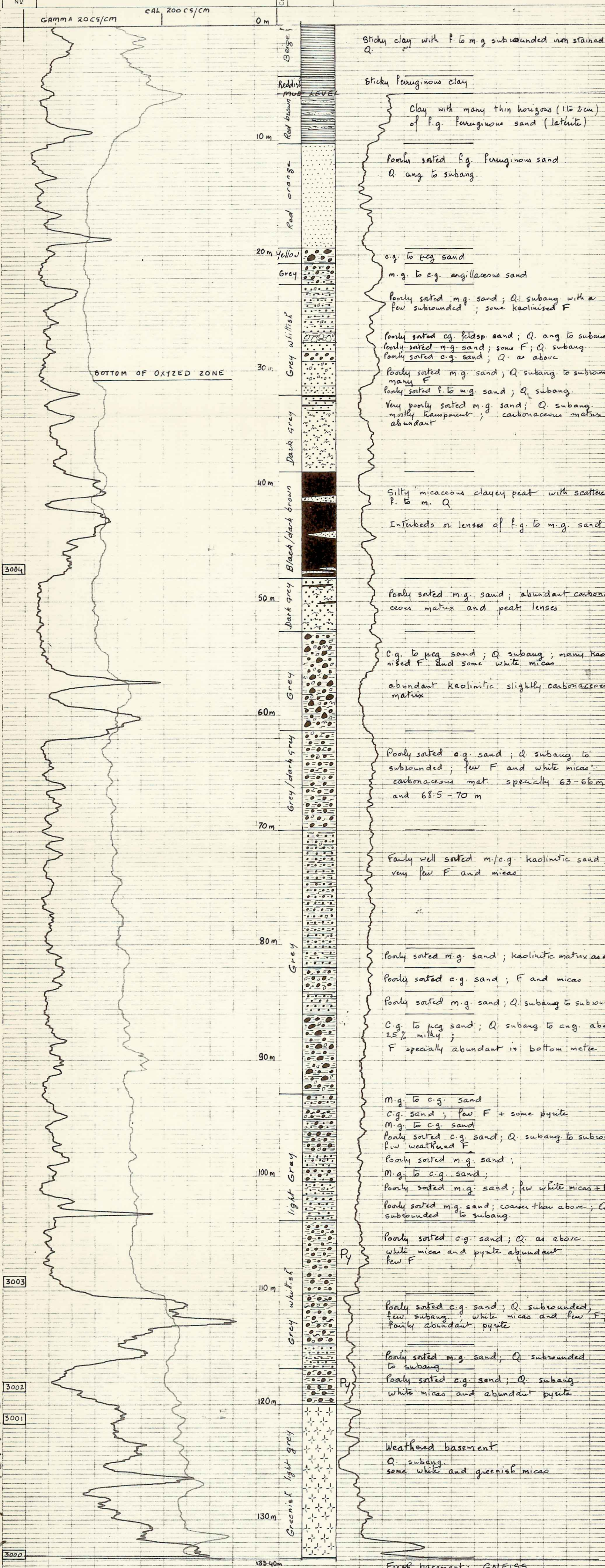
Date : 18.9.72  
Type : P - S.P.  
Device : Neutronic porta logger  
Scale p : 4 ohm/cm  
SP : 4 mv/cm  
Cable speed: 15 m/min  
Operator : B. Young

Date : 18.9.72  
Type : Neutronic porta logger  
Device : Neutronic porta logger  
Probe : 1200 c/sec ≈ 875 ppm U  
Scale : 20 c/sec/cm  
Cable speed: 5 m/min  
Operator : B. Young

Fig. 8a

□ F Feldspar ~ Py Pyrite	■ Limestone	■ Silt (Pelite)	● Poorly sorted coarse-grained sandstone (≥1mm <2.5mm)
■ Undifferentiated superficial formation	■ Marly limestone	■ Psammite	△ Breccia
■ (1) Silcrete (2) Calcrete	■ Marl	■ Well sorted fine-grained sandstone (<0.5mm)	○ Intraformational conglomerate
■ (1) Disseminated carbonaceous mat. (2) Peat or coal interbed	■ Lutite, clay	■ Well sorted medium-grained sandstone (≥0.5mm <1mm)	○ Conglomerate
■ Dolomite	■ Sandy lutite	■ Well sorted coarse-grained sandstone (≥1mm <2.5mm)	++ Basement

Sample No	Gamma Ray & S.P.	Colour	Log	Petrological description & Resistivity
-----------	------------------	--------	-----	--



ENV 1943(I)-7



## DRILL HOLE NO Kapi 14

DATE: 19.9.72

SITE { X: 25 m S.E. of Peg 200  
Y: Profile B  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	86.00	Rotary	Benonite	4 3/4"

TOTAL DEPTH: Drilled: 86.00 m  
Logged: 85.20 m

## ELECTRIC LOGGING

## GAMMA RAY LOGGING

GEOLOGICAL  
LOGGING

Date: 19.9.72 geol. R. Carrie

SAMPLING

Date: -- geol. --

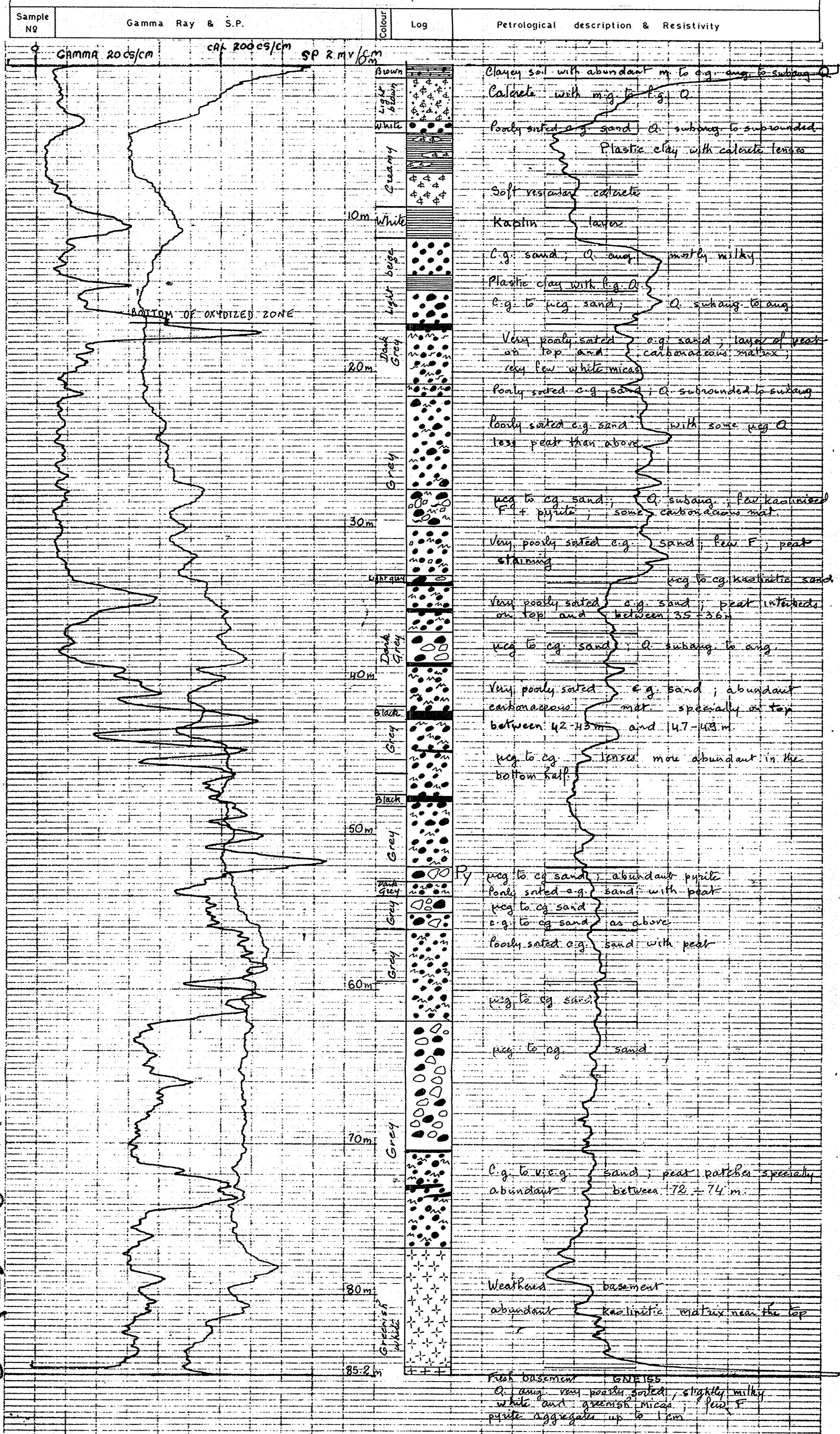
Date: 19.9.72  
Type: P - S.P.  
Device: Neltronic porta logger  
Scale p: 20 ohm/cm  
S.P.: 2 mv/cm  
Cable speed: 15 m/minDate: 19.9.72  
Type: Neltronic porta logger  
Device: Neltronic porta logger  
Probe: 1200 c/sec  $\approx$  875 ppm. U  
Scale: 20 c/sec/cm  
Cable speed: 5 m/min

Operator: B. Young

Operator: B. Young

Fig. 8 b

□ F Feldspar K Kaolin # Calcite ~ Py Pyrite	□ Limestone	□ Silt (Pelite)	□ Poorly sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )
□ Undifferentiated superficial formation	□ Marly limestone	□ Psammite	□ Breccia
□ (1) Silcrete (2) Calcrete	□ Marl	□ Well sorted fine-grained sandstone ( $< 0.5\text{mm}$ )	□ Intraformational conglomerate
□ (1) Disseminated carbonaceous mat. (2) Peat or coal interbed	□ Lutite, clay	□ Well sorted medium-grained sandstone ( $\geq 0.5\text{mm} < 1\text{mm}$ )	□ Conglomerate
□ Dolomite	□ Sandy lutite	□ Well sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )	□ Basement



DRILL HOLE NO Kapi 15

DATE: 20.9.72

SITE { X: 10 m E Pag 107  
Y: Profile A  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	31.40	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 31.40 m  
Logged: 30.80 m

ELECTRIC LOGGING

GEOLOGICAL

LOGGING

Date: 20.9.72 geol. R. Carrie

SAMPLING

Date: — geol. —

Date: 20.9.72  
Type: γ - S.P.  
Device: Neltronic porta logger  
Scale γ: 8 ohm/cm  
S.P.: 4 mv/cm  
Cable speed: 15 m/min

Operator: B. Young

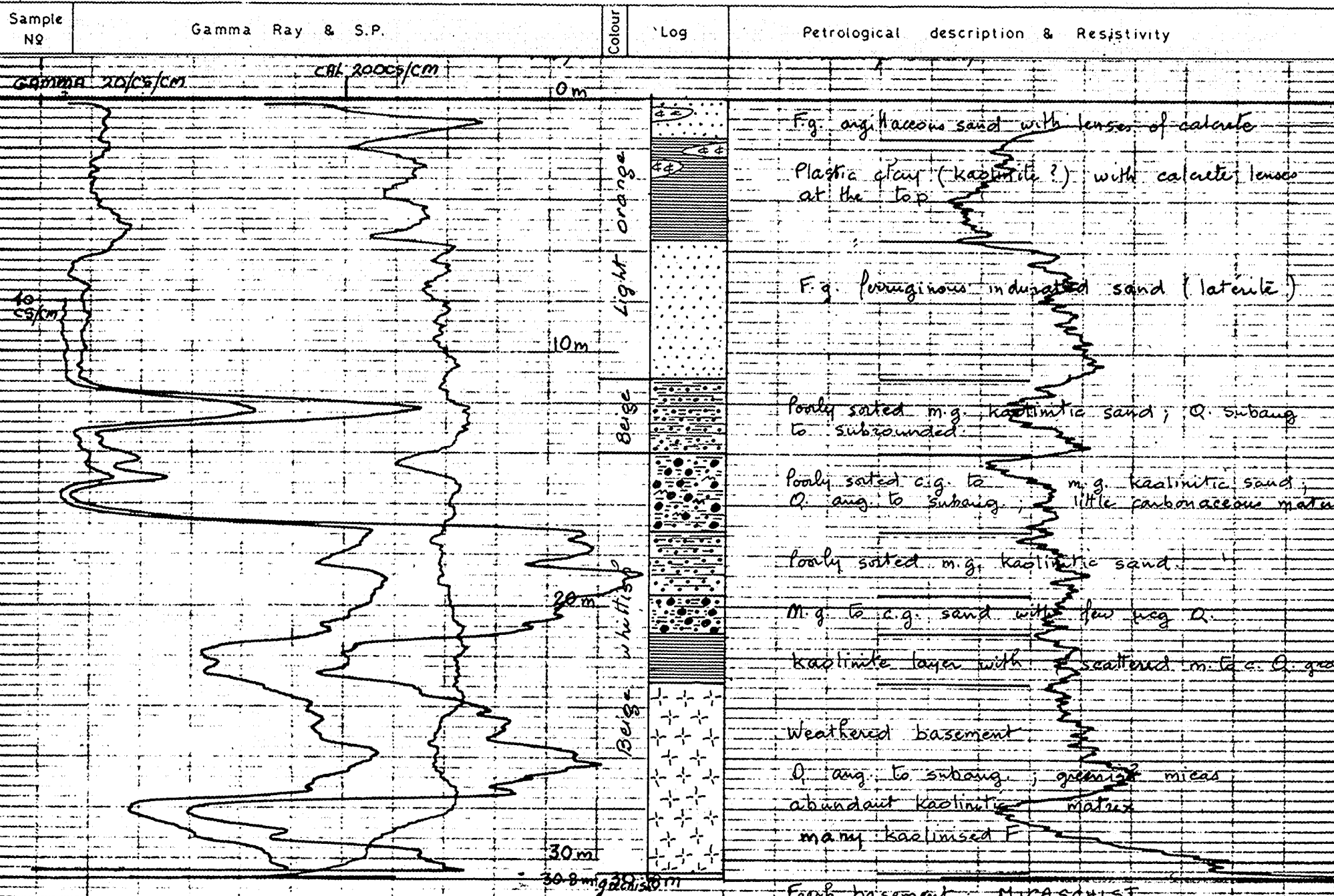
GAMMA RAY LOGGING

Date: 20.9.72  
Type: —  
Device: Neltronic porta logger  
Probe: 1200 c/sec ≈ 875 ppm. U  
Scale: 20 c/sec/cm — 40 c/sec/cm  
Cable speed: 5 m/min — 3 m/min

Operator: B. Young

Fig. 8c

<p>□ F Feldspar K Kaolin ≠ Calcite ~ Py Pyrite</p> <p>Undifferentiated superficial formation</p> <p>(1) Silcrete (2) Calcrete</p> <p>(1) Disseminated carbonaceous mat. (2) Peat or coal interbed</p> <p>Dolomite</p>	<p>Limestone</p> <p>Marly limestone</p> <p>Marl</p> <p>Lutite, clay</p> <p>Sandy lutite</p>	<p>Silt (Pelite)</p> <p>Psammite</p> <p>Well sorted fine-grained sandstone (&lt;0.5 mm)</p> <p>Well sorted medium-grained sandstone (≥0.5 mm &lt;1 mm)</p> <p>Well sorted coarse-grained sandstone (≥1 mm &lt;2.5 mm)</p>	<p>Poorly sorted coarse-grained sandstone (≥1 mm &lt;2.5 mm)</p> <p>Breccia</p> <p>Intraformational conglomerate</p> <p>Conglomerate</p> <p>Basement</p>
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## DRILL HOLE NO Kapi 16

DATE: 20.9.72

SITE { X: Peg 92  
Y: Test profile  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	71.22	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 71.22 m  
Logged: 69.60 m

## ELECTRIC LOGGING

## GAMMA RAY LOGGING

GEOLOGICAL  
LOGGING

Date: 20.9.72 geol. R. Carrie

SAMPLING

Date: 20.9.72 geol.

Date: 20.9.72  
Type: P - S.P.  
Device: Neutronic porta logger  
Scale  $\rho$ : 4 ohm/cm  
S.P.: 2 mv/cm  
Cable speed: 15 m/min

Operator: B. Young

Date: 20.9.72  
Type:  
Device: Neutronic porta logger  
Probe: 1200 c/sec  $\approx$  875 ppm U  
Scale: 20 c/sec/cm - 80 g/sec/cm  
Cable speed: 5 m/min 3 m/min

Operator: B. Young

Fig. 8d

F Feldspar K Kaolin  $\neq$  Calcite  
Py PyriteUndifferentiated superficial  
formation(1) Silcrete  
(2) Calcrete(1) Disseminated carbonaceous mat.  
(2) Peat or coal interbed

Dolomite

Limestone

Marly limestone

Marl

Lutite, clay

Sandy lutite

Silt (Pelite)

Psammite

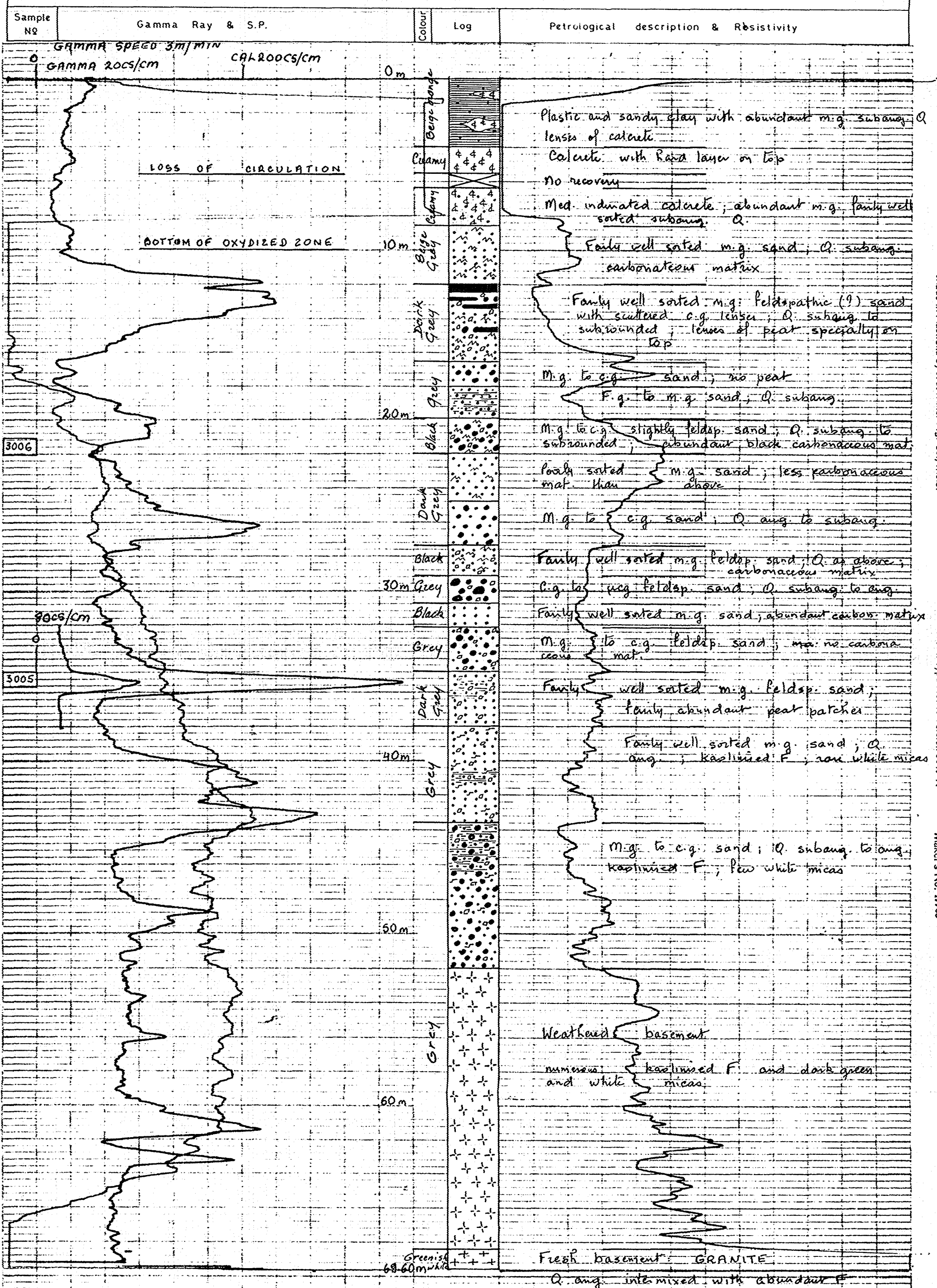
Well sorted fine-grained  
sandstone ( $<0.5$  mm)Well sorted medium-grained  
sandstone ( $>0.5$  mm  $<1$  mm)Well sorted coarse-grained  
sandstone ( $>1$  mm  $<2.5$  mm)Poorly sorted coarse-grained  
sandstone ( $\geq 1$  mm  $<2.5$  mm)

Breccia

Intraformational conglomerate

Conglomerate

Basement





DRILL HOLE NO Kapi 17

DATE: 21.9.72

SITE { X: 400m S of pag 88  
Y: Test Profile.  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	62.17	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 62.17 m  
Logged: 61.40 m

ELECTRIC LOGGING

GAMMA RAY LOGGING

GEOLOGICAL

LOGGING Date: 21.9.72 geol. R. Carrie

SAMPLING

Date: 22.9.72 geol. "

Date : 21.9.72  
Type :  $\varphi$  - S.P.  
Device : Neltronic porta logger  
Scale  $\varphi$  : 4 ohm/cm  
S.P. : 2 mv/cm  
Cable speed: 15 m/min

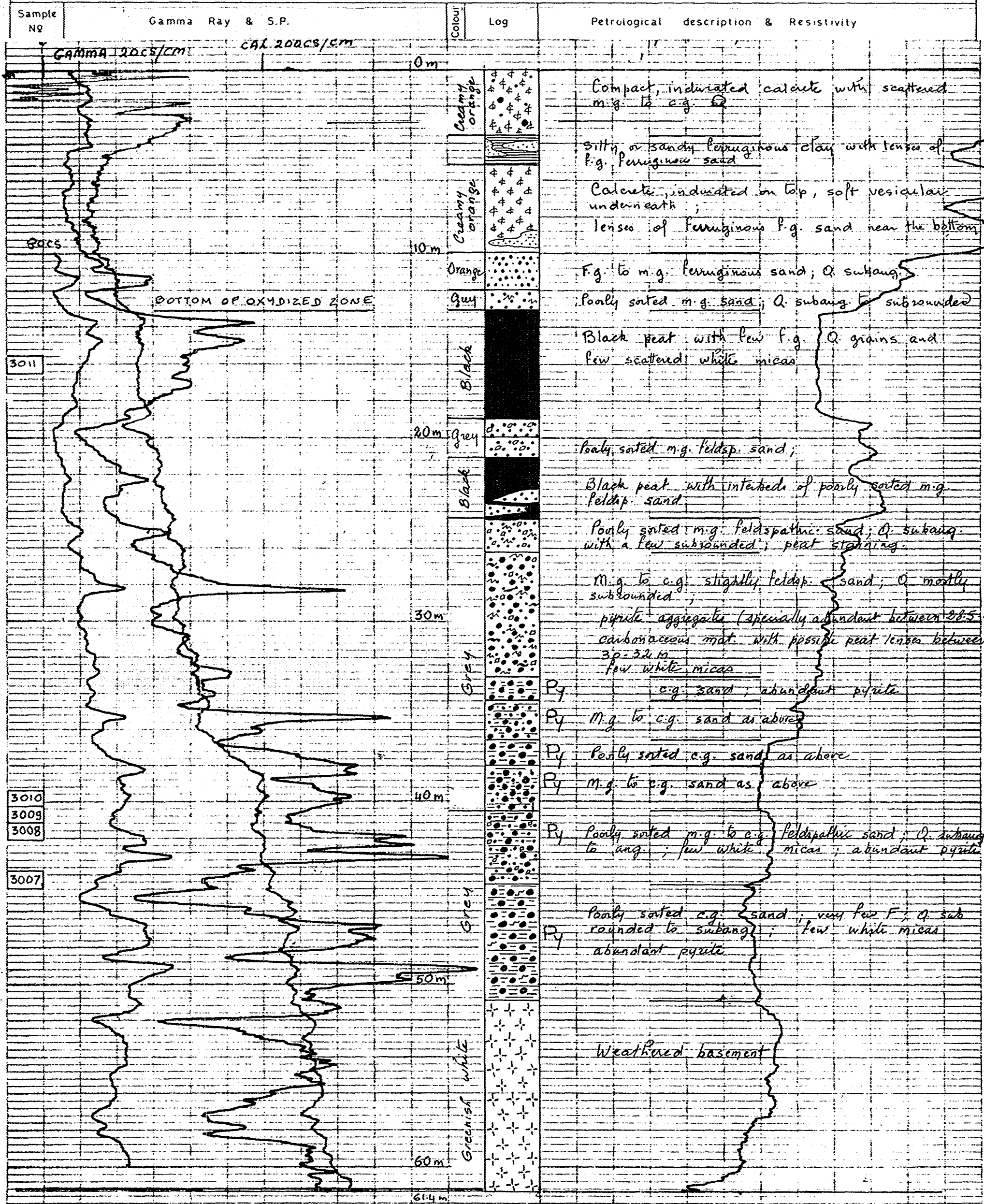
Operator : B. Young

Date : 21.9.72  
Type :  
Device : Neltronic porta logger  
Probe : 1200 c/sec  $\approx$  875 ppm. U  
Scale : 20 c/sec/cm - 80 c/sec/cm  
Cable speed: 5 m/min 3 m/min

Operator : B. Young

Fig. 8 e

F Feldspar	K Kaolin	C Calcite	Limestone	Silt (Pelite)	Poorly sorted coarse-grained sandstone (>1mm <2.5mm)
Py Pyrite	Undifferentiated superficial formation	Marly limestone	Marl	Psammite	Breccia
(1) Silcrete	(2) Calcrete	(1) Disseminated carbonaceous mat. (2) Peat or coal interbed	Lutite, clay	Well sorted fine-grained sandstone (<0.5mm)	Intraformational conglomerate
Dolomite	Sandy lutite			Well sorted medium-grained sandstone (>0.5mm <1mm)	Conglomerate
				Well sorted coarse-grained sandstone (>1mm <2.5mm)	Basement



## DRILL HOLE NO Kapi 18 A

DATE: 22.9.72

SITE { X: 31 m W peg 60  
Y: Profile C  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	42.97	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 42.97 m  
Logged: 42.00 m

## ELECTRIC LOGGING

## GAMMA RAY LOGGING

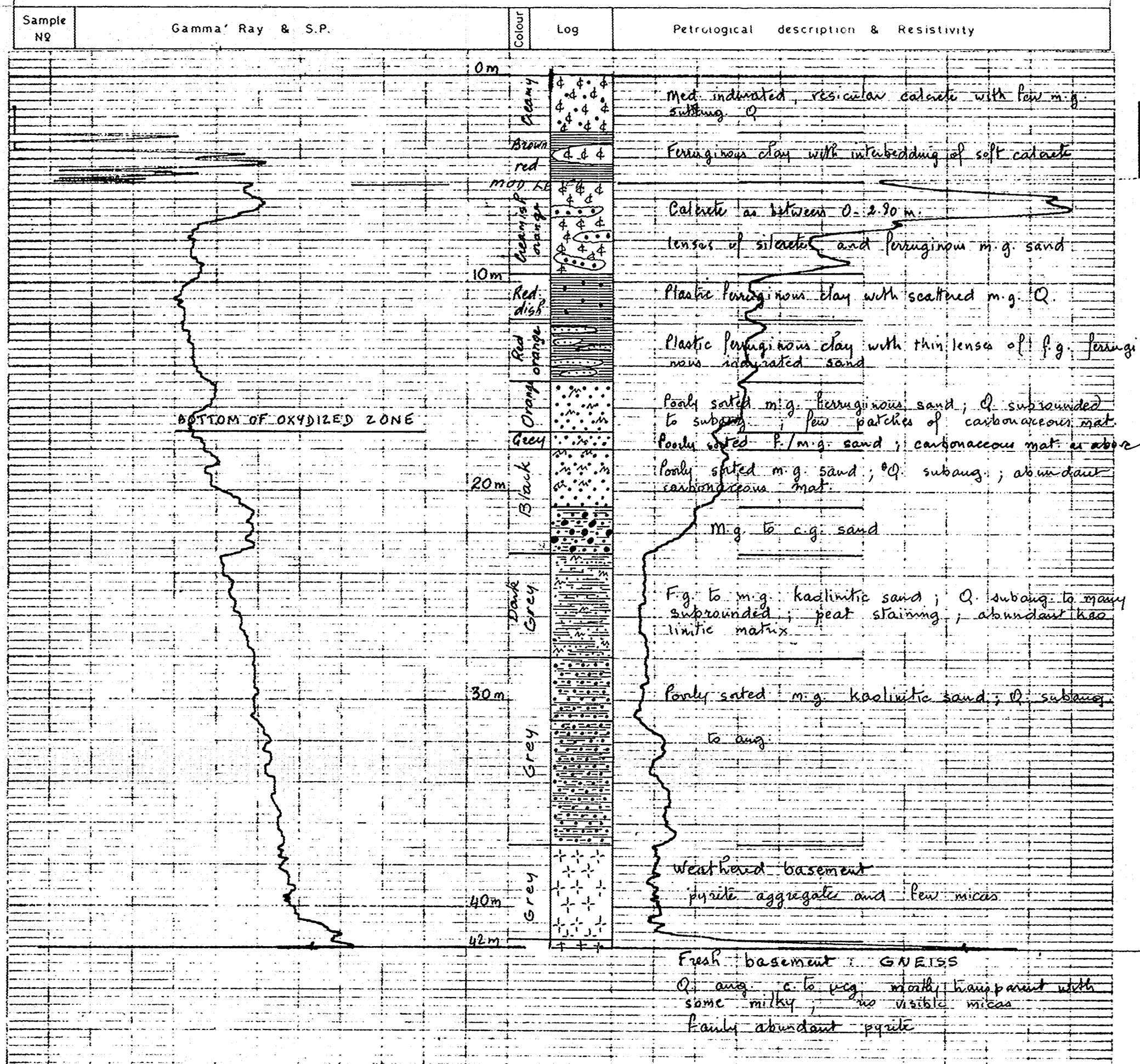
REMARKS: Drilled 31 m W of Kapi 18  
abandoned following successive  
collapses at 23.77 mDate: 22.9.72  
Type: P - S.P.  
Device: Neitronic porta logger  
Scale p: 4 ohm/cm  
S.P.: 2 mv/cm  
Cable speed: 15 m/minDate: 22.9.72  
Type: Neitronic porta logger  
Probe: 1200 c/sec  $\approx$  875 ppm U  
Scale: 20 c/sec/cm  
Cable speed: 5 m/minGEOLOGICAL  
LOGGING Date: 22.9.72 geol. R. Carrie

Operator: B. Young

Operator: B. Young

Fig. 8 f

□ F Feldspar ~ Py Pyrite	□ Limestone	□ Silt (Pelite)	□ Poorly sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )
▨ Undifferentiated superficial formation	▨ Marly limestone	▨ Psammite	▨ Breccia
▨ (1) Silcrete (2) Calcrete	▨ Marl	▨ Well sorted fine-grained sandstone ( $< 0.5\text{mm}$ )	▨ Intraformational conglomerate
▨ (1) Disseminated carbonaceous mat. (2) Peat or coal interbed	▨ Lutite, clay	▨ Well sorted medium-grained sandstone ( $\geq 0.5\text{mm} < 1\text{mm}$ )	▨ Conglomerate
▨ Dolomite	▨ Sandy lutite	▨ Well sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )	▨ Basement





## DRILL HOLE NO Kapi 19

DATE: 22.9.72

SITE { X: Peg 130  
Y: Profile C  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	43.00	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 43.00 m  
Logged: 42.80 m

## ELECTRIC LOGGING

Date: 22.9.72  
Type:  $\varphi$  - S.P.  
Device: Neltronic porta logger  
Scale  $\varphi$ : 4 ohm/cm  
S.P.: 2 mv/cm  
Cable speed: 15 m/min

## GAMMA RAY LOGGING

Date: 22.9.72  
Type:  
Device: Neltronic porta logger  
Probe: 1200 c/sec  $\approx$  875 ppm. U  
Scale: 20 c/sec/cm - 80 c/sec/cm  
Cable speed: 5 m/min 3 m/min

## GEOLOGICAL

LOGGING Date: 22.9.72 geol. R. Carrie

## SAMPLING

Date: - geol. -

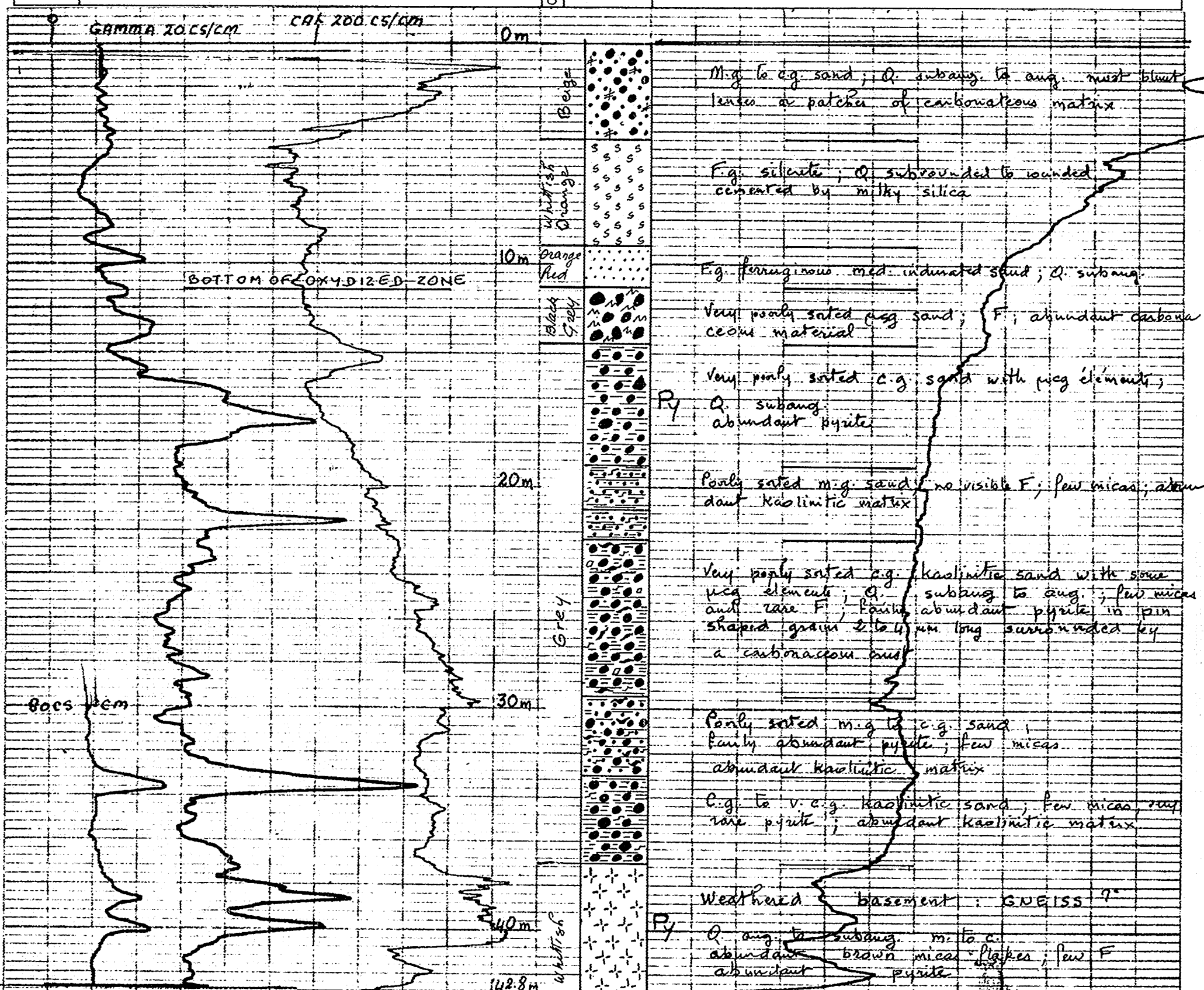
Operator: B. Young

Operator: B. Young

Fig. 8 g

□ F Feldspar K Kaolin ≠ Calcite ~ Py Pyrite	□ Limestone	□ Silt (Pelite)	□ Poorly sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )
□ Undifferentiated superficial formation	□ Marly limestone	□ Psammite	□ Breccia
□ (1) Silcrete (2) Calcrete	□ Marl	□ Well sorted fine-grained sandstone ( $< 0.5\text{mm}$ )	□ Intraformational conglomerate
□ (1) Disseminated carbonaceous mat. (2) Peat or coal interbed	□ Lutite, clay	□ Well sorted medium-grained sandstone ( $\geq 0.5\text{mm} < 1\text{mm}$ )	□ Conglomerate
□ Dolomite	□ Sandy lutite	□ Well sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )	□ Basement

Sample No	Gamma Ray & S.P.	Colour	Log	Petrological description & Resistivity
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## DRILL HOLE NO Kapi 20

DATE: 23.9.72

SITE { X: 10m E Peg 242  
Y: Profile D  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	60.95	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 60.95 m  
Logged: 60.40 m

## ELECTRIC LOGGING

## GAMMA RAY LOGGING

## GEOLOGICAL

LOGGING Date: 23.9.72 geol. R. Carrie

SAMPLING Date: 27.9.72 geol. "

Date : 23.9.72  
Type : P - S.P.  
Device : Neltronic porta logger  
Scale  $\rho$  : 4 ohm/cm  
S.P. : 2 mv/cm  
Cable speed: 15 m/min

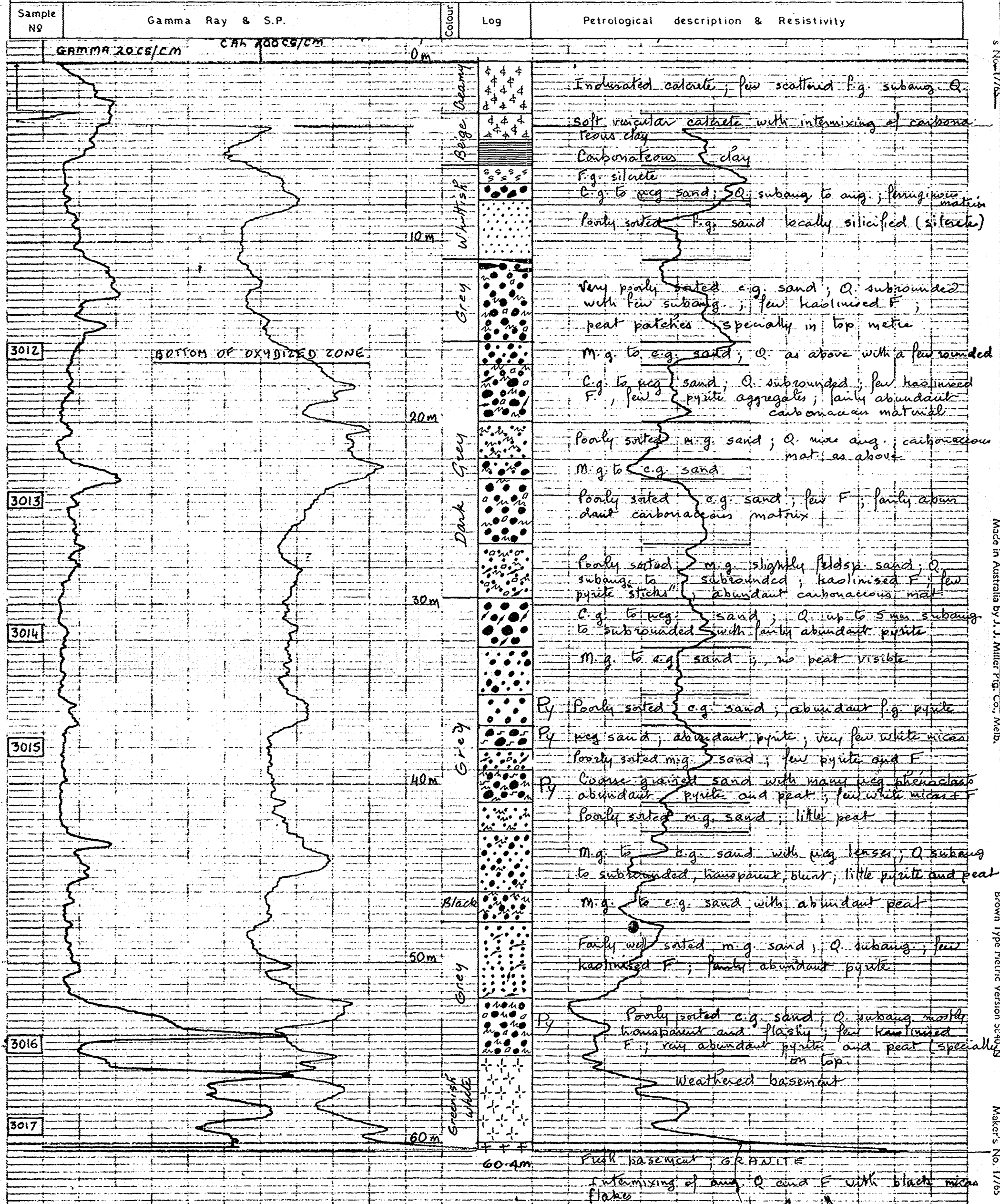
Operator : B. Young

Date : 23.9.72  
Type :  
Device : Neltronic porta logger  
Probe : 1200 c/sec  $\approx$  875 ppm. U  
Scale : 20 c/sec/cm  
Cable speed: 5 m/min

Operator : B. Young

Fig. 8 h

F Feldspar	K Kaolin	Calcite	Limestone	Silt (Pelite)	Poorly sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )
Py Pyrite				Psammite	Breccia
Undifferentiated superficial formation	Marly limestone			Well sorted fine-grained sandstone ( $< 0.5\text{mm}$ )	Intraformational conglomerate
(1) Silcrete	Marl			Well sorted medium-grained sandstone ( $\geq 0.5\text{mm} < 1\text{mm}$ )	Conglomerate
(2) Calcrete	Lutite, clay			Well sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )	Basement
(1) Disseminated carbonaceous mat.	Sandy lutite				
(2) Peat or coal interbed					
Dolomite					





## DRILL HOLE NO Kapi 21

DATE: 23.9.72

SITE { X: Peg 76  
Y: Profile D  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	65.95	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 65.95 m  
Logged: 65.80 m

## ELECTRIC LOGGING

## GAMMA RAY LOGGING

## GEOLOGICAL

## LOGGING

Date: 23-24.9.72 geol. R. Carrie

## SAMPLING

Date: 24.9.72 geol. "

Date: 23.9.72  
Type: γ - S.P.  
Device: Neltronic porta logger  
Scale γ: 4 ohm/cm  
S.P.: 2 mv/cm  
Cable speed: 15 m/minDate: 23.9.72  
Type: Neltronic porta logger  
Probe: 1200 c/sec ≈ 875 ppm. U  
Scale: 20 c/sec/cm - 80 c/sec/cm  
Cable speed: 5 m/min 3 m/min

Operator: B. Young

Operator: B. Young

Fig. 8 i

F Feldspar K Kaolin # Calcite  
Py Pyrite

Undifferentiated superficial formation

(1) Silcrete  
(2) Calcrete(1) Disseminated carbonaceous mat.  
(2) Peat or coal interbed

Dolomite



Limestone



Marly limestone



Marl



Lutite, clay



Sandy lutite



Silt (Pelite)



Psammite



Well sorted fine-grained sandstone (&lt;0.5mm)



Well sorted medium-grained sandstone (&gt;0.5mm &lt;1mm)



Well sorted coarse-grained sandstone (&gt;1mm &lt;2.5mm)



Poorly sorted coarse-grained sandstone (&gt;1mm &lt;2.5mm)



Breccia



Intraformational conglomerate

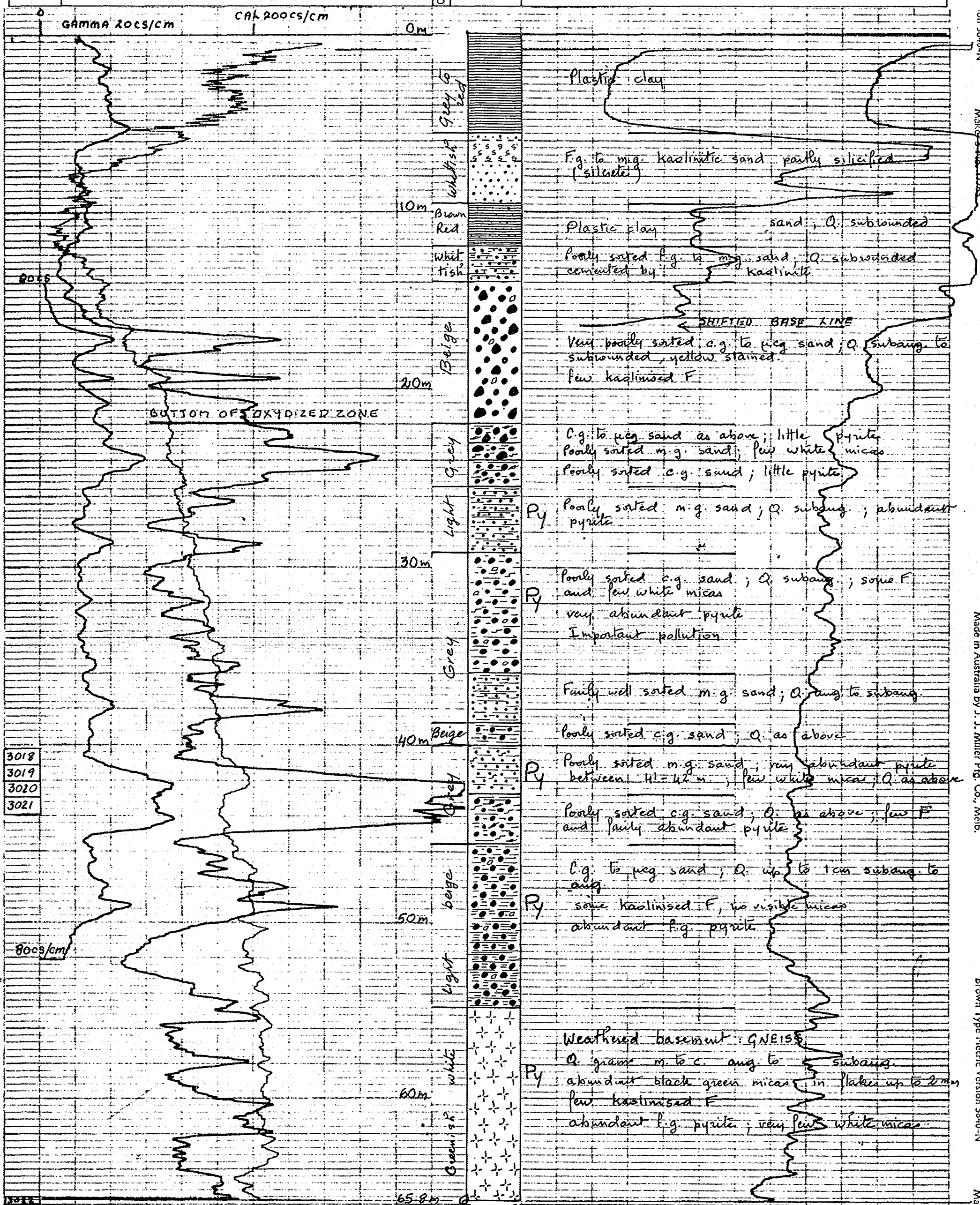


Conglomerate



Basement

Sample No	Gamma Ray & S.P.	Colour	Log	Petrological description & Resistivity
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DRILL HOLE NO Kapi 22

DATE: 25.9.72

SITE { X: 16 m W peg 119  
Y: Profile E  
Z:

DRILLED

CORE D

from	to	method	mud type	$\phi$
0	74.05	Rotary	Benionite	4 3/4"

TOTAL DEPTH:      Drilled: 74.05 m  
                              Logged: 73.20 m

## ELECTRIC LOGGING

Date : 25.9.72  
Type :  $\varphi$  - S.P.  
Device : Jeltrotronic porta logger  
Scale  $\varphi$  : 4 ohm/cm  
S.P. : 2 mv/cm  
Cable speed: 15 m/min

GAMMA RAY LOGGING

Date : 25.9.72  
Type :  
Device : Neutronic porta logger  
Probe : 1200 c/sec  $\approx$  875 ppm U  
Scale : 20 c/sec/cm — 80 c/sec/cm  
Cable speed: 5 m/min 3 m/min

SAMPLING Date: 25.9.72 geol.

Operator : B. Young

Operator : B. Young

Fig. 8 i

- |  |  |   |   |
|--|--|---|---|
| <div style="display: flex; justify-content: space-between;"> <div> <div style="display: flex; align-items: center;"> <div style="width: 10px; height: 10px; border: 1px solid black; margin-right: 5px;"></div> <span>F Feldspar</span> </div> <div style="display: flex; align-items: center;"> <div style="width: 10px; height: 10px; border: 1px solid black; margin-right: 5px;"></div> <span>K Kaolin</span> </div> <div style="display: flex; align-items: center;"> <div style="width: 10px; height: 10px; border: 1px solid black; margin-right: 5px;"></div> <span>≠ Calcite</span> </div> </div> <div style="display: flex; align-items: center;"> <div style="width: 10px; height: 10px; border: 1px solid black; margin-right: 5px;"></div> <span>Py Pyrite</span> </div> </div> | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Limestone</span> </div>       | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Silt (Pelite)</span> </div>  | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Poorly sorted coarse-grained sandstone (<math>\geq 1\text{mm}</math> &lt; <math>2.5\text{mm}</math>)</span> </div> |
| <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Undifferentiated superficial formation</span> </div>  | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Marly limestone</span> </div> | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Psammite</span> </div>   | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Breccia</span> </div>  |
| <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <div> <div>(1) Silcrete</div> <div>(2) Calcrete</div> </div> </div>   | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Marl</span> </div>            | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Well sorted fine-grained sandstone (&lt; <math>0.5\text{mm}</math>)</span> </div>                                | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Intraformational conglomerate</span> </div>  |
| <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <div> <div>(1) Disseminated carbonaceous mat.</div> <div>(2) Peat or coal interbed</div> </div> </div>  | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Lutite, clay</span> </div>    | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Well sorted medium-grained sandstone (<math>\geq 0.5\text{mm}</math> &lt; <math>1\text{mm}</math>)</span> </div> | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Conglomerate</span> </div>   |
| <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Dolomite</span> </div>  | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Sandy lutite</span> </div>    | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Well sorted coarse-grained sandstone (<math>\geq 1\text{mm}</math> &lt; <math>2.5\text{mm}</math>)</span> </div> | <div style="display: flex; align-items: center;"> <div style="width: 30px; height: 30px; border: 1px solid black; margin-right: 5px;"></div> <span>Basement</span> </div>   |

Sample No	Gamma Ray & S.P.	Colour	Log	Petrological description & Resistivity
	GAMMA 20.5/cm CHK 200.25/cm			
		Creamy	f.f.f.f.	Sandy calcareous; Q. f.f.m.g. subang. to subrounded; few lenses of micaceous (black) pyritic sand
		Beige		F.g. argillaceous sand; Q. subrounded; little pyrite
		Creamy	f.f.f.f.	Sandy calcareous as on top
		Beige		Silty or f.g. sandy sticky clay; few f.g. Q.
		Reddish		Sandy ferruginous sticky clay; many m. to c.g. subang. Q.
		Whitish grey with red layers		F.g./m.g. kaolinic sand; Q. mostly subrounded transparent cemented by kaolinitic matrix, replaced in some thin layers by iron hydroxides (9-11 and 13-14)
		White grey and		Argillaceous silt with f.g. sand lenses; Q. subang. to subrounded transparent; some ferruginous lenses
		Reddish		Fairly well sorted f.g. argillaceous sand; few thin layers of carbonaceous mat.
	BOTTOM OF OXYDISED ZONE	Reddish	Ry	Poorly sorted f.g. sand; Q. subrounded; few pyrite aggregates
		Grey		Poorly sorted c.g. to f.g. sand; Q. subrounded; kaolinitic matrix, abundant clayey peat; lenses; few pyrite aggregates
		Dark grey		Poorly sorted m.g. sand; Q. subang. to subrounded, abundant carbonaceous mat. and fairly abundant pyrite
		Grey	Ry	f.g. kaolinic sand; Q. as above; abundant f.g. pyrite and some carbonaceous mat.
		Grey		c.g. to f.g. sand as above; less carbon mat.
		Grey	Ry	F.g. to m.g. sand; pyrite and abundant carbon mat.
		Grey	Ry	c.g. sand; little peat but abundant pyrite
3023		Dark brown		Sticky micaceous clayey peat; some white mica; many f.g. Q.
			Ry	c.g. to f.g. sand; Q. subang.; few white mica and kaolinised F. abundant pyrite
				Poorly sorted m.g. sand; less pyrite than carbon mat. than above
				Poorly sorted c.g. to f.g. sand; Q. subang. transparent; few white mica and little carbon mat.
3024			Ry	c.g. to f.g. sand coarser than above; abundant pyrite cementing the grains
			Ry	m.g. to c.g. sand; Q. subang. with some ang. mat. transp.; fairly abundant carbonaceous matrix and abundant pyrite
			Ry	Poorly sorted m.g. sand; Q. subang. transparent; abundant pyrite with carbonaceous matrix
			Ry	Poorly sorted c.g. to very f.g. sand; as above
			Ry	c.g. to f.g. sand; as above
		Grey	Ry	f.g. sand; Q. up to 1 cm in clittings subang. to ang. partly shiny partly stained; abundant pyrite associated with some carbon mat.
				Lense of peat in bottom metre
3025		Grey		Very abundant kaolinite (>40%) {Q. subang. to ang. some milky, very few kaolinites}
3026		Whitish	Ry	Strongly weathered basement; F. abundant pyrite
3027				
3028				
3029				
3030				
3031				
3032				
3033				
3034				
3035				
			Ry	Weathered basement (less than above); Q. with some crystalline faces mostly milky; abundant slightly kaolinitised F. (>30%) and abundant pyrite
				no visible mica
				73.20 m

Made in Australia by J. J. Miller Pty. Co., Melbourne

Brown Type Metric Version 5840-N

Maker's No. 17765

ENV 1943 (I) - 16

ENV 1943 (I) - 16



## DRILL HOLE NO Kapi 23

DATE: 25.9.72

SITE { X: 11 m N peg 163  
Y: Profile E  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	45.72	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 45.72 m  
Logged: 43.40 m

## ELECTRIC LOGGING

Date: 25.9.72  
Type: γ - S.P.  
Device: Neitronic porta logger  
Scale γ: 4 ohm/cm  
S.P.: 2 mv/cm  
Cable speed: 15 m/min

## GAMMA RAY LOGGING

Date: 25.9.72  
Type: γ  
Device: Neitronic porta logger  
Probe: 1200 c/sec = 875 ppm. U  
Scale: 20 c/sec/cm - 80 c/sec/cm  
Cable speed: 5 m/min 3 m/min

## GEOLOGICAL

LOGGING Date: 25.26.9.72 geol. R. Carrie

## SAMPLING

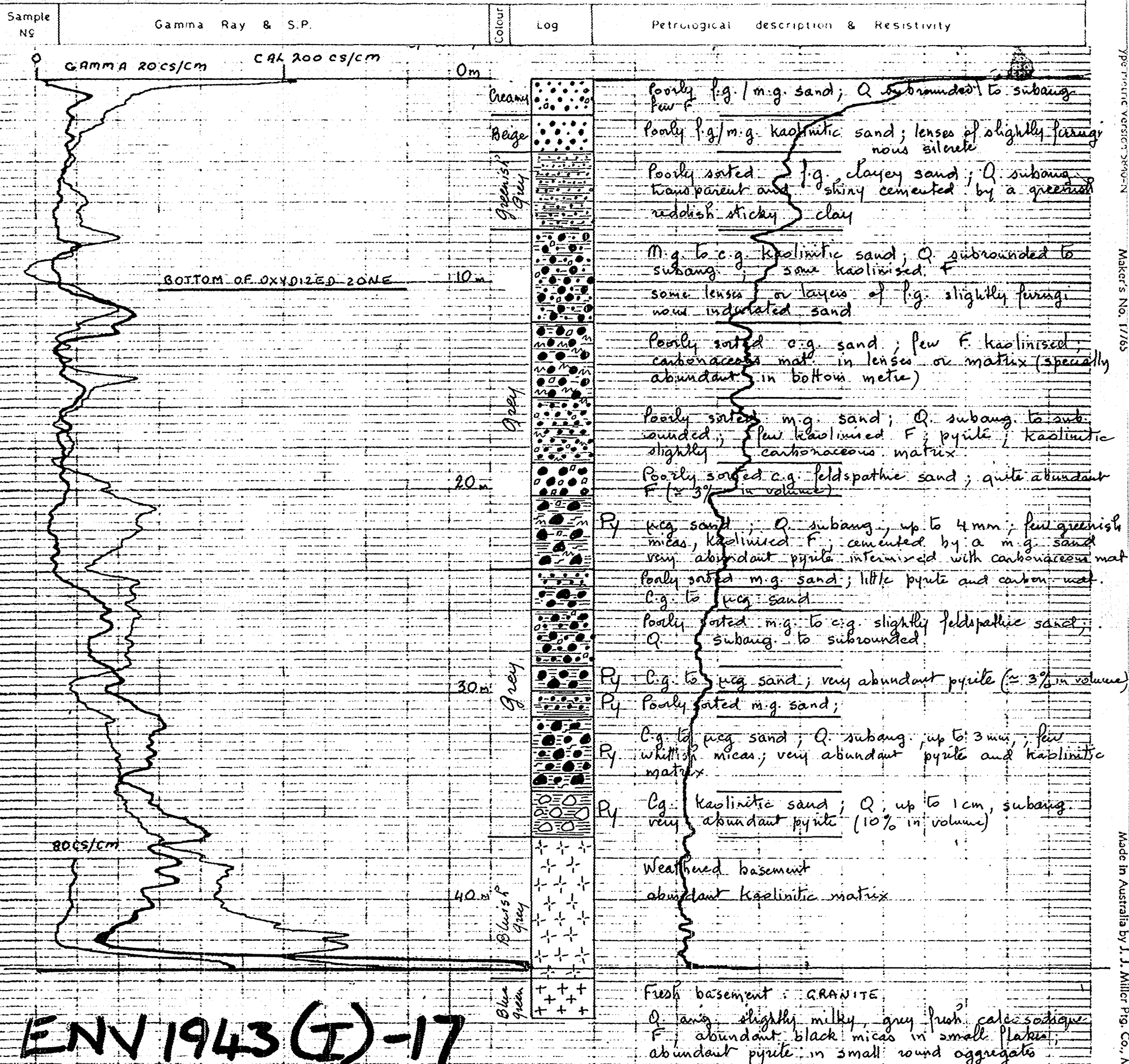
Date: 26.9.72 geol. "

Operator: B. Young

Operator: B. Young

Fig.8k

□ F Feldspar K Kaolin ≠ Calcite ~ Py Pyrite	□ Limestone	□ Silt (Pelite)	□ Poorly sorted coarse-grained sandstone (≥1mm <2.5mm)
□ Undifferentiated superficial formation	□ Marly limestone	□ Psammite	□ Breccia
□ (1) Silcrete (2) Calcicrete	□ Marl	□ Well sorted fine-grained sandstone (<0.5mm)	□ Intraformational conglomerate
□ (1) Disseminated carbonaceous mat. (2) Peat or coal interbed	□ Lutite, clay	□ Well sorted medium-grained sandstone (≥0.5mm <1mm)	□ Conglomerate
□ Dolomite	□ Sandy lutite	□ Well sorted coarse-grained sandstone (≥1mm <2.5mm)	□ Basement



DRILL HOLE NO Kapi 23 A

DATE: 26.9.72

SITE { X: 18 m NE pag 163  
Y: Profile E  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	56.38	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 56.38 m  
Logged: 55.60 m

ELECTRIC LOGGING

GAMMA RAY LOGGING

REMARKS: Drilled following collapse at the bottom of Kapi 23 before logging (located 16 m E of Kapi 23)

Date: 26.9.72  
Type: P -  
Device: Neitronic porta logger  
Scale ρ: 4 ohm/cm  
S.P.: -  
Cable speed: 15 m/min

Date: 26.9.72  
Type: -  
Device: Neitronic porta logger  
Probe: 1200 c/sec ≈ 875 ppm. U  
Scale: 20 c/sec/cm - 80 c/sec/cm  
Cable speed: 5 m/min 3 m/min

GEOLOGICAL LOGGING Date: 26.9.72 geol. R. Carrie

SAMPLING Date: " geol. "

Operator: B. Young

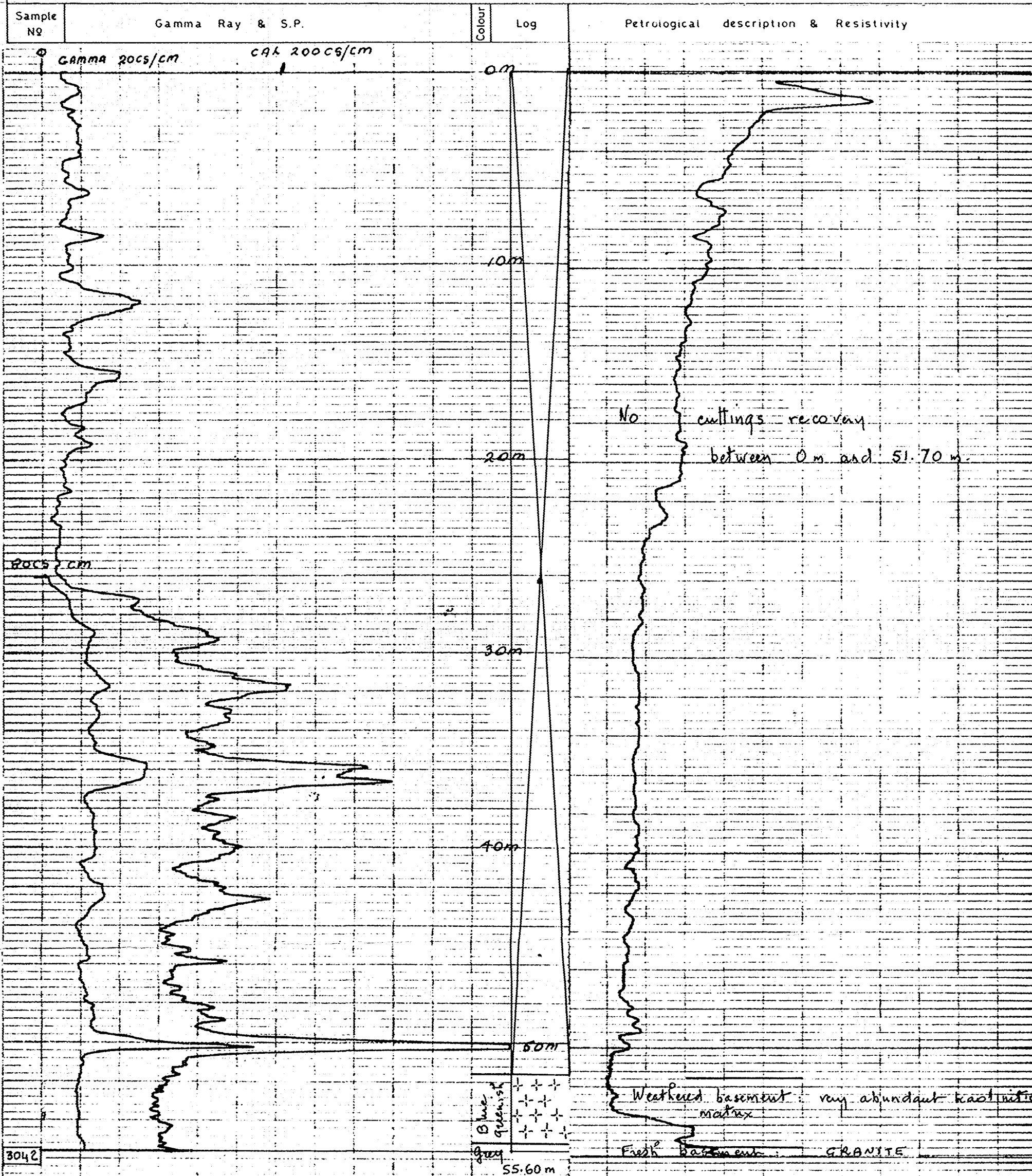
Operator: B. Young

Fig. 81

- F Feldspar K Kaolin ≠ Calcite  
~ Py Pyrite
- Undifferentiated superficial formation
- (1) Silcrete  
(2) Calcrete
- (1) Disseminated carbonaceous mat.  
(2) Peat or coal interbed
- Dolomite
- Limestone
- Marly limestone
- Marl
- Lutite, clay
- Sandy lutite

- Silt (Pelite)
- Psammite
- Well sorted fine-grained sandstone (<0.5mm)
- Well sorted medium-grained sandstone (≥0.5mm <1mm)
- Well sorted coarse-grained sandstone (≥1mm <2.5mm)

- Poorly sorted coarse-grained sandstone (≥1mm <2.5mm)
- Breccia
- Intraformational conglomerate
- Conglomerate
- Basement





1943(I)-19

## DRILL HOLE NO Kapi 24

DATE 26.9.72

SITE { X: 35 m W peg 130  
Y: Profile E  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	78.00	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 78.00 m  
Logged: 78.00 m

## ELECTRIC LOGGING

## GAMMA RAY LOGGING

LOGGING Date: 26.9.72 geol. R. Carrivie  
Date: 26.9.72  
Type: P - S.P.  
Device: Neltronic porta logger  
Scale  $\rho$ : 4 ohm/cm  
SP: 2 mv/cm  
Cable speed: 15 m/min

Date: 26.9.72  
Type: Neltronic porta logger  
Device: Neltronic porta logger  
Probe: 1200 c/sec  $\approx$  875 ppm U  
Scale: 20 c/sec/cm - 80 c/sec/cm  
Cable speed: 5 m/min 3 m/min

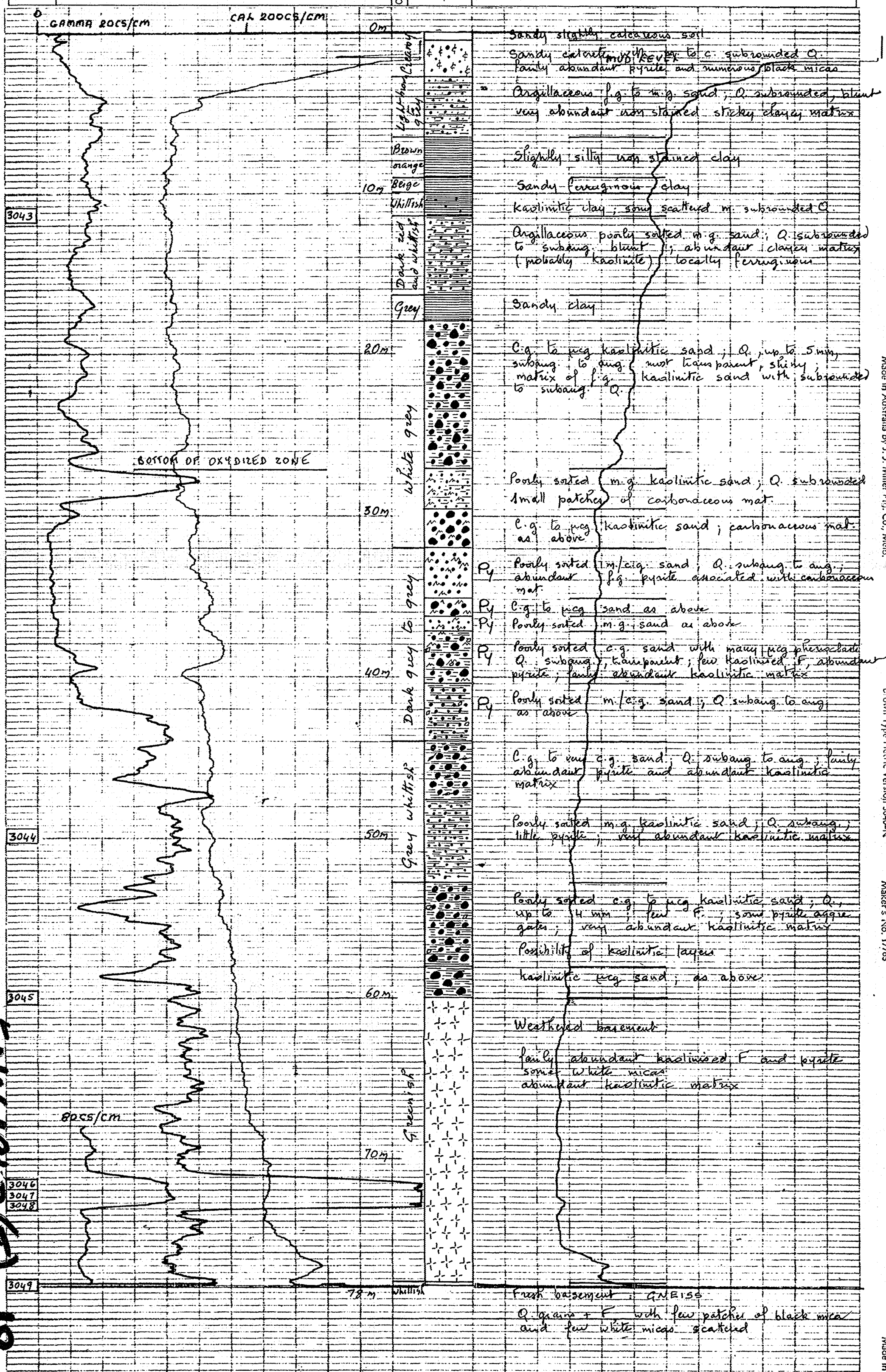
SAMPLING Date: " geol. " Operator: B. Young

Operator: B. Young

Fig. 8 m

$\square$ F Feldspar $\sim$ Py Pyrite	K Kaolin	$\#$ Calcite	Limestone	Sill (Pelite)	Poorly sorted coarse-grained sandstone ( $\geq 1\text{mm}$ < 2.5mm)
Undifferentiated superficial formation	Marly limestone	Marl	Lutite, clay	Psammite	Breccia
(1) Silcrete (2) Calcrete	Sandy lutite			Well sorted fine-grained sandstone (< 0.5mm)	Intraformational conglomerate
(1) Disseminated carbonaceous mat. (2) Peat or coal interbed				Well sorted medium-grained sandstone ( $\geq 0.5\text{mm}$ < 1mm)	Conglomerate
Dolomite				Well sorted coarse-grained sandstone ( $\geq 1\text{mm}$ < 2.5mm)	Basement

Sample No	Gamma Ray & S.P.	Colour	Log	Petrological description & Resistivity
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## DRILL HOLE NO Kapi 25

DATE: 27.9.72

SITE { X: 3m W Peg 22  
Y: Profile D  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	33.83	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 33.83 m  
Logged: 33.00 m

## ELECTRIC LOGGING

Date: 27.9.72  
Type: P - S.P.  
Device: Neitronic porta logger  
Scale  $\rho$ : 2 ohm/cm  
S.P.: 4 mv/cm  
Cable speed: 15 m/min

## GAMMA RAY LOGGING

Date: 27.9.72  
Type:  
Device: Neitronic porta logger  
Probe: 1200 c/sec  $\approx$  875 ppm. U  
Scale: 20 c/sec/cm  
Cable speed: 5 m/min

## GEOLOGICAL

## LOGGING

Date: 27.9.72 geol. R. Carrie

## SAMPLING

Date: geol.

Operator: B. Young

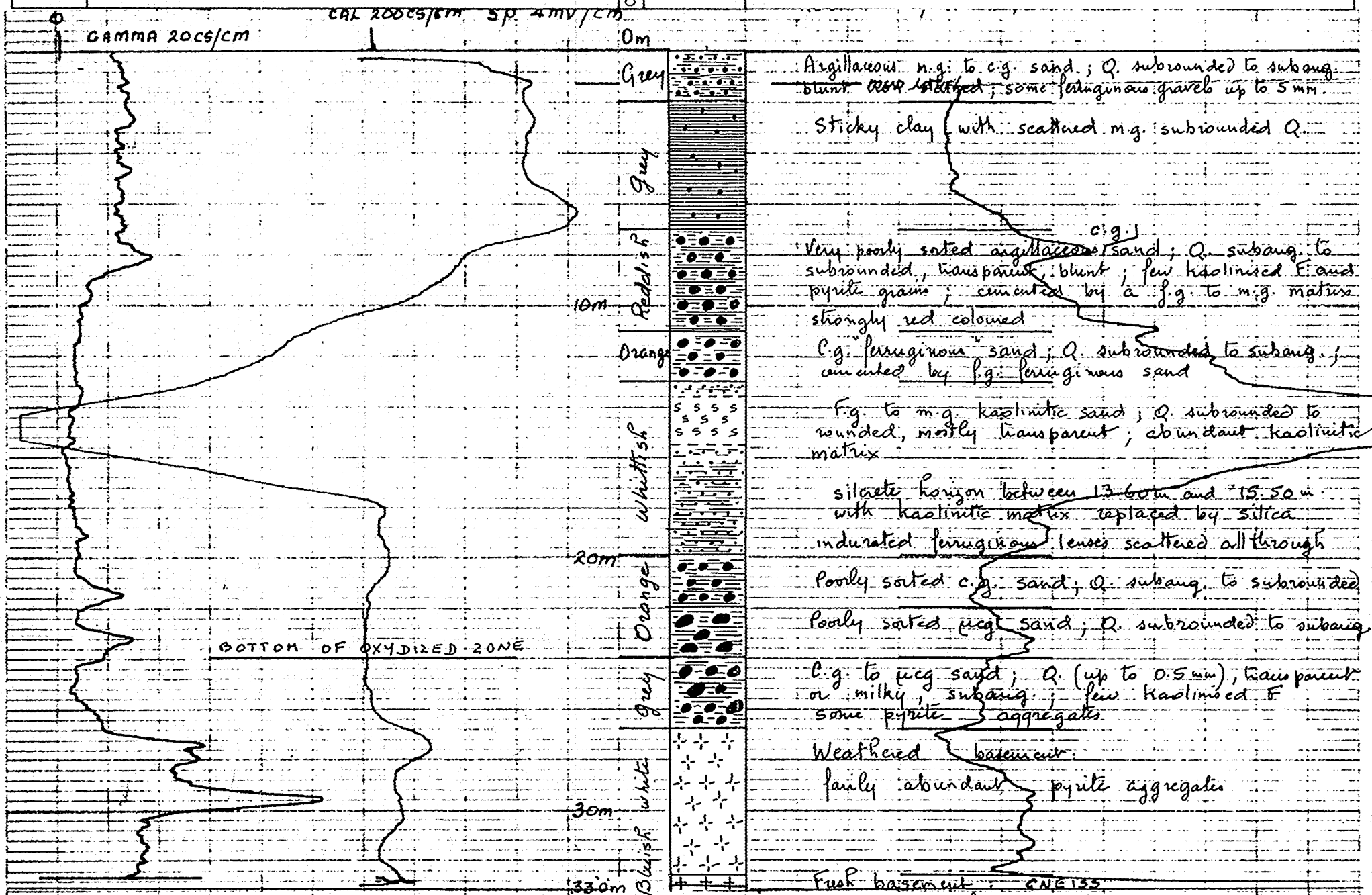
Operator: B. Young

Fig. 8 n

□ F Feldspar	K Kaolin	≠ Calcite	□ Limestone
~ Py Pyrite			
▨ Undifferentiated superficial formation	□ Marly limestone		
SS (1) Silcrete	□ Marl		
SS (2) Calcrete			
▨ (1) Disseminated carbonaceous mat.	▨ Lutite, clay		
▨ (2) Peat or coal interbed			
▨ Dolomite	▨ Sandy lutite		

▨ Silt (Pelite)	▨ Poorly sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )
▨ Psammite	▨ Breccia
▨ Well sorted fine-grained sandstone ( $< 0.5\text{mm}$ )	▨ Intraformational conglomerate
▨ Well sorted medium-grained sandstone ( $\geq 0.5\text{mm} < 1\text{mm}$ )	▨ Conglomerate
▨ Well sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )	▨ Basement

Sample No	Gamma Ray & S.P.	Colour	Log	Petrological description & Resistivity
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## DRILL HOLE NO Kapi 26

DATE: 27.9.72

 SITE  
 X: 10 m E Peg 149  
 Y: Profile B  
 Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	125.27	Rotary	Bentonite	4 3/4"

 TOTAL DEPTH: Drilled: 125.27 m  
 Logged: 125.60 m

ELECTRIC LOGGING

GAMMA RAY LOGGING

 GEOLOGICAL  
 LOGGING Date: 27-28.9.72 geol. R. Carrie

 Date: 27.9.72  
 Type: γ - S.P.  
 Device: Neltronic porta logger  
 Scale γ: 4 ohm/cm  
 S.P.: 2 mv/cm  
 Cable speed: 15 m/min

 Date: 27.9.72  
 Type: Neltronic porta logger  
 Device: Neltronic porta logger  
 Probe: 1200 c/sec ≈ 875 ppm. U  
 Scale: 20 c/sec/cm - 80 c/sec/cm  
 Cable speed: 5 m/min 2 m/n

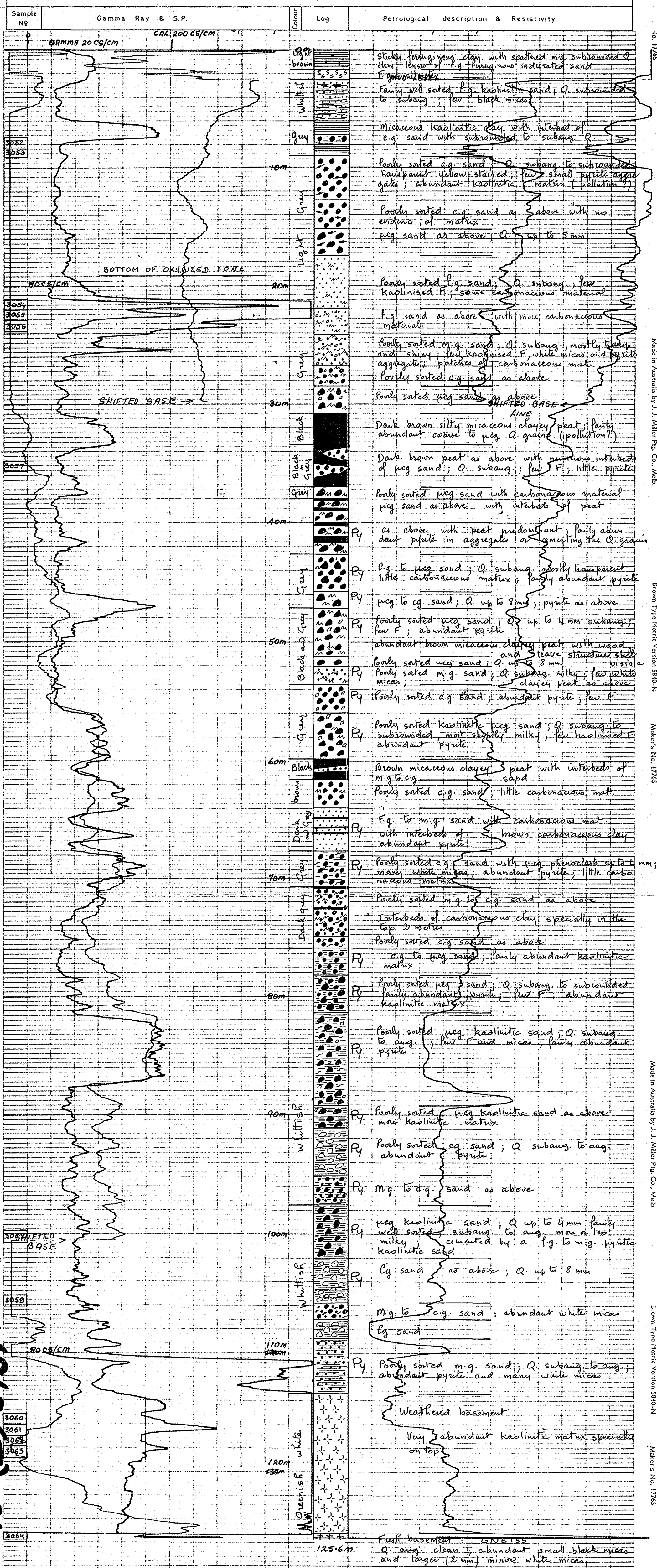
SAMPLING Date: 30.9.72 geol.

Operator: B. Young

Operator: B. Young

Fig. 80

□ F Feldspar	K Kaolin	≠ Calcite	■ Limestone	■ Silt (Pelite)	■ Poorly sorted coarse-grained sandstone (≥1mm <2.5mm)
~ Py Pyrite			■ Marly limestone	■ Psammite	△ Breccia
■ Undifferentiated superficial formation			■ Marl	■ Well sorted fine-grained sandstone (<0.5mm)	○ Intraformational conglomerate
■ (1) Silcrete			■ Lutite clay	■ Well sorted medium-grained sandstone (≥0.5mm <1mm)	○ Conglomerate
■ (2) Calcrete			■ Sandy lutite	■ Well sorted coarse-grained sandstone (≥1mm <2.5mm)	++ Basement
■ (1) Disseminated carbonaceous mat.					
■ (2) Peat or coal interbed					
■ Dolomite					



10.1765

Made in Australia by J. J. Miller Pty. Co., Melb.

Brown Type Electric Version 5840-N

Maker's No. 17765

Made in Australia by J. J. Miller Pty. Co., Melb.

Brown Type Electric Version 5840-N

Maker's No. 17765

1943 (1) -22

## DRILL HOLE NO Kapi 26 A

DATE: 30.9.72

SITE { X: 2 m SW Kapi 26  
Y: Profile B  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	32.0	Rotary	Bentonite	5 1/2"
19.81	25.91	side wall sample	—	1"

TOTAL DEPTH: Drilled: 32.0 m Cored: 6.10 m  
Logged: 27.20 m

## ELECTRIC LOGGING

## GAMMA RAY LOGGING

## GEOLOGICAL

## LOGGING

Date: 30.9.72 geol. R. Carrie

## SAMPLING

Date: 30.9.72 geol. "

Date : 30.9.72  
Type :  $\varphi$  - S.P.  
Device : Neitronic porta logger  
Scale  $\varphi$  : 4 ohm/cm  
S.P. : 4 mv/cm  
Cable speed: 10 m/min

Operator : B. Young

Date : 30.9.72  
Type :  
Device : Neitronic porta logger  
Probe : 1200 c/sec  $\approx$  875 ppm U  
Scale : 20 c/sec/cm - 80 and 200 c/sec/cm  
Cable speed: 5 m/min 2 m/min

Operator : B. Young

Fig. 8 p

- F Feldspar K Kaolin ≠ Calcite  
 ~ Py Pyrite  
 Undifferentiated superficial formation  
 (1) Silcrete  
 (2) Calcrete  
 (1) Disseminated carbonaceous mat.  
 (2) Peat or coal interbed  
 Dolomite  
 Limestone  
 Marly limestone  
 Marl  
 Lutite, clay  
 Sandy lutite

- Silt (Pelite)  
 Psammite  
 Well sorted fine-grained sandstone (<0.5 mm)  
 Well sorted medium-grained sandstone (≥0.5 mm <1 mm)  
 Well sorted coarse-grained sandstone (≥1 mm <2.5 mm)  
 Poorly sorted coarse-grained sandstone (≥1 mm <2.5 mm)  
 Breccia  
 Intraformational conglomerate  
 Conglomerate  
 Basement

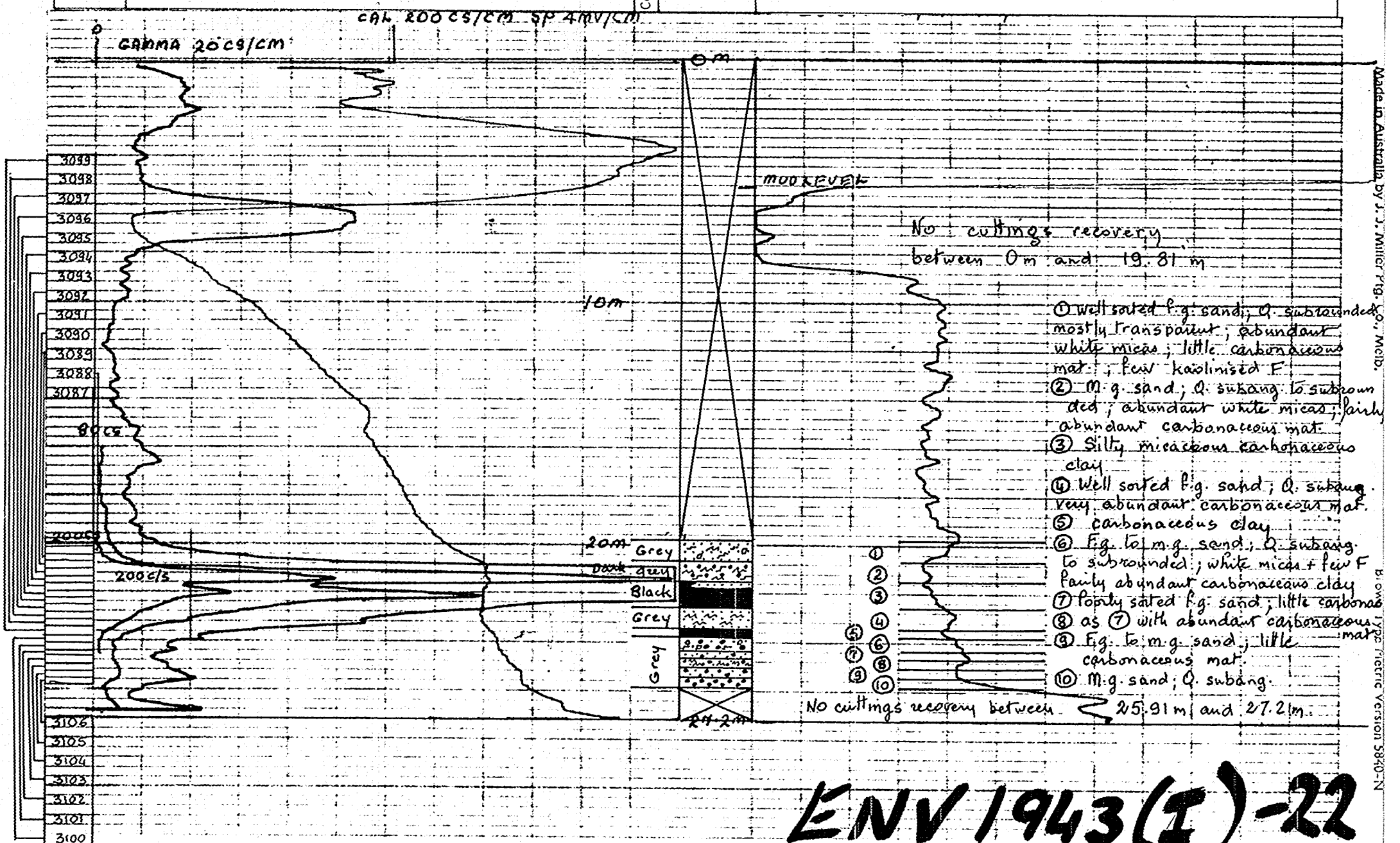
Sample No

Gamma Ray &amp; S.P.

Colour

Log

Petrological description &amp; Resistivity



ENV 1943(I) -22



## DRILL HOLE No Kapi 27

DATE: 28.9.72

DRILLED

CORED

from	to	method	mud type	Ø
0	130.0	Rotary	Bentonite	4 3/4"

SITE  
 X: 1 m E Fog 138  
 Y: Profile B  
 Z:

TOTAL DEPTH: Drilled: 130.0 m  
 Logged: 130.40 m

## ELECTRIC LOGGING

## GAMMA RAY LOGGING

## GEOLOGICAL

LOGGING Date: 28.9.72 geol. R. Carrie

Date: 28.9.72  
 Type: P - S.P.  
 Device: Neltronic porta logger  
 Scale  $\rho$ : 4 ohm/cm  
 S.P.: 2 mv/cm  
 Cable speed: 15 m/min

Date: 28.9.72  
 Type: Neltronic porta logger  
 Device: Neltronic porta logger  
 Probe: 1200 c/sec  $\approx$  875 ppm. U  
 Scale: 20 c/sec/cm - 80 c/sec/cm  
 Cable speed: 5 m/min 3 m/min

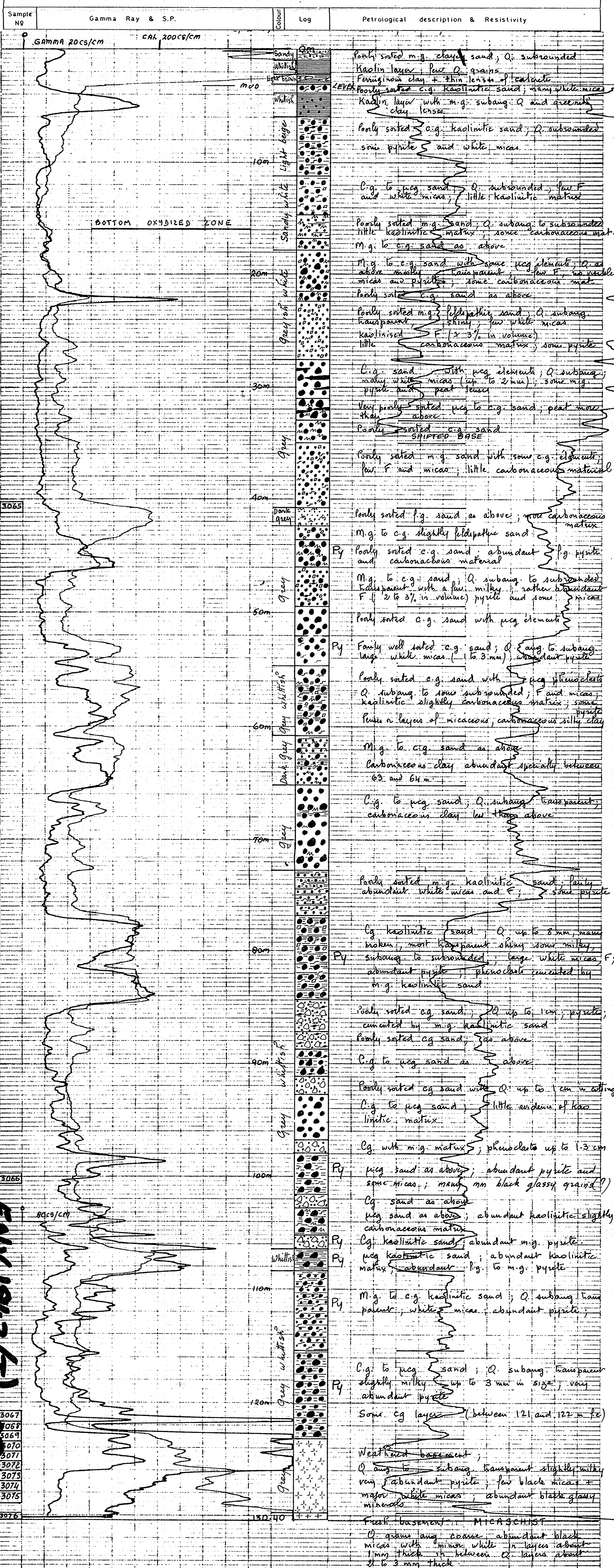
SAMPLING Date: " geol. "

Operator: B. Young

Operator: B. Young

Fig. 8q

<ul style="list-style-type: none"> <li>F Feldspar</li> <li>K Kaolin</li> <li>Calcite</li> <li>Py Pyrite</li> </ul>	<ul style="list-style-type: none"> <li>Limestone</li> <li>Marly limestone</li> <li>Marl</li> <li>Lutite, clay</li> <li>Sandy lutite</li> </ul>	<ul style="list-style-type: none"> <li>Silt (Pelite)</li> <li>Psammite</li> <li>Well sorted fine-grained sandstone (&lt;0.5mm)</li> <li>Well sorted medium-grained sandstone (0.5-1mm)</li> <li>Well sorted coarse-grained sandstone (&gt;1mm &lt;2.5mm)</li> </ul>	<ul style="list-style-type: none"> <li>Poorly sorted coarse-grained sandstone (&gt;1mm &lt;2.5mm)</li> <li>Breccia</li> <li>Intraformational conglomerate</li> <li>Conglomerate</li> <li>Basement</li> </ul>
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## DRILL HOLE NO Kapi 28

DATE: 28-29.9.72

SITE  
X: Peg 158  
Y: Profile B  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	124.35	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 124.35 m  
Logged: 124.00 m

## ELECTRIC LOGGING

GEOLOGICAL  
LOGGING

Date: 29.9.72 geol. R. Carrie

Date: 29.9.72  
Type: P - S.P.  
Device: Neltronic porta logger  
Scale  $\rho$ : 4 ohm/cm  
S.P.: 2 mv/cm  
Cable speed: 15 m/min

## GAMMA RAY LOGGING

Date: 29.9.72  
Type: Neltronic porta logger  
Device: Neltronic porta logger  
Probe: 1200 c/sec  $\approx$  875 ppm. U  
Scale: 20 c/sec/cm - 80 c/sec/cm  
Cable speed: 5 m/min 3 m/min

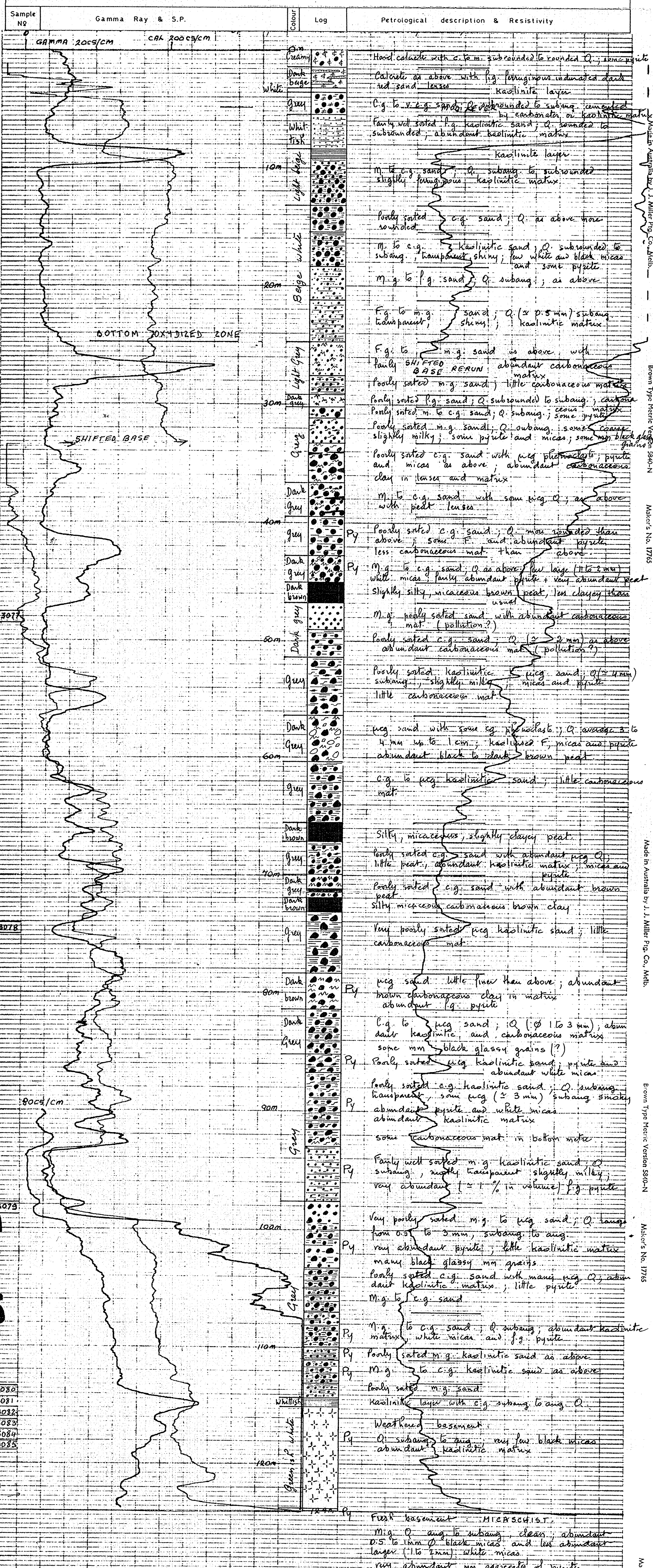
SAMPLING Date: " geol. "

Operator: B. Young

Operator: B. Young

Fig. 8 r

□ F Feldspar ~ Py Pyrite	K Kaolin	≠ Calcite	□ Limestone	□ Silt (Pelite)	□ Poorly sorted coarse-grained sandstone ( $\geq 1$ mm < 2.5mm)
□ Undifferentiated superficial formation	□ Marly limestone	□ Marl	□ Psammite	□ Well sorted fine-grained sandstone (< 0.5mm)	□ Breccia
□ (1) Silcrete (2) Calcrete	□ Lutite, clay	□ Sandy lutite	□ Well sorted medium-grained sandstone ( $\geq 0.5$ mm < 1mm)	□ Well sorted coarse-grained sandstone ( $\geq 1$ mm < 2.5mm)	□ Intraformational conglomerate
□ (1) Disseminated carbonaceous mat. (2) Peat or coal interbed			□ Conglomerate		□ Basement
□ Dolomite					





DRILL HOLE NO Kapi 29

DATE: 29.9.72

SITE { X: 400m NW Kapi II  
Y: Line 2  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	57.0	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 57.0 m  
Logged: 56.80 m

ELECTRIC LOGGING

GAMMA RAY LOGGING

GEOLOGICAL

LOGGING

Date: 29-30.9.72 geol. R. Carrie

SAMPLING

Date: 30.9.72 geol.

Date: 29.9.72  
Type: γ - S.P.  
Device: Neltronic porta logger  
Scale γ: 4 ohm/cm  
S.P.: 2 mv/cm  
Cable speed: 15 m/min

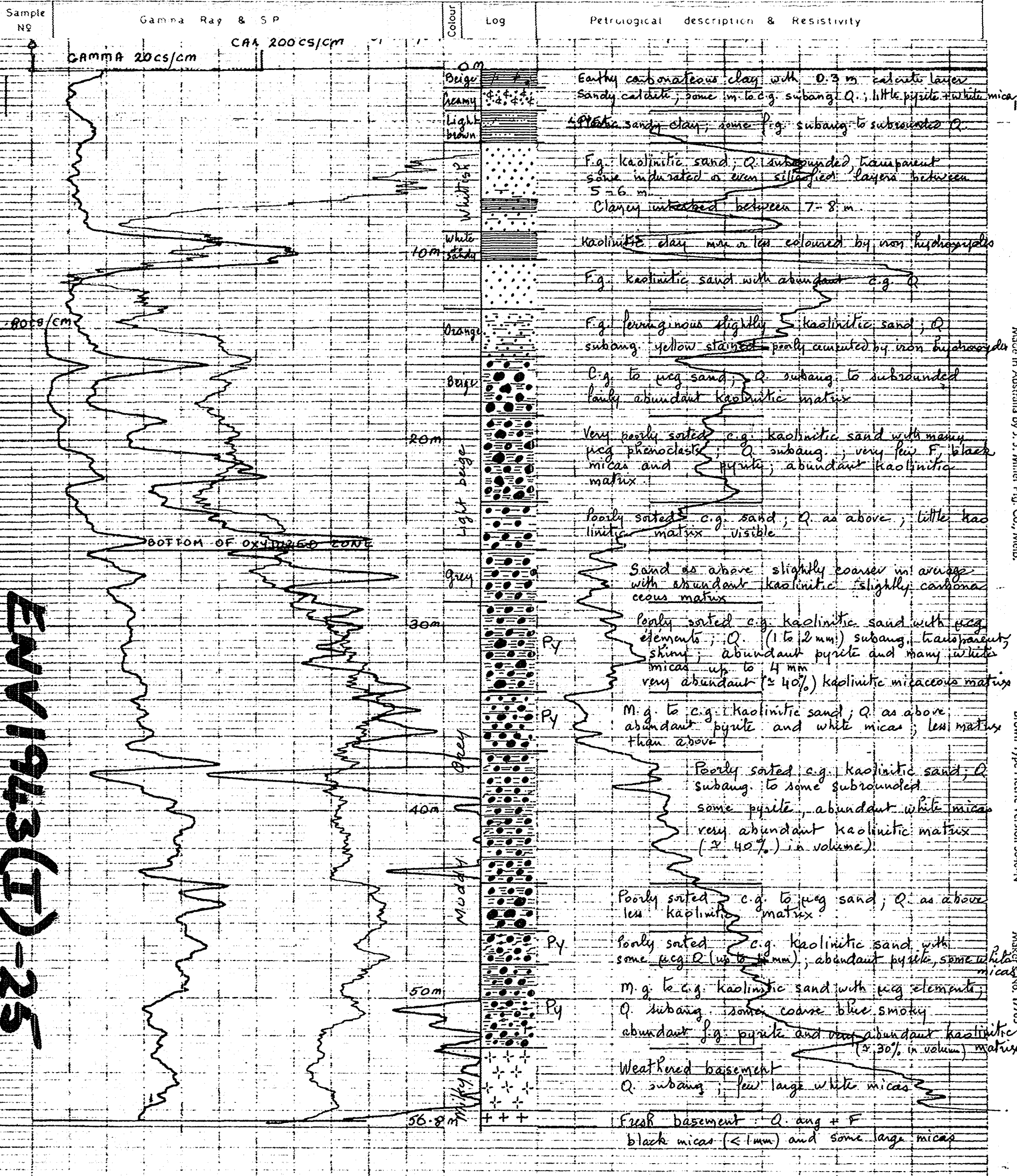
Operator: B. Young

Date: 29.9.72  
Type: Neltronic porta logger  
Probe: 1200 c/sec ≈ 875 ppm. U  
Scale: 20 c/sec/cm - 80 c/sec/cm  
Cable speed: 5 m/min 3 m/min

Operator: B. Young

Fig. 8 s

□ F Feldspar ~ Py Pyrite	K Kaolin ≠ Calcite	Limestone	Silt (Pelite)	Poorly sorted coarse-grained sandstone (≥1mm <2.5mm)
Undifferentiated superficial formation	Marly limestone	Psammite	Breccia	Intraformational conglomerate
(1) Silcrete (2) Calcrete	Marl	Well sorted fine-grained sandstone (<0.5mm)	Conglomerate	Basement
(1) Disseminated carbonaceous mat. (2) Peat or coal interbed	Lutite, clay	Well sorted medium-grained sandstone (≥0.5mm <1mm)		
Dolomite	Sandy lutite	Well sorted coarse-grained sandstone (≥1mm <2.5mm)		



05/30 S.M.L. 642 J/V ENDEAVOUR OIL N.L.

## DRILL HOLE NO Kapi 30

DATE: 30.9.72

SITE { X: 400m SSE Kapi 11  
Y: Line 2  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	20.10	Rotary	Bentonite	4 3/4"
20.10	20.70	"	"	4 1/2"

TOTAL DEPTH: Drilled: 20.70 m  
Logged: 20.0 m

## ELECTRIC LOGGING

## GAMMA RAY LOGGING

GEOLOGICAL  
LOGGING

Date: 30.9.72 geol. R. Carrie

SAMPLING

Date: — geol. —

Date : 30.9.72  
Type :  $\varphi$  - S.P.  
Device : Neltronic porta logger  
Scale  $\varphi$  : 4 ohm/cm  
S.P. : 4 mv/cm  
Cable speed: 15 m/min

Operator : B. Young

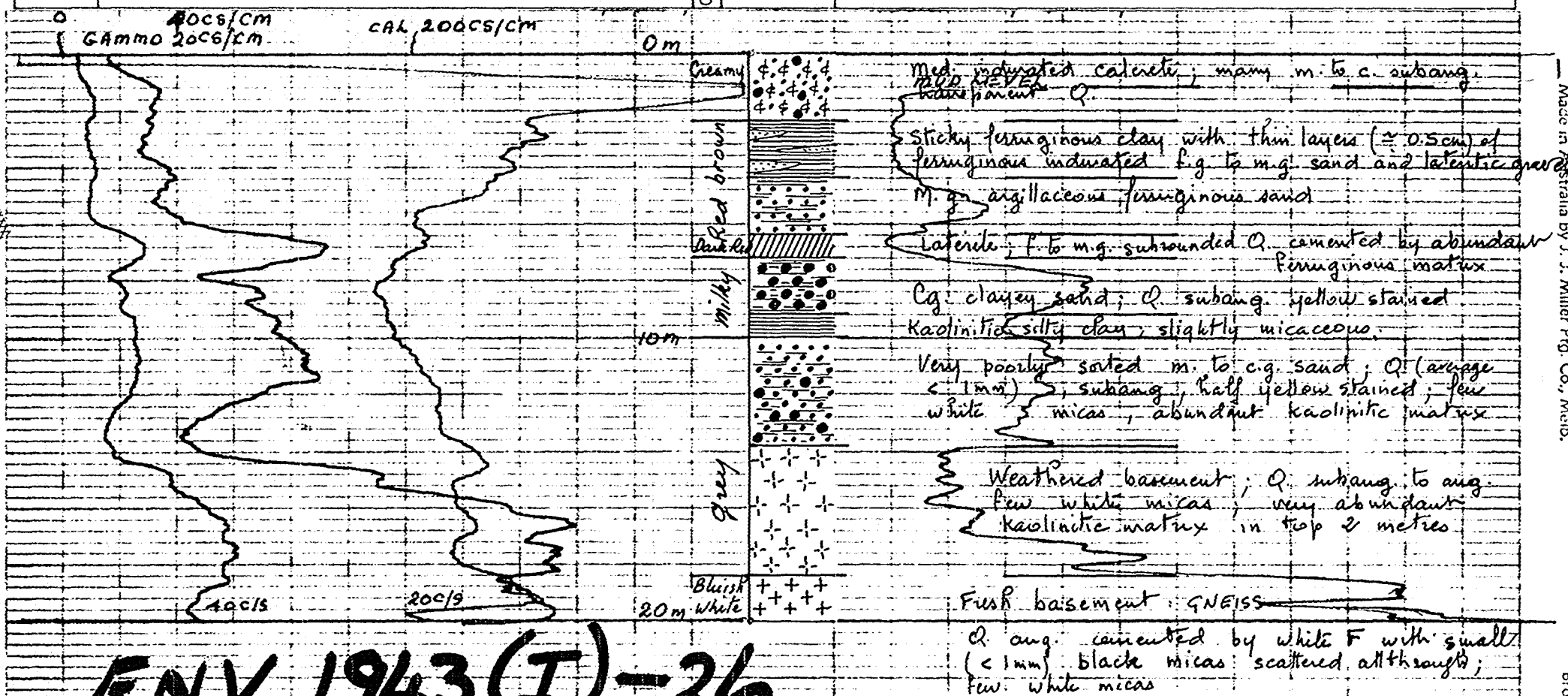
Date : 30.9.72  
Type :  
Device : Neltronic porta logger  
Probe : 1200 c/sec  $\approx$  875 ppm. U  
Scale : 20 c/sec/cm - 40 c/sec/cm  
Cable speed: 5 m/min

Operator : B. Young

Fig. 8 t

<p>□ F Feldspar K Kaolin ≠ Calcite ~ Py Pyrite</p> <p>Undifferentiated superficial formation</p> <p>(1) Silcrete (2) Calcrete</p> <p>(1) Disseminated carbonaceous mat. (2) Peat or coal interbed</p> <p>Dolomite</p>	<p>Limestone</p> <p>Marly limestone</p> <p>Marl</p> <p>Lutite, clay</p> <p>Sandy lutite</p>	<p>Silt (Pelite)</p> <p>Psammite</p> <p>Well sorted fine-grained sandstone (&lt;0.5mm)</p> <p>Well sorted medium-grained sandstone (≥0.5mm &lt;1mm)</p> <p>Well sorted coarse-grained sandstone (≥1mm &lt;2.5mm)</p>	<p>Poorly sorted coarse-grained sandstone (≥1mm &lt;2.5mm)</p> <p>Breccia</p> <p>Intraformational conglomerate</p> <p>Conglomerate</p> <p>Basement</p>
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Sample No	Gamma Ray & S.P.	Colour	Log	Petrological description & Resistivity
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## DRILL HOLE NO Kapi 31

DATE: 1.10.72

SITE { X: Peg 111  
Y: Profile E  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	71.50	Rotary	Bentonite	4 3/4"

TOTAL DEPTH: Drilled: 71.50 m  
Logged: 71.30 m

## ELECTRIC LOGGING

Date: 1.10.72  
Type: P - S.P.  
Device: Neltronic porta logger  
Scale p: 4 ohm/cm  
S.P.: 2 mv/cm  
Cable speed: 15 m/min

## GAMMA RAY LOGGING

Date: 1.10.72  
Type:  
Device: Neltronic porta logger  
Probe: 1200 c/sec  $\approx$  875 ppm. U  
Scale: 20 c/sec/cm  
Cable speed: 5 m/min

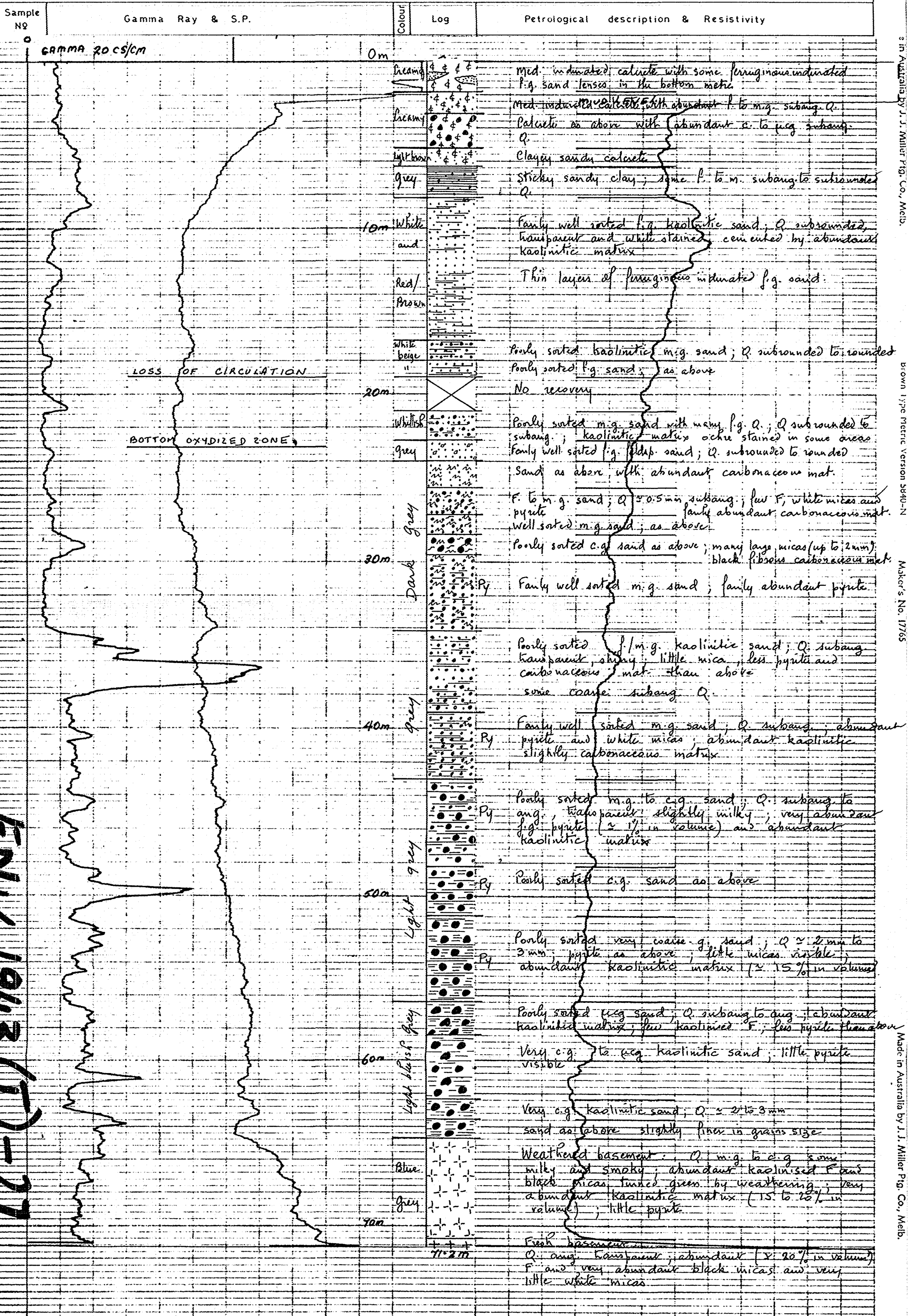
GEOLOGICAL LOGGING Date: 1.10.72 geol. R. Carrie

SAMPLING Date: — geol. — Operator: B. Young

Operator: B. Young

Fig. 8 u

□ F Feldspar ~ Py Pyrite	K Kaolin ≠ Calcite	Limestone	Silt (Pelite)	Poorly sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )
Undifferentiated superficial formation	Marly limestone	Psammite	Well sorted fine-grained sandstone ( $< 0.5\text{mm}$ )	Breccia
(1) Silcrete (2) Calcrete	Marl	Well sorted medium-grained sandstone ( $\geq 0.5\text{mm} < 1\text{mm}$ )	Well sorted coarse-grained sandstone ( $\geq 1\text{mm} < 2.5\text{mm}$ )	Intraformational conglomerate
(1) Disseminated carbonaceous mat. (2) Peat or coal interbed	Lutite, clay			Conglomerate
Dolomite	Sandy lutite			Basement



## DRILL HOLE NO Kapi 32

DATE: 3.10.72

SITE { X: 150 m N 235° from Kapi 26  
Y: Profile B  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	30.48	Rotary	Bentonite	4 1/2"

TOTAL DEPTH: Drilled: 30.48 m  
Logged: 30.80 m

## ELECTRIC LOGGING

## GAMMA RAY LOGGING

## GEOLOGICAL LOGGING

Date: 3.10.72 geol. R. Carrie

## SAMPLING

Date: — geol. —

Date : 3.10.72  
Type : P - S.P.  
Device : Neltronic porta logger  
Scale p : 2 ohm/cm  
S.P. : 4 mv/cm  
Cable speed: 15 m/min

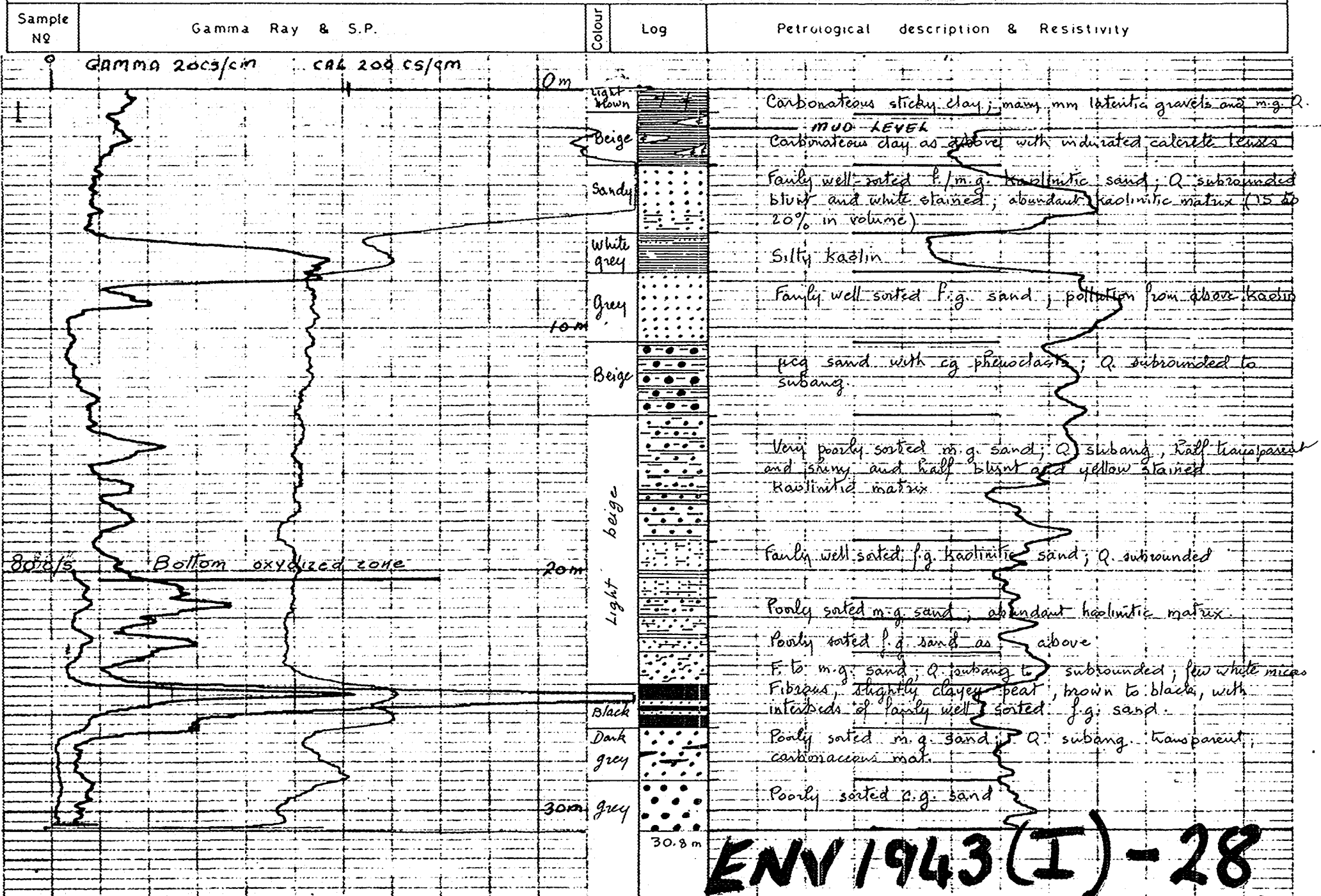
Operator : B. Young

Date : 3.10.72  
Type :  
Device : Neltronic porta logger  
Probe : 1200 c/sec  $\approx$  875 ppm. U  
Scale : 20 c/sec/cm - 80 c/sec/cm  
Cable speed: 5 m/min 2 m/min

Operator : B. Young

Fig. 8 v

<ul style="list-style-type: none"> <li>□ F Feldspar K Kaolin ≠ Calcite</li> <li>~ Py Pyrite</li> <li>Undifferentiated superficial formation</li> <li>(1) Silcrete</li> <li>(2) Calcrete</li> <li>(1) Disseminated carbonaceous mat.</li> <li>(2) Peat or coal interbed</li> <li>Dolomite</li> </ul>	<ul style="list-style-type: none"> <li>Limestone</li> <li>Marly limestone</li> <li>Marl</li> <li>Lutite, clay</li> <li>Sandy lutite</li> </ul>	<ul style="list-style-type: none"> <li>Silt (Pelite)</li> <li>Psammite</li> <li>Well sorted fine-grained sandstone (&lt;0.5mm)</li> <li>Well sorted medium-grained sandstone (≥0.5mm &lt;1mm)</li> <li>Well sorted coarse-grained sandstone (≥1mm &lt;2.5mm)</li> </ul>	<ul style="list-style-type: none"> <li>Poorly sorted coarse-grained sandstone (≥1mm &lt;2.5mm)</li> <li>Breccia</li> <li>Intraformational conglomerate</li> <li>Conglomerate</li> <li>Basement</li> </ul>
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## DRILL HOLE NO Kapi 33

DATE: 3.10.72

SITE { X: 150 m N 55° from Kapi 26  
Y: Profile B  
Z:

DRILLED

CORED

from	to	method	mud type	Ø
0	30.48	Rotary	Bentonite	4 1/2"

TOTAL DEPTH: Drilled: 30.48 m  
Logged: 30.60 m

REMARKS: No cuttings recovery  
between: 0 and 9.15 m  
22 and 30.48 m

GEOLOGICAL LOGGING Date: 3.10.72 geol. R. Carrie

SAMPLING Date: — geol. —

## ELECTRIC LOGGING

Date: 3.10.72  
Type: P - S.P.  
Device: Neltronic porta logger  
Scale  $\rho$ : 2 ohm/cm  
S.P.: 20 mv/cm  
Cable speed: 15 m/mn

Operator: B. Young

## GAMMA RAY LOGGING

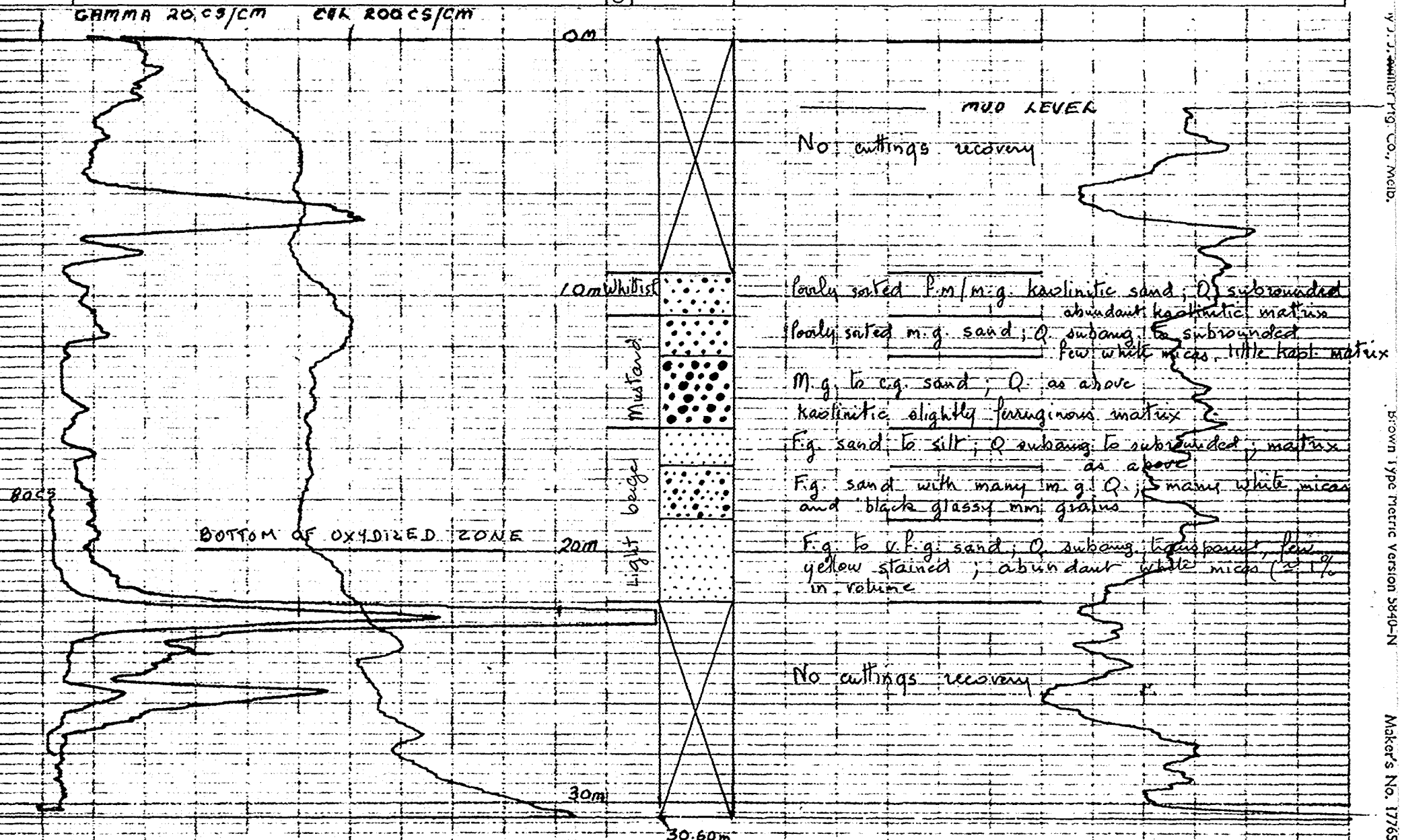
Date: 3.10.72  
Type:  
Device: Neltronic porta logger  
Probe: 1200 c/sec  $\approx$  875 ppm. U  
Scale: 20 c/sec/cm — 80 c/sec/cm  
Cable speed: 5 m/mn 2 m/mn

Operator: B. Young

Fig. 8 w

<p>□ F Feldspar K Kaolin ≠ Calcite ~ Py Pyrite</p> <p>Undifferentiated superficial formation</p> <p>(1) Silcrete (2) Calcrete</p> <p>(1) Disseminated carbonaceous mat. (2) Peat or coal interbed</p> <p>Dolomite</p>	<p>Limestone</p> <p>Marly limestone</p> <p>Marl</p> <p>Lutite, clay</p> <p>Sandy lutite</p>	<p>Silt (Pelite)</p> <p>Psammite</p> <p>Well sorted fine-grained sandstone (&lt;0.5 mm)</p> <p>Well sorted medium-grained sandstone (&gt;0.5 mm &lt;1 mm)</p> <p>Well sorted coarse-grained sandstone (&gt;1 mm &lt;2.5 mm)</p>	<p>Poorly sorted coarse-grained sandstone (&gt;1 mm &lt;2.5 mm)</p> <p>Breccia</p> <p>Intraformational conglomerate</p> <p>Conglomerate</p> <p>Basement</p>
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Sample No	Gamma Ray & S.P.	Colour	Log	Petrological description & Resistivity
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055

REPORT ON SEISMIC SURVEY

CUMMINS

SOUTH AUSTRALIA

FOR

LE NICKEL (AUST) EXPLORATION PTY. LTD.

24-28 COLLINS STREET

MELBOURNE, VICTORIA

BY

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SHEET 18 SEISMIC BEDROCK PROFILES - CUMMINS AREA

I. INTRODUCTION

Exploration by Endeavour Oil in 1971 in the Cummins area of South Australia indicated the presence of buried Tertiary channels.

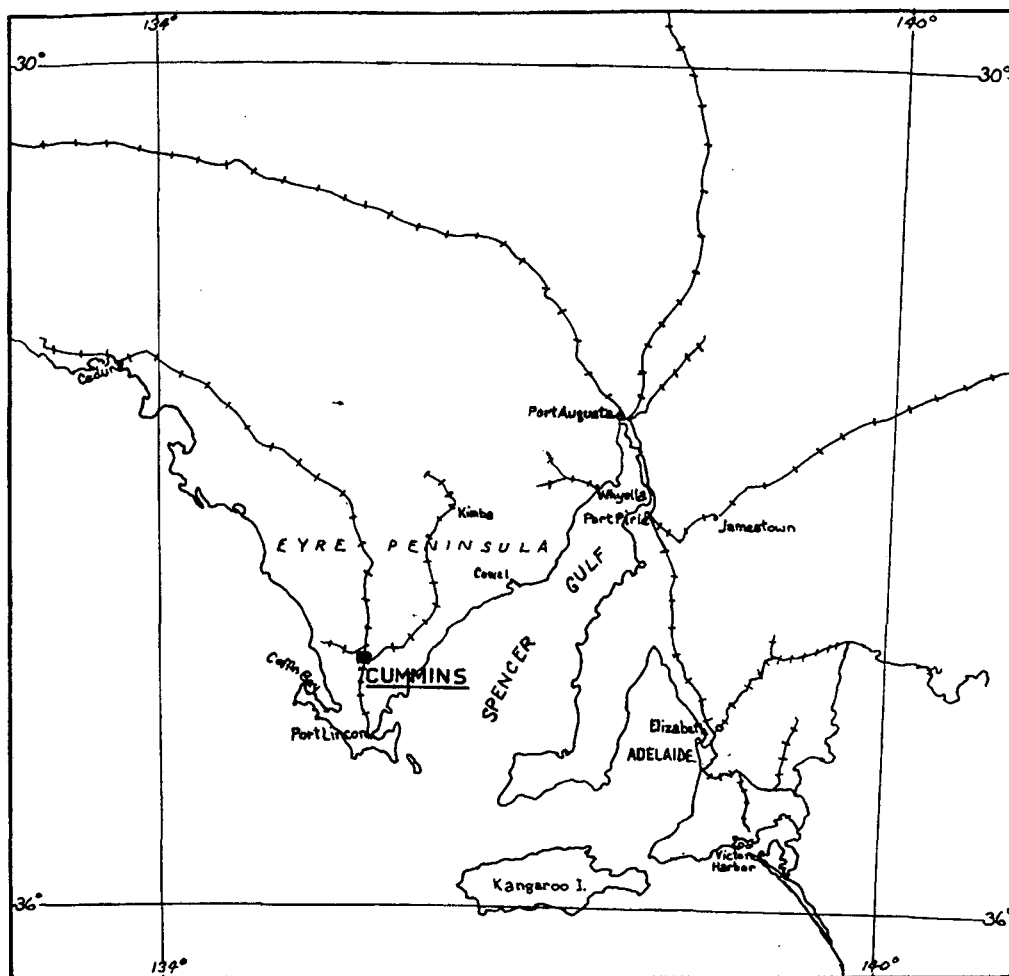
Subsequent discussions with Le Nickel (Aust.) Pty. Ltd. resulted in a joint venture programme to test the area for sedimentary Uranium deposits.

Le Nickel (Aust.) Pty. Ltd. decided to use seismic methods to outline the position of these channels. To reduce costs it was also decided to try shallow reflection methods using the new signal enhancement unit. If this method was not successful then normal refraction methods could be undertaken. However, a limited refraction survey was required to give the velocity of the Cainozoic sediments. As a final check, a series of holes were to be drilled in the most suitable areas to check the velocity of the sediments directly. This would reduce the discrepancies produced between seismic depths and drill hole depths when surface measurements of the sediment velocities are used.

In all, 47 miles of reflection surveying was undertaken after it was found that it provided similar depth data to the refraction spreads. Refraction spreads were undertaken to provide field bedrock profiles for the suitable positioning of the drill holes.

Twelve drill holes were logged to give the variation of velocity of the Cainozoic sediments.

## LOCALITY MAP



CUMMINS  
SOUTH AUSTRALIA

SCALE 1:6,000,000



II. GEOLOGY

The basement in the vicinity of Cummins consists of granite and metamorphosed Pre Cambrian sediments. The main two outcrops of the Pre Cambrian metamorphics are located in the hills to the west of Cummins at Coffin Bay and to the east of Cummins in the coastal hills flanking Spencer Gulf.

The survey indicated depths to basement in excess of 100 metres to the west of Cummins. Within these basements low Tertiary sediments occur. These sediments consist of sands, gravel, clay and peat horizons.

Quaternary sands, clays and calcrete overlie the Tertiary sediments.

### III. METHOD OF SURVEY

#### (a) REFLECTION SURVEY

##### (i) General

This method makes use, as its name indicates, of reflected seismic waves. These waves travel downwards into the earth and are partially reflected back to the surface from some subsurface boundary. Since travel times depend upon depth to the boundary, measurements should permit depths to be computed.

The method offers several advantages over refraction. Greater depths are obtainable, hammer distances are smaller, field work is more rapid and subsurface boundaries can be mapped continuously.

To obtain reflections with the Bison equipment the enhancement principle is used. This principle enables identification of reflections from 50 feet to several hundred feet below ground level.

The unique characteristic of reflected waves lies in the fact that they travel almost horizontally when they return to the surface. This means that the wave front at different points of the surface are at the same phase position with the refracted waves and all seismic noise arrives horizontally or at an angle close

to the horizontal so that the points are reached at different phase positions. Thus by stacking the arrivals from a seismic source, the distance of the source being varied, reflections will be enhanced, and refractions and ground roll cancelled. This principle is outlined in more detail in the section on field procedure.

(ii) Technical Data

The Bison 1570 B signal enhancement seismograph has been arranged into eight functional systems. These are: - the display and front panel, the counter board, the character deflection board, and the deflection board. The display and front panel controls permit viewing of the waveform, logarithmic geophone gain control, marker positioning, sweep selection, geophone selection, power on-off control and CRT intensity and focus adjustment. The power supply circuit board is used to supply the required voltages to operate the circuitry by stepping up the battery voltage. The signal conditioner board amplifies and digitizes the geophone output signal and provides the summing point for signal enhancement. The memory circuit board stores the digitized geophone signal and converts it to an analog signal for the CRT display. The clock board supplies



the timing signals and programming for the circuitry. The counter board provides additional programme circuitry and an elapse time counter for the characters. The character deflection board generates the marker and provides the amplification of the information to be displayed on the CRT.

(iii) Interpretation Difficulties

The limitation of the reflection method is the lack of direct measurement of velocity. There are three ways to measure the velocity which will aid in the interpretation of the data.

Firstly a series of refraction spreads can be run which will give the main velocity units above basement. The limitations of this technique are outlined in the refraction discussion. Hence this method provides only a velocity value for initial reduction.

Secondly the normal movement times can be measured and a  $T^2 - X^2$  plot obtained. The square root of the inverse of the gradient of the plot gives the velocity found immediately above the reflection. However, with the Bison signal enhancement unit difficulty in measurement is found since the unit has a single geophone.

Thirdly the down hole measurements give directly the variation of velocity with depth. This enables the

reflection profiles to be connected to depth more closely than in the two previous techniques.

(iv) Field Procedure

The method of identification of reflection events is based upon the work of T. Meidar (1969). A series of hammer blows were undertaken over the wavelength of the surface waves. These are summed using the signal enhancement principle of the Bison seismograph. The average span of hammer blows for this survey was 15 feet. The first source point was located approximately five feet away from the geophone.

It must be noted that except by the  $T^2 - D^2$  process or TAT process, the velocity used to determine the depths of the various horizons remained unknown. To provide the conversion of reflection times to depth, a series of refraction spreads were undertaken on each of the reflection traverses.

Also, an uphole survey was conducted to measure the velocity of the sedimentary section and to find the one way time of the bedrock reflection.

(b) REFRACTION SURVEY

(i) General

The refraction survey was completed with an Electro-technical Laboratories Porta Seis Engineering

seismograph. Refraction spreads were undertaken at approximately one mile intervals along all the traverses surveyed by reflection. The refraction survey indicated the increase of velocity with depth and the possible depth of each of these horizons. The limitations of a refraction survey are two.

A possible thin intermediate layer may exist which does not give rise to a first event. The seismic graph would normally be interpreted as two layers. The depth of the supposed second layer would be shallower than the true depth. If the true second layer is suspected to be present then a limiting value of the second depth can be estimated. The greatest possible depth can be computed by drawing the imaginary  $V^2$  onto the observed curve depth and computed by using  $X_{C1} = X_{C2} - X_C$ . The true depth of the lower horizon lies between these two values.

The second possible error can be due to the presence of a low velocity layer in the section. This situation can occur in consolidated sediments where there is a continual variation in the type of material present. Also a thin layer of heavily weathered bedrock can occur between the sediments and the weathered bedrock refractor. On this basis the calculated depth is deeper than the true depth.



(ii) Technical Data

The Seismograph used was built by Electro Technical Laboratories of Huston Texas. The Company code name was Er-12 commonly called the "Porta-Seis".

Permanent recording of the galvanometer traces is by means of Polaroid photograph. The maximum timing for the record is approximately 400 milliseconds.

14Cps Geophones were used for the survey.

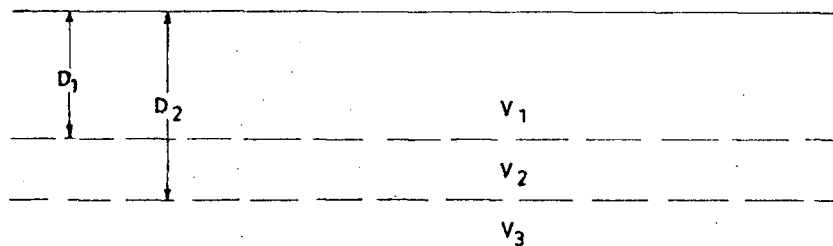
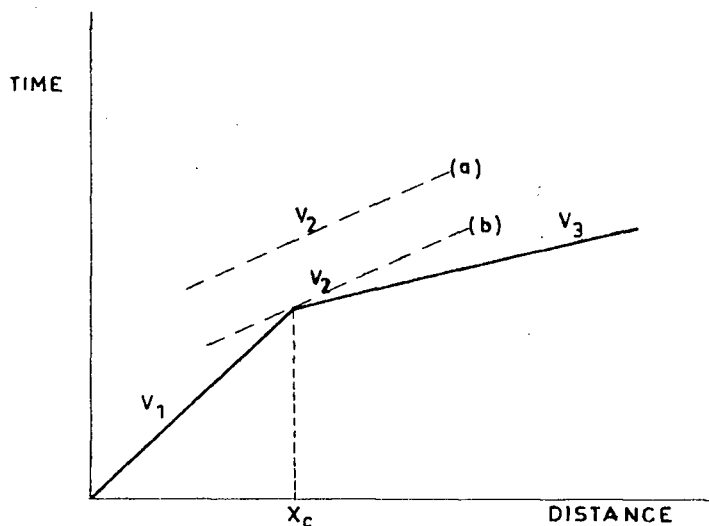
(iii) Interpretation Difficulties

The two major limitations of the method are:-

1. Possible Error Due To A Thin Intermediate Layer

A subsurface condition which may occasionally arise is shown in Figure I. A thin intermediate layer is assumed to be present. The seismic graph is shown immediately above the subsurface section. If the  $V_2$  segment is at any position above (b) - for example, at (a) - then it will not appear on the seismic graph. (The seismic arrivals are present, but it must be recalled that the Seismograph reads only the first arrivals, which would here be either the  $V_1$  or  $V_3$  arrivals.)

Figure I. Case of a Thin Intermediate Layer



The seismic graph of Figure I would normally be misinterpreted as two straight line segments using the formulas of V.B. The computed depth will be slightly shallower than true depth  $D_2$ , and the presence of the  $v_2$  material will not be recognized.

In most cases, these errors are not of great importance.

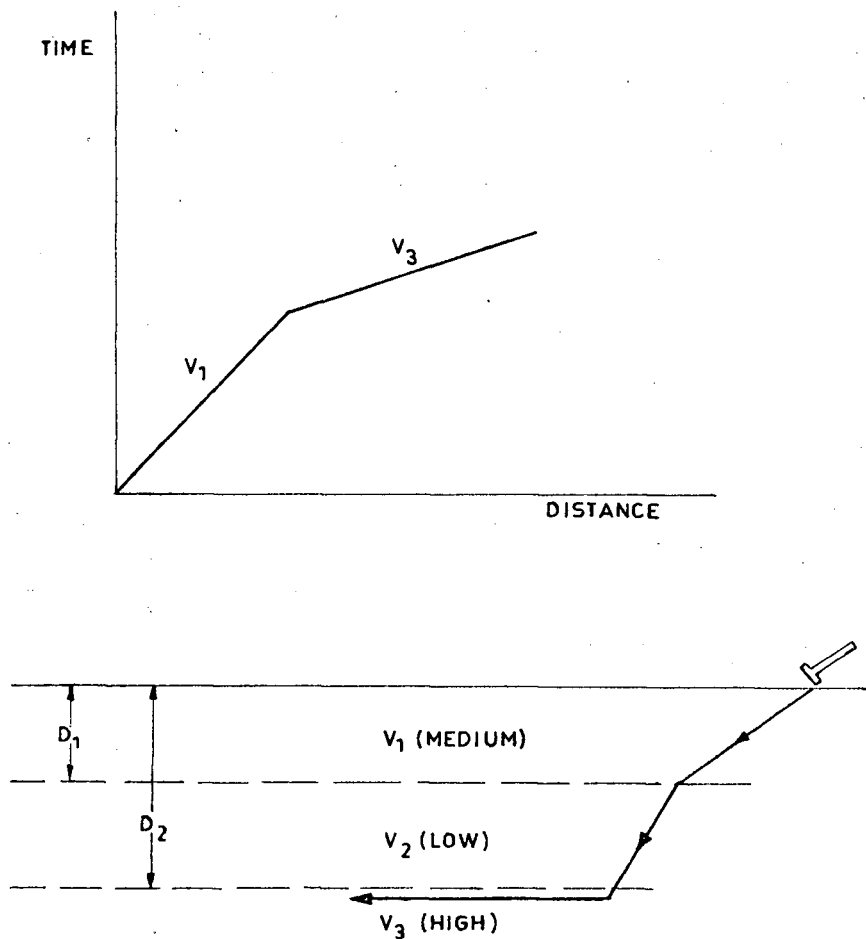
If the  $V_2$  layer is suspected to be present, then limiting values can be obtained for the depth  $D_2$ . The shallowest possible depth is that computed in the preceding paragraph. The greatest possible depth is computed by drawing in the imaginary  $V_2$  segment labelled (b) in Figure I; depths are computed by the formulas of V.D., using  $X_{c1} = X_{c2} - X_c$ . The true depth  $D_2$  will lie somewhere between these two limiting values.

## 2. Possible Error Due to a Low Velocity Layer

Another subsurface condition which may occasionally arise is shown in Figure II. Here a low velocity layer exists overlying the high velocity material. (An example might be sandstone over shale over limestone, or gravel over clay soil over rock.) Recalling Snell's Law, we see that the ray path is bent as shown in the figure, so that no ray path can exist which has its deepest point in the  $V_2$  layer. The seismic graph will appear as shown in the upper part of the figure, and would be misinterpreted as two straight line segments using the formulas of V.B. The computed depth would be



Figure II. Case of a Low Velocity Intermediate Layer



slightly deeper than  $D_2$ , and the presence of the  $v_2$  layer would not be recognized.

The existence of this condition can never be recognized from the seismic data alone. The only protection against it is to check seismic results

against known depths from drill holes or road cuts at every opportunity. Fortunately, the condition is relatively uncommon.

(iv) Field Procedure

Geophones were placed 100 feet apart with the provision for the 12th geophone to provide reciprocal times. The shot point distance in most cases was one hundred feet.

A charge of  $1\frac{1}{2}$  lbs of Ammonium Nitrate 60 was placed at a depth of 3 feet. This gave usable recording distances up to 1300 feet. The limiting factor for refraction was the depth of the unweathered and unjointed basement.

The arrival times were taken off the polaroid film which had ten millisecond time breaks. On all of the polaroid films there was little or no shot point crossfeed.

(c) UP-HOLE MEASUREMENTS

(i) General

The up-hole measurements were taken with the Bison seismograph using a hammer source and down-hole geophone. The characteristics of the down-hole geophone Pc-25/65C 11D digiphone are supplied as Appendix F.

The geophone was lowered to the bottom of the hole and the direct arrival time measured. The phone was then raised up the hole at either 5 or 10 metre spacing and measurements taken. It was found that signal enhancement was a necessity to eliminate cable noise and to amplify the seismic wave.

(ii) Technical Data

The natural frequency of the down-hole phone was  $8.0 \text{ Hz} \pm .5 \text{ Hz}$ . The standard wire resistance at  $25^{\circ}\text{C}$  was  $380 \text{ ohms} \pm 5\%$ . Open circuit damping was  $39\% \pm 10\%$ .

The open circuit overswing ratio was 102.60. The copper weight was 12.1 gms and the total moving mass was 16.1 gms. Intrinsic sensitivity with 380 ohm coil was 0.91 volts/m/sec. Frequency range with tilt was less than 0.2 Hz at  $20^{\circ}$ . Maximum coil excursion was 0.10 inch p-p. The damping constant with the 380 ohm coil was 580. Flux from bottom to top of winding was  $2.1 \times 10^4$  Maxwells.

(iii) Interpretation Difficulties

Interference with the results of measurement can be caused by movement of the cable and also the transmission of the seismic wave down the mud column. The signal enhancement was used to eliminate cable noise. The



second feature can be found from the results as the mud velocity is relatively constant.

(iv) Field Procedure

The hammer was placed at 5-6 metres from the top of the hole. The effect of this placement has its greatest value on the shallow measurements. The observed times were corrected to the top of the drill hole. These results were then analysed by least square methods to determine the variation of the average velocity with depth. The results conform to exponential increase of velocity with depth. The reflection times of weathered basement were then calculated using the least square approximation.

#### IV. TOPOGRAPHIC SURVEY

The topographic survey was carried out by K. Patterson, Licensed Surveyor of Perth.

The traverses were put in on a compass bearing. Then the pegs were aligned by sight along the line with taped intervals. After the completion of the pegging the lines were levelled and the results supplied with this report to the nearest 1/100 of a metre. The peg interval was 200 feet.

#### Distance in Line Miles

<u>Line</u>	<u>Traversing</u>	<u>Levelling</u>
Test	5.265151	5.265151
A	5.000000	5.000000
B	10.227272	7.424242
C	8.446969	8.446969
D	14.015151	14.015151
E	<u>13.863636</u>	<u>13.863636</u>
Total	56.818179 miles	54.015149 miles

± Pe 0.005% using Paterson's third method

# V. RESULTS

## (a) UP-HOLE MEASUREMENTS

### (i) General

The following holes were used to determine the sedimentary section velocity profile. The geology has been supplied by Le Nickel (Australia) Exploration Pty. Ltd.

Hole No.	Profile	Peg	Weathered Rock	Fresh Rock	Depth Logged
13	B	38	124.6	133	133
14	B	25 metres S.E. 200	78.40	83.60	125
15	A	10 metres E. 107	27.60	30.40	304
16	Test	92	63.20	68.00	68.0
18A	C	31 metres W 60	37.00	41.20	41.2
19	C	130	37.60	not reached	47.6
20	D	10 metres E 242		59.20	59.2
21	D	76	54.80	-	68.2
22	E	16 metres W 119	61.20	-	77.5
23	E	11 metres W 163	37.00	44.0	44.0
25	D	3 metres W 22	30.00	32.40	44.0
26	B	10 metres E 149	113.6	125.0	72.0



(ii) Test Line

The hole logged is located at peg 92. The least square exponential fit to this set of data was

$$t = 4.8515 z^{.5562}$$

the correlation coefficient was .98, indicating a reasonable fit to the calculated exponential curve. The travel time from the fresh rock was 45 milliseconds. This gives a two way time of 90 milliseconds for the reflection. The reflection curve for weathered bedrock was interpreted on this basis and also as the first reflection horizon above the refraction intercept times.

(iii) Line A

The hole logged on this traverse is located at 10 metres east of peg 107. The weathered basement was located in the hole at 27.6 metres below ground level. The hole terminated on fresh rock at 30.4 metres. The least square fit to the observed data was

$$t = 8.97004 z^{.29465}$$

t is the reflection time at depth z.

The smaller increase of time with depth could indicate that the section is very close to fresh rock. Also the correlation coefficient of .73 indicates a wider scatter in the observed times.

(iv) Line B

To obtain the depth of bedrock the following procedure was undertaken. First the depth of weathering was obtained by multiplying the velocity of the weathering zone with the corresponding half way time of the reflection. This zone velocity varies between .635 to 1.272 Km/sec so the average velocity of .875 Km/sec was used.

To obtain the depth to reflection of fresh rock the bedrock velocity was used with the following formula:

$$\text{depth} = \frac{(\text{Time observed} - \text{Time of weathering})}{2} \times \text{Bedrock}$$

velocity + depth of weathering.

The following velocities were used to compute the depths:

from peg -16 to peg 138	velocity 1.45 Km/sec
from peg 138 to peg 150	" 2.1 Km/sec
from peg 150 to peg 269	" 1.725 Km/sec

The course for the various velocities is explained in page 24 of this report.

Finally, this method was used only for profile B because of the great variation of the bedrock velocities. The equation of least fit used to calculate the depth of other profiles could not be applied.

The down-hole survey has indicated that there is a range in velocities within the sediments which could correlate to calcrete, peat horizons and sands.

Closer study of the results would require access to the geological logs and gamma and electric logs.

(v) Line C

This traverse has been broken up into three sections 0 - 98, 98 - 159, 160 - 200, by the presence of lake systems. Kapi 18A is located on the 0 - 98 section and Kapi 19 on the 98 - 159 section. Both holes indicated shallow bedrock 37.0 and 37.6 metres below ground level. Both of these holes have been logged and the following characteristics obtained:

Hole No.	Profile	Peg	Equation
18A	B	60 (31 metres W)	$t = 17.61219Z^{.146714}$
19	B	130	$t = 11.20Z^{1.06531}$

The correlation coefficients for these two holes were .66 for Kapi 18A and .99 for Kapi 19. Kapi 19 is anomalous in as much as it has a larger exponential than normally expected. It is hoped that the lower exponentials are indicative of shallow bedrock.



(vi) Line D

Three drill holes were logged to provide correlation of the reflection data with the geological section.

Kapi 20 is located at 107 metres east of peg 242, Kapi 21 at 16 metres west of peg 76 and Kapi 25 3 metres west of peg 22. The following time-depth equations were obtained for these drill holes:

Hole No.	Equation	Correlation Coefficient
Kapi 20	$3.53124Z .6277$	.99
21	$3.20 Z .45527$	.96
25	$1.55415Z .85549$	.98

Kapi 20 encountered fresh rock at 59.2 metres and Kapi 21 at a depth greater than 54.8 metres which is the weathered basement. Kapi 29 encountered weathered basement at 30 metres and fresh basement at 32.4 metres. There seems to be a decrease in time to the basement at Kapi 25 representing a large exponential factor.

(vii) Line E

Two holes were logged on line E at locations Ell9 and El63. These are numbered Kapi 22 and 23 respectively. The time depth relationship for these two holes are

Hole No.	Equation	Correlation Coefficient
Kapi 22	$t = 2.32167Z .70955$	.99
23	$t = 1.67615Z .73580$	.98

of the two holes Kapi 23 is the shallowest with fresh rock at about 44 metres below ground level. In Kapi 22 the weathered rock was located at a depth of 61.2 metres below ground level.

(b) REFRACTION SURVEY

(i) General

The seismic results were plotted manually, the critical points noted and the results fed into a Diehl scientific programmable calculator. There was a least square fit to the observed results and the velocities and time intercepts were calculated. From this the critical angle and dips were calculated and the true depths of the various refractions of the shot points measured.

(ii) Test Line

The results of the survey along the traverse are presented in Appendix D. The refraction survey indicates that generally three zones are present. The surface zone .944 to 1.127 Km/sec represents the sediments. The second zone 1.742 to 2.815 Km/sec represents weathered basement. The third zone represents unweathered bedrock and has a range of 4.542 to 5.682 Km/sec. A velocity of this value for unweathered rock represents granite or metamorphics. There is evidence that under certain conditions the

weathered zone is hidden e.g. section 94.25 to 100.25E. This hidden layer can be found on other traverses. Buried channels represented by variation in depth to weathered granite may not be necessarily represented by the variation in depth to the solid granite.

(iii) Line A

The basic pattern of sediments, weathered rock, and unweathered rock is located on line A. The sediment velocity varied from .985 to 1.456 Km/sec. The weathered rock varied from 1.538 to 1.996 Km/sec. The unweathered bedrock velocity was 4.563 to 6.758 Km/sec. Hidden layers (the weathered zone) are suspected on traverses 65.5W - 70W and 92 W - 98.5W. It is noticed that these could be from the refraction section of the sedimentary section. The depth to the intermediate layer varied from 5 metres to 27 metres below ground level. The fresh bedrock varied from 32 metres to 107 metres below ground level. It must be pointed out that if high velocities are located within the sedimentary section, as is indicated by the down-hole investigations and certain refraction traverses, then on occasions no refractions will be observable from the weathered bedrock horizon. Therefore, by itself, refraction will not necessarily map the weathered horizon and will not clearly outline buried channels.



(iv) Line B

The refraction results for line B indicate that with the deepening of the section an additional velocity zone is located within the sedimentary section. This gives four velocities for the section. The surface zone varies from .635 to 1.272 Km/sec. Below this an additional zone of 1.077 Km/sec to 1.713 Km/sec is found. The lower range of this zone overlaps weathered bedrock ridges. The weathered bedrock varies from 1.713 Km/sec to 3.722 Km/sec. In some cases e.g. peg 69 - 75.5, this weathered zone is hidden. The unweathered basement has a velocity of 7.620 - 12 Km/sec. Again such high velocities indicate granite and metamorphic rocks. Solid unweathered basement was not located on traverses 32 - 39.5, 48 - 54.4, 151 - 157.5, 235 - 241.5. The maximum depth to the weathered horizon was greater than 143 metres below ground level at peg 39.5.

(v) Line C

All the refractions on this traverse indicate two horizons with velocity ranges of 1.272 to 1.686 Km/sec and 4.956 to 5.230 Km/sec. The higher velocity is certainly unweathered granite. The top velocity indicates unconsolidated material with highly weathered bedrock. The solid unweathered bedrock is hidden by

the presence of unweathered bedrock at shallow depths. The depth to the unweathered granite varies from 18 to 49 metres below ground level. This figure would be changed if there is a hidden layer. The true depth would be deeper than calculated.

(vi) Line D

All refractions on line D except for the location 355 - 361.5W show only two velocities. The top velocity is 1.007 to 1.471 Km/sec and represents the sediments. The lower velocity zone is 4.149 to 5.843 Km/sec. This represents the unweathered granite. The intermediate zone, representing solid weathered basement, was not located except along traverse 355 - 361.5 W where an intermediate velocity of 2.922 Km/sec was measured. It is considered that the intermediate zone is present along this traverse but is hidden by the high basement velocity or represents only a marginal increase over the sediment velocity.

(vii) Line E

The results from the refraction survey are similar to the results on traverse D. Two velocity zones are present. The top zone has a velocity of .829 to 1.645 Km/sec. This is thought to represent sediments

and weathered basement. The unweathered basement has a velocity of 5.032 to 5.456 Km/sec. The depth to the unweathered granite varies from 24.65 metres to 75.5 metres below ground level. The same limitations apply to this traverse as apply to lines C, D and E.

(c) REFLECTION SURVEY

(i) General

The results of the reflection survey have been plotted as depth-time sections. The intercept times and the drill holes were then incorporated on these profiles. This enabled the weathered granite or bedrock horizon to be identified. The times for this horizon were then taken off the records and converted to depth by means of the calculated time-depth equation. The regions to which the drill hole data applies have been incorporated on the reflection plan.

(ii) Test Line

The reflection results along the test line indicate that both the unweathered and weathered bedrock levels can be identified. The reflection survey indicates that from peg 1 to peg 51.25 the weathered zone exists as a hidden layer. The reflection survey indicates that the deepest section along this portion of the profile is in the vicinity of peg 23. There is a sudden deepening of the channel between peg 21 and

peg 24 and this may represent the removal of most of the weathered granite or bedrock. These channels will be amplified on the depth section. In the vicinity of peg 54 the weathered bedrock has a thickness of approximately 56 metres and consequently is outlined by the refraction survey. In the vicinity of peg 1 the sediments have a velocity of approximately 1.816 Km/sec and most likely represent weathered bedrock or the presence of calcrete. To the east of peg 77 the thickness to weathered bedrock decreases to a value of approximately 10 - 30 metres. This zone also correlates to a buried channel. The sediments in this zone have a maximum value of 1.741 Km/sec at peg 105. The weathered bedrock again increases in thickness and from this peg to the eastern end of the traverse weathered basement is close to the surface.

There are three characteristic reflections along this traverse. The first horizon is located at a two way reflection time of approximately 15 - 30 milliseconds. This zone most likely corresponds to the top of the Tertiary sediments. The second horizon is the weathered bedrock zone. Finally the remaining profile indicates the fresh bedrock. A small number of reflections can be observed in the sediments and multiples of these



primary waves are also present.

(iii) Line A

The reflection survey indicates three important reflections. Reflection A has a two way time variation from 15 to 35 milliseconds and possibly indicates the top of the sediments derived from the weathered basement, and the base of recent sediments. It is proposed that the solid weathered basement lies below the horizon at a two way reflection time of approximately 40 to 80 milliseconds. The reflection layer below this is the unweathered basement which corresponds to the 4 - 5 Km/sec refraction zone.

The reflection results plus the seismic refraction indicate that over most of this traverse bedrock is located at shallow depths.

(iv) Line B

The reflection survey has indicated that a reflection can be mapped above the high velocity refractor which is interpreted as unweathered and unjointed bedrock. The bedrock refractor can also be followed on the reflection data. Within the deepest portions of the bedrock a reflector above the weathered basement can

be seen between stations 23 and 82. The reflectors above bedrock at the positions of shallow bedrock are not continuous and are difficult to correlate.

Closer interpretation is possible when specific areas are chosen for follow up investigations.

(v) Line C

The refraction data and the down-hole survey indicate that the reflection coinciding with the weathered bedrock is the first horizon. This reflection varies from 15 to 60 milliseconds in two way time.

The deeper reflections correlate to either multiple reflections or are produced by shear zone weathering patterns within the crystalline bedrock. The most noticeable shear zones are located at peg 36 and peg 41.

(vi) Line D

The results along this traverse indicate that the pattern of reflections obtained on this profile are slightly different to results on traverse C. There is on traverse D the appearance of horizontal weathering. This pattern changes to the west of peg 232.

There is on the depth-time plates the presence of two wide buried channels. These zones have an

intermediate reflection which is interpreted as the top of the Tertiary sediments.

The reflections obtained below the unweathered velocity zone could represent shear zones and reflection multiples.

The thickness of weathered basement along the traverse is small compared to Line B. This probably accounts for the fact that it is hidden by the unweathered zone.

(vii) Line E

The results obtained on this profile indicate that a section deeper than that found on line D is present.

The profile shallows to the east of peg 105 and to the west of peg 138. It is considered that the weathered basement is 10-30 metres thick along the major portion of this traverse.

This indicates why the intermediate zone was not determined along this profile by refraction.

## VI. DEPTH INTERPRETATION

### (a) General

Following the calculation of depth by the use of the variation of velocity with depth curves, these values were plotted in profile form. The depth of bedrock obtained from drilling has also been incorporated on the plan. The horizontal scale is 100 metres to the centimetre and the vertical scale is 10 metres to the centimetre. The location and values obtained from the refraction survey are also included.

### (b) Test Line

The test line results indicate the position of two large channels located at 23E and 93E. The depth of these two channels are 80 and 70 metres respectively.

These two major features have been substantiated by drilling.

The western basin is narrower than was expected. The channel is located in a shallower wider feature located between drill holes 6A and 7A.

Three smaller channels are located at 10E, 125E and 137E. However, these basins are possibly only 10 metres in depth and may not be of geological interest.



(c) Line A

This traverse is located in the south-east corner of the survey area. The variation of the depth to basement is most pronounced on the eastern end at peg 2W, and correlates with the deep eastern channel located on line B.

Three other channels are located at 52W, 68W and 125W. West of peg 68, excluding the channels, the depth to basement approximates 20 - 50 metres. At peg 69 there is a rapid change in depth to basement and this may represent an old lineament. The remaining two basement lows, 95W and 20W represent possible represent possible channels.

(d) Line B

Four large channels are possible on this traverse. They are located at pegs -16W, 60W, 150W and 178W. Of the four channels 60W is the widest and deepest zone on this traverse. The channel at -16W has not been mapped completely as it is located beneath the township of Cummins.

(e) Line C

Bedrock along line C is located at approximately 20 - 30 metres below ground level. There are no obvious channels and no further investigations are considered to be necessary on this line.

The results indicate that the area can be divided into two areas by line C. The southern basin is covered by Test line, line B and the eastern portion of line A. The northern basin is covered by lines D and E.

(f) Line D

The seismic depth sections indicate the existence of two wide channels. These channels are located between 50W - 140W and 197W - 255W and have depths of up to 50 - 80 metres. Outside these zones the depth to rock is between 10 - 30 metres. It is considered that these two channels are not connected to the channels south of line C.

(g) Line E

The depth investigations along this traverse were confined to the area between pegs 92W to 248W. A wide channel has been mapped between pegs 100W and 175W. As in the previous lines the filtered curve reflects the depths obtained by drilling more closely than the raw reflection curve.

## VII. CORRELATION OF GEOLOGY AND GEOPHYSICS

The correlation of geology and geophysics is shown in plate form. The overall correlation is immediately seen. The drilling has substantiated that line B is the deepest section and that lines A and C indicate basement ridges. The test line is intermediate between lines B and C. To the north of line C there is an increase in depth to the top of the weathered bedrock.

The smaller intermediate basins indicated along each line by the seismic reflection profile may be worth further investigation.

Hole No.	Traverse Peg	Geology Depth FR	Geophysics Reflection WP Smooth Profile	Difference
13	B38	133	125	- 8
14	B(25metres SE) 200	83.6	83.0	NIL
15	A (10metres E) 107	30.4	32.0	+1.6
16	Test 92	68.0	69.0	+1.0
18A	C (31metres W) 60	41.2	33	-8.0
19	C 130	37.6	32.0	+4.6
20	D 242	59.2	45.0	+14.0
21	D 76	54.8	46.0	+8.8

Hole No.	Traverse Peg	Geology Depth FR	Geophysics Reflection WR Smooth Profile	Difference
22	E (16metres W) 119	61.2	67	-5.8
23	E (11metres W) 163	440-55.0	43.5	-8.0
24	E130	77.6	84.0	-6.4
25	D (3metres W) 22	32.4	25.0	+7.0
26	B (10metres) E) 22	125.0	110	-12
27	B138	129.6	113	-16
28	B 158	123.3	95	-28



# VIII. ACCURACY OF DEPTH DETERMINATION

From the previous plate it can be seen that the average error in determining the depth of the weathered basement is approximately 5%. One factor that has not been mentioned previously is the oscillation that can be seen on the depth profiles. This oscillation is noticeable as there is a 10:1 exaggeration of the scales. This variation in depth is considered to represent the variation in time produced by the stacking of arrivals and it could amount to  $\pm 2$  milliseconds. It is considered that the smoothed profile represents more realistically the variation of weathered bedrock. The average variation above the mean on relevant traverses are as follows:-

Test Line	Approximately $\pm 10$ metres
Line A	Approximately $\pm 47$ metres
Line B	Approximately $\pm 20$ metres
Line C	Approximately $\pm 10$ metres
Line D	Approximately $\pm 17$ metres
Line E	Approximately $\pm 17$ metres

The smoothing of the curve was done by visual inspection, this is considered to be sufficient for this survey.

## IX. CONCLUSIONS

The present survey indicates that the sedimentary section can be divided into two units by reflection A.

The seismic reflection method has mapped the weathered zone not outlined by the refraction method.

The zone indicated by drilling corresponds to the fresh rock which has a velocity range of 1.9 - 2.8 Km/sec. The faster seismic horizon represents a deeper zone within the bedrock which was not located by drilling.

The seismic refraction method has identified the weathered basement horizon on line B and test line. On the remaining lines the weathered zone occurs as a hidden layer.

The application of other geophysical methods e.g. magnetics are considered to be limited. The magnetic pattern would follow the unweathered bedrock and this does not necessarily outline the buried channels.

There are three major channels and it is considered that further investigations connecting the channels between profiles may indicate further deep sections.

## X. RECOMMENDATIONS

If the channels located by this survey are of economic importance it is considered that further investigations connecting the various channels may be warranted.

From the reasons outlined in this report it is considered that only seismic reflection techniques would give the depth to the weathered bedrock. Although refraction would give the weathered zone in the deepest section located in the vicinity of line B, there are problems as the area is under crop and is extensively farmed.

LINE "A"

Peg 1 - 5 Pasture  
Peg 5 Fence  
Peg 10 600' north of 20AD  
Bdy Sect  
Peg 5 - 10 Crop  
Peg 10 - 16 Crop  
Peg 17 Main Road  
17 - 27 Pasture very wet  
27A Fence N-S  
28 - 42A Pasture  
41 Mill  
42A Fence E-W  
43 - 45 Crop  
45A Fence N-S  
Gate near line  
46 Pasture  
Bend 40° south  
Peg 68 + 16' Fence  
68 - 89 Pasture  
79A N-S Fence  
82 Bend 40° N  
91 Main road  
92 - 95 Pasture (swampy)  
95 - 107 Pasture  
107 N-S Fence )  
107 + 24' )  
108-110 Crop  
110A E-W Fence  
111-122 Pasture  
122A N-S Fence  
122-132 Pasture



LINE "B"

B-12	School area
B-4 - 12	Pasture
B-3	House
B-2	Creek
B-2 - 55	Pasture N
B-23	Bend 175° 44'
B-24	N-S Fence open gate
B42	Bend N 178° 06'
B-55	End access
55-62	Pasture
B62	Road to Lettons
B-64	Bend 174° 38' (south side)
64 up	Mag 264 True E-W
Line over pasture to 74	
75	Drain no crossing
76-105	Crop
	No driving
106	Drain
109	Murwawe Hose
109-120	Crop
120	Water pipe on ground
120A	Main road
121-135	Pasture
136	Drain no vehicle crossing
137-148	Crop
149	Main road
150-154	Crop
155-164	Pasture
165	House on line
at 164-170	
	line is offset 200' north
170	Back on true line
Line is along fence thick scrub	

LINE "B" Continued

177	End scrub
177-18	Pasture
180-183	Scrub
183	N-S fence
183-196	Pasture
196	Drain no crossing
201	Fence
206	Track south from main road
	Yellow flagging on road
206-244	scrub - pasture
244	Boundary fence
	No gate 216 Mill
244	Track south from main road along fence
	Yellow flagging on road
244-246	Pasture 244 +21' peg at fence
247-257	Scrub
254	Fence no crossing
261	Concrete tank
270	Swamp end of line

LINE "C1"

1 - 13	Pasture
13-14	Main road
14-70	Pasture
24 + 182'	N-S fence
Fence (N-S)	
63	
C70-75	Scrub
76-77	Lake
77-98	Pasture and scrub

LINE "C2"

C200	End of line
199	N-S fence (B.M.)
199-200	Crop
200-188	Pasture
187A	E-W fence
187-183	Ploughed
182-177	Pasture
177-165	Crop
164	Lake
	No crossing
	access through shed
163	Line around lake
160	End true profile
160 - 1 to 160 - 23	
	Connecting line to road
C159-C98	Traverse along road



LINE "D"

D1	270 chains north Veelanna T.S.
D1-D231	Line along edge of road e-w
D231-257	Pasture good access
D258	N-S road Harris residence south of line (access to line)
D259 D265	Crop
D265	Pasture
D275	7 <sup>0</sup> bend south towards road
D288	Road
D288-D332	Line along road
D333-339	Line in direction of road through scrub
D339	N-S Road
D340-349	Crop
D349-353	Pasture
D354-356	Scrub
D356-368	Pasture
368A	N-S fence
D369-370	Crop
D370	End of line

LINE "E"

1 - 15	Along fence line	)
15	south of creek	)
		)
15	N-S fence gate	
29A	N-S fence gate	
37A	N-S fence gate	
46A	Fence (gate north)	
1-46	Pasture	
47	Crop	
	Track near line	
77	Pasture	
77	Electric fence	
77-91	Crop	
92	Main road	
93-119	Pasture	
Peg 97 + 94'	at fence	
120-136	Crop	
E136 + 17'	Fence peg	
E138-147	Pasture	
E147-155	Swampy	
156-175	Pasture	
E174 + 155		
E183A	N-S fence	
174-200	Crop	
E200A	Fence	
E201-215	Pasture	
215-231	Crop	
232-246	Pasture	
246	Road	
247-250	Crop	
	3 small paddocks access through Harris residence	
251-261	Pasture	
253	N-S fence no gate	
261A	E-W fence no gate access via road south of line	

LINE "F"

(Continued)

261-277	Pasture
E277+107'	peg on fence
E278	Main road
278-280	Scrub
281-287	Crop
287A	Fence (gate)
288	Pasture
309A	Crop
390A	N-S fence gate
310-321	Pasture
310+73	Peg at fence
321	Disused House
321A	N-S fence
322-330	Crop
331	Main road
332-336	Crop
336-337	Scrub
337-341	Crop
341	N-S fence
341-370	Pasture
345+98'	Peg at fence

# Appendix B

## Test Line Reflection Readings<sup>i.</sup>

110

### TEST LINE

Coordinate

Two Way Reflection Times

T1	6	39	78			
1.5		31	61			
2	10	28	63			
2.5	10	50				
3	8	51	96			
3.5	11	28	73			
4	16	56				
4.5	12	62				
5	10	20		Calcrete ridge		
5.5	3	12	46			
6	2	42				
6.5		28		Calcrete no response		
7	3	10	35	56	89	128
7.5	13	32	57	103		
8	4	12	23	40	72	
8.5	13	32	74	133		
9	13	65	102	138		
9.5	18	44				
10	16	36	59	99		
10.5	12	28	68			
11	4	29	57	103		
11.5	3	18	33	78	149	
12	11	20	30	59	97	
12.5	10	27	66			
13	8	18	27	40	58	
13.5	2	23				



ii.

TEST LINE

Coordinate		Two Way Reflection Times				
T14	14	46	62	81		
14.5	18	23	32	67		
15	11	22	30	58		
15.5	18	36				
16	16	34	53	105		
16.5	13	35	60	77	133	178
17	15	44	62	150		
17.5	8	34	57			
18	9	25	34	63		
18.5	10	23	27	62	132	
19	8	27	55	88		
19.5	8	21	30	62		
20	12	35	53	75		
20.5	16	19	31	47	77	
21	19	29	47	76		
21.5	25	38	73	96	131	
22	13	40	71	100		
22.5	28	54	78	104		
23	24	48	72	97		
23.5	24	48	62	87	109	
24	24	40	63	94		
24.5	21	35	50	62		
25	25	40	67			
25.5	22	43	81			
26	9	32	83			
26.5	19	27	45	66		

TEST LINE

Coordinate

Two Way Reflection Times

T27	Lake				
27.5	13	75			
28	6	39	50	103	
28.5	7	30	88		
29	15	41	51	61	
29.5	15	59			
30	20	49	58	71	
30.5	19	33	61	147	
31	20	62	99		
31.5	19	76			
32	18	50	77		
32.5	18	21	38		
33		50			
33.5		47	103		
34	11	36	92	175	228
34.5		32	68	196	225
35	21	48			
35.5	15	49	59	84	
36	14	48	87	133	
36.5	9	15	29	59	115
37	13	45	62		
37.5		36	65	83	
38	15	19	46	62	151
38.5	16	26	45	81	192
39	23	45	192		
39.5	26	41	65		

iv.

TEST LINE


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Coordinate Two Way Reflection Times

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T40	26	63				
40.5	11	27	42	64		
41	16	36	68			
41.5	7	48	71	117		
42	22	43	60	116		
42.5	14	22	58	79		
43	17	57	69	85	116	
43.5	17	41	59	84		
44	12	52	85	98	151	
44.5	13	41	92	154		
45	12	33	52	85		
45.5	17	32	53	71	86	118
46	15	32	44	95	154	
46.5	14	30	72	103		
47	19	27	70	141	167	220
47.5	11	49	80	113	149	181
48	11	45	54	91	143	
48.5	15	64	92			
49	14	27	49	99		
49.5	No response					
50	30	57	114			
50.5	35	37	89			
51	21	45	78			
51.5	19	80				
52	12	44	86			
52.5	22	35	62	89	124	

v.

TEST LINE

Coordinate		Two Way Reflection Times			
153	15	39	81	106	
53.5	14	47	94		
54	16	50	70	117	153
54.5	19	64	116		
55	17	45	67		
55.5	12	92			
56	27	66	93		
56.5	18	34	78	108	144
57	15	47	72		
57.5	13	51	99		
58	18	59	81	100	
58.5	17	72	102		
59	22	85	105		
59.5	22	71			
60	19	68			
60.5					
61	20	60	70		
61.5		54			
62	16	60	140		
62.5	23	60			
63	18	61	95	145	
63.5	17	57			
64	8	20	45	60	120
64.5	15	41	84		
65	10	20	35	50	90
65.5	26	43			



TEST LINE

Coordinate Two Way Reflection Times

T66	15	43			
66.5		47	74		
67	20	50	90		
67.5	23	53	129		
68	35	50	100	150	
68.5	25	46	96		
69	20	32	75		
69.5		42			
70	20	40	65	80	
70.5		53			
71	23	38	72		
71.5	21	31	50	60	103
72	23	48	68		
72.5	25	59			
73	14	30	44	66	80
73.5	15	29	56		
74	20	33	52	87	
74.5	16	25	47		
75	17	45	60	72	150
75.5	16	33	51		
76	20	50	120	190	
76.5	20	28	50	72	
77	20	58	75	87	
77.5		42			
78	21	70	85		
78.5	18	55			

TEST LINE

Coordinate Two Way Reflection Times

79	40	75	110			
79.5	6	28	40	68		
80		90	166			
80.5		60				
81						
81.5	2	24	60			
82						
82.5	19	30	50			
83						
83.5	20	57				
84						
84.5	3	15	58	73		
85						
85.5	7	58				
86						
86.5	9	69				
87						
87.5	6	66				
88						
88.5	8	59				
89						
89.5	10	64	86			
90	6	48	146			
90.5	18	50	98	145		
91	18	44	58	70	84	102
91.5	11	38	63	71	82	120



TEST LINE

Coordinate	Two Way Reflection Times						
T105							
105.5							
106							
106.5							
107	25	48	80				
107.5	24	30	58	82			
108	28	48	91				
108.5	33	73	159	211			
109	37	58	129	182			
109.5	27	39	62	92	184	228	
110	16	37	150				
110.5	16	33	56				
111	16	59	117				
111.5	11	32	52	80	114	200	
112	17	39	52	75	91		
112.5	16	29	62	124			
113	27	55	65	85	117		
113.5	36	69					
114	15	32	44	71	87		
114.5	16	25	78	99	130	173	238
115	13	26	48	76			
115.5	16	36	72	114			
116	15	35	58				
116.5	20	30	56	80			
117	23	50	66	95			
117.5	13	25	38	56	74	90	139



TEST LINE

Coordinate		Two Way Reflection Times					
T118	26	37	58	80	186		
118.5	8	30	38	78	121		
119	19	36	59	84	108	138	
119.5	32	72					
120	29 89						
120.5	32	44	91				
121	30	62	85				
121.5	33	45.8	59.9	76.6			
122		22	50	70	76	112	129.5
122.5	9	28	50	70	124	141	
123	10	24	62	82	118	114.5	
123.5	12	20	27	63	123	116.8	
124	8	28	63	123	116.8		
124.5	11	30	47	82	131	152	
125	12	27	63	107	116.8	140	
125.5	13	24	71	90	131	131.5	
126	12	22	33	61	91	113	
126.5	14	29	49	80			
127	10	24	50	87			
127.5	8	21	63	62	83	114.5	
128	13	23	68	116	126		
128.5		24	71	112	131.3		
129	12	23	63	116.8			
129.5	26	63	116.8				
130	17	27	66	122.2			
130.5	20	42	73	135.2			

TEST LINE

Coordinate Two Way Reflection Times

T131	25	35	60	119	111
131.5	9	34	63	116.8	125
132	19	51	60	111	133
132.5		24	64	118.3	
133	10	21	58	107.3	116
133.5	22	38	58	101	107.3
134	23	51	72	91	132 156
134.5	31	65	120.3		
135	33	49	62	164.7	
135.5	31	56			
136	26	58	107.3		153
136.5	19	29	40	74	81 109
137	31	56	103.6		
137.5	21	62	89	114.7	
138	18	35			
138.5	10	43			

# Appendix B

## Test line Height, Distance & Depth Values

121  
LINE "T"

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
1	60.9	74.40	28	(1) t = 4.8515499Z .55614887	6.7	67.7	
1.5	91.4	74.34	-		-	-	
2	121.9	74.28	14		1.9	72.4	
2.5	152.4	74.28	-		-	-	
3	182.8	74.48	40		12.7	61.8	
3.5	213.3	74.64	30		7.6	67.1	
4	243.8	74.29	35		10.0	64.3	
4.5	274.3	74.76	-		-	-	
5	304.8	74.81	27		6.2	68.6	
5.5	335.2	74.61	50		19.0	55.6	
6	365.7	74.77	40		12.7	62.0	
6.5	396.2	74.10	28		6.7	67.4	
7	426.7	74.81	34		9.5	65.3	
7.5	457.2	74.77	32		8.5	66.2	
8	487.6	74.37	23		4.7	69.6	
8.5	518.1	74.98	32		8.5	66.4	
9	548.6	75.03	49		18.3	56.7	
9.5	579.1	75.15	44		15.1	60.0	
10	609.6	75.27	59		25.6	49.6	
10.5	640.0	75.34	68				
11	670.5	75.58	69		32.2	43.3	
11.5	701.0	74.97	-		-	-	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
12	731.5	74.87	59		25.6	49.2	
12.5	762.0	"	-		-	-	
13	792.4	"	40		12.7	62.1	
13.5	822.9	75.10	43		14.5	60.6	
14	853.4	75.54	46		16.4	59.1	
14.5	883.9	75.92	64		29.7	46.2	
15	914.4	76.18	58		23.3	52.8	
15.5	944.8	76.34	55	(1)	22.6	53.7	
16	975.3	76.87	53		21.1	55.7	
16.5	1005.8	76.97	60		26.4	50.5	
17	1036.3	76.70	62		28.0	48.7	
17.5	1066.8	76.04	57		24.1	51.9	
18	1097.2	76.62	63		28.8	47.8	
18.5	1127.7	76.61	62		28.0	48.6	
19	1158.2	75.98	55		22.6	53.4	
19.5	1188.7	76.19	62		28.0	48.1	
20	1219.2	76.48	75		39.5	36.9	
20.5	1249.6	76.86	77		41.4	35.4	
21	12801.1	77.21	76		40.4	36.8	
21.5	1310.6	77.54	96		61.6	15.9	
22	1341.1	77.98	100		66.3	11.6	
22.5	1371.6	78.04	104		71.1	6.9	

11.



Peg No.	Distance Metres	Altitude Metres	Reflecion Time M.sec	Velocity FN m/s	Depth Metres	P.L. Geological Bedrock	Notes
23	1402	77.44	97		62.7	14.7	
23.5	1432.5	76.74	109		77.7	- 1.0	
24	1463.0	76.70	94		59.3	17.4	
24.5	1493.5	76.76	50		19.0	57.7	
25	1524.0	77.06	40		12.7	64.3	
25.5	1554.4	77.11	43		14.5	62.6	
26	1584.9	76.96	32		8.5	68.4	
26.5	1615.4	76.68	45		15.7	60.9	
27	1645.9	"	-		-	-	
27.5	1676.4	"	-	(1)	-	-	
28	1706.8	76.91	50		19.0	57.9	
28.5	1737.3	77.20	46		16.4	60.8	
29	1767.8	77.52	41		13.3	64.2	
29.5	1798.3	78.16	59		25.6	52.5	
30	1828.8	78.39	49		18.3	60.0	
30.5	1859.2	78.55	61		27.2	51.3	
31	1889.7	78.71	62		28.0	50.7	
31.5	1920.2	78.88	61		28.2	51.6	
32	1950.7	79.11	50		19.0	60.1	
32.5	1981.2	79.49	38		11.6	67.8	
33	2011.6	79.72	50		19.0	60.7	
33.5	2042.1	80.06	47		17.0	63.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	P.L. Geological Bedrock	Notes
34	2072.6	80.46	36		10.5	69.9	
34.5	2103.1	80.47	32		8.5	71.9	
35	2133.6	80.40	48		17.7	62.7	
35.5	2164.0	80.23	49		18.3	61.9	
36	2194.5	80.10	48		17.7	62.4	
36.5	2225.0	79.92	59		25.6	54.3	
37	2255.5	79.75	62		28.0	51.7	
37.5	2286.0	79.33	65		30.5	48.8	
38	2316.4	79.24	62		28.0	51.2	
38.5	2346.9	78.93	45		15.7	63.2	
39	2377.4	78.79	45	(1)	15.7	63.0	
39.5	2407.9	78.79	41		13.3	65.4	
40	2438.4	78.83	63		28.9	50.0	
40.5	2468.8	78.97	64		29.7	49.2	
41	2499.3	79.23	68		33.1	46.1	
41.5	2529.8	79.08	71		35.8	43.2	
42	2560.3	79.57	60		26.5	53.1	
42.5	2590.8	79.40	58		24.9	54.5	
43	2621.2	79.32	57		24.1	55.2	
43.5	2651.7	79.28	41		13.3	65.9	
44	2682.2	79.57	52		20.4	59.1	
44.5	2712.7	79.63	41		13.3	66.3	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
45	2743.2	79.71	33		- .0	70.7	
45.5	2773.6	79.76	32		8.5	71.2	
46	2804.1	79.79	32		8.5	71.2	
46.5	2834.6	79.53	30		7.6	71.9	
47	2865.1	79.47	27		6.2	73.2	
47.5	2895.6	79.38	49		18.3	61.0	
48	2926.0	79.18	45		15.7	63.4	
48.5	2956.5	79.21	64		29.7	49.5	
49	2987.0	79.13	49		18.3	60.8	
49.5	3017.5	79.21	-	(1)	-	-	
50	3048.0	79.18	30		7.6	71.5	
50.5	3078.4	79.33	35		10.0	69.3	
51	3108.9	79.27	21		4.0	75.2	
51.5	3139.4	79.29	13		3.3	75.9	
52	3169.9	79.16	-		-	-	
52.5	3200.4	"	22		4.3	74.8	
53	3230.8	79.11	15		2.1	77.0	
53.5	3261.3	78.48	14		1.9	76.5	
54	3291.8	78.16	16		2.4	75.7	
54.5	3322.3	77.93	19		3.3	74.6	
55	3352.8	77.91	17		2.7	75.2	
55.5	3383.2	77.93	-		-	-	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
56	3413.7	77.81	27		6.2	71.6	
56.5	3444.2	77.77	18		3.0	74.6	
57	3474.7	77.74	15		2.1	75.6	
57.5	3505.2	77.84	13		1.6	76.2	
58	3535.6	78.24	18		3.0	75.2	
58.5	3566.1	78.64	17		2.7	75.9	
59	3596.6	79.20	22		4.3	74.9	
59.5	3627.1	79.19	22		4.3	74.8	
60	3657.6	79.38	19		3.3	76.0	
60.5	3688.0	79.63	-		-	-	
61	3718.5	79.95	20	(1)	3.6	76.3	
61.5	3749.0	80.05	-		-	-	
62	3779.5	80.25	16		2.4	77.8	
62.5	3810.0	80.51	23		4.7	75.8	
63	3840.4	80.69	20		3.6	77.0	
63.5	3870.9	80.84	17		2.7	78.1	
64	3901.4	81.04	20		3.6	77.4	
64.5	3931.9	81.31	47		13.3	68.0	
65	3962.4	81.52	20		3.6	77.8	
65.5	3992.8	81.46	26		.58	75.6	
66	4023.3	81.63	15		2.1	79.5	
66.5	4053.8	82.04	-		-	-	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
67	4084.3	82.30	20		3.6	78.7	
67.5	4114.8	82.54	23		4.7	77.8	
68	4145.2	82.75	35		10.0	72.7	
68.5	4175.7	83.06	25		5.4	77.6	
69	4206.2	83.26	20		3.6	79.6	
69.5	4236.7	83.57	-		-	-	
70	4267.2	83.85	20		3.6	80.2	
70.5	4297.6	84.04	-		-	-	
71	4328.1	84.15	23		4.7	79.4	
71.5	4358.6	84.23	21		4.0	80.2	
72	4389.1	84.21	23	(1)	4.7	79.5	
72.5	4419.6	84.35	25		5.4	78.9	
73	4450.0	84.58	30		7.6	76.9	
73.5	4480.5	84.85	56		23.3	61.5	
74	4511.0	84.94	33		9.0	75.9	
74.5	4541.5	85.04	47		17.0	68.0	
75	4572.0	85.17	45		15.7	69.4	
75.5	4602.4	85.38	51		19.8	65.6	
76	4632.9	85.53	65		30.6	55.0	
76.5	4663.4	85.68	50		19.0	66.6	
77	4693.9	85.84	58		24.9	60.9	
77.5	4724.4	86.12	42		13.9	72.2	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN s/m	Depth Metres	R.L. Geological Bedrock	Notes
78	4754.8	86.36	70		34.9	51.3	
78.5	4785.3	86.57	55		22.6	63.8	
79	4815.8	86.81	75		39.5	47.2	
79.5	4846.3	86.88	68		33.1	53.6	
80	4876.8	87.10	70		34.9	52.2	
80.5	4907.2	87.99	60		26.4	61.5	
81	4937.7	87.83	-		-	-	
81.5	4968.2	88.68	60		26.4	61.2	
82	4998.7	88.47	-		-	-	
82.5	5029.2	87.36	50		19.0	68.3	
83	5059.6	87.24	-	(1)	-	-	
83.5	5090.1	87.24	57		24.1	63.1	
84	5120.6	87.21	-		-	-	
84.5	5151.1	87.11	58		24.9	62.2	
85	5181.6	87.00	-		-	-	
85.5	5212.0	86.93	58		24.9	62.1	
86	5242.5	86.61	-		-	-	
86.5	5273.0	86.21	69		34.0	52.2	
87	5303.5	85.94	-		-	-	
87.5	5334.0	85.70	66		31.4	54.2	
88	5364.4	85.40	-		-	-	
88.5	5394.9	85.09	59		25.6	54.5	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
89	5425.4	84.98	59		25.6	59.3	
89.5	5455.9	84.87	64		29.7	55.1	
90	5486.4	84.58	-		-	-	
90.5	5516.8	84.52	98		63.9	20.6	
91	5547.3	84.47	84		48.4	36.0	
91.5	5577.8	84.52	82		46.4	38.1	
92	5608.3	84.47	96		61.6	22.8	
92.5	5638.8	84.56	122		94.8	-10.3	
93	5669.2	84.57	122		94.8	-10.3	
93.5	5699.7	84.53	100	(1)	66.3	18.2	
94	5730.2	84.66	-		-	-	
94.5	5760.7	84.68	80		44.3	40.3	
95	5791.2	84.83	67		32.2	52.6	
95.5	5821.6	84.89	78		42.5	42.4	
96	5852.1	84.83	83		47.4	37.4	
96.5	5882.6	84.86	72		36.7	48.1	
97	5913.1	84.84	-		-	-	
97.5	5943.6	84.89	80		44.3	40.5	
98	5974.0	84.94	86		50.5	34.4	
98.5	6004.5	84.89	-		-	-	
99	6035.0	84.80	84		48.4	36.4	
99.5	6065.5	85.18	83		47.4	37.7	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
100	6096.0	85.64	83		47.4	38.1	
100.5	6126.4	85.47	85		49.5	35.8	
101	6156.9	85.26	56		23.3	61.8	
101.5	6187.4	85.45	57		24.1	61.2	
102	6217.9	85.56	68		33.1	52.3	
102.5	6248.4	85.50	66		31.4	54.1	
103	6278.8	85.57	76		40.4	45.1	
103.5	6309.3	85.63	80		44.3	41.3	
104	6339.8	85.78	80		44.3	41.4	
104.5	6370.3	85.55	80		44.3	41.2	
105	6400.8	85.39	80	(1)	44.3	41.0	
105.5	6431.2	85.24	80		44.3	40.9	
106	6461.7	85.13	80		44.4	40.8	
106.5	6492.2	85.59	70		34.9	50.6	
107	6522.7	85.87	25		5.4	80.4	
107.5	6553.2	85.81	30		7.6	78.2	
108	6583.6	85.73	28		6.7	79.0	
108.5	6614.1	85.78	33		9.0	76.7	
109	6644.6	86.00	37		11.0	75.0	
109.5	6675.1	86.28	39		12.1	74.1	
110	6705.6	86.53	37		11.1	75.5	
110.5	6736.0	86.40	33		9.0	77.4	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
111	6766.5	86.35	-		-	-	
111.5	6797.0	86.12	52		20.4	65.7	
112	6827.5	85.73	39		12.1	73.6	
112.5	6858.0	85.75	29		7.1	78.6	
113	6888.4	85.80	27		6.2	79.6	
113.5	6918.9	86.00	36		10.5	75.5	
114	6949.4	86.06	32		8.5	77.5	
114.5	6979.9	86.21	25		5.4	80.8	
115	7010.4	86.36	26		5.8	80.5	
115.5	7040.8	86.51	36	(1)	10.5	76.0	
116	7071.3	86.66	35		10.0	76.6	
116.5	7101.8	86.80	30		7.6	79.2	
117	7132.3	86.70	-		-	-	
117.5	7162.8	86.60	38		11.6	75.0	
118	7193.2	86.46	37		11.0	75.4	
118.5	7223.7	86.34	30		7.6	78.7	
119	7254.2	86.42	36		10.5	75.9	
119.5	7284.7	86.55	32		8.5	78.0	
120	7315.2	86.85	-		-	-	
120.5	7345.6	87.22	32		8.5	78.7	
121	7376.1	87.63	-		-	-	
121.5	7406.6	86.73	33		9.0	77.7	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
122	7437.1	87.22	50		19.0	68.2	
122.5	7467.6	88.88	50		19.0	69.8	
123	7498.0	89.48	62		28.0	61.4	
123.5	7528.5	89.97	63		28.8	61.1	
124	7559.0	90.39	63		28.9	61.5	
124.5	7589.5	90.86	47		17.1	73.3	
125	7620.0	91.46	63		28.8	62.6	
125.5	7650.4	92.16	74		38.6	53.6	
126	7680.9	92.91	61	(1)	27.2	65.7	
126.5	7711.4	93.70	49		18.3	75.4	
127	7741.9	94.52	50		19.0	75.5	
127.5	7772.4	95.28	43		14.5	80.7	
128	7802.8	96.12	23		4.7	91.4	
128.5	7833.3	96.80	24		5.0	91.8	
129	7863.8	97.40	23		4.7	92.7	
129.5	7894.3	98.10	26		5.8	92.3	
130	7924.8	98.42	27		6.2	92.2	
130.5	7955.2	98.79	42		13.9	84.8	
131	7985.7	99.08	35		10.0	89.0	
131.5	8016.2	99.03	34		9.5	89.5	
132	8046.7	99.13	51		19.7	79.4	
132.5	8077.2	99.17	24		5.0	94.1	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity Fn m/s	Depth Metres	R.L. Geological Bedrock	Notes
133	8107.6	99.28	42		13.9	85.3	
133.5	8138.1	99.43	30		11.6	87.8	
134	8168.6	99.44	51		19.7	79.7	
134.5	8199.1	99.48	31		8.0	91.4	
135	8229.6	99.48	49		18.3	81.1	
135.5	8260.0	99.69	56		23.3	76.3	
136	8290.5	99.89	58		24.9	74.9	
136.5	8321.0	99.90	40		12.7	87.2	
137	8351.5	99.87	56		23.3	76.5	
137.5	8382.0	99.92	62	(1)	28.0	71.9	
138	8412.4	99.80	35		10.0	89.8	
138.5	8442.9	100.00	40		12.7	87.3	

# Appendix B

## Line A Reflection Readings i.

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### LINE "A"

Coordinate

Two Way Reflection Times

A1								
1.5								
2	13	24	34	43	62	95	120	147
2.5	12	23	62	83	109			
3	7	64	93					
3.5	10	32	61	89				
4	10	83						
4.5	9	33	48	74	91	181		
5	11	22	48	70				
5.5	10	28	49	67	85			
6	10	24	74	96				
6.5	9	24	76	111				
7	6	21	28	54	69	86	217	
7.5	6	23	67					
8	9	18	52	74	93	208		
8.5	8	22	30	69				
9	6	26	48	64	102			
9.5	10	43	72	107				
10	7	41	75	93				
10.5	10	49	60	79	146			
11	8	25	88	123				
11.5	No response							
12	10	19	68					
12.5	No response							
13	15	29	44	79	137	196		
13.5	No response due to mud							
14	17	36	49	84	145			
14.5	9	38	67	82				

LINE "A"

Coordinate		Two Way Reflection Times					
A15	9	31	50	71	123		
15.5	12	29	69	91			
16	8	29	47	76	101	170	
16.5	3	36	62	78	110		
17	3	24	69	89	127		
17.5	6	15	28	40	62	78	153 189
18	7	22	52	85	200		
18.5	7	20	27	37	62	80	230
19	8	22	38	77	138		
19.5	6	19	43	59	72	90	194
20	8	21	51	73			
30	7	33	49	69	88	187	215
30.5	6	17	46	75	103		
31	8	33	48	72	119	166	190
31.5	9	52	71	105			
32	9	34	62	79			
32.5	10	38	76				
33	10	20	50	74			
33.5	8	18	51	72	112		
34	9	40	73	128			
34.5	10	36	79	130	177		
35	9	21	52	98			
35.5	10	21	35	54	82	108	
36	9	22	58	70	105		
36.5	9	51	84	208			



L I N E "A"

Coordinate		Two Way Reflection Times							
A37	8	42	85						
37.5	9	61	97						
38	9	35	49	64	75	98			
38.5	9	38	90						
39	8	25	45	73	115	149			
39.5	8	49	79	140					
40	8	15	31	54	99				
40.5	11	25	57	69	89	115	142	230	
41	8	59	83	98					
41.5	7	27	45	59	93				
42	6	21	40	52	89	162			
42.5	10	33	63	111					
43	8	33	53	84	101	160			
43.5	8	49	83						
44	10	47	58	92	133				
44.5	9	31	49	66	90				
45	7	27	36	92					
45.5	9	39	91	144					
46	8	40	69	97					
46.5	10	43	82						
47	9	52	84						
47.5	8	29	43	60	75	101	190	213	
48	10	27	54	72	92				
48.5	8	69	82						
49	9	27	56	70	90				
49.5	9	59	77	102					
50	8	40	62	91					
50.5	9	42	81	94					
51	9	42	70	87	114				
51.5	9	37	59	78	99	117			

LINE "A"

Coordinate		Two Way Reflection Times					
A52	9	30	51	79	92		
52.5	10	36	70	90			
53	6	44	74	95			
53.5	8	20	48	64	74	94	
54	7	29	50	66	90	196	
54.5	7	74	110				
55	9	79					
55.5	10	45	73	102			
56	12	56	108	150			
56.5	13	37	50	86			
57	11	87	112				
57.5	12	29	40	62	88	107	147
58	8	34	57	77			
58.5	13	49	68	107	126		
59	12	45	63	96	154		
59.5	9	32	56	79	208		
60	13	32	61	100			
60.5	12	25	45	84	109	67	
61	8	49	66	74			
61.5	10	48	78				
62	11	39	77	221			
62.5	10	28	48	78			
63	11	45	66	76	89	156	
63.5	12	30	50	107	145		
64	9	30	59	76	95	120	
64.5	13	33	59	87	106		
65	16	46	64	83	98		
65.5	10	51	64	85	112		

LINE "A"

Coordinate	Two Way Reflection Times							
A66	11	32	44	71	83	117		
66.5	13	36	70	129				
67	12	44	75					
67.5	15	38	77					
68	12	35	78	123				
68.5	12	28	48	75				
69	9	22	26	42	74	106		
69.5	11	44	70					
70	9	48	69					
70.5	7	37	64					
71	8	44	69	208				
71.5	8	49	65	76	101	189		
72	8	35	53	79	124			
72.5	11	59	83					
73	8	38	56	80	201	233		
73.5	10	70						
74	10	48	56	75				
74.5	No response							
75	11	36	74	115				
75.5	10	76	104	134				
76	9	41	79	110	203			
76.5	11	44	91					
77	7	34	49	81	102			
77.5	15	47	77	96				
78	13	29	45	69	90			
78.5	11	51	68	83	117	168	201	

LINE "A"

Coordinate		Two Way Reflection Times						
A79	9	32	72	99	191			
79.5	9	26	41	78				
80	9	32	53	83	104	151		
80.5	13	40	57	83	124	184		
81	10	32	53	63	85	149		
81.5	11	24	42	60	81	105	128	
82	9	28	41	54	86	105	163	
82.5	12	23	41	67	84	137	212	
83	10	46	79	108				
83.5	11	24	42	64	83	136	169	
84	10	27	49	64	80	114	151	175
84.5	18	42	60	80	132	182		
85	12	32	43	87	192			
85.5	12	24	58	80	98	125		
86	16	53	83	110				
86.5	12	35	44	57	70	80		
87	16	42	56	78	108			
87.5	13	36	70	111	127	162		
88	14	46	76	138				
88.5	15	64	81	100	128	168		
89								
89.5								
90	8	18	36	52	86	172		
90.5	6	62	86	132	216	239		
91	6	19	29	51	80	102	170	
91.5	9	24	38	56	71			

L I N E "A"

Coordinate	Two Way Reflection Times						
A92	9	29	72	125	178		
92.5	7	31	53	74	91	142	
93	7	35	82	108	125		
93.5	Under water						
94	6	23	78				
94.5	6	22	36	46	82	122	215
95	13	54	70	89	133		
95.5	11	34	52	76	99	126	
96	9	47	71	113	204		
96.5	8	42	60	91	176	203	
97	5	29	48	69	124		
97.5	No penetration						
98	7	84	106	191			
98.5	6	12	46	68	107	200	220
99	6	14	31	51	66	86	233
99.5	6	24	39	82	95	199	228
100	7	38	59	72			
100.5	8	28	38	61	86	148	213
101	7	17	24	45	84		
101.5	7	25	37	46	92		
102	7	19	34	59	81		
102.5	7	52	84	96	147		
103	5	36	81	106			
103.5	6	21	44	88	111	176	191
104	7	41	61	89			
104.5	5	30	47	63	99	244	



LINE "A"

Coordinate	Two Way Reflection Times								
A105	6	17	29	61	93	186			
105.5	5	15	49	71	84	108	130	151	235
106	6	16	54	67	101	119	199		
106.5	6	17	28	48	69	85	105	145	
107	8	27	89	125					
107.5	5	21	47	72	91	129	204		
108	8	61	96	119	192	219			
108.5	9	18	40	51	65	105	150		
109	6	14	45	63	90	107	128	183	
109.5	7	18	82	115	127	155	184	202	
110	7	29	64	85	111	149	229		
110.5	8	43	58	75	92	113	179		
111	7	18	59	85					
111.5	7	50	61	78	89	102	116	175	
112	7	24	39	60	77				
112.5	9	26	43	59	75	88	107	184	222
113	7	27	57	85	120	220			
113.5	8	17	80	107					
114	9	35	48	63	86	119			
114.5	7	53	86	110	175	209			
115	7	39	59	89					
115.5	8	42	50	65	87				
116	8	25	42	60	78	94	123		
116.5	6	21	34	45	65	95	235		
117	7	19	40	67	87	99	174	194	
117.5	9	35	55	83	100	160			

LINE "A"

Coordinate		Two Way Reflection Times							
A118	9	28	38	48	65	98	119		
118.5	8	35	85	109	189	210			
119	7	31	63	86	113				
119.5	9	31	52	82	98	111	187		
120	7	19	82	105	194	217			
120.5	7	32	53	77	114	179	220		
121	10	22	40	75	104	209			
121.5	8	24	54	84	128	190	235		
122	8	36	66	87	188				
122.5	10	36	96	135	209				
123	12	22	35	70	88	108	223		
123.5	12	70	96	126					
124	10	30	41	69	96	123			
124.5	10	33	70	98	200	222			
125	11	36	58	77	99	136			
125.5	6	36	48	73	89	217	234		
126	8	30	39	53	71	216			
126.5	8	32	41	60	80	96			
127	6	24	61	112	210				
127.5	7	16	38	66	82	229			
128	8	23	42	55	81				
128.5	7	22	44	62	208				
129	8	28	49	79	156				
129.5	6	15	44	73	138	175			
130	7	25	38	52	69	110	142	189	

# Appendix B

## Line A Height, Distance & Depth Values

LINE "A" - 143

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
1	60.9	90.0					
1.5	91.4	"					
2	121.9	"	62		67.2	22.8	
2.5	152.4	"	62	(1)	67.2	22.8	
3	182.8	"	64	t = 8.97004737	74.9	15.1	
3.5	213.3	"	61	.2946531	63.6	26.4	
4	243.8	"	83		181.0	-91.0	
4.5	274.3	"	74		122.6	-32.6	
5	304.8	"	-		-	-	
5.5	335.2	"	67		87.5	2.5	
6	365.7	"	74		122.6	-32.6	
6.5	396.2	"	76		134.2	-44.2	
7	426.7	"	69		96.7	- 6.7	
7.5	457.2	"	67		87.5	2.5	
8	487.6	"	74		122.6	-32.6	
8.5	518.1	"	69		96.7	- 6.7	
9	548.6	"	64		74.9	15.1	
9.5	579.1	"	72		111.7	-21.7	
10	609.6	"	75		128.3	-38.3	
10.5	640.0	"	79		153.0	-63.0	
11	670.5	"	88		220.7	-130.7	
11.5	701.0	"	-		-	-	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
12	731.5	90.0	68		92.0	- 2.0	
12.5	762.0	"	-		-	-	
13	792.4	"	79		153.0	-63.0	
13.5	822.9	"	-		-	-	
14	853.4	"	84		188.5	-98.5	
14.5	883.9	"	82		173.7	-83.7	
15	914.4	"	71		106.5	-16.5	
15.5	944.8	"	69		96.7	- 6.7	
16	975.3	"	76	(1)	134.2	-44.2	
16.5	1005.8	"	-		-	-	
17	1036.3	"	89		229.4	-139.4	
17.5	1066.8	"	78		146.6	-56.6	
18	1097.2	89.8	85		196.2	-106.4	
18.5	1127.7	"	80		159.7	-70.2	
19	1158.2	89.7	77		140.3	-50.6	
19.5	1188.7	"	72		111.7	-22.0	
20	1219.2	89.8	73		117.0	27.2	
20.5	1249.6	"					
21	1280.1	89.5					
21.5	1310.6	"					
22	1341.1	89.7					
22.5	1371.6	"					

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
23	1402.0	89.7					
23.5	1432.5	"					
24	1463.0	"					
24.5	1493.5	"					
25	1524.0	90.0					
25.5	1554.4	"					
26	1584.9	89.9					
26.5	1615.4	"					
27	1645.9	89.5					
27.5	1676.4	"					
28	1706.8	89.3					
28.5	1737.3	"					
29	1767.8	"					
29.5	1798.3	"					
30	1828.8	89.6	88		220.	-131.1	
31.5	1859.2	"	75		128.3	-38.7	
31	1889.7	89.9	72		111.7	-21.8	
31.5	1920.2	"	71	(1)	106.5	-16.6	
32	1950.7	90.2	79		153.0	-62.8	
32.5	1981.2	"	76		134.2	-44.0	
33	2011.6	90.7	74		122.6	-31.9	
33.5	2042.1	"	72		111.7	-21.0	

iii.



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
34	2072.6	91.0	73		117.0	-26.0	
34.5	2103.1	"	79		153.9	-62.0	
35	2133.6	"	52		37.0	54.0	
35.5	2164.0	"	54		42.0	49.0	
36	2194.5	91.2	58		53.6	37.6	
36.5	2225.0	"	51		34.6	56.6	
37	2255.5	91.4	42		17.9	73.5	
37.5	2286.0	"	61		63.6	27.8	
38	2316.4	91.8	49		30.2	61.6	
38.5	2346.9	"	38		12.7	79.1	
39	2377.4	92.3	45	(1)	22.6	69.7	
39.5	2407.9	"	49		30.2	62.1	
40	2438.4	92.7	54		42.3	50.7	
40.5	2468.8	"	57		50.5	42.2	
41	2499.3	92.3	59		56.8	35.5	
41.5	2529.8	"	59		56.8	35.5	
42	2560.3	92.5	52		37.0	55.5	
42.5	2590.8	"	63		71.0	21.5	
43	2631.2	92.6	53		39.5	53.1	
43.5	2651.7	"	49		30.2	62.4	
44	2682.2	93.1	58		53.6	39.5	
44.5	2712.7	"	49		30.2	62.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
45	2743.2	93.5	36		10.6	82.9	
45.5	2773.6	"	39		13.9	79.6	
46	2804.1	93.8	40		15.2	78.6	
46.5	2834.6	"	43		19.4	74.4	
47	2865.1	94.2	52		37.0	57.2	
47.5	2895.6	"	60		60.1	34.1	
48	2926.0	94.7	54		42.0	52.7	
48.5	2956.5	"	69		96.7	-2.0	
49	2987.0	95.0	70		101.5	-6.5	
49.5	3017.5	"	77	(1)	140.3	-45.3	
50	3048.0	95.1	-		-	-	
50.5	3078.4	"	71		106.5	-11.4	
51	3108.9	95.5	70		101.5	-6.0	
51.5	3139.4	"	78		146.6	-51.1	
52	3169.9	95.8	79		153.0	-57.2	
52.5	3200.4	"	70		101.5	-5.3	
53	3230.8	95.7	74		122.6	-26.9	
53.5	3261.3	"	64		74.9	20.8	
54	3291.8	95.5	66		83.1	12.4	
54.5	3322.3	"	74		122.6	-27.1	
55	3352.8	95.4	79		153.0	-57.6	
55.5	3383.2	"	73		117.0	-21.6	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
56	3413.7	95.4	56		47.6	47.8	
56.5	3444.2	"	50		32.4	63.0	
57	2474.7	96.3	-		-	-	
57.5	3505.2	"	62		67.2	29.1	
58	3535.6	96.5	57		50.5	46.0	
58.5	3566.1	"	68		92.0	4.5	
59	3596.6	97.4	63		71.0	26.4	
59.5	3627.1	"	56		47.6	49.8	
60	3657.6	97.2	61		63.6	33.6	
60.5	3688.0	"	45	(1)	22.6	74.5	
61	3718.5	97.5	49		30.2	67.3	
61.5	3749.0	"	48		28.2	69.3	
62	3779.5	98.1	39		13.9	84.2	
62.5	3810.0	"	48		28.2	69.9	
63	3840.4	98.6	45		22.6	76.0	
63.5	3870.9	"	50		32.4	66.2	
64	3901.4	99.1	59		56.8	42.3	
64.5	3931.9	"	59		56.8	42.3	
65	3962.4	99.9	64		74.9	25.0	
65.5	3992.8	"	64		74.9	25.0	
66	4023.3	101.9	71		106.5	-4.6	
66.5	4053.8	"	70		101.5	.4	

VI.

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
67	4084.3	102.5	75		128.3	-25.8	
67.5	4114.8	"	77		140.3	-37.8	
68	4145.2	101.9	78		146.6	-44.7	
68.5	4175.7	"	48		28.2	73.7	
69	4206.2	100.6	42		17.9	82.7	
69.5	4236.7	"	44		21.0	79.6	
70	4267.2	100.2	48		28.2	72.0	
70.5	4297.6	"	37		11.6	88.6	
71	4328.1	99.8	44	(1)	21.0	78.8	
71.5	4358.6	"	49		30.2	69.6	
72	4389.1	99.2	53		39.5	59.7	
72.5	4419.6	"	59		56.8	42.4	
73	4450.0	98.5	56		47.6	50.9	
73.5	4480.5	"	53		39.5	59.0	
74	4511.0	97.6	48		28.2	69.4	
74.5	4541.5	"	42		17.9	79.7	
75	4572.0	97.2	36		10.6	86.6	
75.5	4602.4	"	-		-	-	
76	4632.9	96.7	41		16.5	80.2	
76.5	4663.4	"	44		21.0	75.7	
77	4693.9	96.2	49		30.2	66.0	
77.5	4724.4	"	47		26.2	70.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FM m/s	Depth Metres	R.L. Geological Bedrock	Notes
78	4754.8	96.1	45		22.6	73.5	
78.5	4785.3	"	51		34.6	61.5	
79	4815.8	95.6	32		7.1	88.5	
79.5	4846.3	"	41		16.5	79.1	
80	4876.8	95.3	53		39.5	55.8	
80.5	4907.2	"	56		47.6	47.7	
81	4937.7	94.4	53		39.5	54.9	
81.5	4968.2	"	42		17.9	76.5	
82	4998.7	94.3	41		16.5	77.8	
82.5	5029.2	"	41		16.5	77.8	
83	5059.6	93.2	46		24.4	68.8	
83.5	5090.1	"	42	(1)	17.9	75.3	
84	5120.6	91.4	49		30.2	61.2	
84.5	5151.1	"	42		17.9	73.5	
85	5181.6	89.3	43		19.4	69.9	
85.5	5212.0	"	58		53.6	35.7	
86	5242.5	87.3	53		39.5	47.8	
86.5	5273.0	"	44		21.0	66.3	
87	5303.5	86.4	56		47.6	38.8	
87.5	5334.0	"	36		10.6	75.8	
88	5364.4	85.5	46		24.4	61.1	
88.5	5394.9	"	64		74.9	10.6	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
89	5425.4	84.2	} No response				
89.5	5455.9	"					
90	5486.4	84.3	36		10.6	73.7	
90.5	5516.8	"	-		-	-	
91	5547.3	85.0	29		5.1	79.9	
91.5	5577.8	"	38		12.7	72.3	
92	5608.3	84.5	29		5.1	79.4	
92.5	5638.8	"	31		6.3	78.2	
93	5669.2	84.3	35		9.6	74.7	
93.5	5699.7	"	-	(1)	-	-	
94	5730.2	84.2	23		2.3	81.9	
94.5	5760.7	"	36		10.6	73.6	
95	5791.2	84.3	54		42.0	42.3	
95.5	5821.6	"	52		37.0	47.3	
96	5852.1	84.6	47		26.2	58.4	
96.6	5882.6	"	42		17.9	66.7	
97	5913.1	85.3	48		28.2	57.1	
97.5	5943.6	"	-		-	-	
98	5974.0	87.1	-		-	-	
98.5	6004.5	"	-		-	-	
99	6035.0	90.3	31		6.3	84.0	
99.5	6065.5	"	39		13.9	76.4	

Peg No.	Distance Metres	Altitude Metres	Peflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
100	6096.0	94.0	38		12.7	81.3	
100.5	6126.4	"	38		12.7	81.3	
101	6156.9	95.9	45		22.6	73.1	
101.5	6187.4	"	46		24.4	71.5	
102	6217.9	96.5	59		56.8	39.7	
102.5	6248.4	"	52		37.0	59.5	
103	6278.8	96.6	36		10.6	86.0	
103.5	6309.3	"	44		21.0	75.6	
104	6339.8	96.4	41		16.5	79.9	x
104.5	6370.3	"	47		26.2	70.2	
105	6400.8	96.1	-		-	-	
105.5	6431.2	"	49	(1)	30.2	65.9	
106	6461.7	95.1	54		42.0	53.1	
106.5	6492.2	"	48		28.2	66.8	
107	6522.7	95.4	-		-	-	
107.5	6553.2	"	47		26.2	69.2	
108	6583.6	96.2	-		-	-	
108.5	6614.1	"	40		15.2	81.0	
109	6644.6	97.0	45		22.6	74.4	
109.5	6675.1	"	-		-	-	
110	6705.6	97.4	64		74.9	22.5	
110.5	6736.0	"	58		53.6	43.8	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
111	6766.5	97.8	59		56.8	41.0	
111.5	6797.0	"	61		63.6	34.2	
112	6827.5	97.9	60		60.1	37.8	
112.5	6858.0	"	59		56.8	41.1	
113	6888.4	98.3	57		50.5	47.8	
113.5	6918.9	"	-		-	-	
114	6949.4	98.6	48		28.2	70.4	
114.5	6979.9	"	53		39.5	59.1	
115	7010.4	98.8	59	(1)	56.8	42.0	
115.5	7040.8	"	50		32.4	66.3	
116	7071.3	99.1	42		17.9	81.2	
116.5	7101.8	"	45		22.6	76.5	
117	7132.3	99.2	40		15.2	84.0	
117.5	7162.8	"	35		9.6	89.6	
118	7193.2	99.1	38		12.7	86.4	
118.5	7223.7	"	-		-	-	
119	7254.2	98.8	63		71.0	27.8	
119.5	7284.7	"	52		37.0	61.8	
120	7315.2	98.4	-		-	-	
120.5	7345.6	"	52		37.0	61.4	
121	7376.1	97.9	40		15.2	82.7	
121.5	7406.6	"	54		42.0	55.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
122	7437.1	97.7	66		83.1	14.6	
122.5	7467.6	"	-		-	-	
123	7498.0	97.9	70		101.5	-3.6	
123.5	7528.5	"	70		101.5	-3.6	
124	7559.0	98.4	69		96.7	1.7	
124.5	7589.5	"	70		101.5	-3.1	
125	7620.0	99.4	77		140.3	-40.9	
125.5	7650.4	"	73		117.0	-17.6	
126	7680.9	100.0	71		106.5	-6.5	
126.5	7711.4	"	60	(1)	60.1	38.9	
127	7741.9	100.2	61		63.6	36.6	
127.5	7772.4	"	66		83.1	17.1	
128	7802.8	99.1	42		17.9	81.2	
128.5	7833.3	"	42		17.9	81.2	
129	7863.8	99.4	49		30.2	69.2	
129.5	7894.3	"	44		21.0	78.4	
130	7924.8	98.6	38		12.7	85.9	
130.5	7955.2	"					
131	7985.7	98.1					
131.5	8016.2	"					
132	8046.7	97.9					
132.5	8077.2	"					

# Appendix B

## Line B Reflection Readings

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### LINE "B"

Coordinate	Two Way Reflection Times						
-16	3	61	99	225	303	343	
-15.5	37	139	171	193	269	389	
-15	11	49	137	187	231	347	
-14.5	7	27	78	117	157	265	
-14	9	47	57	147	201	457	
-13.5	3	17	37	121	149	279	311
-13	9	21	73	95	157	357	
-12.5	19	109	147	255			
-12	No response						
-11.5	No response						
-11	No response						
-10.5	No response						
-10	No response						
-9.5	No response						
-9	7	73	101	159	259	393	
-8.5	9	49	103	Interference - power line			
-8	7	77	125	"	"	"	
-7.5	17	91	135	"	"	"	
-7	9	115	129	"	"	"	
-6.5	7	35	49	61	113		
-6	12	55	96				
-5.5	14	52	89	117	140		
-5	12	51	63	108			
-4.5	7	50	69	113			
-4	6	40	48	52	66	79	
-3.5	11	22	52	79			
-3	4	25	40	54	77	117	



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LINE "B"

Coordinate Two Way Reflection Times

-2.5	6	23	35	73	82	
-2	4	39	53	61	76	93
-1.5	6	47	65	82	127	
-1	9	78	137			
-0.5	9	25	45	82	112	
0	9	38	81	100		
0.5	8	44	84			
1	7	56	99	111		
1.5	8	31	65	116		
2	14	102	141	191		

LINE "B"

Coordinate

Two Way Reflection Times

B1							
1.5							
2							
2.5							
3	6	13	42	59	96	111	129
3.5	6	21	41	89			
4	8	15	34	65	98		
4.5	11	38	92				
5	4	66	92	128			
5.5	13	97					
6	16	95					
6.5	6	35	56	79	115		
7	8	28	41	57	81	105	159
7.5	3	14	60	103	120	146	
8	4	48	113				
8.5	8	27	38	71	86	111	170
9	7	28	41	64	96	117	153
9.5	8	15	41	71	103		
10	6	59	99	129			
10.5	8	71	96	112			
11	7	27	54	90	124	152	
11.5	12	30	92	128	160		
12	6	15	44	50	70	110	136
12.5	6	56	82	102	123		
13	4	23	33	70	83		
13.5	12	77					

LINE "B"

Coordinate		Two Way Reflection Times					
B14	7	36	55	88	(doubtful)		
14.5	15	30	57	73	89		
15	7	32	66	101	157		
15.5	12	37	64	90			
16	13	67	95	142			
16.5	9	26	54	102			
17	12	24	67	93	159		
17.5	6	34	54	83			
18	6	27	77	95			
18.5		98					
19		67	90				
19.5		91	113				
20		95					
20.5		123					
21		44	131				
21.5		49	85	150			
22		169	217				
22.5		17	29	90	151		
23		90	167				
23.5	11	101	171				
24	11	37	53	99	125	177	
24.5	13	51	61	101	139	177	305
25	9	25	65	99	133	157	
25.5	5	41	147	163	187		
26	9	19	109	159	201	165	
26.5	11	33	107	141	181	293	

LINE "B"

Coordinate	Two Way Reflection Times									
B27	13	45	63	131	161	197	243			
27.5	13	33	75	111	143	171	211			
28	9	41	73	95	225	317				
28.5	7	61	97	121	157	237	275	327		
29	7	61	95	147	203	273	329			
29.5	11	29	59	99	125	171	209	261		
30	9	21	71	145	169	187	251	381		
30.5	3	35	81	155	181	205	277	343		
31	3	13	107	165	183	227	247	289	379	
31.5	9	65	99	155	303					
32	9	25	109	157	201	209	321			
32.5	11	21	53	101	129	159	177	243	309	
33	39	81	137	187	211	285	355			
33.5	23	55	93	161	237	291	343			
34	25	67	91	119	197	267	315	337		
34.5	No response									
35	29	95	307							
35.5	19	71	101	121	159	181	231			
36	21	83	101	135	203	231	269	291	325	
36.5	No response									
37	7	21	45	109	165	211	289			
37.5	9	53	115	143	169	187	229	409		
38	5	49	55	107	189	255	305			
38.5	9	51	63	85	121	233	281	323		
39	17	35	61	77	97	111	179	243	271	337
39.5	7	17	79	167	201	245	277	329		

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LINE "B"

Coordinate	Two Way Reflection Times						
B40	5	23	141	191	235	331	
40.5	7	131	207	283			
41	7	67	141	190	213	279	331
41.5	7	55	119	147	215	291	
42	9	65	127	215	297		
42.5	9	119	151	207	323		
43	9	43	119	133	161	243	275
43.5	9	49	65	161	245	277	
44	13	29	125	225	289		
44.5	11	59	165	199			
45	9	29	77	109	203		
45.5	9	117	203				
46	9	137	215				
46.5	7	85	151	175	199		
47	5	55	105	143	207	247	
47.5	3	45	113	163			
48	7	147	209				
48.5	3	99	119	155	183		
49	9	43	61	143	209	241	
49.5	No response						
50	9	119	137	177	203		
50.5	9	33	91	115	177	213	
51	9	51	87	121	145	199	233
51.5	11	197	227	325			
52	9	37	103	207			
52.5	11	85	185	219			



L I N E "B"

Coordinate	Two Way Reflection Times						
B53	11	24	45	79	163	189	263
53.5	7	79	157	201	283		
54	7	19	43	131	157	213	295
54.5	7	63	129	173	257		
55	9	19	135	237	285		
55.5	11	23	139	261			
56	9	65	99	247			
56.5	13	133	169	221	285		
57	17	167	225				
57.5	11	101	159	223			
58	11	151	247				
58.5	11	201	99				
59	27	223	167	123	59		
59.5	23	241					
60	23	47	213				
60.5	27	59	83	107	149	211	303
61	27	59	83	107	149	211	303
61.5	21	205	241	285	321	387	
62	27	75	151	171	201	231	
62.5	21	101	173	205	227	261	
63	11	31	105	171	211		
63.5	No response						
64	No response						
64.5	27	109	169	183	209	261	
65	27	49	141	177	215		
65.5	Flooded						

LINE "B"

Coordinate Two Way Reflection Times

Coordinate	Two Way Reflection Times					
B66	Flooded					
66.5	23	47	71	167	231	295
67	25	47	131	171	221	
67.5	25	275				
68	23	119	161	185	217	
68.5	25	57	71	93	217	
69	23	37	99	167	233	
69.5	21	61	193	219	271	309
70	25	41	67	115	235	273
70.5	23	41	61	109	157	217 301
71	21	77	115	205	317	
71.5	23	163	209	261	301	413
72	25	45	61	105	157	225
72.5	29	45	215	253	321	
73	27	51	73	129	159	199
73.5	25	109	221			
74	29	71	171	211		
74.5	13	39	66	116	139	
75	No penetration.					
75.5	6	21	31	40	79	
76	11	90				
76.5	7	25	88	118		
77	No response					
77.5	14	39	48	88		
78	17	33	108			
78.5	14	30	40	68	91	

L I N E "B"

Coordinate		Two Way Reflection Times							
B79	19	32	74						
79.5	18	24	90						
80	11	61	113	135	173	251			
80.5	29	39	101	165	139	233	333		
81	21	67	145	152	275	463			
81.5	23	113	161	228	245	327			
82	13	29	49	125	197	263	95		
82.5	15	27	93	109	191	255			
83	13	81	163	211	275	325	429		
83.5	15	73	152	183	289				
84	11	113	179	253	379	435			
84.5	17	73	145	193	123	305			
85	31	109	183						
85.5	13	37	155	65	131	317			
86	41	69	119	171	289	269			
86.5	35	119	147	121	149	385	211	195	
87	7	23	41	87	147	241	157	295	545
87.5	10	39	89	151	203	251	279		
88	17	37	127	149	279	105	435	349	
88.5	9	33	71	109	225	159	289		
89	12	34	52	65	90				
89.5	11	42	110						
90	11	22	25	50	65	107	202	214	
90.5	15	50	94	105	141				
91	13	113	133	179					
91.5	11	22	44	87	111	163			

LINE "B"

## Coordinate

## Two Way Reflection Times

B92	11	20	29	44	57	64	70	97	117
92.5	10	17	37	46	51	76	114		
93	11	21	39	53	58	90	106	134	
93.5	9	18	29	43	85	92	113	152	
94	No penetration								
94.5	13	26	60	110	164				
95	10	20	31	52	85	115	145	186	213
95.4	10	21	83	92	105	175	234		
96	9	18	24	35	57	79	97	137	193
96.5	9	93	119	165	219				
97	9	27	87	125	183				
97.5	11	25	57	95	145	165	211	395	
98	7	87	111	131	177				
98.5	7	65	167	215	281	331			
99	7	113	189	369					
99.5	9	53	143	185	233				
100	7	43	107	137	169	215			
100.5	7	37	149	223					
101	11	155	215	237	193				
101.5	5	15	85	137	219				
102	11	135	151	321					
102.5	9	133	221						
103	7	17	113	153					
103.5	13	109	181	225					
104	No penetration			Flooded and muddy					
104.5	No penetration			Flooded and muddy					

LINE "B"

Coordinate

Two Way Reflection Times

Coordinate	No penetration	Flooded and muddy					
B105	15	105	215				
105.5							
106	No penetration						
106.5	9	17	147	185	247		
107	11	51	129	169			
107.5	11	43	87	203			
108	Flooded						
108.5	11	75	165				
109	11	77	163	233			
109.5	7	21	119	155			
110	11	25	75	125	161	199	
110.5	6	34	57	66	152	195	83
111	8	53	85	108	132		
111.5	5	29	51	60	83	117	
112	5	40	85	108			
112.5	7	30	53	79	103		
113	5	16	77				
113.5	5	31	87				
114	5	17	29	84	117		
114.5	5	50	69	85	106		
115	6	17	78	101			
115.5	7	28	85	100	128		
116	6	16	24	74	94		
116.5	11	22	42	52	73	93	
117	10	22	76	121			
117.5	12	29	103	133			



L I N E "B"

Coordinate		Two Way Reflection Times					
B118	7	28	85				
118.5	7	121					
119	9	71	151	193	231		
119.5	7	85	135	169			
120	9	111	171				
120.5	7	115	197	249			
121	7	87	223	275			
121.5	11	107	159				
122	9	87	157				
122.5	9	137	165	217			
123	11	91	157				
123.5	11	85	103	155			
124	9	147					
124.5	9	89	127	197			
125	9	63	153				
125.5	9	93	145	189	243		
126	7	17	89	145	177		
126.5	7	169	201				
127	11	67	93	183			
127.5	13	81	183				
128	9	45	135	197			
128.5	9	95	119	147	165	199	225
129	7	19	107	189	237		
129.5	7	127	165	185			
130	9	43	133	177	231		
130.5	11	21	69	93	159	173	

LINE "B"

Coordinate		Two Way Reflection Times						
B131	7	23	127	171				
131.5	9	83	149	215	257	319		
132	7	47	151	191	211			
132.5		93	133	181	245			
133		101	193					
133.5		91	127	167	191			
134		107	151	199				
134.5		147	205					
135		111	149	227				
135.5		101	175	223				
136	7	43	79	129	185	215		
136.5								
137								
137.5								
138	13	103	179	223				
138.5	7	103	149	201				
139	7	31	43	99	159	229		
139.5	9	33	187	225				
140	7	4	115	151	191	243	393	
140.5	11	179	203					
141	Poor contact due to mud							
141.5	Poor contact due to mud							
142	9	27	57	115	221	297		
142.5	11	69	211					
143	9	19	49	131	209	341		
143.5	9	53	69	101	169	259		

L I N E "B"

Coordinate		Two Way Reflection Times							
B144	7	163	187	253	321	451			
144.5	11	49	177	241					
145	9	23	193						
145.5	9	67	123	167	223				
146	9	29	51	79	135	219			
146.5	9	29	67	91	137	177			
147	3	41	85	109	137	185	205	275	
147.5	5	73	117	131	179	249			
148	9	31	85	109	183	225	279		
148.5	9	33	71	89	141	249			
149	11	125	189	223	255				
149.5	5	41	97	223	393				
150	7	37	119	175	233	293			
150.5	9	103	139	221	271				
151	7	29	53	87	127	163	177	207	
151.5	5	33	65	79	111	139	155	209	243
152	7	85	111	171	213	257	297		
152.5	5	40	59	105	135	187	291	301	
153	9	31	71	97	117	153	193	227	259
153.5	7	41	83	131	147	163	177	241	313
154	7	21	83	141	163	217	255		
154.5	5	25	53	193	269	317			
155	11	85	143	221					
155.5		205							
156	7	61	81	89	139	175	247		
156.5	11	233							

LINE "B"

Coordinate		Two Way Reflection Times								
B157	9	21	27	79	125	245	205	227	269	289
157.5	9	103	137	163	217	291				
158		169	225							
158.5		163	203							
159	10	133	147	175	219	233	259			
159.5	7	29	71	137	193	239				
160	9	38	44	61	86	107	135	161		
160.5	10	25	32	90	101	141	175			
161	12	43	117	181						
161.5	11	28	48	89	108	138	159	170		
162	13	25	32	87	143	129				
162.5	8	25	88	137						
163	8	21	31	50	130	184				
163.5	11	26	89	129						
164	5	66	105	132	161					
164.5	8	18	32	63	126	170				
165	10	20	35	41	52	57	93	103	131	179
										158
165.5	9	32	47	63	97	135	198			
166		39	100	157						
166.5	11	22	62	97	147	121				
167	9	23	30	123	165					
167.5	4	15	77	107	122	147				
168	10	126	103	186						
168.5	6	18	70	122	160					
169	6	64	76	115	135	207				
169.5	10	36	43	59	66	90	127			

L I N E "B"

[illegible]

LINE "B"

Coordinate	Two Way Reflection Times						
B183	3	52	82	122			
183.5	4	21	31	60	77	106	
184	6	33	58	98	125	145	
184.5	Mud no penetration						
185	7	49	103				
185.5	10	25	57	95			
186	13	27	60	83	112		
186.5	9	44	84	165			
187	10	26	47	97	156		
187.5	10	23	101	133	181		
188	10	42	60	74	123	188	236
188.5	11	47	75	96	192		
189	8	25	107				
189.5	11	37	59	134	188		
190	14	48	97	158			
190.5	10	85	128				
191	10	99	147				
191.5	11	56	87				
192	15	83	175	309			
192.5	15	91	119	211	309		
193	No penetration						
193.5	16	45	70	97	131		
194	13	64	94				
194.5	9	53	110	171			
195	11	100	134				
195.5	11	46	69	92			



L I N E "B"

Coordinate		Two Way Reflection Times					
B196	15	34	100	197			
196.5	8	48	96				
197	8	20	60	92			
197.5	13	87	133	186			
198	17	59	76	124	186		
198.5	18	76	112	160			
199	17	74	108	149			
199.5	15	60	87				
200	17	105	147	199			
200.5	18	74	168				
201	16	65	84	99	165	194	
201.5	17	37	103				
202	18	65	129	209			
202.5	20	88	130	154			
203	22	99	170				
203.5	18	96	112				
204	20	67	112	167			
204.5	19	64	83	126	157		
205	12	37	68	110	149		
205.5	17	99	128				
206	14	57	133	162			
206.5	11	46	84	155			
207	No penetration						
207.5	16	48	126				
208	15	44	84	No penetration			
208.5	24	46	60	98	113	149	175

LINE "B"

Coordinate	Two Way Reflection Times					
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B209	9	25	71	132	206	226
209.5	8		125			
210	14	82	153			
210.5	12	93	115	145		
211	16	55	133			
211.5	No record Limestone					
212	16	52	125			
212.5	30	64	125			
213	36	63	99	134	160	
213.5	20	59	90	123		
214	22	95	139			
214.5	13	35	86	107		
215	22	64	100			
215.5	8	44	58	90	117	
216	13	80				
216.5	9	50	70	102		
217	9	36	65	79	013	
217.5	6	58	89	149		
218	6	31	54	74	91	
218.5	19	91	155	249		
219	27	65	113	155		
219.5	21	38	55	97	194	
220	20	50	99			
220.5	21	67	124			
221	19	55	130	156		
221.5	14	27	47	129		

L I N E "B"

Coordinate		Two Way Reflection Times							
B222	13	53	87	127	153				
222.5	9	119	139	205	275				
223		137							
223.5		135							
224	23	77	143						
224.5	25	53	67	107					
225	23	71	129						
225.5	23	55	77	135					
226	27	51	77	139	Velocity change				
226.5	No penetration								
227	23	101	157						
227.5	5	67	79	115	159				
228	7	49	107	141					
228.5	7	55	83	109	161				
229	5	107	151	169					
229.5	19	105	181						
230	9	27	77	127	207				
230.5	9	51	87	129	193				
231	9	59	107	217					
231.5	5	27	91	115	159	181	287	337	429
232	15	Poor penetration due to Calcrete							
		151	127	61	83				
232.5	3	101	135	173	227				
233	9	85	150	209	289				
233.5	7	127	215	279					

LINE "B"

Coordinate		Two Way Reflection Times					
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B234	13	37	129	193	271	
234.5	9	41	119	149	219	
235	19	109	139	189	319	
235.5	15	145	193			
236	15	95	167	191	223	
236.5	15	61	81	241	193	
237	15	111	181			
237.5	11	65	141	169	277	
238	15	61	103	181	243	
238.5	11	81	139			
239	19	51	149	215		
239.5	17	183	305			
240	13	45	77	125	209	
240.5	11	77	167	195		
241	15	91	175	229		
241.5	17	39	121	159	263	
242	9	69	153	223		
242.5	13	37	177	213	363	
243	17	33	87	123	191	269
243.5	23	69	101	169	239	315
244	25	75	93	163		
244.5	13	83	127	161		
245	13	35	97	191	281	
245.5	15	61	109	159		
246	15	73	90	137		
246.5	2	12	67	157		

LINE "B"

Coordinate	Two Way Reflection Times					
B247	4	20	66	109	127	154
247.5	No penetration					
248	4	18	28	66	95	163
248.5	4	18	125	167	189	
249	5	53	71	89	127	163 197
249.5	11	17	51	72	148	172
250	10	26	109	162		
250.5	9	23	102	123	179	
251	5	65	91	127	178	
251.5	3	161				
252	7	112	141			
252.5	7	36	64	112	147	186
253	11	25	96	158		
253.5	9	77	108	137		
254	6	29	61	116	168	
254.5	9	46	70	122	174	
255	8	25	89	170		
255.5	No penetration - limestone outcrop					
256	3	37	58	97	121	164
256.5	3	93	144	157	197	
257	6	15	27	58	126	153 189
257.5	9	57	95	107	165	197
258	8	70	104	120	155	
258.5	No response					
259	9	25	39	50	59	128
259.5	8	26	51	80	115	141

LINE "B"

Coordinate

Two Way Reflection Times

B260	6	23	36	132	155			
260.5	9	30	38	55	139			
261	3	100	155					
261.5	2	34	75	108	150			
262	9	16	33	68	118	140		
262.5	6	30	70	123	146			
263	7	21	80	114	167			
263.5	No response							
264	6	33	55	85	Limestone outcrop			
264.5	No penetration			Limestone outcrop				
265	3	13	23	34	72	89	115	Limestone
265.5	2	29	37	112	151			
266	4	31	115	162				
266.5	9	20	51	107				
267	8	29	47	80	93	107	156	
267.5	4	24	40	69	109	140	182	
268	8	85						
268.5	9	20	92	124				
269	3	22	56	92	134			



# Appendix B Line B Height, Distance & Depth Values

L I N E "B"

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Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
-16	-975.3	104.0	225		160.8	-56.8	
-15.5	-944.8	"	193		137.6	-33.6	
-15	-914.4	"	187		133.2	-29.2	
-14.5	-883.9	"	157		111.5	-7.5	
-14	-853.4	"	147	(1)	104.2	-0.2	
-13.5	-822.9	"	149	1.45Km/sec.	105.7	-1.7	
-13	-792.4	"	157		111.5	-7.5	
-12.5	-762.0	"	147		104.2	-0.2	
-12	-731.5	"					
-11.5	-701.0						
-11	-670.5						
-10.5	-640.0						
-10	-609.6						
-9.5	-579.1						
-9	-548.6	"	73		50.6	53.4	
-8.5	-518.1	"	49		33.2	70.8	
-8	-487.6	"	77		53.5	50.5	
-7.5	457.2	"	91		63.6	40.4	
-7	-426.7	"	115		81.0	23.0	
-6.5	-396.2	"	61		41.9	62.1	
-6	-365.7	"	55		37.5	66.5	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
-5.5	-335.2	104.0	52		35.4	68.7	
-5	-304.8	"	41		27.4	76.6	
-4.5	-274.3	"	50		33.9	70.1	
-4	-243.8	"	48		32.5	71.5	
-3.5	-213.3	"	52		35.4	68.6	
-3	-182.8	"	40		26.7	77.3	
-2.5	-152.4	"	35		23.0	81.0	
-2	-121.9	"	39	(1)	25.4	78.1	
-1.5	- 91.4	"	47		31.7	72.3	
-1	- 60.9	"	46		31.0	73.0	
-0.5	- 30.5	"	45		30.3	73.7	
0	0	"	38		25.2	78.8	
0.5	30.5	"	44		29.6	74.5	
1	60.9	"	56		38.3	65.8	
1.5	91.4	"	65		44.8	59.2	
2	121.9	"	-				
2.5	152.4	"	-				
3	182.8	"	59		40.4	63.6	
3.5	213.3	"	41		27.4	76.6	
4	243.8	"	34		22.3	81.7	
4.5	274.3	"	38		25.2	78.8	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
5	304.8	104.0	66		45.5	58.5	
5.5	335.2	"	63		43.3	60.7	
6	365.7	"	59		40.4	63.6	
6.5	396.2	"	56		38.3	65.7	
7	426.7	"	57		39.0	65.0	
7.5	457.2	"	60		41.2	62.8	
8	487.6	"	48		32.5	71.5	
8.5	518.1	"	38		25.2	78.8	
9	548.6	"	41	(1)	27.4	76.6	
9.5	579.1	"	41		27.4	76.6	
10	609.6	"	59		40.4	63.6	
10.5	630.0	"	71		49.1	54.9	
11	670.5	"	92		64.4	39.6	
11.5	701.0	"	92		64.4	39.6	
12	731.5	"	70		48.1	55.9	
12.5	762.0	"	56		38.0	66.0	
13	792.4	"	70		48.1	55.9	
13.5	822.9	"	50		33.6	70.4	
14	853.4	"	36		23.5	80.5	
14.5	883.9	"	30		19.1	84.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
*15	914.4	104.0	32		20.6	83.4	
15.5	944.8	"	37		24.2	79.8	
16	975.3	"	67		45.9	58.1	
16.5	1005.8	"	54		36.5	67.4	
17	1036.3	"	67		45.9	58.1	
17.5	1066.8	"	54		36.5	67.5	
18	1097.2	"	77		53.2	50.8	
18.5	1127.7	"	68		46.7	57.3	
19	1158.2	"	67		45.9	58.1	
19.5	1188.7	"	91	(1)	63.3	40.7	
20	1219.2	"	95		66.2	37.8	
20.5	1249.6	"	88		61.2	42.8	
*21	1280.1	"	86		59.7	44.3	
21.5	1310.6	"	82		56.8	47.2	
22	1341.1	"	85		59.8	45.0	
22.5	1371.6	"	90		62.6	41.4	
23	1402.0	"	90		62.0	42.0	
23.5	1432.5	"	101		70.0	34.0	
24	1463.0	"	125		87.4	16.6	
24.5	1493.5	"	139		97.6	-6.4	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
25	1524.0	104.4	133		93.2	10.8	
25.5	1554.4	"	147		103.4	0.6	
26	1584.9	"	159		112.1	- 8.1	
26.5	1615.4	"	141		99.0	5.0	
27	1645.9	"	161		113.5	- 9.5	
27.5	1676.4	"	171		120.8	-16.8	
28	1706.8	"	180		127.3	-23.3	
28.5	1737.3	"	190		134.5	-30.5	
29	1767.8	"	203	(1)	144.0	-40.0	
29.5	1798.3	"	209		148.3	-44.3	
30	1828.8	"	187		132.4	-28.4	
30.5	1859.2	"	205		145.4	-41.4	
31	1889.7	"	227		161.4	-57.4	
31.5	1920.2	"	220		156.3	-52.3	
*32	1950.7	"	209		148.3	-44.3	
32.5	1981.2	"	243		173.0	-69.0	
33	2011.6	"	187		132.4	-28.4	
33.5	2042.1	"	161		113.5	- 9.5	
34	2072.6	"	197		139.3	-35.3	
34.5	2103.1	"	189		133.5	-29.5	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
35	2133.6	104.0	180		127.0	-23.0	
35.5	2164.0	"	181		127.7	-23.7	
36	2194.5	"	180		127.0	-23.0	
36.5	2225.0	"	178		125.6	-21.6	
37	2255.5	"	165		116.1	-12.1	
37.5	2286.0	"	169		119.0	-15.0	
38	2316.4	"	189		133.5	-29.5	
38.5	2346.9	"	185		130.6	-26.6	
39	2377.4	"	179		126.3	-22.3	
39.5	2407.9	"	201	(1)	142.2	-38.2	
*40	2438.4	"	191		135.0	-31.0	
40.5	2468.8	"	207		146.6	-42.6	
41	2499.3	"	213		150.9	-46.9	
41.5	2529.8	"	215		150.4	-48.4	
42	2560.3	"	215		152.4	-48.4	
42.5	2590.8	"	207		146.6	-42.6	
43	2621.2	"	243		172.7	-68.7	
43.5	2651.7	"	245		174.9	-70.9	
44	2682.2	"	225		159.6	-55.6	
44.5	2712.7	"	199		140.8	-36.8	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
45	2743.2	104.0	203		144.8	-40.8	
45.5	2773.6	"	203		144.8	-40.8	
46	2804.1	"	215		153.5	-49.5	
46.5	2834.6	"	199		141.9	-37.9	
47	2865.1	"	207		147.7	-43.7	
47.5	2895.6	"	163		115.8	-11.8	
*48	2926.0	"	147		104.2	- 0.2	
48.5	2956.5	"	155		110.0	- 6.0	
49	2987.0	"	143		101.3	2.7	
49.5	3017.5	"	170	(1)	120.9	-16.9	
50	3048.0	"	203		144.8	-40.8	
50.5	3078.4	"	213		152.1	-48.1	
51	3108.9	"	233		166.6	-62.6	
51.5	3139.4	"	227		162.2	-58.2	
52	3169.9	"	207		147.7	-43.7	
52.5	3200.4	"	185		131.8	-27.8	
53	3230.8	"	189		134.7	-30.7	
53.5	3261.3	"	201		143.4	-39.4	
54	3291.8	"	213		152.1	-48.1	
54.5	3322.3	"	257		184.0	-80.0	
55	3352.8	"	285		204.3	-100.3	
55.5	3383.2	"	261		186.9	-82.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
56	3413.7	104.0	247		173.3	-69.3	
56.5	3444.2	"	221		154.4	-50.4	
57	3474.7	"	225		157.3	-53.3	
57.5	3505.2	"	223		155.9	-51.9	
58	3535.6	"	247		173.3	-69.3	
58.5	3566.1	"	201		139.9	-35.9	
59	3596.6	"	223		155.9	-51.9	
59.5	3627.1	"	241	(1)	168.9	-64.9	
60	3657.6	"	213		148.6	-44.6	
60.5	3688.0	"	195		135.6	-31.6	
61	3718.5	"	211		147.2	-43.2	
61.5	3749.0	"	205		142.8	-38.8	
62	3779.5	"	201		139.9	-35.9	
62.5	3810.0	"	205		142.8	-38.8	
63	3840.4	"	211		147.2	-43.2	
63.5	3870.9	"	210		146.5	-42.5	
64	3901.4	"	205		142.8	-38.8	
64.5	3931.9	"	209		145.7	-41.7	
65	3962.4	"	215		150.1	-46.1	
65.5	3992.8	"	220		153.7	-49.7	
66	4023.3	"	222		155.2	-51.2	
66.6	4053.8	"	231		161.7	-57.7	

viii.

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
67	4084.3	104.0	221		154.1	-50.1	
67.5	4114.8	"	225		157.0	-53.0	
68	4145.2	"	217		151.2	-47.2	
68.5	4175.7	"	217		151.2	-47.2	
*69	4206.2	"	233		162.8	-58.8	
69.5	4236.7	"	219		152.7	-48.7	
70	4267.2	"	235		164.3	-60.3	
70.5	4297.6	"	217	(1)	151.2	-47.2	
71	4328.1	"	205		142.5	-38.5	
71.5	4358.6	"	209		145.4	-41.4	
72	4389.1	"	225		157.0	-53.0	
72.5	4419.6	"	215		149.8	-45.8	
73	4450.0	"	199		138.2	-34.2	
74	4511.0	"	211		146.9	-42.9	
74.5	4541.5	"	215		149.8	-45.8	
75	4572.0	103.1	210		146.2	-43.1	
75.5	4602.4	"	210		146.2	-43.1	
*76	4632.9	102.9	209		145.4	-42.5	
76.5	4663.4	"	200		138.9	-36.0	
77	4693.9	102.7	195		135.3	-32.6	
77.5	4724.4	"	190		131.7	-29.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
78	4754.8	102.6	180		125.3	-22.7	
78.5	4785.3	"	180		125.3	-22.7	
79	4815.8	102.5	180		125.3	-22.8	
79.5	4846.3	"	180		125.3	-22.8	
80	4876.8	102.4	173		120.2	-17.8	
80.5	4907.2	"	165		114.4	-12.0	
81	4937.7	102.3	152		105.0	- 2.7	
81.5	4968.2	"	161		111.5	- 9.2	x
82	4998.7	102.2	197	(1)	137.6	-35.4	
82.5	5029.2	"	191		133.3	-31.1	
83	5059.6	102.1	163		113.0	-10.9	
83.5	5090.1	"	152		105.0	- 2.9	
84	5120.6	102.1	179		124.6	-22.5	
84.5	5151.1	"	193		134.7	-32.6	
85	5181.6	102.2	183		127.5	-25.3	
85.5	5212.0	"	155		107.2	- 5.0	
86	5242.5	102.3	119		81.1	21.2	
86.5	5273.0	"	119		81.1	21.2	
87	5303.5	102.1	105		70.9	31.2	
87.5	5334.0	"	100		63.3	34.8	
88	5364.4	101.9	95		63.7	38.2	
88.5	5394.9	"	90		60.0	41.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
89	5425.4	102.4	90		62.3	40.1	
89.5	5455.9	"	110		76.8	25.6	
90	5486.4	103.2	107		74.7	28.5	
90.5	5516.8	"	105		73.2	30.0	
91	5547.3	104.0	113		79.0	25.0	
91.5	5577.8	"	87		60.2	43.8	
92	5608.3	104.7	97		67.4	37.3	
92.5	5638.8	"	76	(1)	52.2	52.5	
93	5669.2	105.0	90		62.3	42.7	
93.5	5699.7	"	92		63.8	41.2	
94	5730.2	105.2	105		73.2	32.0	
94.5	5760.7	"	110		76.8	28.4	
95	5791.2	105.3	115		80.5	24.8	
95.5	5821.6	"	105		73.2	32.1	
96	5852.1	104.4	97		67.4	37.0	
96.5	5882.6	"	93		64.5	39.9	
97	5913.1	103.4	87		60.2	43.2	
97.5	5943.6	"	95		66.0	37.4	
98	5974.0	103.4	111		77.6	25.8	
98.5	6004.5	"	105		73.2	30.2	
99	6035.0	103.8	113		79.0	24.8	
99.5	6065.5	"	143		100.8	3.0	

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Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
100	6096.0	103.8	137		96.4	7.4	
100.5	6126.4	"	149		105.1	1.4	
101	6156.9	103.1	155		109.5	6.4	
101.5	6187.4	"	137		96.4	6.7	
102	6217.9	101.5	135		95.0	6.5	
102.5	6248.4	"	133		93.5	8.0	
103	6278.8	100.8	113		79.0	21.8	
103.5	6309.3	"	109		76.1	24.7	
104	6339.8	100.5	103		71.8	28.8	
104.5	6370.3	"	104		72.5	28.0	
105	6400.8	100.8	104	(1)	72.5	28.3	
105.5	6431.2	"	105		73.2	27.6	
106	6461.7	"	130		91.3	9.5	
106.5	6492.2	"	147		103.7	-2.9	
107	6522.7	100.2	129		90.6	9.6	
107.5	6553.2	"	87		60.2	40.0	
108	6583.6	100.1	80		55.1	45.0	
108.5	6614.1	"	75		51.5	48.6	
109	6644.6	100.3	77		52.9	47.4	
109.5	6675.1	"	119		83.4	16.9	
110	6705.6	100.5	125		87.7	12.8	
110.5	6736.0	"	83		57.3	43.2	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
111	6766.5	100.9	85		59.6	41.3	
111.5	6797.0	"	83		58.1	42.8	
112	6827.5	101.0	85		59.6	41.4	
112.5	6858.0	"	79		55.2	45.8	
113	6888.4	101.2	77		53.8	47.4	
113.5	6918.9	"	87		61.0	40.2	
114	6949.4	101.4	84		58.8	42.6	
114.5	6979.9	"	85		59.6	41.8	
115	7010.4	101.3	78		54.5	46.8	
115.5	7040.8	"	85	(1)	59.6	41.7	
116	7071.3	100.9	74		51.6	49.3	
116.5	7101.8	"	73		50.9	50.0	
117	7132.3	100.8	76		53.0	47.8	
117.5	7162.8	"	103		72.6	28.2	
118	7193.2	100.8	85		59.6	41.2	
118.5	7223.7	"	75		52.3	48.5	
119	7254.2	100.3	71		49.4	50.9	
119.5	7284.7	"	85		59.6	40.7	
120	7315.2	101.1	111		78.4	22.7	
120.5	7345.6	"	115		81.3	19.8	
121	7376.1	100.9	87		61.0	31.9	
121.5	7406.6	"	107		75.5	25.4	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
122	7437.1	100.8	87		60.4	40.4	
*122.5	7467.6	"	90		62.6	38.2	
123	7498.0	100.7	91		63.3	37.4	
123.5	7528.5	"	85		59.0	41.7	
124	7559.0	100.6	87		60.4	40.2	
124.5	7589.5	"	89		61.9	38.7	
125	7620.0	100.7	92		64.1	36.6	
125.5	7650.4	"	93		64.8	35.9	
126	7680.9	100.6	89		61.9	38.7	
126.5	7711.4	"	90		62.6	38.0	
*127	7741.9	100.4	93	(1)	64.8	35.6	
127.5	7772.4	"	81		56.1	44.3	
128	7802.8	100.2	94		65.5	34.7	
128.5	7833.3	"	95		66.2	34.0	
129	7863.8	99.7	107		74.9	24.8	
129.5	7894.3	"	105		73.5	26.2	
130	7924.8	99.1	100		69.9	29.2	
130.5	7955.2	"	93		64.8	34.3	
131	7985.7	99.0	90		62.6	26.4	
131.5	8016.2	"	83		57.5	41.5	
132	8046.7	98.7	90		62.6	36.1	
132.5	8077.2	"	93		64.9	33.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
133	8107.6	98.5	101		70.6	27.9	
133.5	8138.1	"	91		63.3	35.2	
134	8168.6	98.3	107		74.9	23.4	
134.5	8199.1	"	110		77.1	21.2	
135	8229.6	98.1	111		77.8	20.3	
135.5	8260.0	"	101		70.6	27.5	
136	8290.5	"	129		90.9	7.2	
136.5	8321.0	"	135		95.2	2.8	
137	8351.5	"	145		102.5	-4.4	
137.5	8382.0	"	165	(1)	117.0	-18.9	
138	8412.4	97.9	179	(2) 2.1Km/sec	127.1	-29.2	
138.5	8442.9	"	149		105.4	-7.5	
139	8473.4	97.5	159		116.4	-18.9	
139.5	8503.9	"	187		137.4	-39.9	
140	8534.4	"	191		144.9	-47.4	
140.5	8564.8	"	203		154.2	-56.7	
141	8595.3	97.6	210		164.7	-67.1	
141.5	8625.8	"	215		168.7	-71.1	
142	8656.3	97.5	221		178.8	-81.3	
142.5	8686.8	"	211		170.5	-73.0	
143	8717.2	97.7	209		173.9	-76.2	
143.5	8747.7	"	169		139.9	-42.2	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
144	8778.2	97.8	163		139.5	-41.7	
144.5	8808.7	"	177		151.8	-54.0	
145	8839.2	97.9	150		131.7	-33.8	
145.5	8869.6	"	123		107.4	-9.5	
146	8900.1	98.0	135		121.4	-23.4	
146.5	8930.6	"	137		123.3	-25.3	
147	8961.1	98.9	137		126.5	-27.6	
147.5	8991.6	"	131		120.8	-21.9	
148	9022.0	99.8	138		134.0	-34.2	
148.5	9052.5	"	141		137.0	-37.2	
149	9083.0	100.8	125	(2)	126.9	-26.1	
149.5	9113.5	"	97		97.5	3.3	
150	9144.0	102.3	119	(3) 1.725Km/sec	120.6	-18.3	
150.5	9174.4	"	103		103.8	-1.5	
*151	9204.9	103.6	87		87.0	16.6	
151.5	9235.4	"	79		78.6	25.0	
152	9265.9	104.4	85		84.9	19.5	
152.5	9296.4	"	105		105.9	-1.5	
153	9326.8	104.2	117		118.5	-14.3	
153.5	9357.3	"	147		150.0	-45.8	
154	9387.8	104.9	141		143.7	-38.8	
154.5	9418.3	"	144		146.9	-42.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
155	9448.8	105.6	143		137.9	-32.3	
155.5	9479.2	"	140		134.9	-29.3	
156	9509.7	106.0	139		133.9	-27.9	
156.5	9540.2	"	135		129.9	-23.9	
157	9570.7	104.9	125		119.9	-15.0	
157.5	9601.2	"	103		97.9	7.0	
158	9631.6	103.4	90		84.9	18.5	
158.5	9662.1	"	84	(3)	78.9	24.5	
159	9692.6	102.2	80		74.9	27.3	
159.5	9723.1	"	71		65.9	36.3	
160	9753.6	100.8	86		80.9	19.9	
160.5	9784.0	"	90		84.9	15.9	
161	9814.5	101.4	90		84.9	16.5	
161.5	9845.0	"	89		83.9	17.5	
162	9875.5	103.0	87		81.9	21.1	
162.5	9906.0	"	88		82.9	20.1	
163	9936.4	102.6	90		84.9	17.7	
163.5	9966.9	"	89		83.9	18.7	
164	9997.4	102.2	66		60.9	41.3	
16.45	10027.9	"	63		57.9	44.3	
165	10058.4	102.3	93		87.9	14.4	
165.5	10088.8	"	97		91.9	10.4	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
166	10119.3	103.3	100		90.9	12.4	
166.5	10149.8	"	97		88.0	15.3	
167	10180.3	103.9	100		90.9	13.0	
167.5	10210.8	"	107		97.5	6.4	
168	10241.2	104.5	103		93.7	10.8	
168.5	10271.7	"	70		62.4	42.1	
169	10302.2	104.1	76		68.1	36.0	
169.5	10332.7	"	90		81.4	22.7	
170	10363.2	104.5	95	(3)	86.1	18.4	
170.5	10393.6	"	96		87.1	17.4	
171	10424.1	104.7	100		90.9	13.8	
171.5	10454.6	"	94		85.2	19.5	
172	10485.1	104.8	91		82.3	22.5	
172.5	10515.6	"	100		90.9	13.9	
173	10546.0	106.0	91		82.3	23.7	
173.5	10576.5	"	93		84.2	21.8	
174	10607.0	107.7	101		91.8	15.9	
174.5	10637.5	"	112		102.3	5.4	
175	10668.0	106.9	104		94.7	12.2	
175.5	10698.4	"	125		114.6	-7.7	
176	10728.9	104.9	144		132.7	-27.8	
176.5	10759.4	"	142		130.8	-25.9	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
177	10789.9	102.7	135		116.8	-14.1	
177.5	10820.4	"	149		129.4	-26.7	
178	10850.8	100.0	135		116.8	-16.8	
178.5	10881.3	"	140		121.3	-21.3	
179	10911.8	98.7	150		130.3	-31.6	
179.5	10942.3	"	143		124.0	-25.3	
180	10972.8	98.3	132		114.1	-15.8	
180.5	11003.2	"	120		103.3	- 5.0	
181	11033.7	98.1	97		82.6	15.5	
181.5	11064.2	"	92	(3)	78.1	20.0	
182	11094.7	98.1	95		80.8	17.3	
182.5	11125.2	"	104		88.9	9.2	
183	11155.6	95.9	122		105.1	-9.2	
183.5	11186.1	"	106		90.7	5.2	
184	11216.6	93.9	98		83.5	10.4	
184.5	11247.1	"	105		89.8	4.1	
185	11277.6	93.2	103		88.0	5.2	
185.5	11308.0	"	95		80.8	12.4	
186	11338.5	92.8	83		70.0	22.8	
186.5	11369.0	"	84		70.9	21.9	
187	11399.5	93.1	97		82.7	10.5	
187.5	11430.0	"	101		86.2	6.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
188	11460.4	93.2	74		58.7	34.5	
188.5	11490.9	"	96		77.7	15.6	
189	11521.4	92.8	107		87.1	5.7	
189.5	11551.9	"	134		110.4	-17.6	
*190	11582.4	92.7	97		78.5	14.2	
190.5	11612.8	"	85		68.2	24.5	
191	11643.3	92.6	99		80.2	12.4	
191.5	11673.8	"	87		69.9	22.7	
192	11704.3	92.3	83		66.4	25.9	
192.5	11734.8	"	91		73.3	19.0	
193	11765.2	92.1	94	(3)	75.9	16.2	
193.5	11795.7	"	97		78.5	13.6	
194	11826.2	92.0	94		75.9	16.1	
194.5	11856.7	"	110		89.7	2.3	
195	11887.2	91.8	100		81.1	10.7	
195.5	11917.6	"	92		74.2	17.6	
196	11948.1	"	100		81.1	10.7	
*196.5	11978.6	"	96		77.7	14.1	
197	12009.1	91.1	92		74.2	16.9	
197.5	12039.6	"	87		69.9	21.2	
198	12070.0	91.2	76		60.4	30.8	
198.5	12100.5	"	76		60.4	30.8	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
199	12131.0	90.9	74		57.0	33.9	
199.5	12161.5	"	87		68.2	22.7	
200	12192.0	91.2	105		83.7	7.5	
200.5	12222.4	"	100		79.4	11.8	
201	12252.9	91.9	99		78.5	13.4	
201.5	12283.4	"	103		82.0	9.9	
202	12313.9	91.7	129		104.4	-12.7	
202.5	12344.4	"	130		105.3	-13.6	
203	12374.8	92.0	99		78.5	13.4	
203.5	12405.3	"	96	(3)	76.0	16.0	
204	12435.8	91.9	112		89.8	2.1	
204.5	12466.3	"	126		101.8	-9.9	
205	12496.8	91.5	110		88.0	3.5	
205.5	12527.2	"	99		78.5	13.0	
206	12557.7	91.4	133		107.9	-16.5	
206.5	12588.2	"	155		126.8	-35.4	
207	12618.7	90.9	132		107.0	-16.1	
207.5	12649.2	"	126		101.8	-10.9	
208	12679.6	91.0	84		65.6	25.4	
208.5	12710.1	"	98		77.7	13.3	
209	12740.6	91.1	96		76.0	15.1	
209.5	12771.1	"	94		74.2	16.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
210	12801.6	91.3	82		63.5	27.9	
210.5	12832.0	"	93		72.9	18.4	
211	12862.5	91.2	133		107.4	-16.2	
211.5	12893.0	"	129		104.0	-12.9	
212	12923.5	91.7	125		100.5	- 8.8	
212.5	12954.0	"	125		100.5	- 8.8	
213	12984.4	93.0	134		108.3	-15.3	
213.5	13014.9	"	123	(3)	98.8	- 5.8	
214	13045.4	92.0	139		112.6	-20.6	
214.5	13075.9	"	135		109.2	-17.2	
215	13106.4	90.6	100		79.0	11.6	
215.5	13136.8	"	117		93.6	- 3.0	
216	13167.3	90.4	135		109.2	-18.8	
216.5	13197.8	"	102		80.7	9.7	
217	13228.3	90.6	113		90.2	0.4	
217.5	13258.8	"	89		69.5	21.1	
218	13289.2	91.1	91		71.2	19.9	
218.5	13319.7	"	91		71.2	19.8	
219	13350.2	91.7	113		90.2	1.5	
219.5	13380.7	"	97		76.4	15.3	
220	13411.2	91.6	99		78.1	13.5	
220.5	13441.6	"	124		99.7	- 8.1	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
221	13472.1	91.0	130		106.1	-15.1	
221.5	13502.6	"	129		105.3	-14.3	
222	13533.1	92.0	127		103.5	-11.5	
222.5	13563.6	"	119		96.6	- 4.6	
223	13594.0	94.0	137		112.2	-18.2	
223.5	13624.5	"	135		110.4	-16.4	
224	13655.0	96.1	143		117.3	-21.2	
224.5	13685.5	"	107		86.3	9.8	
225	13716.0	98.0	129		105.3	- 7.3	
225.5	13746.4	"	135		110.4	-12.4	
226	13776.9	100.2	139	(3)	113.9	-13.7	
226.5	13807.4	"	120		97.5	2.7	
227	13837.9	102.6	101		81.1	21.5	
227.5	13868.4	"	115		93.2	9.4	
228	13898.8	105.0	107		86.3	18.7	
228.5	13929.3	"	109		88.0	17.0	
229	13959.8	107.8	107		86.3	21.5	
229.5	13990.3	"	105		84.6	23.2	
230	14020.8	110.0	127		103.5	6.5	
230.5	14051.2	"	129		105.3	4.7	
231	14081.7	111.6	107		86.3	25.3	
231.5	14112.2	"	91		72.5	39.1	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
232	14142.7	113.1	87		69.0	44.1	
232.5	14173.2	"	83		65.6	47.5	
233	14203.6	114.2	85		67.3	46.9	
233.5	14234.1	"	127		103.5	10.7	
234	14264.6	113.5	129		105.3	8.2	
234.5	14295.1	"	119		96.6	16.9	
*235	14325.6	112.5	109		88.0	24.5	
235.5	14356.0	"	104		83.7	28.8	
236	14386.5	112.2	95	(3)	75.9	36.3	
236.5	14417.0	"	81		63.9	48.3	
237	14447.5	111.6	111		89.7	21.9	
237.5	14478.0	"	141		115.6	- 4.0	
238	14508.4	111.3	103		82.8	28.5	
238.5	14538.9	"	81		63.9	47.4	
239	14569.4	110.7	51		38.0	72.7	
239.5	14599.9	"	60		45.8	65.0	
240	14630.4	109.5	77		60.4	49.1	
240.5	14660.8	"	77		60.4	49.1	
241	14691.3	108.0	91		72.5	35.5	
*241.5	14721.8	"	121		98.4	9.6	
242	14752.3	107.6	153		126.0	-18.4	
242.5	14782.8	"	177		146.7	-39.1	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
243	14813.2	106.9	123		101.8	5.1	
243.5	14843.7	"	101		82.8	24.1	
244	14874.2	106.0	93		75.9	30.1	
244.5	14904.7	"	127		105.2	0.8	
245	14935.2	104.8	97		79.4	25.4	
245.5	14965.6	"	109		89.7	15.1	
246	14996.1	103.4	90		73.3	30.1	
246.5	15026.6	"	67		53.5	49.9	
247	15057.1	103.6	109		89.7	13.9	
247.5	15087.6	"	105	(3)	86.3	17.3	
248	15118.0	105.6	95		77.6	28.0	
248.5	15148.5	"	125		103.5	2.1	
249	15179.0	102.0	127		105.2	- 3.2	
249.5	15209.5	"	148		123.4	-21.4	
250	15240.0	100.7	109		89.7	11.0	
250.5	15270.4	"	123		101.8	- 1.1	
251	15300.9	100.2	127		105.2	- 5.0	
251.5	15331.4	"	125		103.5	- 3.3	
252	15361.9	99.7	112		92.3	7.4	
252.5	15392.4	"	112		92.3	7.4	
253	15422.8	99.2	96		78.5	20.7	
253.5	15453.3	"	108		88.9	10.4	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
254	15483.8	98.3	116		97.5	0.9	
254.5	15514.3	"	122		102.6	- 4.3	
255	15544.8	97.6	89		74.2	23.4	
255.5	15575.2	"	100		83.7	13.9	
256	15605.7	97.5	121		101.8	- 4.3	
256.5	15636.2	"	144		121.6	-24.1	
257	15666.7	96.3	126		106.1	- 9.8	
257.5	15697.2	"	107		89.7	6.6	
258	15727.6	95.1	104		87.1	8.0	
258.5	15758.1	"	110	(3)	92.3	2.8	
259	15788.6	93.8	110		92.3	1.5	
259.5	15819.1	"	115		96.6	- 2.8	
260	15849.6	92.5	110		92.3	0.2	
260.5	15880.0	"	100		83.7	8.8	
261	15910.5	90.8	100		83.7	7.1	
261.5	15941.0	"	108		90.6	0.2	
262	15971.5	89.4	118		99.2	- 9.8	
262.5	16002.0	"	123		103.5	-14.1	
263	16032.4	87.4	114		95.7	- 8.3	
263.5	16062.9	"	100		92.3	- 4.9	
264	16093.4	86.3	85		70.7	15.6	
264.5	16123.9	"	82		68.1	18.2	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
265	16154.4	85.3	89		74.2	11.1	
265.5	16184.8	"	112		94.0	-8.7	
266	16215.3	83.6	115		96.6	-13.0	
266.5	16245.8	"	107	(3)	89.7	-6.1	
267	16276.3	82.5	107		89.7	-7.2	
267.5	16306.8	"	109		91.4	-8.9	
268	16337.2	82.3	85		70.7	11.6	
268.5	16367.7	"	92		76.8	5.6	
269	16398.2	82.3	92		76.8	5.6	
269.5	16428.7	"					
270	16459.2						

# Appendix B

## Line C Reflection Readings<sup>i</sup>

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### LINE "C"

Coordinate		Two Way Reflection Times									
C1	7	39	59	83	145	161	191	439			
1.5	3	33	67	113	209	249	341	407	461		
2	5	27	65	95	115	217	337	485			
2.5	5	29	61	91	233	311	405	463			
3	3	39	61	99	121	187	275	297			
3.5	5	51	89	103	95	225	339				
4	3	39	95	205	225	255	273	409	479		
4.5	3	45	85	101	211	235	351	417	473		
5	3	51	85	143	195	279	437				
5.5	3	21	83	119	169	221	241				
6	7	77	93	185	293	363					
6.5	5	25	47	81	257	293	369	413			
7	7	57	71	83	137	177	201	239	421	475	
7.5	3	37	49	75	89	147	185	261	327		
8	5	31	45	73	97	211	361	475			
8.5	5	23	43	69	109	147	201	265	371	401	461
9	5	63	167	197	285	321	365	491			
9.5	3	39	59	83	111	195	247	305	447		
10	5	55	83	139	203	329	411	451			
10.5	5	43	67	95	125	171	213	235			
11	3	45	83	115	177	255					
11.5	3	45	65	93	159	187	295				
12	3	21	49	73	91	113	185	221	273	365	405
12.5	7	31	91	115	151	193	229	263	309	345	
13	7	37	53	79	95	153	225	273	295	395	
										435	493
13.5	3	19	73	101	221	421	479				

L I N E "C"

Coordinate		Two Way Reflection Times									
C14	3	39	65	83	95	115	127	157	183	211	335 463
14.5	3	33	53	75	101	157	299				
15	3	65	99	117	143	167	213	253	367		
15.5	3	29	57	87	117	215	275	407			
16	5	39	191								
16.5	7	31	71	295							
17	5	43	79	239	427						
17.5	3	47	71	127	209	347	387	471			
18	3	29	59	73	97	115	151	277	379	495	
18.5	5	29	53	79	147	375					
19	3	11	65	103	179	237	425	455			
19.5	5	29	89	165	233	427					
20	5	77	101	245	385	437					
20.5	7	21	101	131	203	409	477				
21	5	31	51	71	167	391	475				
21.5	5	47	75	197	267	303	435				
22	3	39	63	95	195	319	425	455			
22.5	3	67	81	165	209	263	335	433			
23	5	15	41	61	83	99	197	245	387	433	493
23.5	3	61	89	113	149	201	237	287	407		
24	3	45	67	87	109	151	197	243	383	443	487
24.5	7	33	65	95	111	379	485				
25	3	21	59	85	139	211	287	311	423		
25.5	3	21	53	91	103	177	423				
26	3	15	47	85	191	363	455				
26.5	3	29	41	83	150	191	425				

LINE "C"

Coordinate		Two Way Reflection Times									
C27	3	35	41	73	105	211					
27.5	3	21	57	83	101	113	145	175	401	431	473
28	3	25	85	127	155	201	249	293	433	463	
28.5	3	27	39	63	97	119	143	205	233		
29	3	27	59	93	129	185	257	341	459		
29.5	7	21	55	67	81	115	163	183	205	409	453
30	5	35	63	81	107	143	171	379	419	465	
30.5	5	39	67	97	117	151	363	423			
31	5	31	65	79	115	163	357	417			
31.5	7	19	31	51	67	91	111	239	339	415	459
32	5	27	35	59	93	107	157	323	459		
32.5	5	35	71	87	99	169	311	403	463		
33	3	35	45	71	91	109	141	199	233	275	
33.5	5	41	69	105	273	381	453				
34	3	31	65	91	109	149	221				
34.5	3	45	71	93	201	247	307	441			
35	3	41	57	81	101	169	241	273	315	373	
35.5	5	23	45	81	195	239	267	355			
36	3	21	83	119	173	227	265	435	489		
36.5	3	23	47	81	119	235	277	493			
37	5	15	33	65	89	135	185	309	417	455	
37.5	3	33	45	65	93	217	291	385	455		
38	3	31	51	67	93	131	151	199	267	435	457
38.5	3	33	61	85	105	161	191	237	363	441	
39	3		31	51	67	113	175	223	275		
39.5	5	19	57	89	161	203	283	347	465		

LINE "C"

Coordinate		Two Way Reflection Times							
C40	5	33	79	105	129	169	223	317	407
40.5	5	35	55	85	105	175	363	431	
41	7	29	67	93	145				
41.5	5	35	49	61	89	133	209	389	447
42	5	33	63	97	115	311	417	481	
42.5	5	31	63	93	201	275	345	415	447
43	3	47	67	81	107	153	211	433	
43.5	3	43	79	107	141	225	359	457	
44	3	23	39	59	93	143	399		
44.5	3	27	33	67	93	129	213	417	487
45	5	53	85	109	181	299	453		
45.5	5	25	79	97	115	161	289	373	411
46	7	29	55	75	95	155	301	417	453
46.5	7	25	33	93	155	405	443		
47	5	35	51	143	179	277	351	409	467
47.5	7	29	97	119	191	433			
48	3	21	93	167	273	353	437		
48.5	3	35	69	83	141	175	235	451	
49	5	23	71	85	113	159	233		
49.5	5	49	85	123	141	227	323		
50	5	25	61	101	129	189	351	415	
50.5	5	25	51	79	149	205			
51	5	45	81	131	243	289	349		
51.5	3	25	39	91	133	235	313		
52	3	29	49	73	95	125	201	429	
52.5	3	43	73	109	217				
53	3	31	109	139	273	437			
53.5	7	33	47	75	125	177	233	311	457

LINE "C"

Coordinate		Two Way Reflection Times									
C54	7	29	81	201	319	395					
54.5	7	67	97	137	247	421					
55	7	29	59	73	99	177	215	297	409		
55.5	3	37	53	71	85	111	161	267	451		
56	3	69	101	149	175	215	253	385			
56.5	3	29	59	99	185	219	251	295	445	467	
57	3	33	45	91	139	195	247	433			
57.5	3	45	81	105	129	211	273	397	463		
58	3	41	65	85	103	137	201	229	393		
58.5	3	29	75	87	103	171	235	393	455	481	
59	5	37	79	107	157	221	273	373	477		
59.5	3	33	71	85	103	179	229	323	437	491	
60	3	49	81	111	169	299	461				
60.5	5	31	55	87	111	155					
61	5	31	61	125	189	219	473				
61.5	3	21	69	91	123	155	197	239			
62	7	75	103	149	199	305	427				
62.5	3	39	59	81	147	233	411	465			
63	5	13	61	77	99	151	187	239	337	387	455
63.5	5	43	73	85	141	213	267	435			
64	7	23	57	97	121	155	393	457			
64.5	7	55	93	139	177	365	395	457	487		
65	5	20	77	109	217	297	433				
65.5	3	29	49	85	107	239					
66	3	31	73	111	153	207					
66.5	3	23	33	53	95	125	179	229	453		
67	5	29	63	95	131	201	263	419			
67.5	3	15	37	63	99	117	161	211	261	449	469



LINE "C"

Coordinate		Two Way Reflection Times									
C68	3	29	57	103							
68.5	5	33	65	123	199	247	385	489			
69	5	37	39	67	83	117	135	209	231	281	
69.5	5	23	83	105	117	173	199	299	411		
70	3	51	87	109	269	321	433				
70.5	No response										
71	3	45	65	321	431						
71.5	5	59	105	187	423						
72	3	15	51	81	139						
72.5	5	39	45	77	141	277					
73	5	45	95	123	195	243					
73.5	5	49	65	83	131	209	379				
74	9	87	137	339							
74.5	3	33	63	105	225	253					
75	9	35	71	105	131	259	373	443			
76	9	41	85	129	153	211	345	393			
76.5	7	27	49	85	131						
77	3	31	45	73	93	297	379	445			
77.5	5	31	43	75	97	133	191	211			
78	5	29	57	113	149	177	215	407	479		
78.5	5	29	47	83	99	129	219	253	423	441	
79	3	35	73	165	303	373					
79.5	5	71	117	219	309	363	415				
80	5	31	73	109	219	315					
80.5											
81	7	23	93	117	173	345	417	473			
81.5	7	29	55	89	113	141	317	461			

vii.

LINE "C"

Coordinate		Two Way Reflection Times								
C82	3	19	49	73	165	391				
82.5	3	43	81	187	409	453				
83	3	47	59	97	157	335	417	477		
83.5	3	47	81	141	180	319	369	439		
84	5	39	75	99	127	257	329	405	475	
84.5	3	31	53	85	185	235	371	471		
85	5	23	63	85	111	167	213	249	365	480
85.5	9	57	81	105	119	185	243	303	453	
86	5	31	85	111	135	203	277	339	483	
86.5	5	63	85	105	167	207	259	401	455	
87	3	35	61	115	179	211	243	303		
87.5	3	31	43	85	145	185	257	299		
88	3	43	57	79	105	180	237			
88.5	5	31	67	87	313	379				
89	3	15	39	59	89	123	221	313	407	
89.5	5	17	71	99	149					
90	3	31	63	85	179	293	481			
90.5	5	53	85	103	175	203				
91	5	23	43	77	113	163	209	380		
91.5	5	19	75	95	115	187	255	359	431	
92	7	47	77	103	193	277	459			
92.5	3	23	55	75	109	163	215	311	471	
93	7	27	57	77	99	127	155	195	439	483
93.5	7	35	63	81	105	163	217	385		
94	3	31	73	101	139	181	229			
94.5	3	27	63							
95	5	33	59	109	149	179	277	349		
95.5	7	37	63	107						

LINE "C"

Coordinate		Two Way Reflection Times									
C96	7	65	95	121	189	223					
96.5	7	45	91	115	169	233	347				
97	5	33	83	123	177	211	287	479			
97.5	7	55	79	117	169	195	317	584			
98	3	21	38	77	137						
98.5	7	37	75	103	141	219					
99	5	15	35	83	125	195	273	409			
99.5	5	27	77	105	137	185	213	253	359	461	
100	5	39	71	115	155	187	237	303	445		
100.5	9	39	51	71	107	157	259	475			
101	3	21	34	79	109	153	221	311	429	471	
101.5	3	19	45	59	83	103	145	181	405	471	
102	3	31	53	77	113	181	235	301	371	477	
102.5	3	19	67	83	119	139	249	437			
103	3	25	53	89	173						
103.3	7	25	83	135	197	249	353				
104	3	29	83	109	129	189	269	357	387	429	
104.5	3	29	51	67	97	127	157	315	395	493	
105	3	33	67	103	147	185	373				
105.5	3	27	79	123	175	225	305	419	467		
106	3	33	81	115	149	181	295	399			
106.5	3	21	45	107	181						
107	3	29	49	87	119	291	333	359			
107.5	3	17	67	83	123	317	403				
108	3	23	47	65	87						
108.5	3	35	73	91	229	397					
109	3	19	55	97	163	355	417	481			
109.5	3	51	65	111	151						

LINE "C"

Coordinate	Two Way Reflection Times										
C110	3	19	75	101	149	291	377				
110.5	3	37	69	113	147	191					
111	3	33	41	71	141	189	233	479			
111.5	3	23	47	75	109	143	203	277			
112	3	69	99	123	199	281					
112.5	3	57	91	135	187	291	391				
113	3	43	71	95	143	197	249				
113.5	3	11	39	65	113						
114	3	19	43	77	93	165	243	453			
114.5	3	13	61	89	135	179	379				
115	3	29	45	65	87	121	155	209	361	477	
115.5	3	35	57	83	107	149	231	475			
116	3	43	67	87	129	177	385	451	495		
116.5	3	39	57	91	113	169	217	251	301		
117	3	27	81	111	131	341	481				
117.5	3	31	51	83	141	205	227	321			
118	3	27	51	91	133	259	479				
118.5	3	47	61	87	135	281	391				
119	3	47	73	91	121	185	267	471			
119.5	3	33	59	135	159	195	251	347			
120	3	25	57	79	111	163	317	395			
120.5	3	25	39	61	81	109	163	349	385	443	
121	3	27	81	99	113	147	221	307	467		
121.5	5	45	93	137	219	313	377	481			
122	3	51	91	107	435						
122.5	3	17	47	69	89	179	249	305			
123	3	35	47	97	137	187	255	355	467		
123.5	3	43	61	101	209	279	345	373	489		

L I N E "C"

Coordinate		Two Way Reflection Times									
C124	3	43	71	93	131	169	239	359	397		
124.5	3	39	55	99	151	203	423				
125	3	49	93	125	181	385	485				
125.5	3	59	99	141	277	369	407				
126	3	33	55	81	105	143	211	267	341		
126.5	5	47	81	105	135	201	335	437			
127	3	51	109	151	237	429					
127.5											
128	7	29	59	81	119	157	183	451			
128.5	3	33	73	105	145	175	263	313	401		
129	5	41	75	111	175	337					
129.5	5	27	53	95	127	155	225	257	313	481	
130	7	51	73	101	183	271	321				
130.5	5	45	69	107	339						
131	5	47	75	105	247	445					
131.5	5	55	69	107	163	235	271	367	423		
132	5	23	49	67	95	171					
132.5	5	39	61	99	113	139	165	227	281	299	495
133	5	55	83	119	189	255	321	367	443		
133.5	5	37	57	71	83	115	143	199			
134	5	29	47	63	79	107	147	199	221	317	
134.5	5	19	35	81	107	125	179	231	327	413	
135	3	51	81	99	115						
135.5	5	19	73	109	203						
136	3	27	69	93	113	193	353	397			
136.5	3	37	58	91	141	225	313	415			
137	3	29	71	87	111	135	203	289	457	493	
137.5	3	17	69	87	109	147	359				

LINE "C"CoordinateTwo Way Reflection Times

C138	5	43	67	91	169	223	357	423		
138.5	3	29	53	69	135	195				
139	3	21	85	203	299	445				
139.5	3	41	57	85	147	295	403			
140	3	59	95	125	197	233	443			
140.5	3	29	61	103	147	185	251			
141	3	31	63	127	197	297	439	473		
141.2	3	29	43	63	97	207	349	447		
142	3	41	63	103	143	197	261	357	403	
142.5	3	33	59	97	123	169				
143	3	37	55	75	89	141	161	215	249	309
143.5	3	15	38	51	77	103	175	237	443	
144	3	31	63	83	95	123	209	323	397	
144.5	3	21	59	89	137	169	231			
145	3	17	29	59	71	87	117	149	285	349
145.5	3	31	77	91	127	201	247	389	493	
146	3	35	85	97	181	275	417			
146.5	3	27	36	73	93	157	207	273	393	445
147	3	43	83	119	181	231	377			
147.5	3	41	71	97	135	179	359			
148	3	43	79	105	161	221	325	361	479	
148.5	5	23	45	79	99	139	155	261	343	387
149	3	31	49	77	121	151	213	435	475	
149.5	3	24.8	49	69	93	119	143	195	351	393
150	5	21	87	141	181	235	365	395	425	
150.5	3	21	51	65	101	115	143	181	213	315
151	5	29	45	95	169	297	397	441	473	
151.5	5	31	59	113	195	237	273	341	375	

L I N E "C"

[illegible]



L I N E "C"

Coordinate                      Two Way Reflection Times

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C166	26	58	126		
166.5					
167	18	31	71		
167.5					
168	21	49	74	157	
168.5					
169	23	33	97		
169.5					
170	14	35	69	122	
170.5	13	37	44	85	
171	8	31	84		
171.5	12	32	57		
172	14	24	57	88	
172.5	13	51	63		
173	12	44	58		
173.5	12	23	40		
174	22	29	55		
174.5	18	33	65	85	
175	13	26	85	119	
175.5	13	24	42	65	105
176	11	27	51	69	108
176.5	11	38	51	71	116
177	15	33	51	93	
177.5	17	37	63	89	127 163
178	21	41	65	109	201
178.5	19	31	45	89	165 348
179	17	55	75	249	367
179.5	15	51			

xiv.

LINE "C"

Coordinate	Two Way Reflection Times					
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C180	11	41	73	103	371	
180.5	17	31				
181	19	37	71	93		
181.5	17	25	41	73	183	153
182	17	75	37	99	149	193
182.5	21	41	65	131	179	
183	25	55	97	129		
183.5	17	31	53	103	173	
184	11	43	47	73	93	
184.5	17	43	77	97		
185	11	35	61			
185.5	19	57	105			
186	21	38	57	68		
186.5	9	33	67			
187	10	29	42	65	86	189
187.5	8	17	44	77		
188	17	40	67	88		
188.5	14	29	35	59	85	
189	21	45	68	115	148	
189.5	13	22	43	76	162	
190	23	49				
190.5	20	39	57	90		
191	12	30	42	52	75	
191.5	15	28	47			
192	15	25	29	48	66	
192.5	14	30	63			

LINE "C"

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Coordinate	Two Way Reflection Times				
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C193	15	29	45	63	
193.5	12	31	51	62	
194	15	28	48	64	
194.5	11	25	44		
195	9	27	55		
195.5	10	20	48	130	184
196	11	25	41	68	
196.5	9	19	50		
197	8	17	37	56	
197.5					
198	12	27	45	79	
198.5					
199	16	24	39	51	83
199.5					
200	11	18	32	56	

# Appendix B

## Line C Height, Distance & Depth Values

L I N E "C"

220

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN s/m	Depth Metres	R.L. Geological Bedrock	Notes
1	60.9	100.0	39		30.7	69.3	
1.5	91.4	"	33		26.3	73.7	
2	121.9	100.2	27		21.7	78.5	
2.5	152.4	"	29		23.3	76.9	
3	182.8	100.7	39	(1)	30.7	70.0	
3.5	213.3	"	51	t	39.5	61.2	
4	243.8	100.7	39	=	30.7	70.0	
4.5	274.3	"	45	.50665033Z	35.1	65.6	
5	304.8	101.1	51	1.06530717	39.5	61.6	
5.5	335.2	"	21		17.2	83.9	
6	365.7	101.3	77		58.2	43.1	
6.5	396.2	"	25		20.2	81.1	
7	426.7	101.6	57		43.9	57.6	
7.5	457.2	"	37		29.2	72.3	
8	487.6	102.3	31		24.8	77.5	
8.5	518.1	"	23		18.7	83.6	
9	548.6	103.3	63		48.2	55.1	
9.5	579.1	"	39		30.7	72.6	
10	609.6	104.1	55		42.4	61.7	
10.5	640.0	"	43		33.7	70.4	
11	670.5	104.5	45		35.1	69.4	
11.5	701.0	"	45		35.1	69.3	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
12	731.5	105.1	21		17.2	87.9	
12.5	762.0	"	31		24.8	80.3	
13	792.4	105.4	37		29.2	76.1	
13.5	822.9	"	19		15.6	89.8	
14	853.4	104.9	39		30.7	74.2	
14.5	883.9	"	33		26.3	78.6	
15	914.4	104.9	65		49.7	55.2	
15.5	944.8	"	29		23.3	81.6	
16	975.3	103.9	39	(1)	30.7	73.2	
16.5	1005.8	"	31		24.8	79.1	
17	1036.3	103.6	43		33.7	69.9	
17.5	1066.8	"	47		26.6	67.0	
18	1097.2	103.6	29		23.3	80.3	
18.5	1127.7	"	29		23.3	80.3	
19	1158.2	103.7	11		9.3	94.3	
19.5	1188.7	"	29		23.3	80.4	
20	1219.2	103.7	77		58.2	45.5	
20.5	1249.6	"	21		17.2	86.5	
21	1280.1	104.0	31		24.8	79.2	
21.5	1310.6	"	47		36.6	67.4	
22	1341.1	104.1	34		30.7	73.4	
22.5	1371.6	"	67		51.1	53.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
23	1402.0	105.2	15		12.5	92.7	
23.5	1432.5	"	61		46.8	58.4	
24	1463.0	106.1	45		35.1	71.0	
24.5	1493.5	"	33		26.3	79.8	
25	1524.0	105.8	21		17.2	88.6	
25.5	1554.4	"	21		17.2	88.6	
26	1584.9	104.9	15		12.5	92.4	
26.5	1615.4	"	29		23.3	81.5	
27	1645.9	104.1	35		27.7	76.4	
27.5	1676.4	"	21		17.2	86.9	
28	1706.8	103.9	25	(1)	20.2	83.7	
28.5	1737.3	"	27		21.7	82.2	
29	1767.8	103.8	27		21.7	82.1	
29.5	1798.3	"	21		17.2	86.6	
30	1828.8	103.6	35		27.7	75.9	
30.5	1859.2	"	39		30.8	72.9	
31	1889.7	103.0	31		24.8	78.2	
31.5	1920.2	"	19		15.6	87.4	
32	1950.7	102.2	27		21.7	80.5	
32.5	1981.2	"	35		27.7	74.5	
33	2011.6	100.8	35		27.7	73.1	
33.5	2042.1	"	41		32.2	68.6	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
34	2072.6	99.6	31		24.8	74.8	
34.5	2103.1	"	45		35.1	64.5	
35	2133.6	98.6	41		32.2	66.4	
35.5	2164.0	"	23		18.7	79.9	
36	2194.5	97.7	21		17.2	80.5	
36.5	2225.0	"	23		18.7	79.0	
37	2255.5	97.2	15		12.5	84.6	
37.5	2286.0	"	33		26.3	70.9	
38	2316.4	96.4	31		24.8	71.6	
38.5	2346.9	"	33		26.3	70.1	
39	2377.4	95.4	31		24.8	70.6	
39.5	2407.9	"	19		15.6	79.8	
40	2438.4	94.4	33	(1)	26.3	68.1	
40.5	2468.8	"	35		27.7	66.7	
41	2499.3	93.6	29		23.3	70.3	
41.5	2529.8	"	35		27.7	65.9	
42	2560.3	93.1	33		26.3	66.8	
42.5	2590.8	"	31		24.8	68.3	
43	2621.2	92.4	47		36.6	55.8	
43.5	2651.7	"	43		33.7	58.7	
44	2682.2	91.2	23		18.7	72.5	
44.5	2712.7	"	27		21.7	69.5	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
45	2743.2	90.4	53		41.0	49.4	
45.5	2773.6	"	25		20.2	70.2	
46	2804.1	89.8	29		23.3	66.5	
46.5	2834.6	"	25		20.2	69.6	
47	2865.1	89.3	35		27.7	61.6	
47.5	2895.6	"	29		23.3	66.0	
48	2926.0	89.2	21		17.2	72.0	
48.5	2956.5	"	35		27.7	61.5	
49	2987.0	89.3	23		18.7	70.6	
49.5	3017.5	"	49		38.1	51.2	
50	3048.0	89.7	25	(1)	20.2	69.5	
50.5	3078.4	"	25		20.2	69.5	
51	3108.9	90.3	45		35.1	55.2	
51.5	3139.4	"	25		20.2	70.1	
52	3169.9	89.5	29		23.3	66.2	
52.5	3200.4	"	43		33.7	55.7	
53	3230.8	88.1	31		24.8	63.3	
53.5	3261.3	"	33		26.3	61.8	
54	3291.8	86.5	29		23.3	63.2	
54.5	3322.3	"	67		51.1	35.4	
55	3352.8	86.2	29		23.3	62.9	
55.5	3383.2	"	37		29.2	57.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FM m/s	Depth Metres	R.L. Geological Bedrock	Notes
56	3413.7	86.4	69		52.5	33.9	
56.5	3444.2	"	29		23.3	63.1	
57	3474.7	87.1	33		26.3	60.8	
57.5	3505.2	"	45		35.2	52.0	
58	3535.6	88.4	41		32.2	56.2	
58.5	3566.1	"	29		23.3	65.1	
59	3596.6	89.0	37		29.2	59.8	
59.5	3627.1	"	33		26.3	62.7	
60	3657.6	89.0	49		38.1	50.9	
60.5	3688.0	"	31		24.8	64.2	
61	3718.5	88.4	31	(1)	24.8	63.6	
61.5	3749.0	"	21		17.2	71.2	
62	3779.5	87.2	75		56.8	30.4	
62.5	3810.0	"	34		30.7	56.5	
63	3840.4	86.0	13		10.9	75.1	
63.5	3870.9	"	43		33.7	52.3	
64	3901.4	84.7	23		18.7	66.0	
64.5	3931.9	"	55		42.4	42.3	
65	3962.4	83.8	20		16.4	67.4	
65.5	3992.8	"	29		23.3	60.5	
66	4023.3	83.5	31		24.8	58.7	
66.5	4053.8	"	23		18.7	64.8	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
67	4084.3	83.5	29		23.3	60.2	
67.5	4114.8	"	15		12.5	71.0	
68	4145.2	83.9	29		23.3	60.6	
68.5	4175.7	"	33		26.3	57.6	
69	4206.2	84.3	37		29.2	55.1	
69.5	4236.7	"	23		18.7	65.6	
70	4267.2	84.3	51		39.5	44.8	
70.5	4297.6	"	-		-	-	
71	4328.1	85.5	45		35.1	50.4	
71.5	4358.6	"	59		45.3	40.2	
72	4389.1	84.5	15		12.5	72.0	
72.5	4419.6	"	39		30.7	53.8	
73	4450.0	82.3	45	(1)	35.1	47.2	
73.5	4480.5	"	49		38.1	44.2	
74	4511.0	81.7	87*		65.3	16.4	
74.5	4541.5	"	33		26.3	55.4	
75	4572.0	82.5	35		27.7	54.8	
75.5	4602.4	"	41		32.2	50.3	
76	4632.9	82.4	27		21.7	60.7	
76.5	4663.4	"	31		24.8	57.6	
77	4693.9	"	31		24.8	57.6	
77.5	4724.4	"	29		23.3	59.1	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
78	4754.8	82.3	29		23.3	59.0	
78.5	4785.3	"	29		23.3	59.0	
79	4815.8	81.9	35		27.7	54.2	
79.5	4846.3	"	71*		53.9	28.0	
80	4876.8	81.9	31		24.8	57.1	
80.5	4907.2	"	27		21.7	60.2	
81	4937.7	82.6	23		18.7	63.9	
81.5	4968.2	"	29		23.3	59.3	
82	4998.7	83.3	19		15.6	67.7	
82.5	5029.2	"	43		33.7	49.6	
83	5059.6	83.9	47	(1)	36.6	47.3	
83.5	5090.1	"	47		36.6	47.3	
84	5120.6	84.0	39		30.7	53.3	
84.5	5151.1	"	31		24.8	59.2	
85	5181.6	83.2	23		18.7	64.5	
85.5	5212.0	"	57		43.9	39.3	
86	5242.5	82.8	31		24.8	58.0	
86.5	5273.0	"	63		48.2	34.6	
87	5303.5	82.8	35		27.7	55.1	
87.5	5334.0	"	31		24.8	58.0	
88	5364.4	82.2	43		33.7	48.5	
88.5	5394.9	"	31		24.8	57.4	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
89	5425.4	82.3	15		12.5	69.8	
89.5	5455.9	"	17		14.1	68.2	
90	5486.4	83.2	31		24.8	58.4	
90.5	5516.8	"	53		41.0	42.2	
91	5547.3	85.2	23		18.7	66.5	
91.5	5577.8	"	19		15.6	69.6	
92	5608.3	85.6	47		36.6	49.0	
92.5	5638.8	"	23		18.7	66.9	
93	5669.2	85.7	27		21.7	64.0	
93.5	5699.7	"	35		27.7	58.0	
94	5730.2	86.4	31		24.8	61.6	
94.5	5760.7	"	27		21.7	64.7	
95	5791.2	86.7	33	(1)	26.3	60.4	
95.5	5821.6	"	37		29.2	57.5	
96	5852.1	86.6	65		49.7	36.9	
96.5	5882.6	"	45		35.1	51.5	
97	5913.1	100.5	33		26.3	74.2	
97.5	5943.6	"	55		42.0	58.5	
98	5974.0	100.4	21		17.2	83.2	
98.5	6004.5	"	37		29.2	71.2	
99	6035.0	100.8	15		12.5	88.3	
99.5	6065.5	"	27		21.7	79.1	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	P.L. Geological Bedrock	Notes
100	6096.0	100.9	39		30.7	70.2	
100.5	6126.4	"	39		30.7	70.2	
101	6156.9	100.5	21		17.2	83.3	
101.5	6187.4	"	19		15.6	84.9	
102	6217.9	"	31		24.8	75.7	
102.5	6248.4	"	19		15.6	84.9	
103	6278.8	"	25		20.2	80.3	
103.5	6309.3	"	25		20.2	80.3	x
104	6339.8	100.8	29		23.3	77.5	.
104.5	6370.3	"	29		23.3	77.5	
105	6400.8	100.2	33		26.3	73.9	
105.5	6431.2	"	27	(1)	21.7	78.4	
106	6461.7	100.3	33		26.3	74.0	
106.5	6492.2	"	21		17.2	83.1	
107	6522.7	100.6	29		23.3	77.3	
107.5	6553.2	"	17		14.1	86.5	
108	6583.6	101.1	23		18.7	82.4	
108.5	6614.1	"	35		27.7	73.4	
109	6644.6	101.4	19		15.6	85.8	
109.5	6675.1	"	51		39.5	61.9	
110	6705.6	101.9	19		15.6	86.3	
110.5	6736.0	"	37		29.2	72.7	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
111	6766.5	102.0	33		26.3	75.7	
111.5	6797.0	"	23		18.7	83.3	
112	6827.5	102.8	69		52.5	50.3	
112.5	6858.0	"	57		43.9	58.9	
113	6888.4	103.0	43		33.7	69.3	
113.5	6918.9	"	11		9.3	93.7	
114	6949.4	103.3	19		15.6	87.7	
114.5	6979.9	"	13		10.9	92.4	
115	7010.4	103.8	29		23.3	80.5	
115.5	7040.8	"	35		27.7	76.1	
116	7071.3	103.9	43		33.7	70.2	
116.5	7101.8	"	39		30.7	73.2	
117	7132.3	102.6	27		21.7	80.9	
117.5	7162.8	"	31	(1)	24.8	77.8	
118	7193.2	103.6	27		21.7	81.9	
118.5	7223.7	"	47		36.6	67.0	
119	7254.2	104.9	47		36.6	68.3	
119.5	7284.7	"	33		26.3	78.6	
120	7315.2	106.5	25		20.2	86.3	
120.5	7345.6	"	25		20.2	86.3	
121	7376.1	106.8	27		21.7	85.1	
121.5	7406.6	"	45		35.1	71.7	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity m/s	Depth Metres	R.L. Geological Bedrock	Notes
122	7437.1	106.6	51		39.5	67.1	
122.5	7467.6	"	17		14.1	92.5	
123	7498.0	105.8	35		27.8	78.1	
123.5	7528.5	"	43		33.7	72.1	
124	7559.0	106.1	43		33.7	72.4	
124.5	7589.5	"	39		30.7	75.4	
125	7620.0	106.3	49		38.1	68.2	
125.5	7650.4	"	59		45.4	60.9	
126	7680.9	106.6	33		26.3	80.3	
126.5	7711.4	"	47		36.6	70.0	
127	7741.9	107.1	51	(1)	39.5	67.6	
127.5	7772.4	"	39		30.7	76.4	
128	7802.8	107.5	29		23.3	84.2	
128.5	7833.3	"	33		26.3	81.2	
129	7863.8	107.7	41		32.2	75.5	
129.5	7894.3	"	27		21.7	86.0	
130	7924.8	107.7	51		39.5	68.2	
130.5	7955.1	"	45		35.1	72.6	
131	7985.7	108.4	47		36.6	71.8	
131.5	8016.2	"	55		42.4	66.0	
132	8046.7	109.7	23		18.7	91.0	
132.5	8077.2	"	39		30.7	79.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
133	8107.6	111.1	55		42.4	68.7	
133.5	8138.1	"	37		29.2	81.8	
134	8168.6	111.4	29		23.3	88.1	
134.5	8199.1	"	19		15.6	95.8	
135	8229.6	110.1	51		39.5	70.6	
135.5	8260.0	"	19		15.6	94.5	
136	8290.5	109.5	27		21.7	87.8	
136.5	8321.0	"	37		29.2	80.3	
137	8351.5	109.0	29		23.3	85.7	
137.5	8382.0	"	17		14.1	94.9	
138	8412.4	108.2	43		33.7	74.5	
138.5	8442.9	"	29		23.3	84.9	
139	8473.4	107.4	21	(1)	17.2	90.2	
139.5	8503.9	"	41		32.2	75.2	
140	8534.4	107.4	59		45.3	62.1	
140.5	8564.8	"	29		23.3	84.1	
141	8595.3	107.4	31		24.8	82.6	
141.5	8625.8	"	29		23.3	84.1	
142	8656.3	107.6	41		32.2	75.4	
142.5	8686.8	"	33		26.3	81.3	
143	8717.2	108.1	37		29.2	78.9	
143.5	8747.7	"	38		30.0	78.1	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
144	8778.2	108.5	31		24.8	83.7	
144.5	8808.7	"	21		17.2	91.3	
145	8839.2	109.2	17		14.1	95.1	
145.5	8869.6	"	31		24.8	84.4	
146	8900.1	109.8	35		27.7	82.1	
146.5	8930.6	"	27		21.7	88.1	
147	8961.1	110.4	43		33.7	76.7	
147.5	8991.6	"	41		32.2	78.2	
148	9022.0	110.7	43		33.7	77.0	
148.5	9052.5	"	23	(1)	18.7	92.0	
149	9083.0	110.7	31		24.8	85.9	
149.5	9113.5	"	24		19.5	91.2	
150	9144.0	110.5	21		17.2	93.3	
150.5	9174.4	"	21		17.2	93.3	
151	9204.9	109.8	29		23.3	86.5	
151.5	9235.4	"	31		24.8	85.0	
152	9265.9	108.9	35		27.7	81.2	
152.5	9296.4	"	29		23.3	85.6	
153	9326.8	108.2	41		32.2	76.0	
153.5	9357.3	"	47		36.6	71.6	
154	9387.8	107.4	25		20.2	87.2	
154.5	9418.3	"	31		24.8	82.6	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
155		106.7	35		27.7	79.0	
155.5		"	39		30.7	76.0	
156		"	47		36.6	70.1	
156.5		"	35		27.7	79.0	
157		"	39		30.7	76.0	
157.5		"	-	(1)	-	-	
158		105.7	47		36.6	69.1	
158.5		"	-		-	-	
159		"	47		36.6	69.1	
159.5		"					
160-23		104.8					
160-23.5		"					
160-22		105.2					
160-22.5		"					
160-21		106.9					
160-21.5		"					
160-20		107.4					
160-20.5		"					
160-19		108.1					
160-19.5		"					
160-18		108.0					
160-18.5		"					

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
160-17		107.6					
160-17.5		"					
160-16		106.9					
160-16.5		"					
160-15		105.3					
160-15.5		"					
160-14		105.4					
160-14.5		"					
160-13		105.9					
160-13.5		"					
160-12		106.9					
160-12.5		"					
160-11		106.4					
160-11.5		"					
160-10		105.3					
160-10.5		"					
160-9		104.0					
160-9.5		"					
160-8		101.7					
160-8.5		"					
160-7		101.5					
160-7.5		"					

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
160-6		101.7					
160-6.5		"					
160-5		101.4					
160-5.5		"					
160-4		102.4					
160-4.5		"					
160-3		102.5					
160-3.5		"					
160-2		102.2					
160-2.5		"					
160-1		101.5					
160-1.5		"					
160	9753.6	101.2					
160.5	9784.0	"					
161	9814.5	101.3					
161.5	9845.0	"					
162	9875.5	101.3					
162.5	9906.0	"					
163	9936.4	100.2					
163.5	9966.9	"					
164	9997.4	99.9					
164.5	10027.9	"					

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
165	10058.4	100.0	30		24.0	76.0	
165.5	10088.8	-	-		-	-	
166	10119.3	101.0	58		44.6	56.4	
166.5	10149.8	"	-		-	-	
167	10180.3	102.6	31		24.8	77.8	
167.5	10210.8	"	-		-	-	
168	10241.2	103.5	49		38.1	65.4	
168.5	10271.7	"	-		-	-	
169	10302.2	102.9	33		26.3	76.6	
169.5	10332.7	"	-	(1)	-	-	
170	10363.2	103.4	35		27.7	75.7	
170.5	10393.6	"	37		29.2	74.2	
171	10424.1	103.6	31		24.8	78.8	
171.5	10454.6	"	32		25.5	78.1	
172	10485.1	103.9	24		19.5	84.4	
172.5	10515.6	"	51		39.5	64.4	
173	10546.0	104.7	44		34.4	70.3	
173.5	10576.5	"	23		18.7	86.0	
174	10607.0	104.9	29		23.3	81.6	
174.5	10637.5	"	33		26.3	78.6	
175	10668.0	105.5	26		21.0	84.5	
175.5	10698.4	"	24		19.5	86.0	

XVII.



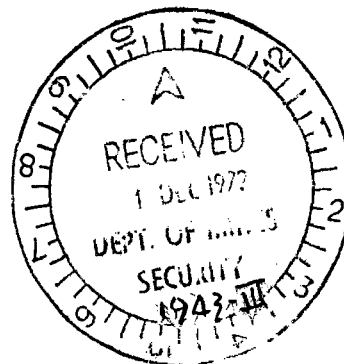
Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
176	10728.9	106.4	27		21.0	84.7	
176.5	10759.4	"	38		30.0	76.4	
177	10789.9	107.0	33		26.0	80.7	
177.5	10820.4	"	37		29.2	77.8	
178	10850.8	106.8	41		32.2	74.6	
178.5	10881.3	"	31		24.8	82.0	
179	10911.8	105.3	55		42.4	62.9	
179.5	10942.3	"	51		39.5	65.8	
180	10972.8	104.2	41		32.2	72.0	
180.5	11003.2	"	31	(1)	24.8	73.4	
181	11033.7	102.1	37		29.3	72.9	
181.5	11064.2	"	25		20.2	81.9	
182	11094.7	104.1	75		56.8	47.3	
182.5	11125.2	"	41		32.2	71.9	
183	11155.6	105.5	55		42.4	63.1	
183.5	11186.1	"	31		24.8	80.7	
184	11216.6	106.7	43		33.7	73.0	
184.5	11247.1	"	43		33.7	73.0	
185	11277.6	107.2	35		27.7	79.5	
185.5	11308.0	"	57		43.9	63.3	
186	11338.5	108.3	38		30.0	78.3	
186.5	11369.0	"	33		26.3	82.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
187	11399.5	109.3	29		23.3	86.0	
187.5	11430.0	"	17		14.1	95.2	
188	11460.4	110.1	40		31.5	78.6	
188.5	11490.9	"	29		23.3	86.8	
189	11521.4	110.7	45		35.1	75.6	
189.5	11551.9	"	22		17.9	92.8	
190	11582.4	110.8	49		38.1	72.7	
190.5	11612.8	"	39		30.7	80.1	
191	11643.3	110.3	30		24.0	86.3	
191.5	11673.8	"	28		22.5	87.8	
192	11704.3	109.5	25	(1)	20.2	89.3	
192.5	11734.8	"	30		24.0	85.5	
193	11765.2	109.3	29		23.3	86.0	
193.5	11795.7	"	31		24.8	84.5	
194	11826.2	109.1	28		22.5	86.6	
194.5	11856.7	"	25		20.2	88.9	
195	11887.2	108.6	27		21.7	86.9	
195.5	11917.6	"	20		16.4	92.2	
196	11948.1	108.2	25		20.2	88.0	
196.5	11978.6	"	19		15.6	92.6	
197	12009.1	108.3	17		15.6	92.6	
197.5	12039.6	"	22		17.9	90.4	

LINE "C"

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Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
198	12070.0	108.8	27		21.7	87.1	
198.5	12100.5	"	-		-	-	
199	12131.0	109.8	24	(1)	19.5	90.3	
199.5	12161.5	"	-		-	-	
200	12192.0	109.6	18		14.8	94.8	



xxx

# Appendix B

## Line D Reflection Readings

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i.

### LINE "D"

Coordinate		Two Way Reflection Times						
D1	5	28	40	65	84	118	149	
1.5	3	29	71	103	133	169		
2	4	43	83	106	138	170	189	
2.5	5	21	51	58	90	133	158	
3	2	19	35	41	65	95	174	
3.5	3	45	91	173	207			
4	4	41	57	74	124	143		
4.5	8	43	72	89	138	168		
5	5	58	98	204				
5.5	5	28	81	95	126	146		
6	5	12	41	102	142			
6.5	5	19	50	73	99	148		
7	7	24	49	69	108	165		
7.5	2	48	66	85	127	178		
8	3	12	26	59	80	99	127	
8.5	3	15	34	49	60	138		
9	4	23	32	68	111	135	157	
9.5	3	28	53	83	111	165	130	
10	6	17	35	58	96	134		
10.5	4	37	109	151	179			
11	7	26	55	68	92	124		
11.5	6	31	49	58	74	96	129	169
12	6	19	60	80	107	137		
12.5	4	21	135	159	179			
13	5	32	84	116	131	150	174	
13.5	5	18	65	88	158	171	204	

LINE "D"

Coordinate	Two Way Reflection Times									
D14	4	13	42	57	85	111	167			
14.5	4	12	41	62	80	123				
15	3	45	66	118	160					
15.5	5	15	32	47	77	113	133	162	191	235
16	3	9	25	60	74	93	112	168		
16.5	3	9	36	51	77	94	112	141	166	
17	5	33	73	112	154	222				
17.5	5	29	40	62	82	130	161			
18	4	15	21	35	48	66	100	170	200	
18.5	4	25	42	77	98	167	198			
19	4	98	156	202						
19.5	3	18	42	124	166					
20	8	15	85	133	177	205	235			
20.5	7	55	109	135	169	229				
21	5	33	97	141	169	245				
21.5	3	13	41	87	145	167	377			
22	5	35	77	101	131	175				
22.5	5	15	43	57	95	179				
23	3	13	77	101	115	141	173			
23.5	3	105	171							
24	3	33	89	149	177	205				
24.5	No penetration due to mud									
25	3	19	167	279						
25.5	15	35	67	97	119	139	171			
26	3	33	35	185						
26.5	3	13	21	91	119	187	227			

LINE "D"

Coordinate		Two Way Reflection Times						
D27	3	11	31	63	95	121	187	
27.5	9	45	61	119	147			
28	9	21	95	125	153			
28.5	7	27	67	93	145	115	177	
29	10	23	39	57	108	141	199	
29.5	5	21	27	58	105	122	141	
30	5	16	48	62	80	126	141	169
30.5	5	58	86	116	151			
31	5	27	43	60	72	95	151	
31.5	6	25	34	71	100	129		
32	5	11	25	51	83	111	126	172
32.5	6	24	52	95	136	191		
33	4	14	32	84	147			
33.5	4	15	40	77	100			
34	2	13	33	47	116			
34.5	3	24	38	49	65	104	139	
35	6	26	40	58	74	145		
35.5	6	24	44	69	107	133	188	
36	3	15	52	84	113	159	197	
36.5	6	25	41	56	120	157		
37	7	18	60	79	94			
37.5	5	15	39	65	99	127		
38	4	27	41	58	90	106	153	
38.5	6	14	27	44	72	95	110	142
39	4	14	36	47	64	86	120	
39.5	7	35	61	77	104	128	173	

L I N E "D"

Coordinate	Two Way Reflection Times						
D40	4	16	43	72	124	144	157
40.5	6	18	41	58	82	122	163
41	5	21	34	63	93	134	146
41.5	5	11	34	55	71	82	114 155
42	8	29	47	69	105	132	208
42.5	7	25	50	94	107	130	
43	7	71	87	107	151		
43.5	3	18	48	60	82	110	155
44	4	21	34	52	67	126	163 186
44.5	5	17	33	52	91	103	137 169
45	4	31	42	97	117	138	
45.5	5	21	43	57	84	125	169
46	2	26	49	78	129	147	
46.5	2	14	46	66	82	103	116 149
47	4	11	59	84	110	133	168
47.5	3	19	39	67	96	139	
48	9	18	30	56	99	115	159
48.5	7	25	41	61	92	114	159
49	7	29	37	63	74	94	130
49.5	4	18	34	48	76	110	151 201
50	2	19	46	60	84	127	170 206
50.5	5	15	34	52	68	116	
51	5	43	67	86	127		
51.5	8	20	36	56	93	110	131 165
52	4	18	49	70	97	124	154
52.5	8	23	44	96	120	134	187



LINE "D"

Coordinate		Two Way Reflection Times							
D53	3	31	42	68	90	116	164		
53.5	3	23	56	101	147				
54	6	23	34	59	76	110	147		
54.5	2	20	61	100	138				
55	3	15	39	52	58	87	97	139	
55.5	5	21	42	66	134				
56	5	38	90	102	129	182			
56.5	4	46	56	71	92	133	154	234	112
57	4	12	31	62	89	118			
57.5	5	18	54	81	96	147			
58	4	28	43	50	67	92	113	145	
58.5	5	21	59	97	109	127	180		
59	5	22	56	92	118	175			
59.5	4	19	38	60	84	102	128		
60	4	88	105	137					
60.5	6	19	29	66	71	103	149		
61	7	17	28	55	86	148			
61.5	6	25	36	91	102	144	177		
62	5	36	112	131					
62.5	5	22	58	92	118	152			
63	6	21	29	84	140				
63.5	5	44	83	101	132				
64	4	30	44	66	78	122	169	236	
64.5	2	92	125	156	187				
65	3	10	22	34	61	86	124	146	221
65.5	6	34	61	110	146				

LINE "D"

Coordinate

Two Way Reflection Times

D66	4	27	37	82	105	133			
66.5	5	26	80	103	130	158			
67	6	36	59	74	92	115	180		
67.5	6	25	36	48	82	102	134		
68	6	35	60	76	101	129	175		
68.5	3	12	24	55	103	165			
69	3	12	31	40	48	57	65	99	151
69.5	8	26	49	97					
70	6	26	47	56	90	109	202		
70.5	4	21	47	68	91	116	138		
71	4	17	58	103	127	197			
71.5	3	13	67	78	93	122	139	167	
72	3	49	91	130	163	225			
72.5	3	21	53	93	127	147	189		
73	5	35	77	107	173				
73.5	5	20	55	71	102	136	196		
74	3	15	37	58	65	106	139		
74.5	2	12	34	64	75	91	119	142	179
75	4	12	36	67	92	142	183		
75.5	3	13	40	60	119	138			
76	2	68	73	128	150				
76.5	2	8	80	176	140				
77	2	15	31	46	73	89	133	174	
77.5	3	12	34	57	75	96	119	138	164
78	6	26	35	45	72	95	138	205	
78.5	6	21	60	82	122				

LINE "D"

Coordinate	Two Way Reflection Times									
D79	6	22	57	84	121					
79.5	5	24	38	56	75	105				
80	8	32	59	80	122					
80.5	4	19	35	82	125	173	211			
81	5	26	36	84	140	153				
81.5	8	26	73	128	162					
82	6	35	62	86	119					
82.5	5	37	69	99	132	155				
83	4	19	63	81	117	140	205			
83.5	3	23	31	79	122	167				
84	5	21	49	77	112	160				
84.5	4	15	45	80	100	146	190			
85	6	20	64	79	103	169				
85.5	4	30	32	66	87	110	129	156	195	
86	2	15	40	69	89	117	136	166	230	
86.5	2	18	35	45	77	91	120	147		
87	3	14	28	40	72	91	119	151	213	
87.5	4	24	37	53	71	116	147	164		
88	4	20	27	48	71	89	118	166		
88.5	6	31	65	87	104	123	177			
89	2	17	28	78	95	127	160	199		
89.5	3	30	48	70	81	102	112	148	166	
90	5	17	52	70	92	117	191			
90.5	3	23	49	65	84	129	147	171		
91	2	35	75	98	111	157	197			
91.5		53	78	97	115	160	196			

L I N E "D"

Coordinate

Two Way Reflection Times

D93		10	61	102	130	157	199				
93.5	3	37	90	110	155	168	199				
94	2	18	27	65	89	117	162				
94.5	4	15	41	67	88	117	146	190			
95	3	14	26	44	63	75	96	122	145	189	
95.5	4	20	43	50	66	93	121	191	225		
96	3	30	38	59	82	132	164	188			
96.5	4	22	43	60	84	131					
97	3	22	67	87	146						
97.5	2	16	28	44	51	76	92	142	177	202	230
98	4	21	37	72	108	135	217				
98.5	3	22	42	60	74	109					
99	3	25	40	69	93	203					
99.5	3	38	81	176	207	224					
100	2	12	76	111	144	171	184	252			
100.5	4	36	83	107	138						
101	3	69	79	137	178	202	216	252			
101.5	3	31	47	79	103	125	144	187	214	245	
102	3	30	41	58	73	113	149				
102.5	3	16	52	63	87	138	175				
103	5	20	34	56	75	91	112	129	187		
103.5	3	54	68	89	117	207					
104	4	20	32	46	63	87	112	139			
104.5	4	26	55	68	94	121	195				
105	2	12	30	68	91	109	133				
105.5	3	22	39	66	92	116					

L I N E "D"

Coordinate		Two Way Reflection Times						
D106	3	20	53	87	93	153		
106.5	2	48	84	101	124	137	160	
107	3	37	57	84	94	122	140	
107.5	4	18	26	42	74	98	155	
108	2	31	41	62	81	105	152	
108.5	3	16	29	50	70	86	124	162
109	2	28	39	74	99	152	198	
109.5	2	40	84	126	163	193		
110	4	17	62	75	97	115	150	174 219
110.5	4	24	42	74	94	114	132	186
111	3	17	46	64	96	139	156	
111.5	3	14	24	47	97	122		
112	3	18	48	77	94	109	135	
112.5	2	23	46	81				
113	3	17	27	60	69	89	114	190
113.5	2	26	83	107	140	209		
114	8	81	108	133	154	170	185	220
114.5	5	17	33	72	92	126	141	155
115	2	49	76	96	134			
115.5		18	38	53	81	96	146	
116	12	20	39	86	109	136	174	199
116.5	4	22	38	53	81	102	142	192 212
117	3	17	35	57	89	131	222	
117.5	2	16	59	81	104	179		
118	3	19	43	58	77	93	118	164
118.5	6	15	63	81	122	145		

LINE "D"

Coordinate		Two Way Reflection Times									
D119	3	11	52	81	106	122	165				
119.5	3	15	37	46	81	106	117	158	194		
120	3	13	34	94	106	139	156	190			
120.5	6	18	36	50	89	123	145	172	200		
121	2	15	31	43	81	157	175				
121.5	4	14	44	84	104	144	179				
122		15	32	83	132	148	165	178			
122.5	2	16	32	47	86	121	161	196			
123		16	33	46	63	103	136	167			
123.5	3	18	27	60	83	99	139				
124	2	13	27	52	80	101	124	140			
124.5	3	13	40	82	104	121	166				
125	3	15	30	65	85	108	118	154	189		
125.5	2	12	22	37	66	83	107	126	165		
126	3	12	31	48	86	109	123	177			
126.5		17	33	83	119	133	149	170			
127	3	12	29	57	66	83	106	154	171		
127.5	3	8	20	40	47	60	76	104	115	128	172
											196
128	5	12	31	57	86	125	159	192			
128.5	3	15	28	37	64	88	109	126	151		
129	2	17	31	48	61	87	108	126	155		
129.5	4	35	42	83	102	126	147	212			
130	3	17	33	43	58	72	88	99	108	128	161
130.5	2	9	14	48	71	96	121	149			
131	2	8	24	56	72	86	121	174			
131.5	2	15	27	57	79	97	140	184	220		

L I N E "D"

Coordinate		Two Way Reflection Times									
D132	2	7	32	48	70	84	108	202	223		
132.5	5	30	43	81	102	157	192				
133	2	18	36	57	85	119	145	181	205		
133.5	2	14	33	62	78	92	143	169	188	108	238
134	2	22	35	44	60	92	113	135	161	209	
134.5	2	14	31	52	68	89	132	141	161	188	227
135	3	18	37	49	49	62	77	108	152		
135.5	2	30	60	82	112	130	165				
136	2	10	22	30	64	85	107	169	199	236	
136.5	2	24	50	82							
137	2	10	37	60	76	90	126				
137.5	2	14	26	34	44	74	101	117	133	151	210
138	2	18	29	58	75	118	146	201	219		
138.5	1	17	22	35	85	107	157				
139	2	8	31	53	70	89	112	144	168		
139.5	2	6	22	39	45	75	95	122	152		
140	2	15	42	76	110	122	148	188	213		
140.5	4	33	74	146	193						
141	2	20	32	51	73	90	159	228			
141.5	2	9	32	60	89	110	134	178			
142	2	15	34	55	73	111	131	148	173		
142.5	3	46	76	107	162						
143	2	8	36	58	71	91	116	160	180	226	
143.5	2	41	70	99	113	162	212				
144	2	63	79	123	141						
144.5	2	21	25	50	75	101	137	167	191	224	

LINE "D"

Coordinate	Two Way Reflection Times									
D145	2	10	30	74	115	140				
145.5	2	23	38	78	103	136	176			
146	2	32	64	77	175					
146.5	5	11	59	77	100	125				
147	6	49	73							
147.5	6	26	40	55	65	79	Doubtful	(Calcrete)		
148	5	29	75	92			"	"		
148.5	7	22	35	45	64	91	"	"		
149	5	26	45	62	85	104	154	"	"	
149.5	No response (Calcrete)									
150	4	13	22	43	80	109	143	"	"	
150.5	4	22	52	73	207		Doubtful	(Calcrete)		
151	4	19	39	56	77	144	160	190	Doubtful	
									(Calcrete)	
151.5	2	27	54	81	114	163				
152	3	12	52	78	97	133	169	204		
152.5	3	29	60	78	96	139	160	223		
153	3	20	39	49	73	88	116	130	151	166
153.5	2	10	74	96	131	153	170	198		
154	2	33	43	58	69	84	138	153		
154.5	2	36	49	72	112	168	192			
155	3	47	82	107	136	178				
155.5	3	31	61	103	119	174	223			
156	3	19	39	66	155	202	231			
156.5	3	12	23	66	122	154				
157	5	40	85	104	166	193				
157.5	2	13	28	61	77	102	179			



LINE "D"

Coordinate	Two Way Reflection Times								
D158	5	29	68						
158.5	3	43	50	60	72	103	160	Calcrete	
159	2	21	62	83	105			"	
159.5	7	30	53	65	75	134	160		
160	2	36	60	76	87	227			
160.5	2	19	51	75	104	143			
161	3	29	50	77	130	164			
161.5	2	34	40	50	74	95	117	162	
162	2	15	42	68	105	156	194		
162.5	2	10	39	54	78	128	150	176	
163	2	14	39	71	108	187			
163.5	2	13	29	41	68	82	105	141	180
164	3	23	41	62	76	112	127		
164.5	2	28	67	93	134	197	225		
165	2	18	40	61	79	110	131	151	
165.5	2	26	33	59	102	145	188		
166	2	24	79	107	161	188			
166.5	3	19	35	81					
167	7	19	60	87	116	173			
167.5	3	11	28	48	80	109	178		
168	2	13	26	80	163	200			
168.5	5	15	35	75	103	138	207	158	
169	4	34	75	100	148	195			
169.5	3	20	34	62	91	113	149		
170	3	15	44	59	78	99	167	211	
170.5	2	9	26	67	82	171			

LINE "D"

Coordinate	Two Way Reflection Times									
D171	2	21	36	50	67	88				
171.5	2	21	33	51	64	95	129	146	175	
172	2	33	59	87	115	143	167	208		
172.5	2	12	36	97	134	160				
173	No response									
173.5	2	12	25	46	79	102				
174	2	18	58	79	129	159	202			
174.5	2	15	36	43	83	123	140	197	230	
175	2	17	37	49	83	118	150			
175.5	2	9	42	60	81	109	145	197		
176	2	41	57	81	101	116	149	162		
176.5	2	18	55	89	123	139	175			
177	3	14	24	43	78	121	177	201		
177.5	3	16	58	86	118	164				
178	2	10	28	42	68	91	171			
178.5	3	19	34	53	87	134	164	211		
179	3	17	45	59	95					
179.5	3	10	18	85	127	172	208	241		
180	6	20	43	95	173	214				
180.5	2	8	35	92	127					
181	4	10	38	90	116	130	173			
181.5	4	56	84	113	139	168				
182	(No response) 5 69 128 173									
182.5	4	18	26	46	81	104	124	140		
183	3	12	39	71	85	120	145	165		
183.5	2	19	58	94	115	148	165	199	245	

L I N E "D"

Coordinate

Two Way Reflection Times

D184	No response									
184.5	3	29	50	86	114	137	205			
185	5	29	40	61	75	91	125	151	207	
185.5	13	28	40	58	92					
186	5	37	58	81	97	116	163			
186.5	4	25	35	52	98	138	206			
187	3	23	37	53	71	99	130			
187.5	2	14	30	42	64	69	95	124	143	183
188	2	32	48	83	115	148				
188.5	2	14	72	112	127	175				
189	2	13	37	52	80	125	152	195		
189.5	3	27	39	64	84	103	113	144		
190	2	20	50	76	125	176				
190.5	2	11	63	84	99	130				
191	7	51	89	112	173					
191.5	3	48	78	87	109	166				
192	3	11	89	111	131	171	204	231		
192.5	3	13	39	48	86	119	179			
193	4	26	57	80	111	168	202			
193.5	3	23	40	80	99	112	153	178	201	
194	6	16	42	58	85	103	131	150		
194.5	6	22	41	84	102	121	169			
195	6	18	39	63	81	92	111	139	198	
195.5		33	43	77	149	181	271	411		
196		35	51	71	99	169	215	271	331	377 447
196.5		19	99	111	145	183	285	371		

L I N E "D"

Coordinate	Two Way Reflection Times									
D197	21	91	105	143	183	253	307	337	381	441
197.5	17	53	85	117	179	249	411	475		
198	27	49	83	117	183	247	281	335	479	
198.5	15	33	57	127	155	217	255	359	419	447
199	15	31	69	109	425	489				
199.5	19	51	31	103	155	193	235	303	391	451
200	17	51	103	129	179	247	277	323	469	493
200.5	29	50	81	101	153	297	365	417	499	
201	13	55	77	111	157	171	257	321	353	439
201.5	15	28	57	71	105	147	191	221	363	483
202	15	49	95	133	163	183	221	255	467 345	489 405
202.5	13	33	48	97	127	169	201	259	345	455 425
203	11	19	67	111	139	223	273	409	469 473	505
203.5	13	25	65	95	127	179	207	245	493	
204	17	83	147	393	453	481				
204.5	13	73	105	153	187	235	377	489		
205	33	85	123	131	163	205	265	337	403	465
205.5	17	29	63	91	117	149	195	223	305	459
206	11	23	45	99	142	167	205	245	429	503 497
206.5	19	53	69	101	151	191	245	473		
207	13	37	55	85	155	197	261	285	433	469
207.5	13	47	133	171	233	279				
208	17	43	55	63	123	155	181	239		
208.5	15	31	71	111	173	259	307	389		
209	11	29	95	131	203	269	303	349	443	491
209.5	19	61	151	181	233	309	375	433	477	

L I N E "D"

Coordinate		Two Way Reflection Times										
D210	11	29	49	107	147	229	179	211	279	343	439	465
210.5	13	27	43	103	143	221						
211	15	27	49.5	119	147	189	219	503				
211.5	19	37	69	95	161	191	243	295	353	449		
212	13	33	49	81	123	157	187					
212.5	13	31	51	119	159	189	249	297				
213	9	81	65	131	195	263	379	431	463	505		
213.5	11	27	55	87	123	185	255	309	439	487		
214	11	49.5	99	147	185	329	273	401	483			
214.5	17	55	73	101	143	155	195	269	321	375	397	467
215	23	51	67	99	171	197	251	327	403	443	479	
215.5	17	39	63	113	171	261	307	373	457	493		
216	9	33	43	61	83	137	199	245	391			
216.5	15	53	73	131	179	207	257	301	393	461	483	
217	53	85	153	169	189	223	255	285	337	445	463	493
217.5	25	51	147	123	185	233	281	329	375			
218	39	53	87	105	481	215	123	215	249	305	399	445
218.5	33	59	87	133	221	177	231	273	333	493		
219	15	51	109	173	221	305	475	443	415	387	357	
219.5	39	69	87	119	173	257	277	317	363	411		
220	25	31	51	93	127	227	281	325	367	497		
220.5	23	31	51	99	145	191	285	313	337	353		
221	24	45	69	121	177	227	267	401	503			
221.5	13	29	83	169	237	317						
222	21	41	81	135	215	259	423	459				
222.5	15	51	63	81	123	181	255	345	477			

L I N E "D"

[illegible]

L I N E "D"

[illegible]

L I N E "D"

Coordinate		Two Way Reflection Times									
D236	9	17	47	69	79	125	157	259	397	457	
236.5	7	19	41	73	81	111	161	193	251	325	419
237	7	19	71	87	113	167	203	261	299	389	431
237.5	9	21	75	87	129	169	241	297	369		
238	9	19	59	73	91	131	157	243	275	317	431
238.5	7	21	41	73	93	107	147	201	297	337	383 441
239	9	57	75	135	165	273	335	371	443		
239.5	7	19	81	101	133	147	207	265	313	373	405
240	5	17	43	67	77	113	153	183	235	277	323
240.5	5	15	31	75	113	147	377	409	439	355 487	389
241	5	25	43	95	133	173	211	303	363	483	
241.5	5	27	59	87	99	145	177	285	367	415	471
242	3	33	87	103	131	343	469				
242.5	5	29	71	83	133	193	257	343			
243	7	41	53	71	117	145	249	301	463		
243.5	5	17	65	103	141	235	267	333	361	447	491
244	3	23	51	69	115	217	243	309	453		
244.5	7	31	39	55	129	203	259				
245	7	25	57	95	127	215	321				
245.5	5	39	75	95	177	265	333	393			
246	11	31	81	129	185	259	303				
246.5	7	39	85	169	211	241					
247	7	29	81	109	153	213	257	387			
247.5	7	15	57	83	101	123	215	295			
248	5	25	57	83	109	155	229	295			
248.5	3	23	37	77	93	127	295	339	451		
249	7	19	49	71	83	95	127	173	241	297	337
249.5	3	17	31	55	79	97	119	189	231	271	351 431



L I N E "D"

[illegible]

L I N E "D"

Coordinate

Two Way Reflection Times

D263	5	27	75	95	119	205	449												
263.5	7	29	57	75	95	139	213	271	301	407	473								
264	7	31	45	69	129	151	473												
264.5	9	29	41	59	119	149	213	323	373	457									
265	7	45	65	91	147	351	411												
265.5	7	15	51	71	171	209	239	303	403	425									
266	7	19	43	63	89	119	159	207	269	301	325	405	463						
266.5	5	19	37	57	73	91	131	159	247										
267	5	15	53	79	95	153	219	299	333										
267.5	5	23	55	83	109	173	217	269	353	451									
268	7	15	33	93	135	155	223	257	299	367									
268.5	7	23	35	59	93	137	171	227	303	335	459								
269	9	25	61	73	111	169	265												
269.5	9	21	41	77	123	177	297												
270	5	33	71	105	127	221	265	395											
270.5	7	27	35	61	81	97	117	157	201	229	261	311							
271	5	47	77	105	171	227	271												
271.5	9	47	69	83	105	137	169	225	299	345	443								
272	7	53	73	101	135	175	227	267											
272.5	5	51	171	239	273	401	433												
273	5	13	39	53	67	103	153	229	253	379									
273.5	5	20	37	53	121	191	271	315	345										
274	5	21	39	47	77	89	143	175	217	255	339	383							
274.5	5	17	57	75	93	117	163	207	227	259	303	393							
275	5	25	45	67	91	121	167	215	251	297	359								
275.5	5	23	55	77	97	143	189	223	245	299	327	455							

LINE "D"

Coordinate		Two Way Reflection Times											
D276	5	25	53	75	103	191	223	293	387				
276.5	7	41	56	79	113	181	337						
277		25	65	85	143	199	257	459					
277.5	7	45	54	79	109	151	301	417					
278	7	23	49	56	83	113	143	203	253	283	309	379	419
278.5	5	21	47	71	123	211	225	287	369				
279	5	13	37	69	101	169	201	251	321				
279.5	7	19	37	71	127	195	287						
280	7	23	37	81	177	279	357						
280.5	9	33	71	131	221	267	337						
281	7	27	45	61	73	121	159	207	305	341			
281.5	5	35	51	67.5	93	135	221	251	339				
282	7	23	31	59	77	103	149	185	401	467			
282.5	6	21	53	71	107	165	227	343	461				
283	7	43	79	141	161	213	247	369	489				
283.5	7	19	45	65	97	167	211	235	379				
284	7	45	67	113	121	165	221	261	319	357			
284.5	7	17	63.5	87	137	193	211	289	313	391			
285	7	25	61	121	167	221	399						
285.5	7	21	43	75	109	139	175	233	315	433			
286	9	23	55	83	129	177	211	225	423				
286.5	7	29	47	69	93	125	219	247	397	463			
287	7	17	57	87	127	163	217	265	297				
287.5	7	23	57	115	185	225	261						
288	19	39	55	99	179								
288.5	17	31	37.5	71	117	198							

I. I N E "D"

Coordinate		Two Way Reflection Times									
D289	21	49	109	199							
289.5	21	45	53	129	189	100	245				
290	23	41	49	111	113	155	203	311	371	407	
290.5	19	35	93	135	177	217	447				
291	15	41	59	153	231						
291.5	35	57	71	101	139	163	251	305			
292	13	45	105	173	217						
292.5	15	21	71	43	57	69	105	123	191	337	
293	13	25	67	47	113	219	275	377			
293.5	15	23	47	71	99	159	211	295	351	411	469
294	19	23	43	85	105	137	169				
294.5	21	31	43	55	85	103	153	189	219	427	
295	17	24	39	44	64	149	183	215	275	355	295
295.5	11	25	67	153	415						
296	15	25	43	51.5	103	143	183	211	259	467	
296.5	29	41	63	85	167	215	311	329	471		
297	19	35	89	57	71	161	207	363	405	499	
297.5	43	61	65	139	207	263	275				
298	21	31	48	61	85	119	387	439			
298.5	13	23	53.5	73	107	159	193	421	461		
299	17	49	81	117	183	231	467	483			
299.5	17	39	67	99	133	222	265	327	381		
300	13	23	41	67	59	125	285	427	483		
300.5	15	45	69	109	144	169	199	253	439	477	
301	27	69	101	125	179	203	235	265	405	453	491
301.5	21	49	115	207	269	489					

LINE "D"

Coordinate		Two Way Reflection Times									
D302	29	37	55	77	151	119	155	203	471		
302.5	27	59	77	141	225	333	391				
303	17	25	63	95	119	209	149	189	227		
303.5	39	67	87	125	158	199					
304	24	44	58	92	153	78					
304.5	19	32	55.5	79	111	157	202				
305	7	19	29	49	83	139	197	223			
305.5	7	31	41	67	83	135	169	319			
306	3	11	54	67	87	109	133	189	301	341	
306.5	3	23	43	75	95	125	183	235	309		
307	7	33	47	69	91	201	239	287			
307.5	11	27	55	77	107	147	193	291			
308	3	63	83	119	137	171	273				
308.5	3	13	27	46	71	93	119	163	195		
309	7	43	85	105	153						
309.5	3	11	47	77	101	123	211	305	479		
310	3	15	23	43	99	145	189	265	325		
310.5	3	27	41	51	85	97	131	191	283	459	
311	3	21	45	61	79	121	151	177	219	301	413
311.5	3	21	40	73	81	97	131	179	199	289	323
312	3	13	29	42.5	55	65	85	151			
312.5	3	21	40.5	73	81	117	171	349			
313	3	25	57	85	127						
313.5	3	23	55	83	125	173	365	487			
314	3	9	19	55	81	111	173	319	467		
314.5	3	21	47	95	169	197	319	407	479		

L I N E "D"

Coordinate		Two Way Reflection Times									
D315	9	33	49	71	91	111	143	209	263	409	
315.5	5	19	39	53	93	151	175	239	329	491	
316	3	25	37	53	85	111	155	197	305		
316.5		33	46.5	69	93	171	201	273	415		
317	5	39	47.5	63	95	139	173	229	297	435	
317.5	3	19	47	65	95	123	151	181	251	319	381 441
318	3	33	45	85	115	145	195	255	363	437	
318.5	3	31	55	91	143	273	419				
319	3	35	73	013	131	393					
319.5	3	21	57	109	169	219	261	479			
320	3	21	37	61	97	117	159				
320.5	3	19	35	91	373	425	471				
321	3	31	49	79	95	225	393				
321.5	3	17	39	67	101	183	237	365	399		
322	7	17	41	59	99	127	177	289	401	475	
322.5	3	13	37	79	89	129	163	243	385		
323	7	25	46.5	61	93	121	151	255	369	473	
323.5	3	25	49	61	83	111	177	243	313		
324	9	31	79	149	199	321	393	451			
324.5	5	25	55	107	129	297					
325	3	25	93	131	155	191	227	287	337		
325.5	7	35	67	85	129						
326	3	21	47	63	79	99	139	163	193	317	495
326.5		15	39	69	97	133	165	347	421		
327	7	33	51	89	111	147	179	273	365		
327.5	7	39	65	83	129	177	245	307	395	441	

LINE "D"

Coordinate		Two Way Reflection Times									
D328	3	33	83	119	149	227	267	347			
328.5		27	45	85	155	317	373	461			
329	5	23	49	65	87	117	151	191	395	435	
329.5		17	31	45	59	83	131	177	261		
330		11	20.5	23	45	53	93	105	143	227	371 407 439
330.5	3	25	91	137	281	395					
331	5	20.5	41	65	139	157	177	281	265	431	481
331.5	3	26.5	53	69	107	145	205	229	367	419	
332	3	21	33	61	79	115	139	309	491		
332.5	3	24.5	49	63	77	89	119	195	243	331	377 421
333	7	39	71	95	195	277	321	339	441		
333.5	3	25	67	91	145	237	265	423			
334	5	35	59	93	119	151	167	381			
334.5	3	43	101	147	179	265					
335	5	33	49	85	139	201	259	313	387	461	
335.5	5	19	47	73	113	187	255	299	379	485	
336	5	33	55	89	169	195	429				
336.5	3	35.5	47	71	103	195	345	381	419		
337	5	25	45	67	75	123	173	429			
337.5	5	29	49	75	109	149	179	237	331		
338	3	35	65	85	151	195	267	367	439		
338.5	9	37	65	101	121	149	207	255	293	323	455
339											
339.5	3	31	47	61	93	195	241	311	483		
340	3	33.5	47	67	99	143	185	365	391		
340.5	3	27	71	93	135	181	245	325	477		

L I N E "D"

Coordinate		Two Way Reflection Times									
D341	3	33	87	115	201	271	475				
341.5	5	33	89	181	309	433	Limestone outcrop				
342	5	41.5	59	83	119	163	263	345	433		
342.5	3	19	33	121	163	193	237	479			
343	3	49	89	171	253	471					
343.5	3	19	35	57	75	111	309	439			
344	3	9	49	95	173	285	455				
344.5	7	43	95	119	159	409	493				
345	3	27	45.5	67	91	103	119	331	421	457	
345.5	5	43.5	57	69	87	101	149	299	367	485	
346	3	29	43	63	81	119	201	267	403		
346.5	3	53	87	109	123	137	205	267	367	471	
347	5	40.5	53	81	101	117	157	187	303	485	
347.5	3	19	41	71	103	133	151	187	343	431	
348	3	17	44.5	69	89	125	323	399	445		
348.5	5	43.1	31	54	87	103	151	217	301	485	
349	3	40.5	17	57	71	81	109	213	327	361	463
349.5	3	17	39	53	63	73	99	165	263	357	425
350	3	39	59	81	97	131	163	215	301	379	473
350.5	3	40.5	81	99	111	133	169	257	469		
351	3	11	43	57	93	117	143	169	207	233	261 297 367
351.5	3	49	65	95	141	247	293	383	447	473	457
352	3	47	73	109	173	495					
352.5	5	37	65	131	155	193	233	319	359	479	



LINE "D"

Coordinate

Two Way Reflection Times

D353	7	31	49	75	117	173	455						
353.5	9	25	69	99	151	181	339	387	423	457			
354	3	53	73	91	125	149	197	295	343	413	451		
354.5	3	19	33	45	79	121	149	185	199	287	389	451	
355	3	44.5	65	89	105	133	173	213	313	455			
355.5	3	33	69	87	113	147	185	253					
356	5	41	69	87	113	131	169	245	293	413			
356.5	7	33	69	119	179	259							
357	3	27	57	73	101	137	163	195	225	301	343	433	
357.5	3	47	81	105	129	145	175	219	287	447			
358	5	33	61	83	125	185	313	267	479				
358.5	5	40.5	61	81	101	187	227	285	319	359	409	497	
359	3	21	35	53	83	109	119	177	205	237	295	359	
359.5	3	17	49	87	163	197	243	313	381	471			
360	3	35	47	81	117	147	221	261	477				
360.5	3	41	55	89	105	139	271	357	467				
361	3	19	69	131	147	199	229	337	459				
361.5	3	37	55	75	93	185	263	397	457	463			
362	3	29	43.5	61	87	101	127	259	289	363	443		
362.5	3	21	43	91	115	163	193	253	299	373	489		
363	3	31	51	93	121	145	209	265	425	483			
363.5	3	17	41	75	91	121	175	265	405				
364	3	33	45	61	89	117	147	213	273	449			
364.5	3	35	83	105	185	253	407	483					
365	5	35	57	77	95	201	247	367	429				
365.5	7	39	83	91	109	137	221	251	475				
366	5	47	38	77	109	161	217	377	451				
366.5	5	25	57	87	101	139	179	227	269	347	405	479	

LINE "D"

Coordinate

Two Way Reflection Times

D367	5	27	65	95	113	147	227	335	393	449	481
367.5	3	53	83	113	149	201	267	299	369	429	
368	5	47	71	95	113	233	283	331	379	403	453
368.5	7	29	45.5	91	105	131	231	283	479		
369	9	45	63	91	130	155	181	221	335	419	
369.5	7	37	59	85	103	147	177	251	301	439	
370	7	33	61	95	113	165	237	373	481		

# Appendix B

## Line D Height, Distance & Depth Values

L I N E "D"

271

Peg No.	Distance Metres	Altitude Metres	Reflection Time M/sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
1	60.9	98.7	28	(1)  t = 1.55415839Z • 85548668	13.0	85.7	
1.5	91.4	"	29		13.6	85.1	
2	121.9	97.4	43		21.5	75.9	
2.5	152.4	"	21		9.3	88.1	
3	182.8	96.7	19		8.2	88.5	
3.5	213.3	"	45		22.7	74.0	
4	243.8	95.6	41		20.3	75.3	
4.5	274.3	"	43		21.5	74.1	
5	304.8	95.0	58		30.5	64.5	
5.5	335.2	"	28		13.0	82.0	
6	365.7	94.2	12		4.8	89.4	
6.5	396.2	"	19		8.2	86.0	
7	426.7	93.6	24		10.9	82.7	
7.5	457.2	"	48		24.5	69.1	
8	487.6	92.4	26		11.9	80.5	
8.5	518.1	"	15		6.2	86.2	
9	548.6	91.3	23		10.3	81.0	
9.5	579.1	"	23		10.3	81.0	
10	609.6	90.3	17		7.2	83.1	
10.5	640.0	"	17		7.2	83.1	
11	670.5	89.3	26		11.9	77.4	
11.5	701.0	"	31		14.7	74.6	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
12	731.5	88.6	19		8.2	80.4	
12.5	762.0	"	21		9.3	79.3	
13	792.4	88.0	32		15.2	72.8	
13.5	822.9	"	18		7.7	80.3	
14	853.4	87.0	42		20.9	66.1	
14.5	883.9	"	41		20.3	66.7	
15	914.4	86.5	45		22.7	63.8	
15.5	944.8	"	32		15.2	71.3	
16	975.3	85.5	25		11.4	74.1	
16.5	1005.8	"	36		17.5	68.0	
17	1036.3	84.7	33	(1)	15.8	68.9	
17.5	1066.8	"	40		19.8	64.9	
18	1097.2	83.9	35		16.9	67.0	
18.5	1127.7	"	42		20.9	63.0	
19	1158.2	83.0	42		20.9	62.1	
19.5	1188.7	"	42		20.9	62.1	
20	1219.2	82.3	49		25.1	57.2	
20.5	1249.6	"	55		28.7	53.6	
21	1280.1	81.9	33		15.8	66.1	
21.5	1310.6	"	41		20.3	61.6	
22	1341.1	81.4	35		16.9	64.5	
22.5	1371.6	"	43		21.5	59.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	P.L. Geological Bedrock	Notes
23	1402.0	81.1	77		42.6	38.5	
23.5	1432.5	"	105		61.2	19.9	
24	1463.0	80.8	89		50.4	30.5	
24.5	1493.5	"	81		45.2	35.7	
25	1524.0	80.5	72		39.3	41.2	
25.5	1554.4	"	67		36.2	44.3	
26	1584.9	80.4	33		15.8	64.6	
26.5	1615.4	"	21		9.3	71.1	
27	1645.9	80.5	31	(1)	14.7	65.8	
27.5	1676.4	"	45		22.7	57.8	
28	1706.8	"	55		28.7	51.8	
28.5	1737.3	"	67		36.2	44.3	
29	1767.8	80.8	57		29.9	50.6	
29.5	1798.3	"	58		30.5	50.0	
30	1828.8	80.7	62		33.0	47.7	
30.5	1859.2	"	58		30.5	50.2	
31	1889.7	79.9	43		21.5	58.4	
31.5	1920.2	"	34		16.3	63.5	
32	1950.7	79.5	25		11.4	68.1	
32.5	1981.2	"	24		10.9	68.6	
33	2011.6	79.3	14		5.8	73.5	
33.5	2042.1	"	15		6.2	73.1	

H.H.

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.J. Geological Bedrock	Notes
34	2072.6	79.0	33		15.8	63.2	
34.5	2103.1	"	38		18.6	60.4	
35	2133.6	78.4	40		19.8	58.6	
35.5	2164.0	"	44		22.1	56.3	
36	2194.5	77.3	52		26.9	50.4	
36.5	2225.0	"	56		29.3	48.0	
37	2255.5	75.9	60		31.8	44.1	
37.5	2286.0	"	65		34.9	41.0	
38	2316.4	74.8	58		30.5	44.3	
38.5	2346.9	"	72	(1)	39.3	35.5	
39	2377.4	74.1	64		34.3	39.8	
39.5	2407.9	"	61		32.4	41.7	
40	2438.4	73.9	72		39.3	34.6	
40.5	2468.8	"	58		30.5	43.4	
41	2499.3	74.2	63		33.6	40.6	
41.5	2529.8	"	55		28.7	45.5	
42	2560.3	75.5	47		23.9	51.6	
42.5	2590.8	"	50		25.7	49.8	
43	2621.2	76.6	49		25.1	51.5	
43.5	2651.7	"	48		16.3	60.5	
44	2682.2	76.8	34		16.3	60.5	
44.5	2712.7	"	33		15.8	61.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
45	2743.2	76.2	42		20.9	55.3	
45.5	2773.6	"	43		21.5	54.7	
46	2804.1	75.1	49		25.1	50.0	
46.5	2834.6	"	46		23.3	51.8	
47	2865.1	74.3	59		31.2	43.1	
47.5	2895.6	"	39		19.2	55.1	
48	2926.0	74.1	30		14.1	60.0	
48.5	2956.5	"	41		20.3	53.8	
49	2987.0	73.7	37	(1)	18.0	55.7	
49.5	3017.5	"	34		16.3	57.4	
50	3048.0	73.6	46		23.3	50.3	
50.5	3078.4	"	34		16.3	57.3	
51	3108.9	73.5	43		21.5	52.0	
51.5	3139.4	"	36		17.5	56.0	
52	3169.9	"	49		25.1	48.4	
52.5	3200.4	"	44		22.1	51.4	
53	3230.8	"	42		20.9	52.6	
53.5	3261.3	"	47		23.9	49.6	
54	3291.8	73.6	34		16.3	57.3	
54.5	3322.3	"	61		32.4	41.2	
55	3352.8	73.5	58		30.5	43.0	
55.5	3383.2	"	66		35.5	38.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
56	3413.7	73.5	90		51.1	22.4	
56.5	3444.2	"	71		38.7	34.8	
57	3474.7	73.3	62		33.0	40.3	
57.5	3505.2	"	54		28.1	45.2	
58	3535.6	73.2	43		21.5	51.7	
58.5	3566.1	"	59		31.2	42.0	
59	3596.6	73.0	56		29.3	43.7	
59.5	3627.1	"	60		31.8	41.2	
60	3657.6	72.5	88		40.8	22.7	
60.5	3688.0	"	66	(1)	35.5	37.0	
61	3718.5	72.3	55		28.7	43.5	
61.5	3749.0	"	91		51.7	20.6	
62	3779.5	72.3	112		66.0	6.3	
62.5	3810.0	"	92		52.4	19.9	
63	3840.4	72.1	84		47.1	25.0	
63.5	3870.9	"	83		46.5	25.6	
64	3901.4	71.8	78		43.2	28.6	
64.5	3931.9	"	92		52.4	19.4	
65	3962.4	71.5	75		41.3	30.2	
65.5	3992.8	"	61		32.4	39.1	
66	4023.3	70.7	82		45.8	24.9	
66.5	4053.8	"	80		44.5	26.2	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
67	4084.3	70.0	74		46.7	23.3	
67.5	4114.8	"	48		18.0	52.0	
68	4145.2	70.8	35		9.0	61.8	
68.5	4175.7	"	24		3.9	66.9	
69	4206.2	67.6	31		6.9	60.7	
69.5	4236.7	"	49	(2)	18.9	48.7	
70	4267.2	69.5	47		17.2	52.3	
70.5	4297.6	"	47	t = 6.42537902Z	17.2	52.3	
71	4328.1	69.9	58		27.3	42.6	
71.5	4358.6	"	67	.45527136	37.6	32.3	
72	4389.1	70.3	49		18.9	51.4	
72.5	4419.6	"	53		22.5	48.8	
73	4450.0	70.4	77		51.0	19.4	
73.5	4480.5	"	71		42.7	27.7	
74	4511.0	71.1	65		35.1	36.0	
74.5	4541.5	"	64		34.0	37.1	
75	4572.0	71.5	67		37.6	33.9	
75.5	4602.4	"	60		29.5	42.0	
76	4632.9	71.9	73		45.3	26.6	
76.5	4663.4	"	80		55.5	16.4	
77	4693.9	71.6	73		45.3	26.3	
77.5	4724.4	"	75		48.1	23.5	

vii.

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
78	4754.8	71.1	72		44.0	27.1	
78.5	4785.3	"	60		29.5	41.6	
79	4815.8	70.7	57		26.3	44.4	
79.5	4846.3	"	56		25.3	45.4	
80	4876.8	70.3	59		28.4	41.9	
80.5	4907.2	"	82		58.4	11.7	
81	4937.7	70.5	84		61.7	8.8	
81.5	4968.2	"	73		45.3	25.2	
82	4998.7	70.7	62		31.7	39.0	
82.5	5029.2	"	69	(2)	40.1	30.6	
83	5059.6	70.8	81		57.0	13.8	
83.5	5090.1	"	79		54.0	16.9	
84	5120.6	70.7	77		51.0	19.7	
84.5	5151.1	"	80		55.5	15.2	
85	5181.6	70.7	64		34.0	36.7	
85.5	5212.0	"	66		36.3	34.3	
86	5242.5	70.7	69		40.1	30.6	
86.5	5273.0	"	77		51.0	19.7	
87	5303.5	70.6	72		44.0	26.6	
87.5	5334.0	"	71		42.7	27.9	
88	5364.4	70.9	71		42.7	28.2	
88.5	5394.9	"	87		66.7	4.2	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
89	5425.4	71.4	78		52.3	18.9	
89.5	5455.9	"	70		41.3	30.1	
90	5486.4	71.8	70		41.3	30.5	
90.5	5516.8	"	65		35.1	36.7	
91	5547.3	71.9	75		48.1	23.8	
91.5	5577.8	"	78		52.5	19.4	
92	5608.3	72.0	73		45.3	26.7	
92.5	5638.8	"	64		34.0	38.0	
93	5669.2	71.9	61		30.5	41.4	
93.5	5699.7	"	90		71.8	0.1	
94	5730.2	71.8	65		35.1	26.7	
94.5	5760.7	"	67		37.6	34.2	
95	5791.2	71.7	63	(2)	32.8	38.9	
95.5	5821.6	"	50		19.7	52.0	
96	5852.1	71.1	38		10.8	60.3	
96.5	5882.6	"	43		14.1	57.0	
97	5913.1	70.4	67		37.6	32.8	
97.5	5943.6	"	76		49.5	20.9	
98	5974.0	69.4	72		44.0	25.4	
98.5	6004.5	"	74		46.7	22.7	
99	6035.0	68.4	69		40.1	28.3	
99.5	6065.5	"	81		57.0	11.4	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FM m/s	Depth Metres	P.L. Geological Bedrock	Notes
100	6096.0	67.4	76		49.5	17.9	
100.5	6126.4	"	83		60.1	7.3	
101	6156.9	69.9	79		53.9	16.0	
101.5	6187.4	"	79		53.9	16.0	
102	6217.9	66.8	73		45.3	21.5	
102.5	6248.4	"	63		32.8	34.0	
103	6278.8	66.8	75		48.1	18.7	
103.5	6309.3	"	68		38.8	28.0	
104	6339.8	66.9	63		32.8	34.1	
104.5	6370.3	"	68		38.8	28.1	
105	6400.8	67.1	68		38.8	28.3	
105.5	6431.2	"	66	(2)	36.3	30.8	
106	6461.7	66.7	53		22.4	44.3	
106.5	6492.2	"	48		18.0	48.7	
107	6522.7	66.2	37		10.2	56.0	
107.5	6553.2	"	42		13.4	52.8	
108	6583.6	66.3	41		12.7	53.6	
108.5	6614.1	"	50		19.7	46.6	
109	6644.6	"	74		46.7	19.6	
109.5	6675.1	"	84		61.7	4.6	
110	6705.6	"	62		31.7	34.5	
110.5	6736.0	"	42		13.4	52.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
111	6766.5	66.8	46		16.4	50.4	
111.5	6797.0	"	47		17.2	49.6	
112	6827.5	67.0	48		18.0	49.0	
112.5	6858.0	"	46		16.4	50.6	
113	6888.4	67.0	60		29.5	37.5	
113.5	6918.9	"	83		60.1	6.9	
114	6949.4	67.6	81		57.0	10.6	
114.5	6979.9	"	72		44.0	23.6	
115	7010.4	67.3	76		49.5	17.8	
115.5	7040.8	"	81	(2)	57.0	10.3	
116	7071.3	67.2	86		65.0	2.2	
116.5	7101.8	"	81		57.0	10.2	
117	7132.3	66.2	89		70.1	-3.9	
117.5	7162.8	"	81		57.0	9.2	
118	7193.2	65.3	77		51.0	14.3	
118.5	7223.7	"	81		57.0	8.3	
119	7254.2	64.7	81		57.0	7.7	
119.5	7284.7	"	81		57.0	7.7	
120	7315.2	64.6	94		79.1	-14.5	
120.5	7345.6	"	89		70.1	-5.5	
121	7376.1	"	81		57.0	7.6	
121.5	7406.6	"	84		61.7	2.8	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
122	7437.1	64.5	83		60.1	4.4	
122.5	7467.6	"	86		65.0	-0.5	
123	7498.0	64.8	103		96.7	-31.9	
123.5	7528.5	"	83		60.1	4.7	
124	7559.0	64.7	80		55.5	9.2	
124.5	7589.5	"	82		58.6	6.1	
125	7620.0	"	85		63.4	1.3	
125.5	7650.4	"	83		60.1	4.6	
126	7680.9	64.6	86		65.0	-0.4	
126.5	7711.4	"	83	(2)	60.1	4.5	
127	7741.9	65.1	83		60.1	5.0	
127.5	7772.4	"	76		49.5	15.6	
128	7802.8	65.5	86		65.0	-0.5	
128.5	7833.3	"	88		68.4	-2.9	
129	7863.8	65.8	87		66.7	-0.9	
129.5	7894.3	"	83		60.1	5.7	
130	7924.8	65.8	72		44.0	21.8	
130.5	7955.2	"	71		42.7	23.1	
131	7985.7	66.2	72		44.0	22.2	
131.5	8016.2	"	79		53.9	12.3	
132	8046.7	66.8	84		61.7	5.1	
132.5	8077.2	"	81		57.0	9.8	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
133	8107.6	66.3	57		26.3	40.0	
133.5	8138.1	"	62		31.7	34.6	
134	8168.6	66.1	60		29.5	36.6	
134.5	8199.1	"	68		38.8	27.3	
135	8229.6	66.8	62		31.7	35.1	
135.5	8260.0	"	60		29.5	37.3	
136	8290.5	67.0	64		34.0	33.0	
136.5	8321.0	"	50		19.7	47.3	
137	8351.5	66.5	60	(2)	29.5	37.0	
137.5	8382.0	"	74		46.7	19.8	
138	8412.4	66.5	75		48.1	18.4	
138.5	8442.9	"	67		37.6	28.9	
139	8473.4	66.2	53		22.4	43.8	
139.5	8503.9	"	45		15.6	50.6	
140	8534.4	66.4	42		13.4	53.0	
140.5	8564.8	"	33		7.9	58.5	
141	8595.3	66.9	32		7.4	59.5	
141.5	8625.8	"	32		7.4	59.5	
142	8656.3	67.3	34		8.4	58.9	
142.5	8686.8	"	46		16.4	50.9	
143	8717.2	"	36		9.6	57.7	
143.5	8747.7	"	41		12.7	54.6	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
144	8778.2	66.8	63		32.8	34.0	
144.5	8808.7	"	21		2.9	63.9	
145	8839.2	65.8	10		0.5	65.3	
145.5	8869.6	"	23		3.5	62.3	
146	8900.1	64.6	32		7.4	57.2	
146.5	8930.6	"	59		28.4	36.2	
147	8961.1	64.7	49		18.9	45.8	
147.5	8991.6	"	26		4.7	60.0	
148	9022.0	64.6	29		5.9	58.7	
148.5	9052.5	"	22		3.2	61.4	
149	9083.0	64.3	26	(2)	4.7	59.6	
149.5	9113.5	"	24		3.9	60.4	
150	9144.0	64.5	22		3.2	61.3	
150.5	9174.4	"	22		3.2	61.3	
151	9204.9	64.8	19		2.3	62.5	
151.5	9235.4	"	27		5.1	59.7	
152	9265.9	65.0	12		0.8	64.2	
152.5	9296.4	"	29		5.9	59.1	
153	9326.8	65.4	20		2.6	62.8	
153.5	9357.3	"	10		0.5	64.9	
154	9387.8	65.3	33		7.9	57.4	
154.5	9418.3	"	36		9.6	55.7	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
155	9448.8	65.5	47		17.2	48.3	
155.5	9479.2	"	31		6.9	58.6	
156	9509.7	64.5	39		11.4	53.0	
156.5	9540.2	"	23		3.5	61.0	
157	9570.7	63.5	40		12.1	51.4	
157.5	9601.2	"	28		5.5	58.0	
158	9631.6	62.3	29		5.9	56.4	
158.5	9662.1	"	60		29.5	32.8	
159	9692.6	61.6	62		31.7	29.9	
159.5	9723.1	"	65		35.1	26.5	
160	9753.6	61.4	60	(2)	29.6	31.9	
160.5	9784.0	"	51		20.6	40.8	
161	9814.5	61.6	50		19.7	41.9	
161.5	9845.0	"	50		19.7	41.9	
162	9875.5	61.8	42		13.4	48.4	
162.5	9906.0	"	39		11.4	50.4	
163	9936.4	62.0	39		11.4	50.6	
163.5	9966.9	"	41		12.7	49.3	
164	9997.4	61.7	41		12.7	49.0	
164.5	10027.9	"	28		5.5	56.2	
165	10058.4	61.1	18		2.0	59.1	
165.5	10088.8	"	26		4.7	56.4	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
166	10119.3	60.4	24		3.9	56.5	
166.5	10149.8	"	19		2.3	58.1	
167	10180.3	60.3	19		2.3	58.0	
167.5	10210.8	"	28		5.5	54.8	
168	10241.2	60.3	26		4.7	55.6	
168.5	10271.7	"	35		9.0	51.3	
169	10302.2	60.4	34		8.4	52.0	
169.5	10332.7	"	34		8.4	52.0	
170	19363.2	60.3	44		14.9	45.4	
170.5	10393.6	"	26		4.8	55.6	
171	10424.1	60.3	36	(2)	9.6	50.7	
171.5	10454.6	"	33		7.9	52.4	
172	10485.1	60.0	33		7.9	52.1	
172.5	10515.6	"	12		0.8	59.2	
173	10546.0	59.7	12		0.8	58.9	
173.5	10576.5	"	12		0.8	58.9	
174	10607.0	59.3	18		2.0	57.3	
174.5	10637.5	"	18		1.4	57.9	
175	10668.0	59.1	17		1.8	57.3	
175.5	10698.4	"	19		0.4	58.7	
176	10728.9	58.7	13		1.0	57.7	
176.5	10759.4	"	18		2.0	56.7	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	P.L. Geological Bedrock	Notes
177	10789.9	58.1	14		1.2	56.9	
177.5	10820.4	"	16		1.6	56.5	
178	10850.8	57.8	10		0.5	57.3	
178.5	10881.3	"	19		2.3	55.4	
179	10911.8	57.0	17		1.8	55.2	
179.5	10942.3	"	10		0.5	56.5	
180	10972.8	56.4	20		2.6	53.8	
180.5	11003.2	"	8		0.3	56.1	
181	11033.7	56.2	10		0.5	55.7	
181.5	11064.2	"	56		25.3	30.9	
182	11094.7	56.3	69	(2)	40.1	16.2	
182.5	11125.2	"	46		16.4	39.9	
183	11155.6	56.1	12		0.8	55.3	
183.5	11186.1	"	19		2.3	53.8	
184	11216.6	56.0	23		3.5	52.5	
184.5	11247.1	"	29		5.9	50.1	
185	11277.6	56.1	29		5.9	50.2	
185.5	11308.0	"	28		5.5	50.6	
186	11338.5	55.5	37		10.2	45.3	
186.5	11369.0	"	25		4.3	51.2	
187	11399.5	55.4	23		3.5	51.9	
187.5	11430.0	"	14		1.2	54.2	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
188	11460.4	55.4	32		7.4	48.0	
188.5	11490.9	"	14		1.2	54.2	
189	11521.4	"	13		1.0	54.4	
189.5	11551.9	"	27		5.1	50.3	
190	11582.4	55.7	20		2.6	53.1	
190.5	11612.8	"	11		0.7	55.0	
191	11643.3	56.5	51		20.7	35.9	
191.5	11673.8	"	48		18.1	38.5	
192	1170.4	57.0	11		0.7	56.3	
192.5	11734.8	"	13		1.0	56.0	
193	11765.2	56.0	26	(2)	4.7	51.3	
193.5	11795.7	"	23		3.5	52.5	
194	11826.2	56.3	16		1.7	54.7	
194.5	11856.7	"	22		3.2	53.1	
195	11887.2	55.7	18		2.0	53.7	
195.5	11917.6	"	33		7.9	47.8	
196	11948.1	55.7	35		9.0	46.7	
196.5	11978.6	"	49		18.9	36.8	
197	12009.1	56.0	41		12.7	43.3	
197.5	12039.6	"	53		22.4	33.6	
198	12070.0	56.0	49		18.9	37.1	
198.5	12100.5	"	57		26.3	29.7	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
199	12131.0	56.2	69	(3)  t = 3.531245922 • 62772710	37.7	18.5	
199.5	12161.5	"	62		31.8	24.4	
200	12192.0	56.7	54		25.5	31.2	
200.5	12222.4	"	50		22.6	34.1	
201	12252.9	56.7	54		25.5	31.2	
201.5	12283.4	"	57		27.8	28.9	
202	12313.9	56.0	59		29.4	26.6	
202.5	12344.4	"	62		31.8	24.2	
203	12374.8	56.3	67		36.0	20.3	
203.5	12405.3	"	65		34.3	22.0	
204	12435.8	56.2	83		50.6	5.6	
204.5	12466.3	"	73		41.3	15.0	
205	12496.8	56.1	85		52.6	3.5	
205.5	12527.2	"	63		32.6	23.5	
206	12557.7	56.3	45		19.1	37.2	
206.5	12588.2	"	53		24.8	31.6	
207	12618.7	56.1	55		26.3	29.8	
207.5	12649.2	"	47		20.5	35.7	
208	12679.6	56.1	43		17.7	38.4	
208.5	12710.1	"	31		10.5	45.6	
209	12740.6	56.6	29		9.4	47.1	
209.5	12771.1	"	19		4.8	51.8	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
210	12801.6	57.1	29		9.4	47.7	
210.5	12832.0	"	27		8.4	48.7	
211	12862.5	56.0	27		8.4	47.5	
211.5	12893.0	"	37		13.9	42.0	
212	12923.5	55.6	33		11.7	44.0	
212.5	12954.0	"	51		23.3	32.3	
213	12984.4	55.6	81		48.7	6.9	
213.5	13014.9	"	87	(3)	54.6	1.0	
214	13045.4	55.0	99		67.0	-12.0	
214.5	13075.9	"	73		41.2	13.8	
215	13106.4	55.0	67		36.0	19.0	
215.5	13136.8	"	63		32.6	22.4	
216	13167.3	54.6	61		31.0	23.6	
216.5	13197.8	"	53		24.7	29.9	
217	13228.3	54.4	53		24.7	29.7	
217.5	13258.8	"	51		23.3	31.1	
218	13289.2	54.6	53		24.8	29.9	
218.5	13319.7	"	59		29.4	25.2	
219	13350.2	54.8	51		23.3	31.5	
219.5	13380.7	"	69		37.7	17.1	
220	13411.2	55.7	51		23.3	32.4	
220.5	13441.6	"	51		23.3	32.4	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
221	13472.1	56.3	45		19.1	37.2	
221.5	13502.6	"	83		50.6	5.7	
222	13533.1	55.8	81		48.7	7.1	
222.5	13563.6	"	81		48.7	7.1	
223	13594.0	55.9	81		48.7	7.2	
223.5	13624.5	"	77		44.9	11.0	
224	13655.0	55.7	75		43.1	12.6	
224.5	13685.5	"	79		46.8	8.9	
225	13716.0	55.7	95		62.8	- 7.1	
225.5	13746.4	"	71		39.5	16.2	
226	13776.9	55.9	59	(3)	29.4	26.5	
226.5	13807.4	"	47		20.4	35.5	
227	13837.9	55.0	47		20.4	34.6	
227.5	13868.4	"	57		27.8	27.2	
228	13898.8	55.6	49		21.8	33.8	
228.5	13929.3	"	39		15.2	40.4	
229	13959.8	57.2	41		16.4	40.8	
229.5	13990.3	"	31		10.5	46.7	
230	14020.8	57.4	45		19.1	38.3	
230.5	14051.2	"	43		17.7	39.7	
231	14081.7	57.2	47		20.4	36.8	
231.5	14112.2	"	77		44.9	12.3	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FM m/s	Depth Metres	R.L. Geological Bedrock	Notes
232	14142.7	56.1	73		41.2	14.9	
232.5	14173.2	"	73		41.2	14.9	
233	14203.6	55.9	73		41.2	14.7	
233.5	14234.1	"	91		58.6	2.8	
234	14264.6	56.0	85		52.6	3.4	
234.5	14295.1	"	83		50.6	5.4	
235	14235.6	56.2	81		48.7	7.5	
235.5	14256.0	"	67		36.0	20.2	
236	14386.5	56.3	69		37.7	18.6	
236.5	14417.0	"	73		41.3	15.1	
237	14447.5	56.3	71	(3)	39.5	16.8	
237.5	14478.0	"	75		43.1	13.2	
238	14508.4	56.7	73		41.2	15.5	
238.5	14538.9	"	73		41.2	15.5	
239	14569.4	57.5	77		44.9	12.6	
239.5	14599.9	"	81		48.7	8.8	
240	14630.4	58.7	77		44.9	13.8	
240.5	14660.8	"	75		43.1	15.6	
241	14691.3	59.1	95		62.8	-3.7	
241.5	14721.8	"	87		54.6	4.5	
242	14752.3	59.3	87		54.6	4.7	
242.5	14782.8	"	83		50.6	8.7	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
243	14813.2	58.6	71		39.5	19.1	
243.5	14843.7	"	65		34.3	24.3	
244	14874.2	56.3	51		23.3	33.0	
244.5	14904.7	"	55		26.3	30.0	
245	14935.2	57.6	57		27.8	29.8	
245.5	14965.6	"	75		43.1	14.5	
246	14996.1	58.1	81		48.8	9.4	
246.5	15026.6	"	85		52.7	5.5	
247	15057.1	59.0	81		48.8	10.3	
247.5	15087.6	"	57		27.9	31.2	
248	15118.0	59.7	57		27.9	31.9	
248.5	15148.5	"	37	(3)	13.9	45.8	
249	15179.0	60.4	49		21.9	38.6	
249.5	15209.5	"	55		26.3	34.1	
250	15240.0	60.9	59		29.4	31.5	
250.5	15270.4	"	69		37.7	23.2	
251	15300.9	61.5	57		27.8	33.7	
251.5	15331.4	"	43		17.7	43.8	
252	15361.9	61.8	49		21.9	40.0	
252.5	15392.4	"	45		19.2	42.7	
253	15422.8	62.1	37		13.9	48.2	
253.5	15453.3	"	61		31.0	31.1	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
254	15483.8	62.5	61		31.0	31.5	
254.5	15514.3	"	35		12.8	49.7	
255	15544.8	62.7	23		6.5	56.2	
255.5	15575.2	"	29		9.4	53.3	
256	15605.7	62.0	17		4.0	58.0	
256.5	15636.2	"	29		9.4	52.6	
257	15666.7	62.1	27		8.4	53.7	
257.5	15697.2	"	41		16.5	45.7	
258	15727.6	62.0	21		5.6	56.4	
258.5	15758.1	"	35		12.9	49.2	
259	15788.6	62.5	43	(3)	17.7	44.8	
259.5	15819.1	"	49		21.8	40.7	
260	15849.6	63.3	41		16.4	46.9	
260.5	15880.0	"	51		23.3	40.0	
261	15910.5	64.0	43		17.7	46.3	
261.5	15941.0	"	63		32.6	31.4	
262	15971.5	65.0	61		31.0	34.0	
262.5	16002.0	"	63		32.6	32.4	
263	16032.4	65.7	65		34.4	31.4	
263.5	16062.9	"	57		27.8	37.9	
264	16093.4	65.2	45		19.1	46.1	
264.5	16123.9	"	41		16.4	48.8	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
265	16154.4	64.6	45		19.1	45.5	
265.5	16184.8	"	51		23.3	41.3	
266	16215.3	64.3	43		17.7	46.6	
266.5	16245.8	"	19		4.8	59.5	
267	16276.3	64.3	15		3.3	61.0	
267.5	16306.8	"	23		6.5	57.8	
268	16337.2	64.4	15		3.3	61.1	
268.5	16367.7	"	23		6.5	57.9	
269	16398.2	64.3	25		7.5	56.9	
269.5	16428.7	"	21		5.6	58.6	
270	16459.2	64.2	33		11.6	52.6	
270.5	16489.6	"	27	(3)	8.4	55.8	
271	16520.1	64.6	47		20.4	44.2	
271.5	16550.6	"	47		20.4	44.2	
272	16581.1	65.8	53		24.7	41.1	
272.5	16611.6	"	51		23.3	42.5	
273	16642.0	66.8	39		15.2	51.6	
273.5	16672.5	"	20		5.2	61.6	
274	16703.0	66.8	21		5.6	61.2	
274.5	16733.5	"	17		4.0	62.8	
275	16764.0	66.4	25		7.4	58.9	
275.5	16794.4	"	23		6.5	59.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
276	16824.9	66.0	25		7.4	58.6	
276.5	16855.4	"	41		16.4	49.6	
277	16885.9	65.4	25		7.4	58.0	
277.5	16916.4	"	45		19.1	46.3	
278	16946.8	64.0	49		21.8	42.2	
278.5	16977.3	"	47		20.4	43.6	
279	17007.8	62.7	37		13.9	48.8	
279.5	17038.3	"	37		13.9	48.8	
280	17068.8	62.7	37		13.9	48.8	
280.5	17099.2	"	33		11.6	51.1	
281	17129.7	62.8	45		19.1	43.7	
281.5	17160.2	"	51	(3)	23.3	39.5	
282	17190.7	63.6	59		29.4	34.2	
282.5	17221.2	"	53		24.8	38.9	
283	17251.6	64.0	43		17.7	46.3	
283.5	17282.1	"	45		19.1	44.9	
284	17312.6	64.7	45		19.1	45.6	
284.5	17343.1	"	17		4.0	60.7	
285	17373.6	65.5	25		7.4	58.1	
285.5	17404.0	"	43		17.7	47.8	
286	17434.5	66.1	55		26.3	39.8	
286.5	17465.0	"	47		20.5	45.7	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
287	17495.5	66.4	57		27.8	38.6	
287.5	17526.0	"	57		27.8	38.6	
288	17556.4	65.4	39		15.2	50.2	
288.5	17586.9	"	31		10.5	54.9	
289	17617.4	65.4	49		21.8	43.6	
289.5	17647.9	"	45		19.1	46.3	
290	17678.4	65.5	41		16.4	49.1	
290.5	17708.8	"	35		12.8	52.7	
291	17739.3	65.1	41		16.4	48.7	
291.5	17769.8	"	57		27.9	37.3	
292	17800.3	64.5	45		19.2	45.4	
292.5	17830.8	"	43		17.7	46.8	
293	17861.2	64.5	47	(3)	20.4	44.1	
293.5	17891.7	"	47		20.4	44.1	
294	17922.2	63.5	43		17.7	45.8	
294.5	17952.7	"	43		17.7	45.8	
295	17983.2	63.3	44		18.4	44.9	
295.5	18013.6	"	67		36.2	27.1	
296	18044.1	63.2	43		17.7	45.5	
296.5	18074.6	"	41		16.4	46.2	
297	18105.1	63.2	35		12.8	50.4	
297.5	18135.6	"	43		17.7	45.5	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
298	18166.0	63.3	31		10.5	52.8	
298.5	18196.5	"	23		6.5	56.8	
299	18227.0	63.6	17		4.0	59.6	
299.5	18257.5	"	17		4.0	59.6	
300	18288.0	63.8	23		6.5	57.3	
300.5	18318.4	"	15		3.3	60.5	
301	18348.9	64.0	27		8.5	55.6	
301.5	18379.4	"	21		5.6	58.4	
302	18409.9	64.3	29		9.4	54.9	
302.5	18440.4	"	27	(3)	8.4	55.9	
303	18470.8	64.8	25		7.4	57.4	
303.5	18501.3	"	39		15.2	49.6	
304	18531.8	65.6	24		7.0	58.6	
304.5	18562.3	"	19		4.8	60.8	
305	18592.8	66.3	19		4.8	61.5	
305.5	18623.2	"	31		10.5	55.8	
306	18653.7	66.6	11		2.0	64.6	
306.5	18684.2	"	23		6.5	60.1	
307	18714.7	66.7	33		11.6	55.1	
307.5	18745.2	"	27		8.4	58.3	
308	18775.6	66.8	63		32.6	34.2	
308.5	18806.1	"	13		2.6	64.2	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
309	18836.6	67.0	43		17.7	49.3	
309.5	18867.1	"	11		2.0	65.0	
310	18897.6	66.6	15		3.3	63.3	
310.5	18928.0	"	27		8.4	58.2	
311	18958.5	66.4	21		5.6	60.8	
311.5	18989.0	"	21		5.6	60.8	
312	19019.5	65.7	29		9.4	56.3	
312.5	19050.0	"	21		5.6	60.1	
313	19080.4	65.6	25		7.4	58.2	
313.5	19110.9	"	23		6.5	59.1	
314	19141.4	65.8	19		4.8	61.0	
314.5	19171.9	"	21		5.6	60.2	
315	19202.4	65.3	33	(3)	11.6	53.7	
315.5	19232.8	"	19		4.8	60.5	
316	19263.3	64.8	25		7.4	57.4	
316.5	19293.8	"	33		11.6	53.2	
317	19324.3	63.6	39		15.2	48.4	
317.5	19354.8	"	19		4.8	58.8	
318	19385.2	62.7	33		11.6	51.1	
318.5	19415.7	"	31		10.5	52.2	
319	194416.2	62.1	35		12.8	49.3	
319.5	19476.7	"	21		5.6	56.5	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
320	19507.2	62.0	21		5.6	56.4	
320.5	19537.6	"	19		4.8	57.2	
321	19568.1	61.7	31		10.5	51.2	
321.5	19598.6	"	17		4.0	57.7	
322	19629.1	61.2	17		4.0	57.2	
322.5	19659.6	"	13		2.6	58.6	
323	19690.0	60.5	25		7.4	53.1	
323.5	19720.5	"	25		7.4	53.1	
324	19751.0	60.1	31		10.5	49.6	
324.5	19781.5	"	25		7.4	52.7	
325	19812.0	60.2	25		7.4	52.8	
325.5	19842.4	"	35	(3)	12.8	47.4	
326	19872.9	60.7	21		5.6	55.1	
326.5	19903.4	"	15		3.3	57.3	
327	19933.9	60.2	33		11.6	48.6	
327.5	19964.4	"	39		15.2	45.0	
328	19994.8	60.6	33		11.6	49.0	
328.5	20025.3	"	27		8.4	52.2	
329	20055.8	60.0	23		6.5	53.5	
329.5	20086.3	"	17		4.0	56.0	
330	20116.8	"	11		2.0	58.0	
330.5	20147.2	"	25		7.4	52.6	

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Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	P.L. Geological Bedrock	Notes
331	20177.7	60.6	20		5.2	55.4	
331.5	20208.2	"	26		7.9	52.7	
332	20238.7	61.3	21		5.6	55.7	
332.5	20269.2	"	24		7.0	54.3	
333	20299.6	61.6	39		15.2	46.4	
333.5	20330.1	"	25		7.4	54.2	
334	20360.6	61.1	35		12.8	48.3	
334.5	20391.1	"	43		17.7	43.4	
335	20421.6	61.4	33		11.6	49.8	
335.5	20452.0	"	19		4.8	56.6	
336	20482.5	62.0	33		11.6	50.4	
336.5	20513.0	"	35	(3)	12.8	49.2	
337	20543.5	62.1	25		7.4	54.7	
337.5	20574.0	"	29		9.4	52.7	
338	20604.4	62.9	35		12.8	50.1	
338.5	20634.9	"	37		13.9	49.0	
339	20665.4	64.1	34		12.2	51.9	
339.5	20695.9	"	31		10.5	53.6	
340	20726.4	65.4	33		11.6	53.8	
340.5	20756.8	"	27		8.4	57.0	
341	20787.3	66.8	33		11.7	55.2	
341.5	20817.8	"	33		11.7	55.2	

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Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
342	20848.3	69.1	41		16.5	52.7	
342.5	20878.8	"	33		11.6	57.4	
343	20909.2	69.9	49		21.8	48.1	
343.5	20939.7	"	35		12.8	57.1	
344	20970.2	68.8	49		21.8	47.0	
344.5	21000.7	"	43		17.7	51.1	
345	21031.2	70.9	27		8.5	62.5	
345.5	21061.8	"	43		17.7	53.2	
346	21092.1	72.2	29		9.4	62.8	
346.5	21122.6	"	53		24.7	47.5	
347	21153.1	72.9	40	(3)	15.9	57.1	
347.5	21183.6	"	19		4.8	68.1	
348	21214.0	73.7	17		4.1	69.7	
348.5	21244.5	"	23		6.6	67.2	
349	21275.0	74.2	17		4.0	70.2	
349.5	21305.5	"	17		4.0	70.2	
350	21336.0	75.2	39		15.2	60.0	
350.5	21366.4	"	40		15.8	59.4	
351	21396.9	76.1	41		16.4	59.7	
351.5	21427.4	"	49		21.8	54.3	
352	21457.9	76.6	47		20.5	56.2	
352.5	21488.4	"	37		13.9	62.7	

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Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
353	21518.8	77.4	31		10.5	66.9	
353.5	21549.3	"	25		7.4	70.0	
354	21579.8	77.8	22		6.1	71.7	
354.5	21610.3	"	19		4.8	73.0	
355	21640.8	77.8	44		18.4	59.4	
355.5	21671.2	"	33		11.6	66.2	
356	21701.7	77.4	41		16.5	61.0	
356.5	21732.2	"	33		11.6	65.8	
357	21762.7	77.4	27		8.4	69.0	
357.5	21793.2	"	47	(3)	20.4	57.0	
358	21823.6	76.8	33		11.6	55.2	
358.5	21854.1	"	40		15.8	51.0	
359	21884.6	76.5	21		5.6	70.9	
359.5	21915.1	"	17		4.0	72.5	
360	21945.6	76.9	35		12.8	64.1	
360.5	21976.0	"	41		16.4	60.5	
361	22006.5	77.0	19		4.8	72.2	
361.5	22037.0	"	37		13.9	63.1	
362	22067.5	77.5	29		9.4	68.1	
362.5	22098.0	"	21		5.6	71.9	
363	22128.4	78.0	31		10.5	67.5	
363.5	22158.9	"	17		4.0	74.0	

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Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
364	22189.4	78.7	33		11.6	67.1	
364.5	22219.9	"	35		12.8	65.9	
365	22250.4	79.3	35		12.8	66.5	
365.5	22280.8	"	39		15.2	64.1	
366	22311.3	79.3	47		20.4	58.9	
366.5	22341.8	"	25		7.4	71.9	
367	22372.3	78.6	27		8.4	70.2	
367.5	22402.8	"	53		24.7	53.9	
368	22433.2	77.5	47		20.4	57.1	
368.5	22463.7	"	29		9.4	68.1	
369	22494.2	76.8	45		19.1	57.7	
369.5	22524.7	"	37	(3)	13.9	62.9	
370	22555.2	76.0	33		11.6	64.4	

## Line E Reflection Readings

LINE "E"

## Coordinate

## Two Way Reflection Times

E92	10	23	114	87	132		
92.5	8	19	33	79			
93	10	18	37	77	133		
93.5	10	21	39	81			
94	9	20	29	62	92	149	
94.5	14	28	39	45	59	82	117
95	10	20	42	80	113		
95.5	8	19	43	92			
96							
96.5							
97	5	24	48	69			
97.5	4	13	33	51	106		
98	5	13	43	69	168		
98.5	3	18	44	101			
99	8	18	33	82	119	158	
99.5	8	18	43	86			
100	5	20	37				
100.5	11	22	33	46			
101	16	32	46	112			
101.5	14	26	48	82	121		
102	5	15	40	50			
102.5	6	13	18	39	82		
103	6	13	33	47			
103.5	10	23	34	63			
104	5	14	23	53	92		
104.5	7	16	33	63	99		
105	6	16	31	50	76		
105.5	6	24	61	108	140		

LINE "E"

Coordinate		Two Way Reflection Times							
E106	11	33	50	62	86				
106.5	9	29	98	111	139				
107	10	33	50	73	100				
107.5	11	34	49	66	116				
108	10	29	48	70	85				
108.5	7	26	39	47	82				
109	9	29	50	74					
109.5	8	16	59	97	134				
110	10	21	32	53	100	136			
110.5	8	31	58	97	120	175			
111	11	22	45	98	150	241			
111.5	8	14	26	58	108	138	170		
112	13	21	41	95	140				
112.5	10	27	42	50	92				
113	17	31	43	80	104				
113.5	10	43	82	91	157				
114	5	28	44	61	81	133			
114.5	8	22	34	63	114	130			
115	9	25	46	62	82	111			
115.5	11	28	37	81					
116	12	21	31	64	94	117			
116.5	10	28	38	49	82	104	138		
117	10	30	59	78	142				
117.5	9	25	39	57	90	97	127		
118	8	19	27	45	56	118	201		
118.5	14	25	46	98					
119	12	20	34	59	109				
119.5	5	11	26	36	53	92	103	142	

LINE "E"

Coordinate	Two Way Reflection Times							
E120	12	26	31	45	80	101	143	
120.5	5	19	48	59	99	139		
121	11	29	37	49	54	68	87	113
121.5	12	22	53	92	124	155		
122	14	23	35	87				
122.5	10	31	38	52	88	104	130	
123	14	32	40	90	125	64		
123.5	12	21	43	56	80	102	161	
124	14	29	63	97				
124.5	11	21	31	46	59	82	136	
125	12	25	39	49	98	132		
125.5	16	40	65	108	125			
126	6	19	31	48	54			
126.5	9	20	52	89	104			
127	6	12	29	44	72	104		
127.5	5	29	39	63				
128	3	28						
128.5	3	23	42	70	117	93		
129	8	14	27	43	71	94	135	165
129.5	8	20	38	63	77	106	180	
130	11	23	44	54	64	88	117	147
130.5	10	35	46	100	134			
131	9	22	74	48	101			
131.5	10	42	68	114	148			
132	13	71	119					
132.5	11	24	45	69	126			
133	10	20	55	71	87			
133.5	12	28	41	52	108			

LINE "E"

Coordinate	Two Way Reflection Times						
E134	15	23	44	91	140		
134.5	10	22	32	36	49	113	
135	9	32	53	67	95		
135.5	8	15	26	46	87	134	
136	6	22	35	77	46	126	182 208
136.5	7	11	37	54	72	199	
137	8	29	67	49	86		
137.5	9	21	33	63	79	99	
138	11	30	56	135			
138.5	12	48	68	83	215		
139	11	39	76	108	194		
139.5	13	38	59	79	121	212	
140	12	29	54	96	120	184	
140.5	14	34	47	89	162		
141	15	39	55	79	100	160	221
141.5	13	34	46	59	68	91	124 228
142	12	29	63	109	143	206	
142.5	12	30	59	111	158	233	
143	13	28	40	61	122	176	
143.5	17	37	83	117	185	243	
144	26	50	70	142			
144.5	21	31	55	81	112	154	196
145	17	26	47	78	120	179	133
145.5	16	29	76	93	153		
146	11	23	61	84	109	134	
146.5	11	21	44	66	87	135	165



LINE "E"

Coordinate		Two Way Reflection Times				
E147	19	73	115	158	188	
147.5	20	89	165			
148	17	26	47	79	135	
148.5	19	63	107	141		
149	12	24	73	118	141	
149.5	14	24	47	124	172	230
150	19	40	93	120	160	186
150.5	11	41	76	128	174	
151	16	42	66	87	137	
151.5	10	55	89	143	199	
152	20	65	93	122		
152.5						
153	11	30	75			
153.5	No response swamp - under water					
154	"				"	
154.5	"				"	
155	17	55	84	141		
155.5	19	58	92			
156	19	60	98	134		
156.5	19	53	96			
157	15	37	72	88		
157.5	23	67	92	140		
158	20	58	74	122		
158.5	18	56	96	132		
159	16	48	86	126		
159.5	20	71	108			
160	20	65	109	178		
160.5	18	41	50	79	126	

LINE "E"

Coordinate		Two Way Reflection Times					
E161	18	37	63	99			
161.5	16	28	48	110	183		
162	20	40	54	68	82	149	
162.5	14	46	64	85	121		
163	15	33	61	100	178		
163.5	20	64	99	163			
164	15	40	70	100			
164.5	17	28	50	62	88	97	
165	12	34	64	89	118		
165.5	11	39	54	70	108		
166	12	21	40	57	73		
166.5	13	49	93				
167	10	41	96	109			
167.5	10	25	36	63	90		
168	12	27	53	86	113		
168.5	19	42	51	80	98		
169	13	50	75	104	147	200	
169.5	13	34	72	101			
170	11	44	66				
170.5	12	29	44	59	76	122	161
171	19	49	99	115			
171.5	11	37	66	93	151		
172	12	61	90	126	155		
172.5	24	43	71	114	92		
173	5	28	40	72	104		
173.5	11	31	52	75	132	224	
174	11	29	41	56	71	100	
174.5	10	21	33	49	86	113	144

LINE "E"

Coordinate	Two Way Reflection Times					
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E175	10	29	36	72	91	136
175.5	7	20	37	65		
176	14	34	63	89		
176.5	8	21	43	52	74	129
177	10	25	35	64	77	109
177.5	9	18	48	68	94	
178	7	23	33	54	71	102
178.5	16	46	62	88		
179	8	35	69	119		
179.5	24	36	85	56	115	169
180	11	43	86	136	154	
180.5						
181						
181.5						
182		25	54	88		
182.5						
183	10	33				
183.5						
184	11	20	31			
184.5	8	17	29	49	78	
185	14	23	48	59	138	
185.5	11	21	32	56	79	88
186	13	23	62			
186.5	15	40	64	110		
187	11	21	41	57	96	
187.5	10	20	41			
188	14	27	48	90		
188.5	11	27	42	58	98	132

LINE "E"


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Coordinate Two Way Reflection Times

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Fl89	12	22	36	58	85	127
189.5	15	31	54	73	106	
190	14	44	78			
190.5	15	29	54	79		
191	15	27	38	65		
191.5	10	22	35	86		
192	13	27	48	81	105	
192.5	12	51	78	151		
193	12	25	51	72	128	
193.5	16	51	94			
194	16	32	40	124		
194.5	17	31	58			
195	17	33	59			
195.5	25	44	84	124		
196	17	36	72	97		
196.5	14	22	40	53	135	
197	9	22	40	62	95	
197.5	9	22	41	69		
198	21	35	47	66		
198.5	9	23	46			
199	19	45				
199.5	10	19	34	80		
200	12	23	29	75		
200.5	13	20	45			
201	11	31	54			
201.5	12	30	63			
202	12	24	50	82		
202.5	14	37	67	128		

LINE "E"

Coordinate		Two Way Reflection Times					
E203	12	24	45	65			
203.5	12	26	67				
204	17	28	59				
204.5	12	39	82				
205	11	30	47	75			
205.5	13	20	47	94			
206	16	39	80	117			
206.5	11	32	73	150			
207	12	41	61	73	120		
207.5	10	44	61	98			
208	9	25	44	102			
208.5	18	27	37				
209	14	21	51	99			
209.5							
210	11	24	61				
210.5	11	14	31	92			
211	10	20	25	43	90		
211.5	20	38	51				
212	21	40	74	102	164		
212.5	14	27	40	60	97	100	127
213	9	34	53	72			
213.5	10	19	48	69			
214	12	23	59	73			
214.5	12	38	59				
215	15	37	51				
215.6	9	32	61	98			
216	12	25	59				
216.5	13	33	45	73			

LINE "E"

Coordinate		Two Way Reflection Times					
E217	13	37					
217.5	13	37					
218	10	23	42	67			
218.5	9	26	42	70			
219	11	34	53				
219.5	10	22	44				
220	8	22	36	51			
220.5	9	17	37	47			
221	11	24	40				
221.5	10	24	64				
222	7	19	38	55			
222.5	11	20	53	111			
223	10	21	44	58			
223.5	7	17	25	34	56		
224	6	21	72	135			
224.5	9	17	33	62			
225	10	19	39	92			
225.5	13	45	84				
226	8	27	51				
226.5	10	41	74				
227	10	20	31	50	70		
227.5	6	11	16	45			
228	11	27	36	48	96		
228.5	12	61	92	138			
229	9	24	36	52	68	100	
229.5	12	30	56	88	172		
230	11	23	36	43	78	102	133
230.5	12	37	69	98	123		

LINE "E"

Coordinate		Two Way Reflection Times					
E231	13	28	36	45			
231.5	15	45	62	98	158		
232	12	41	63	92	135		
232.5	11	41	88	149			
233	10	24	45	79			
233.5	9	19	35	51			
234	8	15	49				
234.5	10	18	33	60			
235	10	30	48	65	116		
235.5	10	33	64	89			
236	13	39	58	103			
236.5	12	26	66	82			
237	12	38	64	92			
237.5	11	26	59	105			
238	12	26	53	76	53		
238.5	13	30	49				
239	10	48	97				
239.5	11	25	66	110			
240	14	38	49	86			
240.5	9	18	50	88			
241	9	25	57	114			
241.5	12	34	48	66	109	215	
242	10	44	55	89	122	180	
242.5	10	27	51	54	82	114	161
243	12	30	52	74	92		
243.5	11	37	90	130			
244	13	38	41	91	123		
244.5	8	22	35	69	106		

LINE "E"

Coordinate                      Two Way Reflection Times

E245	12	30	48	62	79
245.5	7	21	46	84	120
246	12	24	37	77	116



# Appendix B

## Line E Height, Distance & Depth Values

LINE "E"

317

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
89	5425.4	98.9					
89.5	5455.9	"					
90	5486.4	97.5					
90.5	5516.8	"					
91	5547.3	96.2					
91.5	5577.8	"					
92	5608.3	95.4	44	(1)	23.7	71.7	
92.5	5638.8	"	33	t = 2.321676957	15.8	79.6	
93	5669.2	94.3	37		18.6	75.7	
93.5	5699.7	"	39		20.0	74.3	
94	5730.2	93.9	29		13.2	80.7	
94.5	5760.7	"	39		20.0	73.9	
95	5791.2	"	42		22.2	71.7	
95.5	5821.6	"	43		23.0	70.9	
96	5852.1	94.3	45		24.5	69.8	
96.5	5882.6	"	-		-	-	
97	5913.1	94.8	48		26.8	68.0	
97.5	5943.6	"	-		-	-	
98	5974.0	94.0	43		23.0	71.0	
98.5	6004.5	"	44		23.7	70.3	
99	6035.0	91.8	33		15.8	76.0	
99.5	6065.5	"	43		23.0	68.8	

Peg No.	Distance Metres	Altitude Metres	Reflecion Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
100	6096.0	91.0	37		18.6	72.4	
100.5	6126.4	"	46		25.3	65.7	
101	6156.9	90.8	46		25.3	65.5	
101.5	6187.4	"	48		26.8	64.0	
102	6217.9	90.8	40		20.7	70.1	
102.5	6248.4	"	82		57.2	33.6	
103	6278.8	91.2	75		50.4	40.8	
103.5	6309.3	"	63		39.4	51.8	
104	6339.8	91.4	53	(1)	30.9	60.5	
104.5	6370.3	"	63		39.4	52.0	
105	6400.8	91.9	76		51.3	40.6	
105.5	6431.2	"	108		84.3	7.6	
106	6461.7	92.9	86		61.1	31.8	
106.5	6492.2	"	111		87.6	5.3	
107	6522.7	93.6	100		75.6	18.0	
107.5	6553.2	"	116		93.2	0.4	
108	6583.6	94.2	85		60.1	34.1	
108.5	6614.1	"	82		57.2	37.0	
109	6644.6	94.6	74		49.4	45.2	
109.5	6675.1	"	97		72.4	22.2	
110	6705.6	95.0	100		75.6	19.4	
110.5	6736.0	"	97		72.4	22.6	

Peg No.	Distance Metres	Altitude Metres	Reflecion Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
111	6766.5	95.0	98		73.5	21.4	
111.5	6797.0	"	108		84.3	10.7	
112	6827.5	94.3	95		70.3	24.0	
112.5	6858.0	"	92		67.2	27.1	
113	6888.4	92.8	104		79.9	12.9	
113.5	6918.9	"	91		66.2	26.6	
114	6949.4	91.7	81		56.2	35.5	
114.5	6979.9	"	63		39.4	52.2	
115	7010.4	91.3	82		57.2	34.1	
115.5	7040.8	"	81		56.2	35.1	
116	7071.3	91.9	94	(1)	69.3	22.6	
116.5	7101.8	"	104		79.9	12.0	
117	7132.3	92.7	-		-	-	
117.5	7162.8	"	97		72.4	20.3	
118	7193.2	92.5	-		-	-	
118.5	7223.7	"	98		73.5	19.0	
119	7254.2	92.2	109		85.4	6.8	
119.5	7284.7	"	103		78.8	13.4	
120	7315.2	92.4	101		76.7	15.7	
120.5	7345.6	"	99		74.5	17.9	
121	7376.1	92.7	87		62.1	30.6	
121.5	7406.6	"	92		67.2	25.4	

111.

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
122	7437.1	93.7	87		62.1	31.6	
122.5	7467.6	"	88		63.1	30.6	
123	7498.0	94.9	90		65.2	29.7	
123.5	7528.5	"	102		77.8	17.1	
124	7559.0	96.4	97		72.4	24.0	
124.5	7589.5	"	82		57.2	39.2	
125	7620.0	96.7	98		73.5	23.2	
125.5	7650.4	"	108		84.3	12.4	
126	7680.9	95.7	-		-	-	
126.5	7711.4	"	104		79.9	15.8	
127	7741.9	94.7	104	(1)	79.9	14.8	
127.5	7772.4	"	-		-	-	
128	7802.8	93.5	-		-	-	
128.5	7833.3	"	93		68.3	25.2	
129	7863.8	93.6	94		69.3	24.3	
129.5	7894.3	"	106		82.1	11.5	
130	7924.8	94.2	117		94.4	-0.2	
130.5	7955.2	"	100		75.6	18.6	
131	7985.7	93.5	101		76.7	16.8	
131.5	8016.2	"	114		91.0	2.5	
132	8046.7	93.0	119		96.6	-3.6	
132.5	8077.2	"	126		104.7	-11.7	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
133	8107.6	92.2	87		62.1	30.1	
133.5	8138.1	"	108		84.3	7.9	
134	8168.6	90.5	91		66.2	24.3	
134.5	8199.1	"	113		89.8	0.7	
135	8229.6	89.0	95		70.3	18.7	
135.5	8260.0	"	87		62.1	26.9	
136	8290.5	87.5	76		51.3	36.2	
136.5	8321.0	"	72		47.6	39.9	
137	8351.5	86.6	69		44.8	41.8	
137.5	8382.0	"	63		39.4	47.2	
138	8412.4	85.8	56		33.4	52.4	
138.5	8442.9	"	68	(1)	43.9	41.9	
139	8473.4	86.0	76		51.3	34.7	
139.5	8503.9	"	79		54.2	31.8	
140	8534.4	85.6	96		71.4	14.2	
140.5	8564.8	"	89		64.2	21.4	
141	8595.3	85.4	79		54.2	31.2	
141.5	8625.8	"	68		43.9	41.5	
142	8656.3	85.4	63		39.4	46.0	
142.5	8686.8	"	59		35.9	49.5	
143	8717.2	85.2	61		37.6	47.6	
143.5	8747.7	"	83		58.1	27.1	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
144	8778.2	85.0	70		45.7	39.3	
144.5	8808.7	"	81		56.2	28.8	
145	8839.2	85.1	78		53.3	31.8	
145.5	8869.6	"	76		51.4	33.8	
146	8900.1	84.9	84		59.1	25.8	
146.5	8930.6	"	87		62.1	22.8	
147	8961.1	84.8	73		48.5	36.3	
147.5	8991.0	"	89		64.2	20.6	
148	9022.0	84.5	79		54.2	30.3	
148.5	9052.5	"	63		39.4	45.1	
149	9083.0	84.5	73	(1)	48.5	36.0	
149.5	9113.5	"	-		-	-	
150	9144.0	84.5	93		68.3	16.2	
150.5	9174.4	"	76		51.3	33.2	
151	9204.9	84.5	66		42.1	42.4	
151.5	9235.4	"	55		32.5	52.0	
152	9265.9	84.3	65		41.2	43.1	
152.5	9296.4	"	-		-	-	
153	9326.8	84.4	75		50.4	34.0	
153.5	9357.3	"	-		-	-	
154	9387.8	84.6	-		-	-	
154.5	9418.3	"	-		-	-	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
155	9448.8	84.5	55		32.5	52.0	
155.5	9479.2	"	58		35.1	49.4	
156	9509.7	84.4	60		36.8	47.6	
156.5	9540.2	"	53		30.9	53.5	
157	9570.7	84.5	72		47.6	36.9	
157.5	9601.2	"	67	(2)	43.0	41.5	
158	9631.6	84.6	58		35.1	49.5	
158.5	9662.1	"	56		33.4	51.2	
159	9692.6	84.8	48	t = 1.6785874Z	26.8	58.0	
159.5	9723.1	"	71		46.6	38.2	
160	9753.6	84.7	65	.73580473	41.2	43.5	
160.5	9784.0	"	79		54.2	30.5	
161	9814.5	"	63		39.4	45.3	
161.5	9845.0	"	48		26.8	57.9	
162	9875.5	"	54		31.7	53.0	
162.5	9906.0	"	64		40.3	44.4	
163	9936.4	85.0	61		37.6	47.4	
163.5	9966.9	"	64		40.3	44.7	
164	9997.4	85.2	70		45.7	39.5	
164.5	10027.9	"	62		38.5	46.7	
165	10058.4	85.5	64		40.3	45.2	
165.5	10088.8	"	70		45.7	39.8	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FM m/s	Depth Metres	R.L. Geological Bedrock	Notes
166	10119.3	85.5	73		48.5	37.0	
166.5	10149.8	"	93		67.2	18.3	
167	10180.3	85.2	96		71.4	13.8	
167.5	10210.8	"	90		65.2	20.0	
168	10241.2	"	86		61.1	24.1	
168.5	10271.7	"	80		55.2	30.0	
169	10302.2	84.5	75		50.4	34.1	
169.5	10332.7	"	72		47.6	36.9	
170	10363.2	84.4	66		42.1	42.3	
170.5	10393.6	"	59		35.9	48.5	
171	10424.1	85.2	49	(2)	27.6	57.6	
171.5	10454.6	"	66		42.1	43.1	
172	10485.1	85.5	61		37.6	47.9	
172.5	10515.6	"	71		46.6	38.9	
173	10546.0	"	72		47.6	37.9	
173.5	10576.5	"	75		50.4	35.1	
174	10607.0	"	71		46.6	38.9	
174.5	10637.5	"	49		27.6	57.9	
175	10668.0	86.3	36		17.9	68.4	
175.5	10698.4	"	37		18.6	67.7	
176	10728.9	86.4	34		16.5	69.9	
176.5	10759.4	"	43		23.0	63.4	



Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
177	10789.9	88.9	35		17.2	71.6	
177.5	10820.4	"	48		26.8	62.1	
178	10850.8	90.6	54		31.7	38.9	
178.5	10881.3	"	46		25.3	65.3	
179	10911.8	92.0	35		17.2	74.8	
179.5	10942.3	"	36		17.9	74.1	
180	10972.8	93.0	43		23.0	70.0	
180.5	11003.2	"	-		-	-	
181	11033.7	93.4	-		-	-	
181.5	11064.2	"	-		-	-	
182	11094.7	93.1	25	(2)	10.7	82.4	
182.5	11125.2	"	-		-	-	
183	11155.6	93.0	33		15.8	77.2	
183.5	11186.1	"	-		-	-	
184	11216.6	93.5	31		14.5	79.0	
184.5	11247.1	"	49		27.6	65.9	
185	11277.6	94.0	59		35.9	58.0	
185.5	11308.0	"	56		33.4	60.6	
186	11338.5	94.9	62		38.6	56.4	
186.5	11369.0	"	40		20.7	74.2	
187	11399.5	96.1	41		21.5	74.6	
187.5	11430.0	"	41		21.5	74.6	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity m/s	Depth Metres	R.L. Geological Bedrock	Notes
188	11460.4	96.9	48		26.8	70.1	
188.5	11490.9	"	58		35.1	61.8	
189	11521.4	97.7	58		35.1	62.6	
189.5	11551.9	"	54		31.7	66.0	
190	11582.4	97.9	44		23.7	74.2	
190.5	11612.8	"	54		31.7	66.2	
191	11643.3	98.3	65		41.2	56.1	
191.5	11673.8	"	35		17.2	81.1	x
192	11704.3	98.6	48		26.8	71.8	
192.5	11734.8	"	51		29.2	69.4	
193	11765.2	98.1	51		29.2	68.9	
193.5	11795.7	"	51	(2)	29.2	68.9	
194	11826.2	97.2	40		20.7	76.5	
194.5	11856.7	"	58		35.1	62.1	
195	11887.2	96.8	59		35.9	60.9	
195.5	11917.6	"	84		59.1	37.7	
196	11948.1	"	72		47.6	47.7	
196.5	11978.6	"	53		30.9	65.9	
197	12009.1	97.0	62		38.5	58.5	
197.5	12039.6	"	69		44.8	52.2	
198	12070.0	97.3	66		42.1	55.2	
198.5	12100.5	"	46		25.3	72.0	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
199	12131.0	98.0	45		24.5	73.5	
199.5	12161.5	"	80		55.2	42.8	
200	12192.0	98.1	75		50.4	47.7	
200.5	12222.4	"	45		24.5	73.6	
201	12252.9	97.8	54		31.7	66.1	
201.5	12283.4	"	63		39.4	58.4	
202	12313.9	97.0	50		28.4	68.6	
202.5	12344.4	"	67		43.0	54.0	
203	12374.8	96.3	65		41.2	55.1	
203.5	12405.3	"	67	(2)	43.0	53.3	
204	12435.8	"	59		35.9	60.4	
204.5	12466.3	"	82		57.2	39.1	
205	12496.8	96.0	75		50.4	45.6	
205.5	12527.2	"	94		69.3	26.7	
206	12557.7	96.5	80		55.2	41.3	
206.5	12588.2	"	73		48.5	48.0	
207	12618.7	97.5	73		48.5	49.0	
207.5	12649.2	"	61		37.6	59.9	
208	12679.6	98.2	44		23.7	74.5	
208.5	12710.1	"	37		18.6	79.6	
209	12740.6	98.2	51		29.2	69.0	
209.5	12771.1	"	-		-	-	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Denth Metres	R.L. Geological Bedrock	Notes
210	12801.6	98.1	61		37.6	60.5	
210.5	12832.0	"	-		-	-	
211	12862.5	97.8	43		23.0	74.7	
211.5	12893.0	"	51		29.2	68.6	
212	12923.5	97.1	74		49.4	47.7	
212.5	12954.0	"	77		52.3	44.8	
213	12984.4	96.5	72		47.6	48.9	
213.5	13014.9	"	69		44.8	51.7	
214	13045.4	95.8	73	(2)	48.6	47.3	
214.5	13075.9	"	59		35.9	60.0	
215	13106.4	95.2	51		29.2	66.0	
215.5	13136.8	"	61		37.7	57.6	
216	13167.3	94.4	59		35.9	58.5	
216.5	13197.8	"	45		24.5	69.9	
217	13228.3	94.2	37		18.6	75.6	
217.5	13258.8	"	37		18.6	75.6	
218	13289.2	94.1	42		22.2	71.9	
218.5	13319.7	"	42		22.2	71.9	
219	13350.2	94.2	34		16.5	77.7	
219.5	13350.2	"	44		23.7	70.5	
220	13411.2	94.5	36		17.9	76.5	
220.5	13441.6	"	37		18.6	75.8	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
221	13472.1	95.5	40		20.7	74.8	
221.5	13502.6	"	64		40.3	55.2	
222	13533.1	96.3	55		32.5	63.8	
222.5	13563.6	"	53		30.9	65.4	
223	13594.0	97.2	58		35.1	62.1	
223.5	13624.5	"	56		33.4	63.8	
224	13655.0	98.5	72		47.6	50.9	
224.5	13685.5	"	62		38.5	60.0	
225	13716.0	99.1	72		47.6	51.5	
225.5	13746.4	"	84		59.1	40.0	
226	13776.9	99.7	-		-	-	
226.5	13807.4	"	74	(2)	49.4	50.3	
227	13837.9	99.0	70		45.7	53.3	
227.5	13868.4	"	45		24.5	74.5	
228	13898.8	99.4	48		26.8	72.6	
228.5	13929.3	"	61		37.6	61.8	
229	13959.8	98.7	68		43.9	54.8	
229.5	13990.3	"	88		63.1	35.6	
230	14020.8	98.3	78		53.3	45.0	
230.5	14051.2	"	69		44.8	53.5	
231	14081.7	98.2	45		25.5	73.7	
231.5	14112.2	"	62		38.5	59.7	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
232	14142.7	97.5	63		39.4	58.1	
232.5	14173.2	"	41		21.5	76.0	
233	14203.6	97.1	45		24.5	72.6	
233.5	14234.1	"	51		29.2	67.9	
234	14264.6	96.7	49		27.6	69.1	
234.5	14295.1	"	60		36.9	59.9	
235	14325.6	96.6	65		41.2	55.4	
235.5	14356.0	"	64		40.3	56.3	
236	14386.5	96.8	58		35.1	61.7	
236.5	14417.0	"	66		42.1	54.7	
237	14447.5	97.1	64		40.3	56.8	
237.5	14478.0	"	59	(2)	35.9	61.2	
238	14508.4	97.7	53		30.9	66.8	
238.5	14538.9	"	49		27.6	70.1	
239	14569.4	98.1	48		26.8	71.3	
239.5	14599.9	"	66		42.1	56.0	
240	14630.4	98.0	49		27.6	70.4	
240.5	14660.8	"	50		28.4	69.6	
241	14691.3	98.6	57		34.2	64.4	
241.5	14721.8	"	48		26.9	71.8	
242	14752.3	99.1	55		30.0	66.6	
242.5	14782.8	"	51		29.2	69.9	

Peg No.	Distance Metres	Altitude Metres	Reflection Time M.sec	Velocity FN m/s	Depth Metres	R.L. Geological Bedrock	Notes
243	14813.2	99.5	52		30.1	69.4	
243.5	14843.7	"	37		18.6	80.9	
244	14874.2	99.5	41		21.5	78.0	
244.5	14904.7	"	69	(2)	44.8	54.7	
245	14935.2	99.3	48		26.9	72.5	
245.5	14965.6	"	46		25.3	74.0	
246	14996.1	98.8	37		18.7	80.2	
246.5	15026.6	"					
247	15057.1	97.7					
247.5	15087.6	"					
248	15118.0	97.1					
248.5	15148.5	"					
249	15179.0	96.4					
249.5	15209.5	"					
250	15240.0	95.8					
250.5	15270.4	"					
251	15300.9	95.4					
251.5	15331.4	"					
252	16361.9	95.4					
252.5	15392.4	"					
253	15422.8	96.1					
253.5	15453.3	"					

A P P E N D I X C.

KAPI 13 Peg B38

Depth	Average velocity (Surface to Geophone) Km/sec.
10	.454
20	1.015
30	1.235
40	1.201
50	1.404
60	1.685
70	1.458
80	1.572
90	1.528
100	1.616
110	1.600
130	1.640
136.8	1.685

KAPI 14 Peg B 200 (25 metres S.E.)

2.5	.735
7.5	.688
12.5	1.033



KAPI 15 Peg A 107 (10 metres E)

Depth	Average velocity (surface to Geophone) Km/sec.
-------	--

3.6	.356
8.6	.363
13.6	.548
18.6	.959
23.6	1.073
28.6	1.502
33.6	1.355

KAPI 16 Peg T 92

6.2	.439
11.2	.612
16.2	.720
21.2	.880
26.2	.929
31.2	.850
36.2	1.014
41.2	1.164
46.2	1.060
51.2	1.135
56.2	1.269
61.2	1.236
66.2	1.157
71.2	1.582

KAPI 18A Peg C60 (31 metres W)

Depth	Average velocity (surface to Geophone) Km/sec.
17.7	.695
22.7	.782
27.7	.930
32.7	1.044
37.7	1.310
42.7	1.454

KAPI 19

6.2	-
11.2	.925
16.2	-
21.2	.977
26.2	.981
31.2	1.591
36.2	1.560
41.2	1.584
43.0	1.416

KAPI 20 Peg D 242 (10 metres E)

Depth	Average velocity (surface to Geophone) Km/sec.
-------	--

2.5	.415
7.5	.634
12.5	.857
17.5	.705
22.5	.839
27.5	.852
32.5	.932
37.5	.950
42.5	1.159
47.5	1.236
52.5	1.273
57.5	1.380
62.5	1.560

KAPI 21

Depth	Average velocity (surface to Geophone) Km/sec.
-------	--

3.2	.40
8.2	.439
13.2	.589
18.2	.722
23.2	.872
28.2	.993
33.2	1.087
38.2	1.173
43.2	1.204
48.2	1.294
53.2	1.265
58.2	1.253
63.2	2.038
68.2	1.453

KAPI 22 Peg E 119 (16 metres W)

Depth	Average velocity (surface to Geophone) Km/sec.
2.5	.554
7.5	.714
12.5	.925
17.5	1.022
22.5	1.121
27.5	1.197
32.5	1.215
37.5	1.303
42.5	1.329
47.5	1.376
52.5	1.349
57.5	1.433
62.5	1.367
67.5	1.463
72.5	1.532
77.5	1.534

KAPI 23 Peg E 163 (11 metres W)

Depth	Average velocity (surface to Geophone) Km/sec.
-------	--

5.5	.852
10.5	1.027
15.5	1.304
20.5	1.370
25.5	1.688
30.5	1.626
35.5	1.580
40.5	1.391
45.5	1.413

KAPI 25 Peg D 22 (3 metres W)

2.5	-
14.5	.884
19.5	.994
24.5	1.109
29.5	1.143
34.5	1.030
39.5	1.076
44.5	1.062

KAPI 26

2.5	.248
12.5	.470
22.5	.658
32.5	.935
42.5	1.121
52.5	1.353
62.5	1.536
72.5	1.520

K E Y

T = Time of intercept of Velocity Line

V<sub>0</sub> = Velocity 0

V<sub>1</sub> = Velocity 1

V<sub>2</sub> = Velocity 2

i<sub>1</sub> = Critical Angle 1

i<sub>2</sub> = Critical Angle 2

θ<sub>1</sub> = Dip of Layer 1

θ<sub>2</sub> = Dip of Layer 2

D<sub>1</sub> = Depth of 1st Layer

D<sub>2</sub> = Depth of 2nd Layer



APPENDIX D

LOCATION OF REFRACTION TRAVERSES

DEPTH AND VELOCITIES MEASURED

TEST LINE

1E - 6.5E	5.000	Vo	)	
	0.000	T1	)	
	14.388	V1	)	1E
	26.016	T2	)	
	6.916	Vo	)	
	1.190	T1	)	6.5E
	15.418	V1	)	
	35.371	T2	)	
1.816 Km/s	5.958	Vo		
4.542 Km/s	14.903	V1		
	23.598	i1		
	0.864	-θ1		
	0.000		)	
25.78m	84.593	-D1	)	1E
	0.000		)	
35.05m	115.010	-D1	)	6.5E

TEST LINE (Continued)

25E - 31E	4.210	Vo	)	
	3.800	-T1	)	
	8.928	V1	)	
	41.200	T2	)	25E
	15.625	V2	)	
	74.300	T3	)	
	2.857	Vo	)	
	0.000	T1	)	
	9.388	V1	)	
	56.084	T2	)	31E
	33.333	V2	)	
	125.000	T3	)	
1.077 Km/s	3.533	Vo		
2.791 Km/s	9.158	V1		
7.461 Km/s	24.479	V2		
	22.712	i1		
	25.778	i2		
	0.602	-θ1		
	8.824	-θ2		
	0.000		)	
24.05m	78.921	-D1	)	25E
71.64m	235.053	-D2	)	
	0.000		)	
32.74m	107.434	-D1	)	31E
134.94m	442.748	-D2	)	

iii.

TEST LINE (Continued)

51.25E - 57.25E	5.000	Vo	)	
	0.000	T1	)	
	11.067	V1	)	51.25E
	21.732	T2	)	
	31.666	V2	)	
	74.315	T3	)	
	4.285	Vo	)	
	0.000	T1	)	
	7.407	V1	)	57.25E
	21.750	T2	)	
	25.303	V2	)	
	61.411	T3	)	
1.415 Km/s	4.642	Vo		
2.218 Km/s	9.237	V1		
8.682 Km/s	28.485	V2		
	31.808	i1		
	18.554	i2		
	7.004	θ1		
	4.769	θ2		
	0.000		)	
18.23m	59.811	-D1	)	51.25E
91.10m	298.916	-D2	)	
	0.000		)	
18.24m	59.861	-D1	)	57.25E
81.86m	235.779	-D2	)	

iv.

TEST LINE (Continued)

88.25E - 94.25E	3.696	Vo	)	
	1.263	T1	)	
	6.666	V1	)	
	37.500	T2	)	88.25E
	17.375	V2	)	
	81.384	T3	)	
	2.500	Vo	)	
	0.000	T1	)	
	4.761	V1	)	
	24.500	T2	)	94.25E
	21.948	V2	)	
	104.519	T3	)	
.944 Km/s	3.098	Vo		
1.741 Km/s	5.714	v1		
5.993 Km/s	19.662	V2		
	34.141	i1		
	16.903	i2		
	6.448	θ1		
	7.484	-θ2		
	0.000		)	
21.52m	70.635	-D1	)	88.25E
54.92m	180.208	-D2	)	
	0.000		)	
14.06m	46.148	-D1	)	94.25E
83.02m	272.388	-D2	)	

TEST LINE (Continued)

94.25E - 100.25E	3.945	Vo	)	
	3.476	T1	)	
	16.048	V1	)	94.25E
	78.012	T2	)	
	3.453	Vo	)	
	0.037	-T1	)	
	16.119	V1	)	100.25E
	83.732	T2	)	
1.127 Km/s	3.699	Vo		
4.902 Km/s	16.084	V1		
	13.298	i1		
	0.029	-e1		
	0.000		)	
45.19m	148.284	-D1	)	94.25E
	0.000		)	
48.51m	159.157	-D1	)	100.25E

TEST LINE (Continued)

100.25E - 106.25E	3.902	Vo	)	
	3.700	T1	)	
	9.433	V1	)	
	53.400	T2	)	100.25E
	19.454	V2	)	
	101.205	T3	)	
	3.191	Vo	)	
	0.000	T1	)	
	5.263	V1	)	
	19.833	T2	)	106.25E
	14.267	V2	)	
	77.350	T3	)	
1.080 Km/s	3.546	Vo		
2.239 Km/s	7.348	V1		
5.138 Km/s	16.860	V2		
	32.226	i1		
	24.693	i2		
	10.142	θ1		
	6.557	-θ2		
	0.000		)	
35.66m	113.724	-D1	)	100.25E
82.58m	270.947	-D2	)	
	0.000		)	
12.87m	42.238	-D1	)	106.25E
80.01m	262.489	-D2	)	

LINE A

36.5 W - 30 W	4.444	Vo	)	
	0.000	T1	)	
	5.000	V1	)	
	5.000	T2	)	36.5W
	12.658	V2	)	
	85.800	T3	)	
	3.846	Vo	)	
	0.000	T1	)	
	5.617	V1	)	
	17.933	T2	)	30W
	22.727	V2	)	
	132.200	T3	)	
1.263 Km/s	4.145	Vo		
1.617 Km/s	5.308	V1		
5.392 Km/s	17.692	V2		
	51.776	i1		
	18.991	i2		
	4.226	- a1		
	4.326	- a2		
	0.000		)	
5.11m	16.794	- D1	)	36.5W
72.04m	236.357	- D2	)	
	0.000		)	
18.35m	60.236	- D1	)	30W
107.76m	353.544	- D2	)	

LINE A (Continued)

58.5W - 52W	3.733	Vo	)	
	0.357	T1	)	
	6.250	V1	)	58.5W
	34.000	T2	)	
	15.015	V2	)	
	86.967	T3	)	
	3.773	Vo	)	
	0.000	T1	)	
	5.917	V1	)	52W
	24.700	T2	)	
	14.925	V2	)	
	86.900	T3	)	
1.144 Km/s	3.753	Vo		
1.854 Km/s	6.083	V1		
4.562 Km/s	14.970	V2		
	38.140	i1		
	23.963	i2		
	1,230	e1		
	0.804	-e2		
	0.000		)	
24.73m	81.148	-D1	)	58.5W
70.50m	231.317	-D2	)	
	0.000		)	
17.96m	58.951	-D1	)	52W
75.29	247.013	-D2	)	



LINE A (Continued)

71.5W - 65W	3.333	Vo	)	
	0.000	T1	)	
	7.692	V1	)	
	51.000	T2	)	71.5W
	16.964	V2	)	
	82.157	T3	)	
	2.857	Vo	)	
	0.000	T1	)	
	5.405	V1	)	
	39.000	T2	)	65W
	27.384	V2	)	
	110.327	T3	)	
.943 Km/s	3.095	Vo		
1.996 Km/s	6.548	V1		
6.758 Km/s	22.174	V2		
	29.330	i1		
	18.164	i2		
	5.602	θ1		
	10.751	-θ2		
	0.000		)	
27.72m	90.968	-D1	)	71.5W
53.45m	175.364	-D2	)	
	0.000		)	
21.20m	69.564	-D1	)	65W
91.65m	300.724	-D2	)	

LINE A (Continued)

76.5W - 70W	2.857	Vo	)	
	0.000	T1	)	
	16.125	V1	)	76.5W
	70.870	T2	)	
	3.608	Vo	)	
	1.857	- T1	)	70W
	14.581	V1	)	
	68.929	T2	)	
.985 Km/s	3.232	Vo		
4.679 Km/s	15.353	V1		
	12.186	i1		
	0.622	θ1		
	0.000		)	
35.72m	117.198	- D1	)	76.5W
	0.000		)	
34.74m	113.988	- D1	)	70W

LINE A (Continued)

98.5W - 92W	5.982	Vo )	
	1.142	T1 )	
	18.944	V1 )	98.5W
	50.737	T2 )	
	3.571	Vo )	
	0.000	T1 )	
	16.361	V1 )	92W
	42.486	T2 )	
1.456 Km/s	4.777	Vo	
5.380 Km/s	17.652	V1	
	15.791	i1	
	1.185	θ1	
	0.000	)	
38.39m	125.971 - D1	)	98.5
	0.000	)	
32.15m	105.486 - D1	)	92W

LINE A (Continued)

117.5W - 111W	2.985	Vo	)	
	0.000	T1	)	
	4.347	V1	)	117.5W
	21.000	T2	)	
	14.747	V2	)	
	69.890	T3	)	
	3.508	Vo	)	
	0.000	T1	)	
	5.747	V1	)	111W
	23.600	T2	)	
	16.678	V2	)	
	83.180	T3	)	
.989 Km/s	3.246	Vo		
1.538 Km/s	.047	V1		
4.789 Km/s	15.712	V2		
	41.356	i1		
	18.460	i2		
	6.956	-e1		
	2.764	e2		
	0.000		)	
13.94m	45.756	-D1	)	117.5W
48.30m	158.489	-D2	)	
	0.000		)	
15.67m	51.421	-D1	)	111W
58.05m	190.463	-D2	)	

LINE B

15.25W - 21.25W	2.830	Vo	)	
	0.000	T1	)	
	7.692	V1	)	15.25W
	39.500	T2	)	
	11.788	V2	)	
	58.984	T3	)	
	3.000	Vo	)	
	0.000	T1	)	
	5.154	V1	)	21.25W
	24.100	T2	)	
	33.242	V2	)	
	133.721	T3	)	
.888 Km/s	2.915	Vo		
1.957 Km/s	6.423	V1		
6.862 Km/s	22.515	V2		
	28.354	i1		
	22.501	i2		
	6.084	θ1		
	18.636	-θ2		
	0.000		)	
20.05m	65.792	-D1	)	15.25W
36.47m	119.477	-D2	)	
	0.000		)	
12.23m	40.141	-D1	)	21.25W
131.50m	431.456	-D2	)	

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LINE B (Continued)

32W - 39.5W	3.740	Vo	)	
	7.195	T1	)	
	3.740	Vo	)	32W
	7.195	T1	)	
	3.740	Vo	)	
	7.195	T1	)	
	2.692	Vo	)	
	1.428	-T1	)	
	4.166	V1	)	39.5W
	71.000	T2	)	
	10.000	V2	)	
	220.000	T3	)	
.980 Km/s	3.216	Vo	)	
1.205 Km/s	3.953	V1	)	
2.094 Km/s	6.870	V2	)	
	0.000		)	
60.72m	199.231	-D1	)	39.5W
143.77m	471.717	-D2	)	
48W - 54.5W	2.500	Vo	)	
	0.000	T1	)	
	3.536	V1	)	48W
	23.095	T2	)	
	8.000	V2	)	
	192.500	T3	)	
.762 Km/s	2.500	Vo	)	
1.077 Km/s	3.536	V1	)	
2.438 Km/s	8.000	V2	)	
	44.978	i1	)	
	26.238	i2	)	
	0.000		)	
12.44m	40.811	-D1	)	48W
109.48m	359.191	-D2	)	

xv.

LINE B (Continued)

69W - 75.5W	2.222	Vo	)	
	0.000	T1	)	
	3.551	V1	)	
	31.369	T2	)	69W
	40.000	V2	)	
	312.333	T3	)	
	2.857	Vo	)	
	0.000	T1	)	
	3.435	V1	)	
	2.678	T2	)	75.5
	10.000	V2	)	
	220.000	T3	)	
.774 Km/s	2.539	Vo		
1.064 Km/s	3.493	V1		
7.620 Km/s	25.000	V2		
	46.656	i1		
	12.704	i2		
	1.009	θ1		
	7.314	θ2		
	0.000		)	
17.6°m	58.042	-D1	)	69W
164.84m	540.837	-D2	)	
	0.000		)	
1.51m	4.956	-D1	)	75.5W
120.46m	395.216	-D2	)	

LINE B (Continued)

121W - 127.5W	3.333	Vo	)	
	0.000	T1	)	
	5.533	V1	)	121W
	27.714	T2	)	
	58.823	V2	)	
	193.200	T3	)	
	3.636	Vo	)	
	0.166	-T1	)	
	5.714	V1	)	127.5W
	27.712	T2	)	
	20.000	V2	)	
	155.000	T3	)	
1.061 Km/s	3.484	Vo		
1.713 Km/s	5.623	V1		
12.012 Km/s	39.411	V2		
	38.305	i1		
	10.920	i2		
	0.727	-θ1		
	5.884	θ2		
	0.000		)	
18.75m	61.543	-D1	)	121W
157.56m	516.945	-D2	)	
	0.000		)	
18.75m	61.543	-D1	)	127.5
124.04m	406.967	-D2	)	



LINE B (Continued)

121.5W - 127W	2.500	Vo	)	
	0.000	T1	)	
	5.327	V1	)	
	24.028	T2	)	121.5W
	7.692	V2	)	
	68.000	T3	)	
	20.000	V3	)	
	150.000	T4	)	
	2.500	Vo	)	
	0.000	T1	)	
	5.216	V1	)	
	17.895	T2	)	127W
	7.692	V2	)	
	68.000	T3	)	
	33.333	V3	)	
	173.000	T4	)	
.762 Km/s	2.500	Vo		
1.606 Km/s	5.271	V1		
2.344 Km/s	7.692	V2		
8.127 Km/s	26.666	V3		
	28.313	i1		
	43.259	i2		
	17.985	i3		
	0.325	θ1		
	0.565	-θ2		
	4.916	-θ3		
	0.000		)	
10.39m	34.117	-D1	)	121.5W
56.94m	186.816	-D2	)	
140.65m	461.454	-D3	)	
	0.000		)	
7.74m	25.409	-D1	)	127W
61.55m	201.956	-D2	)	
170.94m	560.858	-D3	)	

LINE B (Continued)

151W - 157.5W	2.083	Vo	)	
	0.000	T1	)	
	3.726	V1	)	151W
	46.583	T2	)	
	10.000	V2	)	
	220.000	T3	)	
	2.083	Vo	)	
	0.000	T1	)	
	3.636	V1	)	157.5W
	42.242	T2	)	
	7.407	V2	)	
	173.500	T3	)	
.635 Km/s	2.083	Vo		
1.122 Km/s	3.681	V1		
2.652 Km/s	8.703	V2		
	34.471	i1		
	25.676	i2		
	0.482	A1		
	3.662	A2		
	0.000		)	
17.94m	58.861	-D1	)	151W
121.02m	397.073	-D2	)	
	0.000		)	
16.23m	53.250	-D1	)	157.5
93.56m	306.975	-D2	)	

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LINE B (Continued)

190W - 196.5W	4.620	Vo	)	
	1.357	T1	)	
	11.111	V1	)	190W
	99.333	T2	)	
	22.727	V2	)	
	147.400	T3	)	
	3.727	Vo	)	
	1.428	T1	)	
	13.333	V1	)	196.5W
	112.800	T2	)	
	33.333	V2	)	
	167.000	T3	)	
1.272 Km/s	4.173	Vo		
3.725 Km/s	12.222	V1		
8.543 Km/s	28.030	V2		
	20.153	i1		
	26.645	i2		
	1.910	-θ1		
	1.216	-θ2		
	0.000		)	
67.34m	220.948	-D1	)	190W
156.65m	513.961	-D2	)	
	0.000		)	
76.47m	250.902	-D1	)	196.5W
177.09m	581.020	-D2	)	

xx.

LINE B (Continued)

235W - 241.5W	2.477	Vo	)	
	0.357	T1	)	
	8.000	V1	)	235W
	173.333	T2	)	
	10.000	V2	)	
	200.000	T3	)	
	2.374	Vo	)	
	0.047	T1	)	
	5.494	V1	)	241.5W
	131.500	T2	)	
	15.384	V2	)	
	246.500	T3	)	
.739 Km/s	2.426	Vo		
2.056 Km/s	6.747	V1		
3.868 Km/s	12.692	V2		
	21.929	i1		
	35.120	i2		
	4.274	θ1		
	17.901	-θ2		
	0.000		)	
69.28m	227.301	-D1	)	235W
91.21m	299.241	-D2	)	
	0.000		)	
52.56m	172.443	-D1	)	241.5W
194.39m	637.783	-D2	)	

LINE C

6.5W - 0W	4.000	Vo	)	
	0.000	T1	)	
	15.571	V1	)	6.5W
	28.792	T2	)	
	4.347	Vo	)	
	0.000	T1	)	
	17.085	V1	)	0W
	35.218	T2	)	
1.272 Km/s	4.173	Vo		
4.976 Km/s	16.328	V1		
	14.844	i1		
	0.704	-θ1		
	0.000		)	
18.94m	62.167	-D1	)	6.5W
	0.000		)	
23.17m	76.043	-D1	)	0W
36.5W - 30W	5.000	Vo	)	
	0.000	T1	)	
	15.708	V1	)	36.5W
	31.919	T2	)	
	4.000	Vo	)	
	0.000	T1	)	
	18.546	V1	)	30W
	47.822	T2	)	
1.371 Km/s	4.500	Vo		
5.220 Km/s	17.127	V1		
	15.344	i1		
	1.302	-θ1		
	0.000		)	
22.71m	74.493	-D1	)	36.5W
	0.000		)	
34.02m	111.606	-D1	)	30W

LINE C (Continued)

103.5W - 97W	5.843	Vo	)	103.5W
	0.742	T1	)	
	17.844	V1	)	
	55.165	T2	)	
	5.223	Vo	)	97W
	0.428	T1	)	
	16.476	V1	)	
	46.659	T2	)	
1.686 Km/s	5.533	Vo		
5.230 Km/s	17.160	V1		
	18.844	i1		
	0.779	θ1		
49.16m	0.000		)	103.5W
	161.287	-D1	)	
41.58m	0.000		)	97W
	136.410	-D1	)	
149W - 142.5W	4.166	Vo	)	149W
	0.000	T1	)	
	15.821	V1	)	
	36.465	T2	)	
	4.444	Vo	)	142.5W
	0.000	T1	)	
	16.702	V1	)	
	37.798	T2	)	
1.312 Km/s	4.305	Vo		
4.956 Km/s	16.262	V1		
	15.364	i1		
	0.426	-θ1		
24.81m	0.000		)	149W
	81.413	-D1	)	
25.72m	0.0-0		)	142.5W
	84.390	-D1	)	

LINE D

78.5W - 72W	4.221	Vo	)	78.5W
	1.270	T1	)	
	13.918	V1	)	
	90.885	T2	)	
	4.672	Vo	)	72W
	4.000	T1	)	
	13.307	V1	)	
	92.028	T2	)	
1.355 Km/s	4.447	Vo		
4.149 Km/s	13.613	V1		
	19.077	i1		
	0.444	el		
65.18m	0.000		)	78.5W
	213.839	-D1	)	
66.00m	0.000		)	72W
	216.529	-D1	)	
110W - 103.5W	4.299	Vo	)	110W
	2.171	T1	)	
	14.009	V1	)	
	70.436	T2	)	
	4.369	Vo	)	103.5W
	2.257	T1	)	
	16.618	V1	)	
	82.473	T2	)	
1.321 Km/s	4.334	Vo		
	15.313	V1		
	16.571	i1		
	1.451	-el		
48.56m	0.000		)	110W
	159.324	-D1	)	
56.86m	0.000		)	103.5W
	186.553	-D1	)	

xxiv.

LINE D (Continued)

162.5W - 156W	3.753	Vo	)	162.5W
	2.071	-T1	)	
	16.441	V1	)	
	62.666	T2	)	
	4.430	Vo	)	156W
	0.285	-T1	)	
	17.169	V1	)	
	68.537	T2	)	
1.247 Km/s	4.091	Vo		
5.122 Km/s	16.805	V1		
	14.099	i1		
	0.311	-e1		
40.29m	0.000		)	162.5W
	132.194	-D1	)	
44.06m	0.000		)	156W
	144.579	-D2	)	
200.5W - 194W	4.794	Vo	)	200.5W
	0.571	T1	)	
	20.854	V1	)	
	55.772	T2	)	
	4.545	Vo	)	194W
	0.000	T1	)	
	17.486	V1	)	
	38.138	T2	)	
1.423 Km/s	4.669	Vo		
5.843 Km/s	19.170	V1		
	14.214	i1		
	1.274	e1		
40.95m	0.000		)	200.5W
	134.375	-D1	)	
28.00m	0.000		)	194W
	91.888	-D1	)	



LINE D (Continued)

227.5W - 221W	4.651	Vo	)	
	0.000	T1	)	
	11.494	V1	)	227.5W
	38.100	T2	)	
	18.362	V2	)	
	59.851	T3	)	
	5.000	Vo	)	
	0.000	T1	)	
	7.692	V1	)	221W
	20.333	T2	)	
	18.944	V2	)	
	62.737	T3	)	
1.470 Km/s	4.825	Vo	)	
2.923 Km/s	9.593	V1	)	
5.685 Km/s	18.653	V2	)	
	31.838	i1	)	
	30.335	i2	)	
	7.014	θ1	)	
	8.524	-θ2	)	
	0.000		)	
33.23m	109.024	-D1	)	227.5W
60.98m	200.089	-D2	)	
	0.000		)	
17.73m	58.184	-D1	)	221W
85.29m	279.846	-D2	)	

LINE   D   (Continued)

257W - 250.5W	4.117	Vo	)	257W
	0.857	T1	)	
	13.230	V1	)	
	56.029	T2	)	
	4.907	Vo	)	250.5W
	0.540	T1	)	
	20.265	V1	)	
	85.885	T2	)	
1.375 Km/s	4.512	Vo		
5.104 Km/s	16.748	V1		
	16.403	i1		
	3.537	-e1		
40.24m	0.000		)	257W
	132.027	-D1	)	
61.68m	0.000		)	250.5W
	202.381	-D1	)	
284.5W - 278W	3.174	Vo	)	284.5W
	0.000	T1	)	
	15.618	V1	)	
	59.240	T2	)	
	3.703	Vo	)	278W
	0.000	T1	)	
	15.039	V1	)	
	60.564	T2	)	
1.048 Km/s	3.439	Vo		
4.672 Km/s	15.328	V1		
	12.969	i1		
	0.249	e1		
31.86m	0.000		)	284.5W
	104.536	-D1	)	
32.57m	0.000		)	278W
	106.873	-D1	)	

LINE D (Continued)

316.5W - 310W	3.333	Vo	)	
	0.000	T1	)	
	13.576	V1	)	316.5W
	37.419	T2	)	
	3.278	Vo	)	
	0.000	T1	)	
	17.600	V1	)	310W
	62.818	T2	)	
1.007 Km/s	3.306	Vo		
4.751 Km/s	15.588	V1		
	12.460	i1		
	1.633	-Θ1		
	0.000		)	
19.31m	63.373	-D1	)	316.5W
	0.000		)	
32.42m	106.386	-D1	)	310W
330.5W - 324W	5.882	Vo	)	
	0.000	T1	)	
	13.940	V1	)	330.5W
	17.683	T2	)	
	3.773	Vo	)	
	0.000	T1	)	
	20.551	V1	)	324W
	43.919	T2	)	
1.471 Km/s	4.827	Vo		
5.256 Km/s	17.246	V1		
	16.924	i1		
	3.337	-Θ1		
	0.000		)	
13.62m	44.697	-D1	)	330.5W
	0.000		)	
33.83m	111.010	-D1	)	324W

LINE D (Continued)

361.5W - 355W	4.347	Vo	)	361.5W
	0.000	T1	)	
	9.174	V1	)	
	24.100	T2	)	
	18.918	V2	)	
	51.285	T3	)	
	4.166	Vo	)	355W
	0.000	T1	)	
	10.000	V1	)	
	28.666	T2	)	
	16.196	V2	)	
	43.587	T3	)	
1.295 Km/s	4.257	Vo	)	
2.922 Km/s	9.587	V1	)	
5.351 Km/s	17.557	V2	)	
	26.422	i1	)	
	33.435	i2	)	
	1.225	-θ1	)	
	4.903	θ2	)	
	0.000		)	
17.46m	57.296	-D1	)	361.5W
61.72m	202.505	-D2	)	
	0.000		)	355W
20.77m	68.153	-D1	)	
42.81m	140.466	-D2	)	

LINE E

55.5W - 49W	2.739	Vo )	
	0.000	T1 )	55.5W
	17.499	V1 )	
	69.571	T2 )	
	2.702	Vo )	
	0.000	T1 )	49W
	15.518	V1 )	
	58.627	T2 )	
.829 Km/s	2.721	Vo	
5.032 Km/s	16.509	V1	
	9.522	i1	
	0.576	θ1	
	0.000	)	
29.25m	94.986	-D1 )	55.5W
	0.000	)	
24.65m	80.887	-D1 )	49W
144W - 137.5W	5.354	Vo )	
	4.108	T1 )	144W
	16.223	V1 )	
	73.786	T2 )	
	5.439	Vo )	
	2.714	T1 )	137.5W
	19.178	V1 )	
	87.428	T2 )	
1.645 Km/s	5.396	Vo	
5.395 Km/s	17.700	V1	
	17.886	i1	
	1.542	-θ1	
	0.000	)	
63.79m	209.294	-D1 )	144W
	0.000	)	
75.59m	247.988	-D1 )	137.5W

xxx.

LINE E (Continued)

181.5W - 175W	4.093	Vo	)	
	1.285	T1	)	
	21.512	V1	)	181.5W
	67.074	T2	)	
	4.444	Vo	)	
	0.000	T1	)	
	14.290	V1	)	175W
	46.216	T2	)	
1.301 Km/s	4.269	Vo		
5.456	17.901	V1		
	14.413	i1		
	2.968	θ1		
	0.000		)	
45.12m	148.021	-D1	)	181.5W
	0.000		)	
31.08m	101.992	-D1	)	175W
209.5W - 203W	3.398	Vo	)	
	1.285	T1	)	
	14.584	V1	)	209.5W
	74.053	T2	)	
	4.312	Vo	)	
	3.270	T1	)	
	19.535	V1	)	203W
	94.770	T2	)	
1.175 Km/s	3.855	Vo		
5.200 Km/s	17.060	V1		
	13.354	i1		
	1.972	-θ1		
	0.000		)	
44.74m	146.799	-D1	)	209.5W
	0.000		)	
57.26m	187.868	-D1	)	203W

A P P E N D I X      E.

FIELD STAFF

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SURVEYOR

K. Patterson

Appendix F  
Characteristics of GSC/110  
Digiphone

372

PRODUCT BULLETIN 797

**GSC-11D DIGIPHONE®  
SUBMINIATURE  
DIGITAL GRADE  
GEOPHONE**

**FEATURES**

**BASIC UNIT\***

- High output/weight ratio
- Hermetically sealed basic unit
- Dual, hum-bucking coil
- Shock-proof, rotating coil
- Maximum coil excursion without distortion or shorting
- Wide range of coil resistances and frequencies
- Easily replaceable in the field
- Three year guarantee on all models

\* Manufactured under U. S. Patent No. 3577184

**CASE AND ACCESSORIES**

- High-impact polycarbonate (Lexan) construction
- Basic unit insulated from ground, no leakage to case
- Patented KNOT-ANCHORED TAKEOUT\*\* with radiused cable entry to reduce fatigue
- Large selection of land and marsh cases
- Large selection of spikes and bases, easily interchangeable to meet all requirements

\*\* Manufactured under U. S. Patent No. 3119978

DESIGNED, MANUFACTURED AND  
SERVICED WORLD-WIDE BY . . .

**GEO SPACE**

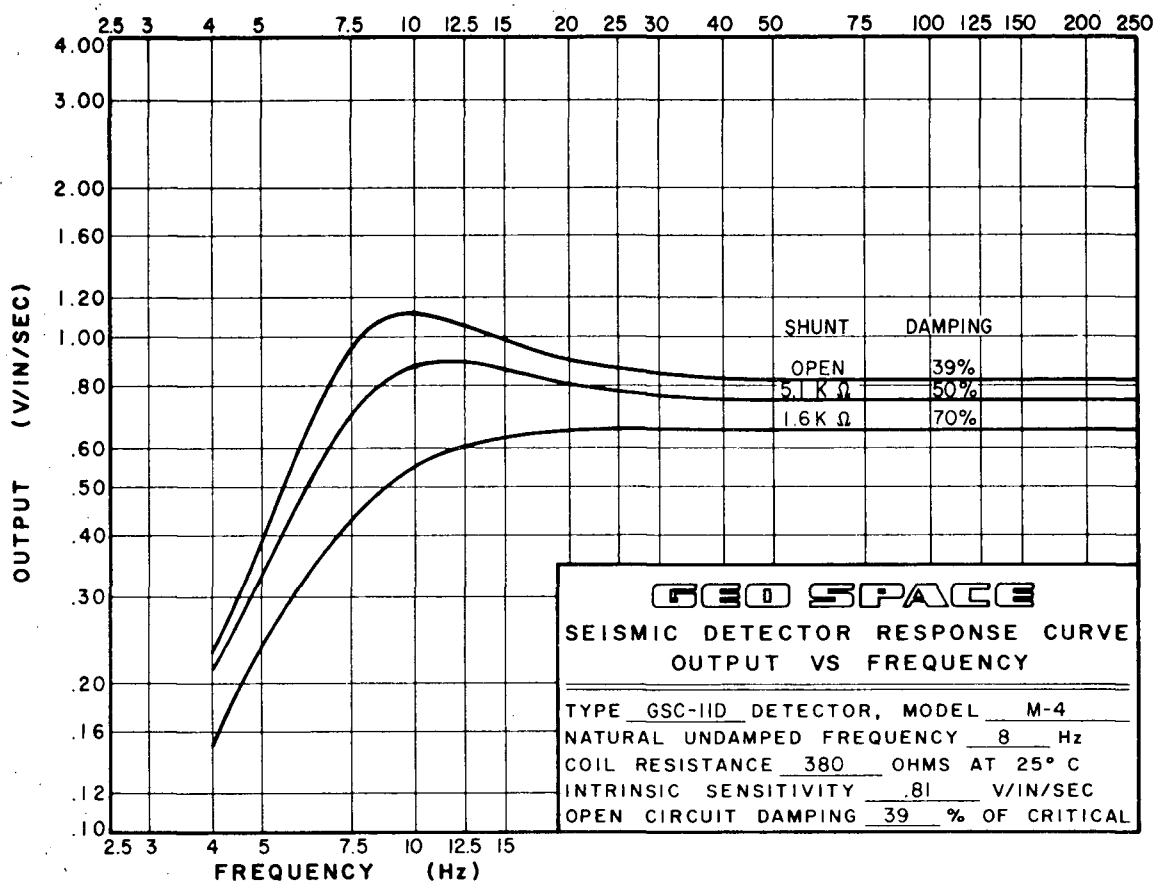


® REGISTERED TRADEMARK OF GEO SPACE CORPORATION

PC-21-SR LAND CASE  
WITH S-10 SPIKE  
PART NO. 52417

PC-25 MARSH CASE  
WITH S-10 SPIKE  
PART NO. 52376



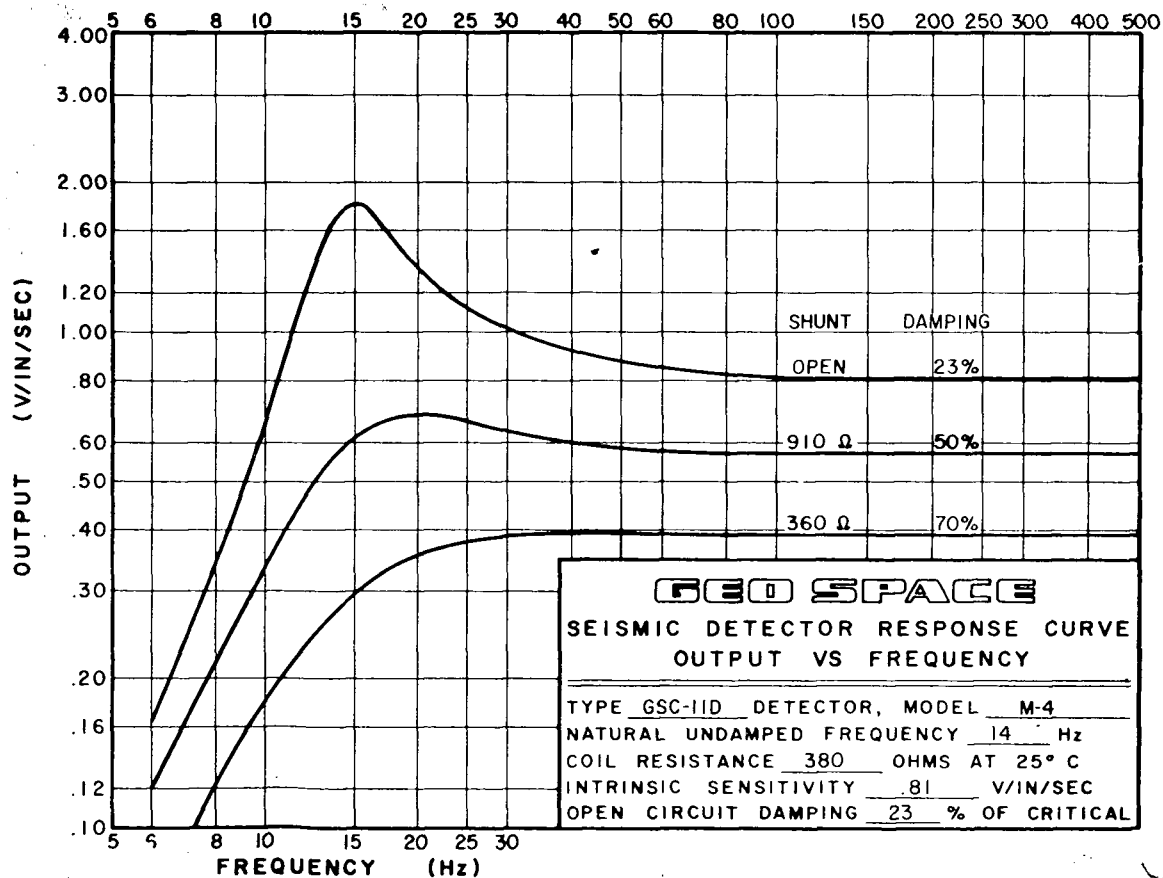
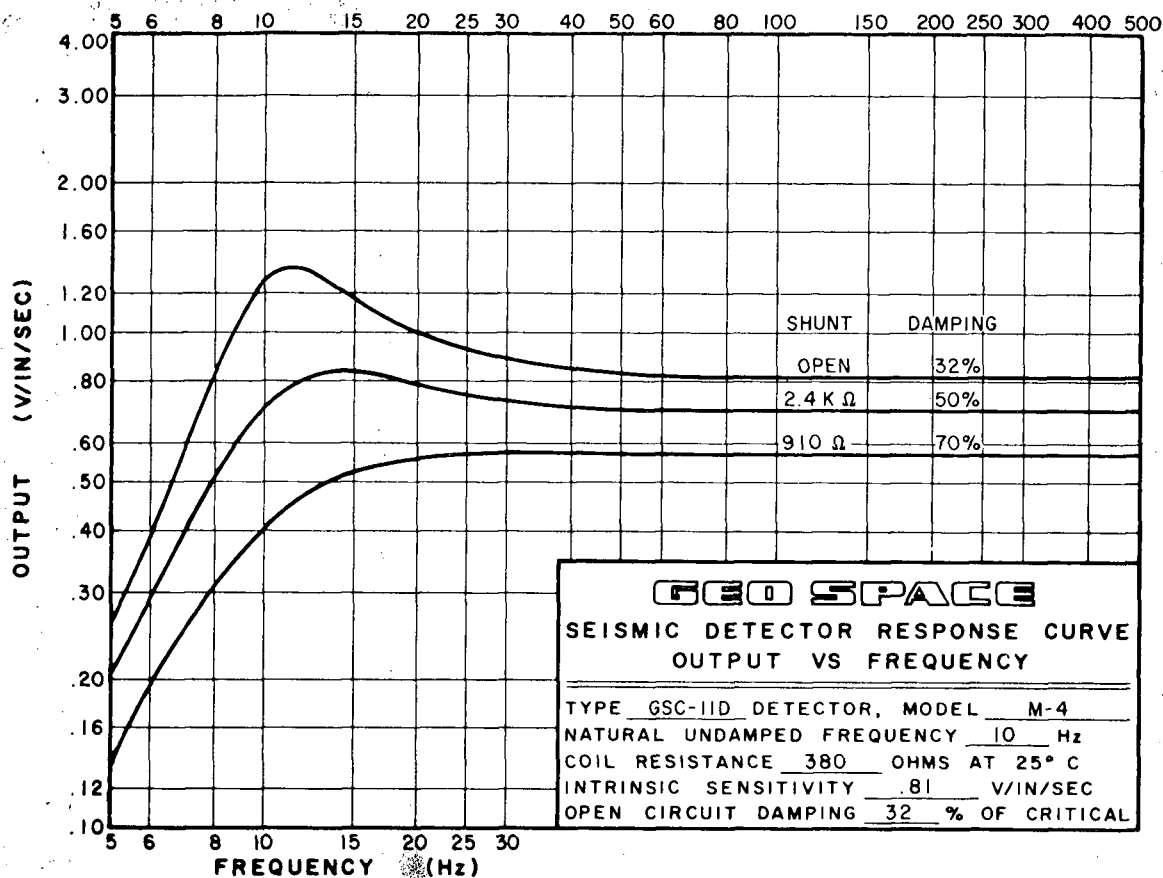


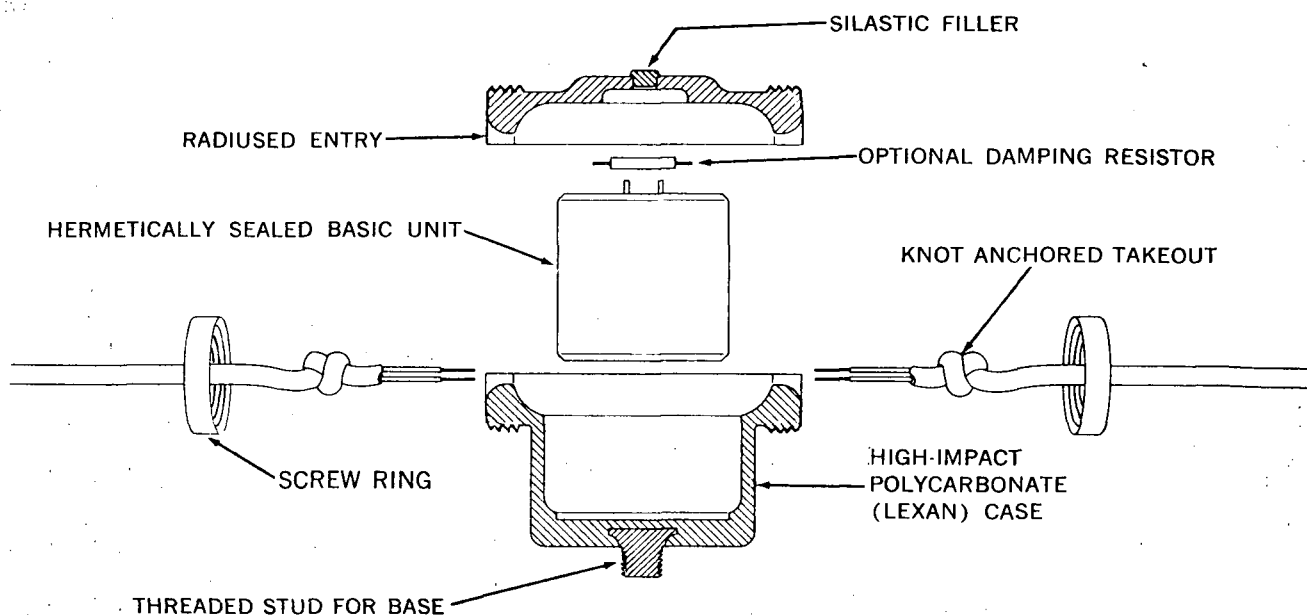
## GSC-11D SPECIFICATIONS

Natural frequency:	8.0 Hz, 10.0 Hz and 14.0 Hz $\pm$ 0.5 Hz or 5%		
Standard coil resistance @ 25°C:	380 $\Omega$ $\pm$ 5%		
Optional coil resistances:	56 $\Omega$ , 160 $\Omega$ , and 870 $\Omega$ $\pm$ 5%		
Total moving mass:	.568 oz (16.1 g)		
Intrinsic voltage sensitivity			
with 380 ohm coil:	0.81 V/in/s (0.32 V/cm/s)		
Intrinsic power sensitivity:	1.74 mW/in/s (.69 mW/cm/s)		
Voltage/weight ratio:	.208 V/in/s/oz (.0029 V/cm/s/g) @ 395 $\Omega$		
Power/weight ratio:	.45 mW/in/s/oz (.0062 mW/cm/s/g)		
Normalized transduction constant:	.042 $\sqrt{R_c}$		
Harmonic distortion:	0.2% or less with driving velocity of 0.7 in/s (1.8 cm/s) peak to peak		
Maximum coil excursion:	0.10 in (.25 cm) peak to peak		
Damping constant with 380 ohm coil:	632 (8 Hz), 506 (10 Hz) and 361 (14 Hz)		

Dimensions	Basic Unit	With PC-21 Case	With PC-25 Case
Height:	1.32 in (3.36 cm)	2.06 in (5.23 cm)	4.75 in (12.07 cm)
Diameter:	1.25 in (3.18 cm)	1.50 in (3.82 cm)	1.75 in (4.45 cm)
Weight:	3.9 oz (111.0 g)	5.1 oz (145.0 g)	6.82 oz (193.3 g)

# FREQUENCY RESPONSE CURVES - 374

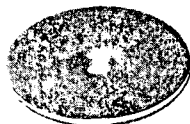


**WARRANTY**

Two (2) years on prorated basis.  
External voltage and highline damage  
not including in the warranty.

**GSC-11D ACCESSORIES**

PART NO. 51471  
1 1/2"  
FLAT BASE  
F-1



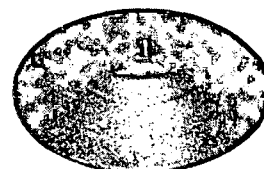
PART NO. 51749  
2" FLAT BASE  
F-4



PART NO. 51508  
1 1/2" TRIPOD  
T-1



PART NO. 51757  
3" TRIPOD  
T-2



PART NO. 51886  
3" CONICAL BASE  
T-3



PART NO. 51399  
1 1/2" TUBULAR  
SPIKE  
S-1



PART NO. 51919  
2" EXTENSION



PART NO. 51676  
2" PIN SPIKE  
S-6



PART NO. 51527  
3 1/2" TUBULAR  
SPIKE  
S-8



PART NO. 51999  
3" SPIKE  
S-10



PART NO. 52079  
2" SPIKE  
S-11

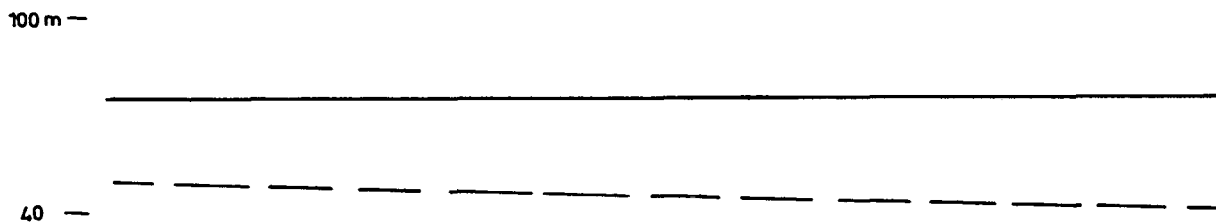
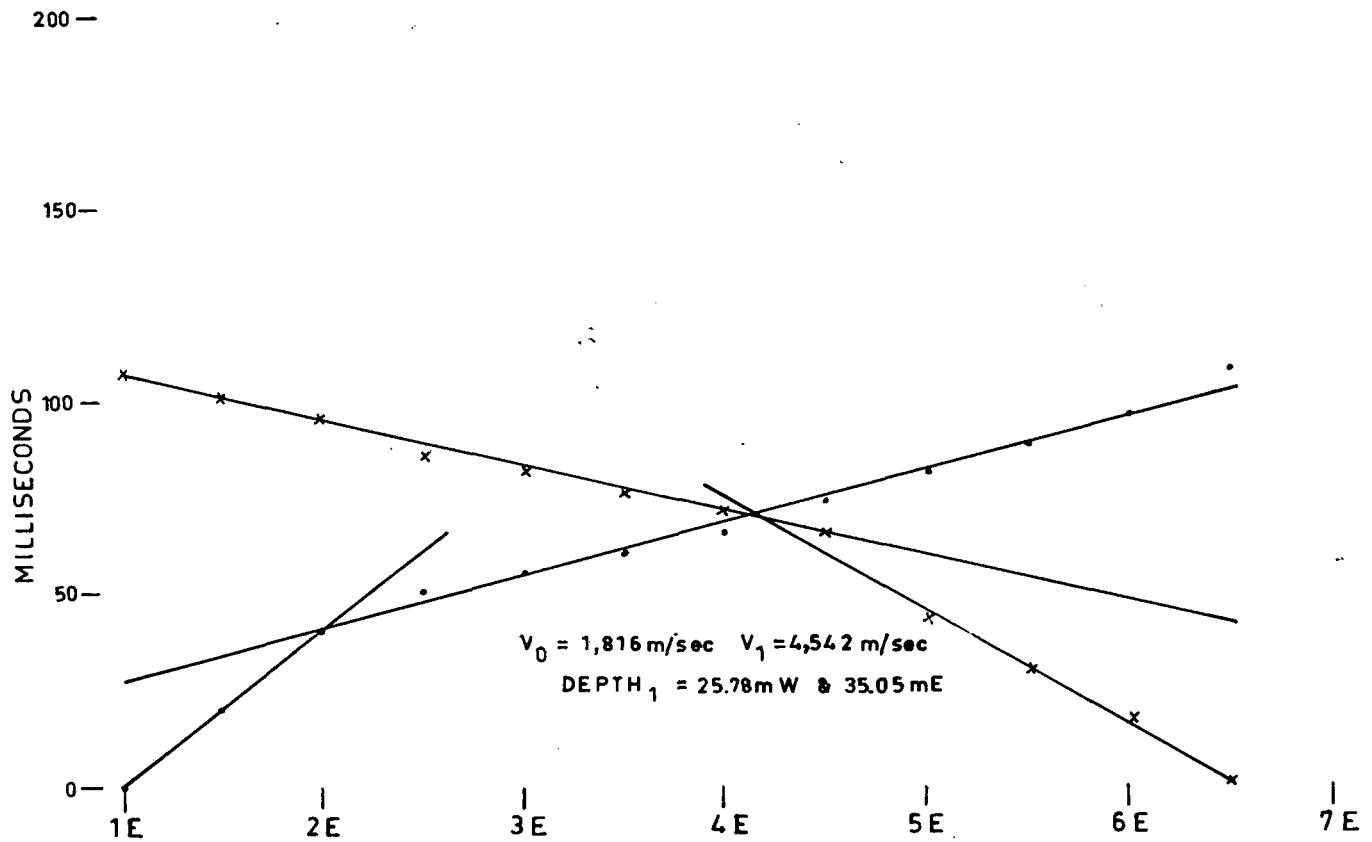


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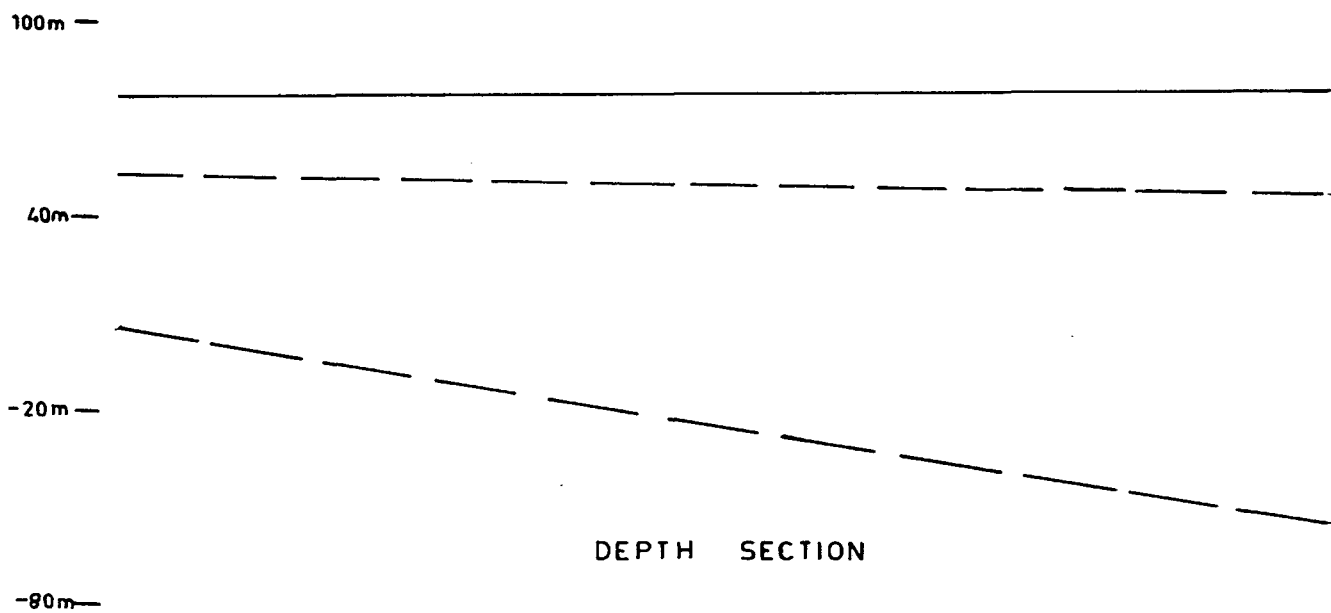
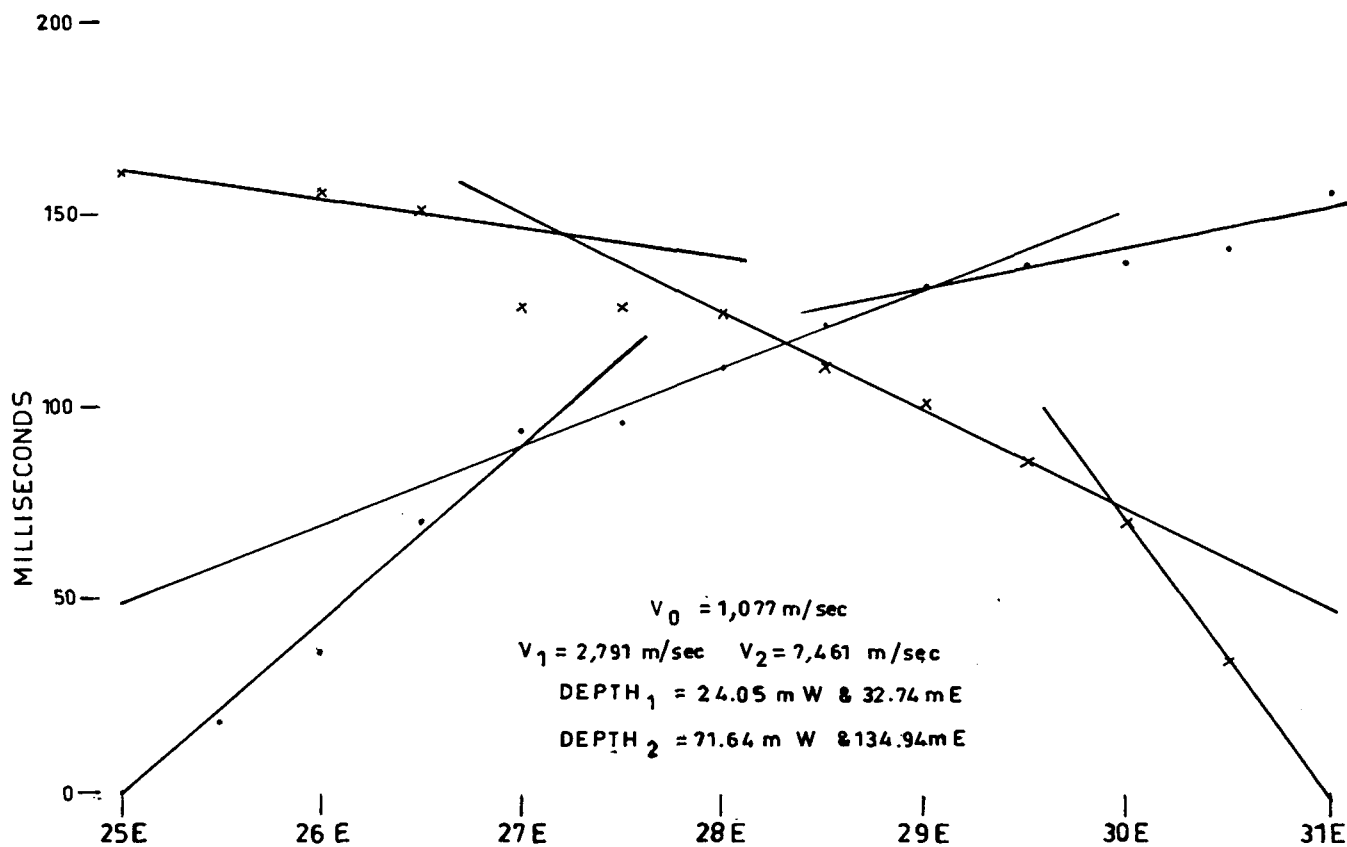
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376

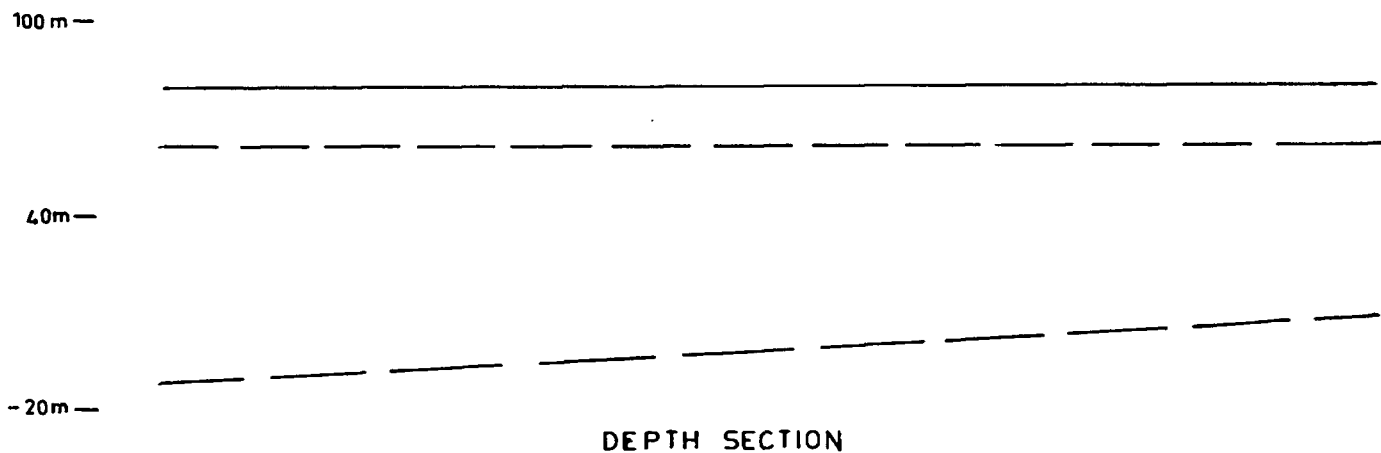
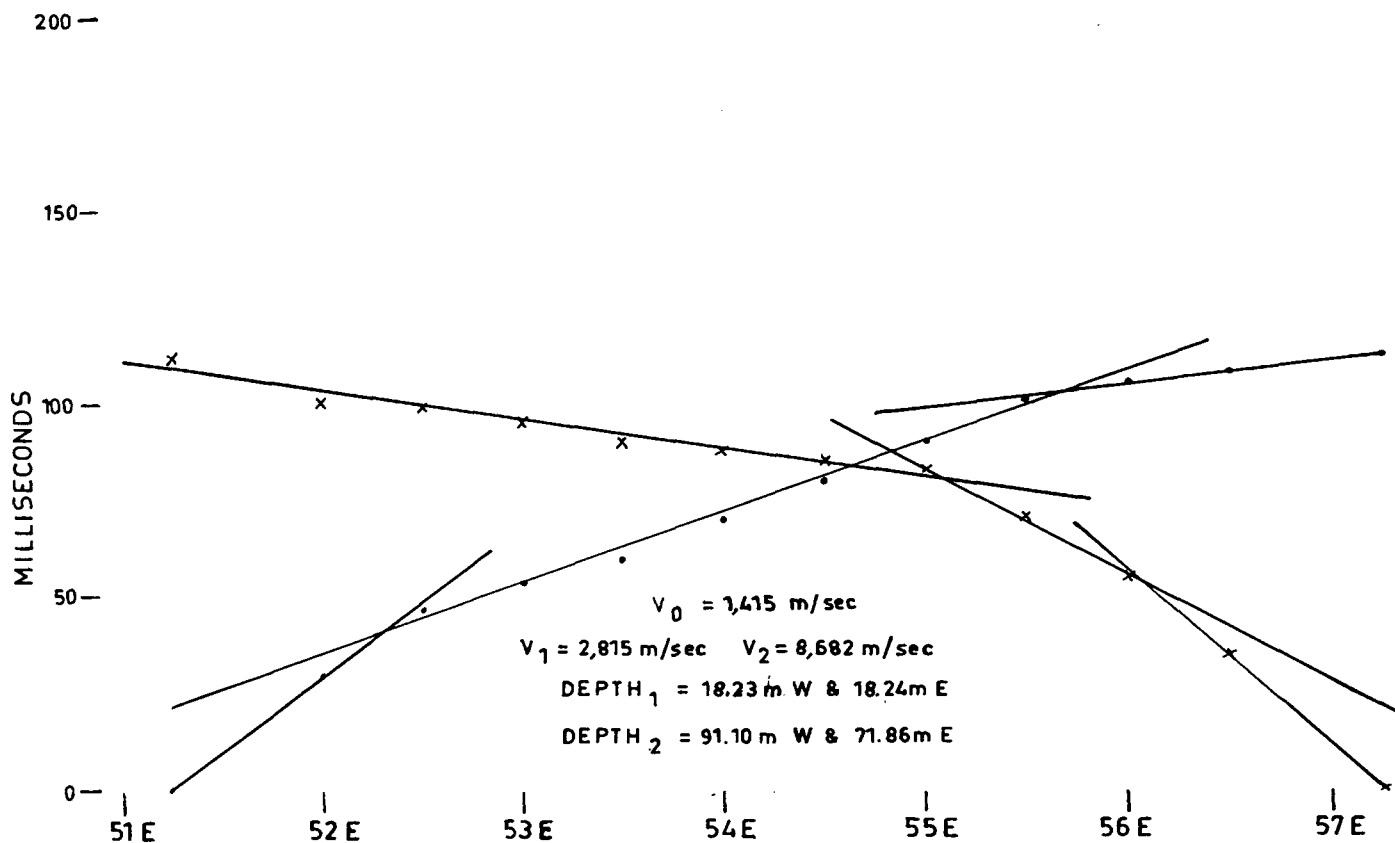


DEPTH SECTION

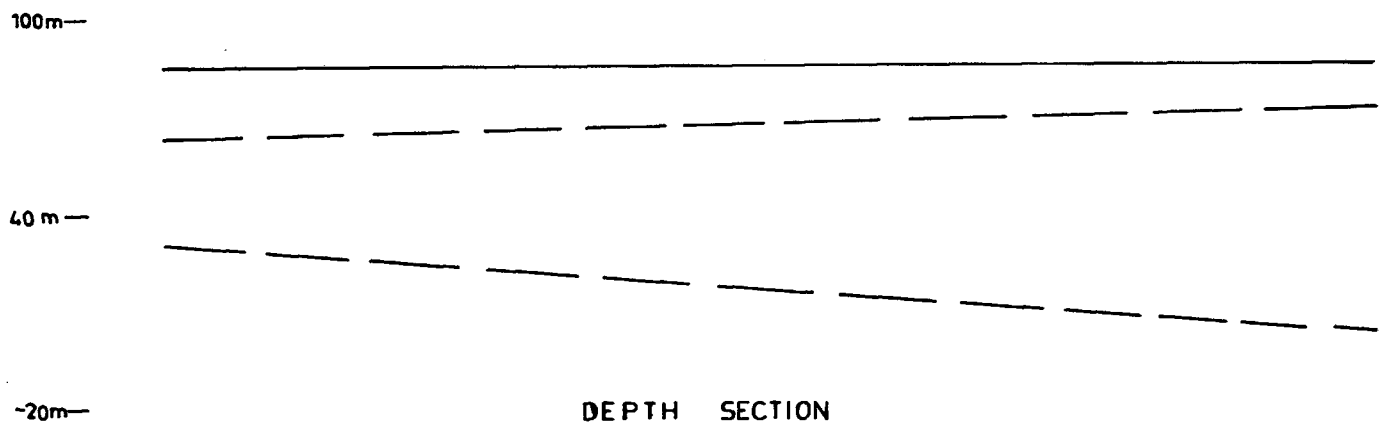
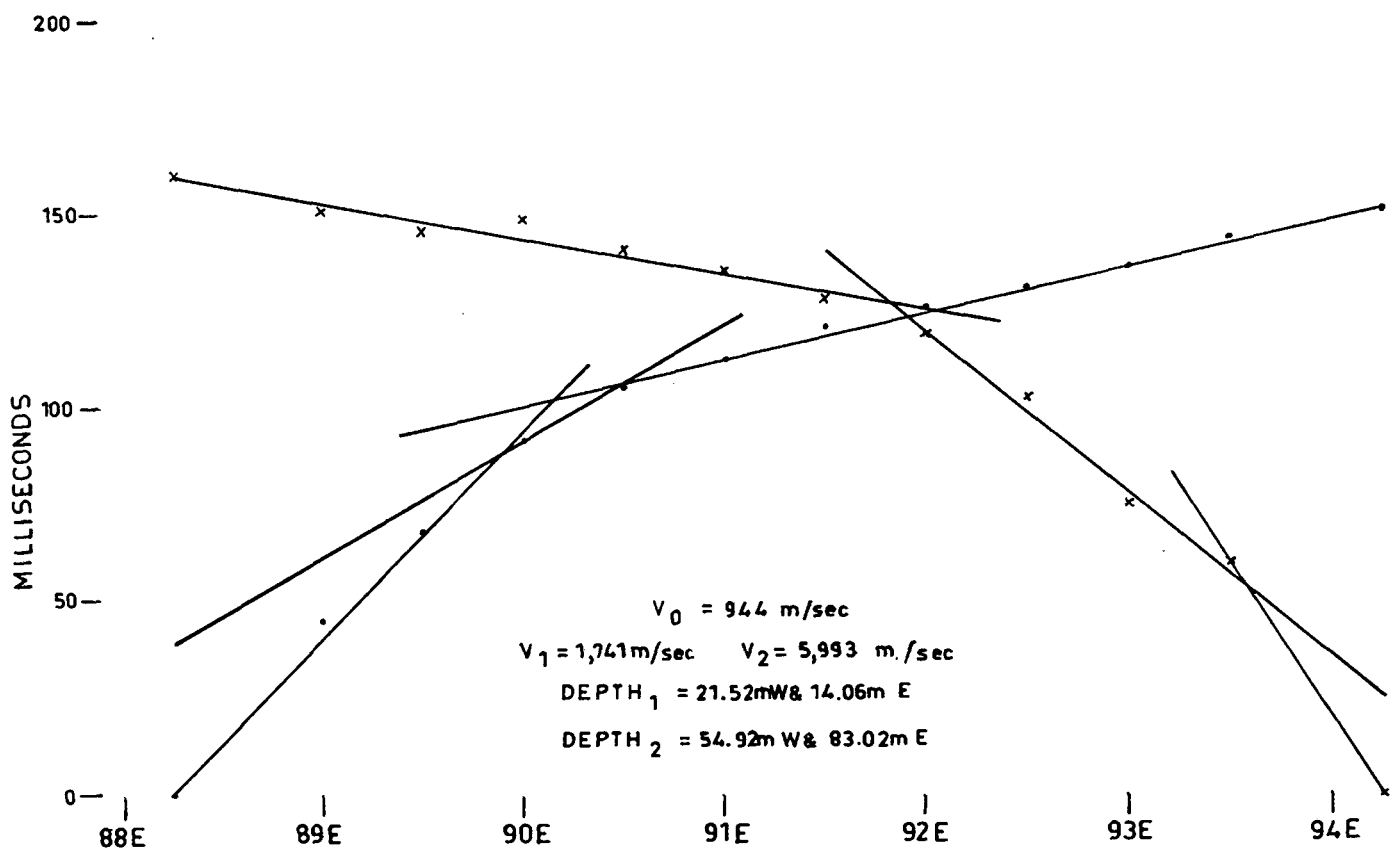
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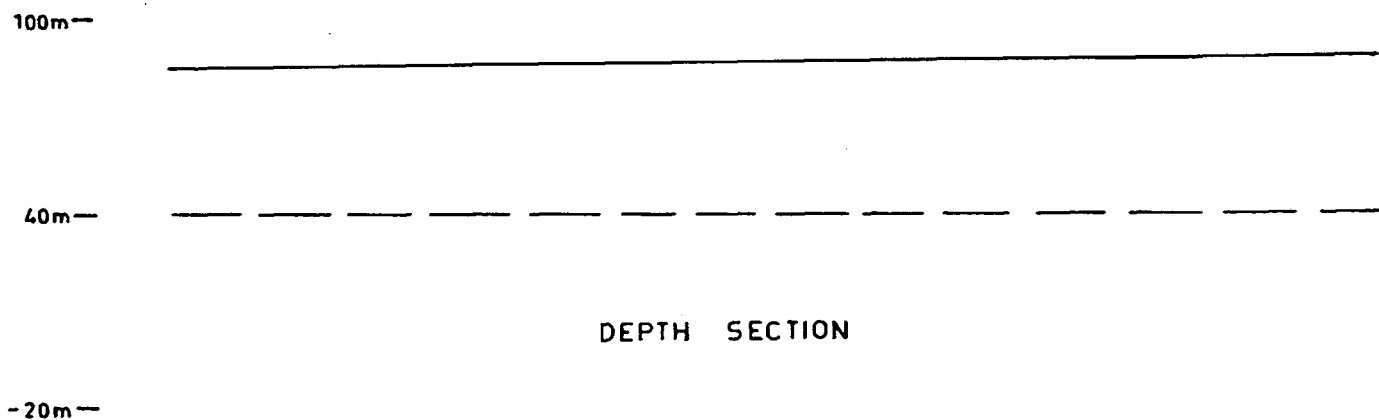
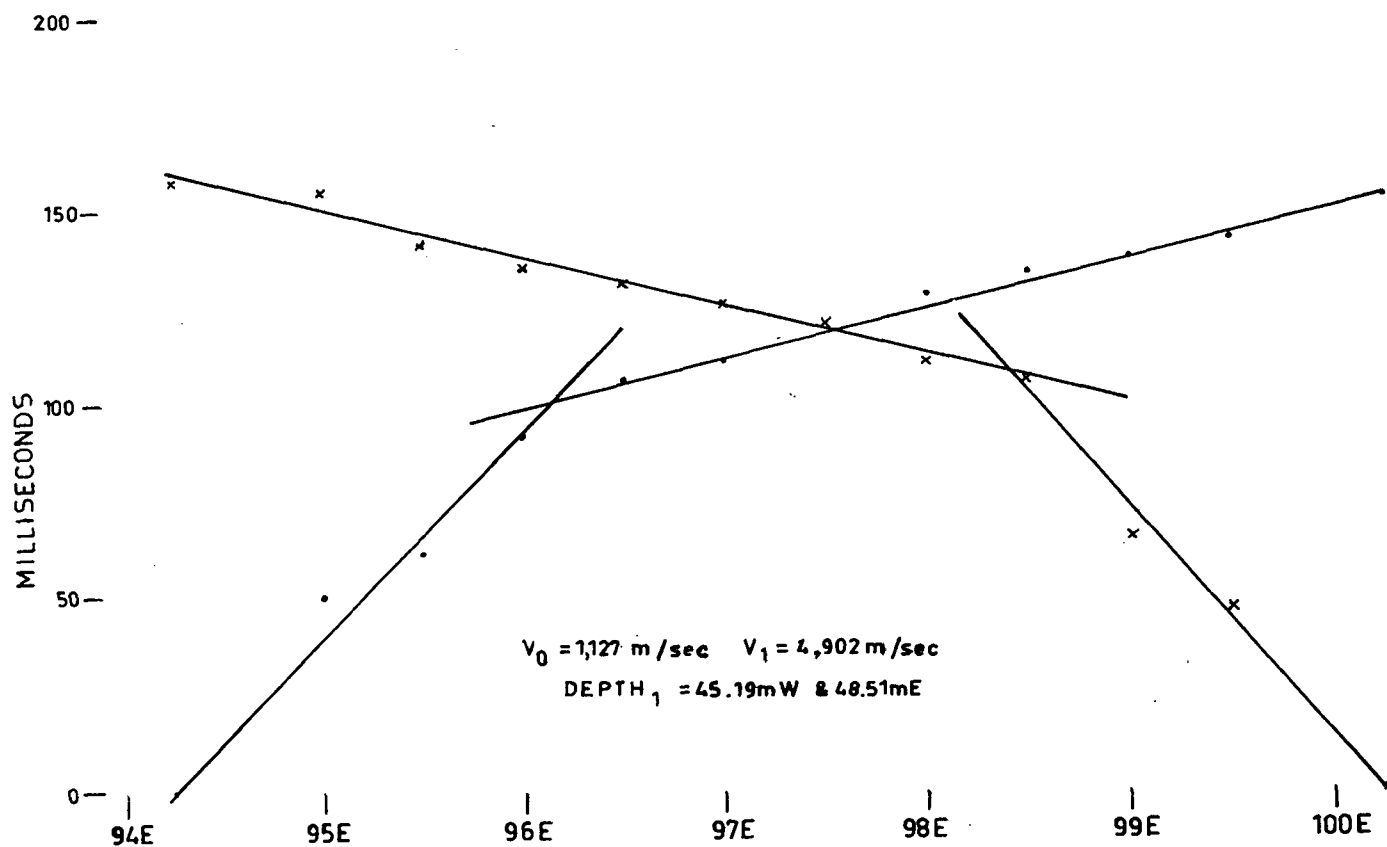
# TEST TRAVERSE 378



# TEST TRAVERSE 379

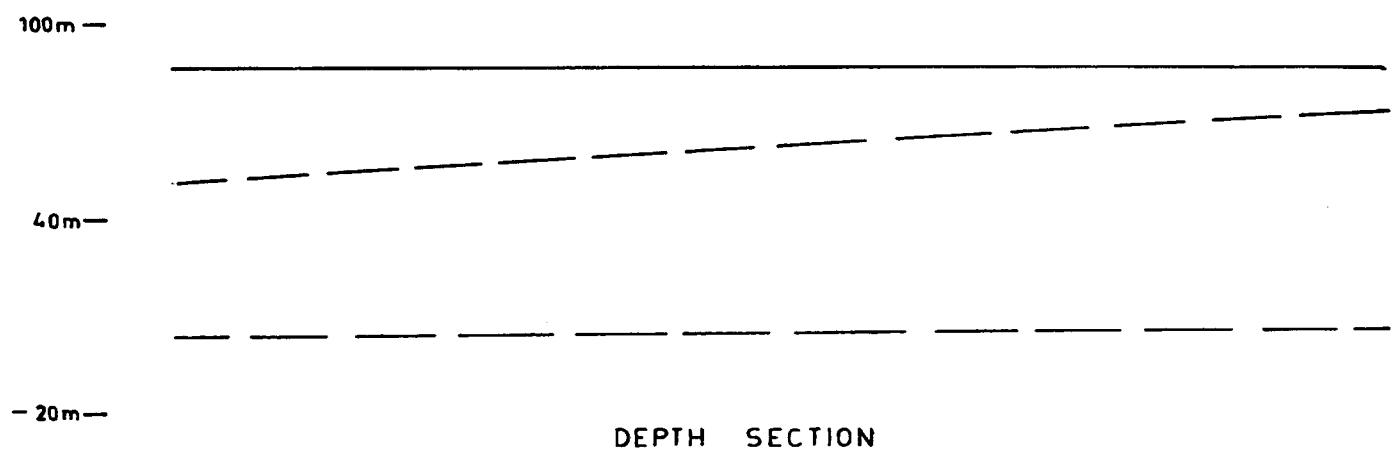
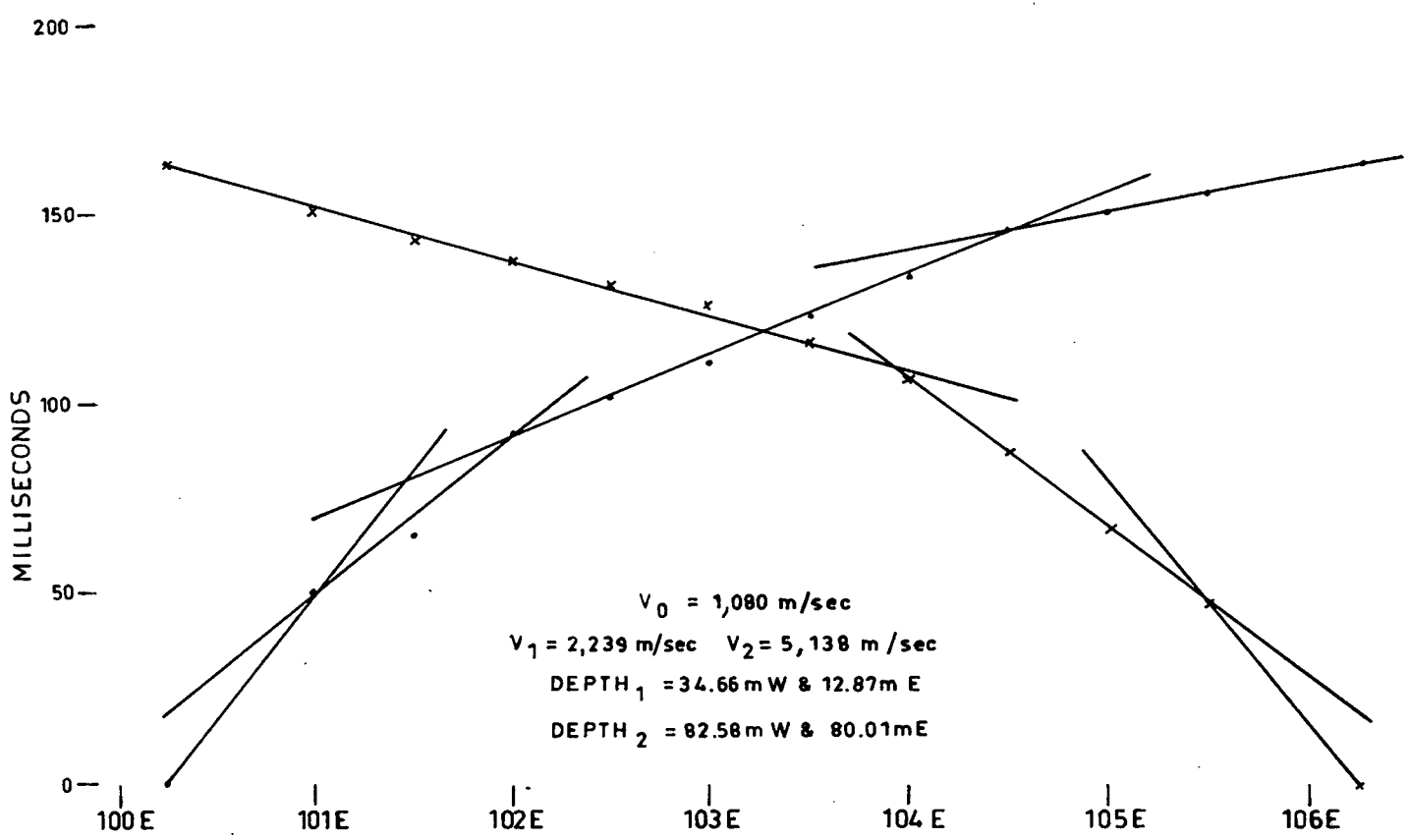


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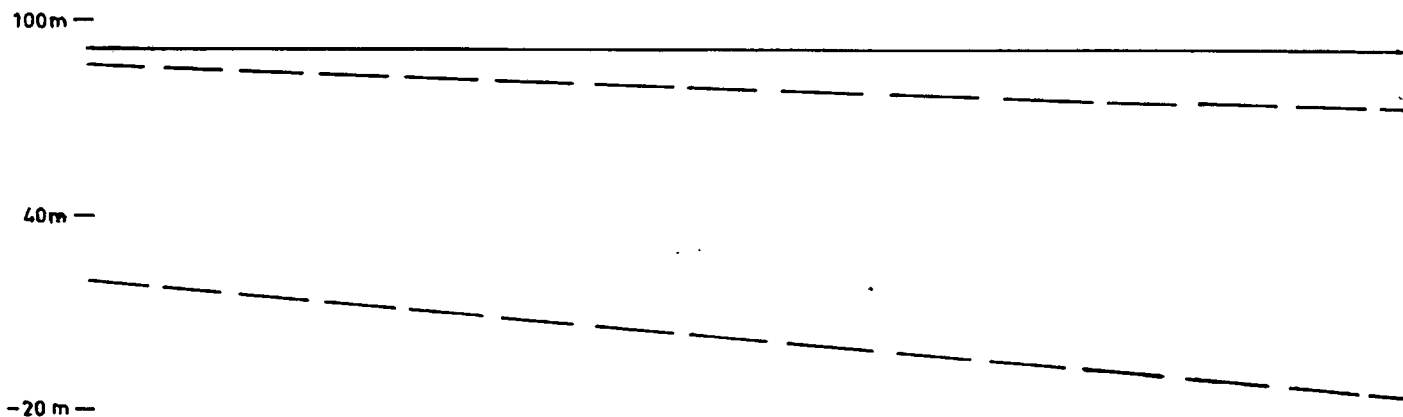
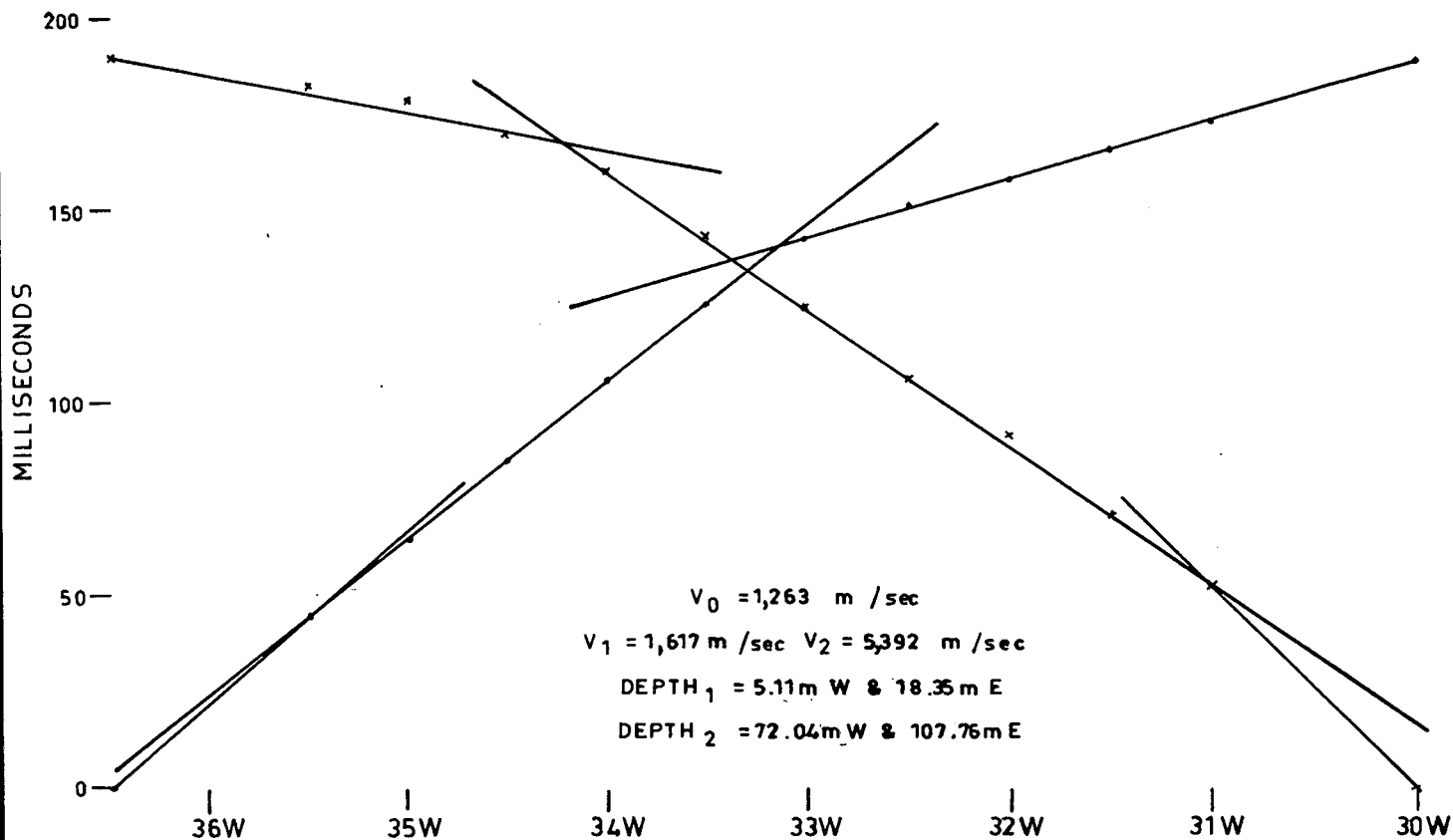




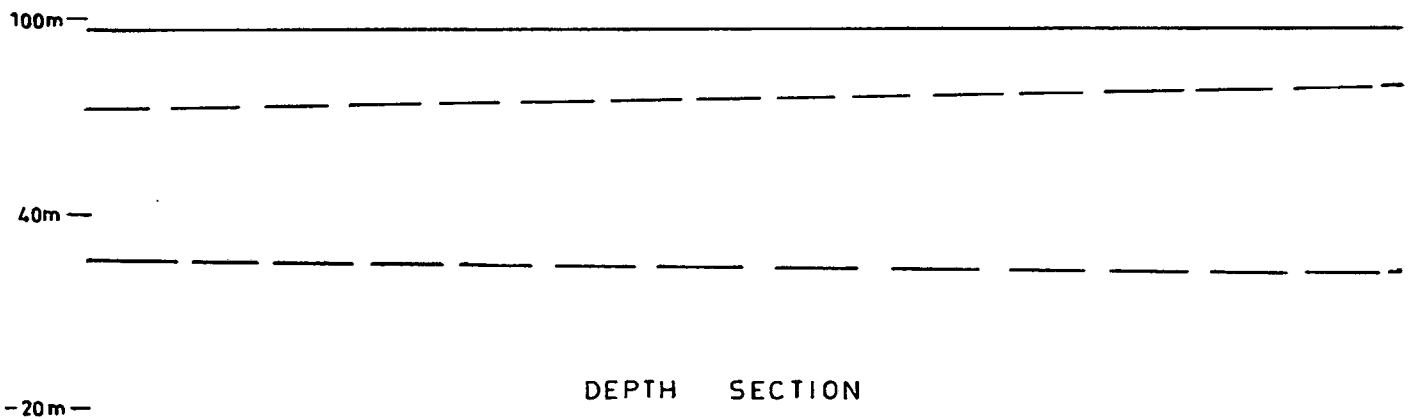
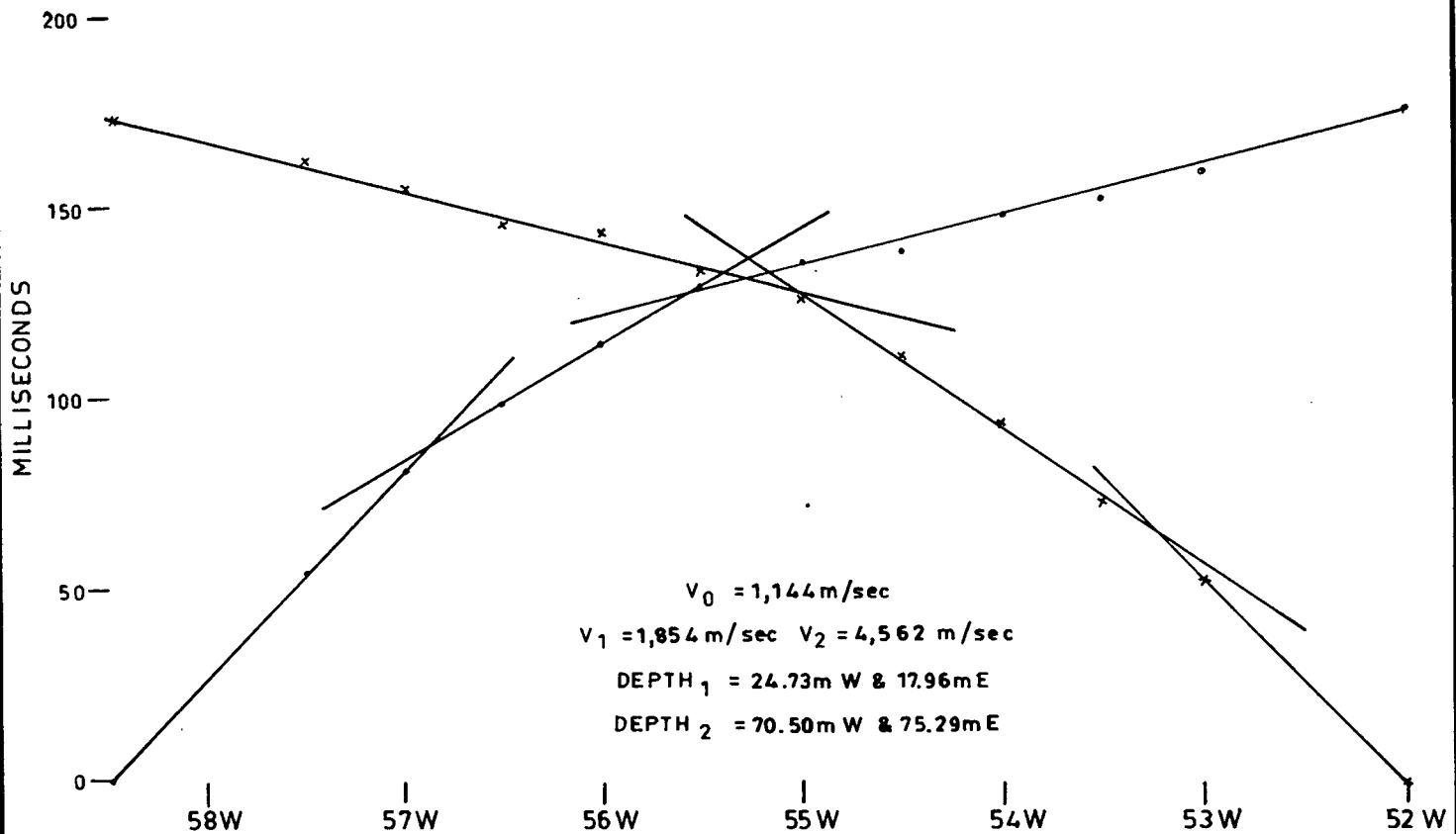
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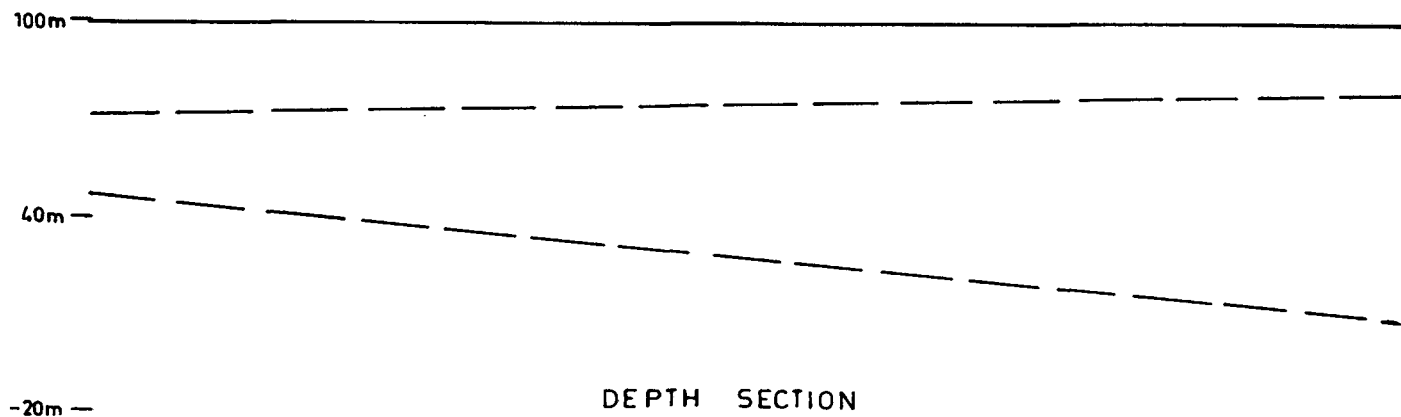
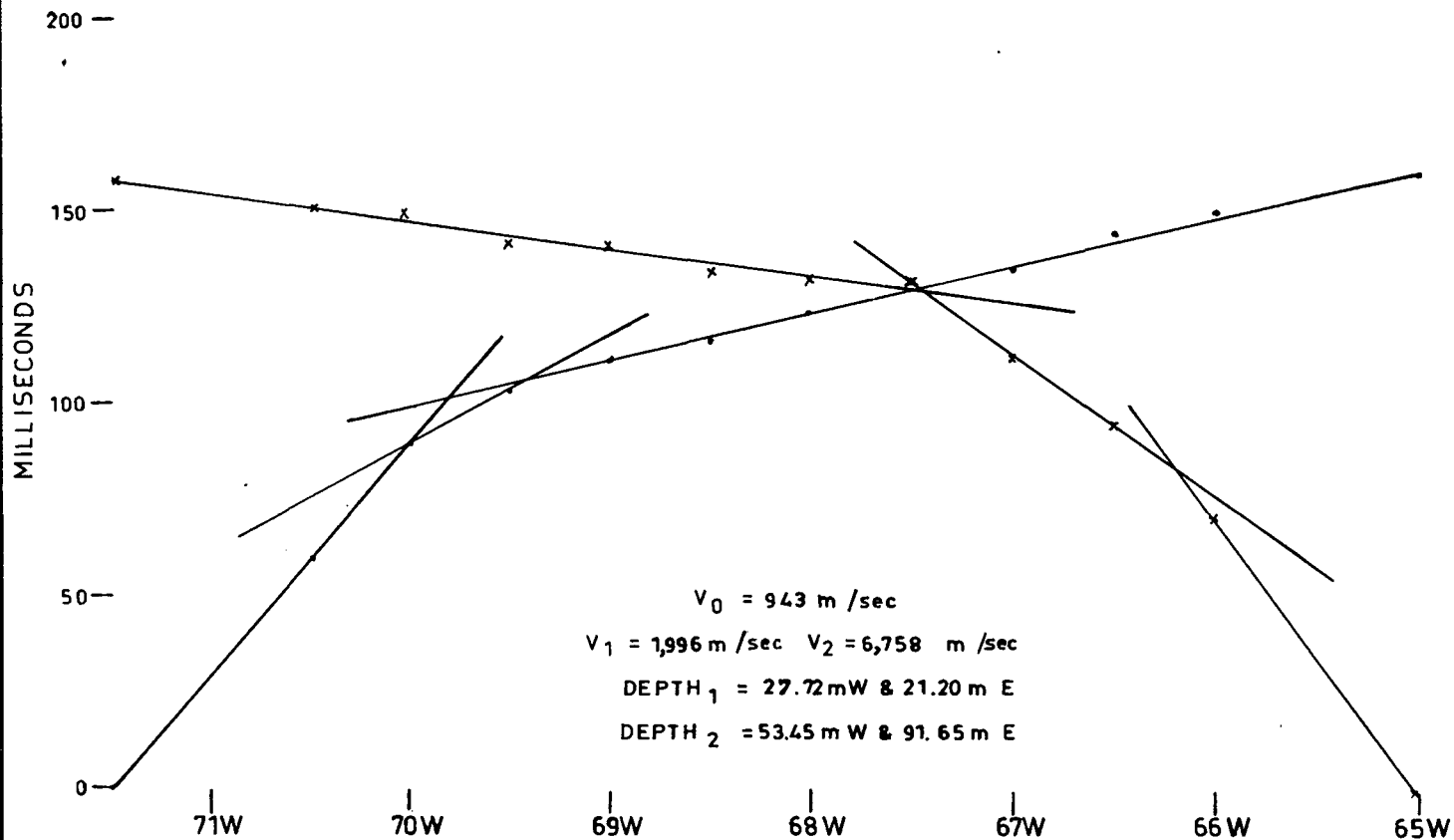
# LINE A 382



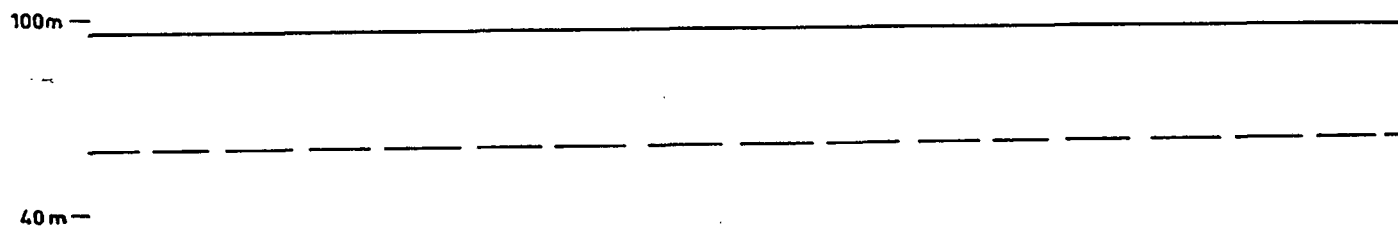
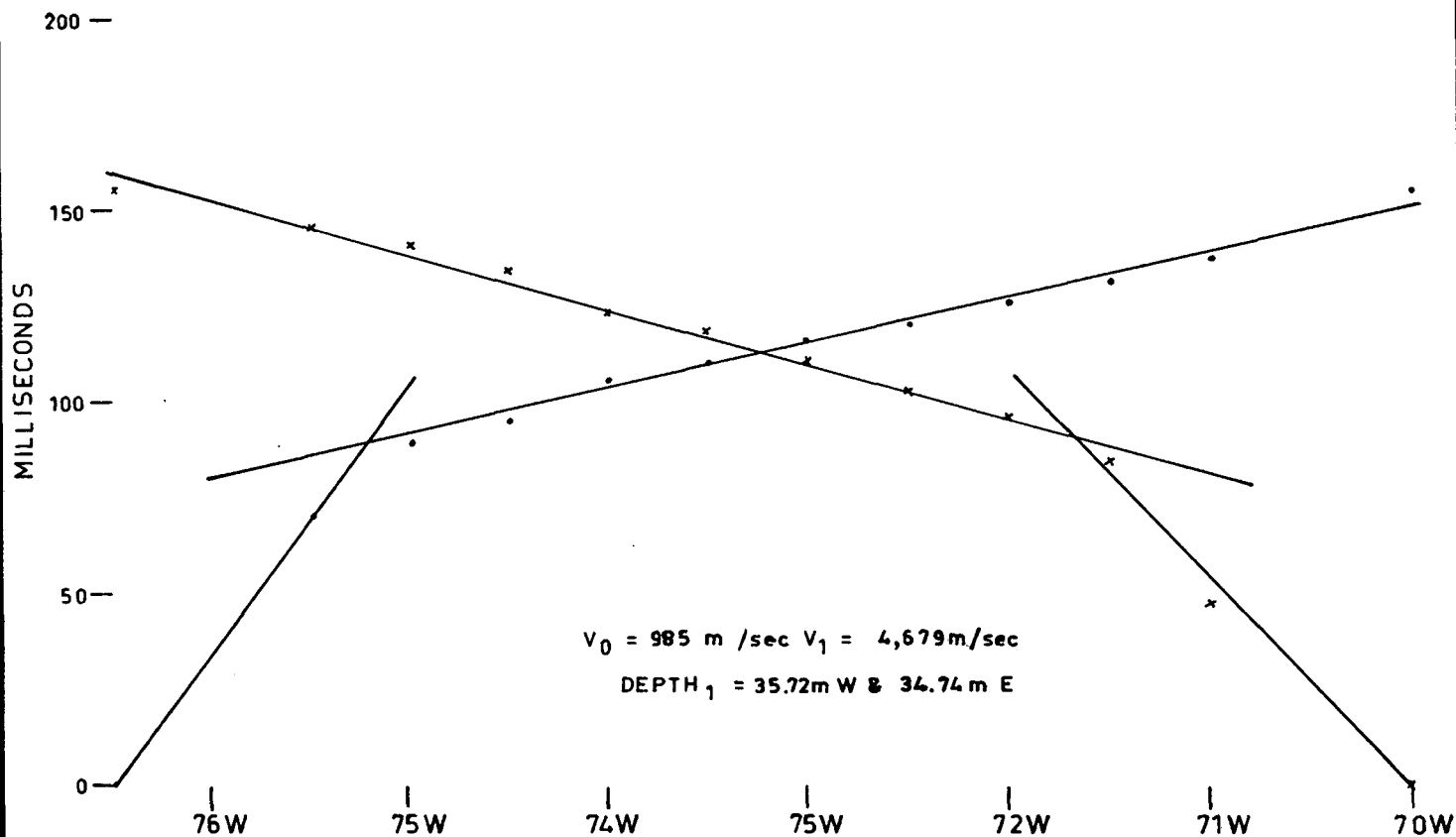
DEPTH SECTION



# LINE A-384

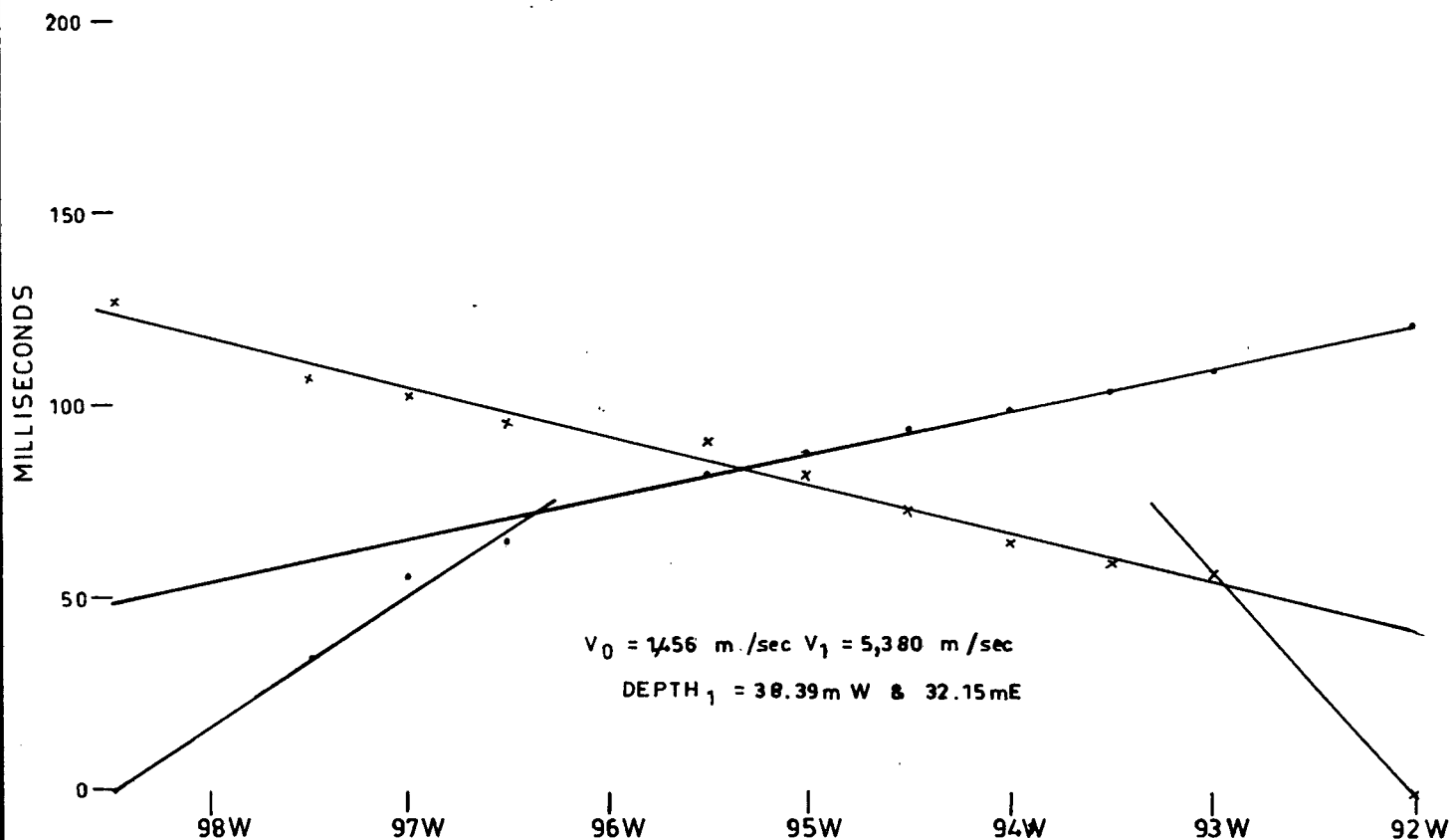


# LINE A--385



DEPTH SECTION

# LINE A - 386

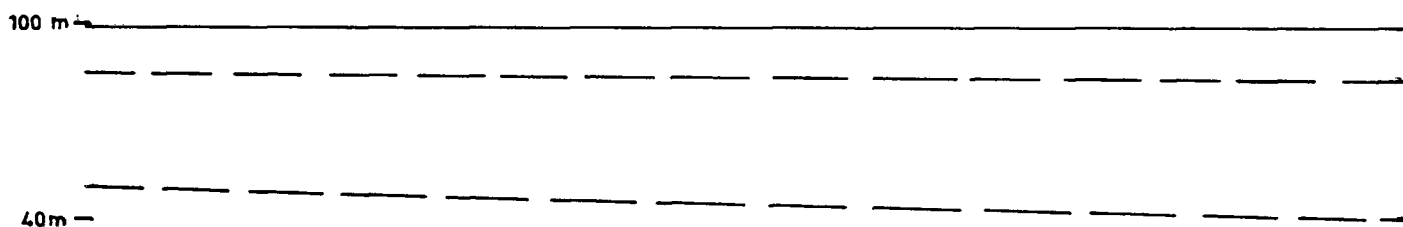
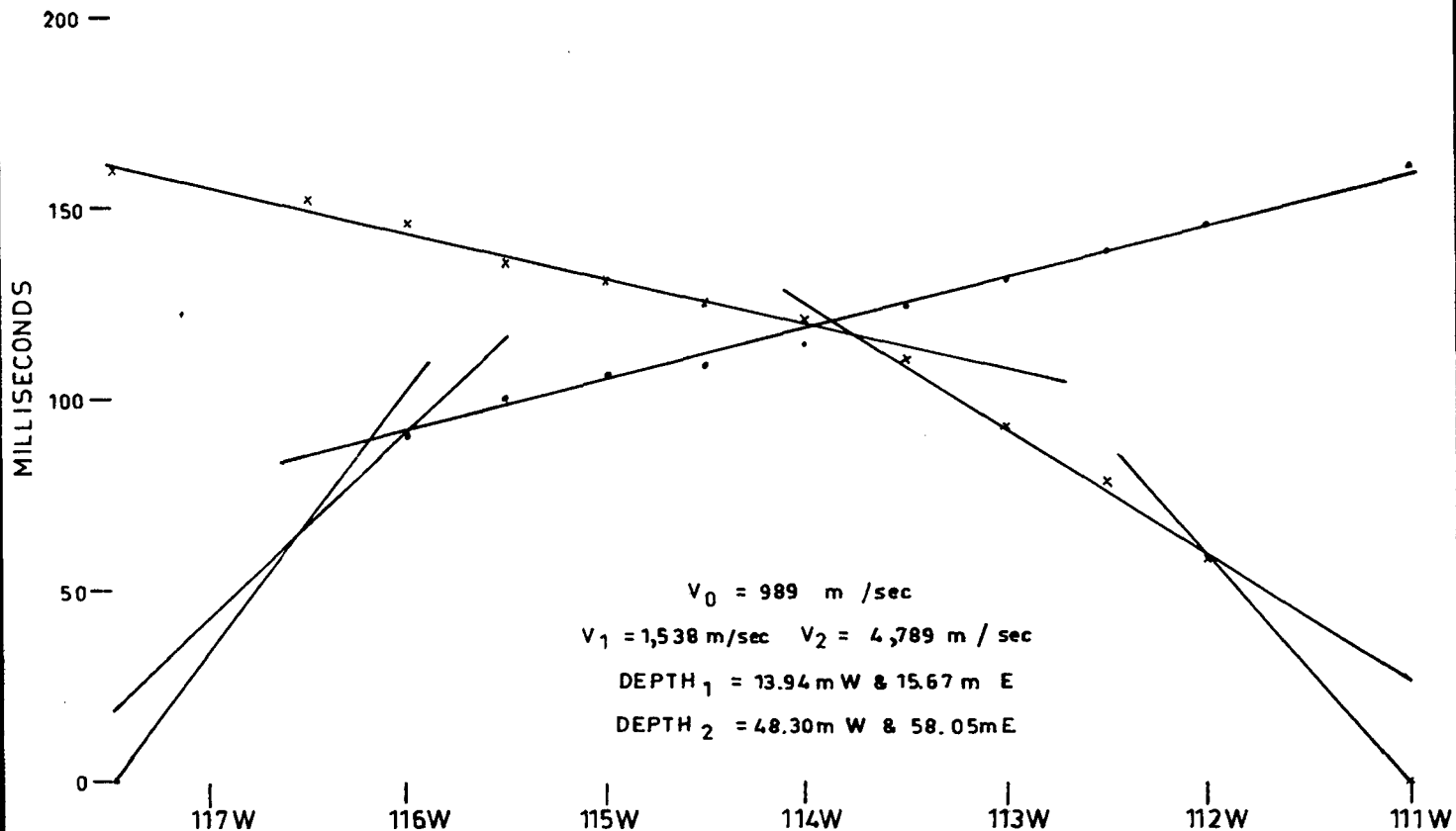


100m —

40m —

DEPTH SECTION

# LINE A -- 387



DEPTH SECTION

350—

LINE B 388

300 —

250—

200 —

MILLISECONDS

100 —

50 —

0 —

21W

20W

19W

18W

17W

16W

15W

 $V_0 = 888 \text{ m./sec}$  $V_1 = 1,957 \text{ " "}$  $V_2 = 6,862 \text{ " "}$ DEPTH<sub>1</sub> = 12.23 m W & 20.05 m EDEPTH<sub>2</sub> = 131.50 m W & 36.47 m E

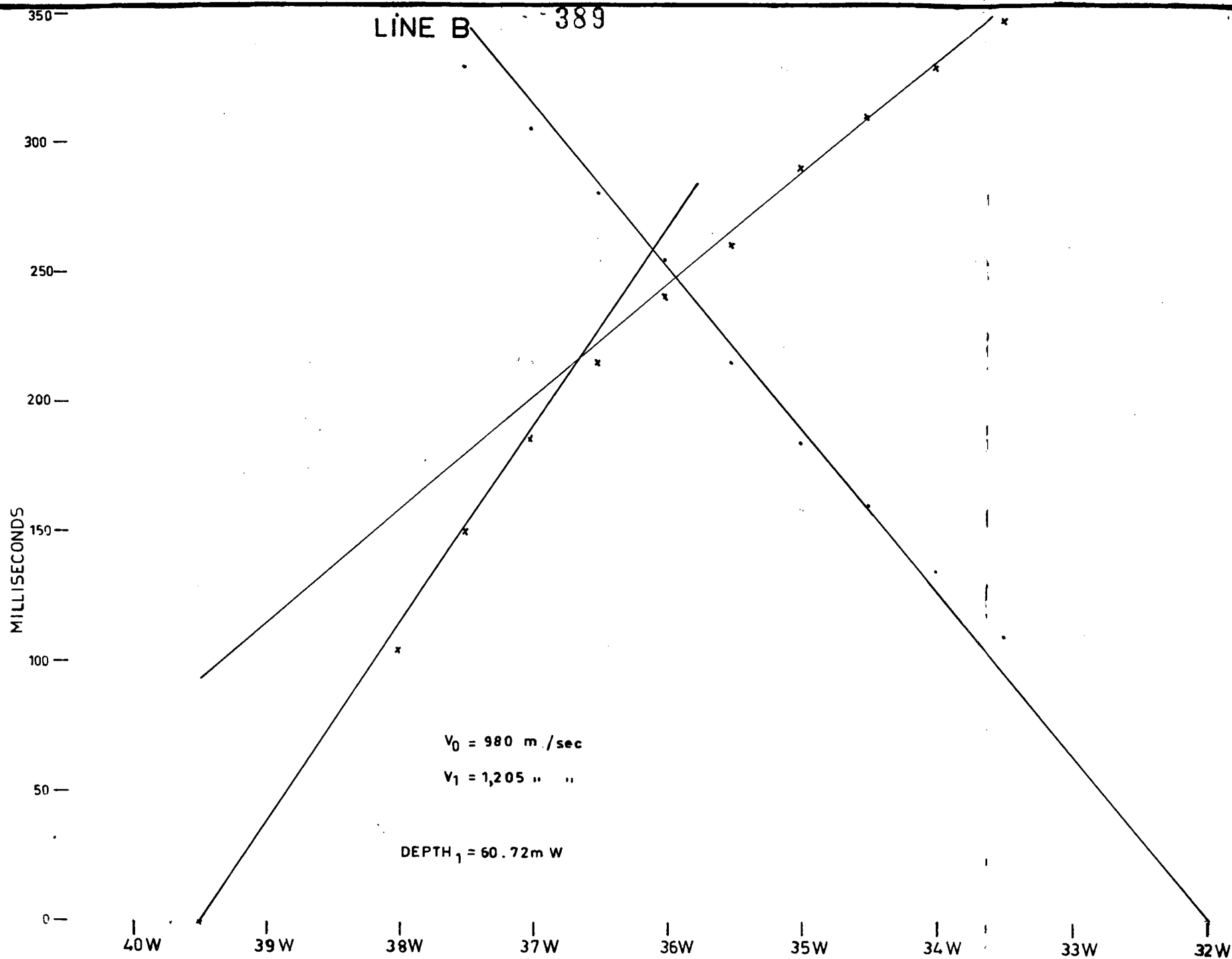
100m—

40m—

-20m—

DEPTH SECTION





40m

40m

# LINE B -- 390

MILLISECONDS

350 —  
300 —  
250 —  
200 —  
150 —  
100 —  
50 —  
0 —

54W

53W

52W

51W

50W

49W

48W

$V_0 = 762 \text{ m./sec}$

$V_1 = 1,077 \text{ " "}$

$V_2 = 2,438 \text{ " "}$

$\text{DEPTH}_1 = 12.44 \text{ m E}$

$\text{DEPTH}_2 = 109.48 \text{ m E}$

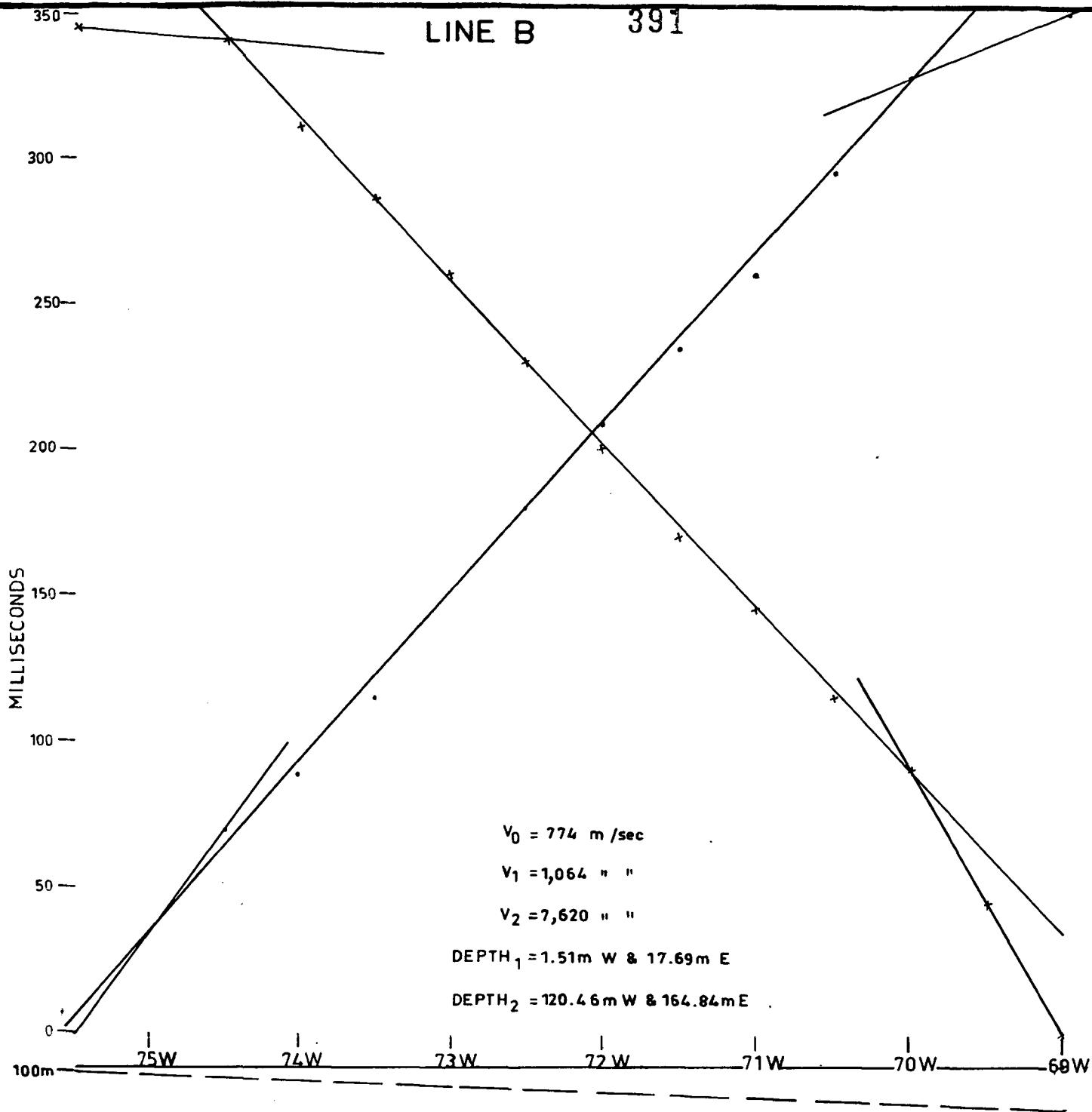
100m—

40m—

DEPTH SECTION

LINE B

391



DEPTH SECTION

350—

## LINE B 392

300 —

250—

200 —

MILLISECONDS

150 —

100 —

50 —

0

$$V_0 = 1,061 \text{ m / sec}$$

$$V_1 = 1,713 \text{ " "}$$

$$V_2 = 12,012 \text{ " "}$$

$$\text{DEPTH}_1 = 18.75 \text{ m W \& 18.75 m E}$$

$$\text{DEPTH}_2 = 124.04 \text{ m W \& 157.56 m E}$$

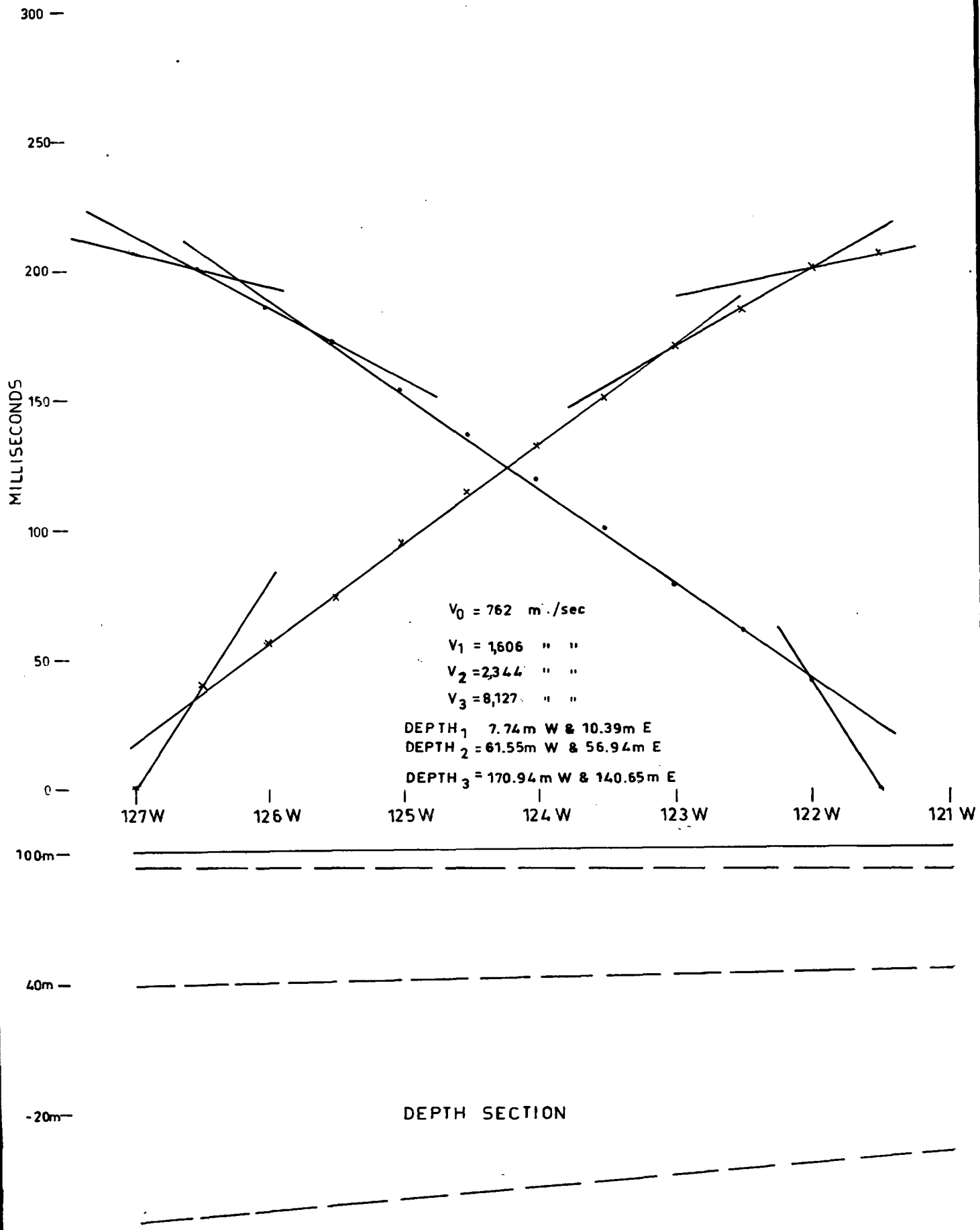
100 m — 127W 126W 125W 124 W 123 W 122 W 121 W

40 m —

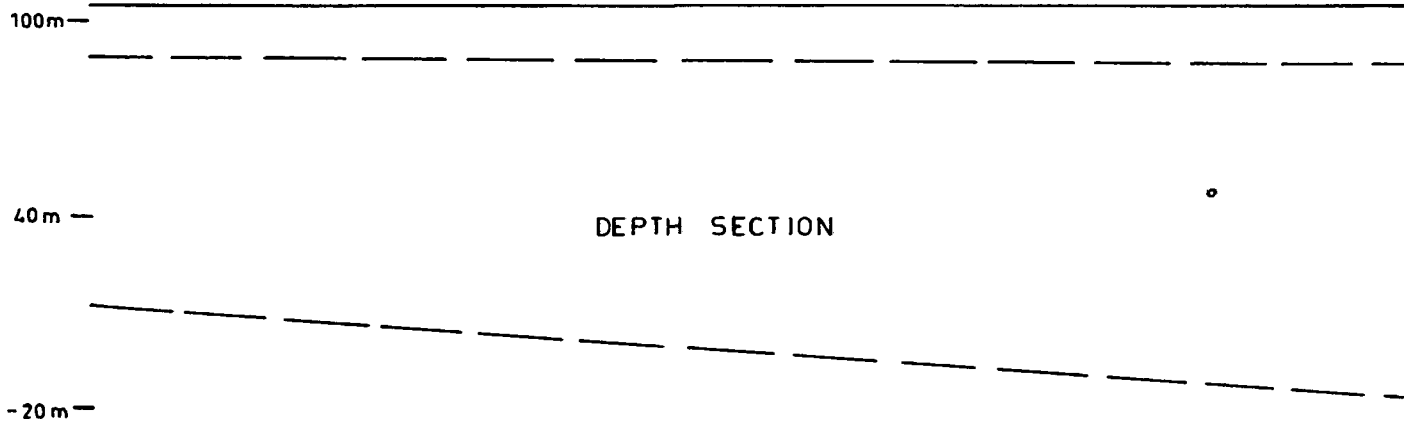
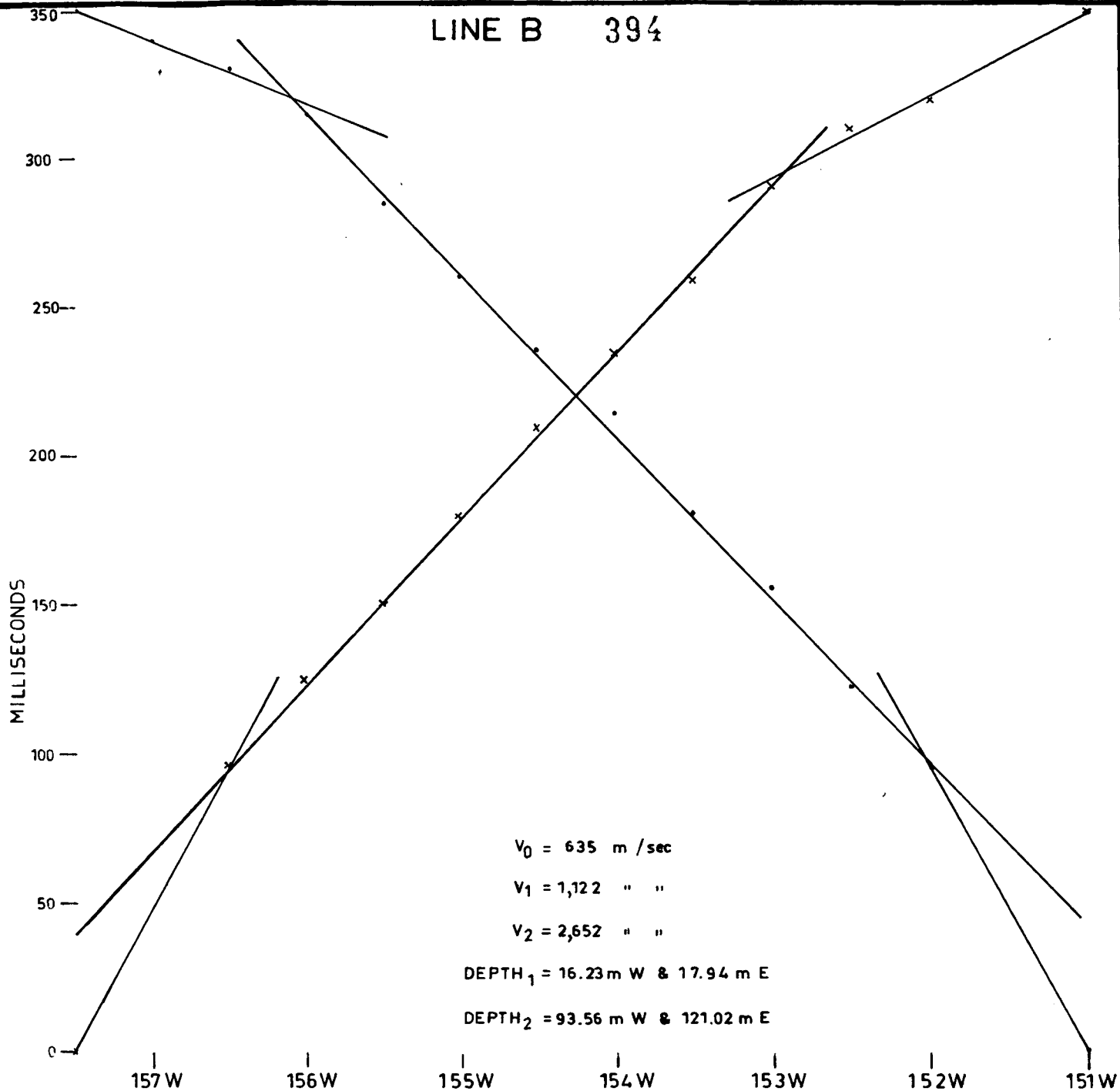
DEPTH SECTION

-20 m —

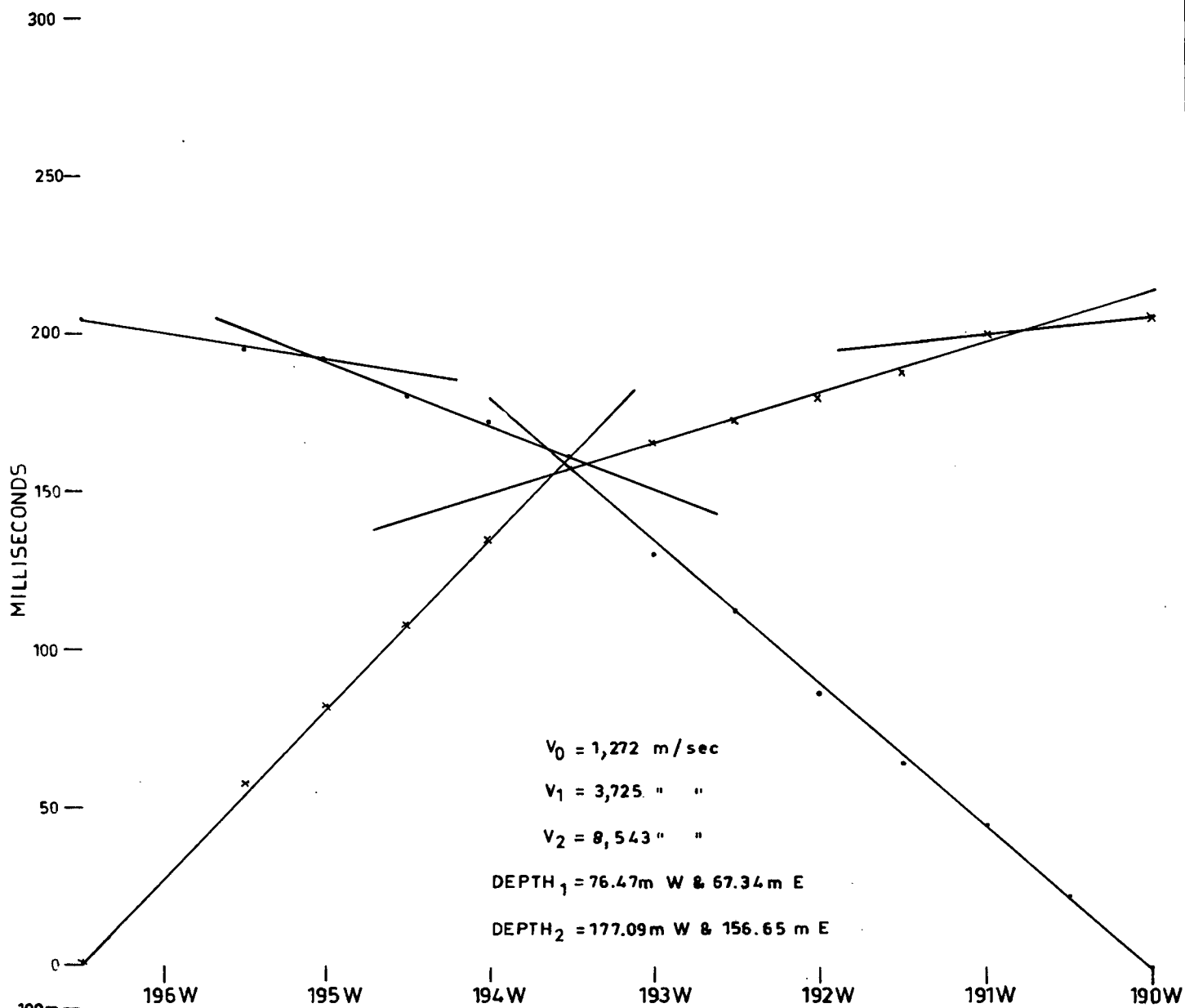
# LINE B 393



# LINE B 394



# LINE B 395

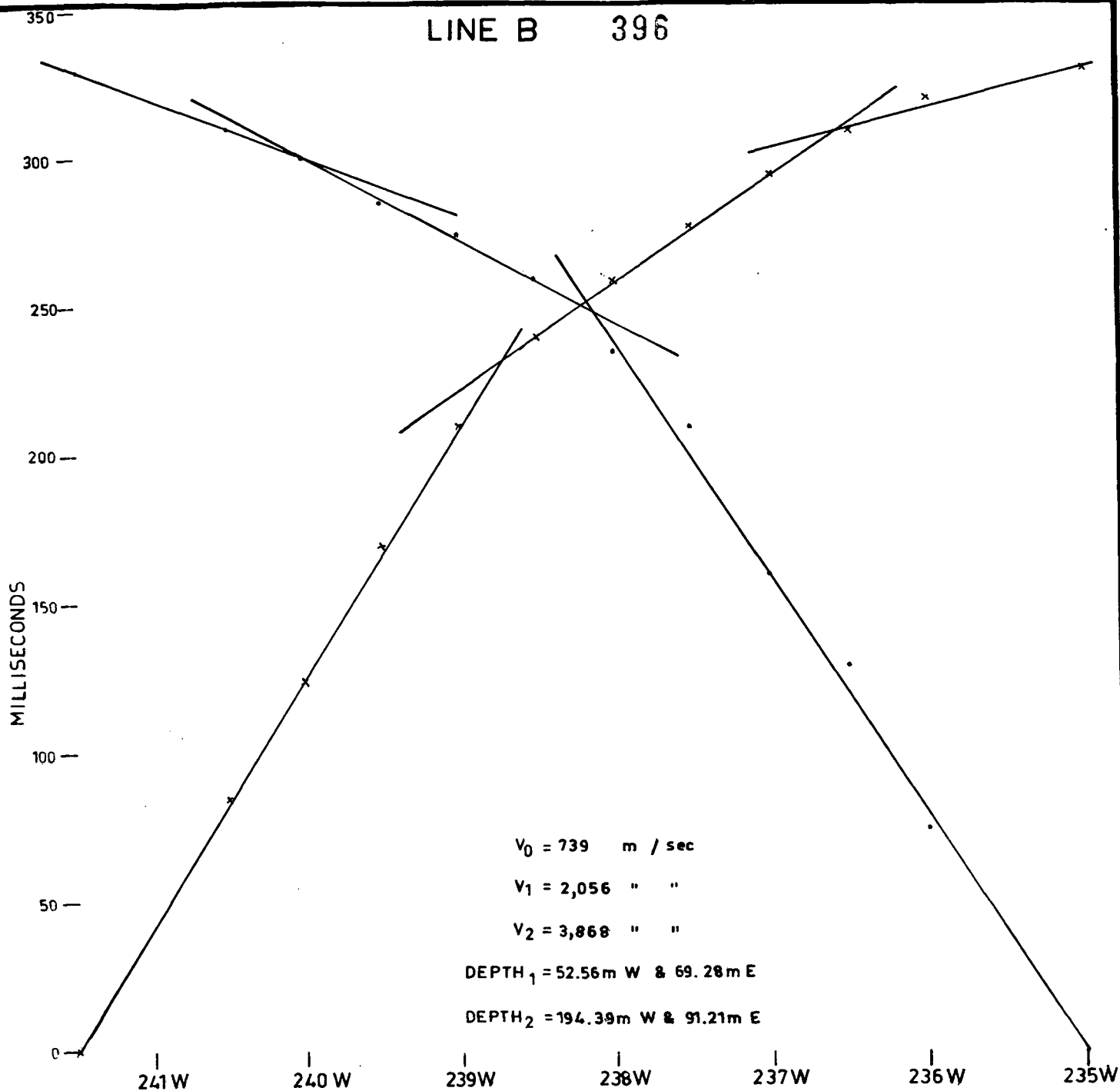


40m —

20m —

DEPTH SECTION

# LINE B 396



100m—

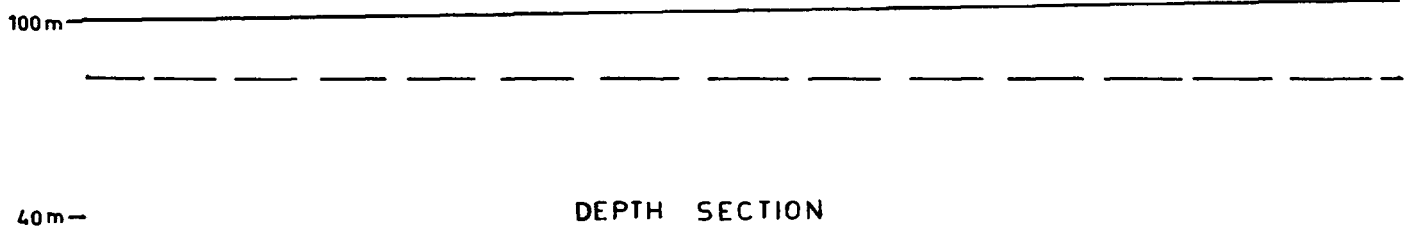
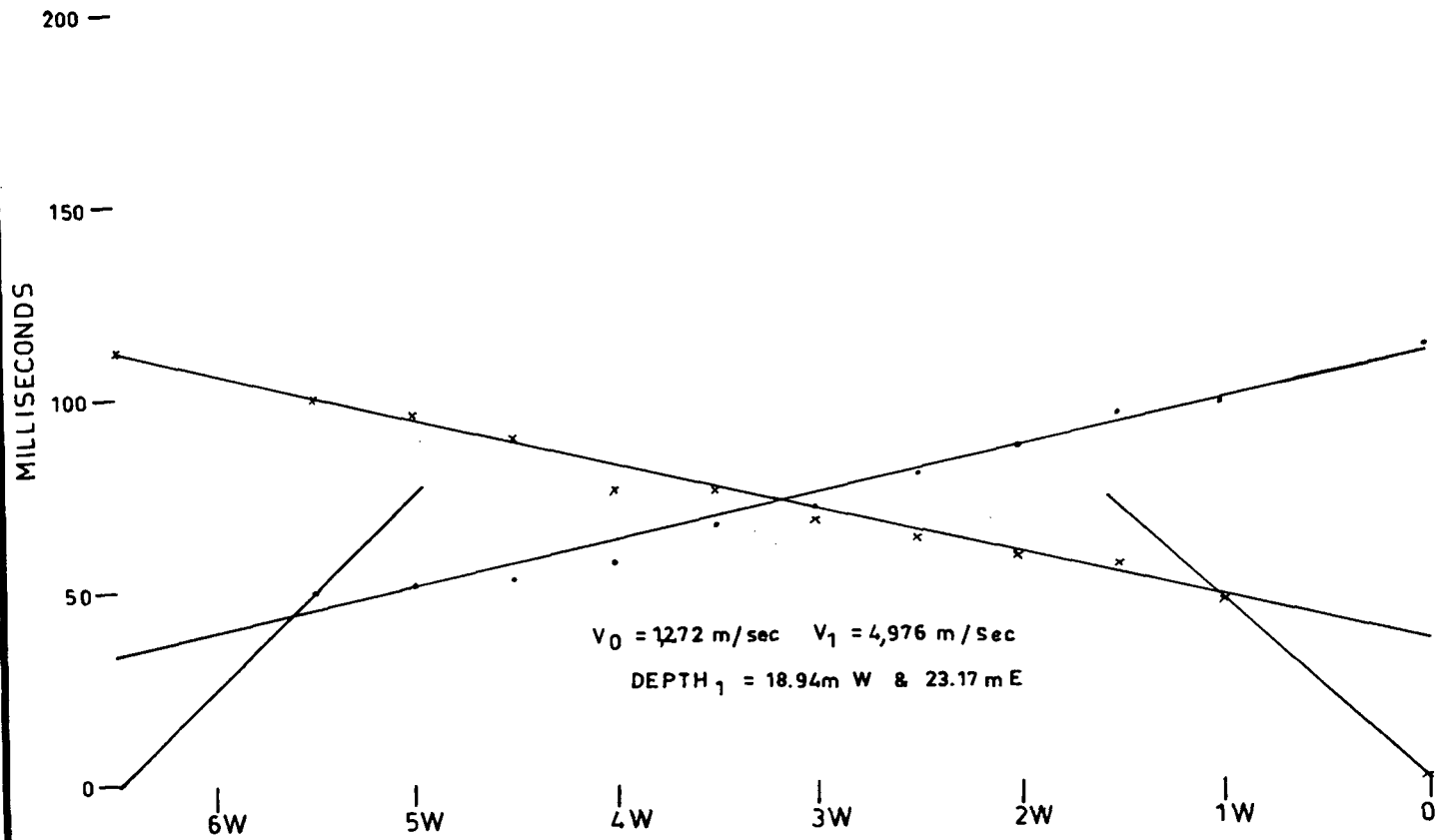
20m—

-60m—

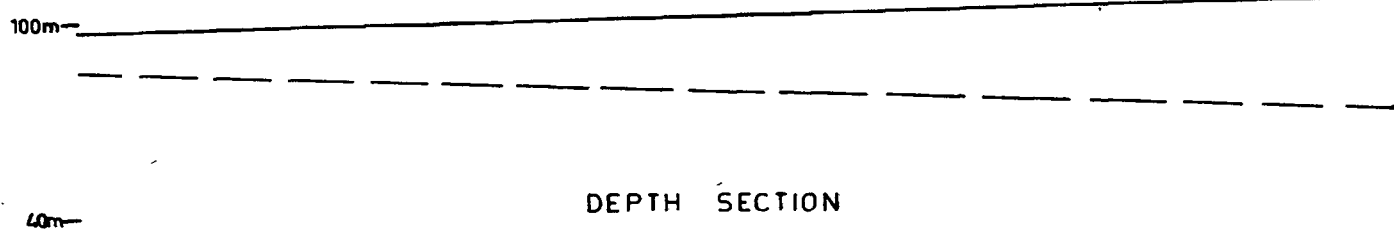
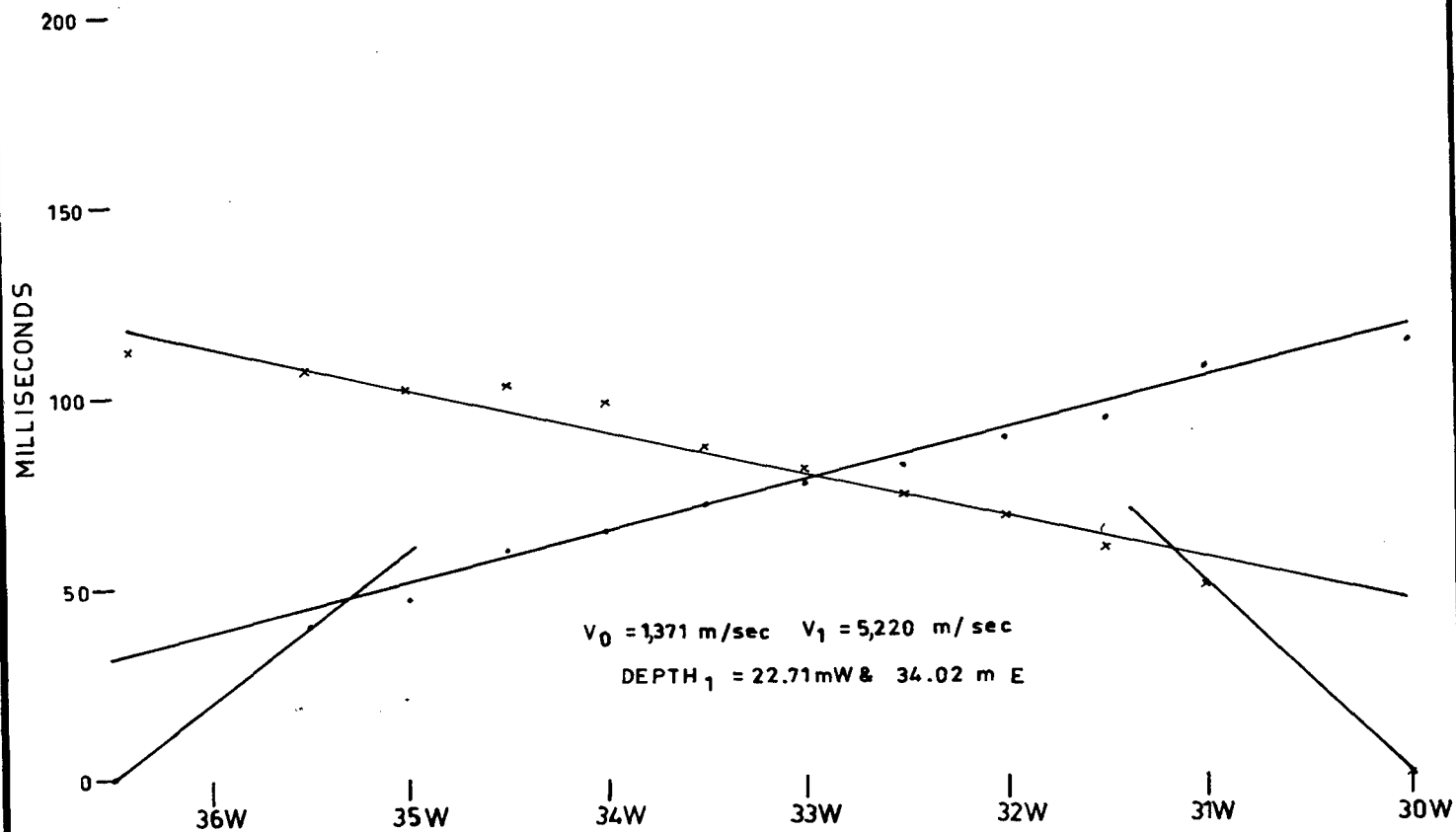
DEPTH SECTION

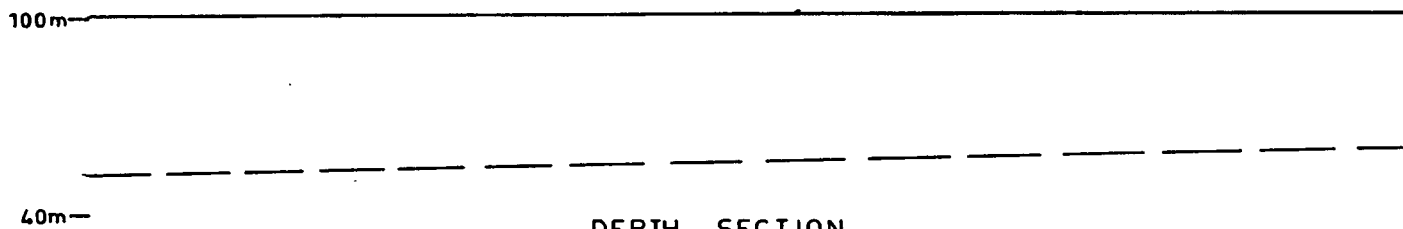
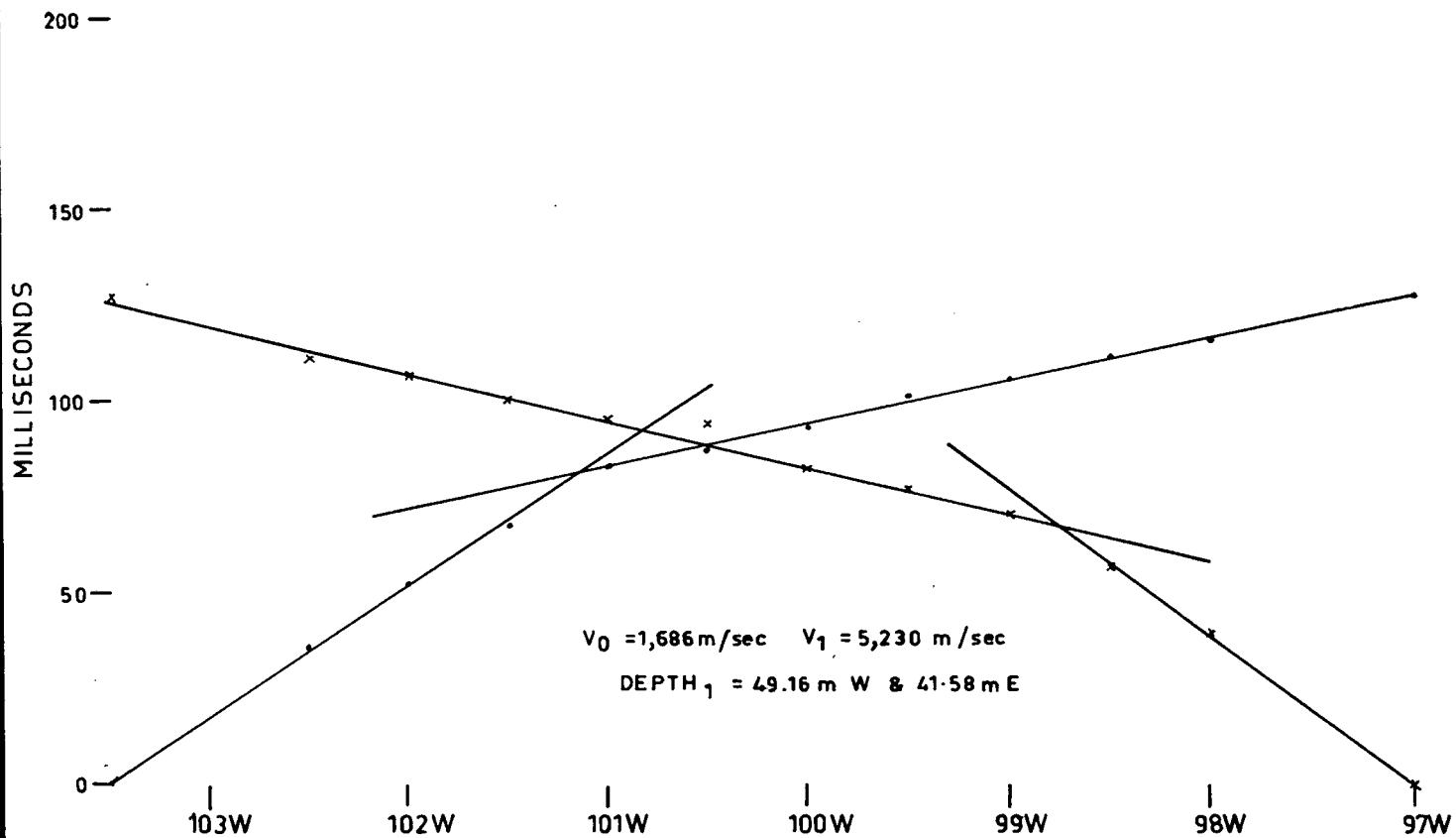


# LINE C 397

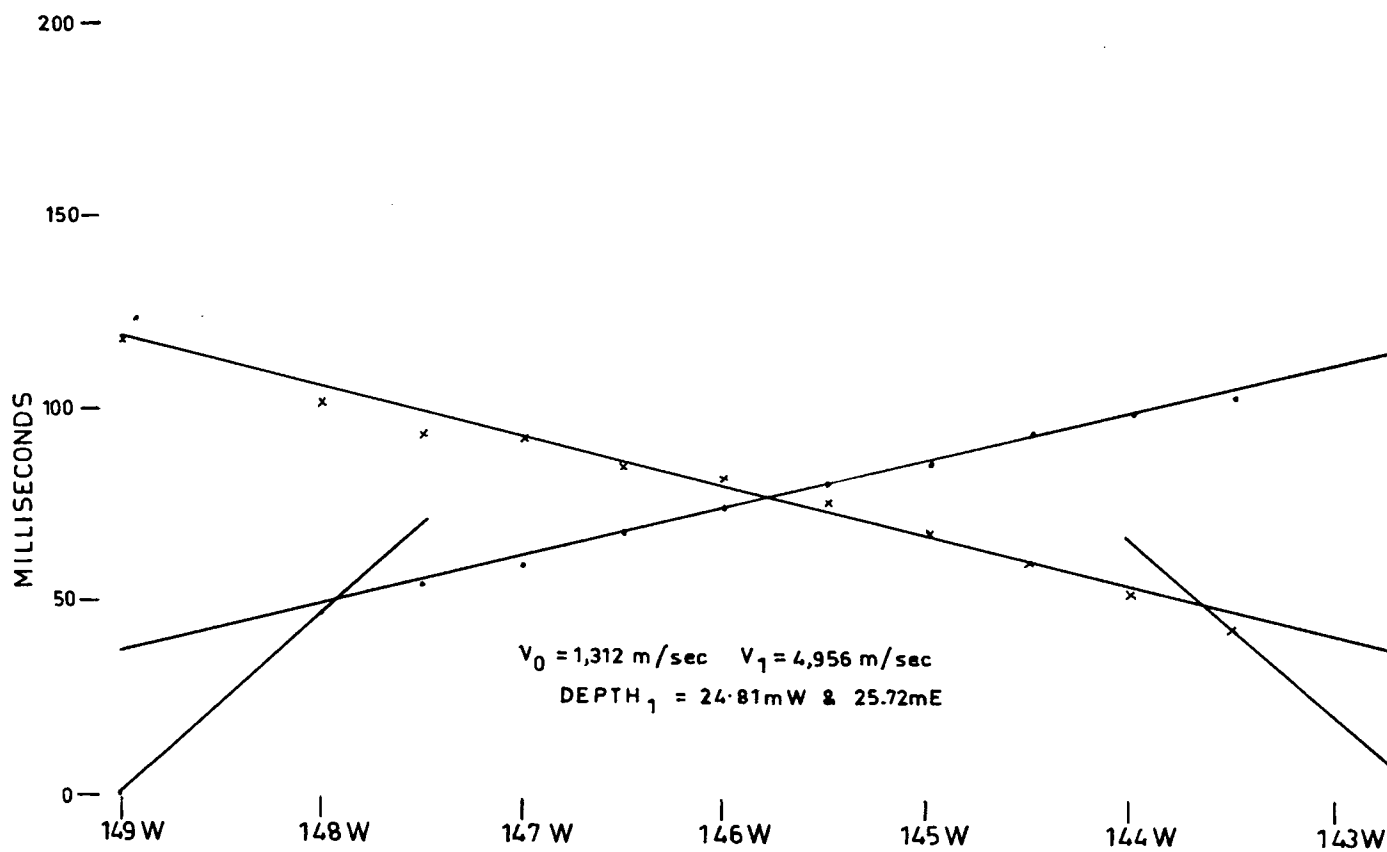


# LINE C 398





# LINE C 400

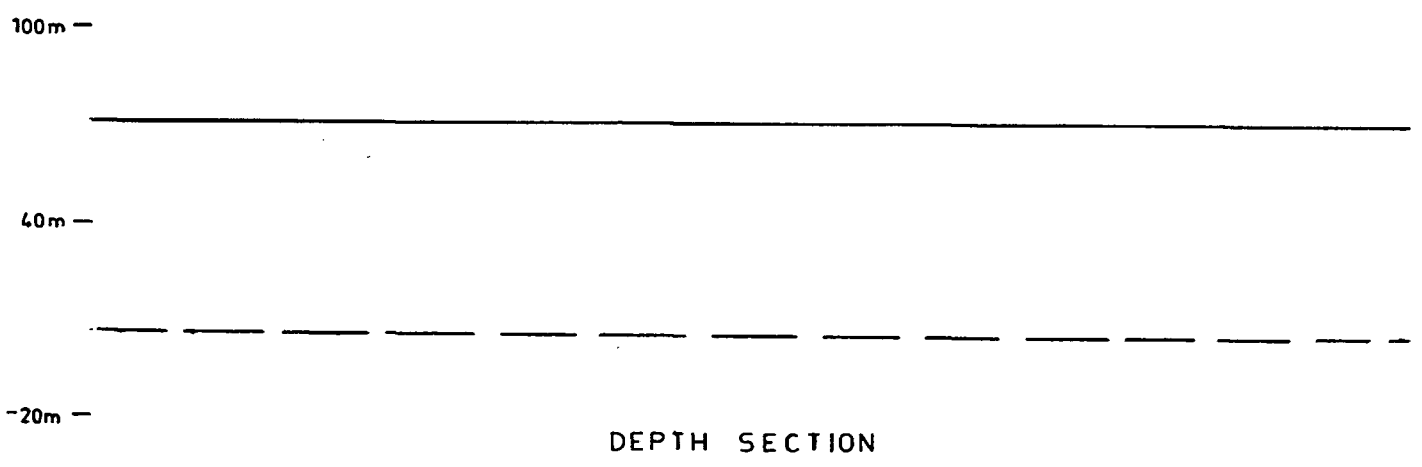
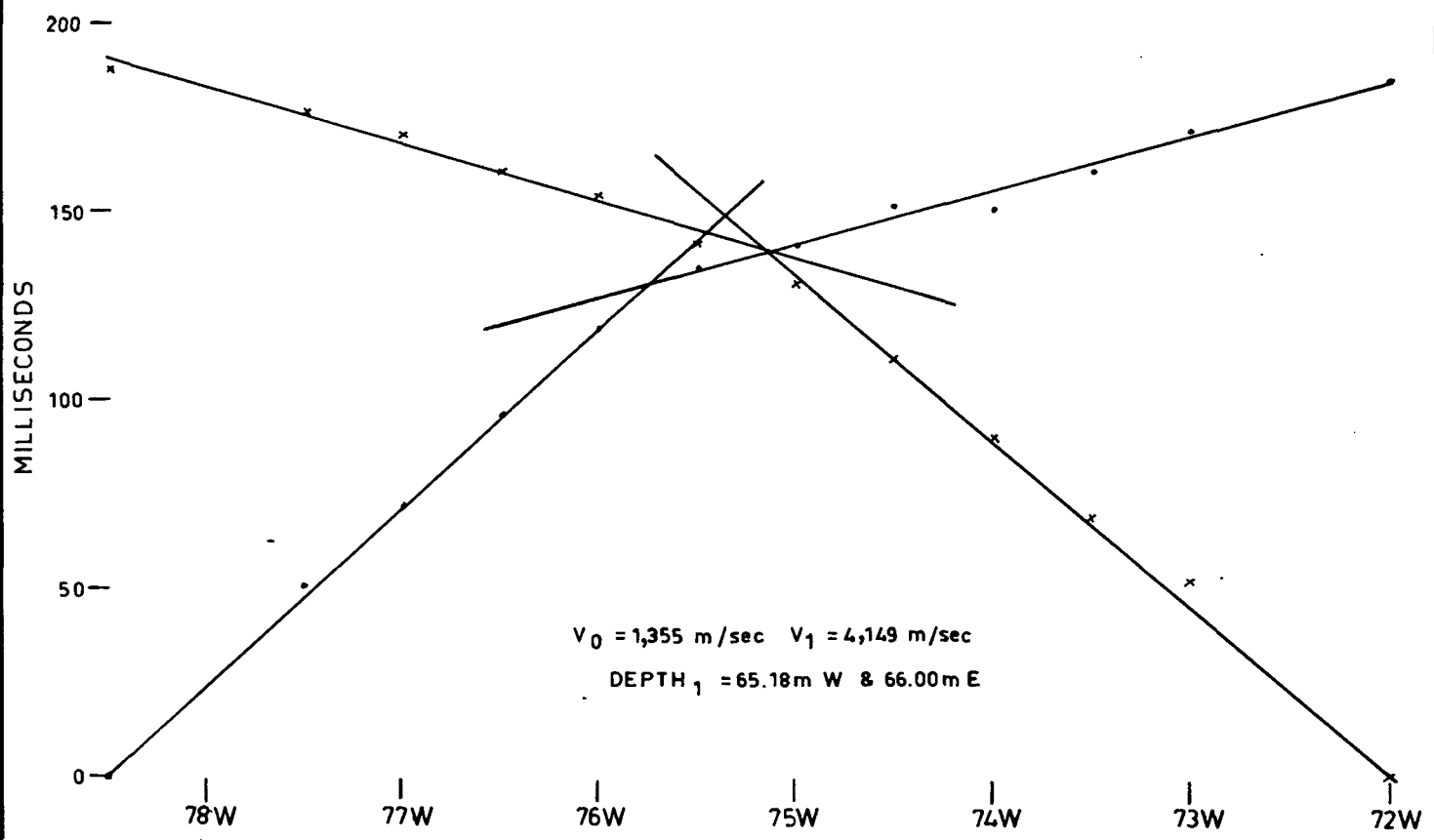


100 m —

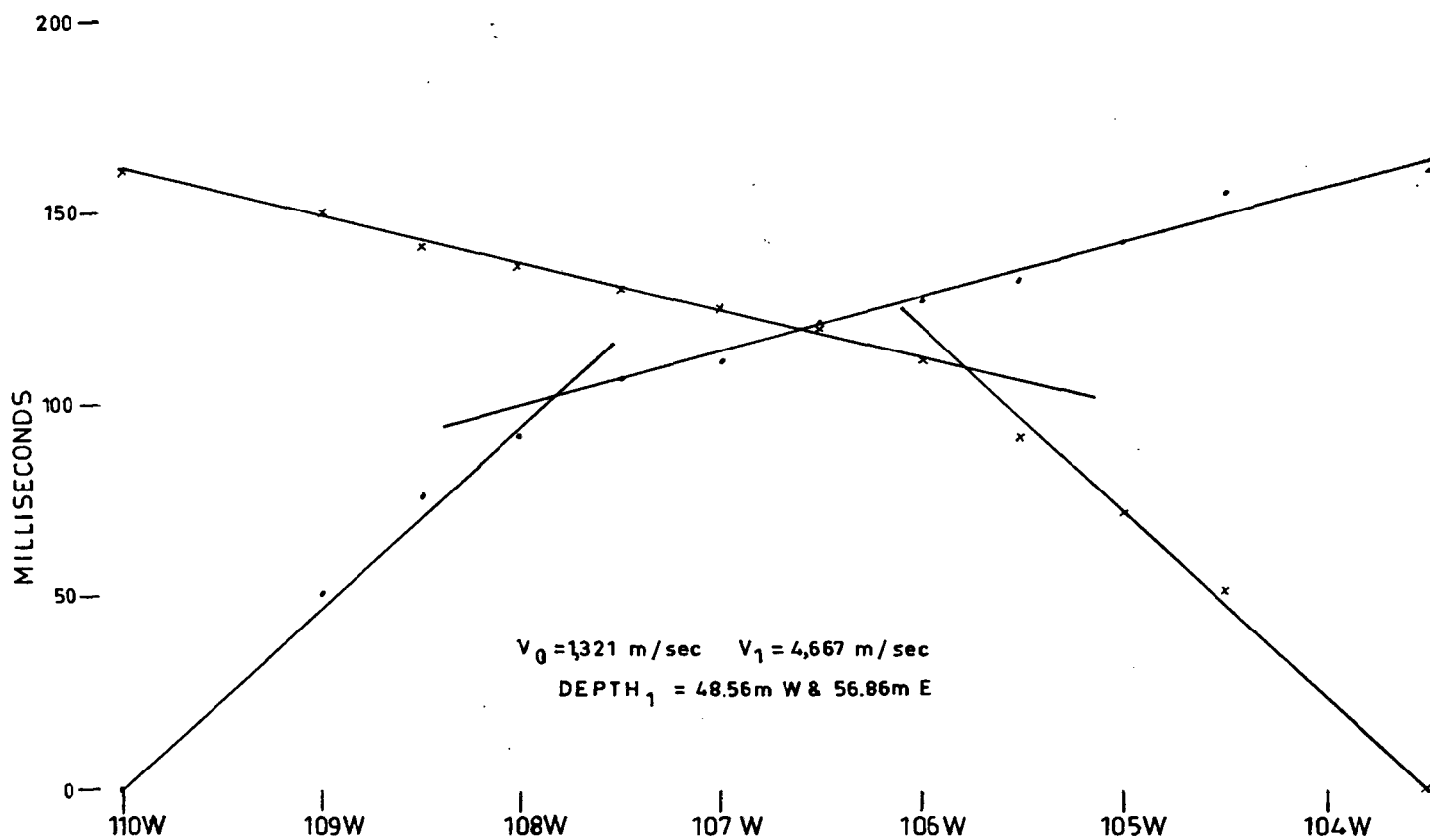
40 m —

DEPTH SECTION

# LINE D 401



# LINE D 402



100 m —

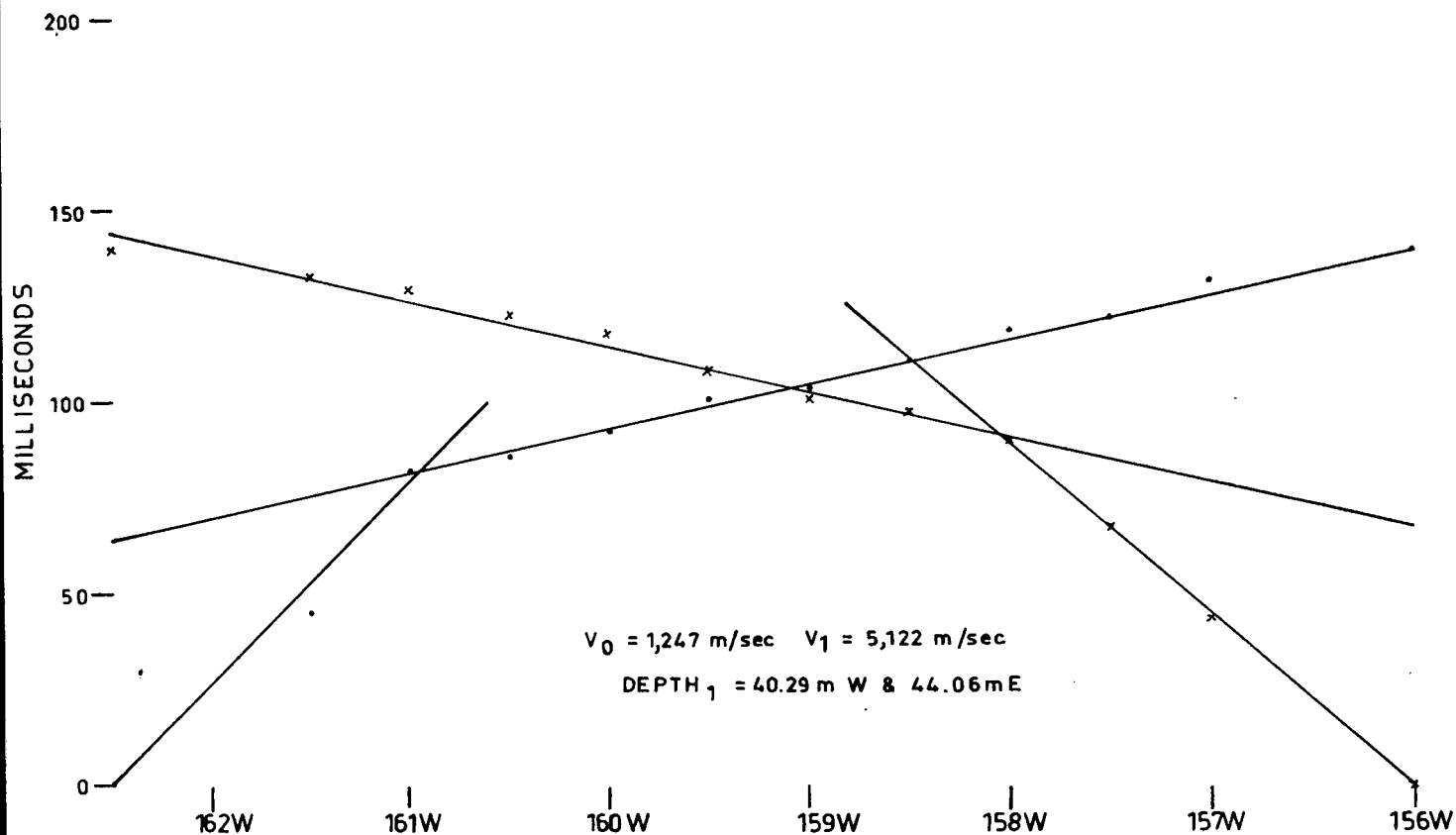
40 m —

-20 m —

DEPTH SECTION

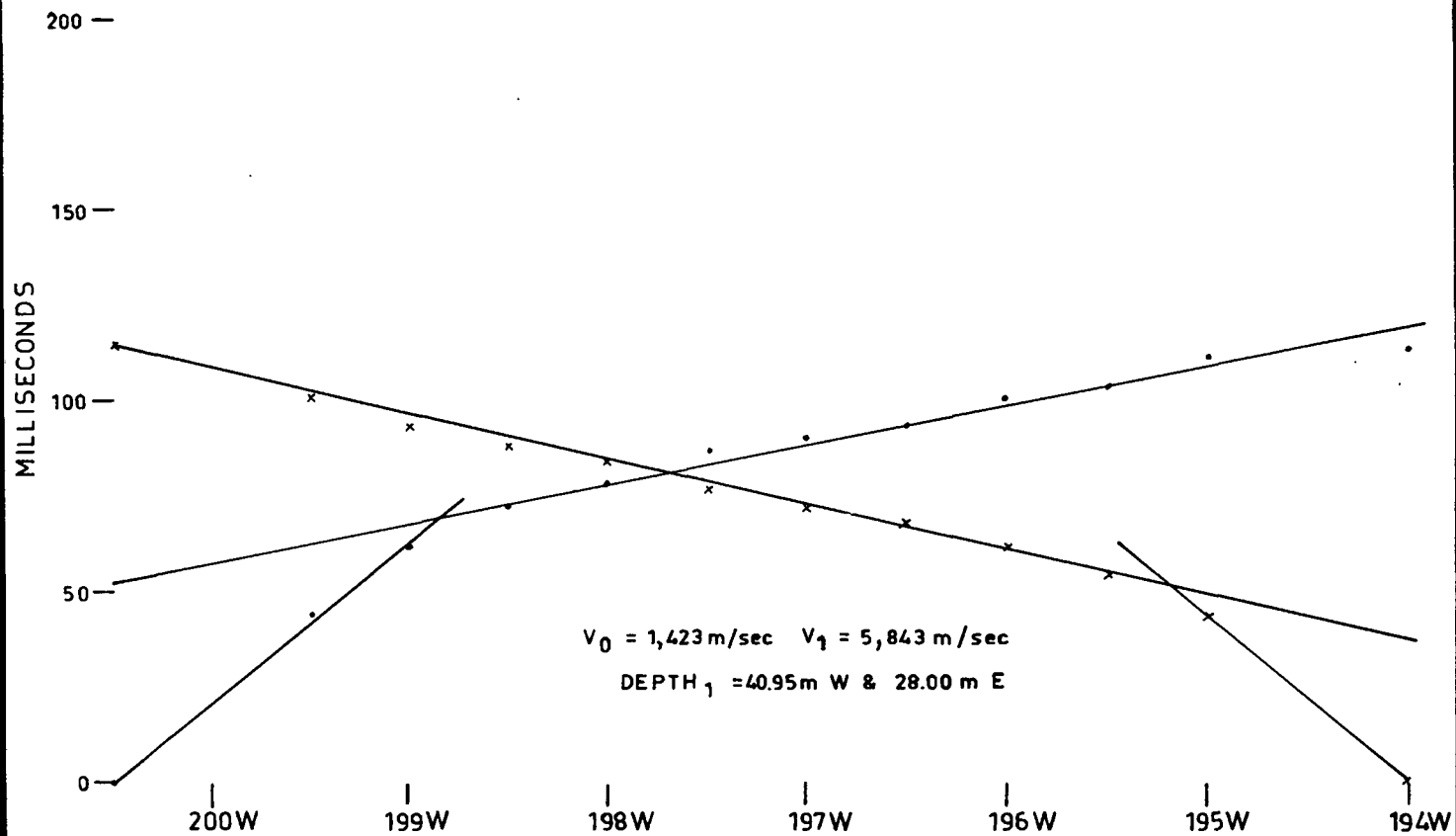
# LINE D

403



DEPTH SECTION

# LINE D 404



100m —

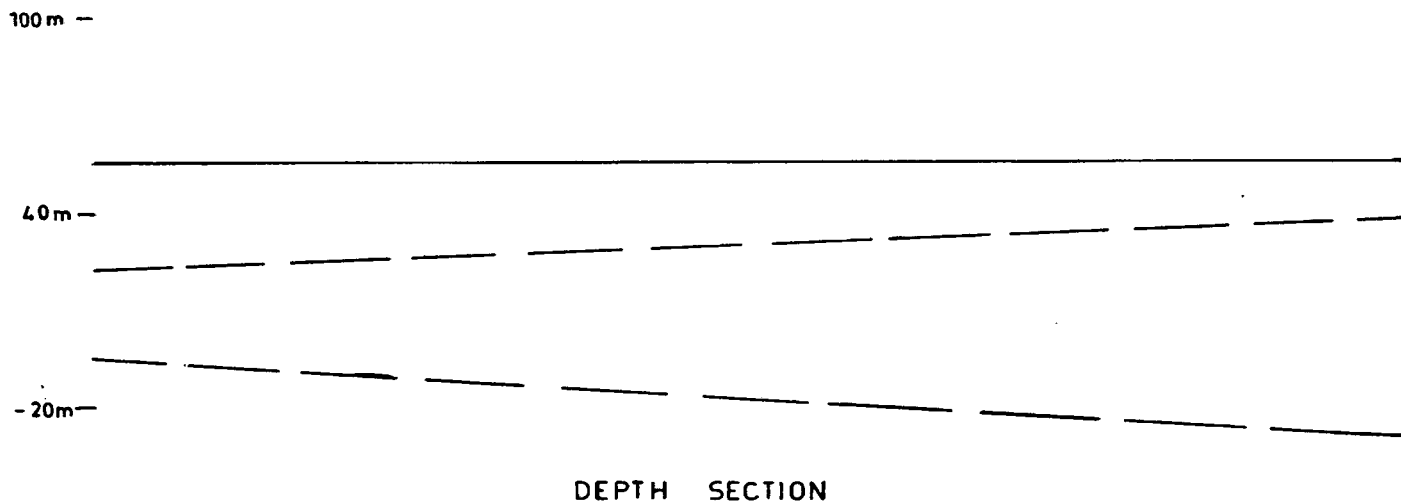
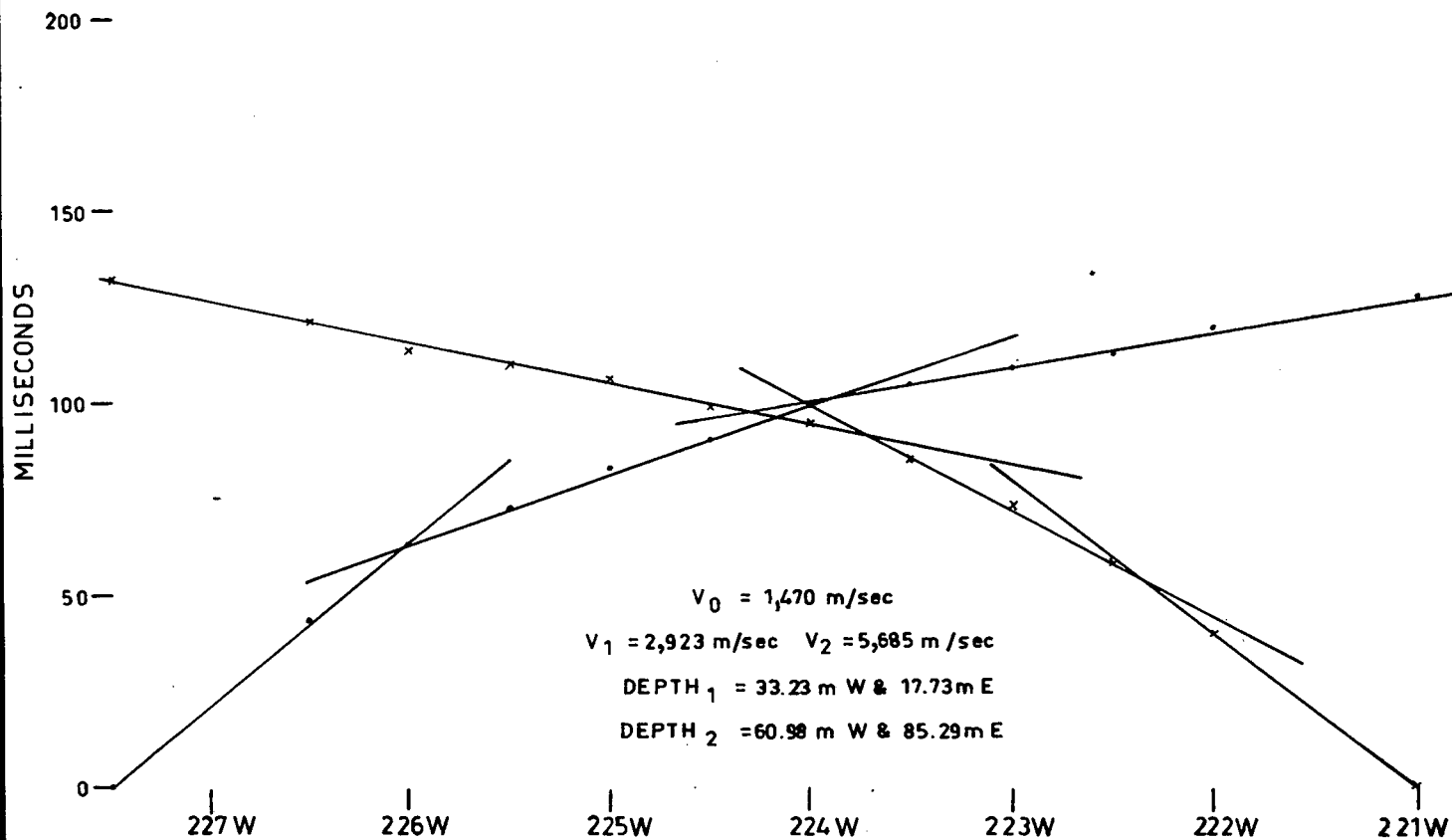
40m —

-20m —

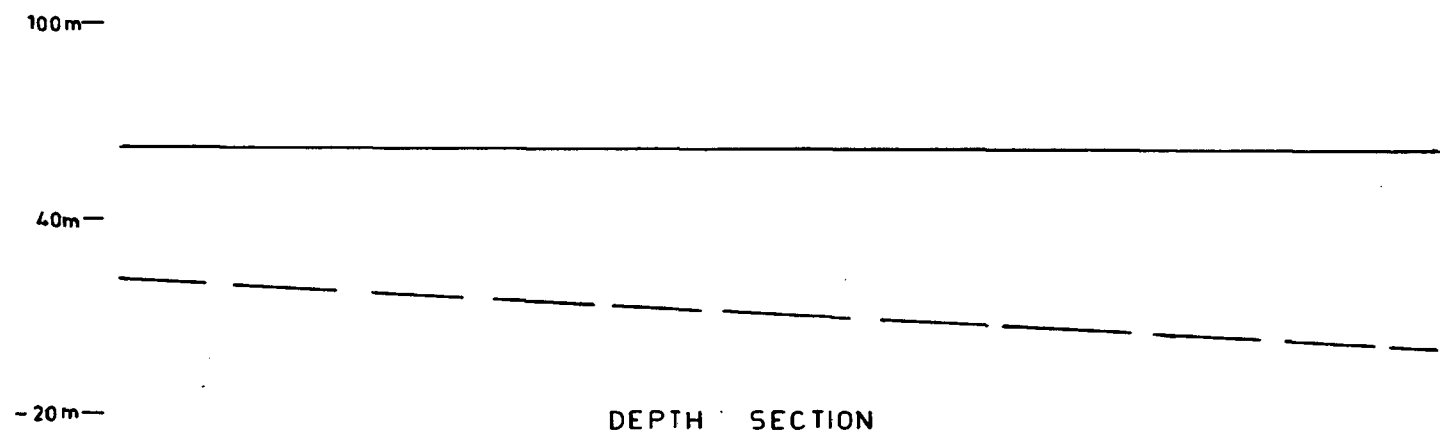
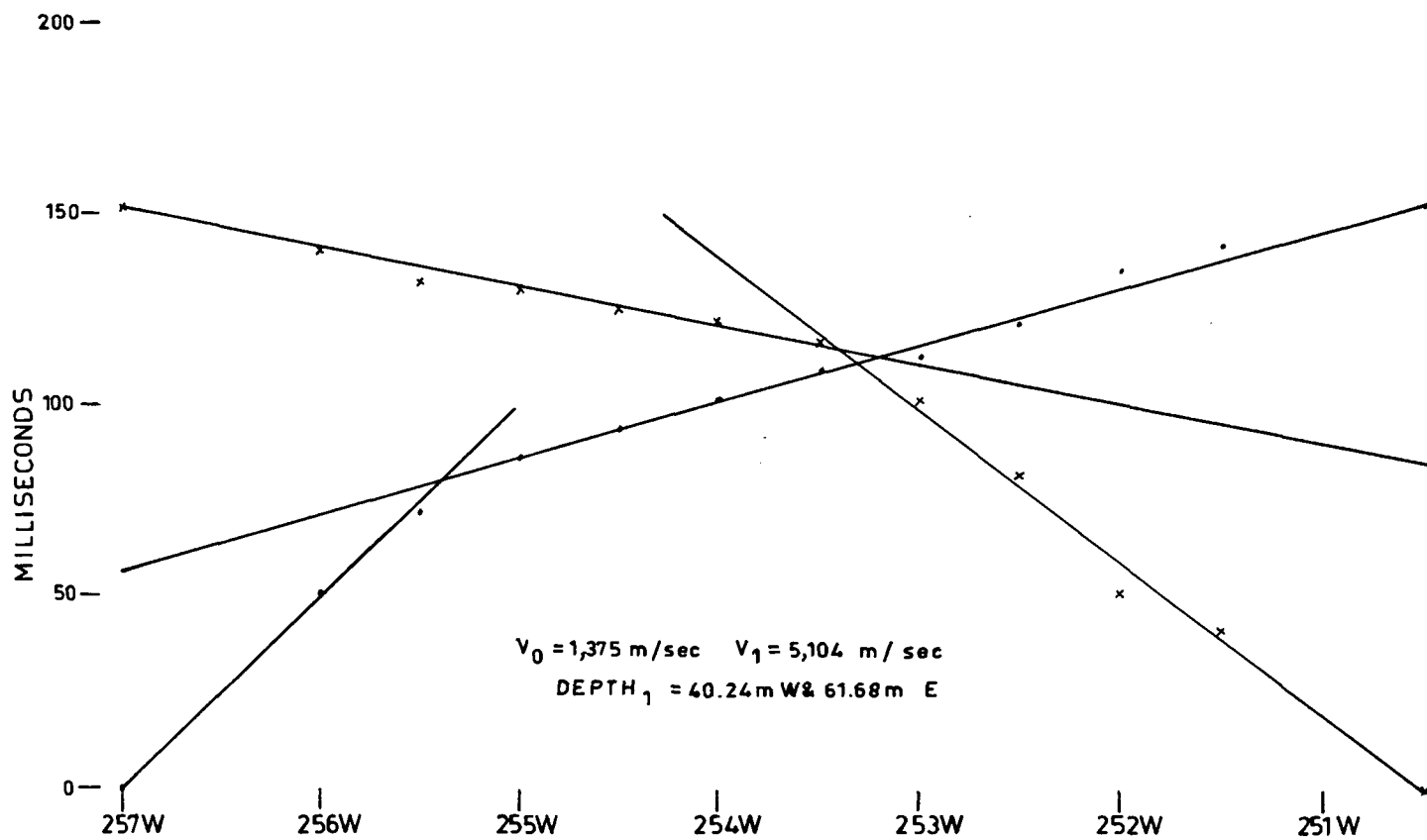
DEPTH SECTION



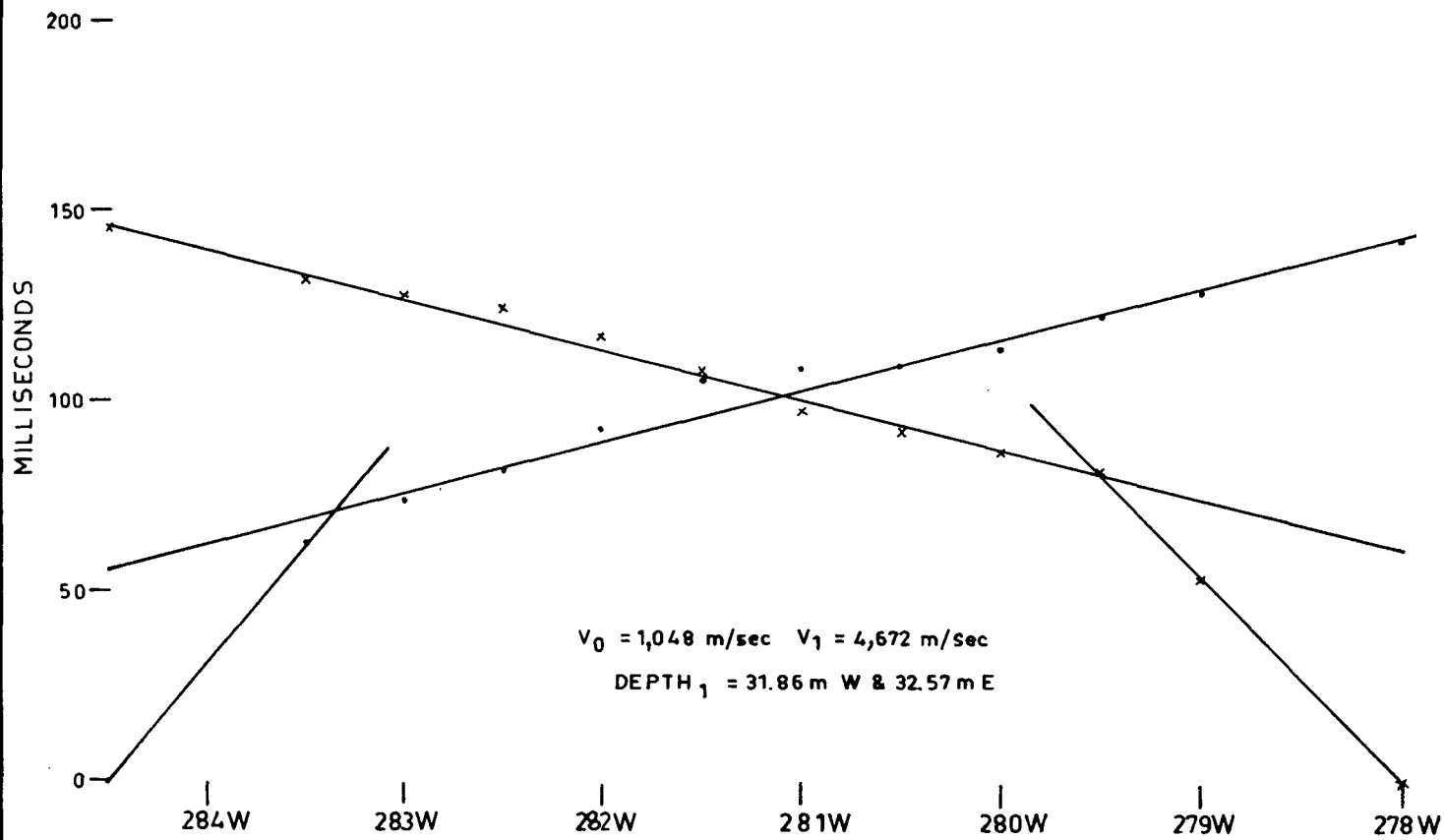
# LINE D 405



# LINE D 406



# LINE D 407

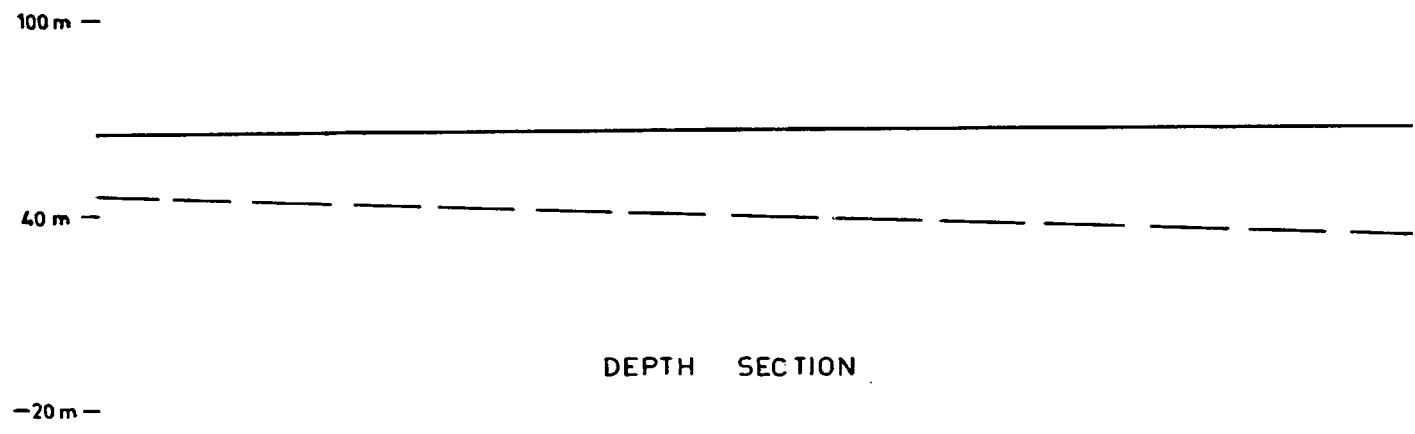
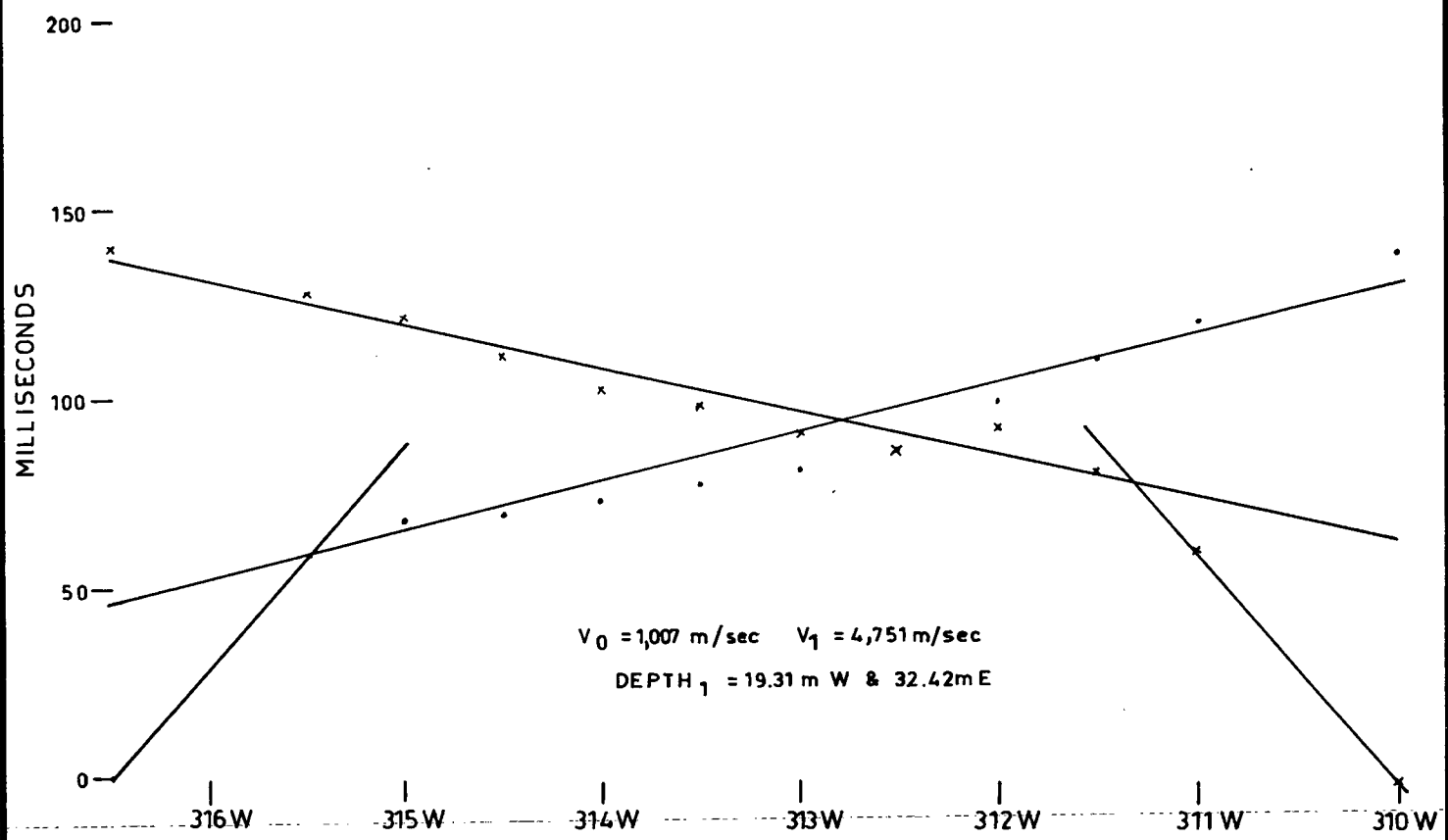


DEPTH SECTION

100m —

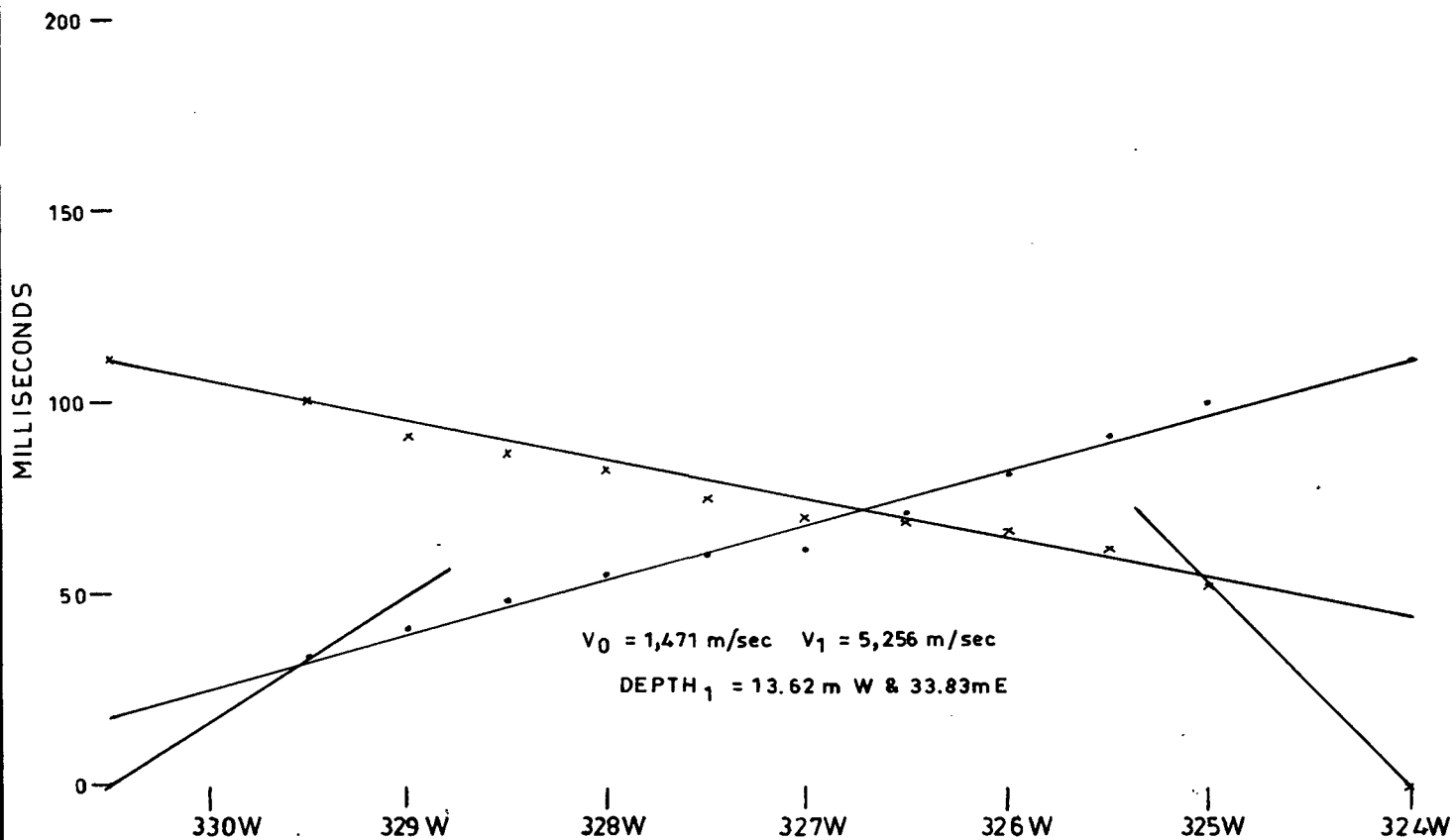
40m —

-20m —

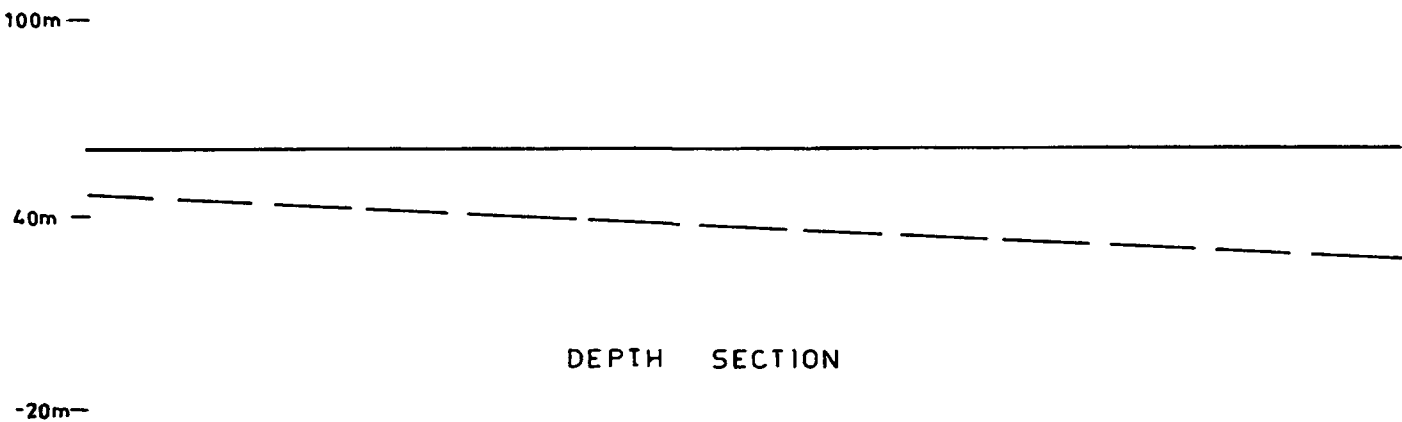


# LINE D

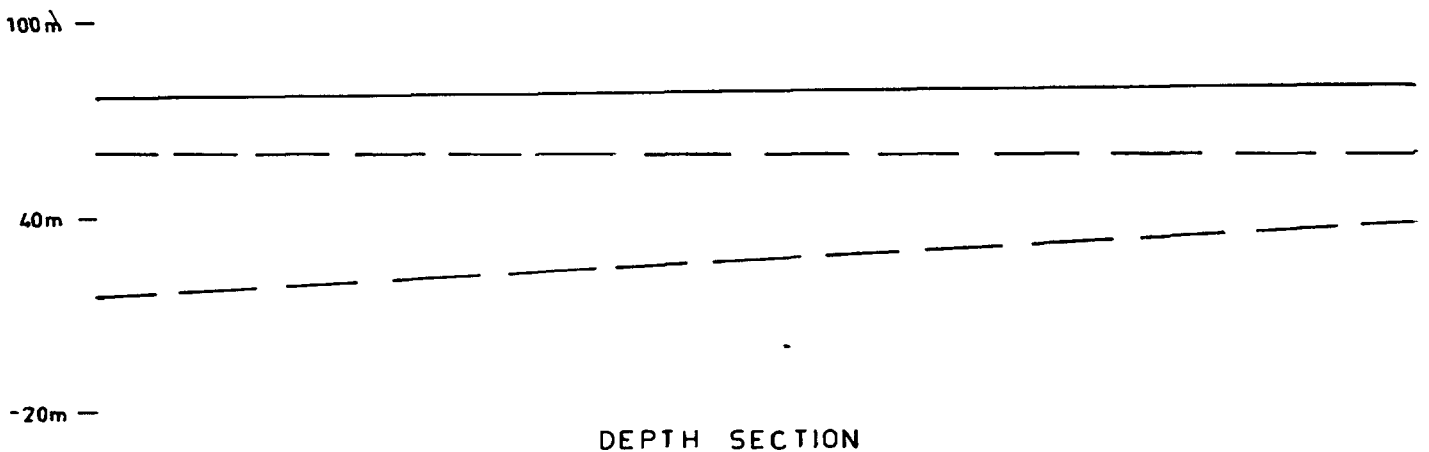
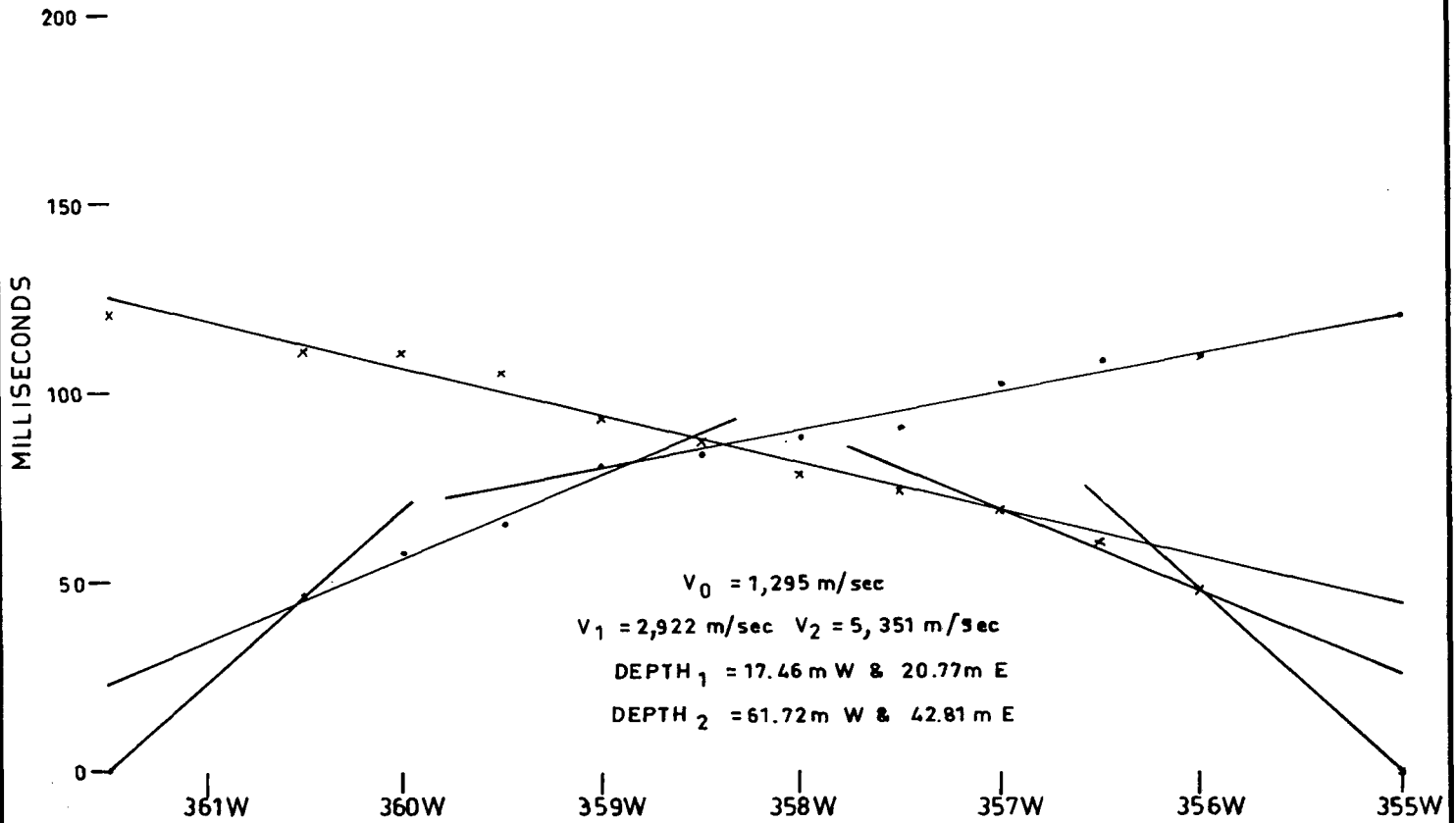
409

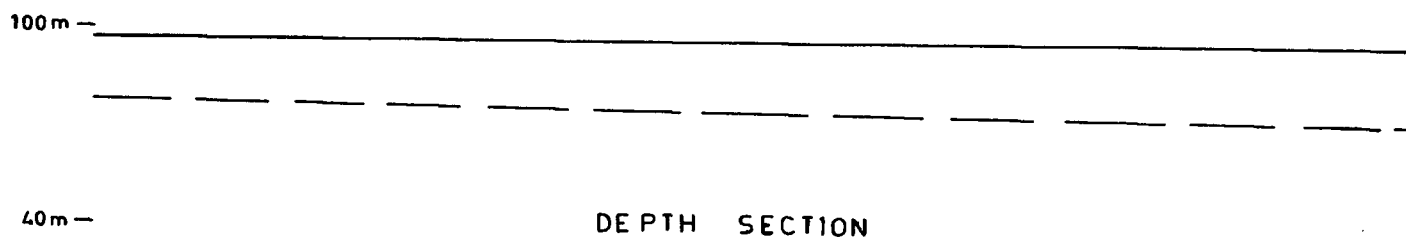
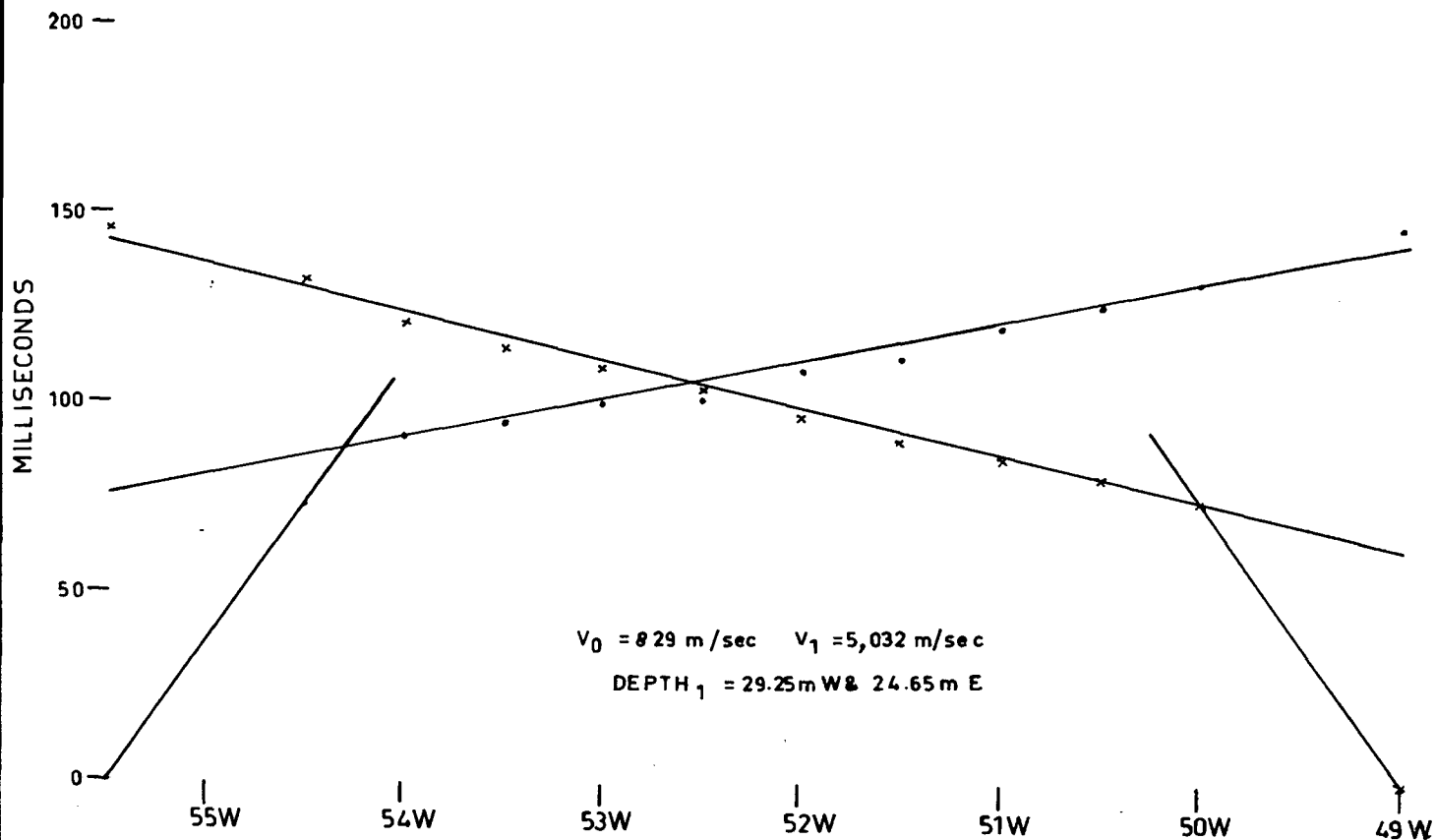


DEPTH SECTION



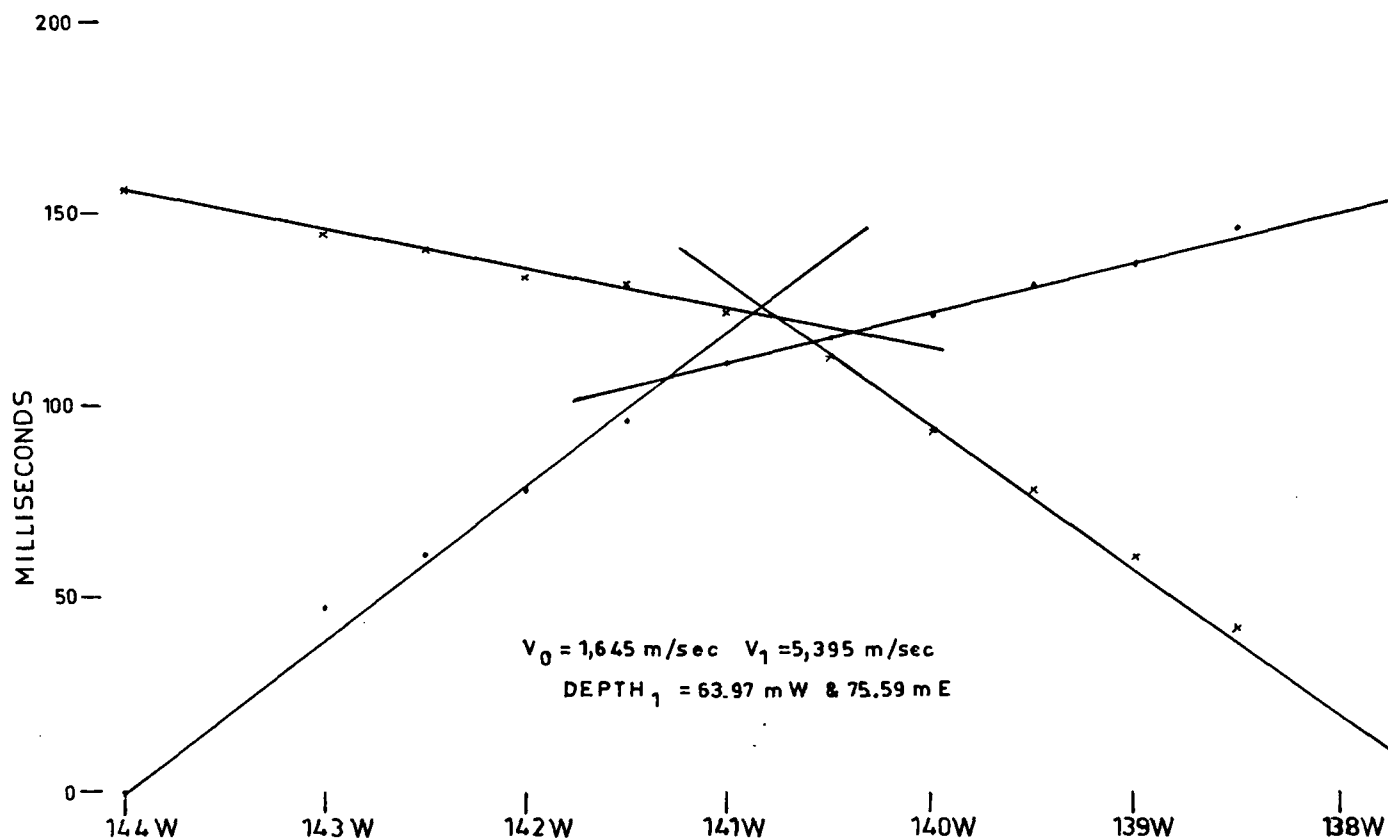
# LINE D 410





LINE E

412



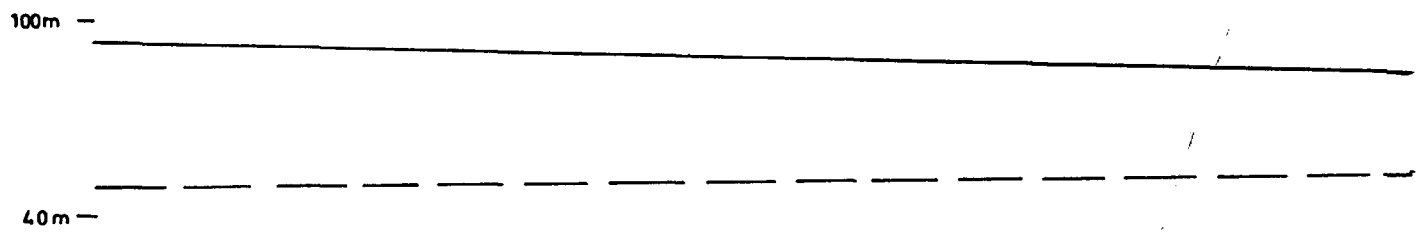
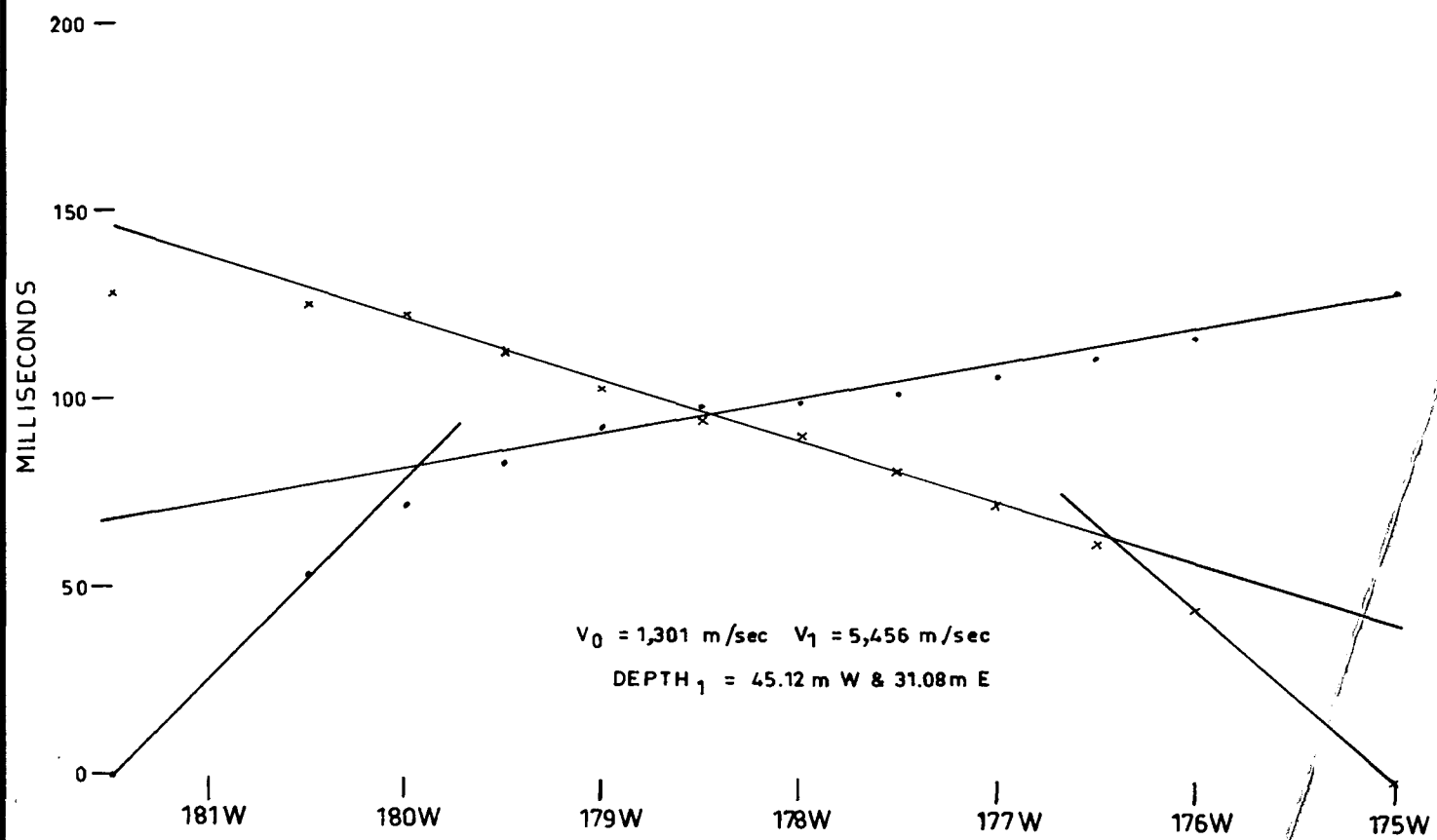
100m—

40m—

-20m—

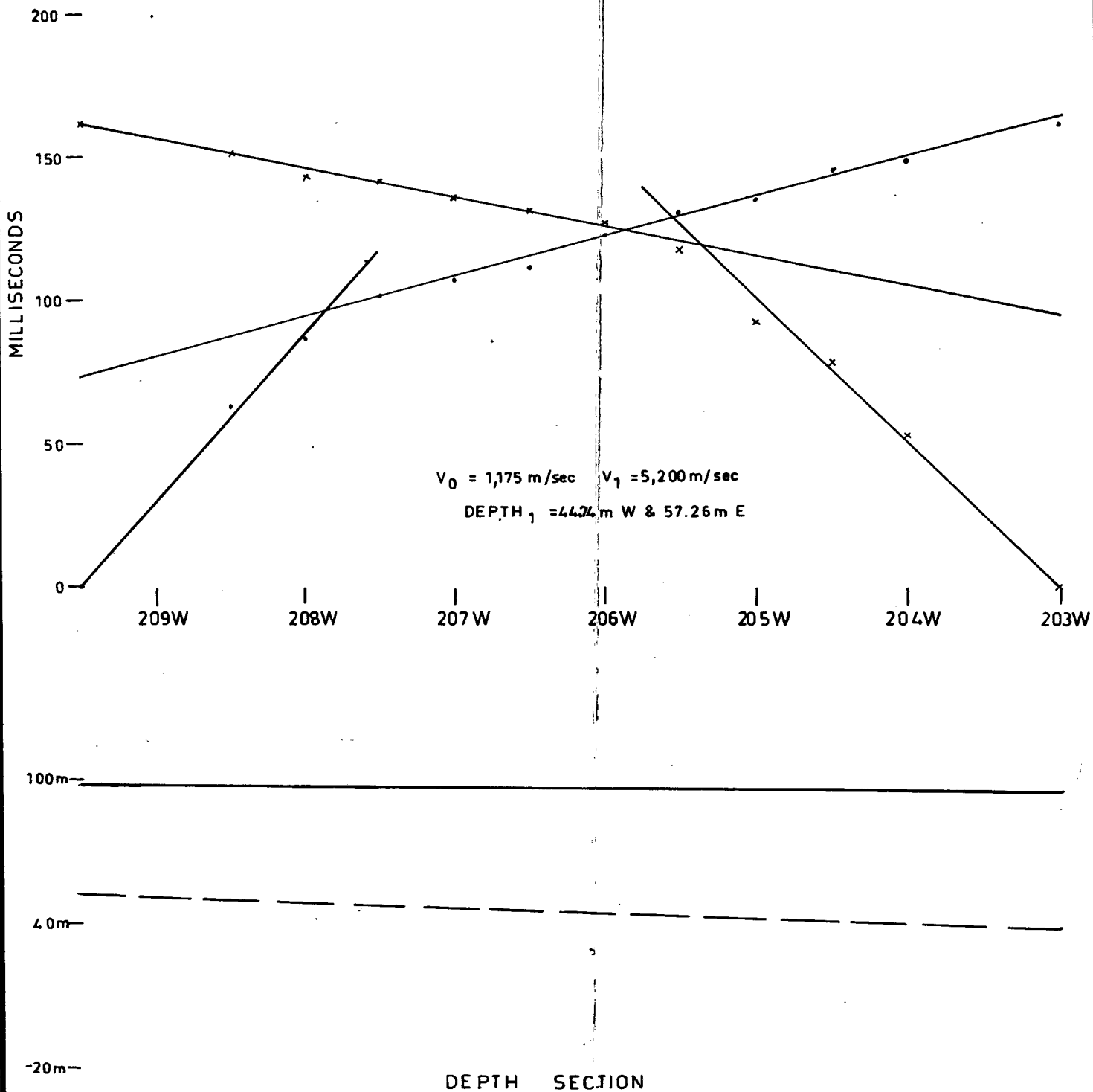
DEPTH SECTION

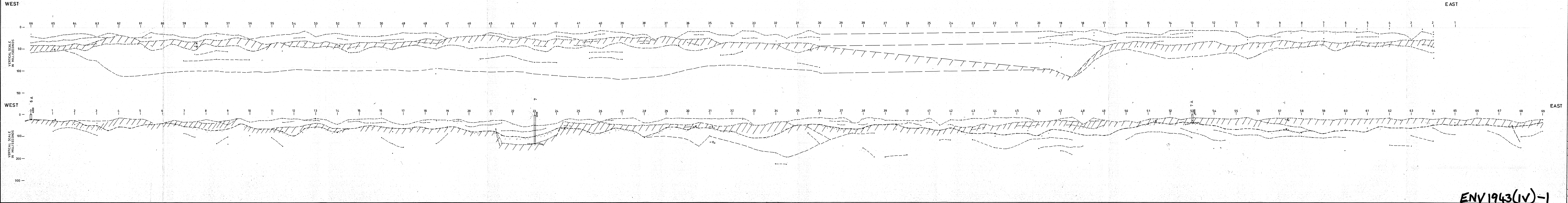




DEPTH SECTION

# LINE E 414





LEGEND

- Location of control refraction spreads
- Location and No of survey peg at 200ft interval
- 1971-72 Drill holes
- Weathered basement surface: geological interpretation
- Two way reflexion
- Weathered basement surface raw reflexion results
- Refraction

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J. STARKEY and ASSOCIATES

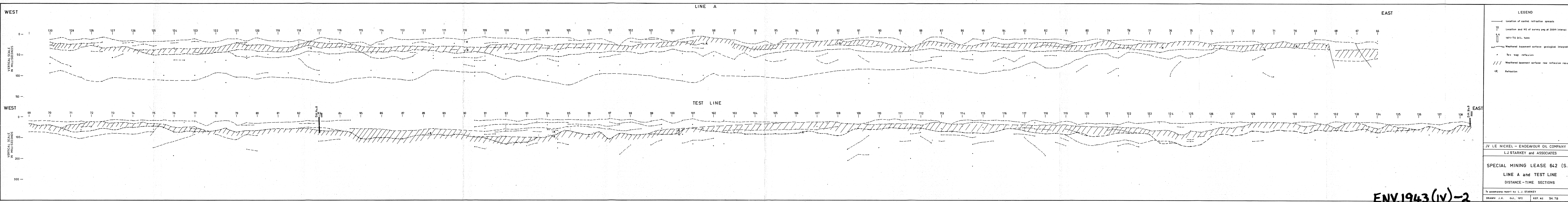
SPECIAL MINING LEASE 642 (S.A.)

LINE A and TEST LINE

DISTANCE-TIME SECTIONS

To accompany report by L. J. STARKEY

DRAWN: J.H. Oct., 1972 REF. NO. SH. 7A



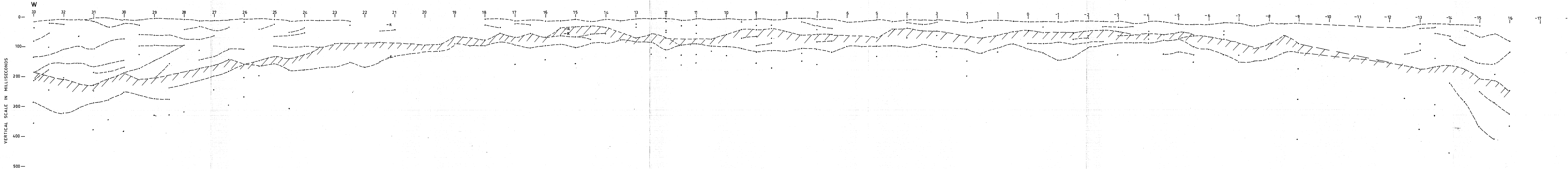
ENV.1943(IV)-2

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.  
L.J. STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)  
LINE A and TEST LINE  
DISTANCE-TIME SECTIONS

To accompany report by L.J. STARKEY

DRAWN: J.H. Oct., 1972 REF. N2 SH. 7B



# LEGEND

- Location of control refraction spreads
- 10 | Location and No of survey peg at 200ft interval
- 6 A | 1971-72 Drill holes
- Weathered basement surface: geological interpretation
- Two way reflexion
- /// Weathered basement surface raw reflexion results
- R Refraction

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J.STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

Line B

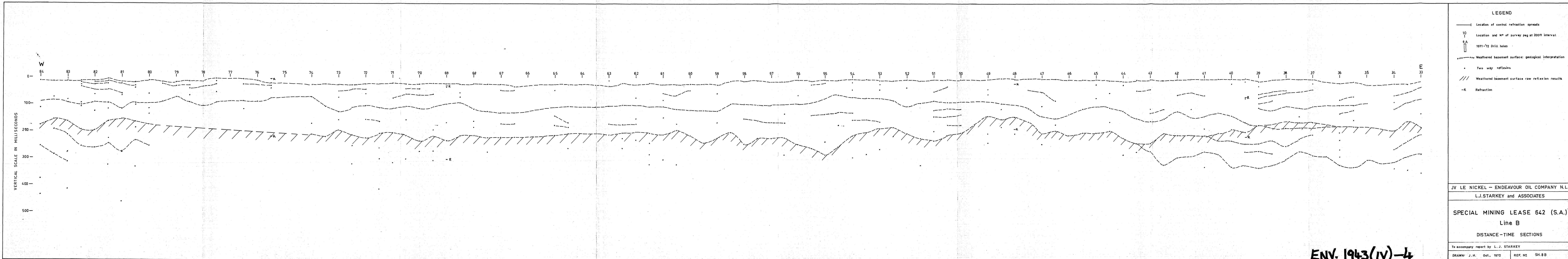
DISTANCE-TIME SECTIONS

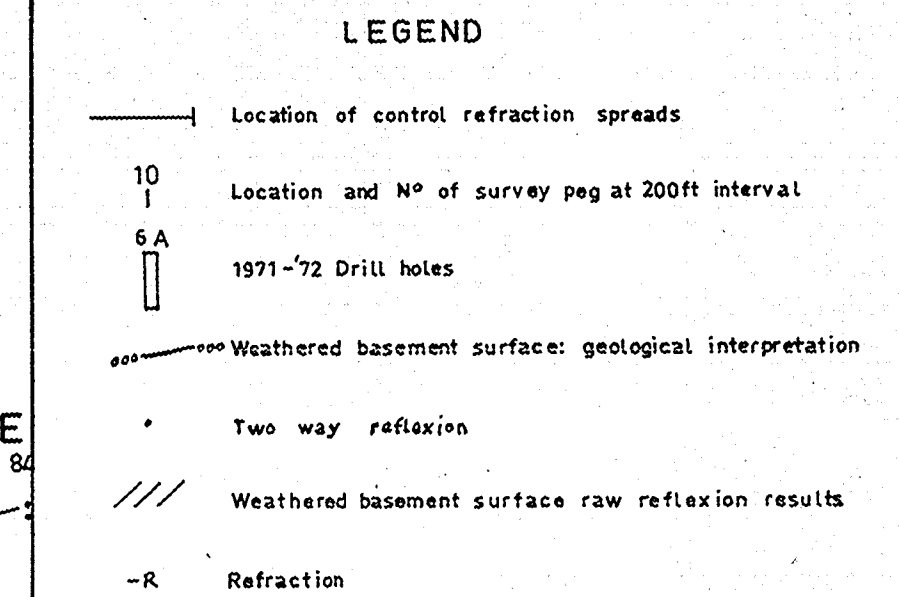
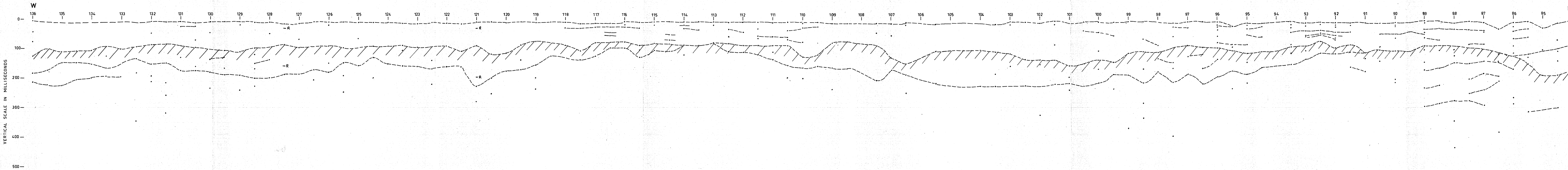
To accompany report by L. J. STARKEY

DRAWN: J.H. Oct., 1972 REF. No SH 8A

ENV. 1943(IV)-3







JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J. STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

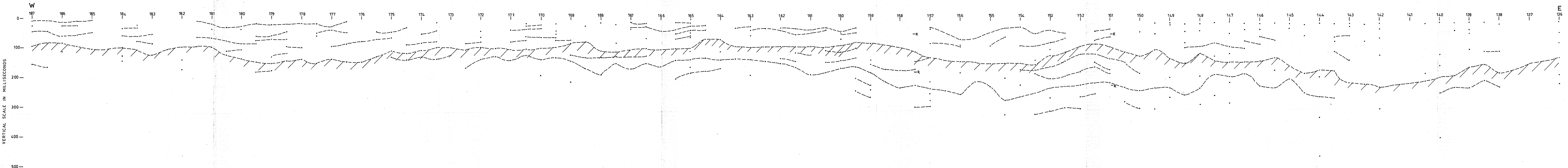
Line B

DISTANCE-TIME SECTIONS

To accompany report by L. J. STARKEY

DRAWN: J. H. Oct., 1972 REF. NO SH. 8C

ENV. 1943(IV)-5



- LEGEND
- Location of control refraction spreads
  - 10 | Location and No. of survey peg at 200ft interval
  - 6 A | 1971-72 Drill holes
  - ... Weathered basement surface: geological interpretation
  - Two way reflexion
  - /// Weathered basement surface raw reflexion results
  - R Refraction

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J.STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

Line B

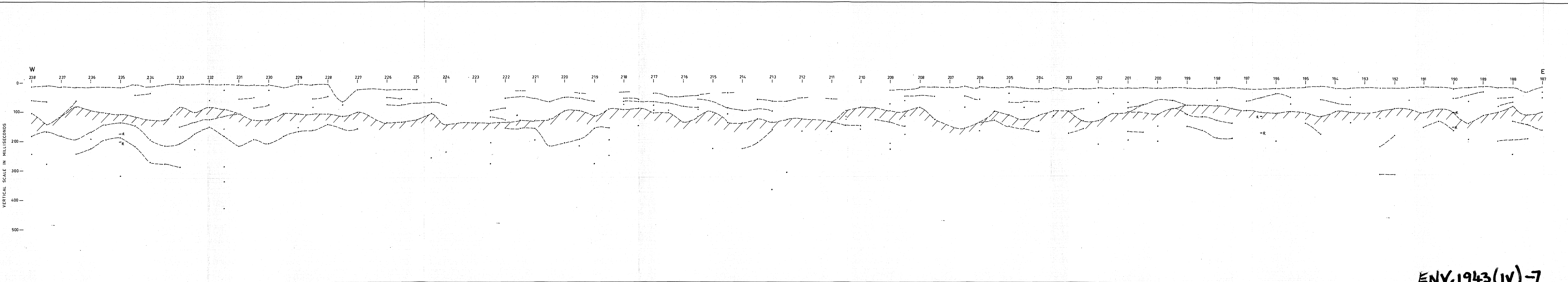
DISTANCE-TIME SECTIONS

To accompany report by L. J. STARKEY

DRAWN: J. H. Oct., 1972 REF. No SH. 8 D

ENV. 1943 (IV)-6





**LEGEND**

- Location of control refraction spreads
- 10  
6 A  
Location and N° of survey peg at 200ft interval
- 1971-72 Drill holes
- Weathered basement surface: geological interpretation
- Two way reflexion
- /// Weathered basement surface raw reflexion results
- R Refraction

JV LE NICKEL — ENDEAVOUR OIL COMPANY N.L.

L.J. STARKEY and ASSOCIATES

**SPECIAL MINING LEASE 642 (S.A.)**

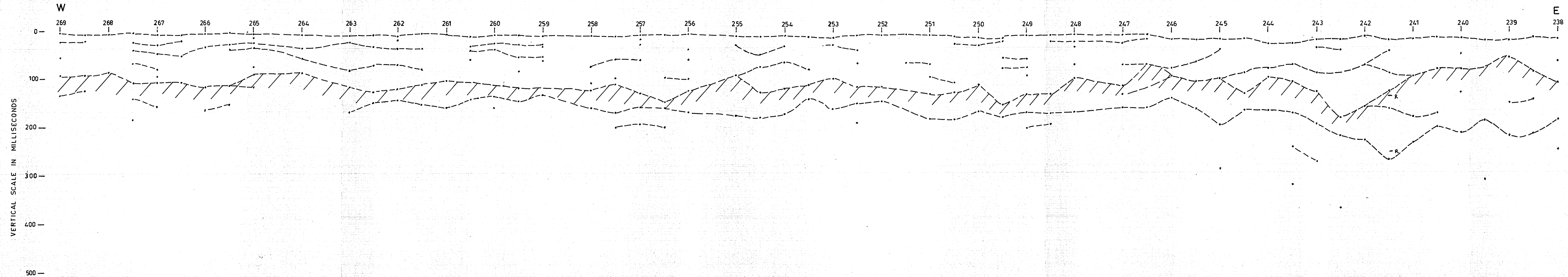
Line B

DISTANCE-TIME SECTIONS

To accompany report by L. J. STARKEY

DRAWN: J.H. Oct., 1972 REF. N° SH. 8E

ENV.1943(UV)-7



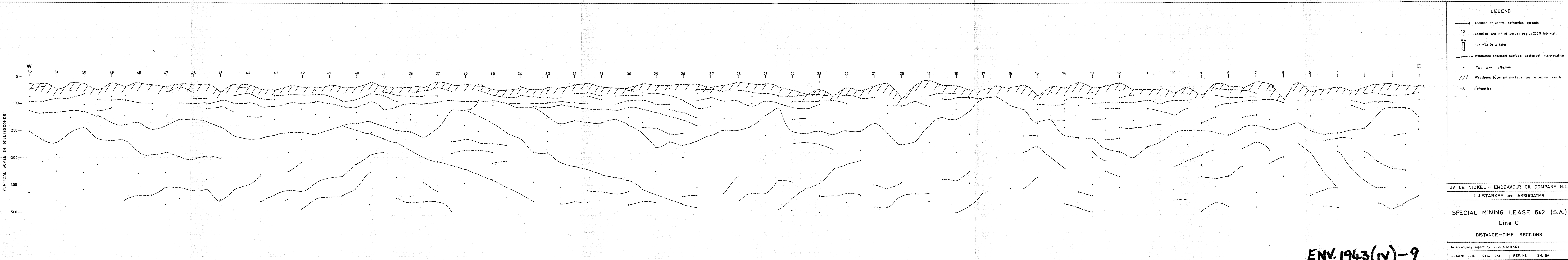
- LEGEND
- Location of control refraction spreads
  - 10 Location and N° of survey peg at 200ft interval
  - 6 A 1971-72 Drill holes
  - Weathered basement surface: geological interpretation
  - Two way reflexion
  - Weathered basement surface raw reflexion results
  - R Refraction

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.  
L.J.STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)  
Line B  
DISTANCE-TIME SECTIONS

To accompany report by L. J. STARKEY  
DRAWN: J. H. Oct., 1972 REF. N° SH. 8 F

ENV. 1943(IV)-8



LEGEND

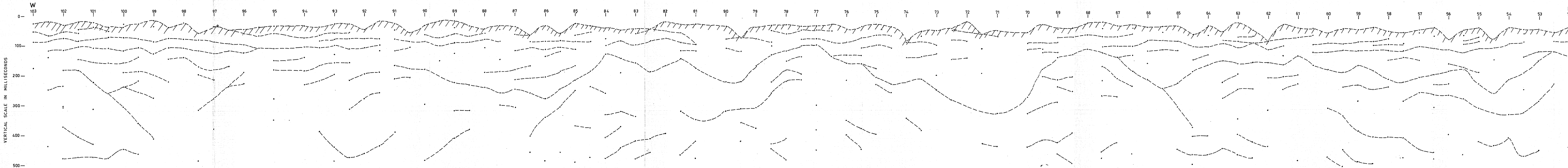
- Location of control refraction spreads
- 10  
|  
6 A Location and No of survey peg at 200ft interval
- 1971-72 Drill holes
- ... Weathered basement surface: geological interpretation
- Two way reflexion
- /// Weathered basement surface raw reflexion results
- R Refraction

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L.J. STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)  
Line C  
DISTANCE-TIME SECTIONS

To accompany report by L. J. STARKEY

DRAWN: J. H. Oct., 1972 REF. No SH. 9A



# LEGEND

- Location of control refraction spreads
- 10  
|  
6A  
|  
1971-72 Drill holes
- Weathered basement surface: geological interpretation
- Two way reflexion
- /// Weathered basement surface raw reflexion results
- R Refraction

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J. STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

Line C

DISTANCE-TIME SECTIONS

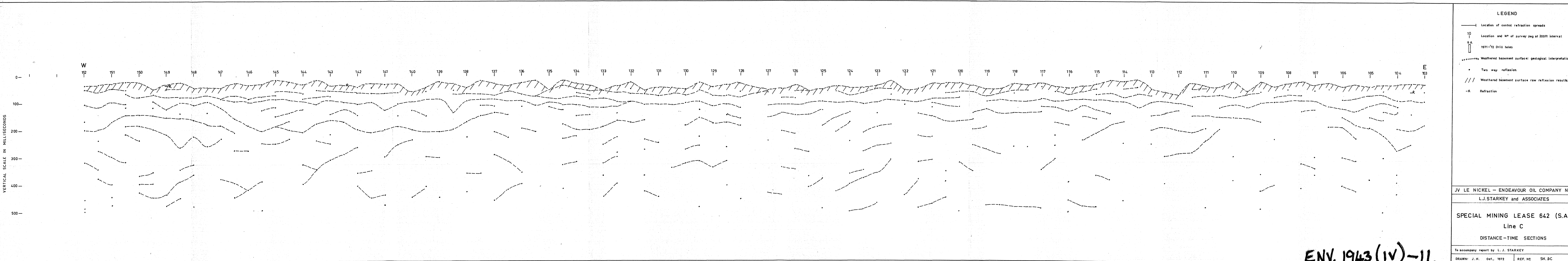
To accompany report by L. J. STARKEY

DRAWN: J. H. Oct., 1972

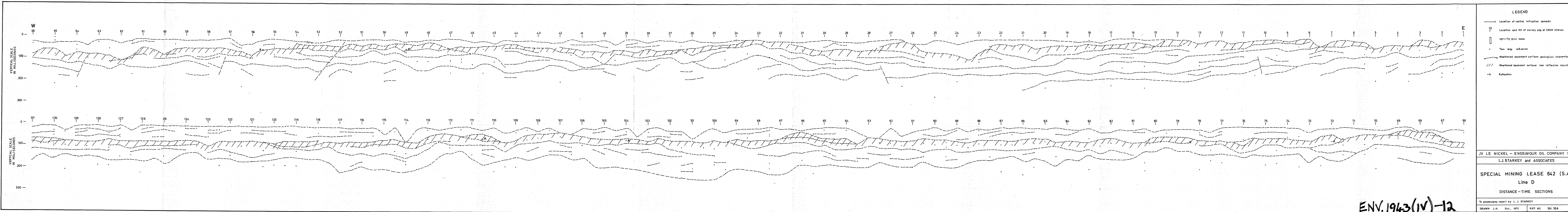
REF. NO SH. 9B

ENV. 1943(IV)-10

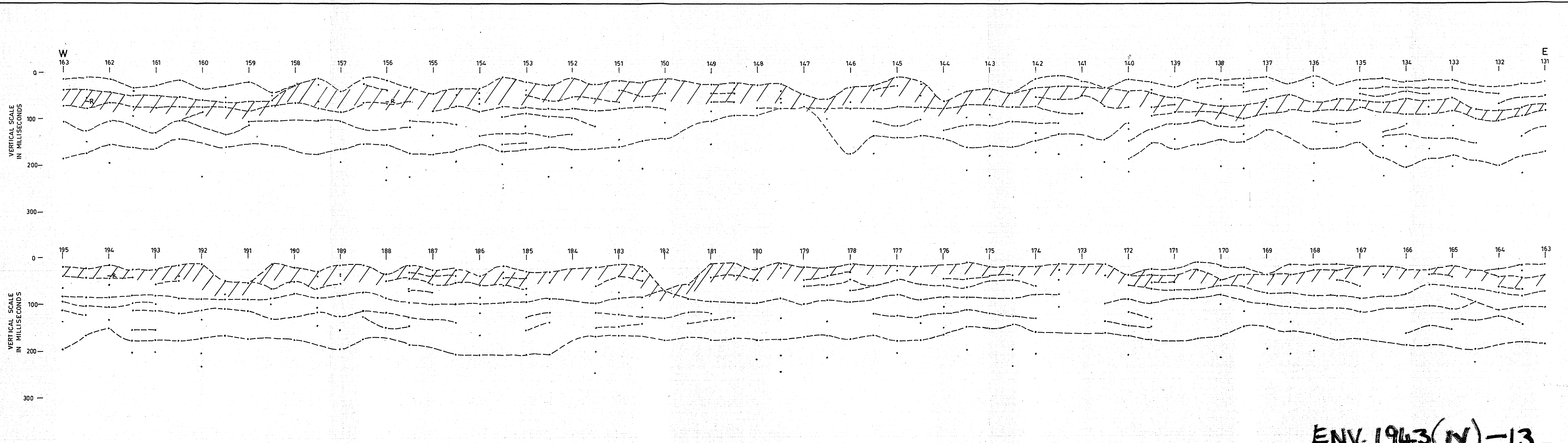




ENV. 1943 (IV)-11



ENV. 1943(IV)-12



**LEGEND**

- Location of control refraction spreads
- 10 Location and N2 of survey peg at 200ft interval
- 6 A 1971-72 Drill holes
- ... Weathered basement surface: geological interpretation
- \* Two way reflexion
- /// Weathered basement surface: raw reflexion results
- R Refraction

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J. STARKEY and ASSOCIATES

**SPECIAL MINING LEASE 642 (S.A.)**

**Line D**

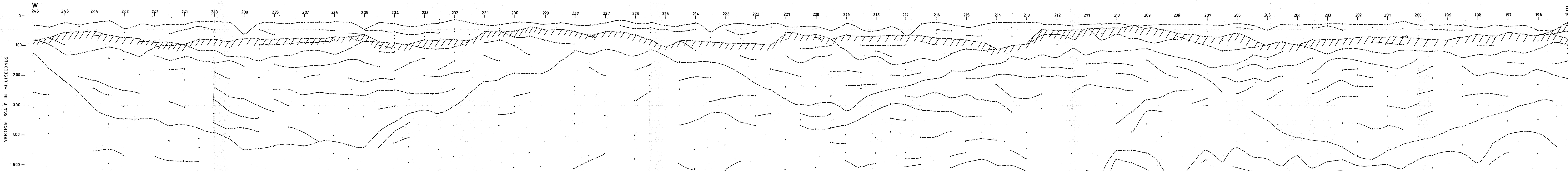
**DISTANCE - TIME SECTIONS**

To accompany report by L.J. STARKEY

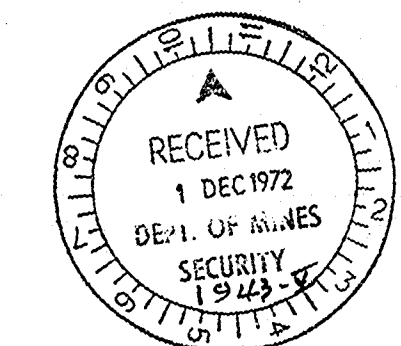
DRAWN: J.H. Oct., 1972 REF. N2 SH. 10B

ENV. 1943(N)-13





- LEGEND
- Location of control refraction spreads
  - 10  
|  
Location and No of survey peg at 200ft interval
  - 6 A  
|  
1971-72 Drill holes
  - Weathered basement surface: geological interpretation
  - Two way reflexion
  - /// Weathered basement surface raw reflexion results
  - R Refraction



JV LE NICKEL — ENDEAVOUR OIL COMPANY N.L.

L.J. STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

Line D

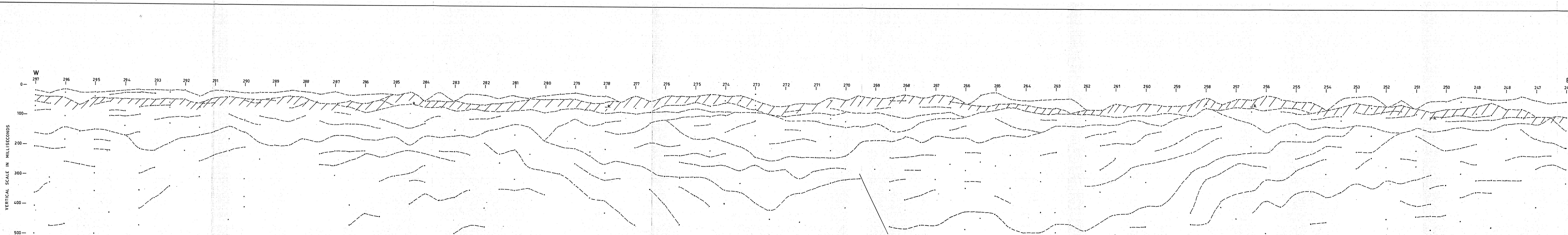
DISTANCE — TIME SECTIONS

To accompany report by L. J. STARKEY

DRAWN: J. H. Oct., 1972 REF. No SH. 10C

ENV. 1943(V)-2





- LEGEND
- Location of control refraction spreads
  - 10  
|  
Location and N° of survey peg at 200ft interval
  - 6 A  
|  
1971-72 Drill holes
  - ..... Weathered basement surface: geological interpretation
  - Two way reflexion
  - /// Weathered basement surface raw reflexion results
  - R Refraction

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J.STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

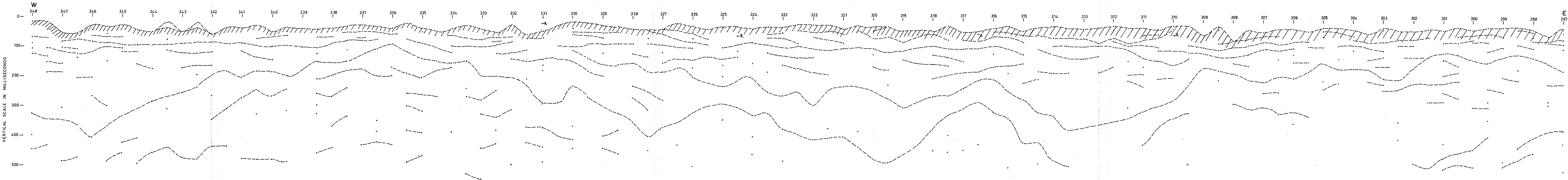
Line D

DISTANCE-TIME SECTIONS

To accompany report by L. J. STARKEY

DRAWN: J. H. Oct., 1972 REF. N° SH.10D

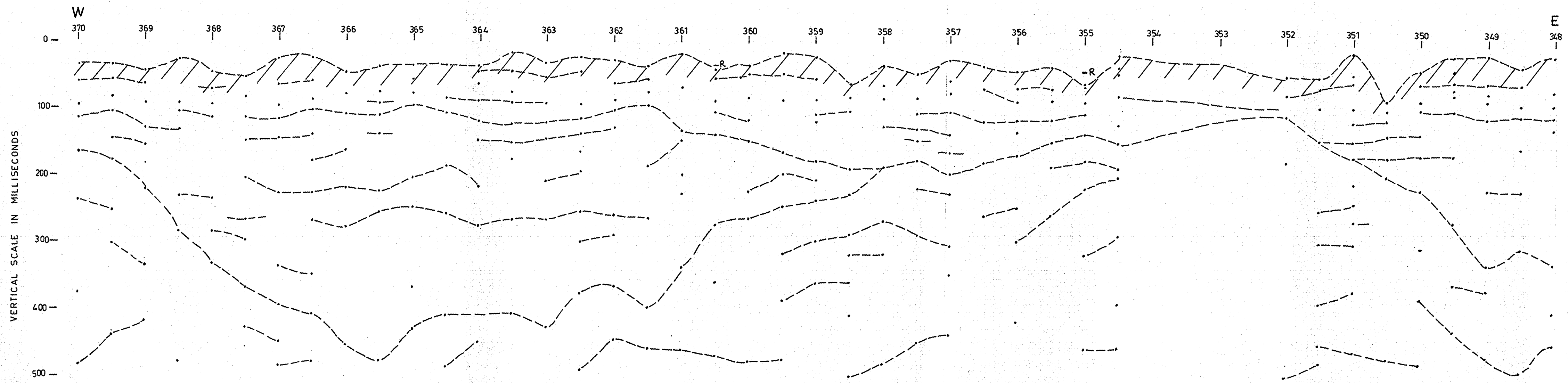
ENV.1943(V)-3



ENV. 1943(V)-4

LEGEND	
	Location of control refraction spreads
	10 Location and No of survey pag at 200ft interval
	6A 1971-72 Drill holes
	Weathered basement surface: geological interpretation
	Two way reflexion
	Weathered basement surface raw reflexion results
	-R Refraction

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.	
L.J. STARKEY and ASSOCIATES	
SPECIAL MINING LEASE 642 (S.A.)	
Line D	
DISTANCE - TIME SECTIONS	
To accompany report by L. J. STARKEY	
DRAWN: J. H. Oct., 1972	REF. No SH. 10E



# LEGEND

- Location of control refraction spreads
- 10 | Location and N° of survey peg at 200ft interval
- 6 A | 1971-'72 Drill holes
- Weathered basement surface: geological interpretation
- Two way reflexion
- /// Weathered basement surface raw reflexion results
- R Refraction

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L.J. STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

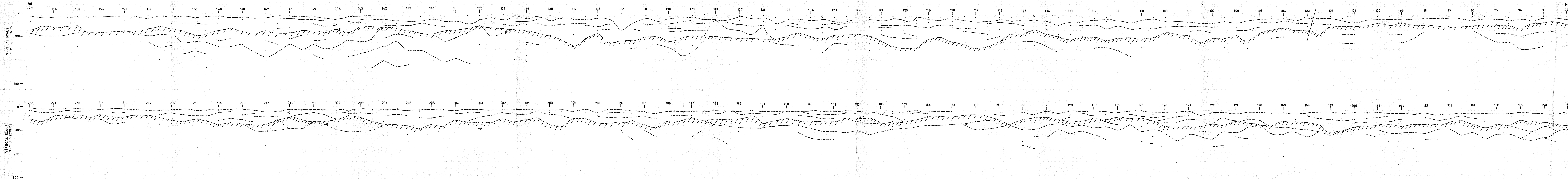
Line D

DISTANCE — TIME SECTIONS

To accompany report by L. J. STARKEY

DRAWN: J.H. Oct., 1972 REF. N° SH. 10F

ENV 1943(V)-5



- LEGEND
- Location of control refraction spreads
  - 10 Location and N2 of survey peg at 200ft interval
  - 6 A 1971-72 Drill holes
  - Weathered basement surface: geological interpretation
  - Two way reflexion
  - /// Weathered basement surface: raw reflexion results
  - R Refraction

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J. STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

Line E

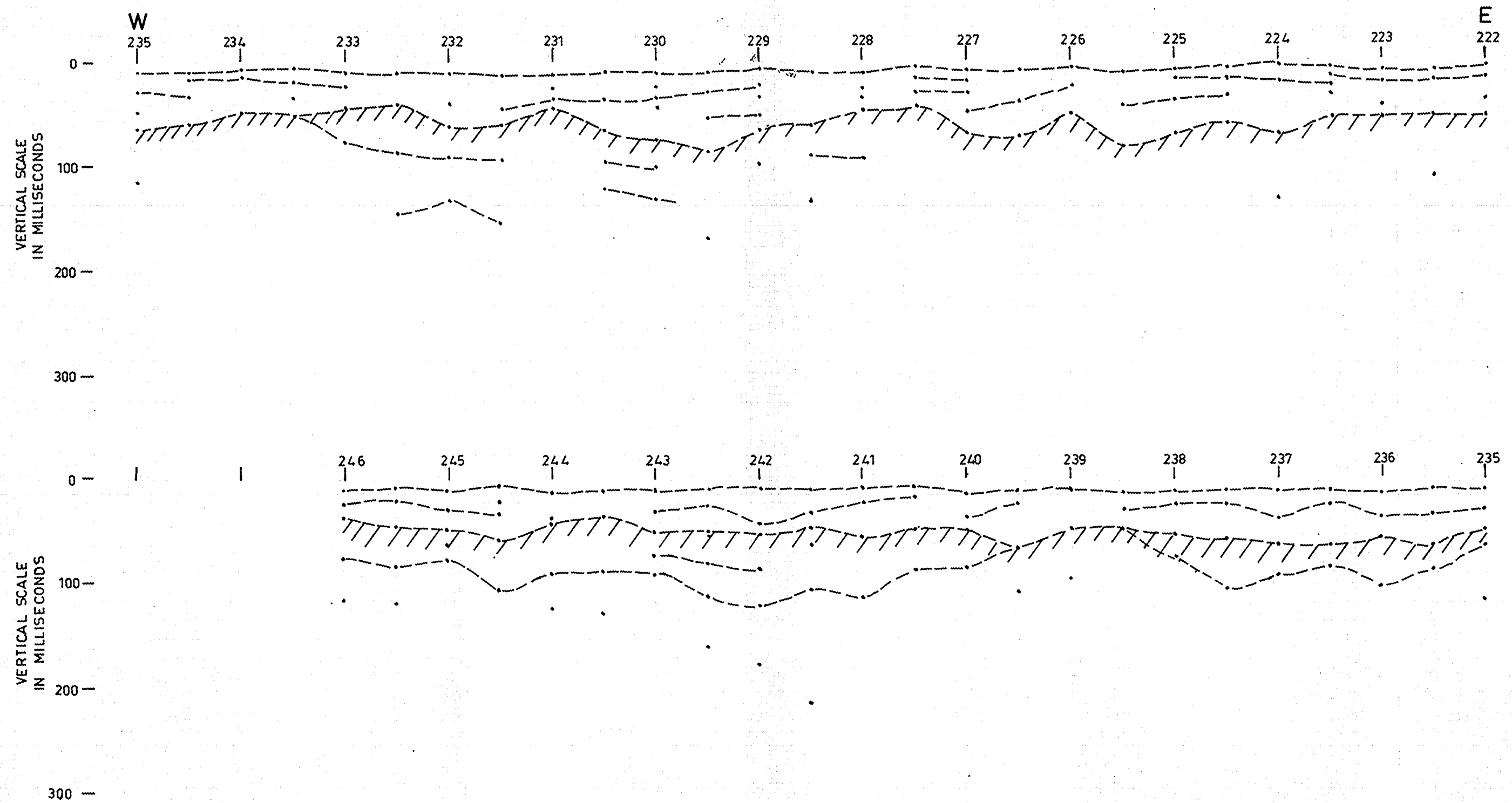
DISTANCE - TIME SECTIONS

To accompany report by L. J. STARKEY

DRAWN: J.H. Oct., 1972 REF. N2 SH. 11A

ENV 1943(V)-6





# LEGEND

- Location of control refraction spreads
- 10 Location and N<sup>o</sup> of survey peg at 200ft interval
- 6 A 1971-72 Drill holes
- Weathered basement surface: geological interpretation
- Two way reflexion
- Weathered basement surface raw reflexion results
- R Refraction

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J. STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

Line E

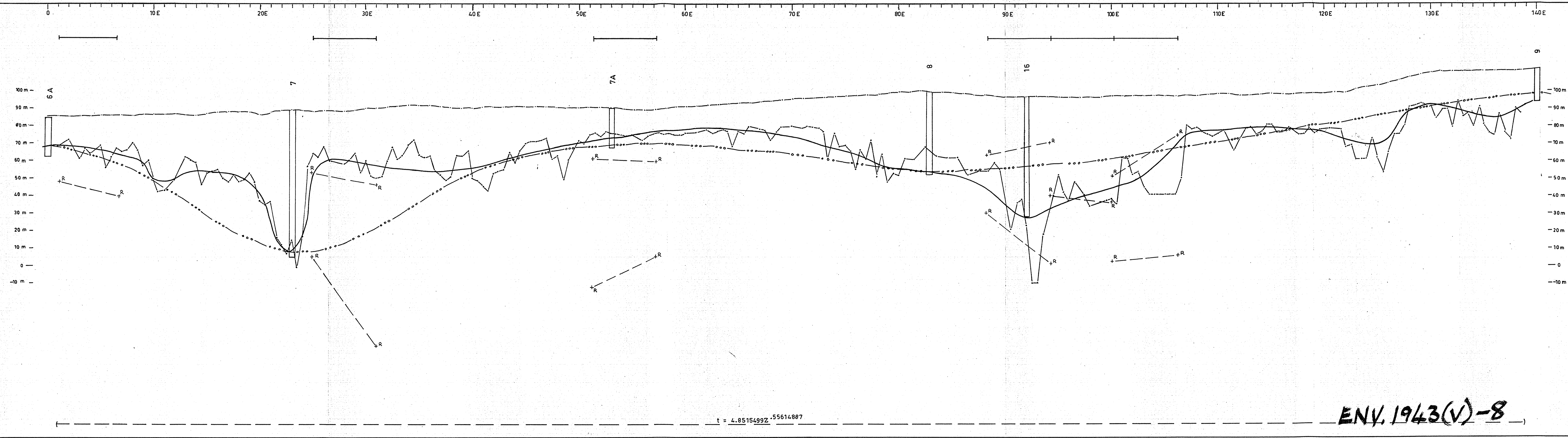
DISTANCE - TIME SECTIONS

To accompany report by L. J. STARKEY

DRAWN: J.H. Oct., 1972

REF. N<sup>o</sup> SH.11 B

ENV.1943(V)-7



**LEGEND**

- Location of control refraction spreads
- 10 Location and N° of survey peg at 200ft interval
- 6 A 1971-'72 Drill holes
- ... Weathered basement surface: geological interpretation
- Weathered basement surface: average reflexion results
- ^ Weathered basement surface raw reflexion results
- +R Refraction
- Natural surface

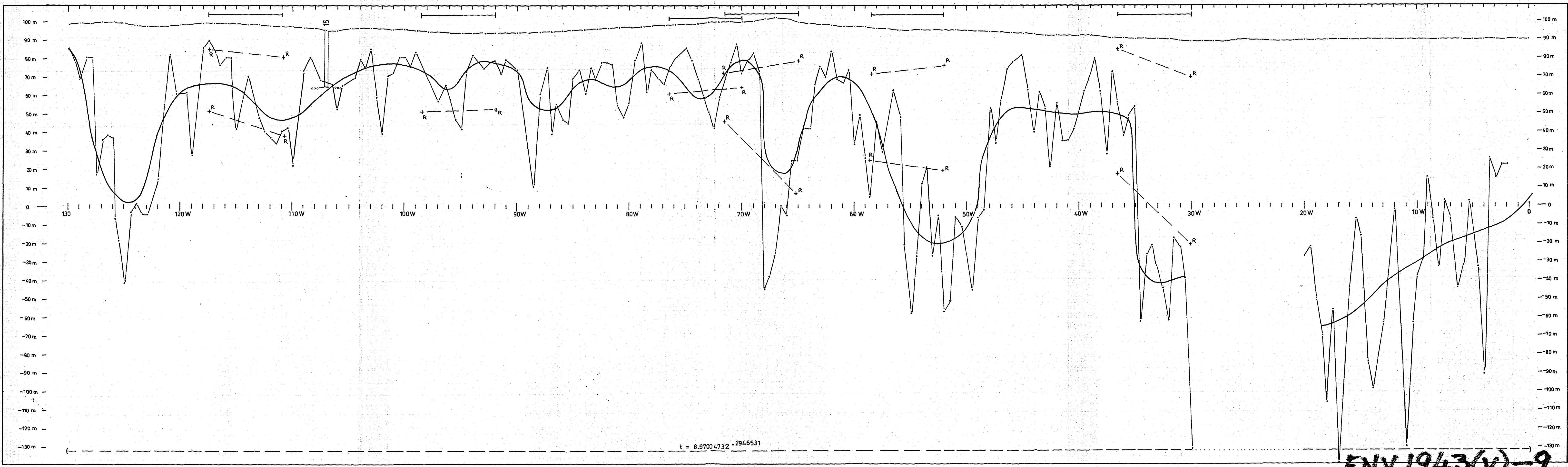
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Horizontal scale :- 1cm to 100m  
( t=1.2 ) Depth conversion equation

JV LE NICKEL — ENDEAVOUR OIL COMPANY N.L.  
L.J.STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)  
Test Line  
WEATHERED BASEMENT PROFILE

To accompany report by L. J. STARKEY

DRAWN: J. H. Oct., 1972 REF. N° SH.12



LEGEND

- Location of control refraction spreads
- Location and N° of survey peg at 200ft interval
- 1971-72 Drill holes
- Weathered basement surface: geological interpretation
- Weathered basement surface: average reflexion results
- Weathered basement surface raw reflexion results
- Refraction
- Natural surface

Vertical scale :- 1cm to 10m

Horizontal scale :- 1cm to 100m

( $t \pm 1.2$ ) Depth conversion equation

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J.STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

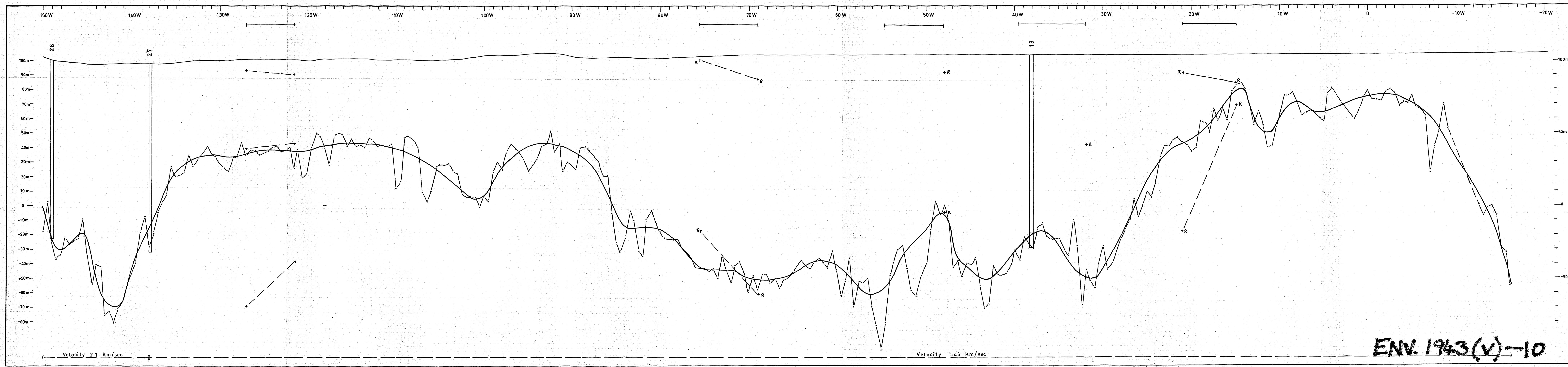
Line A

WEATHERED BASEMENT PROFILE

To accompany report by L. J. STARKEY

DRAWN: J.H. Oct., 1972 REF. No SH.13

ENV 1943(v)-9



**LEGEND**

- Location of control refraction spreads
- 10 | Location and No of survey peg at 200ft interval
- 6 A | 1971-72 Drill holes
- ... Weathered basement surface: geological interpretation
- Weathered basement surface: average reflexion results
- - - Weathered basement surface raw reflexion results
- +R Refraction
- Natural surface
- Vertical scale :- 1cm to 10m
- Horizontal scale :- 1cm to 100 m
- 1.4 Km/sec Depth conversion velocity

JV LE NICKEL — ENDEAVOUR OIL COMPANY N.L.  
L.J. STARKEY and ASSOCIATES

**SPECIAL MINING LEASE 642 (S.A.)**  
**Line B**

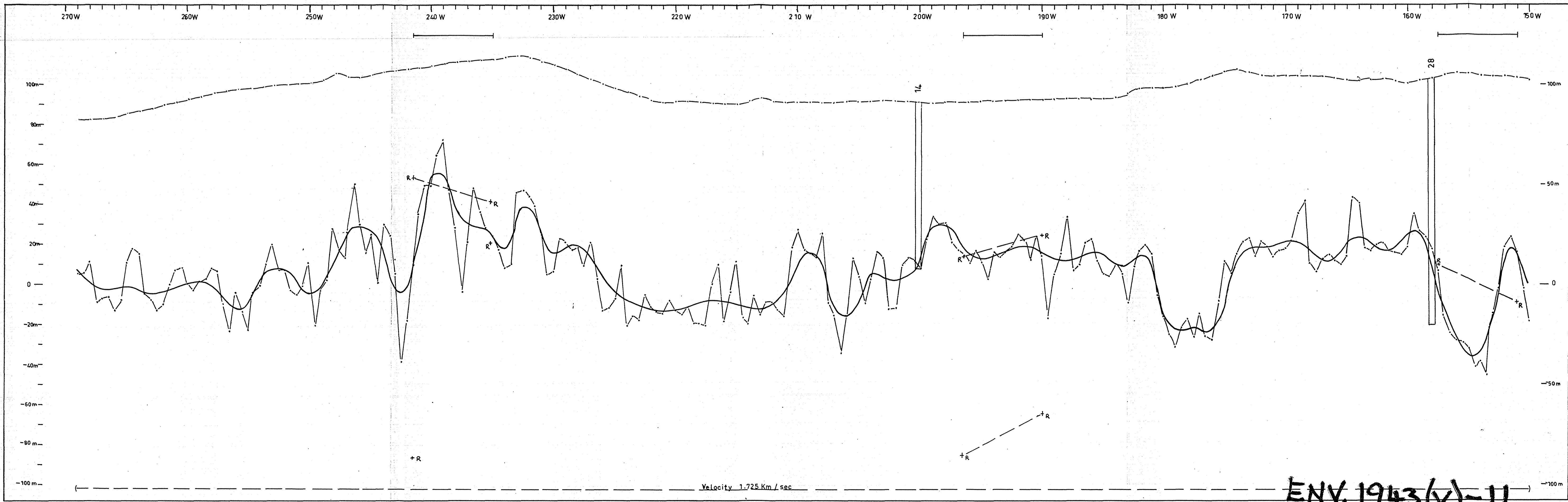
**WEATHERED BASEMENT PROFILE**

To accompany report by L. J. STARKEY

DRAWN: J.H. Oct., 1972 REF. No SH. 14 A

**ENV. 1943(V)-10**





**LEGEND**

- Location of control refraction spreads
- 10 Location and N° of survey peg at 200ft interval
- 6 A 1971-'72 Drill holes
- Weathered basement surface: geological interpretation
- Weathered basement surface: average reflexion results
- ^ Weathered basement surface raw reflexion results
- +R Refraction
- Natural Surface

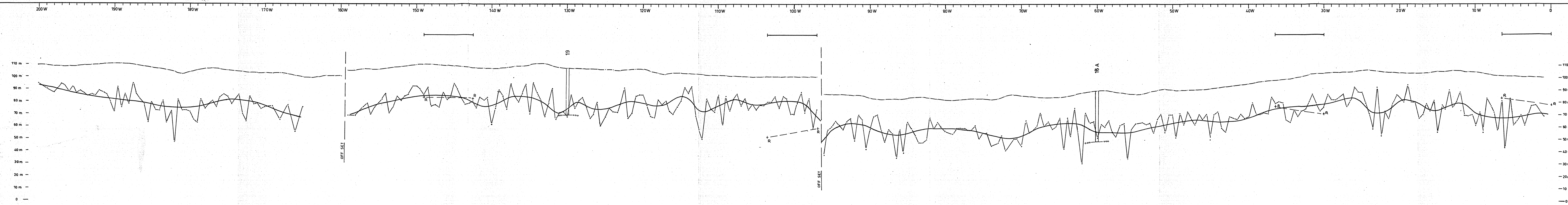
Vertical scale :- 1cm to 10m  
Horizontal scale :- 1cm to 100m  
1.7 Km/sec Depth conversion velocity

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.  
L.J. STARKEY and ASSOCIATES

**SPECIAL MINING LEASE 642 (S.A.)**  
**Line B**  
**WEATHERED BASEMENT PROFILE**

To accompany report by L. J. STARKEY

DRAWN: J. H. Oct., 1972 REF. N° SH. 14 B



- LEGEND
- Location of control refraction spreads
  - 10 | Location and N° of survey peg at 200ft interval
  - 6 A | 1971-72 Drill holes
  - ~ Weathered basement surface: geological interpretation
  - Weathered basement surface: average reflexion results
  - ^ Weathered basement surface raw reflexion results
  - +R Refraction
  - Natural surface
- Vertical scale :- 1cm to 10m  
Horizontal scale :- 1cm to 100m  
(t=1.2) Depth conversion equation

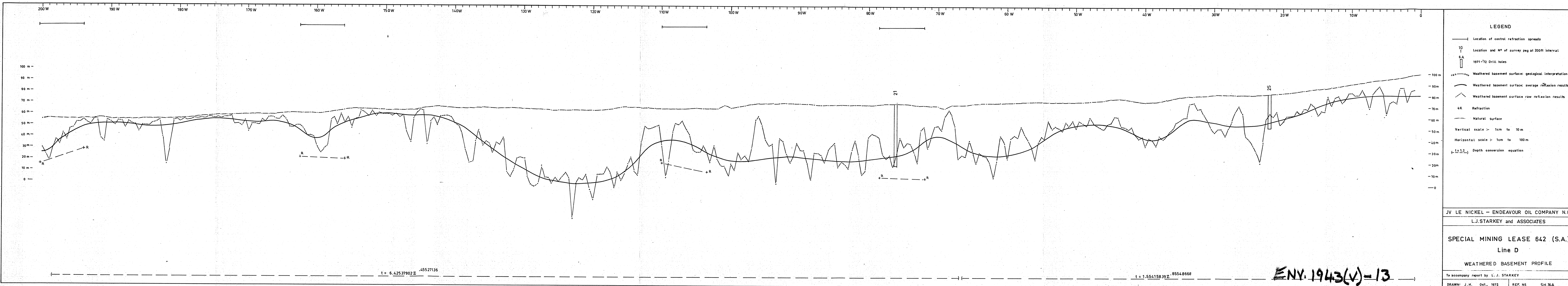
JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.  
L.J.STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)  
Line C  
WEATHERED BASEMENT PROFILE

To accompany report by L. J. STARKEY  
DRAWN: J. H. Oct., 1972 REF. N° SH. 15

t = .50665033 Z 1.06530717

ENY.1943(v)-12



LEGEND

- Location of control refraction spreads
- Location and N° of survey peg at 200ft interval
- 1971-72 Drill holes
- Weathered basement surface: geological interpretation
- Weathered basement surface: average reflexion results
- Weathered basement surface raw reflexion results
- Refraction
- Natural Surface

Vertical scale : 1cm to 10m  
Horizontal scale : 1cm to 100m  
Depth conversion equation

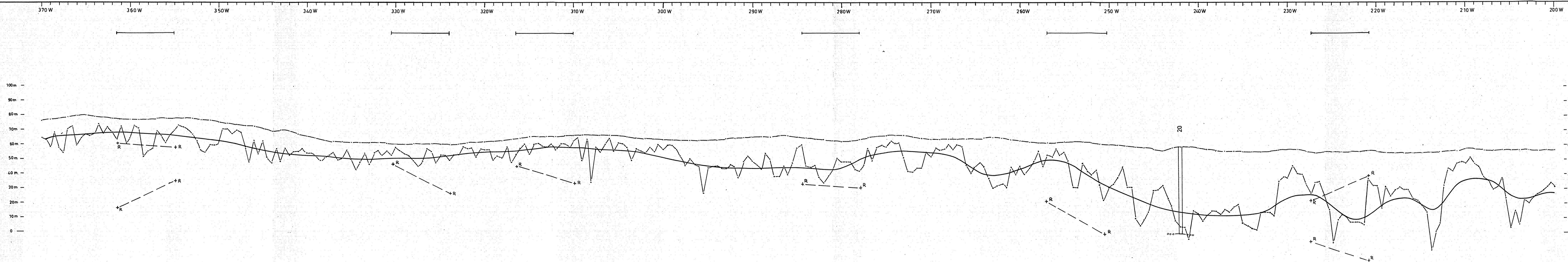
JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.  
L.J. STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)  
Line D

WEATHERED BASEMENT PROFILE

To accompany report by L. J. STARKEY

DRAWN: J. H. Oct., 1972	REF. N°	SH. 16A
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- LEGEND
- Location of control refraction spreads
  - Location and No of survey peg at 200ft interval
  - 1971-'72 Drill holes
  - Weathered basement surface: geological interpretation
  - Weathered basement surface: average reflexion results
  - Weathered basement surface raw reflexion results
  - +R Refraction
  - Natural surface
  - Vertical scale :- 1cm to 10 m
  - Horizontal scale :- 1cm to 100m
  - Depth conversion equation

JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.

L.J.STARKEY and ASSOCIATES

SPECIAL MINING LEASE 642 (S.A.)

Line D

WEATHERED BASEMENT PROFILE

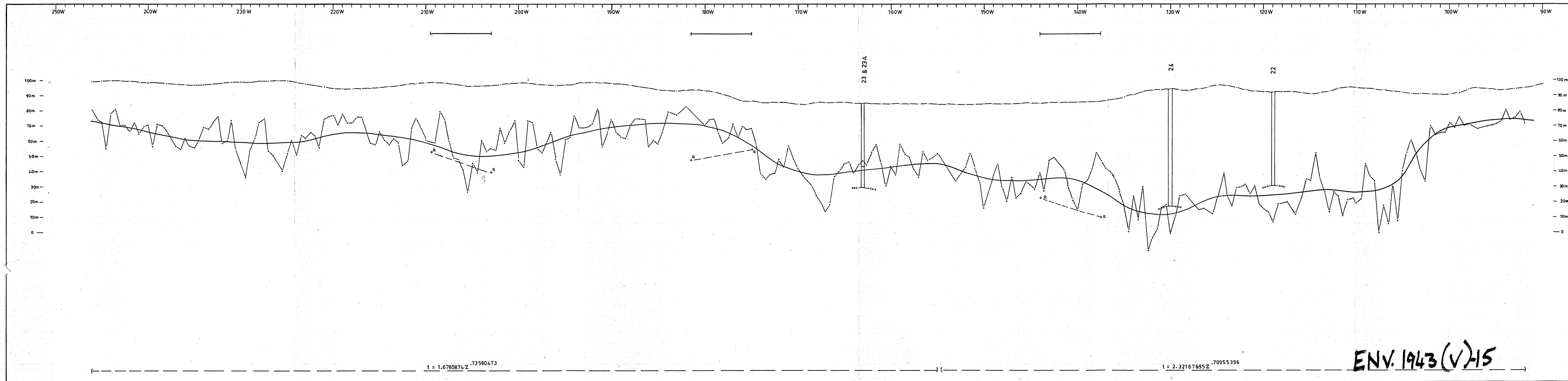
To accompany report by L. J. STARKEY

DRAWN: J. H. Oct., 1972 REF. No SH.16B

t = 3.5312 45922 62772710

ENV.1943(V)-14





**LEGEND**

- Location of control refraction spreads
- 10  
|  
6 A  
| Location and N° of survey peg at 200ft interval
- 1971-72 Drill holes
- Weathered basement surface: geological interpretation
- Weathered basement surface: average reflexion results
- Weathered basement surface raw reflexion results
- +R Refraction
- Natural surface
- Vertical scale :- 1cm to 10m
- Horizontal scale :- 1cm to 100m
- (1 ± 1.2) Depth conversion equation

JV LE NICKEL — ENDEAVOUR OIL COMPANY N.L.

L.J.STARKEY and ASSOCIATES

**SPECIAL MINING LEASE 642 (S.A.)**

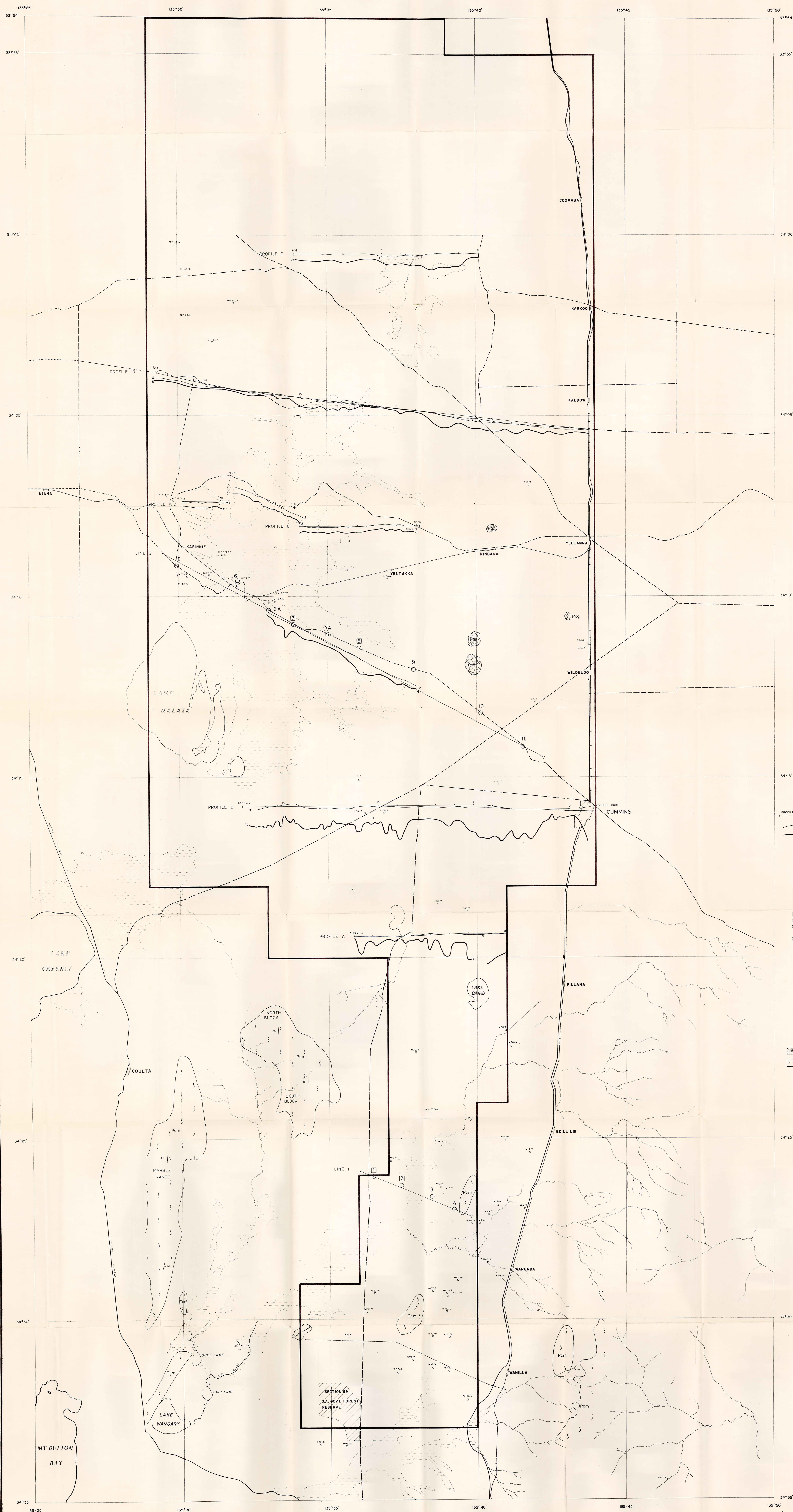
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**WEATHERED BASEMENT PROFILE**

To accompany report by L. J. STARKEY

DRAWN: J. H.	Oct., 1972	REF. N°	SH.17
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1972 SEISMIC PROGRAMME

PROFILE A  
Seismic profile location

Surface

Bedrock

1971 DRILLING PROGRAMME


1

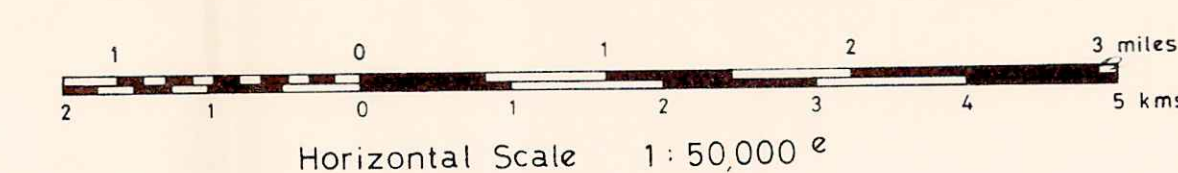
- ☐ Rotary drill hole
- ☒ Rotary drill hole — side wall sampled
- ☒ Rotary drill hole with mineralisation




1972 DRILLING PROGRAMME

## GEOLOGY

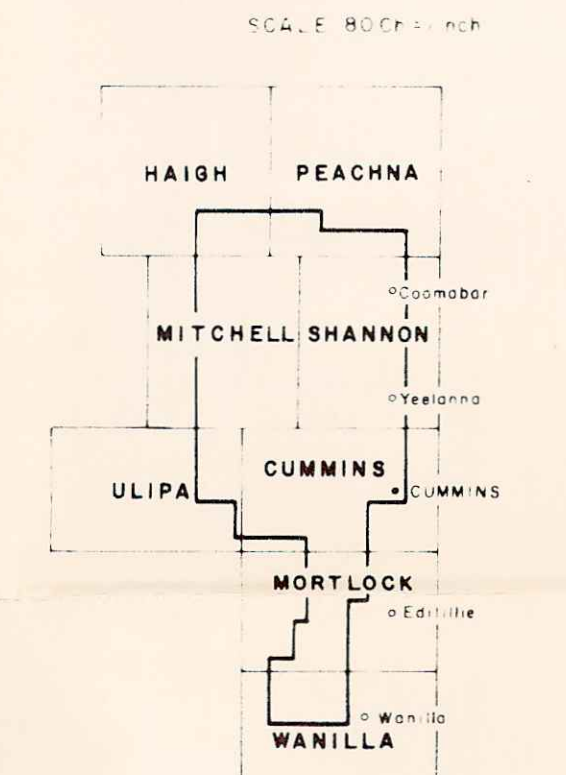
 Precambrian granite outcrop

 Precambrian metamorphics outcrop

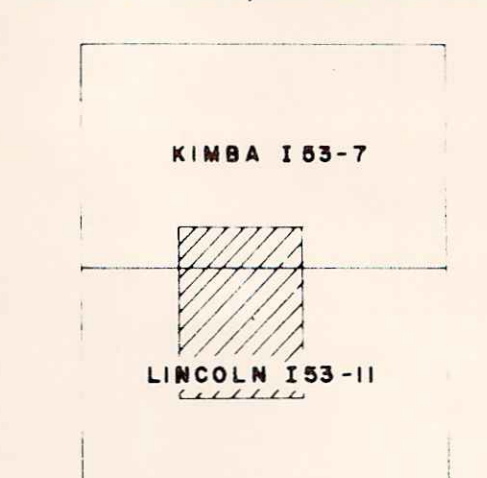


Road - sealed	
Road - unsealed	
Railway, station	
Built up area	
Water bore	
Water well	

INDEX TO PLANS OF THE HUNDREDS



INDEX TO 1:250,000 SERIES MAPS



JV LE NICKEL - ENDEAVOUR OIL COMPANY N.L.  
URANIUM PROJECT 05/30

SPECIAL MINING LEASE 642 (S.A.)

SEISMIC BEDROCK PROFILES

To accompany report by L. J. STARKEY

SH. 18

ENV. 1943(v)-1



nine hundred and seventy-two BETWEEN LE NICKEL (AUSTRALIA)

EXPLORATION PTY. LTD. a company incorporated in the State of Victoria and having its registered office at 24 Collins Street Melbourne in the said State (hereinafter called "LNE") and

ENDEAVOUR MINERALS NO LIABILITY a company incorporated in the State of Victoria and having its registered office at 232 Victoria Parade East Melbourne in the said State (hereinafter called

"Endeavour") WHEREAS Endeavour has carried out certain exploration work in respect of the Exploration Area described in the

Schedule to this Agreement AND WHEREAS the parties hereto

desire to establish a joint venture to carry out further exploration and development work with respect to the said Exploration Area all on the terms and conditions hereinafter set forth;

NOW THEREFORE in consideration of the premises and of the mutual covenants and agreements hereinafter set forth the parties hereto hereby agree as follows :-

#### PART 1 - DEFINITIONS

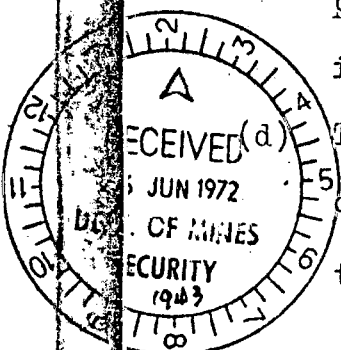
1. Unless the context otherwise requires the terms defined in this Clause 1 shall for all purposes of this Agreement have the meanings specified in this Clause 1 and all references to Clauses shall be deemed to refer to Clauses of this Agreement.

(a) The term "Administrative Committee" means a committee organised pursuant to Part 3 of this Agreement.

(b) The term "Associated Company" means with respect to any Participant any corporation deemed to be related to such Participant under Section 6 of the Companies Act 1961 of the State of Victoria.

(c) The term "Contribution Proportion" means with respect to any Participant at any particular time the percentage determined in accordance with Clause 7 representing the percentage of funds which at such time such Participant is obligated or entitled to contribute to the Joint Venture.

(d) The term "the Entity" means the legal entity to be used for commercial exploitation and organised pursuant to Part 3 of this Agreement.



- (e) The term "Exploration Area" means the area covered by the Mining Title and described in the Schedule to this Agreement as such area may be changed by mutual agreement between the parties hereto in accordance with Clause 5 (in which case the Schedule shall be changed accordingly).
- (f) The term "Joint Venture" means the Joint Venture established pursuant to Clause 2.
- (g) The term "Manager" means the person firm or corporation which shall at the particular time be the manager of the Joint Venture pursuant to Clause 4 (a).
- (h) The term "Mining Title" means the Mining Title referred to in the Schedule hereto as same may be varied or amended.
- (i) The term "Participant" means at any particular time a person firm or corporation which then has a Participating Interest in the Joint Venture pursuant to Clause 6.
- (j) The term "Participating Interest" means with respect to any Participant at any particular time the fraction expressed as a percentage figure determined in accordance with Clause 6 which at such time represents the interest of such Participant in the Joint Venture and the Mining Title.

## PART 2 - ESTABLISHMENT AND OBJECT OF THE JOINT VENTURE

2. The parties hereto hereby establish the Joint Venture effective from the First day of July One thousand nine hundred and seventy-two (hereinafter called "the commencement date") for the purpose of carrying out exploration work and if commercially feasible exploitation of all mineral substances covered by the mining titles to the Exploration Area except that Endeavour retains the sole right, at all times, to explore for and exploit any kaolin clay ore in the Exploration Area. Endeavour undertakes that, in exploring for and exploiting such kaolin clay ore it will not jeopardise the exploration for or the mining or extraction of other minerals from the Exploration Area.

## PART 3 - ADMINISTRATIVE COMMITTEE

3. (a) An Administrative Committee will be designated within one month following the signing of the present Agreement. The



Administrative Committee shall consist of 4 persons -

2 members designated by LNE and their alternates

2 members designated by Endeavour and their alternates.

Two members (one designated by LNE and one designated by Endeavour) present in person or alternate or by proxy shall be a quorum for the meetings of the Administrative Committee. The chairman of the meeting of the Administrative Committee shall be a representative of LNE. The Administrative Committee will act during the exploration period and will make decisions concerning the exploration programmes, the budgets and the results of the different exploration activities. The decisions of the Administrative Committee must be agreed to by a majority vote. In the event that the parties' Participating Interest shall change then the composition of the Administrative Committee shall be varied to reflect such change. For the purposes of such change a Participating Interest of 25% shall entitle a Participant to appoint one member to the Administrative Committee.

(b) Until LNE has contributed the sum of \$50,000 to the Joint Venture the Participants shall each have two votes. Thereafter each Participant shall have a vote at any such meeting equal to its then Contribution Proportion. Each Participant shall cast its votes as a block exercisable by one only of its representatives present at such meeting.

#### PART 4 - MANAGEMENT OF THE VENTURE

4. (a) The manager for the exploration stage of the Joint Venture shall be LNE or as otherwise determined by the Administrative Committee and shall act subject to the terms and conditions set out in this Part 4. All such work shall be carried out at cost i.e. without any fees or other amounts representing profit to the Manager. It is understood however that the costs and expenses incurred for the account of the Joint Venture shall include in addition to costs and expenses directly allocable thereto general administrative and overhead expenses of the Manager properly allocable thereto.

(b) The manager undertakes to explore the area in accordance with good exploration practice and in conformity with the terms and conditions of the Mining Title covering the Exploration Area.

5. (a) The manager will have all necessary powers to act on behalf of the Venture within the scope of the provisions of Clause 4 hereinabove. The manager shall prepare and submit to the Administrative Committee programmes and budgets on an annual basis (or on such other basis as the Administrative Committee may direct) and in reasonable detail covering further work to be carried out with respect to the Exploration Area during the period to which such programmes and budgets relate. Any such programme and budget may recommend that related additional areas be included in the Exploration Area and that other areas included in the Exploration Area be surrendered or abandoned. Any such programme and budget (as the same shall be revised in accordance with requests made by the Administrative Committee) that shall be approved by the Administrative Committee shall be final and binding on the manager and the Participants and the manager shall to the extent of the funds contributed to the Joint Venture as hereinafter provided promptly proceed to carry out such work as set forth in such approved programme and budget. Each such approved budget shall specify the aggregate amount of costs and expenses covered thereby. In no event shall the manager incur for the account of the Joint Venture any costs or expenses otherwise than in conformity with programmes and budgets that shall have been approved as provided in this Clause 5. The manager will furnish to each of the Participants progress reports on a monthly basis (or on such other basis as the Administrative Committee may prescribe) with respect to exploration carried out pursuant to approved programmes and budgets. The costs and expenses incurred for the account of the Joint Venture shall be subject to audit (on an annual basis and at such other times as the Administrative Committee may determine) with respect to compliance with the provisions of this Agreement by a firm of

Chartered Accountants who are auditors of the manager and the cost of such audit with respect to any period shall constitute an expense properly incurred by the Joint Venture in carrying out exploration for the period in which such audit is made.

(b) The non-managing Participants shall have the right at all reasonable times to inspect the Exploration Area to observe the conduct of exploration hereunder and to have access to all maps geological geophysical and geochemical data trenching and drill hole data analyses surveys records reports and other information and data relating to such Area that the manager shall have or develop but such inspection shall not interfere with the manager's operation. During the period commencing with the date of this Agreement and ending two years after the termination of the Joint Venture each of the parties to this Agreement shall treat all such information and data as confidential and shall not without the prior written consent of the other Participant or of an Exploitation Entity organised pursuant to Part 8 of this Agreement disclose any of such information or data to any third party except to the extent required for compliance with applicable laws and with applicable rules regulations and orders of a governmental instrumentality or stock exchange having jurisdiction; Provided However that in the case of a proposed sale assignment or other disposition in accordance with Clause 20 the Disposing Party may to the extent allowed by the prior written consent of the other Participant which consent will not be unreasonably withheld disclose information or data to the prospective transferee. Nothing in this Clause 5 (b) shall be deemed to impose any restrictions with respect to disclosure of such information to any entity formed to undertake commercial exploitation of the Exploration Area.

#### PART 5 - PARTICIPATING INTEREST AND CONTRIBUTION PROPORTION

6. (a) The parties acknowledge that Endeavour has

expended \$30,000 on the Exploration Area and at the commencement date Endeavour will have a Participating Interest of 100%.

LNE may acquire a Participating Interest of 50% by contributing the sum of \$50,000 to the Joint Venture for expending on the Exploration Area and in addition by paying direct to Endeavour a sum of \$15,000 to reimburse it for one half of Endeavour's exploration expenses. When the amount of \$50,000 has been contributed by LNE to the Joint Venture and the said sum of \$15,000 has been paid to Endeavour, the Participating Interest of the Participants will be adjusted to the following :-

<u>Name of Participant</u>	<u>Participating Interest</u>
LNE	50%
Endeavour	50%

(b) The Participating Interest of each Participant

shall thereafter be subject to automatic adjustment so that at any particular time the Participating Interest of any Participant shall be a fraction whose numerator shall be the number of dollars contributed or deemed to be contributed to the Joint Venture by such Participant and whose denominator shall be the number of dollars contributed or deemed to be contributed to the Joint Venture by or on behalf of all Participants pursuant thereto. At the date upon which LNE acquires a Participating Interest of 50% and Endeavour's Participating Interest is adjusted to 50% the parties acknowledge that Endeavour will be deemed to have contributed \$50,000 to the Joint Venture and LNE will be deemed to have contributed \$50,000 to the Joint Venture.

7. The Participants will make contributions to the Joint Venture as follows :-

(a) LNE will contribute not less than \$35,000 before the 31st day of December, 1972 to be expended on the Exploration Area.

(b) On or before the 31st day of December, 1972 LNE shall elect whether to continue as a Participant in the Joint Venture. Such election shall be by notice in writing.

and shall be served upon Endeavour in accordance with the terms hereof. If LNE elects to continue it shall thereupon be bound to contribute a total of \$50,000 to the Joint Venture to be expended on the Exploration Area and to pay forthwith to Endeavour direct \$15,000 to reimburse it for one-half of Endeavour's previous exploration expenses. In computing the said sum of \$50,000 all monies contributed by LNE to the Joint Venture pursuant to Clause 7 (a) shall be counted. If LNE elects not to continue then the Joint Venture shall cease and determine forthwith but without affecting the parties accrued rights and liabilities at that date.

(c) The Contribution Proportion of each Participant shall be applicable with respect to contributions required to be made to the Joint Venture to provide for costs and expenses covered by the programmes and budgets approved by the Administrative Committee pursuant to Clause 5. After LNE has made an election to continue pursuant to Clause 7 (b) and has contributed the said sum of \$50,000 to the Joint Venture the Contribution Proportions of the parties with respect to the following programmes and budgets shall be as follows :-

<u>Name of Participant</u>	<u>Contribution Proportion</u>
LNE	50%
Endeavour	50%

At the end of any programme and budget either Participant may elect to reduce its Contribution Proportion to the next programme and budget but once such election is made the Participant making same shall have no right without the consent of the other Participant to restore its Contribution Proportion to its previous level.

8. Except as otherwise determined by the Administrative Committee all funds required to be contributed under Clause 7 shall be paid to the Manager for the account of the Joint Venture according to the needs and upon request of the Manager, after approval of the applicable programme and budget.

9. No Participant shall have the right to oppose the continuation of exploration works on the exploration area and the only action it shall be entitled to take is to reduce its Contribution Proportion pursuant to Clause 7 (c).

10. A Participant shall be obligated to withdraw from the Joint Venture if its Participating Interest falls below two per centum. Effective as of the date of such withdrawal the Participating Interest and the Contribution Proportion if any of such withdrawing Participant shall terminate and the Participating Interest and Contribution Proportion of the remaining Participant shall be rateably increased. The withdrawal of any Participant shall not relieve any party of any obligation or liability accrued prior to the date of withdrawal.

#### PART 6 - INTERRUPTION OF EXPLORATION AND EVENTUAL RESUMPTION

11. The decision to stop temporarily the exploration works must be agreed to by a Participant or Participants holding in excess of a sixty per centum Participating Interest. Each of the Participants will always have the right, subsequently, to demand resumption of the works. In order to do this, it must notify its intention to the other Participant, such notification will result, within 30 days following the mailing of this notification, in the calling by the Manager of an Administrative Committee meeting. Should the Participants not come to an agreement at the Administrative Committee meeting in regard to the resumption of the works, the Participant who requested the resumption of the works can proceed but at its expense.

#### PART 7 - PERMANENT ABANDONMENT OF EXPLORATION DECIDED BY MUTUAL AGREEMENT

12. The Joint Venture shall terminate upon a unanimous determination by the Administrative Committee not to carry out any further exploration nor to proceed with exploitation with respect to the Exploration Area and in the event of such termination the following provisions shall apply -

- (i) the termination of the Joint Venture shall not relieve any Participant of any obligation or liability accrued prior to the date of termination;

9.

- (ii) all unexpended funds arising from contributions made pursuant to Clause 7 shall promptly be distributed to the Participants actually making such contributions pro rata according to the respective amounts actually contributed by them;
- (iii) any consideration received by the Joint Venture in connection with any sale or other disposition of the Exploration Area shall be distributed to the Participants pro rata according to their respective Participating Interests on the date of such sale or other disposition;
- (iv) all plant or equipment the property of the Joint Venture at the time of the determination of the same and purchased with funds contributed therein shall be sold or otherwise disposed of and the proceeds of such sale or other disposal shall be distributed to the Participants pro rata according to their respective Participating Interests on the date of such sale or other disposition;
- (v) the Participants will be entitled to a preference before third parties in the purchase of the assets of the Joint Venture. As between Participants the Participant with the largest Participating Interest shall take precedence.

#### PART 8 - MINING AREA

13. Unless and to the extent that the Administrative Committee shall otherwise determine all prospecting permits temporary reserves licence concessions leases mining tenements rights to mine and other mineral rights with respect to the Exploration Area shall be the property of the Joint Venture and held in the name of the Participants. In case of discovery and of formation of an entity for exploitation the said titles and rights covering the mining area will be transferred to the exploitation entity.

#### PART 9 - COMMERCIAL EXPLOITATION

14. In the event that a Participant with a Participating Interest of not less than 40% considers that the Exploration Area contains an orebody or orebodies (hereinafter called "the

10.

orebody") of sufficient grade and tonnage to warrant commercial exploitation such Participant shall have the right to require the Joint Venture to proceed to commercial exploitation of the orebody Provided That such Participant can establish that there is a reasonable expectation of a rate of return on capital invested (including monies expended on exploration) of not less than fifteen per centum per annum over the life of the mine calculated on a discounted cash flow basis. In determining the return royalties direct taxes on extraction or sale and income tax shall be deducted. In the event that another Participant challenges the figures the matter shall be referred to arbitration in accordance with Clause 22 hereof. If the Participants agree to proceed to commercial exploitation they shall be entitled to such interest as they may agree or failing agreement an interest equal to their then Participating Interests.

15. Subject to Clause 14 being satisfied if one of the Participants does not wish to participate in commercial exploitation or without the consent of the other Participant takes an interest less than its then Participating Interest it shall have no right to oppose commercial exploitation or the manner affecting same in accordance with sound mining practice. The other participant shall however take into account the views of the first mentioned Participant regarding method of exploitation but only so long as the first mentioned Participant retains an interest.

16. The Participant having the largest interest in the commercial exploitation shall after taking into account on a fair and reasonable basis the particular requirements and needs (in particular taxation) of all Participants have the right to designate the form of legal entity to be used which the Participants acknowledge could be any one of a Joint Venture, a partnership or a corporation (the relevant one of which is hereinafter called "the entity").

17. The management body of the entity will be constituted in such a way that the contribution of each of the Participants



to the entity is reflected. The decisions of the management body will be taken by a majority vote.

18. The Participants in this exploration Joint Venture will transfer to the entity at cost the mining titles covering the orebody and all other rights and titles ancillary thereto namely exploration works and expense of the Venture. The entity will be under no obligation to pay for these in cash but will, if the entity is a company, issue fully paid shares for same at par or will, if the entity is a Joint Venture or partnership, credit the transferors as may be agreed or failing agreement as may be determined by arbitration in accordance with Clause 22 hereof.

#### PART 10 - DEFAULT

19. (a) In the event that either Participant ("the defaulting Participant") shall commit a breach of this Agreement and fail to remedy such breach within 60 days from the date of notice in writing from the other Participant ("the non-defaulting Participant") requiring it to remedy such breach the non-defaulting Participant may forthwith terminate the Joint Venture by written notification to the defaulting Participant. Upon such termination the Joint Venture including the mining rights shall become the sole property and responsibility of the non-defaulting Participant it being the intent that the defaulting Participant shall thereafter have no right claim or interest in the Joint Venture or against the non-defaulting Participant except as provided in Clause 19 (b).

(b) The defaulting Participant shall not be relieved or discharged from any obligation or liability imposed on it as a Participant in the Joint Venture as a result of or arising from the activities of the Joint Venture prior to the termination of the Joint Venture as provided in Clause 19 (a) but the defaulting Participant shall be indemnified by the non-defaulting Participant against all actions suits claims costs and demands of every description whatsoever made or brought against it by third parties and arising directly or indirectly from the carrying on by

the non-defaulting Participant of the business of the Joint Venture subsequent to the termination of the Joint Venture.

#### PART 11 - TRANSFER OF PARTICIPATING INTERESTS

20. All transfers to third parties of Participating Interests in the Joint Venture at the exploration stage require the unanimity of the Participants, provided that each party will have the right to transfer freely all or part of its Participating Interest to an Associated Company. It is further understood that if the interest of the assignor in a subsidiary or affiliate shall be reduced to below 50%, the assignor shall re-acquire the interest therefor assigned.

21. (a) Each party will have the right to transfer freely all or part of its Participating Interest to an Associated Company. It is further understood that if the interest of the assignor in a subsidiary or affiliate shall be reduced to below 50% the assignor shall re-acquire the interest therefor assigned.

(b) Should any Participant wish to sell, except to an Associated Company, the whole or part of its interest in the exploitation entity, it must first offer to sell such interest to the other Participants, in proportion to their respective Participating Interests, at a price and on conditions to be agreed or settled by arbitration under Clause 22 (if arbitration applies the price shall be the fair market value). If anyone or more of the other Participants are unwilling to purchase at such price and on such conditions the party willing to sell shall then be free to sell such part of its said interests as Participants have refused, to a third party at the same or on a greater price and on the same conditions. The Articles of Association of the exploitation entity shall contain appropriate detailed provisions to cover this arrangement.

#### PART 12 - ARBITRATION

22. All disputes arising in connection with the present contract shall be finally settled under the Rules of Conciliation and Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with the rules.

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The award of the arbitrators shall be final and binding upon the parties. Any such arbitration shall be held in Melbourne and if appropriate the award of the arbitrator may be registered in any court of competent jurisdiction in any country in which it could be duly enforced.

PART 13 - FORCE MAJEURE

23. If either Participant shall be prevented or delayed in performing any of its obligations or the conditions on its part to be performed hereunder by reason of acts of nature, acts of God, acts of enemies, strikes, threat of imminent strike, labour dispute, walkout, fire, flood, explosion, severe weather conditions, forest closure, war, insurrection, requirements or regulations of government, lack of transportation facilities, curtailment of power supply, inability to obtain necessary materials in open markets, economic recession or by any cause not within the control of the Participant affected which by exercise of due diligence such Participant shall not have been able to avoid or overcome, then in such event such failure to perform shall not be deemed to be a breach of this Agreement, but performance shall be deemed suspended for a time equal to the period of disability. The party invoking force majeure shall take all reasonable action to remedy the position and to minimise the loss if any to the other party.

PART 14 - MISCELLANEOUS PROVISIONS

24. The interpretation and enforceability of this Agreement shall be governed by the laws of the State of Victoria.

25. Subject to and in accordance with the provisions of this Agreement (including without limitation the provisions of Clauses 20 and 21) this Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective successors and assigns.

26. Any notice notification advice report or other communication to be given under this Agreement shall be in writing and shall be sufficiently given if personally delivered or mailed by airmail or sent by cable addressed to the Participants at their

addresses herein stated, or to such other address as the party in question may designate by written notice to the other party.

27. Subject to Clause 16 this Agreement shall not be construed for any purpose to give rise to a partnership association or any other relationship in which any of the parties hereto may be liable for the acts or omissions of the other party hereto and the obligations and liabilities of the parties hereto in respect of the Joint Venture shall be several and not joint.

28. This Agreement is subject to the approval of the relevant South Australian government authority where such approval is required being obtained by the Thirtieth day of June One thousand nine hundred and seventy-two or such later date as LNE may designate.

29. LNE shall pay all stamp duties and legal costs associated with the preparation and execution of this Agreement.

30. During the Joint Venture LNE shall maintain in the joint names of LNE and Endeavour insurance covering them jointly and severally against claims for negligence by third parties arising out of LNE's activities in the Exploration Area. Any premiums paid on such insurance policies shall be an expense payable from the Joint Venture funds.

31. Endeavour warrants that the mining title is valid and subsisting and that it is not in default in respect of its obligations under same.

IN WITNESS whereof these presents have been executed the day and year first hereinbefore written.

THE SCHEDULE HEREINBEFORE REFERRED TO:

Exploration Area

The area covered by South Australian Special Mining Lease No. 642 being an area of approximately 472 square miles commencing at a point being the intersection of latitude 33°54'S and longitude 135°29'E, east to longitude 135°39'E, south to latitude 33°55'S, east to longitude 135°44'E, south to latitude 34°18'S, west to longitude 135°41'E, south to latitude 34°24'S, west to longitude 135°40'E, south to latitude 34°33'S, west to longitude 135°34'E, north to latitude 34°28'S,

east to longitude 135°36'E, north to latitude 34°26'S, east to longitude 135°37'E, north to latitude 34°20'S, west to longitude 135°33'E, north to latitude 34°18'S, west to longitude 135°29'E, north to point of commencement. Proposed National Park over Section 99, hundred of Wanilla to be excluded.

THE COMMON SEAL of LE NICKEL )  
(AUSTRALIA) EXPLORATION PTY. LTD. )  
was hereunto affixed in accordance )  
with its Articles of Association in )  
the presence of : )

Director

Secretary

THE COMMON SEAL of ENDEAVOUR )  
MINERALS NO LIABILITY was here - )  
unto affixed in accordance with )  
its Articles of Association in the )  
presence of : )

Director

Secretary

THIS GUARANTEE is given the                      day of                      One thousand nine hundred and seventy-two by ENDEAVOUR OIL COMPANY NO LIABILITY a company incorporated in the State of Victoria and having its registered office at 232 Victoria Parade East Melbourne in the said State (hereinafter called "Endeavour Oil") to LE NICKEL (AUSTRALIA) EXPLORATION PTY. LTD. a company incorporated in the State of Victoria and having its registered office at 24 Collins Street Melbourne in the said State (hereinafter called "LNE") on the terms and conditions hereinafter set forth -

WHEREAS :

- (a) ENDEAVOUR MINERALS NO LIABILITY a company incorporated in the State of Victoria and having its registered office at 232 Victoria Parade East Melbourne in the said State (hereinafter called "Endeavour Minerals") is a wholly owned subsidiary of Endeavour Oil.
- (b) LNE has entered into a Joint Venture Agreement of even date herewith (hereinafter called "the Joint Venture Agreement") whereby Endeavour Minerals and LNE agree to establish a Joint Venture to carry out exploration and development work with respect to the area more particularly described in South Australian Special Mining Lease No. 642.

FOR THIS DEED WITNESSETH that in consideration of LNE entering into the Joint Venture Agreement with Endeavour Minerals -

1. Endeavour Oil HEREBY GUARANTEES to LNE the due performance of each and every one of the covenants and obligations of Endeavour Minerals set forth in the Joint Venture Agreement.

2. Without limiting the generality of the foregoing Endeavour Oil warrants that South Australian Special Mining Lease No. 642 is valid and subsisting and that Endeavour Minerals is not in default in respect of its obligations under same.

3. Endeavour Oil shall not be exonerated by any time concession or other indulgence given by LNE to Endeavour Minerals or by anything done or omitted to be done by LNE which but for this provision might operate to exonerate Endeavour Oil.



4. The guarantee hereby given is to be a continuing guarantee and accordingly shall remain in operation until such time as the Joint Venture Agreement is either terminated pursuant to the provisions of Clause 12 of the Joint Venture Agreement or Endeavour Minerals assigns, with the consent of LNE (which consent shall not be unreasonably withheld) its entire interest in the Joint Venture Agreement to Endeavour Oil by an agreement to which LNE is a party and in which Endeavour Oil covenants with LNE to duly perform the obligations of Endeavour Minerals whether past present or future.

5. LNE shall be entitled to determine from time to time when it shall enforce this guarantee and LNE shall be entitled to enforce this guarantee without taking steps or proceedings against Endeavour Minerals.

6. In the event of liquidation (whether voluntary or by Order of the Court) of Endeavour Minerals, Endeavour Oil will not prove in any such liquidation in competition with LNE.

7. All notices or demands herein may be served by leaving same at the offices of the addressees as herein stated or at their registered office.

IN WITNESS whereof these presents have been executed the day and year first hereinbefore written.

THE COMMON SEAL of ENDEAVOUR  
OIL COMPANY NO LIABILITY was  
hereunto affixed in accordance  
with its Articles of Association  
in the presence of :

Director

Secretary

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ENDEAVOUR OIL COMPANY N.L.

QUARTERLY REPORT

FOR THE SECOND QUARTER PERIOD ENDING 11th MAY, 1972

S.M.L. 642, EYRE PENINSULA

SOUTH AUSTRALIA

BY

L.G. NIXON

L.G.B. NIXON & ASSOCIATES

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CLAY SAMPLE      LOCALITY PLAN	1 : 250,000

15th May, 1972.



ENDEAVOUR OIL COMPANY N.L.QUARTERLY REPORTFOR THE SECOND QUARTER PERIOD ENDING 11th MAY, 1972S.M.L. 642, EYRE PENINSULASOUTH AUSTRALIASUMMARY

Preliminary laboratory tests carried out by AMDEL on two selected samples of kaolin clays from S.M.L 642 showed that results from one sample were sufficiently encouraging to warrant further work. The other sample was not considered worth further testing because of its poor reflectivity.

The kaolin is residual in origin and for this reason it is expected to be widespread.

In order to evaluate the potential of the better clay a bulk sample was collected for additional testing and a limited drilling programme is proposed.

INTRODUCTION

White clay was intersected in several bores sunk by Endeavour Oil during exploration for sedimentary uranium in the Central Basin. It was noted that the clay occurrences were mainly located on the western margin of the Special Mining Lease. The clay sample of interest was collected from a well in Section 8, Hundred of Mitchell about one mile north of Kapinnie railway station. (See plan attached). In addition it was noted that in Mining Review No.78 a good quality white china-clay was reported from a well on Section No. 6, Hundred of Mitchell, which is about  $2\frac{1}{2}$  miles to the west of the sample tested by Endeavour.

These clay occurrences suggested that kaolin in this area may be widespread.

The Company is also examining the possibilities of a joint venture

over the area for continuing the search for sedimentary uranium.

#### WORK DONE

The work carried out included examination of all available geological logs of Mines Department water bores drilled in the area. From this work a number of bores indicating kaolin at relatively shallow depth were selected for field examination.

The reconnaissance programme included examination of all bore sites selected from literature search. In addition resident property owners were contacted in the field and all new bore and well sites not previously recorded were visited.

The prospecting party included one technical assistant, one field assistant. Towards the end of the prospecting period a geologist joined the field party and examined clay occurrences selected for inspection by the prospecting party.

The two best samples selected after visual examination were taken from well sites in Section 8, Hd. Mitchell and Section 98, Hd. Wanilla, marked Mitchell 8.B and Wan. 98 A, respectively and submitted to AMDEL for assessment. A copy of AMDEL's report is attached. Sample Mitchell 8.B is designated CE.3985 and Wan 98.A is designated CE.3986

AMDEL's report on sample Mitchell 8.B was sufficiently encouraging to warrant further testing. Consequently a 30lb. sample was collected, split into two equal portions and forwarded to two major overseas clay users for their laboratory testing. No reports have been received from these companies to date.

Work done on the clays consisted of crushing, blunging, splitting at the 20-micron level and measuring the reflectivity of the 20 micron fraction.

SUMMARY OF RESULTS

Clay sample Mitchell 8.B has a high reflectivity (88.5%) at both the minus 20- micron fraction and minus 2- micron and the minus 2- micron fraction amounts to an estimated 8%.

Clay sample WAN 98.A has poor reflectivity (73.0%) at the 20- micron level and no further work was done.

FURTHER WORK

Drilling to prove up reserves is the next step to be taken providing the samples being tested meet consumers requirements.

Because of variations in the composition of the bedrock from which the kaolin is derived, it is anticipated that a fairly intensive pattern of vertical and angled holes and close sampling will be necessary to outline a koalin body, the physical and chemical characteristics of which are known.

COST ESTIMATES

Geological	1545.00
Analytical	100.00
Transportation	244.33
Accomodation	378.93
Previous Expenditure	<u>30,000.00</u>
Total Expenditure to date.	<u><u>32,268.26</u></u>



L.G. NIXON  
L.G.B. NIXON & ASSOCIATES

15th May, 1972

ENDEAVOUR OIL COMPANY N.L.

QUARTERLY REPORT NO.3

for the period ending 11th August, 1972

SML 642, Co's FLINDERS & MUSGRAVE

EYRE PENINSULA, SOUTH AUSTRALIA

11th August, 1972.



CONTENTS

1.00     INTRODUCTION

2.00     WORK DONE

3.00     SEDIMENTARY URANIUM

4.00     KAOLIN

5.00     COSTS

APPENDIX 1     Farm-in Agreement

APPENDIX 2     Kaolin Work Proposal

1.00 INTRODUCTION

During the period under review, Endeavour Oil Company N.L. negotiated an agreement with Le Nickel (Australasia) Ltd., Melbourne to conduct an exploration programme for sedimentary uranium to follow-up the 1971 work completed by Endeavour. In addition, continued sampling of kaolin found in water bores near Kapinnie emphasised the possible economic significance of this mineral, and a drilling programme has been prepared. The kaolin deposits in SML 642 are 100% owned by Endeavour.

2.00 WORK DONE

Two days were spent by a field geologist and assistant in examining water bores in the Kapinnie area. Twenty pounds of kaolin was taken from Mitchell 1A bore, 1 mile north of Kapinnie, for detailed analysis by commercial kaolin users. Few bores in this area reach the level at which kaolin would be expected to occur.

Previous investigations of the kaolin had shown that this material has a high reflectivity at both minus 20 and minus 2 micron fractions, and had potential at paper filling and paper coating grades. (Amdel report MT 1924/72).

3.00 SEDIMENTARY URANIUM

A joint venture agreement between Le Nickel (Australia) Exploration Pty. Ltd. and Endeavour Minerals N.L. was approved by the Minister of Development and Mines on 18th July, 1972. Le Nickel will acquire a 50% interest by contributing the sum of \$50,000 to the joint venture for expending on the Exploration area, and reimbursement of one-half of Endeavour's previous expenditure. Le Nickel will expend not less than \$35,000 on the Exploration area before 31st December, 1972. The agreement covers all minerals except for kaolin clay. (See Appendix 1).

At a joint venture meeting held on 24th July, 1972, the following programme was approved. An orientation survey using seismic hammer refraction at intervals of 100 feet between the drill holes

R6 to R9 on the Cummins-Kiana Road. It is anticipated that the hammer method should be able to penetrate down to at least 400 feet depth. On satisfactory performance of this technique, a series of five east-west oriented lines totalling 60 miles will be completed on each side of the orientation line. Seismic refraction using detonations would be utilised if the hammer method is unsuccessful. The total costs for a 40-day programme has been estimated between \$22,800 (hammer refraction) and \$33,200 (seismic refraction) depending which method is applied-

The geophysical programme was phased to begin on 30th July, 1972, but was delayed by inclement weather. The completion date of 19th September, 1972 would be put back beyond the time necessary to decide on a possible reduction of the SML 642 area. It is understood that the Mines Department will be favourably disposed for the joint venture partnership to retain the full SML 642 area beyond the expiry date of 11th November, 1972.

The second exploration stage will involve rotary drilling of 20 holes of average 200 feet depth on the most prospective channels indicated by the geophysical survey. The cost is expected to be approximately \$20,000.

The programme is essentially reconnaissance in nature. The geophysics are intended to determine the most prospective sub-surface channels in which sedimentary uranium would be expected to occur. The drilling programme is hoped to indicate those structures which may be considered for detailed drilling during 1973.

#### 4.00 KAOLIN

Endeavour has been investigating the possibilities of establishing a kaolin mine within SML642. The most prospective area is at Kapinnie near the western boundary. It is clear that extreme care has to be taken during the drilling, extraction and analysis of the kaolin. Consequently, a drilling programme has been approved but not yet implemented. (See Appendix 2).

A total of \$15,000 has been budgetted for this work, which will commence as soon as a suitable driller is engaged and laboratory requirements are established by the prospective buyer of the product. A number of overseas companies have been contacted, and have shown encouraging interest.

5.00 COSTS (11.10.70 - 11.8.72)

Tenure	\$ 178.00
Equipment hire	2,238.00
Assays & Analyses	786.00
Drafting, maps & reports	283.00
Travelling & accommodation	879.00
Consultant's fees & expenses	16,231.00
Drilling Costs	11,961.00
Company salaries & wages	1,363.00
Miscellaneous	114.00
	<hr/>
	\$34,033.00
	<hr/>



LE NICKEL (AUSTRALIA) EXPLORATION  
PTY. LTD.

- and -

ENDEAVOUR MINERALS NO LIABILITY

JOINT VENTURE AGREEMENT

BLAKE & RIGGALL,  
Solicitors,  
120 William Street,  
MELBOURNE. VIC. 3000.

AGREEMENT made the NINETEENTH day of JUNE One thousand nine hundred and seventy-two BETWEEN LE NICKEL (AUSTRALIA) EXPLORATION PTY. LTD. a company incorporated in the State of Victoria and having its registered office at 24 Collins Street Melbourne in the said State (hereinafter called "LNE") and ENDEAVOUR MINERALS NO LIABILITY a company incorporated in the State of Victoria and having its registered office at 232 Victoria Parade East Melbourne in the said State (hereinafter called "Endeavour") WHEREAS Endeavour has carried out certain exploration work in respect of the Exploration Area described in the Schedule to this Agreement AND WHEREAS the parties hereto desire to establish a joint venture to carry out further exploration and development work with respect to the said Exploration Area all on the terms and conditions hereinafter set forth; NOW THEREFORE in consideration of the premises and of the mutual covenants and agreements hereinafter set forth the parties hereto hereby agree as follows :-

PART 1 - DEFINITIONS

1. Unless the context otherwise requires the terms defined in this Clause 1 shall for all purposes of this Agreement have the meanings specified in this Clause 1 and all references to Clauses shall be deemed to refer to Clauses of this Agreement.

- (a) The term "Administrative Committee" means a committee organised pursuant to Part 3 of this Agreement.
- (b) The term "Associated Company" means with respect to any Participant any corporation deemed to be related to such Participant under Section 6 of the Companies Act 1961 of the State of Victoria.
- (c) The term "Contribution Proportion" means with respect to any Participant at any particular time the percentage determined in accordance with Clause 7 representing the percentage of funds which at such time such Participant is obligated or entitled to contribute to the Joint Venture.
- (d) The term "the Entity" means the legal entity to be used for commercial exploitation and organised pursuant to Part 8 of this Agreement.

- (e) The term "Exploration Area" means the area covered by the Mining Title and described in the Schedule to this Agreement as such area may be changed by mutual agreement between the parties hereto in accordance with Clause 5 (in which case the Schedule shall be changed accordingly).
- (f) The term "Joint Venture" means the Joint Venture established pursuant to Clause 2.
- (g) The term "Manager" means the person firm or corporation which shall at the particular time be the manager of the Joint Venture pursuant to Clause 4 (a).
- (h) The term "Mining Title" means the Mining Title referred to in the Schedule hereto as same may be varied or amended.
- (i) The term "Participant" means at any particular time a person firm or corporation which then has a Participating Interest in the Joint Venture pursuant to Clause 6.
- (j) The term "Participating Interest" means with respect to any Participant at any particular time the fraction expressed as a percentage figure determined in accordance with Clause 6 which at such time represents the interest of such Participant in the Joint Venture and the Mining Title.

## PART 2 - ESTABLISHMENT AND OBJECT OF THE JOINT VENTURE

2. The parties hereto hereby establish the Joint Venture effective from the First day of July One thousand nine hundred and seventy-two (hereinafter called "the commencement date") for the purpose of carrying out exploration work and if commercially feasible exploitation of all mineral substances covered by the mining titles to the Exploration Area except that Endeavour retains the sole right, at all times, to explore for and exploit any kaolin clay ore in the Exploration Area. Endeavour undertakes that, in exploring for and exploiting such kaolin clay ore it will not jeopardise the exploration for or the mining or extraction of other minerals from the Exploration Area.

## PART 3 - ADMINISTRATIVE COMMITTEE

3. (a) An Administrative Committee will be designated within one month following the signing of the present Agreement. The

Administrative Committee shall consist of 4 persons -

2 members designated by LNE and their alternates

2 members designated by Endeavour and their alternates.

Two members (one designated by LNE and one designated by Endeavour) present in person or alternate or by proxy shall be a quorum for the meetings of the Administrative Committee. The chairman of the meeting of the Administrative Committee shall be a representative of LNE. The Administrative Committee will act during the exploration period and will make decisions concerning the exploration programmes, the budgets and the results of the different exploration activities. The decisions of the Administrative Committee must be agreed to by a majority vote. In the event that the parties' Participating Interest shall change then the composition of the Administrative Committee shall be varied to reflect such change. For the purposes of such change a Participating Interest of 25% shall entitle a Participant to appoint one member to the Administrative Committee.

(b) Until LNE has contributed the sum of \$50,000 to the Joint Venture the Participants shall each have two votes. Thereafter each Participant shall have a vote at any such meeting equal to its then Contribution Proportion. Each Participant shall cast its votes as a block exercisable by one only of its representatives present at such meeting.

#### PART 4 - MANAGEMENT OF THE VENTURE

4. (a) The manager for the exploration stage of the Joint Venture shall be LNE or as otherwise determined by the Administrative Committee and shall act subject to the terms and conditions set out in this Part 4. All such work shall be carried out at cost i.e. without any fees or other amounts representing profit to the Manager. It is understood however that the costs and expenses incurred for the account of the Joint Venture shall include in addition to costs and expenses directly allocable thereto general administrative and overhead expenses of the Manager properly allocable thereto.

(b) The manager undertakes to explore the area in accordance with good exploration practice and in conformity with the terms and conditions of the Mining Title covering the Exploration Area.

5. (a) The manager will have all necessary powers to act on behalf of the Venture within the scope of the provisions of Clause 4 hereinabove. The manager shall prepare and submit to the Administrative Committee programmes and budgets on an annual basis (or on such other basis as the Administrative Committee may direct) and in reasonable detail covering further work to be carried out with respect to the Exploration Area during the period to which such programmes and budgets relate. Any such programme and budget may recommend that related additional areas be included in the Exploration Area and that other areas included in the Exploration Area be surrendered or abandoned. Any such programme and budget (as the same shall be revised in accordance with requests made by the Administrative Committee) that shall be approved by the Administrative Committee shall be final and binding on the manager and the Participants and the manager shall to the extent of the funds contributed to the Joint Venture as hereinafter provided promptly proceed to carry out such work as set forth in such approved programme and budget. Each such approved budget shall specify the aggregate amount of costs and expenses covered thereby. In no event shall the manager incur for the account of the Joint Venture any costs or expenses otherwise than in conformity with programmes and budgets that shall have been approved as provided in this Clause 5. The manager will furnish to each of the Participants progress reports on a monthly basis (or on such other basis as the Administrative Committee may prescribe) with respect to exploration carried out pursuant to approved programmes and budgets. The costs and expenses incurred for the account of the Joint Venture shall be subject to audit (on an annual basis and at such other times as the Administrative Committee may determine) with respect to compliance with the provisions of this Agreement by a firm of

## 5.

Chartered Accountants who are auditors of the manager and the cost of such audit with respect to any period shall constitute an expense properly incurred by the Joint Venture in carrying out exploration for the period in which such audit is made.

(b) The non-managing Participants shall have the right at all reasonable times to inspect the Exploration Area to observe the conduct of exploration hereunder and to have access to all maps geological geophysical and geochemical data trenching and drill hole data analyses surveys records reports and other information and data relating to such Area that the manager shall have or develop but such inspection shall not interfere with the manager's operation. During the period commencing with the date of this Agreement and ending two years after the termination of the Joint Venture each of the parties to this Agreement shall treat all such information and data as confidential and shall not without the prior written consent of the other Participant or of an Exploitation Entity organised pursuant to Part 8 of this Agreement disclose any of such information or data to any third party except to the extent required for compliance with applicable laws and with applicable rules regulations and orders of a governmental instrumentality or stock exchange having jurisdiction; Provided However that in the case of a proposed sale assignment or other disposition in accordance with Clause 20 the Disposing Party may to the extent allowed by the prior written consent of the other Participant which consent will not be unreasonably withheld disclose information or data to the prospective transferee. Nothing in this Clause 5 (b) shall be deemed to impose any restrictions with respect to disclosure of such information to any entity formed to undertake commercial exploitation of the Exploration Area.

PART 5 - PARTICIPATING INTEREST AND CONTRIBUTION PROPORTION

6. (a) The parties acknowledge that Endeavour has

## 6.

expended \$30,000 on the Exploration Area and at the commencement date Endeavour will have a Participating Interest of 100%.

LNE may acquire a Participating Interest of 50% by contributing the sum of \$50,000 to the Joint Venture for expending on the Exploration Area and in addition by paying direct to Endeavour a sum of \$15,000 to reimburse it for one half of Endeavour's exploration expenses. When the amount of \$50,000 has been contributed by LNE to the Joint Venture and the said sum of \$15,000 has been paid to Endeavour, the Participating Interest of the Participants will be adjusted to the following :-

<u>Name of Participant</u>	<u>Participating Interest</u>
LNE	50%
Endeavour	50%

(b) The Participating Interest of each Participant

shall thereafter be subject to automatic adjustment so that at any particular time the Participating Interest of any Participant shall be a fraction whose numerator shall be the number of dollars contributed or deemed to be contributed to the Joint Venture by such Participant and whose denominator shall be the number of dollars contributed or deemed to be contributed to the Joint Venture by or on behalf of all Participants pursuant thereto. At the date upon which LNE acquires a Participating Interest of 50% and Endeavour's Participating Interest is adjusted to 50% the parties acknowledge that Endeavour will be deemed to have contributed \$50,000 to the Joint Venture and LNE will be deemed to have contributed \$50,000 to the Joint Venture.

7. The Participants will make contributions to the Joint Venture as follows :-

(a) LNE will contribute not less than \$35,000 before the 31st day of December, 1972 to be expended on the Exploration Area.

(b) On or before the 31st day of December, 1972 LNE shall elect whether to continue as a Participant in the Joint Venture. Such election shall be by notice in writing.

and shall be served upon Endeavour in accordance with the terms hereof. If LNE elects to continue it shall thereupon be bound to contribute a total of \$50,000 to the Joint Venture to be expended on the Exploration Area and to pay forthwith to Endeavour direct \$15,000 to reimburse it for one-half of Endeavour's previous exploration expenses. In computing the said sum of \$50,000 all monies contributed by LNE to the Joint Venture pursuant to Clause 7 (a) shall be counted. If LNE elects not to continue then the Joint Venture shall cease and determine forthwith but without affecting the parties accrued rights and liabilities at that date.

(c) The Contribution Proportion of each Participant shall be applicable with respect to contributions required to be made to the Joint Venture to provide for costs and expenses covered by the programmes and budgets approved by the Administrative Committee pursuant to Clause 5. After LNE has made an election to continue pursuant to Clause 7 (b) and has contributed the said sum of \$50,000 to the Joint Venture the Contribution Proportions of the parties with respect to the following programmes and budgets shall be as follows :-

<u>Name of Participant</u>	<u>Contribution Proportion</u>
LNE	50%
Endeavour	50%

At the end of any programme and budget either Participant may elect to reduce its Contribution Proportion to the next programme and budget but once such election is made the Participant making same shall have no right without the consent of the other Participant to restore its Contribution Proportion to its previous level.

8. Except as otherwise determined by the Administrative Committee all funds required to be contributed under Clause 7 shall be paid to the Manager for the account of the Joint Venture according to the needs and upon request of the Manager, after approval of the applicable programme and budget.



8.

9. No Participant shall have the right to oppose the continuation of exploration works on the exploration area and the only action it shall be entitled to take is to reduce its Contribution Proportion pursuant to Clause 7 (c).

10. A Participant shall be obligated to withdraw from the Joint Venture if its Participating Interest falls below two per centum. Effective as of the date of such withdrawal the Participating Interest and the Contribution Proportion if any of such withdrawing Participant shall terminate and the Participating Interest and Contribution Proportion of the remaining Participant shall be rateably increased. The withdrawal of any Participant shall not relieve any party of any obligation or liability accrued prior to the date of withdrawal.

#### PART 6 - INTERRUPTION OF EXPLORATION AND EVENTUAL RESUMPTION

11. The decision to stop temporarily the exploration works must be agreed to by a Participant or Participants holding in excess of a sixty per centum Participating Interest. Each of the Participants will always have the right, subsequently, to demand resumption of the works. In order to do this, it must notify its intention to the other Participant, such notification will result, within 30 days following the mailing of this notification, in the calling by the Manager of an Administrative Committee meeting. Should the Participants not come to an agreement at the Administrative Committee meeting in regard to the resumption of the works, the Participant who requested the resumption of the works can proceed but at its expense.

#### PART 7 - PERMANENT ABANDONMENT OF EXPLORATION DECIDED BY MUTUAL AGREEMENT

12. The Joint Venture shall terminate upon a unanimous determination by the Administrative Committee not to carry out any further exploration nor to proceed with exploitation with respect to the Exploration Area and in the event of such termination the following provisions shall apply -

- (i) the termination of the Joint Venture shall not relieve any Participant of any obligation or liability accrued prior to the date of termination;

9.

- (ii) all unexpended funds arising from contributions made pursuant to Clause 7 shall promptly be distributed to the Participants actually making such contributions pro rata according to the respective amounts actually contributed by them;
- (iii) any consideration received by the Joint Venture in connection with any sale or other disposition of the Exploration Area shall be distributed to the Participants pro rata according to their respective Participating Interests on the date of such sale or other disposition;
- (iv) all plant or equipment the property of the Joint Venture at the time of the determination of the same and purchased with funds contributed therein shall be sold or otherwise disposed of and the proceeds of such sale or other disposal shall be distributed to the Participants pro rata according to their respective Participating Interests on the date of such sale or other disposition;
- (v) the Participants will be entitled to a preference before third parties in the purchase of the assets of the Joint Venture. As between Participants the Participant with the largest Participating Interest shall take precedence.

#### PART 8 - MINING AREA

13. Unless and to the extent that the Administrative Committee shall otherwise determine all prospecting permits temporary reserves licence concessions leases mining tenements rights to mine and other mineral rights with respect to the Exploration Area shall be the property of the Joint Venture and held in the name of the Participants. In case of discovery and of formation of an entity for exploitation the said titles and rights covering the mining area will be transferred to the exploitation entity.

#### PART 9 - COMMERCIAL EXPLOITATION

14. In the event that a Participant with a Participating Interest of not less than 40% considers that the Exploration Area contains an orebody or orebodies (hereinafter called "the

## 10.

orebody") of sufficient grade and tonnage to warrant commercial exploitation such Participant shall have the right to require the Joint Venture to proceed to commercial exploitation of the orebody Provided That such Participant can establish that there is a reasonable expectation of a rate of return on capital invested (including monies expended on exploration) of not less than fifteen per centum per annum over the life of the mine calculated on a discounted cash flow basis. In determining the return royalties direct taxes on extraction or sale and income tax shall be deducted. In the event that another Participant challenges the figures the matter shall be referred to arbitration in accordance with Clause 22 hereof. If the Participants agree to proceed to commercial exploitation they shall be entitled to such interest as they may agree or failing agreement an interest equal to their then Participating Interests.

15. Subject to Clause 14 being satisfied if one of the Participants does not wish to participate in commercial exploitation or without the consent of the other Participant takes an interest less than its then Participating Interest it shall have no right to oppose commercial exploitation or the manner affecting same in accordance with sound mining practice. The other participant shall however take into account the views of the first mentioned Participant regarding method of exploitation but only so long as the first mentioned Participant retains an interest.

16. The Participant having the largest interest in the commercial exploitation shall after taking into account on a fair and reasonable basis the particular requirements and needs (in particular taxation) of all Participants have the right to designate the form of legal entity to be used which the Participants acknowledge could be any one of a Joint Venture, a partnership or a corporation (the relevant one of which is hereinafter called "the entity").

17. The management body of the entity will be constituted in such a way that the contribution of each of the Participants

11.

to the entity is reflected. The decisions of the management body will be taken by a majority vote.

18. The Participants in this exploration Joint Venture will transfer to the entity at cost the mining titles covering the orebody and all other rights and titles ancillary thereto namely exploration works and expense of the Venture. The entity will be under no obligation to pay for these in cash but will, if the entity is a company, issue fully paid shares for same at par or will, if the entity is a Joint Venture or partnership, credit the transferors as may be agreed or failing agreement as may be determined by arbitration in accordance with Clause 22 hereof.

PART 10 - DEFAULT

19. (a) In the event that either Participant ("the defaulting Participant") shall commit a breach of this Agreement and fail to remedy such breach within 60 days from the date of notice in writing from the other Participant ("the non-defaulting Participant") requiring it to remedy such breach the non-defaulting Participant may forthwith terminate the Joint Venture by written notification to the defaulting Participant. Upon such termination the Joint Venture including the mining rights shall become the sole property and responsibility of the non-defaulting Participant it being the intent that the defaulting Participant shall thereafter have no right claim or interest in the Joint Venture or against the non-defaulting Participant except as provided in Clause 19 (b).

(b) The defaulting Participant shall not be relieved or discharged from any obligation or liability imposed on it as a Participant in the Joint Venture as a result of or arising from the activities of the Joint Venture prior to the termination of the Joint Venture as provided in Clause 19 (a) but the defaulting Participant shall be indemnified by the non-defaulting Participant against all actions suits claims costs and demands of every description whatsoever made or brought against it by third parties and arising directly or indirectly from the carrying on by

the non-defaulting Participant of the business of the Joint Venture subsequent to the termination of the Joint Venture.

#### PART 11 - TRANSFER OF PARTICIPATING INTERESTS

20. All transfers to third parties of Participating Interests in the Joint Venture at the exploration stage require the unanimity of the Participants, provided that each party will have the right to transfer freely all or part of its Participating Interest to an Associated Company. It is further understood that if the interest of the assignor in a subsidiary or affiliate shall be reduced to below 50%, the assignor shall re-acquire the interest therefor assigned.

21. (a) Each party will have the right to transfer freely all or part of its Participating Interest to an Associated Company. It is further understood that if the interest of the assignor in a subsidiary or affiliate shall be reduced to below 50% the assignor shall re-acquire the interest therefor assigned.

(b) Should any Participant wish to sell, except to an Associated Company, the whole or part of its interest in the exploitation entity, it must first offer to sell such interest to the other Participants, in proportion to their respective Participating Interests, at a price and on conditions to be agreed or settled by arbitration under Clause 22 (if arbitration applies the price shall be the fair market value). If anyone or more of the other Participants are unwilling to purchase at such price and on such conditions the party willing to sell shall then be free to sell such part of its said interests as Participants have refused, to a third party at the same or on a greater price and on the same conditions. The Articles of Association of the exploitation entity shall contain appropriate detailed provisions to cover this arrangement.

#### PART 12 - ARBITRATION

22. All disputes arising in connection with the present contract shall be finally settled under the Rules of Conciliation and Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with the rules.

## 13.

The award of the arbitrators shall be final and binding upon the parties. Any such arbitration shall be held in Melbourne and if appropriate the award of the arbitrator may be registered in any court of competent jurisdiction in any country in which it could be duly enforced.

PART 13 - FORCE MAJEURE

23. If either Participant shall be prevented or delayed in performing any of its obligations or the conditions on its part to be performed hereunder by reason of acts of nature, acts of God, acts of enemies, strikes, threat of imminent strike, labour dispute, walkout, fire, flood, explosion, severe weather conditions, forest closure, war, insurrection, requirements or regulations of government, lack of transportation facilities, curtailment of power supply, inability to obtain necessary materials in open markets, economic recession or by any cause not within the control of the Participant affected which by exercise of due diligence such Participant shall not have been able to avoid or overcome, then in such event such failure to perform shall not be deemed to be a breach of this Agreement, but performance shall be deemed suspended for a time equal to the period of disability. The party invoking force majeure shall take all reasonable action to remedy the position and to minimise the loss if any to the other party.

PART 14 - MISCELLANEOUS PROVISIONS

24. The interpretation and enforceability of this Agreement shall be governed by the laws of the State of Victoria.

25. Subject to and in accordance with the provisions of this Agreement (including without limitation the provisions of Clauses 20 and 21) this Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective successors and assigns.

26. Any notice notification advice report or other communication to be given under this Agreement shall be in writing and shall be sufficiently given if personally delivered or mailed by airmail or sent by cable addressed to the Participants at their

addresses herein stated, or to such other address as the party in question may designate by written notice to the other party.

27. Subject to Clause 16 this Agreement shall not be construed for any purpose to give rise to a partnership association or any other relationship in which any of the parties hereto may be liable for the acts or omissions of the other party hereto and the obligations and liabilities of the parties hereto in respect of the Joint Venture shall be several and not joint.

28. This Agreement is subject to the approval of the relevant South Australian government authority where such approval is required being obtained by the Thirtieth day of June One thousand nine hundred and seventy-two or such later date as LNE may designate.

29. LNE shall pay all stamp duties and legal costs associated with the preparation and execution of this Agreement.

30. During the Joint Venture LNE shall maintain in the joint names of LNE and Endeavour insurance covering them jointly and severally against claims for negligence by third parties arising out of LNE's activities in the Exploration Area. Any premiums paid on such insurance policies shall be an expense payable from the Joint Venture funds.

31. Endeavour warrants that the mining title is valid and subsisting and that it is not in default in respect of its obligations under same.

IN WITNESS whereof these presents have been executed the day and year first hereinbefore written.

THE SCHEDULE HEREINBEFORE REFERRED TO:

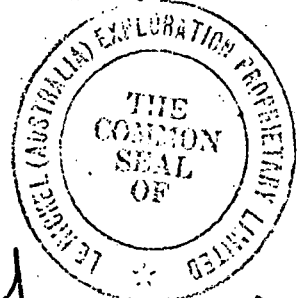
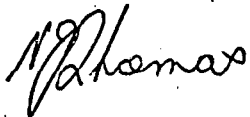
Exploration Area

The area covered by South Australian Special Mining Lease No. 642 being an area of approximately 472 square miles commencing at a point being the intersection of latitude 33°54'S and longitude 135°29'E, east to longitude 135°39'E, south to latitude 33°55'S, east to longitude 135°44'E, south to latitude 34°18'S, west to longitude 135°41'E, south to latitude 34°24'S, west to longitude 135°40'E, south to latitude 34°33'S, west to longitude 135°34'E, north to latitude 34°28'S,

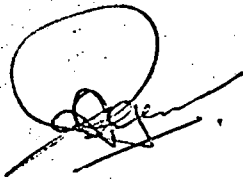
15.

east to longitude 135°36'E, north to latitude 34°26'S, east to longitude 135°37'E, north to latitude 34°20'S, west to longitude 135°33'E, north to latitude 34°18'S, west to longitude 135°29'E, north to point of commencement. Proposed National Park over Section 99, hundred of Wanilla to be excluded.

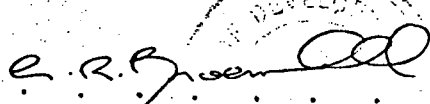
THE COMMON SEAL of LE NICKEL  
(AUSTRALIA) EXPLORATION PTY. LTD.  
was hereunto affixed in accordance  
with its Articles of Association in  
the presence of :

Director X Secretary 

THE COMMON SEAL of ENDEAVOUR  
MINERALS NO LIABILITY was here -  
unto affixed in accordance with  
its Articles of Association in the  
presence of :

Director Secretary 

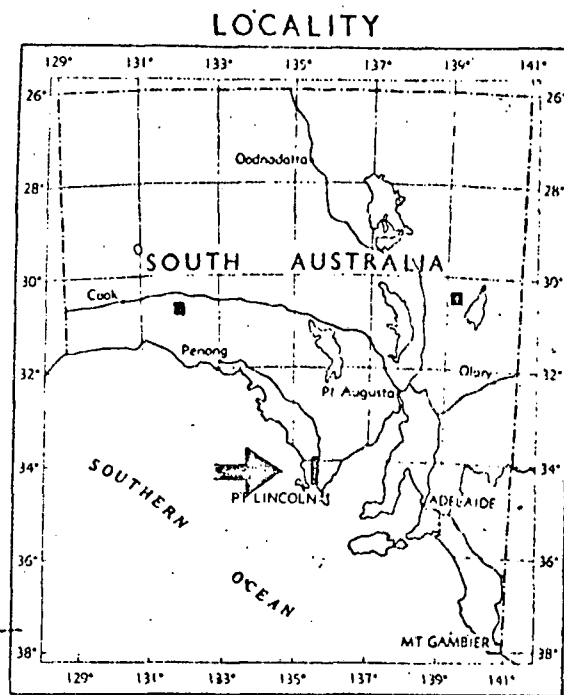
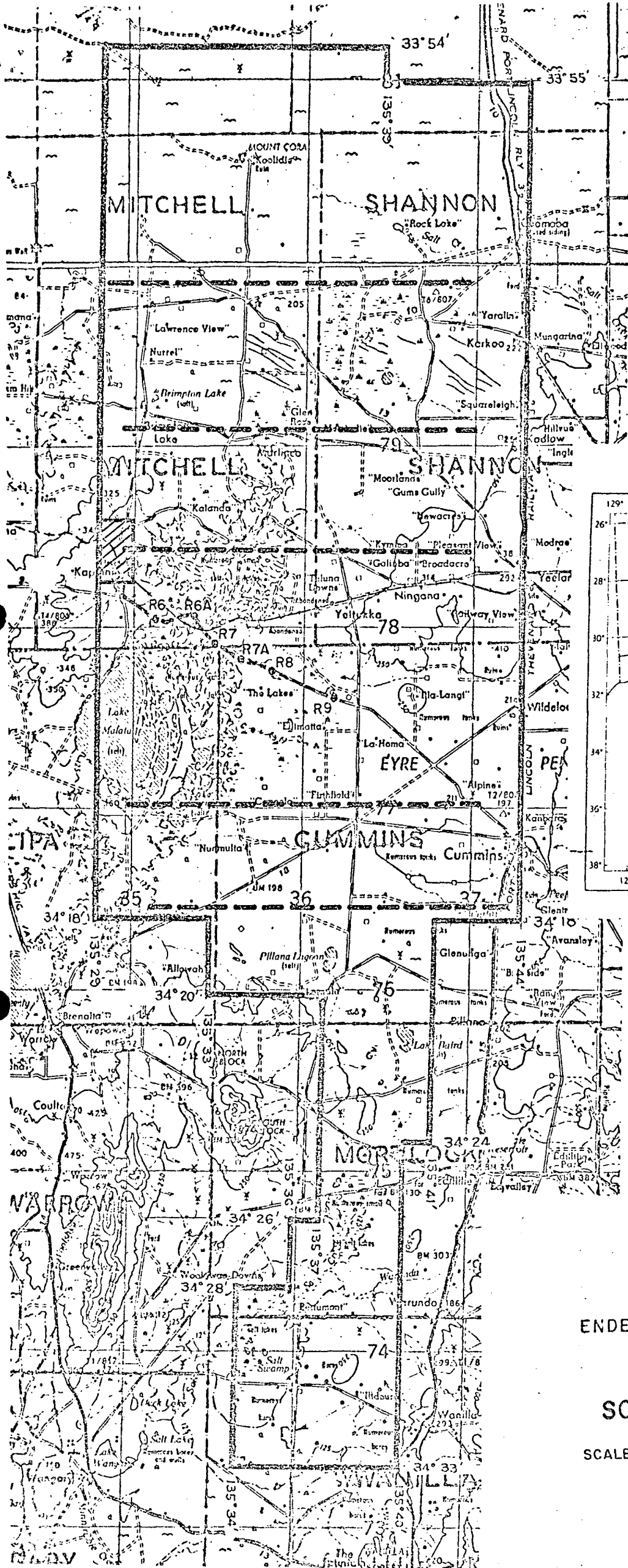
I consent,

  
Minister of Development & Mines.

18 JUL 1972



ACCOUNTANT



- Approximate position of seismic refraction traverse
- R7• Rotary drill hole
- Orientation seismic line
- Koolin area

ENDEAVOUR OIL COMPANY N.L.

SML 642  
SOUTH AUSTRALIA

SCALE: 1:250,000

August, 1972

Figure 1

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PROGRESS REPORT ON S.M.L. 642  
FOR THE MONTH OF AUGUST, 1972

September, 1972.

R. CARRIE  
NIMEX 917/72-H



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PROGRESS REPORT ON S.M.L. 642  
FOR THE MONTH OF AUGUST, 1972

by R. Carrie

1. INTRODUCTION

1.1 1971 Results

The exploration programme carried out in 1971 on S.M.L. 642 indicated that the basement, mostly Precambrian gneiss, granites and metaquartzites, was overlain, except for a few limited outcrops in the central eastern and southern parts of the permit by a predominantly sandy sequence up to 155 m. thick with an average of 75m.; from the bottom upwards were intersected:

- (a) "weathered basement": maximum known thickness 15 m., average 3 m. to 4.5 m.
- (b) coarse loose sand with <sup>h</sup>tin, locally pyritic, black clayey beds: maximum known thickness 92 m., average 15 m. to 45 m.
- (c) coarse loose sand with numerous interbeds of peat: maximum known thickness 45 m., average 12 m.
- (d) up to 6 m. of clay and lateritic profile overlain, over approximately 70% of the area by a calcrete capper, either outcropping or covered by less than 1 to 2 m. of soil.

Units (b) and (c) are assumed to be tertiary and (d) quaternary.

The type of deposit which can be expected in this kind of environment is of Colorado Plateau and/or Wyoming type, the first being more likely.

While drilling along line 2, two anomalous zones, with  $U_3O_8$  content more than four times the regional background, were intersected over two relatively shallow paleochannels:

- 110 p.p.m. over 0.75 m. at 35 m. deep within white kaolinitic clayey material with associated peat (hole No. 8)
- 100 p.p.m. over 1.50 m., between 12.20 m. and 13.70 m., in clay with peat (hole No. 10).

## 2.

1.2 1972 Programme

The purpose of the 1972 exploration programme, essentially reconnaissance in nature, are:

- (a) To determine the precise depth and shape of the old basement surface in order to detect buried paleochannels which may provide, where suitable environment develops, traps for uranium mineralisation.

With the accuracy required, the seismic method was considered to be the most able to fill this purpose.

With the necessity of deciding on a possible reduction of the S.M.L. surface prior to 11/11/1972, the seismic programme was designed to cover as much as possible of the area not yet explored by 5 East-West profiles located 4 to 5 miles apart; this spacing is considered as a maximum if any correlation between profiles is to be attempted.

- (b) To try to locate, by drilling the most promising of the indicated seismic channels, some zones offering the most suitable sedimentary environment for mineralised concentrations, preferably with associated uranium indications.

Drill holes were also to be used for up-hole velocity survey with hammer reflection techniques.

2. SEISMIC SURVEY

The survey has been contracted to L.J. Starkey and Associates of Perth, with Le Nickel providing unskilled labour and vehicles.

2.1 Method

The seismic method used is the hammer reflection, with station every 100 feet and recording on a Bison signal enhancement 1570B seismograph.

Field technique for each station consists of summing the signals from hammer points at different distances between 1.50 m. and 9.15 m. from a geophone. Times for reflection waves will be the same for all points, hence signals will add, whereas travel times for other waves (such as direct or refracted) will be different, hence will tend to cancel.

360 m. refraction spreads are also done at an average spacing of 1600 m. to 2400 m. to check the reflection times and to determine any detectable change in sedimentary velocity.

Field technique consists of two shots (1 to 1½ lb. of dynamite at 0.5 to 1 m. depth) off ends (30 to 90 m.), with geophones at 30 m. spacing, using geophone 1 and 12 as reciprocal; the recording device is an Electro-tech seismograph model E.R. 75A-12.

As variations in relief elevation are of about the same order of magnitude as the expected variations in basement depth, each profile has been levelled with an accuracy of  $\pm 0.4$  m. per kilometer.

Due to access problems in flooded or crop areas, the kilometrage to be seismically surveyed is only 77 kms. (instead of the original 96 kms.) broken down as follows:

Profile A:	7.99 kms.
Profile B:	17.20 kms.
Profile Test:	8.36 kms.
Profile C:	12.00 kms.
Profile D:	22.60 kms.
Profile E:	9.39 kms.

## 2.2 Schedule

2.2.1 The topographic survey started on Monday, 31st July, and was completed on Sunday, 27th August. 92 km. were surveyed, needing 83 M/day; average turnover was 3.90 kms/day in traversing and 3.6 kms/day in levelling.

2.2.2 Due to equipment breakdown and bad weather conditions, the seismic survey started only on Thursday, 13th August.

The crew includes one operator, two field assistants and one geophysicist carrying out a daily interpretation of field data.

By 3rd September, 44 kms. of reflection and 7.3 kms. of refraction have been done; profile tests A and B are completed and 11.26 kms. have been surveyed on Profile D.

Average turnover was 2.95 kms/day in reflection and 2.92 kms/day in refraction.

## 2.3 Results (Figures 1, 2, 3 and 4)

### 2.3.1 Profile Test (Figure 2)

To ascertain the ability of the hammer reflection to cope with our requirements, the method was first tested along 8.36 kms. of Line 2 drilled at 1 to 2 miles spacing last year and providing a good diversity in basement depths (between holes 6A and 9 inclusive).

Refraction provided three zones of different velocity, from top downwards:

- an intermittent 1830 m/sec. zone corresponding to patches of superficial calcrete
- an intermediate zone of 1130 m/sec. corresponding to the tertiary sequence
- a deep 4270 m/sec. zone which, by its features, represents the fresh basement.

Reflection and refraction intercept times obtained by the reciprocal method for the 4270 m/sec. zone correlate generally within 2 or 3 milliseconds; this difference, introducing less than 4 m. in discrepancy, could be attributed, among other reasons related to the method itself, to the fact that reflection is not usually obtained at the same depth level as refraction.

This indicates that the hammer reflection method is able to mark the top of the basement, thereby answering our basic requirements.

Further work along Profile B showed that the reflection technique can penetrate deeper than 150 m. as, in a slow velocity area, say below 900 m/sec., the refraction, due to the refraction timing device, cannot record greater than 300 milliseconds.

This also suggests that refraction, though nearly twice as expensive for the same average daily speed, would not provide more accurate information at this stage than reflection.



Comparison of seismic and drilling interpretations provides:

- (a) a reasonably good correlation of the reflection basement lows and highs with location of channels and ridges as as interpreted from drilling.
- (b) satisfactory shape and depth correlations over the eastern half of the profile.
- (c) total lack of correlation in the western half, with the exception of hole 6A and some 30 m. to 45 m. discrepancy at hole 7 site.

As the seismic reflection, substantiated by refraction, almost certainly mark the top of the basement, the discrepancy can only be explained at this stage (apart from possible wrong geological interpretation of drilling results) by progressive changes in sediment velocity, most likely related to changes in sediments themselves, that neither reflection nor refraction can detect from the surface.

In the vicinity of hole 7, for example, several interbeds of peat, thin and spaced wide enough apart not to produce any noticeable refraction wave, can provide the high velocity required for good correlation with drilling interpretation.

Such a problem can only be solved by up-hole velocity survey providing travel times and velocity at different depth in the sedimentary sequence.

For various reasons it was not possible to carry out such a survey before proceeding with the rest of the seismic programme. Furthermore, it was not estimated necessary; as basement reflections were obtained, the method itself did not appear questionable any more, the only problem being to provide enough functional information to reach the accuracy in interpretation which is required.

#### 2.3.2 Profiles A, B and D (Figures 1,3,4)

Further seismic results prove to be most encouraging:

- (a) Along profile B seismic interpretation corresponds fairly well in depth and shape of basement with what is expected in this area, with good correlation between refraction and reflection depths except in one area to be tested by drilling (pegs 190 to 197).

Basement rises gradually towards the west from an average 120 m. to about 60 m. Four well defined channels have been intersected, two of them broad and fairly deep down to 160 m, being good targets for drilling.

If possible, this profile will be extended eastwards to intersect the deep channel drilled by the school bore.

- (b) Profile A shows a fairly constant 60 m. to 70 m. basement depth much shallower than encountered to the north and south with the exception of a U-shaped, pretty steep channel down to 140 m. deep near the eastern end.

Refraction and reflection depths correlate well along the eastern half and poorly on the western half with refraction depths shallower.

Both Profiles A and B show in their eastern half a sudden discontinuity in basement reflection horizon from one station to the other with downthrow to the east; these features may, in trend with the regional structural pattern, mark the intersection of a NNE-SSW geological fault.

- (c) First results on Profile D also correlate well with what was expected; a fairly shallow basement deepening from 20 m. to 50 m. towards the east with four well-defined V-shaped channels, the two eastern ones potential targets for drilling.

### 3. Programme for September

#### 3.1 Seismic survey

The survey is expected to be completed by September 16; 32.7 kms. remain to be done:

- Profile D: 11.34 kms.
- Profile C: 12.00 kms.
- Profile E: 9.39 kms.

### 3.2 Drilling programme

It is expected to start on September 18th and to be completed around October 4th.

Depending on results 10 to 15 holes representing 1000 to 1400 m will be drilled along seismic profiles.

Each hole will be:

- . geologically sampled by taking drill cuttings every 3 feet
- . logged for gamma-ray, self-potential and single point resistivity with a Neltronic porta-logger of the South Australian Department of Mines
- . surveyed for up-hole velocity

Depending on results a small coring programme involving no more than 60 m of core may take place at the end of the drilling programme.

5. LIST OF ILLUSTRATIONS ACCOMPANYING THIS REPORT . . . .

Seismic and Drilling Cross Sections

Seismic Results and Correlation

Test Profile

Profile A

Profile B