

TENEMENT: EXPLORATION LICENCE No. 157

002

TENEMENT HOLDER: URANERZ (AUSTRALIA ) PTY. LTD

REPORTS:

WOBER, H. 1975

Letter: E.L. 157. First quarterly report for E.L. 157  
covering the period October 21st 1974 to  
20th January 1975. (pg. 5)

URANERZ (AUST). PTY. LTD 1975

First quarterly report on Exploration work  
carried out on E.L. 175. coverong the period  
October 21st 1974 to January 20th 1975.  
(No Plans) (pgs. 6-15)

APPENDIX 1

WEBB, B.P. 1975

Palynology of cores samples Bore 18.  
Exploration Licence No. 157 (pgs. 16)

REPORTS:

GATZWEILER, R. 1975

Letter: Final report E.L. 157, covering the period  
21st October 1974 to 20th April 1975. (pgs. 17)  
(No Plans)

NELSON, R.G 1975

Progress report on geophysical survey in  
E.L. 157, Mulgathing area. January 1975. (pgs.18-60)

Plans:

S11160 Locality Plan. (pg. 30)  
S11161 Location of geophysical traverses. (pg. 29)  
S11162 Regional gravity contours. (pg. 31)

APPENDIX 3

GEOPHYSICAL LOGS DRILL HOLE 1-18

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Hole 7-15 (2477(2)-8)  
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Plans:GEOPHYSICAL LOGS DRILL HOLES

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REPORT:

DEWHURST, R. 1975

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| Exploration 1974 on E.L. 157<br>in the Tarcoola area, South Australia. | (pgs. 61-95) |
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| Map 2 Aeromagnetic contours, E.L. 157, section of 1:250,000<br>Tarcool sheet | (pg.77)      |
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| Map 4 Cross-section from seismic and gravity data for traverse<br>2.         | (2477(2)-10) |
| Map 5 Cross -section from seismic and gravity data for traverse<br>2.        | (2477(2)-11) |
| Map 6 Cross section from seismic data for traverses 3.                       | (2477(2)-12) |
| Map 7 Cross- section from seismic and gravity data for<br>traverses 4.       | (2477(2)-13) |
| Map 8 Cross-section from seismic data for traverses 5.                       | (1477(2)-14) |

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# URANERZ (AUSTRALIA) PTY. LTD.

27 OXFORD STREET, LEEDERVILLE, W.A., 6007

P.O. Box 43, CLAREMONT, W.A., 6010.  
Cable: Uranerz Perth

Telephone: Perth 81 4366  
Telex: Perth AA 93437

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WO/CBB

17th January, 1975

Department of Mines,  
169 Rundle Street,  
ADELAIDE, S.A. 5000

Attention: Director of Mines

Dear Sir,

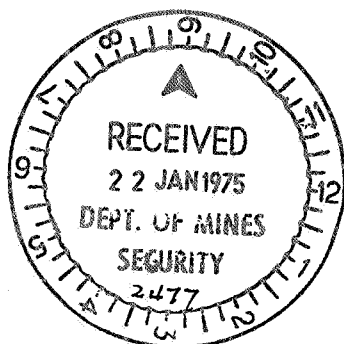
Re: EL 157

Please find enclosed our First Quarterly Report for EL 157, covering the period October 21st 1974 to January 20th 1975.

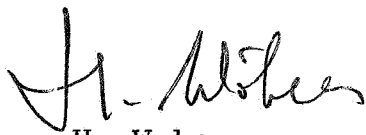
The following costs were incurred to 31st December 1974:

|                                                                        |                    |
|------------------------------------------------------------------------|--------------------|
| Preliminary investigations and expenses                                | 7,616.15           |
| Field work:                                                            |                    |
| Salaries                                                               | 2,923.84           |
| Geophysical Contractors                                                | 11,516.29          |
| Drilling                                                               | 9,727.98           |
| Field operating costs, consumables, fuel, repairs, freight, fares etc. | 2,222.13           |
| Vehicles and Instruments, part of annual depreciation                  | <u>975.93</u>      |
|                                                                        | <u>\$34,982.32</u> |

No further work is anticipated. Having fulfilled the work commitments, the EL will be allowed to expire. Please advise if an earlier formal surrender is desired.



Yours faithfully,  
URANERZ (AUSTRALIA) PTY. LTD.

  
H. Wober  
Technical and  
Administration Manager

Encl.

FIRST QUARTERLY REPORT ON EXPLORATION WORK CARRIED OUT ON EXPLORATION LICENCE NO. 157 COVERING THE PERIOD OCTOBER 21ST 1974 TO JANUARY 20TH 1975.

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## S U M M A R Y

During October reconnaissance was carried out in order to prepare for forthcoming geophysical and drilling programmes. In November and December refraction seismic and gravity surveys were successfully carried out and followed up with an eighteen hole rotary drilling and down-hole logging programme.

## I N T R O D U C T I O N

EL 157 is bounded by latitudes  $30^{\circ}10'S$  and  $30^{\circ}28'S$  and longitudes  $133^{\circ}37'E$  and  $134^{\circ}04'E$ . It is 650km NW of Adelaide and 80km WNW of Tarcoola by road.

Durkin outstation in the north west section of the EL was chosen as a camp site on the basis of access to the EL and the availability of potable water.

Tarcoola lies on the Trans-Australian Railway line from Perth to Port Augusta. Access to Tarcoola is also possible by road from Kingoonya on the Stuart Highway. These roads, however, are frequently in very bad condition and have, on several occasions recently, been impassable following heavy rain. Access to Mulgathing, from the railway road west of Tarcoola, is normally good. The roads on Mulgathing property are kept in good condition throughout the year.

The writer was in the area from October 2nd to 6th inspecting the area and making arrangements with the property manager for the forthcoming work. The writer was again in the area from November 5th to December 5th inclusive, observing and supervising geophysical work and drilling. Seismic and gravity

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surveys were carried out between November 7th and November 24th, while drilling and down-hole logging took place between November 28th and December 5th.

### GEOLOGY

Banded ironstone, granite gneiss and granite basement rocks of the Gawler Platform outcrop around the margins of the EL. Within the EL Upper Tertiary and Quaternary aeolianites pre-dominate at the surface with subordinate areas of calcrete and middle Tertiary silcrete. These sediments overlies strongly kaolinized gneiss and schist to the south, granite, gneiss and banded ironstone to the north and Lower Permian and Tertiary sediments in the central areas.

### TARGETS

Tertiary sediments overlying a Lower Permian palaeochannel, the Mulgathing Trough, located by a previous explorer, were expected to be carbonaceous and to contain any accumulations of uranium derived from surrounding granitic rocks. The Permian palaeochannel, whose depth was unsuspected prior to the seismic surveys, was considered likely to contain basal arkosic sediments which could also host uranium mineralization.

# INVESTIGATIONS AND RESULTS 008

## (a) Refraction seismic surveys.

Surveys, as summarized below, were carried out over five lines crossing the palaeochannel position inferred from previous work done by Nissho-Iwai and regional gravity maps.

A twenty-four channel vehicle mounted recorder operated in the centre of 4,800ft. (1,463m) spreads with geophones were spread at 200ft. (61m), intervals. Shots were fired at each end of the spread to allow corrections for dip to be made. The widespread occurrence of silcrete and calcrete at or near the surface precluded the use of a Gemco drill to prepare shot holes. As a result charges of 6 lb (2.7kg) of gelignite were fired in pits of 0.6m to 1.0m depth.

Spreads were moved 2,400ft. (732m) after each pair of shots, maintaining a constant overlap of 2,400ft. (732m).

Preliminary results of this seismic work indicated a somewhat sinuous 430m deep channel in high seismic velocity basement rocks (5,800 - 6,000 m/sec), believed to be granite. The channel appeared to be largely filled with medium seismic velocity sediments (2,100 m/sec) believed to be Lower Permian in age. Overlying the Permian sediments a 30-100m thickness of Tertiary sediment of low seismic velocity (1,200 - 1,500 m/sec) was indicated. The indicated average width of the channel, at a depth of 100m, was 5,600m.

| <u>Line</u> | <u>Direction</u> | <u>Seismic</u>   | <u>Gravity</u>   |
|-------------|------------------|------------------|------------------|
| 1 A         | E-W              | 1,463m           |                  |
| B           | NE-SW            | 4,998m           |                  |
| C           | N-S              | 2,804m           |                  |
| 2 A         | SW-NE            | 4,998m           | 4,998m           |
| B           | E-W              | 2,530m           | 2,530m           |
| C           | SW-NE            | 2,072m           | 2,072m           |
| 3           | N-S              | 11,582m          |                  |
| 4           | SW-NE            | 10,120m          | 10,120m          |
| 5           | NW-SE            | <u>9,754m</u>    | <u>9,754m</u>    |
|             |                  | > <u>50,321m</u> | > <u>29,474m</u> |

Additionally several refraction seismic weathering spreads, in which preliminary results are not at present available, were conducted on lines 2 and 5. This work occupied less than one full day on the day of departure of the contractors.

(b) Gravity Surveys.

Gravity surveys were carried out on lines 2, 4 and 5 in the course of 3 to 4 days. The surveys, for which preliminary results are available for one line only, line 5, confirm the result of the seismic survey.

(c) Levelling.

Levels were carried from Bench Mark #4528, on Commonwealth Hill Station north west of Tarcoola, to and along all lines on which seismic and gravity work was carried out.

Personnel.

Geophysical work was carried out by a team of four (later three) from the South Australian Department of Mines, led by Mr. R. Nelson a geophysicist of that Department.

Levelling was carried out by a team of two surveyors from the South Australian Department of Mines.

(d) Drilling.

Eighteen open holes were drilled by Thompson Drilling Company of Millicent. Details of the holes are tabulated below. A Mayhew 1000 rig equipped for HQ wireline coring was used throughout the programme, operated by a team of three. A large water truck and Toyota Landcruiser were used as support vehicles. The crew operated on a seven day week 12 hour shift basis, drilling a total of 1,307m in eight days and averaging 163m per day. The average output was diminished by long distances between lines and between drill locations and water supplies. Two coring runs delayed the completion of the final hole by 1½ days.

| <u>Hole#</u> | <u>Line#</u>                 | <u>Position<br/>on line</u> | <u>Drilled<br/>depth</u> | <u>Probed<br/>depth</u> | <u>Core</u> |
|--------------|------------------------------|-----------------------------|--------------------------|-------------------------|-------------|
| 1            | 2A                           | 2,438m                      | 44m                      | (41)m                   |             |
| 2            | 2A                           | 3,353                       | 120                      | (119)                   |             |
| 3            | 2A                           | 4,267                       | 46                       | (46)                    |             |
| 4            | 200m north of Durkin Bore    |                             | 47                       | (46)                    |             |
| 5            | 1B                           | 610                         | 158                      | (157)                   |             |
| 6            | 1B                           | 1,524                       | 38                       | (37)                    |             |
| 7            | 1B                           | 2,438                       | 29                       | (25)                    |             |
| 8            | 3                            | 7,010                       | 38                       | (37)                    |             |
| 9            | 3                            | 7,925                       | 43                       | (41)                    |             |
| 10           | 3                            | 6,096                       | 43                       | (42)                    |             |
| 11           | 4                            | 4,877                       | 75                       | (73)                    |             |
| 12           | 4                            | 3,962                       | 75                       | 60m(73)                 |             |
| 13           | 4                            | 3,048                       | 61                       | 60                      |             |
| 14           | Adjacent to Snake Rocks Bore |                             | 50                       | 49 (49)                 |             |
| 15           | 5                            | 3,048m                      | 61                       | 60 (59)                 |             |
| 16           | 5                            | 3,962                       | 52                       | 50                      |             |
| 17           | 5                            | 4,877                       | 66                       | 64                      |             |
| 18           | 5                            | 5,944                       | 261                      | 261                     | 3.35m       |

Probe depths in parenthesis indicate use of suitcase logging unit.

Drilling results tended to confirm the position of the basement - Permian contact with considerable accuracy except on the shallow flanks of the basement depression. Estimates of thickness of the Tertiary sediments tended to exceed the actual thicknesses though it should be emphasized that the predictions were based on a seismic programme planned to locate the basement depression at depths of 150m or more.

#### (e) Probing.

Gamma, resistivity and self potential logging was carried out by Geoscience Associates of Adelaide. At the start of the programme a portable suitcase logging unit was used in the absence of a new vehicle mounted logging unit which was being

prepared for the contract. Towards the end of the programme the new unit was used. Eleven holes were probed with the suitcase unit, three holes with both units and four holes with the vehicle mounted unit.

Gamma logs were obtained in each drillhole. The maximum radioactivity, in weathered granite in Hole #14, was 40cps (vehicle mounted unit) estimated to be equivalent to 28ppm  $eU_3O_8$  in the absence of thorium. In general, radioactivity varied from 4 to 20cps which can be regarded as low background activity.

No significant gamma peaks were noted at the interface between Tertiary and Carbonaceous Permian sediments. Such peaks would be expected if significant amounts of uranium were contained in the groundwater.

Resistivity and self-potential logs proved generally unsuccessful in this environment with the exception of Holes #12 and 13. The writer believes that the generally saline groundwater, estimated to contain about 1% salt, reduced the formation resistivity to uniform levels of about 5 ohm-metres. The self-potential logs were also affected by the salinity, but the use of drilling water drawn from the formations being logged probably contributed to the lack of definition to a greater extent. Copies of the geophysical logs will be included in the final report.

(f) Logging.

Samples were recovered at 5ft. (1.52m) intervals and lithologically logged on site. Special attention was paid to lithology, particle size, colour, oxidation and presence of carbon, pyrite and feldspar.

Hole #5 on Line 1 is given as an example of the generalized section of the flank of the basement depression.

Lithological logs of all drillholes will be included in the final report.

- 0 - 9m Soil, red-brown, variable grain size, strong oxidation, no carbon pyrite or feldspar.
- 9 - 12m Silcrete, grey-brown, massive, unoxidized, no carbon pyrite or feldspar.
- 12 - 21m Calcrete, sand, white, very fine-grained, unoxidized, no carbon pyrite or feldspar.
- 21 - 38m Sand, clay, white, fine to medium grained quartzose, sub-angular, unoxidized, no carbon pyrite or feldspar.
- 38 - 43m Granules, quartzose, white. No oxidation, carbon pyrite or feldspar. Bottom of Tertiary.
- 43 - 158m Clay-silt or shale, dark grey, no oxidation, abundant carbon, no pyrite or feldspar. Permian.
- 158m Probable granite basement. No sample recovery.

Middle Tertiary silcrete and calcrete of varying thickness occur at or near the surface throughout the area. These are frequently overlain by red-brown wind-blown sands and silts. The calcrete or calcareous sand normally underlies the silcrete and grades downward into silts, sands and kaolinitic clays largely of granitic origin and immediate provenance.

Towards the edges of the basement depression the Tertiary sequence tends to become clayey. Coarse granules and fine gravels, derived from locally outcropping kaolinized granites, are present in restricted zones in the Tertiary sequence. These may represent infill deposits in channels cut in a predominantly fine grained Tertiary sequence. However, lack of evidence renders this somewhat speculative.

At the base of the Tertiary sequence pink or yellow-grey clays occasionally underlie white quartz granite and kaolin deposits, sometimes showing a gradational colour change into typical dark grey to black, occasionally fissile, Permian mudstone and shale. Lower Permian age for these sediments has already been established, by palynologists of the South Australian

Mines Department, working on material provided by Nissho-Iwai.

The mudstone and shale is now known, in Hole #18, to extend to a depth of 261 metres. The writer believes that the shale extends to a greater depth in the centre of the depression but that an increase in grain size is likely to occur and that coarse grained and possibly arkosic sediments may occur at the bottom of the depression. Staff of the South Australian Mines Department have postulated the presence of Lower Permian glacial deposits.

Permian coal deposits are known to occur in the Phillipson Trough some distance to the north. However, they are believed to be Upper Permian in age and younger than the sediments occurring in the Mulgathing Trough.

Pink orthoclase granite outcrops at Mulgathing Rocks and at Snake Rocks south-east of Mulgathing Homestead. At Snake Rocks it is associated with a white kaolinized, possibly originally leucocratic, granite. This granite also outcrops south-west of Charcott Bore near the south-west end of seismic line 1B. It is this kaolinized granite that is believed to have contributed the kaolin and sub-angular coarse grained to fine gravel-sized quartz appearing in the Tertiary sequence.

The evidence of sand and clay banding in the electric logs of Holes #12 and 13, suggests that the clay and sand fractions were distinct before transport, and therefore that kaolinization of arkosic sediments in situ is less probable than the erosion and transport of kaolinized granite.

That the pink orthoclase granite and the kaolinized granite are distinct lithological units is indicated by the contact located in Hole #14 and their surface appearance at Snake Rocks.

### SAMPLING/ASSAYING

16 selected dust samples were collected from those holes drilled with air, entirely or in part. The samples were analyzed for uranium by AMDEL using the fluorimetric method and the results are listed in Table 1.

It should be noted that all uranium values are extremely low, being well below those that might be expected in an environment hosting sedimentary uranium deposits.

The results of palynological examinations of core samples from Hole No. 18 are included as Appendix 1. It should be noted that the Lower Permian sediments referred to are younger than the Permian glacial deposits occurring in South Australia and that these may well be included in the basal sediments of the Mulgathing Trough which may be of glacial origin.

### OUTLOOK

Final seismic and gravity profiles, together with a report, are expected from the Geophysical Section of the South Australian Mines Department shortly. Petrological descriptions of drillhole samples are expected from The Australian Mineral Development Laboratories.

A final report will be prepared which will include all work carried out on the EL.

### R E C O M M E N D A T I O N S

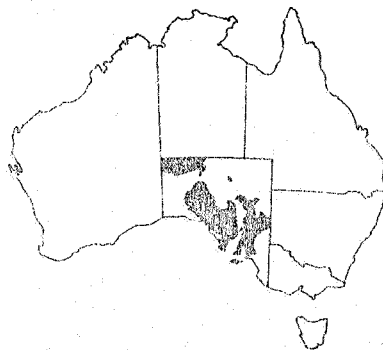
In view of the lack of gamma anomalism in the holes drilled, low gamma background, low uranium analyses and lack of favourable Tertiary sediment characteristics, the writer recommends relinquishment of the area effective at the end of the first quarter year on January 21st, 1975.

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ASSAY RESULTS OF DRILLHOLE SAMPLES

Table 1

| <u>Hole No.</u> | <u>Depth<br/>(ft.)</u> | <u>U<sub>3</sub>O<sub>8</sub><br/>(ppm)</u> |
|-----------------|------------------------|---------------------------------------------|
| 1               | 10 - 15                | 1.2                                         |
|                 | 25 - 30                | 1.4                                         |
|                 | 40 - 45                | 1.1                                         |
|                 | 55 - 60                | 0.8                                         |
|                 | 95 - 100               | 1.3                                         |
|                 | 100 - 105              | 1.4                                         |
|                 | 115 - 120              | 1.1                                         |
|                 | 140 - 145              | 1.8                                         |
| 2               | 70 - 75                | 3.2                                         |
|                 | 100 - 105              | 3.6                                         |
|                 | 285 - 290              | 2.9                                         |
| 3               | 40 - 45                | 1.2                                         |
|                 | 60 - 65                | 1.4                                         |
|                 | 90 - 95                | 3.2                                         |
| 7               | 35 - 40                | 1.4                                         |
|                 | 65 - 70                | 2.0                                         |



DEPARTMENT OF MINES  
SOUTH AUSTRALIA

169 RUNDLE ST. ADELAIDE

Box 38 Rundle St. P.O. S.A. 5000  
Phone: ~~23 0461~~ Telegrams: Domex  
223 0461

OUR REF. EL.157 WKH:PAL

10th January 1975

016

Mr. R.H. Dewhurst,  
Uranerz (Australia) Pty. Ltd.  
37 Taunton Avenue,  
ENFIELD. 5085

Dear Sir,

Palynology of Core Samples, Bore 18, EL.157

Three core samples from this borehole (locality TARCOOLA 196235) have yielded the following results.

Core 1 at 246ft 9 ins. and at 252ft. 6 ins. (sample Nos. S3265, S3266) - abundant carbonaceous matter with spores indicative of the Early Permian Stage 3 microfloras. Lithologically and palynologically the samples correlate with the Stuart Range Beds (high in the section of this unit) of the Arckaringa Basin. The samples however appear to be non-marine.

Core 2 at 817ft 9 ins (sample No. S3267) - sparse organic matter in the bottom of the core (top of core badly contaminated) with palynomorphs indicative of early Stage 2 (early Permian - late Carboniferous) microfloras. This core, a diamictite, correlates with the Boorthanna Formation of the Arckaringa Basin. Marine influence is not indicated.

Yours faithfully

*BP Well*

DIRECTOR OF MINES *perm*

# URANERZ (AUSTRALIA) PTY. LTD.

27 OXFORD STREET, LEEDERVILLE, W.A., 6007

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P.O. Box 43, CLAREMONT, W.A., 6010.  
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Telex: Perth AA 93437

Dr.Ga/CBB

17th April, 1975

The Director of Mines,  
Department of Mines,  
169 Rundle Street,  
ADELAIDE, S.A. 5000

Dear Sir,

Re: EL 157

Please find enclosed our Final Report for EL 157 covering the period 21st October, 1974 to 20th April, 1975. Please note that Appendix 2, "Report on Geophysical Survey in EL 157, Mulgathing Area" by R.G. Nelson will be supplied by the Geophysical Branch of your Department. Maps 4 to 8 of our Final Report, however, represent final interpretations of the geophysical work carried out by your Department.

The following expenditures were incurred for work on the EL during the term:

|                                                                                                                                |                    |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Preliminary investigations and expenses                                                                                        | \$7,616.15         |
| Salaries and wages                                                                                                             | 3,242.22           |
| Field operating costs                                                                                                          | 2,291.69           |
| Geophysical Contractor                                                                                                         | 11,516.29          |
| Drilling                                                                                                                       | 9,727.98           |
| Distribution of Head Office costs,<br>Management and Chief Geologist,<br>Vehicle, Instruments (part of<br>annual depreciation) | <u>10,080.50</u>   |
|                                                                                                                                | <u>\$44,474.83</u> |

We herewith confirm that we will not seek an extension to the licence.



Yours faithfully,  
URANERZ (AUSTRALIA) PTY. LTD.

*R. Gatzweiler*

Dr. R. Gatzweiler  
Exploration Manager

Encls.

PROGRESS REPORT ON GEOPHYSICAL SURVEY  
IN E.L. 157, MULGATHING AREA.

by

R. G. NELSON  
Geophysicist  
Geophysical Services Section

JANUARY 16TH, 1975

REPT.BK.NO. 75/5  
D.M. NO. E.L. 157  
G.S. NO. 5546

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## PLANS

| <u>Plan No.</u> | <u>Title</u>                      | <u>Scale</u> |
|-----------------|-----------------------------------|--------------|
| S11160          | Locality Plan                     | As shown     |
| S11161          | Location of geophysical traverses | 1:250 000    |
| S11162          | Regional gravity contours         | 1:250 000    |

REPT.BK.NO. 75/5  
D.M. NO. E.L. 157  
G.S. NO. 5546

PROGRESS REPORT ON GEOPHYSICAL SURVEY  
IN E.L. 157, MULGATHING AREA.

INTRODUCTION

Five geophysical traverses were made within the area covered by E.L. 157 (see Plan No. S11160) at the request of Uranerz (Australia) Pty. Ltd. Their object was to locate and outline the shape and depth of a paleo-channel lying within basement, the existence of which had been inferred from previous drilling information (see the reports on E.L. 48 by Nissho-Iwai Co. (Aust.) Pty. Ltd., held on open file by the South Australian Department of Mines - Envelope 2390.

GEOLOGY

Acid metamorphic rocks of probably Lower Proterozoic age form basement in the area: these appear to be predominantly granite gneisses, although outcrop is sparse.

The paleo-channel inferred from the Nissho-Iwai drilling has been filled by a black mudstone, palynological examination of which indicates "abundant spores of early Permian Age" (W.K. Harris (1973) - report in S.A. Department of Mines envelope 2390, on E.L. 48).

Tertiary sediments (white sandstones and siltstones) overly unconformably both basement and Permian rocks. A thin silcrete duricrust has developed over much of the area.

GEOPHYSICAL METHODS USED

The five traverses were made along lines selected by Uranerz. These cross an elongated gravity low on the Bureau of Mineral Resources 1:250 000 Bouguer gravity map (see Plan No. S11162) which is thought to

be an expression of the paleo-channel. An inspection of aeromagnetic maps of the area shows that the channel may be delineated similarly by use of these. A north-easterly trending linear feature passing through Durkin in the north-west of the leased area appears on both the regional gravity and the aeromagnetic maps, obscuring to some extent the channel anomalies. This may be caused either by a deep-seated structure within basement or by a change in basement rock type.

The seismic refraction technique was used on all five lines. Gravity readings were made on lines 2, 4 and 5. See Plan No. S11161 for locations of the traverses.

## 1. Seismic refraction

### a. Instrumentation

Texas Instrument Co. 7000B 24-channel recording seismograph interfaced with a Geospace R1801 electrostatic camera using paper speed of 50 cms/second.

Filters: low-cut - out;

high-cut - type L, 57 hz.

Amplifiers were tested regularly in parallel using an oscillatory signal to check for uniformity in amplitude and phase response. Regular checks were also made on instrumental noise.

Radio time breaks were used (2 140 kHz).

### b. Geophone layout

Originally it was thought that the paleo-channel would be no more than 150 metres deep and that good results would be obtained by arranging the geophones 61 metres (200 feet) apart in line along the traverse, firing a shot in the centre of the spread, then moving the geophone spread one quarter of its length along the traverse, firing another shot at spread centre, and so on.

In this way it was felt that overlapping basement refractions from forward and reverse shots would be obtained and thence a detailed outline of the basement profile.

However, it soon became clear that basement lay at depths of 300 metres or more in the centre of the channel and we were forced to fire shots at both ends of the basic spread and then move it one half of its length at a time. Even by adopting this procedure refractions from basement in the deeper parts of the channel were obtained only on the last few traces of each record. However, overlapping arrivals were available to give good resolution on the Tertiary-Permian interface.

A Gemco drilling rig mounted on the back of a Land Rover utility was to have been used to place the shots at depths of at least 5 metres, but the hard silcrete layer common through out the area prevented the drill from penetrating to any significant depth. Use of the rig was abandoned and near-surface shots consisting of two 1.5 kg sticks of AN60 gelignite were used. The resulting records are of mediocre quality but nevertheless give the required information at minimum cost.

### c. Recording techniques

The silcrete layer presents a special problem as it forms a high-speed layer overlying lower velocity material. Now, according to optical ray theory, this should form a velocity inversion resulting in overestimates in depths. However, ray path theory does not hold where the high-speed layer becomes very thin in relation to the seismic wavelength: refraction arrivals from such thin layers show a relatively rapid amplitude decay with decreasing frequency (Lavergne, 1966; Poley & Nootboom, 1966).

Poley and Nootboom (1966) provide data which show that this attenuation is greatest when the thickness/wavelength ratio is less than 0.3. It was found that by using a high-cut filter with a 3 dB value of 57 Hz and a slope of 12 dB/octave (type L on the 7000B system) the refractions from the silcrete layer were attenuated below general noise levels beyond a horizontal distance of 30 metres.

## 2. Gravity

### a. Instrumentation

La Coste and Romberg gravity meter; serial no. LRG-212.

| <u>Calibration factor</u> | <u>Date</u> |
|---------------------------|-------------|
| 1.0582 mgals/division     | 30.10.74    |
| 1.0581 mgals/division     | 17.12.74    |

### b. Control base station

Both elevations and gravity values were tied to Department of Lands BM4528 on the Commonwealth Hill road which has been assigned the following values:

elevation - 155.694 metres A.S.L.

observed gravity - 979 300.30 mgals.

### c. Drift control

Tie stations were established at intervals along each traverse such that the time taken to read gravity values at stations in between would be not more than one hour. Linear gravity drift was assumed between tie stations.

### d. Base network control

A series of readings were made to tie the ends of traverses together and to form a network for control purposes. The resulting loop misclosure diagram was adjusted by a least squares method (Smith, 1951) to distribute errors. Average loop misclosure was 0.07 dial divisions.

### e. Horizontal control

Stations were established at 122 metre intervals along each traverse by placing a peg at every second geophone station on the seismic traverses.

Control was maintained by referring the ends of lines and stations in between to known points on 1:47 520 base maps of the area. Latitudes for the various stations were derived from these maps.

f. Accuracy

024

Observed gravity accurate to 0.01 mgals.

Elevation considered accurate to 3 cms (equivalent to 0.01 mgals).

Latitude accurate to 10 metres (0.01 mgals).

Therefore the data are considered accurate to  $((0.01)^2 + (0.01)^2 + (0.01)^2)^{1/2} = 0.02$  mgals.

g. Reduction of data

Data were reduced according to standard formulae (vide Grant and West, 1966, pp 238-239). Thus the latitude, free-air and elevation corrections were applied. No topographic corrections have been made as topographic relief is slight.

A density of 1.9 gms/cc was assumed in applying the elevation and is borne out by the following information from core taken from Uranerz drill hole No. 18 on Line 5.

| <u>Rock type</u> | <u>Depth</u> | <u>Dry Bulk Density</u> | <u>Wet Bulk Density</u> |
|------------------|--------------|-------------------------|-------------------------|
| Permian mudstone | 76 m         | 1.77                    | 1.88                    |
| " "              | 259 m        | 2.07                    | 2.27                    |

FURTHER DETAILS

1. Personnel

R. G. Nelson (Geophysicist) - 5.11.74 to 26.11.74

B. A. C. Brice (staff field assistant) - 4.11.74 to 26.11.74

J. Davis (field assistant) - 4.11.74 to 26.11.74

M. Ross (field assistant) - 4.11.74 to 16.11.74

2. Seismic coverage

| <u>Line</u> | <u>Distance (km)</u> |
|-------------|----------------------|
| 1A          | 2.8                  |
| 1B          | 5.0                  |
| 1C          | 1.3                  |
| 2           | 5.0                  |
| 2A          | 2.7                  |

025

| <u>Line</u>  | <u>Distance (km)</u> |
|--------------|----------------------|
| 2B           | 2.1                  |
| 3            | 11.6                 |
| 4            | 10.1                 |
| 5            | 9.8                  |
| <b>Total</b> | <u>50.4</u>          |

### 3. Gravity coverage

| <u>Line</u>  | <u>Distance (km)</u> |
|--------------|----------------------|
| 2            | 5.0                  |
| 2A           | 2.7                  |
| 2B           | 2.1                  |
| 4            | 10.1                 |
| 5            | 9.8                  |
| <b>Total</b> | <u>29.7</u>          |

Altogether 250 stations were occupied.

## DISCUSSION OF RESULTS

### 1. Seismic refraction

Sections were drawn in the field to aid in the drilling programme. These were made from spot depth estimates. Further reduction and interpretation of the data is underway and it is expected that greater resolution will be achieved. The channel is at least 300 metres deep.

The general distribution of velocities within the various rock types is tabled below.

| <u>Rock type</u>                   | <u>Velocity</u> | <u>Remarks</u>                                              |
|------------------------------------|-----------------|-------------------------------------------------------------|
| Sandy soil                         | 330-450 m/s     | Up to 2 m thick; information from short weathering spreads. |
| Silcrete                           | 2 000-2 700 m/s | Weathering spreads                                          |
| Tertiary sandstones and siltstones | 1 000-1 700 m/s |                                                             |
| Permian mudstone                   | 2 040 m/s       | 1 860 m/s on basin margins;                                 |

| <u>Rock type</u>                              | <u>Velocity</u> | <u>Remarks</u>                                                                                                                                        |
|-----------------------------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Beneath Permian<br>mudstone<br>(type unknown) | 2 870 m/s       | 2 130 m/s in deeper sections.<br>Possibly weathered basement;<br>could also be lower member in<br>Permo-Carboniferous Series -<br>see comments below. |

Crystalline basement 5 600 m/s

Comments:

The 2 870 m/s refractor below the Permian mudstone was not noted in the original field interpretation, but revealed itself in an overall appraisal of the results of the traverses studied in detail so far.

The closest available seismic studies for the purpose of comparison are from the Arckaringa Basin over 100 km to the north-east. Typical velocities here are:

| <u>Age</u>                                                | <u>Velocity</u>                          |
|-----------------------------------------------------------|------------------------------------------|
| Lower Cretaceous                                          | c.2 200 m/s                              |
| Top of Permian                                            | c.2 500 m/s                              |
| Unit 1 - Lower Permian<br>(top of Stuart Range Formation) | c.2 900 m/s                              |
| Unit 2 - Lower Permian<br>(near base of Boorthanna Fm.)   | c.3 200 m/s with occasional<br>4 100 m/s |
| Crystalline basement                                      | c.5 600 m/s                              |

A correlation of ages with seismic velocities for the Mulgathing data would equate the mudstone with either the Lower Cretaceous or the top of the Permian sequence, and the refractor below the mudstone (2 870 m/s) with Unit 1 of the Lower Permian. Crystalline basement at 5 900 m/s is probably not significantly different from the 5 600 m/s basement in the Arckaringa Basin. The fact that the mudstone has been identified as Lower Permian indicates possible different depositional environments, depth of burial, and compaction and lithification processes.

If the 2 870 m/s refractor exists, it will make depth estimates to basement in the centre of the channel substantially greater.

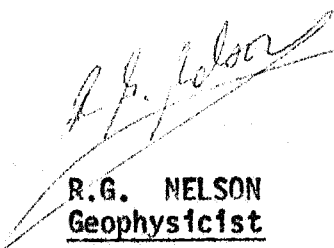
Seismic refraction appears to have outlined the paleo-channel quite well.

## 2. Gravity

Bouguer gravity values have been calculated and plotted for each of the traverses made. Each traverse shows a distinct gravity low with steep sides which is undoubtedly associated with the channel itself.

Further work to be undertaken involves removal of the regional effects and then estimating depths from the residual gravity profiles. Possibly a density vs. depth relationship may have to be derived to give a more accurate picture of basement depths than the simple assumption of fixed density contrast would give.

JANUARY 16TH, 1975  
RGN:TJB

  
R.G. NELSON  
Geophysicist

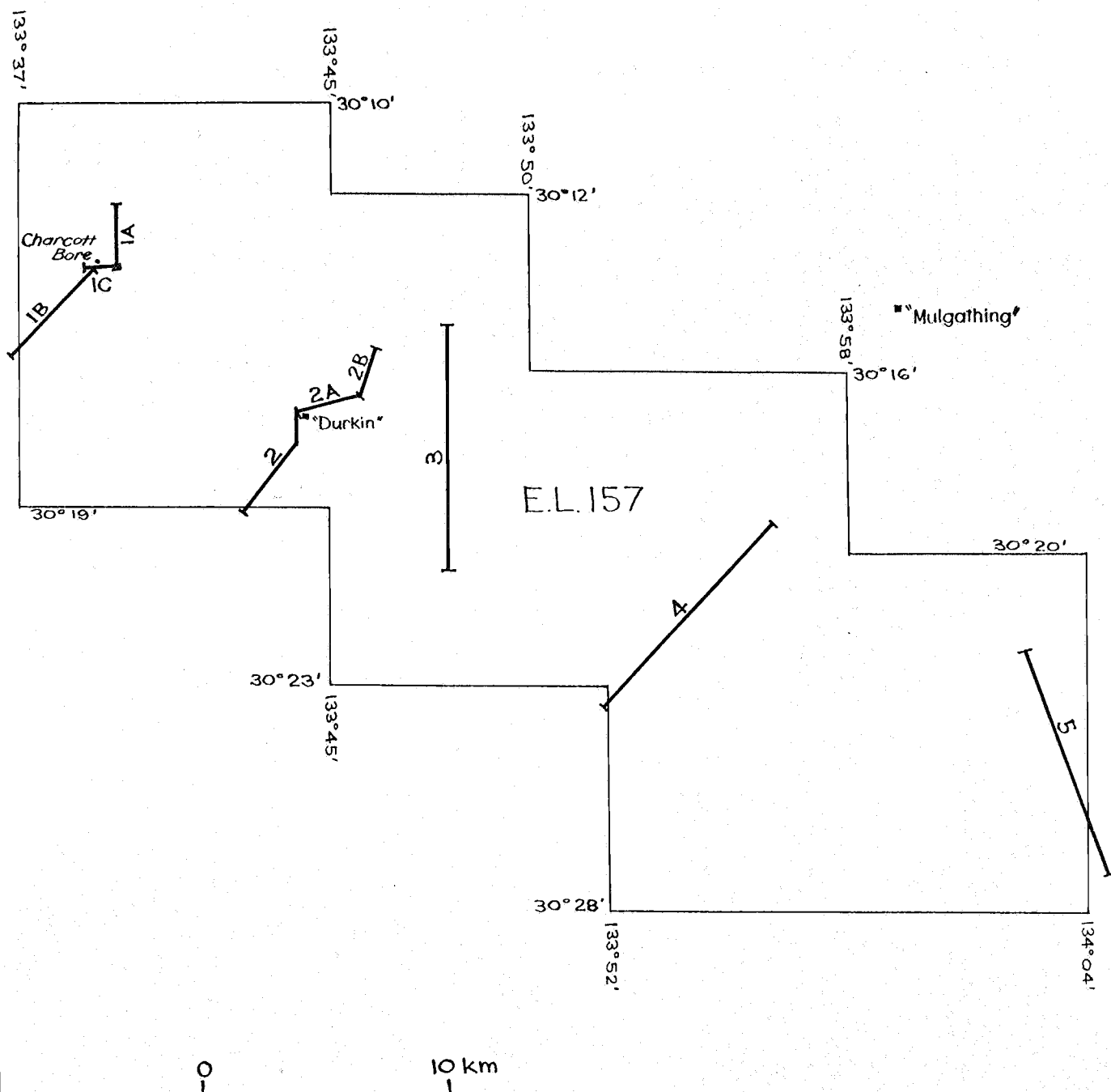
## REFERENCES

- GRANT, F.S. and WEST, G.F., 1966. Interpretation theory in applied geophysics. McGraw-Hill; New York: 584 pp.
- LAVERGNE, M., 1966. Refraction le long des bancs minces rapides et effet d'ecran pour les marqueurs profonds. Geophysical Prospecting, 14: 504-527.
- POLEY, J.Ph, and NOOTEBOOM, J.J., 1966. Seismic refraction and screening by thin high-velocity layers. Geophysical Prospecting, 14: 184-203.

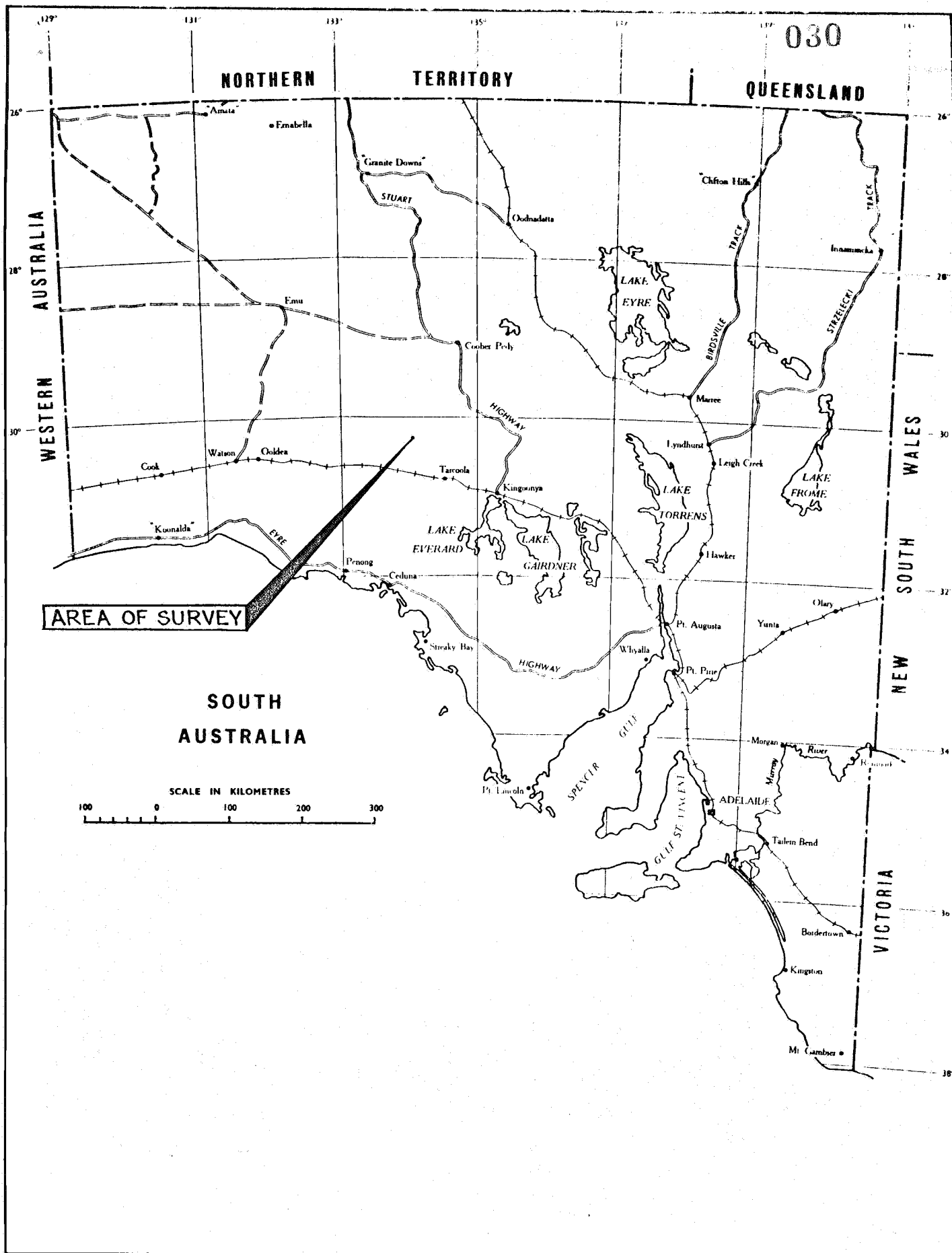
SMITH, A.E., 1951. Graphic adjustment by least squares. Geophysics, 028

26: 222-227.

029



|                                       |  |                     |
|---------------------------------------|--|---------------------|
| DEPARTMENT OF MINES — SOUTH AUSTRALIA |  | Scale : 1 : 250 000 |
| MULGATHING GEOPHYSICAL SURVEY         |  | Date : JAN 1975     |
| E.L. 157                              |  | Drg No.             |
| LOCATION OF GEOPHYSICAL TRAVERSES     |  | S11161              |



DEPARTMENT OF MINES — SOUTH AUSTRALIA

Compiled. R.G.N.

Drn. A.F.

Ckd.

MULGATHING GEOPHYSICAL SURVEY

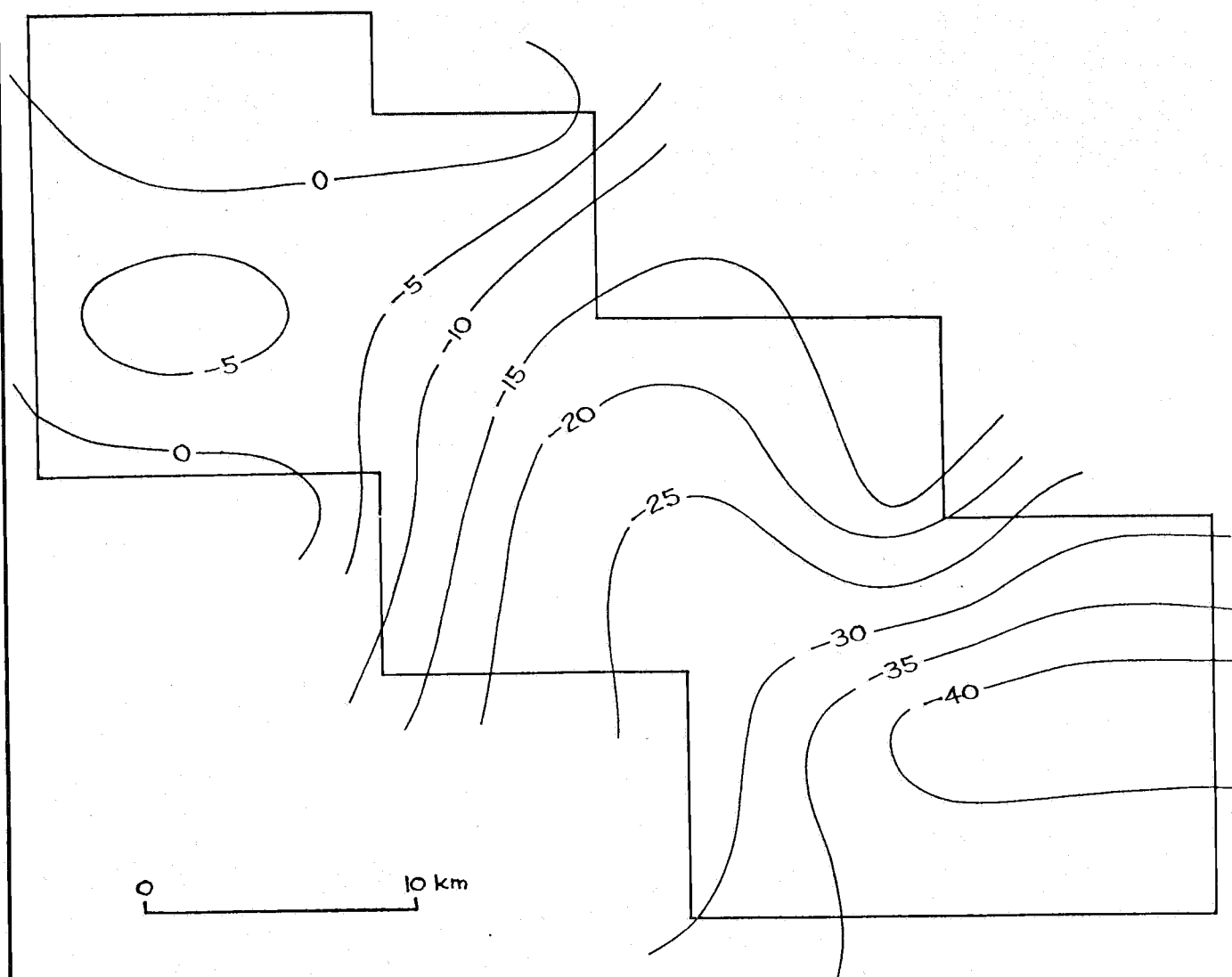
E.L. 157

LOCALITY PLAN

Date: JAN 1975

Org. No.

S11160



B.M.R. Regional gravity contours  
 Assumed density for calculation of  
 bouguer gravity values - 2.2 gm/cc.

|                       |     |                                       |                     |
|-----------------------|-----|---------------------------------------|---------------------|
|                       |     | DEPARTMENT OF MINES — SOUTH AUSTRALIA | Scale : 1 : 250 000 |
| Compiled : R.G.Nelson |     | MULGATHING GEOPHYSICAL SURVEY         | Date : JAN 1975     |
| Drn. A.F.             | Ckd | E.L. 157                              | Drg. No.            |
|                       |     | REGIONAL GRAVITY CONTOURS             | S11162              |

APPENDIX 2

Report on Geophysical Survey in EL 157,  
Mulgathing Area. R.G. Nelson 1975.  
Text of Report not yet to hand - seismic  
and gravity sections are included as  
Maps 4, 5, 6, 7 and 8.

APPENDIX 3

Geophysical Logs - Drillholes 1 - 18.

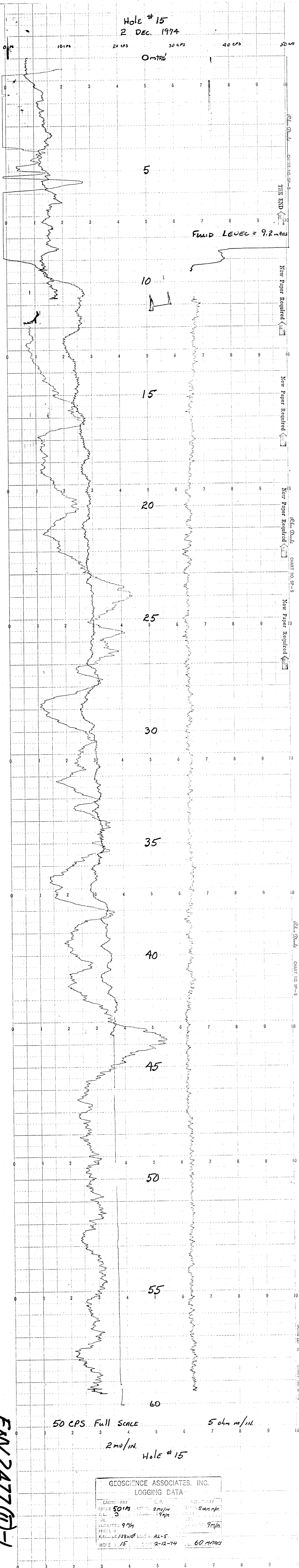
Geoscience.



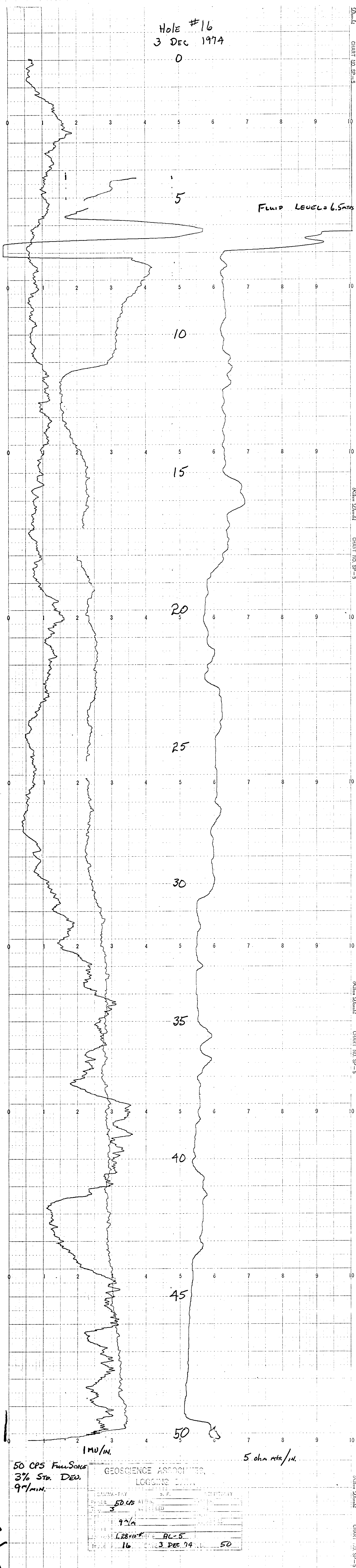
## LOGGING DATA

DATE 2 Dec. 1974

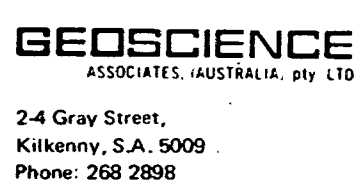
|                                                                             |  |  |  |                                                                             |  |  |  |                                             |  |  |  |
|-----------------------------------------------------------------------------|--|--|--|-----------------------------------------------------------------------------|--|--|--|---------------------------------------------|--|--|--|
| LOCATION: <b>MUSKATINGS</b>                                                 |  |  |  | HOLE NUMBER: <b># 15</b>                                                    |  |  |  | CLIENT: <b>URRNEZ</b>                       |  |  |  |
| State: <b>SOUTH AUST</b>                                                    |  |  |  | Collar elev. _____ ft.                                                      |  |  |  | Claim: _____                                |  |  |  |
| Area: _____                                                                 |  |  |  | Depth drilled: <b>63 METERS</b>                                             |  |  |  | Owned by: _____                             |  |  |  |
| Project: _____                                                              |  |  |  | CASING DATA                                                                 |  |  |  | Operated by: <b>STEVENS</b>                 |  |  |  |
| Prospect: _____                                                             |  |  |  | Walt size _____ in. Dia. <b>4 7/8</b> from <b>0</b> to <b>10</b> ft.        |  |  |  | Unit Operator: _____                        |  |  |  |
| Lat: <b>0</b> " <b>0</b> " <b>0</b> " Long <b>0</b> " <b>0</b> " <b>0</b> " |  |  |  | Dia. (inside) _____ in. Dia. _____ from _____ to _____                      |  |  |  | Unit No. <b>AL-5</b> Office: <b>AOEL</b>    |  |  |  |
| GAMMA RAY                                                                   |  |  |  |                                                                             |  |  |  | ELECTRIC                                    |  |  |  |
|                                                                             |  |  |  |                                                                             |  |  |  |                                             |  |  |  |
|                                                                             |  |  |  |                                                                             |  |  |  |                                             |  |  |  |
| Logged depth (K.M) <b>60</b>                                                |  |  |  | Type _____                                                                  |  |  |  | Logged depth <b>60 m</b> <b>60 m</b>        |  |  |  |
| Range (Full scale) <b>50 cps</b>                                            |  |  |  | Sampled Interval <b>5'</b>                                                  |  |  |  | Resist. scale <b>50 ohm/in</b> <b>2</b>     |  |  |  |
| Time constant (Sec.) <b>3</b>                                               |  |  |  | Cured hole ( ) _____ Non cured hole <input checked="" type="checkbox"/>     |  |  |  | S.P. scale _____ <b>2 mv/in</b>             |  |  |  |
| Paper speed <b>1/2 in</b>                                                   |  |  |  | INTERPRETATION DATA                                                         |  |  |  | Paper speed <b>1 m/2 cm</b> <b>1 m/2 cm</b> |  |  |  |
| Logging speed <b>9 m/m</b>                                                  |  |  |  | Probe No. _____ Standard _____ (cps) K factor <b>1.28 x 10<sup>-5</sup></b> |  |  |  | Logging speed <b>9 m/m</b> <b>9 m/m</b>     |  |  |  |
| Bgknd count (cps) <b>4</b>                                                  |  |  |  |                                                                             |  |  |  | Probe size <b>2 in</b> <b>2 in</b>          |  |  |  |
| Probe No. <b>50 203</b>                                                     |  |  |  |                                                                             |  |  |  | Type <b>ORE</b> <b>ORE</b>                  |  |  |  |
| Size (dia.) (in.) <b>2 in</b>                                               |  |  |  |                                                                             |  |  |  | Bias _____                                  |  |  |  |
| Type <b>ORE</b>                                                             |  |  |  | REMARKS                                                                     |  |  |  | CALIPER                                     |  |  |  |
| Standard (cps) _____                                                        |  |  |  |                                                                             |  |  |  | Logged depth _____                          |  |  |  |
| Dead time <b>6</b> _____ <b>u sec.</b>                                      |  |  |  |                                                                             |  |  |  | Scale <b>1 in. def.</b>                     |  |  |  |
| Amp. Gain _____                                                             |  |  |  |                                                                             |  |  |  | Paper Speed _____                           |  |  |  |
| Ratemeter No. _____                                                         |  |  |  |                                                                             |  |  |  | Logging speed _____                         |  |  |  |
| Bore hole medium _____                                                      |  |  |  |                                                                             |  |  |  | Arm Length _____ in.                        |  |  |  |
| Mud density _____                                                           |  |  |  |                                                                             |  |  |  | Max. Def. _____ in.                         |  |  |  |
| Digital readout _____                                                       |  |  |  |                                                                             |  |  |  |                                             |  |  |  |
| Time base _____                                                             |  |  |  |                                                                             |  |  |  |                                             |  |  |  |
| Upper Disc. _____                                                           |  |  |  |                                                                             |  |  |  |                                             |  |  |  |
| Lower Disc. _____                                                           |  |  |  |                                                                             |  |  |  |                                             |  |  |  |



|                                   |  |                                                                                        |  |                                                 |  |
|-----------------------------------|--|----------------------------------------------------------------------------------------|--|-------------------------------------------------|--|
| <b>LOCATION</b> <b>MULGATHING</b> |  | <b>HOLE NUMBER:</b> <b>16</b>                                                          |  | <b>CLIENT:</b> <b>URANEZ</b>                    |  |
| State: <b>SOUTH AUSTRALIA</b>     |  | Collar elev. _____ ft.                                                                 |  | Claim: _____                                    |  |
| Area: _____                       |  | Depth drilled: <b>53 mtrs.</b>                                                         |  | Owned by: _____                                 |  |
| Project: _____                    |  | <b>CASING DATA</b>                                                                     |  | Operated by: _____                              |  |
| Prospect: _____                   |  | HOLE DATA                                                                              |  | Unit Operator: <b>STEUENS</b>                   |  |
| Lat: 0° _____ Long 0° _____       |  | Wall size in. Dia. <b>4 1/4</b> in. to <b>0</b> T.D.                                   |  | Unit No. <b>RL-5</b> Office: <b>SPDEL</b>       |  |
| Dia. (inside) in. _____           |  | Dia. from to _____                                                                     |  | ELECTRIC                                        |  |
| Cased from to ft. _____           |  | Dia. from to _____                                                                     |  | 1 2 3 4                                         |  |
| <b>GAMMA RAY</b>                  |  | Cored hole <input type="checkbox"/> Non-cored hole <input checked="" type="checkbox"/> |  | Logged depth <b>50</b> <b>50</b>                |  |
| INITIAL RUN 2 3 4                 |  | Sampled Interval _____ Type <b>FRESH H<sub>2</sub>O</b>                                |  | Resist. scale <b>500/m</b> <b>50</b>            |  |
| Logged depth <b>50</b>            |  | S.P. scale _____                                                                       |  | S.P. scale <b>1 mV/m</b> <b>1 mV/m</b>          |  |
| Range (Full scale) <b>50</b>      |  | <b>INTERPRETATION DATA</b>                                                             |  | Paper speed <b>1 1/2</b> in. <b>1 1/2</b> in.   |  |
| Time constant (Sec.) <b>3</b>     |  | Probe No. _____ Standard _____ (cps) K factor <b>1.28 x 10<sup>-5</sup></b>            |  | Logging speed <b>9 1/2</b> in. <b>9 1/2</b> in. |  |
| Paper speed <b>1 1/2</b> in.      |  | Cores _____                                                                            |  | Probe size <b>2</b> in. <b>2</b> in.            |  |
| Bgnd count (cps) <b>5</b>         |  | Remarks <b>ADDED RO-Phos to FLUID BEFORE LOG.</b>                                      |  | Type <b>ORE</b> <b>ORE</b>                      |  |
| Probe No. <b>50</b> <b>203</b>    |  |                                                                                        |  | Bias _____                                      |  |
| Size (dia.) (in.) <b>2</b>        |  |                                                                                        |  | <b>CALIPER</b>                                  |  |
| Type <b>ORE</b>                   |  |                                                                                        |  | Logged depth _____                              |  |
| Standard (cps) _____              |  |                                                                                        |  | Scale _____                                     |  |
| Dead time <b>6.0</b> u. sec.      |  |                                                                                        |  | in. def. _____                                  |  |
| Amp. Gain _____                   |  |                                                                                        |  | Paper Speed _____                               |  |
| Ratemeter No. _____               |  |                                                                                        |  | Logging speed _____                             |  |
| Bore hole medium _____            |  |                                                                                        |  | Arm Length _____                                |  |
| Mud density _____                 |  |                                                                                        |  | Max. Def. _____                                 |  |
| Digital readout _____             |  |                                                                                        |  |                                                 |  |
| Time base _____                   |  |                                                                                        |  |                                                 |  |
| Upper Disc. _____                 |  |                                                                                        |  |                                                 |  |
| Lower Disc. _____                 |  |                                                                                        |  |                                                 |  |



ENV 2477 (II)-2



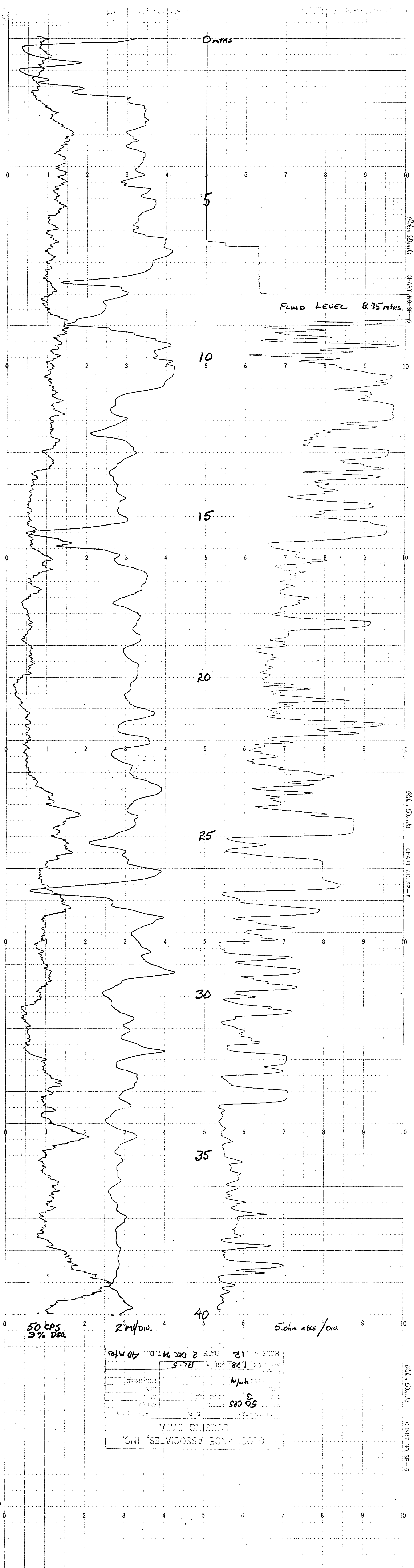
# HOLE

## LOGGING DATA

# 12

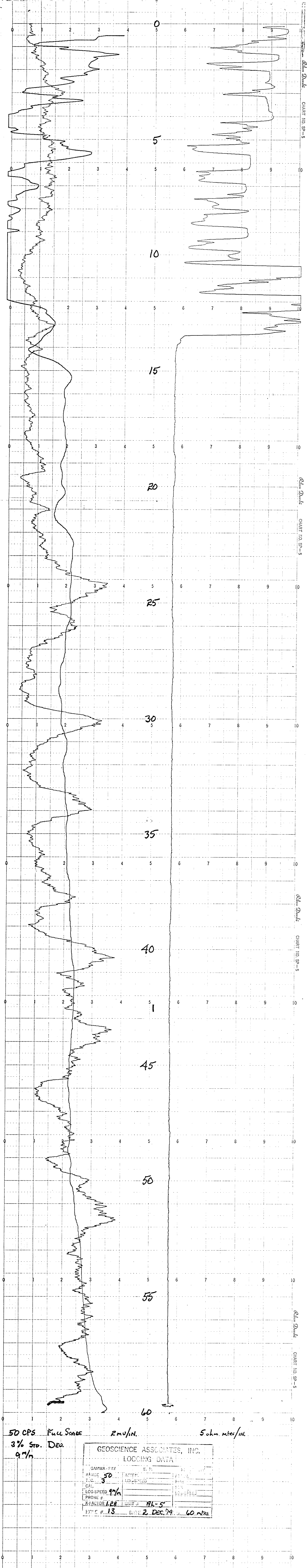
DATE 2-12-74

| LOCATION <b>MOLGATHING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                  | HOLE NUMBER: <b>12</b>                                                                                                                                                   |   | DATE: <b>1971</b>                        |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------|---|---|--------------------|-----------|--|--|--|--------------------|-----------|--|--|--|----------------------|----------|--|--|--|-------------|---------------|--|--|--|---------------|---------------|--|--|--|-------------------|----------|--|--|--|-----------|---------------|--|--|--|-------------------|----------|--|--|--|------|------------|--|--|--|----------------|----------|--|--|--|-----------|--|--|--|---------------|-----------|--|--|--|--|----------------|--|--|--|--|------------------|--|--|--|--|-------------|--|--|--|--|-----------------|--|--|--|--|-----------|--|--|--|--|-------------|--|--|--|--|-------------|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---|---|---|---|--------------|------------|------------|--|---------------|----------------|--|--|------------|--|----------------|--|-------------|------------------|------------------|--|---------------|------------------|------------------|--|------------|-------------|----------|--|------|------------|------------|--|------|--|--|--|
| State: <b>SOUTH AUSTRALIA</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  | Collar elev. _____ ft.                                                                                                                                                   |   | Client: <b>URANES</b>                    |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Area: _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  | Depth drilled: <b>74 metres</b>                                                                                                                                          |   | Claimed: _____                           |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Project: _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  | CASING DATA                                                                                                                                                              |   | Owned by: _____                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Prospect: _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  | HOLE DATA                                                                                                                                                                |   | Operated by: <b>STEUENS</b>              |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Lat: <b>0</b> " <b>0</b> " Long: <b>0</b> " <b>0</b> "                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  | Wall size in. Dia. <b>4.75</b> from <b>0</b> to <b>TD</b><br>Dia. (inside) in. Dia. from to<br>Cased from to ft Dia. from to<br>Cased hole (ft) <b>None cased hole</b> ✓ |   | Unit Operator: _____                     |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| GAMMA RAY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  | Sampled Interval                                                                                                                                                         |   | Unit No. <b>AL-5</b> Office: <b>ADSL</b> |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>Initial</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> <tr> <td>Logged depth (ft.)</td> <td><b>40</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Range (Full scale)</td> <td><b>50</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Time constant (Sec.)</td> <td><b>3</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Paper speed</td> <td><b>1 1/4"</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Logging speed</td> <td><b>9 1/4"</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Bkgnd count (cps)</td> <td><b>4</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Probe No.</td> <td><b>50-203</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Size (dia.) (in.)</td> <td><b>2</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Type</td> <td><b>ORE</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Standard (cps)</td> <td><b>6</b></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Dead time</td> <td></td> <td></td> <td></td> <td><b>4 sec.</b></td> </tr> <tr> <td>Amp. Gain</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Rate meter No.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Bore hole medium</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Mud density</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Digital readout</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Time base</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Upper Disc.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Lower Disc.</td> <td></td> <td></td> <td></td> <td></td> </tr> </table> |                  | Initial                                                                                                                                                                  | 1 | 2                                        | 3 | 4 | Logged depth (ft.) | <b>40</b> |  |  |  | Range (Full scale) | <b>50</b> |  |  |  | Time constant (Sec.) | <b>3</b> |  |  |  | Paper speed | <b>1 1/4"</b> |  |  |  | Logging speed | <b>9 1/4"</b> |  |  |  | Bkgnd count (cps) | <b>4</b> |  |  |  | Probe No. | <b>50-203</b> |  |  |  | Size (dia.) (in.) | <b>2</b> |  |  |  | Type | <b>ORE</b> |  |  |  | Standard (cps) | <b>6</b> |  |  |  | Dead time |  |  |  | <b>4 sec.</b> | Amp. Gain |  |  |  |  | Rate meter No. |  |  |  |  | Bore hole medium |  |  |  |  | Mud density |  |  |  |  | Digital readout |  |  |  |  | Time base |  |  |  |  | Upper Disc. |  |  |  |  | Lower Disc. |  |  |  |  | Type <b>FRESH H2O</b><br>Interpretation Data<br>Probe No. <b>50-203</b> Standard (cps) <b>K factor 1.28 x 10<sup>-5</sup></b> |  | ELECTRIC<br><table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> <tr> <td>Logged depth</td> <td><b>60m</b></td> <td><b>60m</b></td> <td></td> </tr> <tr> <td>Resist. scale</td> <td><b>180m/in</b></td> <td></td> <td></td> </tr> <tr> <td>S.P. scale</td> <td></td> <td><b>2 mV/in</b></td> <td></td> </tr> <tr> <td>Paper speed</td> <td><b>1 1/4"/in</b></td> <td><b>1 1/4"/in</b></td> <td></td> </tr> <tr> <td>Logging speed</td> <td><b>9 1/4"/in</b></td> <td><b>9 1/4"/in</b></td> <td></td> </tr> <tr> <td>Probe size</td> <td><b>2 in</b></td> <td><b>2</b></td> <td></td> </tr> <tr> <td>Type</td> <td><b>ORE</b></td> <td><b>ORE</b></td> <td></td> </tr> <tr> <td>Bias</td> <td></td> <td></td> <td></td> </tr> </table> |  | 1 | 2 | 3 | 4 | Logged depth | <b>60m</b> | <b>60m</b> |  | Resist. scale | <b>180m/in</b> |  |  | S.P. scale |  | <b>2 mV/in</b> |  | Paper speed | <b>1 1/4"/in</b> | <b>1 1/4"/in</b> |  | Logging speed | <b>9 1/4"/in</b> | <b>9 1/4"/in</b> |  | Probe size | <b>2 in</b> | <b>2</b> |  | Type | <b>ORE</b> | <b>ORE</b> |  | Bias |  |  |  |
| Initial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                | 2                                                                                                                                                                        | 3 | 4                                        |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Logged depth (ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>40</b>        |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Range (Full scale)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>50</b>        |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Time constant (Sec.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>3</b>         |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Paper speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>1 1/4"</b>    |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Logging speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>9 1/4"</b>    |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Bkgnd count (cps)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>4</b>         |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Probe No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>50-203</b>    |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Size (dia.) (in.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>2</b>         |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>ORE</b>       |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Standard (cps)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>6</b>         |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Dead time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                                                                                                                                                                          |   | <b>4 sec.</b>                            |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Amp. Gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Rate meter No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Bore hole medium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Mud density                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Digital readout                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Time base                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Upper Disc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Lower Disc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2                | 3                                                                                                                                                                        | 4 |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Logged depth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>60m</b>       | <b>60m</b>                                                                                                                                                               |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Resist. scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>180m/in</b>   |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| S.P. scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                  | <b>2 mV/in</b>                                                                                                                                                           |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Paper speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>1 1/4"/in</b> | <b>1 1/4"/in</b>                                                                                                                                                         |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Logging speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>9 1/4"/in</b> | <b>9 1/4"/in</b>                                                                                                                                                         |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Probe size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>2 in</b>      | <b>2</b>                                                                                                                                                                 |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>ORE</b>       | <b>ORE</b>                                                                                                                                                               |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| Bias                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |                                                                                                                                                                          |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
| REMARKS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  | CALIPER                                                                                                                                                                  |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  | Logged depth<br>Scale <b>in. in. def.</b>                                                                                                                                |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  | Paper Speed                                                                                                                                                              |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  | Logging speed                                                                                                                                                            |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  | Arm Length in.                                                                                                                                                           |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  | Max. Def. in.                                                                                                                                                            |   |                                          |   |   |                    |           |  |  |  |                    |           |  |  |  |                      |          |  |  |  |             |               |  |  |  |               |               |  |  |  |                   |          |  |  |  |           |               |  |  |  |                   |          |  |  |  |      |            |  |  |  |                |          |  |  |  |           |  |  |  |               |           |  |  |  |  |                |  |  |  |  |                  |  |  |  |  |             |  |  |  |  |                 |  |  |  |  |           |  |  |  |  |             |  |  |  |  |             |  |  |  |  |                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |   |   |   |   |              |            |            |  |               |                |  |  |            |  |                |  |             |                  |                  |  |               |                  |                  |  |            |             |          |  |      |            |            |  |      |  |  |  |



ENV 2477 (II)-3

|                               |  |                               |  |                                                    |  |
|-------------------------------|--|-------------------------------|--|----------------------------------------------------|--|
| LOCATION <b>MULGATHING</b>    |  | HOLE NUMBER: <b>13</b>        |  | CLIENT: <b>URANEZ</b>                              |  |
| State: <b>SOUTH AUSTRALIA</b> |  | Collar elev. _____ ft.        |  | Claim: _____                                       |  |
| Area: _____                   |  | Depth drilled: <b>60 mtrs</b> |  | Owned by: _____                                    |  |
| Project: _____                |  | CASING DATA                   |  | Operated by: _____                                 |  |
| Prospect: _____               |  | HOLE DATA                     |  | Unit Operator: <b>STEVENS</b>                      |  |
| Lat: 0° 0' 0" Long: 0° 0' 0"  |  | Wall size _____ in.           |  | Unit No. <b>RL-5</b> Office <b>PERDUE</b>          |  |
| DIA. (INSIDE) _____ in.       |  | DIA. FROM _____ TO _____      |  | DIA. FROM _____ TO _____                           |  |
| DIA. (OUTSIDE) _____ in.      |  | DIA. FROM _____ TO _____      |  | DIA. FROM _____ TO _____                           |  |
| Cased from _____ to _____     |  | Cased hole 1: _____           |  | Non-cased hole <input checked="" type="checkbox"/> |  |
| Cased hole 1: _____           |  | Type: <b>FRESH H2O</b>        |  | Type: _____                                        |  |
| Sampled Interval <b>5'</b>    |  | INTERPRETATION DATA           |  | Type: _____                                        |  |
| Probe No. <b>50-203</b>       |  | Standard _____                |  | K factor <b>1.28x10<sup>-5</sup></b>               |  |
| Type: <b>ORE</b>              |  | REMARKS                       |  | REMARKS                                            |  |
| Standard (cps) _____          |  | Log depth _____               |  | Log depth _____                                    |  |
| Dead time <b>6</b>            |  | Scale _____                   |  | Scale _____                                        |  |
| Amp. Gain _____               |  | Paper Speed _____             |  | Paper Speed _____                                  |  |
| Rate meter No. _____          |  | Logging speed _____           |  | Logging speed _____                                |  |
| Bore hole medium _____        |  | Arm Length _____              |  | Arm Length _____                                   |  |
| Mud density _____             |  | Max. Def. _____               |  | Max. Def. _____                                    |  |
| Digital readout _____         |  | _____                         |  | _____                                              |  |
| Time base _____               |  | _____                         |  | _____                                              |  |
| Upper Disc. _____             |  | _____                         |  | _____                                              |  |
| Lower Disc. _____             |  | _____                         |  | _____                                              |  |



ENV2477(4)-4



GEOSCIENCE ASSOCIATES, AUSTRALIA, PTY. LTD.  
2-4 Gray Street,  
Kilkenny, S.A. 5009  
Phone: 268 2898

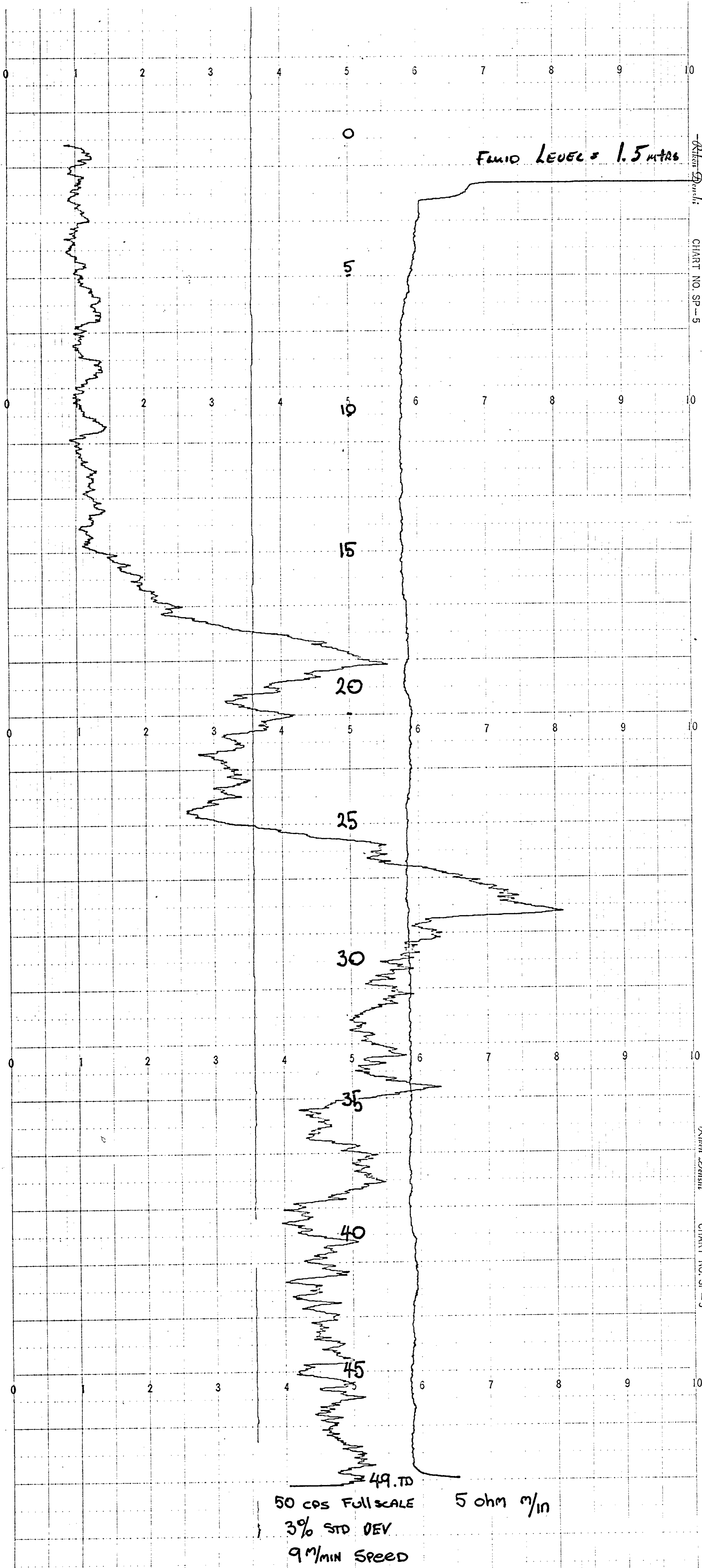
HOLE

LOGGING DATA

#14

DATE 2-12-74

|                                     |  |                                                                               |  |                                          |  |
|-------------------------------------|--|-------------------------------------------------------------------------------|--|------------------------------------------|--|
| LOCATION <b>Mulgathing</b>          |  | HOLE NUMBER: <b># 14</b>                                                      |  | CLIENT: <b>URANE3</b>                    |  |
| State: <b>S+h Aust</b>              |  | Collar elev. _____ ft.                                                        |  | Claim: _____                             |  |
| Area: _____                         |  | Depth drilled: <b>50 METRE</b>                                                |  | Owned by: _____                          |  |
| Project: _____                      |  | CASING DATA                                                                   |  | Operated by: <b>STEVENS</b>              |  |
| Prospect: _____                     |  | HOLE DATA                                                                     |  | Unit Operator: <b>STEVENS</b>            |  |
| Lat: 0 " " Long 0 " "               |  | Wall size in. Dia <b>475</b> from <b>0</b> to <b>TD</b>                       |  | Unit No. <b>AL-5</b> Office: <b>ADEL</b> |  |
| Cased from to ft.                   |  | Dia. from to                                                                  |  | ELECTRIC                                 |  |
| Cored hole <input type="checkbox"/> |  | Non-cored hole <input checked="" type="checkbox"/>                            |  | 1 2 3 4                                  |  |
| Logged depth <b>49</b>              |  | Sampled Interval <b>5'</b> Type <b>FRESH H2O</b>                              |  | Logged depth <b>49</b>                   |  |
| Range (Full scale) <b>50 CPS</b>    |  | INTERPRETATION DATA                                                           |  | Resist. scale <b>50 ohm m/in</b>         |  |
| Time constant (Sec.) <b>3</b>       |  | Probe No. <b>50-203</b> Standard (cps) K factor <b>1.28 x 10<sup>-5</sup></b> |  | S.P. scale                               |  |
| Paper speed <b>1 m/cm</b>           |  | REMARKS                                                                       |  | Paper speed <b>1 m/cm</b>                |  |
| Logging speed <b>9 m/m</b>          |  |                                                                               |  | Logging speed <b>9 m/m</b>               |  |
| Bkgnd count (cps) <b>4</b>          |  |                                                                               |  | Probe size <b>2 in</b>                   |  |
| Probe No. <b>50 203</b>             |  |                                                                               |  | Type <b>ORE</b>                          |  |
| Size (dia.) (in.) <b>2 in</b>       |  |                                                                               |  | Bias                                     |  |
| Type <b>ORE</b>                     |  |                                                                               |  | CALIPER                                  |  |
| Standard (cps)                      |  |                                                                               |  | Logged depth                             |  |
| Dead time <b>6</b> 4 sec.           |  |                                                                               |  | Scale in. def.                           |  |
| Amp. Gain                           |  |                                                                               |  | Paper Speed                              |  |
| Ratemeter No.                       |  |                                                                               |  | Logging speed                            |  |
| Bore hole medium                    |  |                                                                               |  | Arm Length in.                           |  |
| Mud density                         |  |                                                                               |  | Max. Def. in.                            |  |
| Digital readout                     |  |                                                                               |  |                                          |  |
| Time base                           |  |                                                                               |  |                                          |  |
| Upper Disc.                         |  |                                                                               |  |                                          |  |
| Lower Disc.                         |  |                                                                               |  |                                          |  |

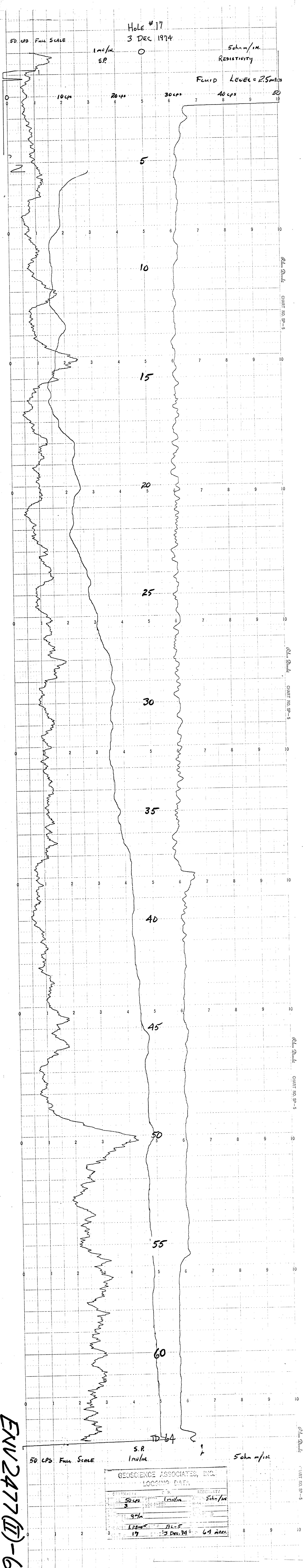


ENC 2477 (II)-5

|                             |              |
|-----------------------------|--------------|
| GEOSCIENCE ASSOCIATES, INC. |              |
| LOGGING DATA                |              |
| 50 CPS                      | RESISTIVITY  |
| 3 3                         | 5 ohm m/in   |
| 9 m/m                       | 9 m/m        |
| CR 1.28 x 10 <sup>-5</sup>  | AL-5         |
| HOLE # 14                   | DATE 2-12-74 |
| T.O. 4.9 METRES             |              |

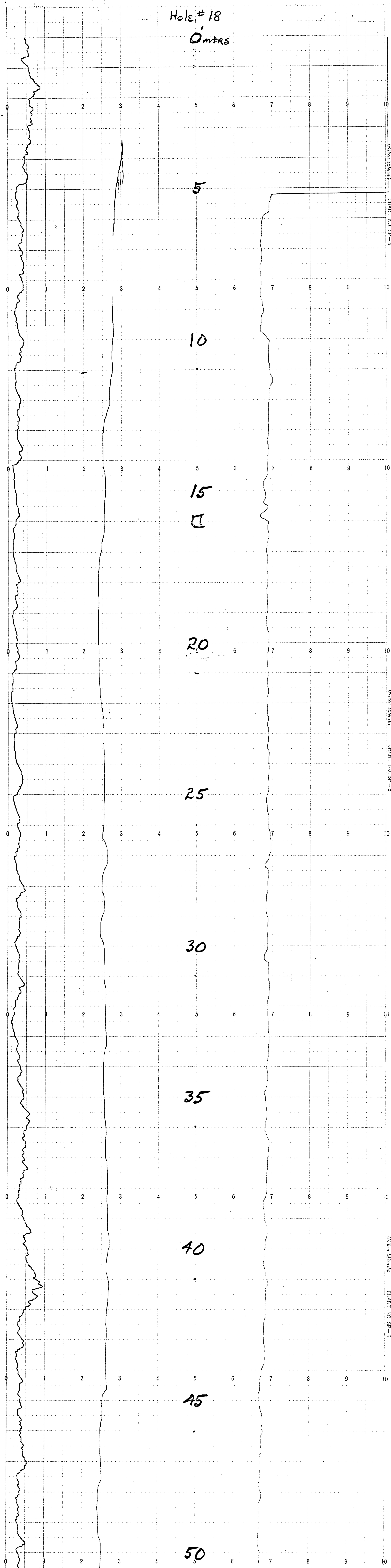
Time 2 sec

|                                            |          |                                                                                                      |                                                         |
|--------------------------------------------|----------|------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| <b>LOCATION</b> <b>MALGATHING</b>          |          | <b>HOLE NUMBER:</b> <b>17</b>                                                                        | <b>CLIENT:</b> <b>URANERZ</b>                           |
| <b>State:</b> <b>SOUTH AUSTRALIA</b>       |          | <b>Collar elev.</b> _____ <b>ft.</b>                                                                 | <b>Claim:</b> _____                                     |
| <b>Area:</b> _____                         |          | <b>Depth drilled:</b> <b>64.5 METERS</b>                                                             | <b>Owned by:</b> _____                                  |
| <b>Project:</b> _____                      |          | <b>CASING DATA</b>                                                                                   | <b>Operated by:</b> _____                               |
| <b>Prospect:</b> _____                     |          | <b>WALL SIZE</b>                                                                                     | <b>Unit Operator:</b> <b>STUENS</b>                     |
| <b>Lat:</b> 0° _____ <b>Long:</b> 0° _____ |          | <b>in.</b> <b>4 1/4</b> <b>from 0 to TD</b>                                                          | <b>Unit No.</b> <b>AK-5</b> <b>Office:</b> <b>ADEL.</b> |
| <b>GAMMA RAY</b>                           |          | <b>in.</b> _____ <b>from</b> _____ <b>to</b> _____                                                   | <b>ELECTRIC</b>                                         |
| <b>INITIAL</b>                             | <b>2</b> | <b>ft.</b> _____ <b>from</b> _____ <b>to</b> _____                                                   | <b>1</b>                                                |
| <b>3</b>                                   | <b>4</b> | <b>Cased hole</b> <input type="checkbox"/> <b>Non-cased hole</b> <input checked="" type="checkbox"/> | <b>2</b>                                                |
| <b>Logged depth (m)</b> <b>64</b>          |          | <b>Sampled interval</b> <b>5 ft.</b> <b>FRESH H<sub>2</sub>O</b>                                     | <b>3</b>                                                |
| <b>Range (Full scale)</b> <b>50</b>        |          | <b>INTERPRETATION DATA</b>                                                                           | <b>4</b>                                                |
| <b>Time constant (msec)</b> <b>3</b>       |          | <b>Probe No.</b> <b>30-203</b> <b>Standard</b> <b>(cps) K factor</b> <b>1.28x10<sup>-5</sup></b>     | <b>Logged depth</b> <b>64</b> <b>64</b>                 |
| <b>Paper speed</b> <b>1 1/2 m</b>          |          |                                                                                                      | <b>Resist. scale</b> <b>5 ohm/m</b>                     |
| <b>Logging speed</b> <b>9 m/m</b>          |          |                                                                                                      | <b>S.P. scale</b> <b>1 mV/m</b>                         |
| <b>Bkgnd count (cps)</b> <b>5</b>          |          |                                                                                                      | <b>Paper speed</b> <b>1 1/2 m</b>                       |
| <b>Probe No.</b> <b>50</b> <b>203</b>      |          |                                                                                                      | <b>Logging speed</b> <b>9 m/m</b>                       |
| <b>Size (dia.) (in.)</b> <b>2</b>          |          |                                                                                                      | <b>Probe size</b> <b>2</b> <b>in</b>                    |
| <b>Type</b> <b>ORE</b>                     |          |                                                                                                      | <b>Type</b> <b>ORE</b> <b>ORE</b>                       |
| <b>Standard</b> <b>(cps)</b>               |          | <b>REMARKS</b>                                                                                       | <b>Bias</b>                                             |
| <b>Dead time</b> <b>6.0</b>                |          | <b>ALL DEPTHS IN METERS</b><br><b>RO-PHOS ADDED TO MUD</b>                                           | <b>CALIPER</b>                                          |
| <b>Amp. Gain</b>                           |          |                                                                                                      | <b>Logged depth</b>                                     |
| <b>Ratemeter No.</b>                       |          |                                                                                                      | <b>Scale</b>                                            |
| <b>Bore hole medium</b>                    |          |                                                                                                      | <b>Paper Speed</b>                                      |
| <b>Mud density</b>                         |          |                                                                                                      | <b>Logging speed</b>                                    |
| <b>Digital readout</b>                     |          |                                                                                                      | <b>Arm Length</b>                                       |
| <b>Time base</b>                           |          |                                                                                                      | <b>Max. Def.</b>                                        |
| <b>Upper Disc.</b>                         |          |                                                                                                      |                                                         |
| <b>Lower Disc.</b>                         |          |                                                                                                      |                                                         |



**ENV 2477(II)-6**

|                               |  |                                                                                        |  |                                         |  |
|-------------------------------|--|----------------------------------------------------------------------------------------|--|-----------------------------------------|--|
| LOCATION <b>MULGATHING</b>    |  | HOLE NUMBER: <b>18</b>                                                                 |  | CLIENT: <b>URANEC</b>                   |  |
| State: <b>SOUTH AUSTRALIA</b> |  | Collar elev. _____ ft.                                                                 |  | Claim: _____                            |  |
| Area: _____                   |  | Depth drilled: <b>855 ft. - 261 mtrs</b>                                               |  | Owned by: _____                         |  |
| Project: _____                |  | Casing DATA                                                                            |  | Operated by: _____                      |  |
| Lat: 0° _____ Long 0° _____   |  | HOLE DATA                                                                              |  | Unit Operator: <b>STEVENS</b>           |  |
|                               |  | Wall size in. Dia. <b>4 1/4</b> from 0 to T.D.                                         |  | Unit No. <b>FL-5</b> Office: <b>RDE</b> |  |
|                               |  | Dia. (inside) in. Dia. from to                                                         |  | ELECTRIC                                |  |
|                               |  | Cased from to ft. Dia. from to                                                         |  | 1 2 3 4                                 |  |
| GAMMA RAY                     |  | Cased hole <input checked="" type="checkbox"/> Non cased hole <input type="checkbox"/> |  | Logged depth <b>261 261</b>             |  |
| Initial _____                 |  | Sampled Interval _____ Type _____                                                      |  | Resist. scale <b>500/in</b>             |  |
| Logged depth (ft.) <b>261</b> |  | 5 ft. <b>FRESH H<sub>2</sub>O</b>                                                      |  | S.P. scale <b>100/m</b>                 |  |
| Range (Full scale) <b>50</b>  |  | INTERPRETATION DATA                                                                    |  | Paper speed <b>1 1/2 in</b>             |  |
| Time constant (Sec.) <b>3</b> |  | Probe No. <b>203</b> Standard _____ (cps) K factor <b>1.28 x 10<sup>-5</sup></b>       |  | Logging speed <b>9 1/2 in</b>           |  |
| Paper speed <b>1 1/2 in</b>   |  |                                                                                        |  | Probe size <b>2 in</b>                  |  |
| Bgnd count (cps) <b>5</b>     |  |                                                                                        |  | Type <b>ORE</b>                         |  |
| Probe No. <b>203</b>          |  |                                                                                        |  | Bias _____                              |  |
| Size (dia.) (in.) <b>2</b>    |  |                                                                                        |  | CALIPER                                 |  |
| Type <b>ORE</b>               |  |                                                                                        |  | 1 2 3 4                                 |  |
| Standard (cps) _____          |  |                                                                                        |  | Logged depth _____                      |  |
| Dead time <b>6.0</b>          |  |                                                                                        |  | Scale _____                             |  |
| Amp. Gain _____               |  |                                                                                        |  | Paper Speed _____                       |  |
| Rate meter No. _____          |  |                                                                                        |  | Arm Length _____                        |  |
| Bore hole medium _____        |  |                                                                                        |  | Max. Def. _____                         |  |
| Mud density _____             |  |                                                                                        |  |                                         |  |
| Digital readout _____         |  |                                                                                        |  |                                         |  |
| Time base _____               |  |                                                                                        |  |                                         |  |
| Upper Disc. _____             |  |                                                                                        |  |                                         |  |
| Lower Disc. _____             |  |                                                                                        |  |                                         |  |



55

60

65

70

75

80

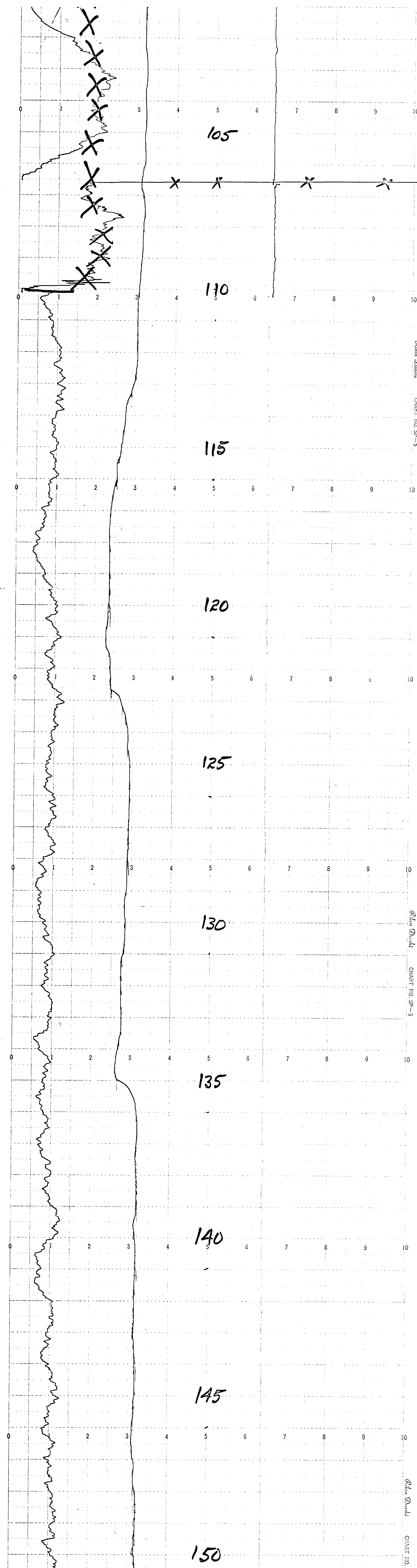
85

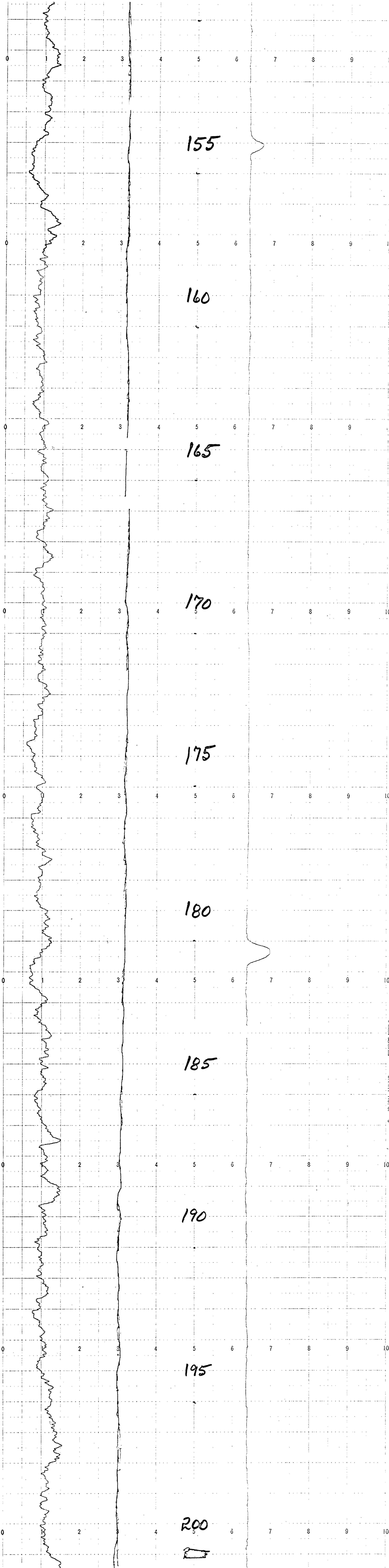
90

95

100

XX





155

160

165

170

175

180

185

190

195

200

Riley Denshi CHART NO. SP-5

Riley Denshi CHART NO. SP-5

205

210

215

220

225

230

235

240

245

250

255

260

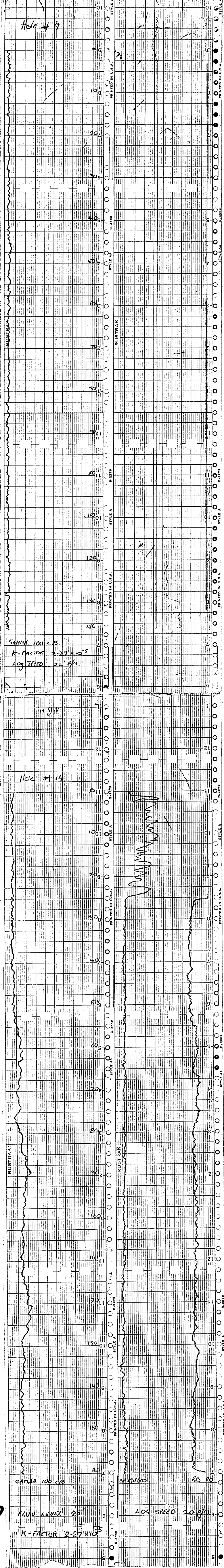
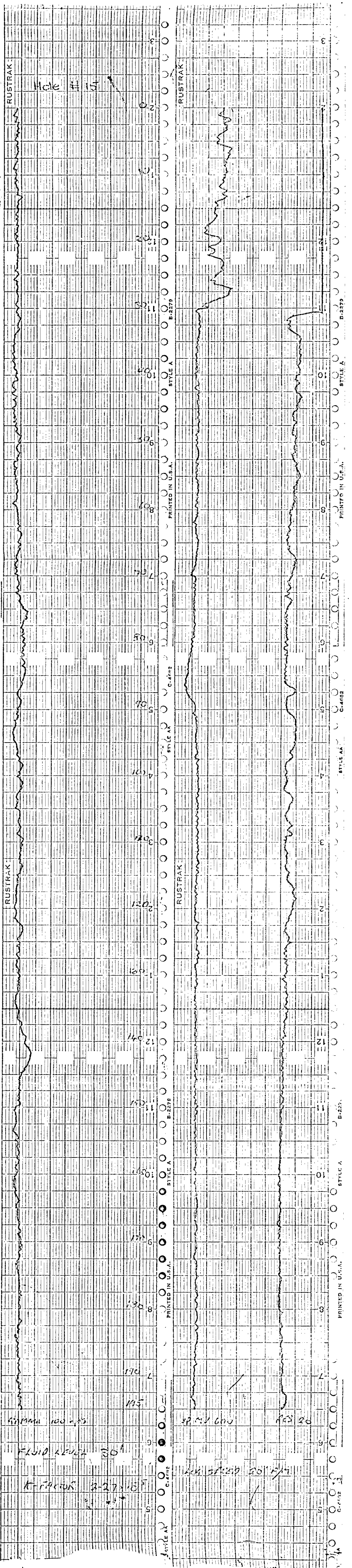
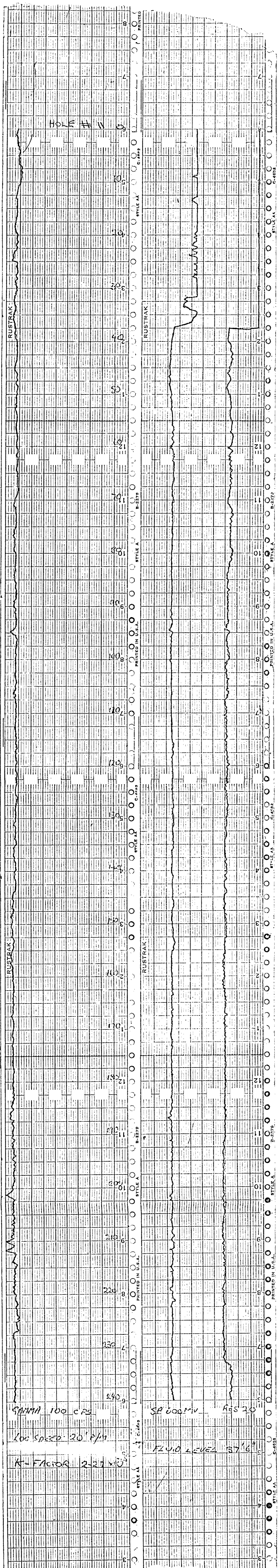
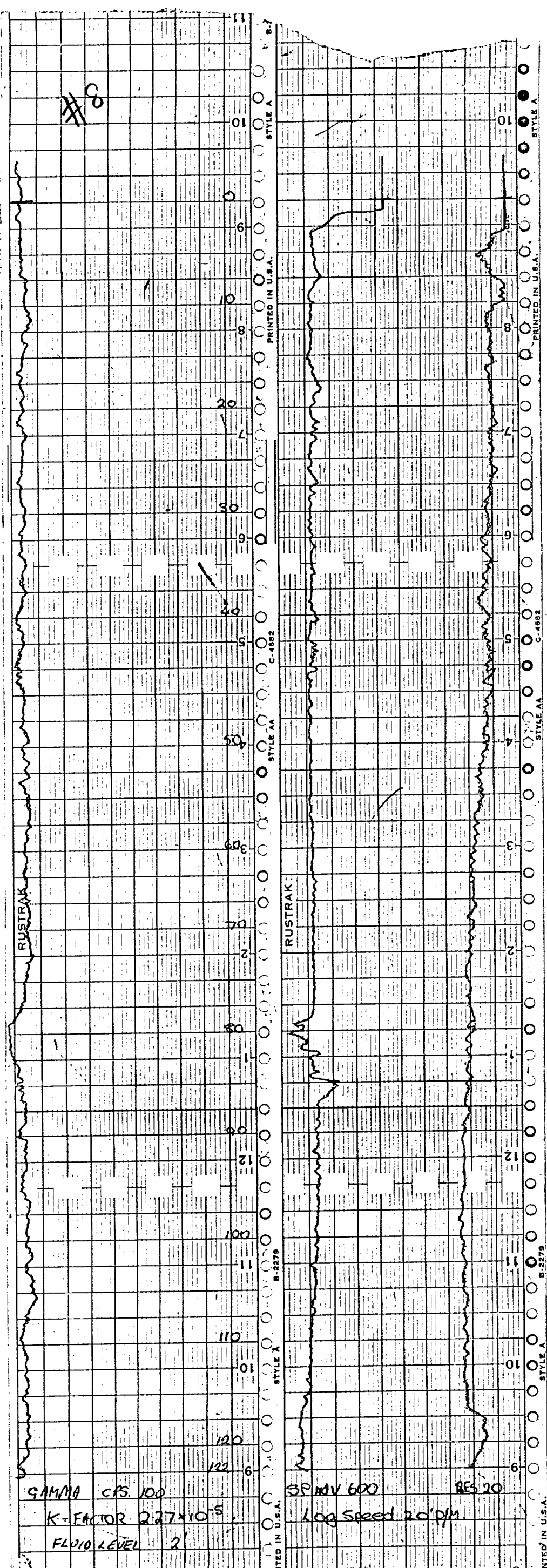
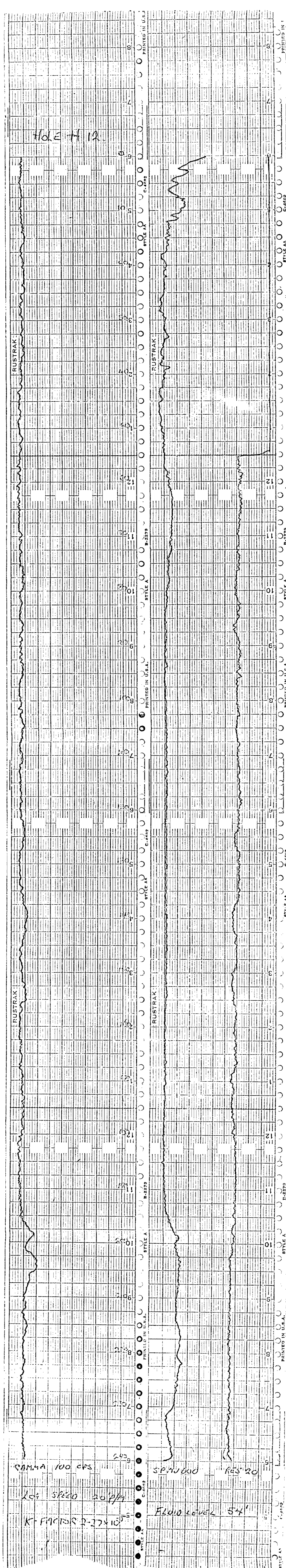
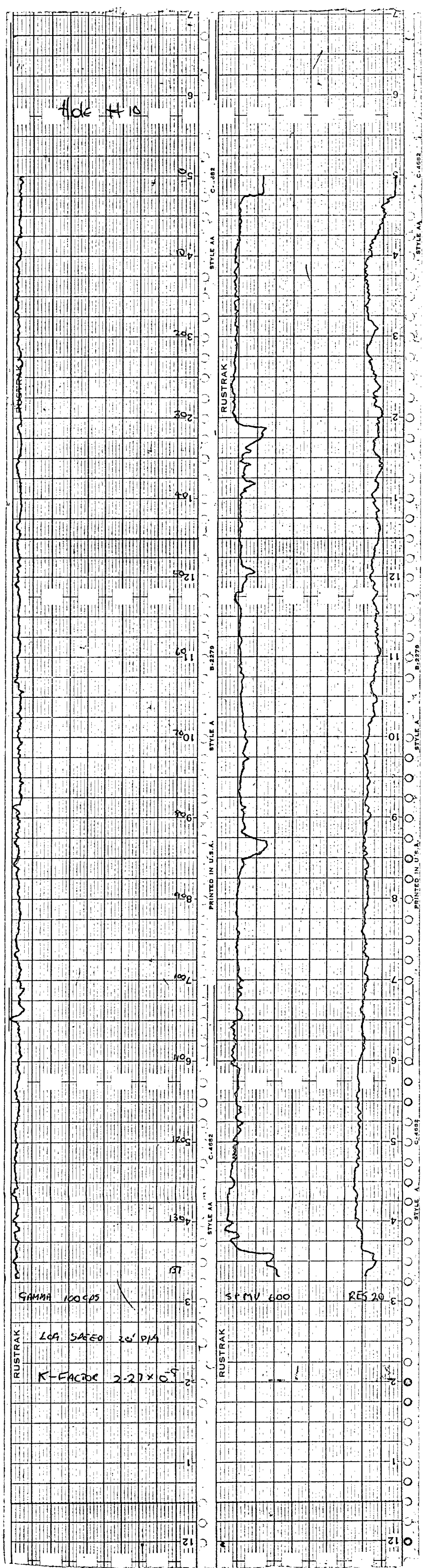
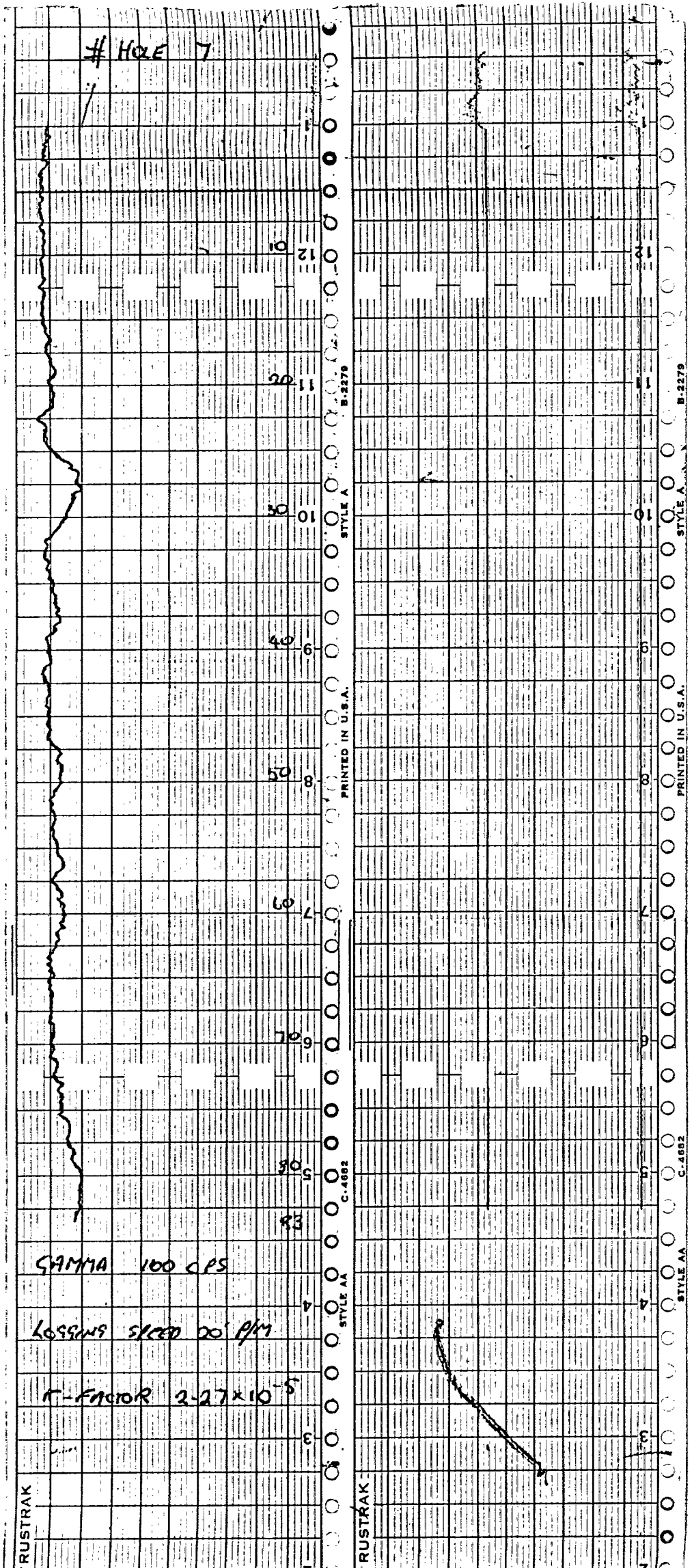
TD 261 MTRS.

50 CPS  
3% STD. DEV.  
9m/min.

GEOSCIENTE ASSOCIATES, INC.  
LOGGING IN  
FL-5  
5-12-74  
261 MTRS.

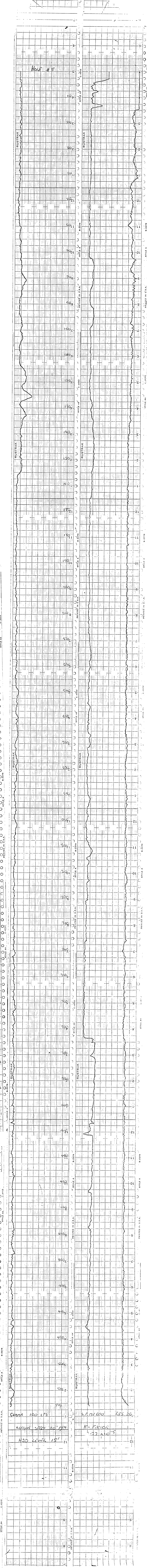
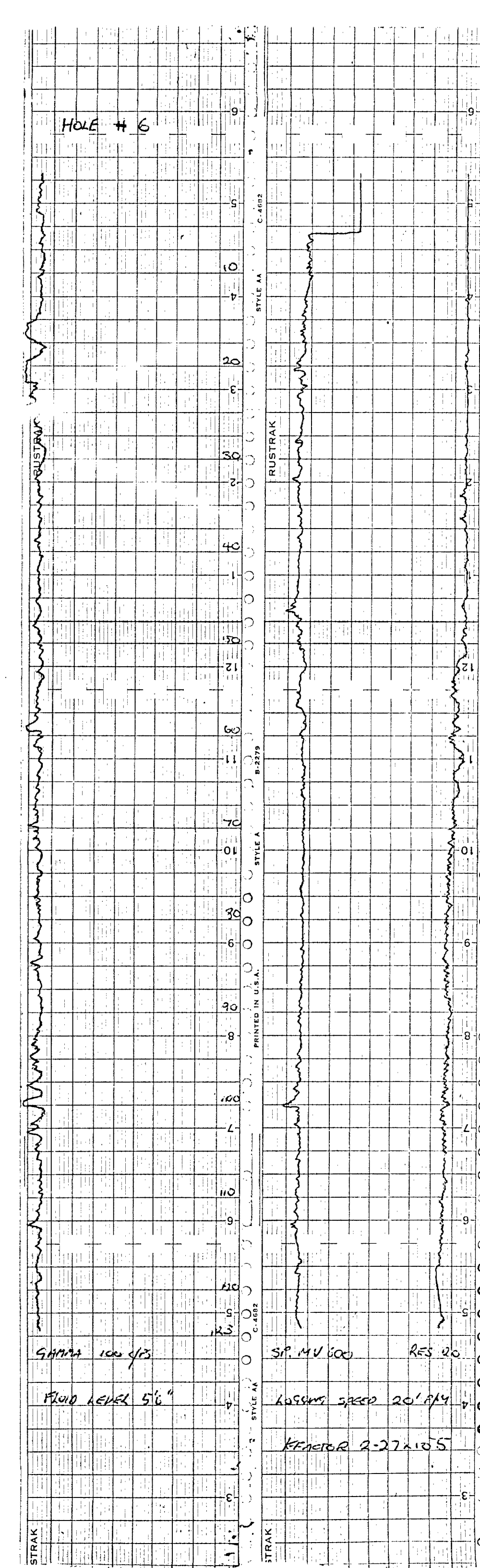
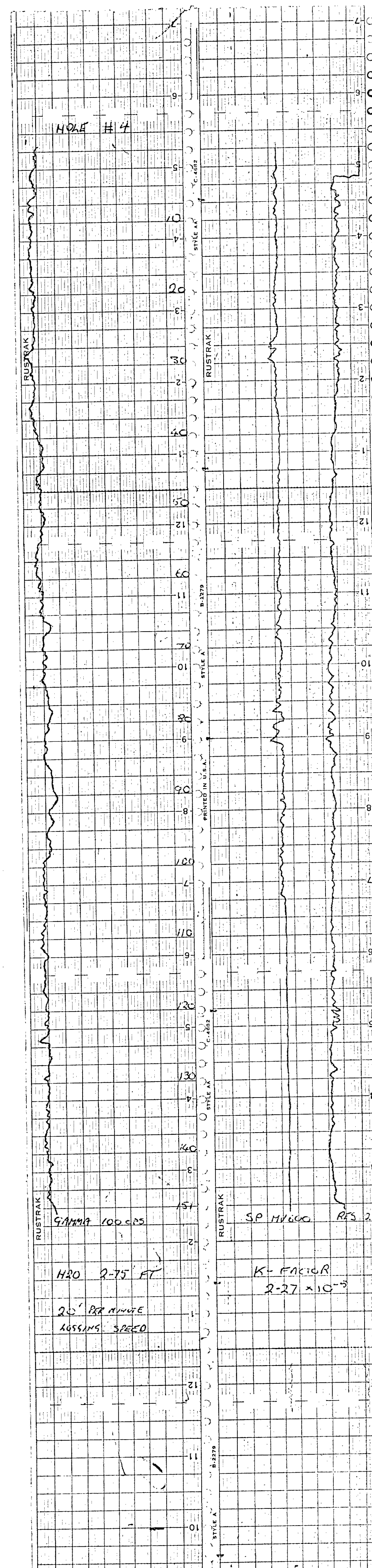
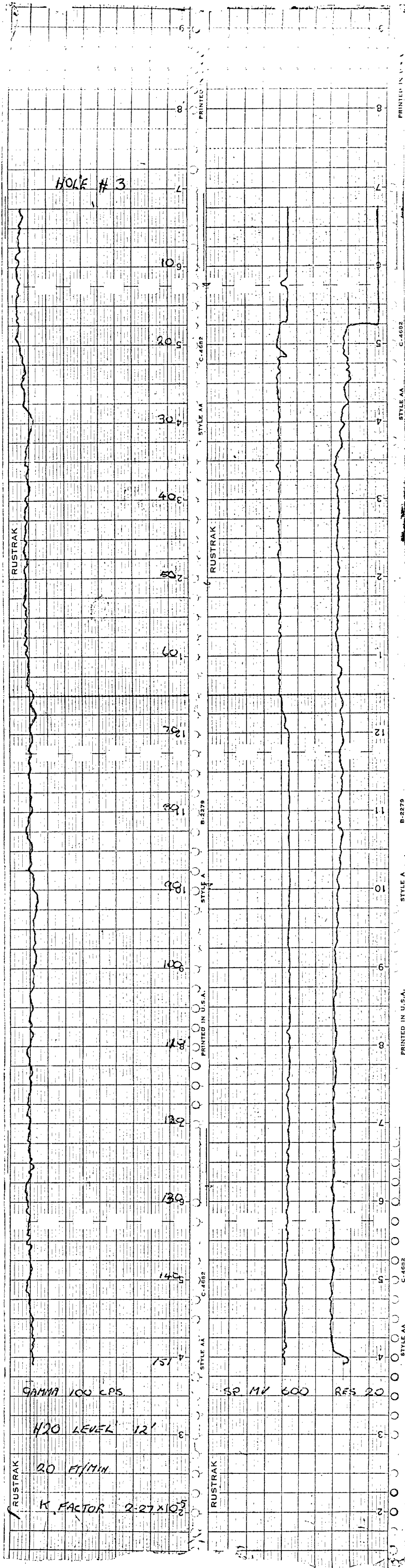
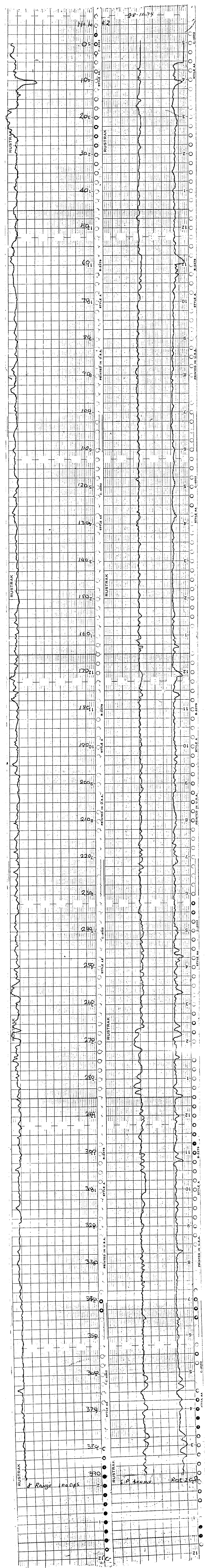
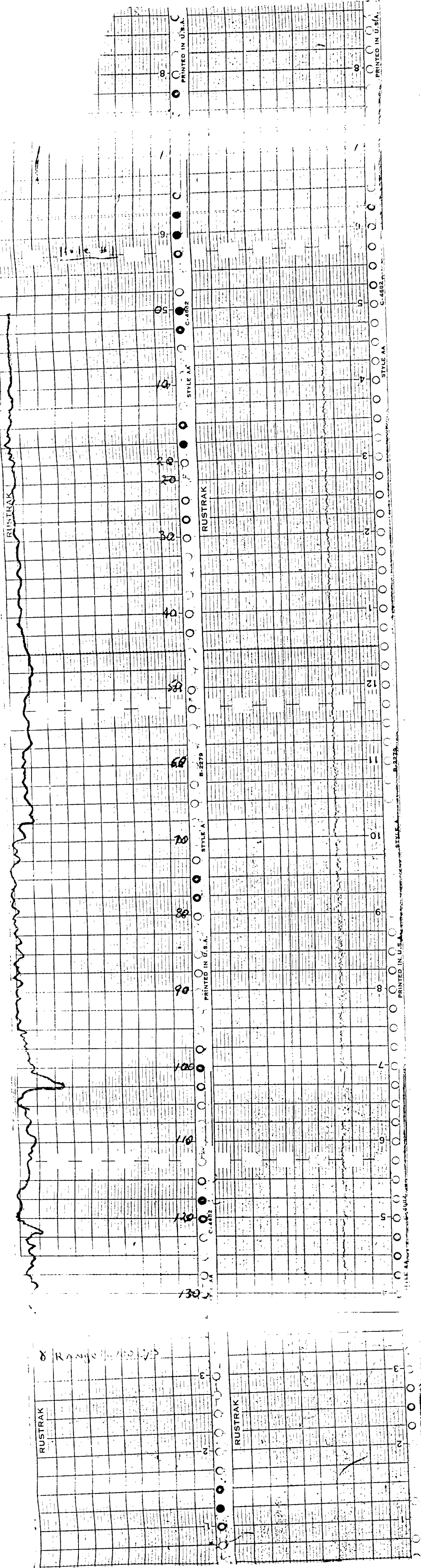
FILL DEPTHS IN MTRS.

ENV 2477(E) 7



ENV 2477(II)-8

γ-, S.P. and Resistivity logs



APPENDIX 4

Lithological Logs - Drillholes 1 - 18.

List of Abbreviations Used

|        |                     |      |           |
|--------|---------------------|------|-----------|
| slst   | siltstone           | p    | pale      |
| sst    | sandstone           | var  | variable  |
| gn     | granules            | dk   | dark      |
| gv     | gravel              | wh   | white     |
| vfg    | very fine grained   | w    | weak      |
| fg     | fine grained        | mod  | moderate  |
| mg     | medium grained      | st   | strong    |
| cg     | coarse grained      | n    | nil       |
| vco    | very coarse grained | v    | very      |
| tr     | trace               | Haem | Haematite |
| mass   | massive             | Lim  | Limonite  |
| x'tals | crystals            |      |           |

# DRILL HOLE RECORD

036

Uranerz (Australia) Pty. Ltd.

| PROJECT: 2r      |      |                  |                    |                  | HOLE NO: 1 |        |        |        |      | DRILLER: Gordon Sadler                                                                       |  |               |  |  |
|------------------|------|------------------|--------------------|------------------|------------|--------|--------|--------|------|----------------------------------------------------------------------------------------------|--|---------------|--|--|
| TENEMENT: EL 157 |      |                  |                    |                  | DEPTH: 44m |        |        |        |      | DATE: 28.11.74                                                                               |  |               |  |  |
| LOCATION: Line 2 |      |                  |                    |                  | ELEVATION: |        |        |        |      | LOGGED BY: R.H. Dewhurst                                                                     |  |               |  |  |
| DEPTH<br>FROM TO |      | LITHOLOGY        | COLOUR             | PARTICLE<br>SIZE | OXID.      | CARBON | PYRITE | FELDS. | SRAT | REMARKS                                                                                      |  | SAMPLE<br>NO. |  |  |
| 0                | 1.5  | Soil<br>Calcrete | p.brown            | vfg              | mod-st     | -      | -      | -      |      |                                                                                              |  |               |  |  |
| 1.5              | 6.0  | Calcrete         | p.yellow<br>- grey | -                | nil        | -      | -      | -      |      |                                                                                              |  |               |  |  |
| 6.0              | 10.6 | Gneiss           | var.               | vfg              | st         | -      | -      | mod    | }    |                                                                                              |  |               |  |  |
| 10.6             | 13.7 | Gneiss           | brown,<br>var.     | vfg              | v.st       | -      | -      | mod    |      | abundant                                                                                     |  |               |  |  |
| 13.7             | 32.0 | Granite          | grey, var          | vfg              | st         | -      | -      | mod    |      | mica                                                                                         |  |               |  |  |
| 32.0             | 44.2 | Granite          | brown,<br>var.     | vfg              | v.st       | -      | -      | mod    |      |                                                                                              |  |               |  |  |
|                  |      |                  |                    |                  |            |        |        |        |      | Hole abandoned at 44m due to<br>increasing rock hardness. Air<br>drilling, no water in hole. |  |               |  |  |

# DRILL HOLE RECORD

037

**Uranerz (Australia) Pty. Ltd.**

[illegible]

# DRILL HOLE RECORD

038

Uranerz (Australia) Pty. Ltd.

| PROJECT: 2r      |      |           |                     | HOLE NO: 3       |             |        |        |        | DRILLER: Gordon Sadler   |                                         |  |               |
|------------------|------|-----------|---------------------|------------------|-------------|--------|--------|--------|--------------------------|-----------------------------------------|--|---------------|
| TENEMENT: EL 157 |      |           |                     | DEPTH: 45.7m     |             |        |        |        | DATE: 29.11.74           |                                         |  |               |
| LOCATION: Line 2 |      |           |                     | ELEVATION:       |             |        |        |        | LOGGED BY: R.H. Dewhurst |                                         |  |               |
| DEPTH<br>FROM    | TO   | LITHOLOGY | COLOUR              | PARTICLE<br>SIZE | OXID.       | CARBON | PYRITE | FELDS. | SRAT                     | REMARKS                                 |  | SAMPLE<br>NO. |
| 0                | 1.5  | Soil      | Red-brown           | var              | v.st        | -      | -      | -      |                          |                                         |  |               |
| 1.5              | 10.7 | Calcrete  | White               | massive          | -           | -      | -      | -      |                          |                                         |  |               |
| 10.7             | 12.2 | Silt      | Pink, brown         |                  | weak        | -      | -      | -      |                          |                                         |  |               |
| 12.2             | 21.3 | Silt      | Grey-white          |                  | nil         | -      | -      | -      |                          |                                         |  |               |
| 21.3             | 27.4 | Silt/Sand | p.grey, yellow, red | vfg              | weak (Haem) | -      | -      | -      |                          |                                         |  |               |
| 27.4             | 30.5 | Silt/Sand | Yellow              | vfg              | mod (Lim)   | -      | -      | -      |                          | Bottom of Tertiary                      |  |               |
| 30.5             | 45.7 | Silt/Clay | dark grey           | -                | nil         | mod st | -      | -      |                          | Permian                                 |  |               |
|                  |      |           |                     |                  |             |        |        |        |                          | Air drilling to 20m. Water table 16.7m. |  |               |

# DRILL HOLE RECORD

039 Uranerz (Australia) Pty. Ltd.

| PROJECT: 2r                         |      |           | HOLE NO: 4            |               |       |        |        |        | DRILLER: Gordon Sadler   |                                             |            |
|-------------------------------------|------|-----------|-----------------------|---------------|-------|--------|--------|--------|--------------------------|---------------------------------------------|------------|
| TENEMENT: EL 157                    |      |           | DEPTH: 47.2m          |               |       |        |        |        | DATE: 29.11.74           |                                             |            |
| LOCATION: 200m north of Durkin Bore |      |           | ELEVATION:            |               |       |        |        |        | LOGGED BY: R.H. Dewhurst |                                             |            |
| DEPTH FROM                          | TO   | LITHOLOGY | COLOUR                | PARTICLE SIZE | OXID. | CARBON | PYRITE | FELDS. | SRAT                     | REMARKS                                     | SAMPLE NO. |
| 0                                   | 1.5  | Silcrete  | p.brown               | massive       | mod   | -      | -      | -      |                          |                                             |            |
| 1.5                                 | 13.7 | Calcrete  | white                 | massive       | nil   | -      | -      | -      |                          |                                             |            |
| 13.7                                | 19.8 | Silt      | p.grey                |               | nil   | -      | -      | -      |                          | Bottom of Tertiary                          |            |
| 19.8                                | 25.9 | gv, gn    | p. grey               | vsg           | nil   | -      | -      | -      |                          | Sub-angular quartz<br>Algebuckina Formation |            |
| 25.9                                | 30.5 | Clay      | p.grey<br>yellow-grey |               | weak  | -      | -      | -      |                          |                                             |            |
| 30.5                                | 47.2 | Clay/Silt | dark grey             |               | nil   | st     | -      | -      |                          | Permian                                     |            |
|                                     |      |           |                       |               |       |        |        |        |                          | Water at 20m.                               |            |
|                                     |      |           |                       |               |       |        |        |        |                          | Air drilling to 26m and mud to completion.  |            |

# DRILL HOLE RECORD

040

Uranerz (Australia) Pty. Ltd.

| PROJECT: 2r      |       |                     |                | HOLE NO: 5       |       |        |        | DRILLER: Gordon Sadler   |      |                                                                                      |               |
|------------------|-------|---------------------|----------------|------------------|-------|--------|--------|--------------------------|------|--------------------------------------------------------------------------------------|---------------|
| TENEMENT: EL 157 |       |                     |                | DEPTH: 158.5m    |       |        |        | DATE: 29.11.74           |      |                                                                                      |               |
| LOCATION: Line 1 |       |                     |                | ELEVATION:       |       |        |        | LOGGED BY: R.H. Dewhurst |      |                                                                                      |               |
| DEPTH<br>FROM    | TO    | LITHOLOGY           | COLOUR         | PARTICLE<br>SIZE | OXID. | CARBON | PYRITE | FELDS.                   | SRAT | REMARKS                                                                              | SAMPLE<br>NO. |
| 0                | 9.1   | Soil                | med<br>brown   | var              | v.st  | -      | -      | -                        |      |                                                                                      |               |
| 9.1              | 12.2  | Silcrete            | grey-<br>brown | massive          | -     | -      | -      | -                        |      |                                                                                      |               |
| 12.2             | 21.3  | Calcrete<br>Sand    | white          | vfg              | -     | -      | -      | -                        |      |                                                                                      |               |
| 21.3             | 38.1  | Sand/Clay           | white          | fg-mg            | -     | -      | -      | -                        |      | } Kaolinitic and Quartzose<br>Algebuckina Formation                                  |               |
| 38.1             | 42.7  | gn                  | white          | vcg              | -     | -      | -      | -                        |      |                                                                                      |               |
| 42.7             | 158.5 | Clay/Silt/<br>Shale | dark<br>grey   | -                | nil   | st     | -      | -                        |      | Permian                                                                              |               |
| 158.5            |       | Granite?            |                |                  |       |        |        |                          |      | Basement, probably granite, no<br>samples, no penetration.                           |               |
|                  |       |                     |                |                  |       |        |        |                          |      | More clay and carbon in the lower<br>half of the Permian Section, with<br>less silt. |               |
|                  |       |                     |                |                  |       |        |        |                          |      | Water table 21m.                                                                     |               |

# DRILL HOLE RECORD

041

Uranerz (Australia) Pty. Ltd.

| PROJECT: 2r      |      |                 |                                 | HOLE NO: 6       |       |        |        | DRILLER: Gordon Sadler   |      |                               |               |
|------------------|------|-----------------|---------------------------------|------------------|-------|--------|--------|--------------------------|------|-------------------------------|---------------|
| TENEMENT: EL 157 |      |                 |                                 | DEPTH: 38.1m     |       |        |        | DATE: 30.11.74           |      |                               |               |
| LOCATION: Line 1 |      |                 |                                 | ELEVATION:       |       |        |        | LOGGED BY: R.H. Dewhurst |      |                               |               |
| DEPTH<br>FROM    | TO   | LITHOLOGY       | COLOUR                          | PARTICLE<br>SIZE | OXID. | CARBON | PYRITE | FELDS.                   | SRAT | REMARKS                       | SAMPLE<br>NO. |
| 0                | 3.0  | Silcrete        | brown                           | mass             | mod   | -      | -      | -                        |      |                               |               |
| 3.0              | 9.1  | Calcrete        | white                           | mass             | -     | -      | -      | -                        |      |                               |               |
| 9.1              | 13.7 | Calc.<br>Sltst. | p.brown                         | vfg              | weak  | -      | -      | -                        |      |                               |               |
| 13.7             | 22.9 | Sand/Silt       | white<br>red/brown              | fg-cg            | weak  | -      | -      | +                        |      | Sub rounded quartz            |               |
| 22.9             | 32.0 | Clay            | grey-<br>brown                  |                  | weak  | -      | -      | -                        |      |                               |               |
| 32.0             | 38.1 | Clay            | yellow-<br>grey<br>dark<br>grey |                  | nil   | st     | -      | -                        |      | Bottom of Tertiary<br>Permian |               |
|                  |      |                 |                                 |                  |       |        |        |                          |      | Water table 13.7m             |               |

# DRILL HOLE RECORD

042

**Uranerz (Australia) Pty. Ltd.**

| PROJECT: 2r                        |      |                      |                 |               | HOLE NO: 7   |        |        |        |      | DRILLER: Gordon Sadler            |            |  |
|------------------------------------|------|----------------------|-----------------|---------------|--------------|--------|--------|--------|------|-----------------------------------|------------|--|
| TENEMENT: EL 157                   |      |                      |                 |               | DEPTH: 28.9m |        |        |        |      | DATE: 30.11.74                    |            |  |
| LOCATION: Line 1                   |      |                      |                 |               | ELEVATION:   |        |        |        |      | LOGGED BY: R.H. Dewhurst          |            |  |
| DEPTH FROM<br>TO                   |      | LITHOLOGY            | COLOUR          | PARTICLE SIZE | OXID.        | CARBON | PYRITE | FELDS. | SRAT | REMARKS                           | SAMPLE NO. |  |
| 0                                  | 1.5  | Soil                 | brown           |               | St           | -      | -      | -      |      |                                   |            |  |
| 1.5                                | 6.1  | Silcrete<br>Calcrete | brown<br>white  |               | weak         | -      | -      | -      |      |                                   |            |  |
| 6.1                                | 7.6  | Calcrete             | white           |               | -            | -      | -      | -      |      |                                   |            |  |
| 7.6                                | 10.7 | Silt                 | white           | vfg           | -            | -      | -      | -      |      |                                   |            |  |
| 10.7                               | 13.7 | Silt                 | p.grey          |               | -            | -      | -      | -      |      |                                   |            |  |
| 13.7                               | 18.3 | Silt                 | p.grey<br>brown |               | weak         | -      | -      | -      |      | } Iva<br>Oxidized top of Permian? |            |  |
| 18.3                               | 24.3 | Silt<br>Clay         | yellow<br>olive |               | weak         | -      | -      | -      |      |                                   |            |  |
| 24.3                               | 28.9 | Clay<br>Silt         | dark<br>grey    |               | nil          | St     | -      | -      |      | Permian                           |            |  |
| Air drilling only. No water table. |      |                      |                 |               |              |        |        |        |      |                                   |            |  |

# DRILL HOLE RECORD

043

**Uranerz (Australia) Pty. Ltd.**

[illegible]

# DRILL HOLE RECORD

044

**Uranerz (Australia) Pty. Ltd.**

| PROJECT: 2r      |      |           |           | HOLE NO: 9       |       |        |        |        |      | DRILLER: Gordon Sadler                                                                                    |               |
|------------------|------|-----------|-----------|------------------|-------|--------|--------|--------|------|-----------------------------------------------------------------------------------------------------------|---------------|
| TENEMENT: EL 157 |      |           |           | DEPTH: 42.7m     |       |        |        |        |      | DATE: 30.11.74                                                                                            |               |
| LOCATION: Line 3 |      |           |           | ELEVATION:       |       |        |        |        |      | LOGGED BY: R.H. Dewhurst                                                                                  |               |
| DEPTH<br>FROM TO |      | LITHOLOGY | COLOUR    | PARTICLE<br>SIZE | OXID. | CARBON | PYRITE | FELDS. | SRAT | REMARKS                                                                                                   | SAMPLE<br>NO. |
| 0                | 3.0  | Soil      | red-brown |                  | St    | -      | -      | -      |      |                                                                                                           |               |
| 3.0              | 9.1  | Silt/Sand | p. brown  | vfg              | weak  | -      | -      | -      |      |                                                                                                           |               |
| 9.1              | 12.2 | Calcrete  | p. grey   | massive          | -     | -      | -      | -      |      |                                                                                                           |               |
| 12.2             | 25.9 | Clay      | yellow    |                  | weak  | -      | -      | -      |      |                                                                                                           |               |
| 25.9             | 36.6 | Clay      | med-grey  |                  | weak  | -      | -      | -      |      |                                                                                                           |               |
| 36.6             | 42.7 | Clay      | black     |                  | nil   | V.St.  | -      | -      |      |                                                                                                           |               |
|                  |      |           |           |                  |       |        |        |        |      | Water injection because of hard band at surface. Hole logged without mud therefore no resistivity or S.P. |               |

# DRILL HOLE RECORD

045

Uranerz (Australia) Pty. Ltd.

| PROJECT: 2r      |      |           | HOLE NO: 10       |                  |       |        |        |        | DRILLER: Gordon Sadler   |                        |               |
|------------------|------|-----------|-------------------|------------------|-------|--------|--------|--------|--------------------------|------------------------|---------------|
| TENEMENT: EL 157 |      |           | DEPTH: 42.7m      |                  |       |        |        |        | DATE: 1.12.74            |                        |               |
| LOCATION: Line 3 |      |           | ELEVATION:        |                  |       |        |        |        | LOGGED BY: R.H. Dewhurst |                        |               |
| DEPTH<br>FROM    | TO   | LITHOLOGY | COLOUR            | PARTICLE<br>SIZE | OXID. | CARBON | PYRITE | FELDS. | SRAT                     | REMARKS                | SAMPLE<br>NO. |
| 0                | 1.5  | Silcrete  | brown             |                  | st    | -      | -      | -      |                          |                        |               |
| 1.5              | 9.1  | Calcrete  | brown             |                  | mod   | -      | -      | -      |                          |                        |               |
| 9.1              | 16.8 | Silt      | white             | vfg              | nil   | -      | -      | -      |                          |                        |               |
| 16.8             | 21.3 | Silt/Sand | white             | Cg               | nil   | -      | -      | -      |                          | Quartzose              |               |
| 21.3             | 24.4 | Silt      | white             | vfg              | -     | -      | -      | -      |                          |                        |               |
| 24.4             | 35.0 | Clay/Silt | yellow            |                  | mod   | -      | -      | -      |                          |                        |               |
| 35.0             | 42.7 | Clay      | chocolate<br>grey |                  | -     | St     | -      | -      |                          |                        |               |
|                  |      |           |                   |                  |       |        |        |        |                          | Water injection at 32m |               |

# DRILL HOLE RECORD

046

**Uranerz (Australia) Pty. Ltd.**

| PROJECT: 2r      |      |           |              | HOLE NO: 11      |       |        |        |        |      | DRILLER: Gordon Sadler   |               |
|------------------|------|-----------|--------------|------------------|-------|--------|--------|--------|------|--------------------------|---------------|
| TENEMENT: EL 157 |      |           |              | DEPTH: 74.7      |       |        |        |        |      | DATE: 1.12.74            |               |
| LOCATION: Line 4 |      |           |              | ELEVATION:       |       |        |        |        |      | LOGGED BY: R.H. Dewhurst |               |
| DEPTH<br>FROM TO |      | LITHOLOGY | COLOUR       | PARTICLE<br>SIZE | OXID. | CARBON | PYRITE | FELDS. | SRAT | REMARKS                  | SAMPLE<br>NO. |
| 0                | 4.6  | Soil      | red<br>brown |                  | v.st  | -      | -      | -      |      |                          |               |
| 4.6              | 10.7 | Silcrete  | brown        |                  | st    | -      | -      | -      |      | Ferruginous              |               |
| 10.7             | 16.8 | Silcrete  | red<br>brown |                  | v.st  | -      | -      | -      |      |                          |               |
| 16.8             | 22.9 | Sand      | var.         | cg-vcg           | w     |        |        | m      |      | Lithic frags.            |               |
| 22.9             | 24.4 | Sand      | white        | vfg-vcg          | n     | -      | -      | -      |      | Partly cemented          |               |
| 24.4             | 53.3 | Sand/Clay | white        | fg-mg            | -     | -      | -      | -      |      | kaolinitic               |               |
| 53.3             | 62.5 | Sand/Clay | white        | vcg              | -     | -      | -      | -      |      | kaolinitic               |               |
| 62.5             | 67.0 | Clay      | grey<br>dark |                  | -     | tr     | -      | -      |      |                          |               |
| 67.0             | 74.7 | Clay      | grey         |                  | -     | st     | -      | -      |      | Permian                  |               |
|                  |      |           |              |                  |       |        |        |        |      | Air drilling to 16.8m.   |               |
|                  |      |           |              |                  |       |        |        |        |      | Water table 16.8m.       |               |

# DRILL HOLE RECORD

047

**Uranerz (Australia) Pty. Ltd.**

| PROJECT: 2r      |      |              |                 | HOLE NO: 12      |       |        |        |        |      | DRILLER: Gordon Sadler                          |               |
|------------------|------|--------------|-----------------|------------------|-------|--------|--------|--------|------|-------------------------------------------------|---------------|
| TENEMENT: EL 157 |      |              |                 | DEPTH: 74.7m     |       |        |        |        |      | DATE: 1.12.74                                   |               |
| LOCATION: Line 4 |      |              |                 | ELEVATION:       |       |        |        |        |      | LOGGED BY: R.H. Dewhurst                        |               |
| DEPTH<br>FROM TO |      | LITHOLOGY    | COLOUR          | PARTICLE<br>SIZE | OXID. | CARBON | PYRITE | FELDS. | SRAT | REMARKS                                         | SAMPLE<br>NO. |
| 0                | 4.6  | Soil         | brown           |                  | v.st  | -      | -      | -      |      |                                                 |               |
| 4.6              | 15.2 | Silcrete     | brown           |                  | v.st  | -      | -      | -      |      | ferruginous                                     |               |
| 15.2             | 18.3 | Sand<br>Clay | yellow<br>brown | cg               | mod   | -      | -      | -      |      |                                                 |               |
| 18.3             | 61.0 | Sand/Clay    | white           | cg               | nil   | -      | -      | tr     |      | } Algebuckina Formation<br>Grey quartz crystals |               |
| 61.0             | 65.5 | Sand         | grey            | mg-vcg           | -     | -      | -      | -      |      |                                                 |               |
| 65.5             | 74.7 | Clay         | dark<br>grey    |                  | -     | st     | -      | -      |      | Permian                                         |               |
|                  |      |              |                 |                  |       |        |        |        |      | Air drilling to 15.2m.                          |               |
|                  |      |              |                 |                  |       |        |        |        |      | Water table 15.2m.                              |               |

# DRILL HOLE RECORD

048

**Uranerz (Australia) Pty. Ltd.**

| PROJECT: 2r            |      |               |           |               | HOLE NO: 13 |        |        |        |      | DRILLER: Gordon Sadler   |                         |  |
|------------------------|------|---------------|-----------|---------------|-------------|--------|--------|--------|------|--------------------------|-------------------------|--|
| TENEMENT: EL 157       |      |               |           |               | DEPTH: 61m  |        |        |        |      | DATE: 2.12.74            |                         |  |
| LOCATION: Line 4       |      |               |           |               | ELEVATION:  |        |        |        |      | LOGGED BY: R.H. Dewhurst |                         |  |
| DEPTH FROM TO          |      | LITHOLOGY     | COLOUR    | PARTICLE SIZE | OXID.       | CARBON | PYRITE | FELDS. | SRAT | REMARKS                  | SAMPLE NO.              |  |
| 0                      | 6.1  | Soil Silcrete | red-brown |               | St          | -      | -      | -      |      |                          |                         |  |
| 6.1                    | 10.7 | Silcrete      | red-brown |               | V.st        | -      | -      | -      |      | ferruginous              |                         |  |
| 10.7                   | 12.2 | Silcrete Sand | red-brown | v.c.g.        | V.st        | -      | -      | -      |      |                          |                         |  |
| 12.2                   | 13.7 | Sand          | yellow    | mg-v.c.g.     | mod.        | -      | -      | -      |      |                          |                         |  |
| 13.7                   | 29.0 | Clay/Sand     | white     | fg-v.c.g.     | -           | -      | -      | -      |      | kaolinitic               | } Algebuckina Formation |  |
| 29.0                   | 35.0 | Sand          | white     | cg            | -           | -      | -      | -      |      |                          |                         |  |
| 35.0                   | 41.1 | Clay/Sand     | white     | fg-v.c.g.     | -           | -      | -      | -      |      | kaolinitic               |                         |  |
| 41.1                   | 53.3 | Clay          | p.grey    |               | -           | -      | -      | -      |      |                          |                         |  |
| 53.3                   | 61.0 | Clay          | black     |               | -           | V.st   | -      | -      |      | Permian                  |                         |  |
| Air drilling to 12.2m. |      |               |           |               |             |        |        |        |      |                          |                         |  |
| Water table 12.2m      |      |               |           |               |             |        |        |        |      |                          |                         |  |

# DRILL HOLE RECORD

049

**Uranerz (Australia) Pty. Ltd.**

[illegible]

# DRILL HOLE RECORD

050

Uranerz (Australia) Pty. Ltd.

| PROJECT: 2r      |      |                        |               | HOLE NO: 15      |       |        |        | DRILLER: Gordon Sadler   |      |                                  |               |
|------------------|------|------------------------|---------------|------------------|-------|--------|--------|--------------------------|------|----------------------------------|---------------|
| TENEMENT: EL 157 |      |                        |               | DEPTH: 61.0m     |       |        |        | DATE: 2.12.74            |      |                                  |               |
| LOCATION: Line 5 |      |                        |               | ELEVATION:       |       |        |        | LOGGED BY: R.H. Dewhurst |      |                                  |               |
| DEPTH<br>FROM    | TO   | LITHOLOGY              | COLOUR        | PARTICLE<br>SIZE | OXID. | CARBON | PYRITE | FELDS.                   | SRAT | REMARKS                          | SAMPLE<br>NO. |
| 0                | 6.1  | Soil                   | Red-<br>brown |                  | V.St  | -      | -      | -                        |      |                                  |               |
| 6.1              | 12.2 | Silcrete               | p.brown       | mass.            | w     | -      | -      | -                        |      |                                  |               |
| 12.2             | 18.3 | Calc./Sltst            | white         |                  | -     | -      | -      | -                        |      |                                  |               |
| 18.3             | 29.0 | Kaolin                 | white         |                  | -     | -      | -      | -                        |      |                                  |               |
| 29.0             | 35.1 | Sand/Clay/<br>Granules | white         | vsg              | -     | -      | -      | -                        |      | Kaolinitic Algebuckina Formation |               |
| 35.1             | 44.2 | Sand/Silt/<br>Clay     | white<br>grey | vsg              | -     | -      | -      | -                        |      | Kaolinitic                       |               |
| 44.2             | 61.0 | Clay                   | dark<br>grey  | -                | -     | V.St   | -      | -                        |      | Permian                          |               |
|                  |      |                        |               |                  |       |        |        |                          |      | Water table 18.3m.               |               |
|                  |      |                        |               |                  |       |        |        |                          |      | Air drilling to 18.3m.           |               |

# DRILL HOLE RECORD

051

Uranerz (Australia) Pty. Ltd.

| PROJECT: 2r      |      |           |                  | HOLE NO: 16      |       |        |        | DRILLER: Gordon Sadler   |      |                        |               |
|------------------|------|-----------|------------------|------------------|-------|--------|--------|--------------------------|------|------------------------|---------------|
| TENEMENT: EL 157 |      |           |                  | DEPTH: 51.8m     |       |        |        | DATE: 3.12.74            |      |                        |               |
| LOCATION: Line 5 |      |           |                  | ELEVATION:       |       |        |        | LOGGED BY: R.H. Dewhurst |      |                        |               |
| DEPTH<br>FROM    | TO   | LITHOLOGY | COLOUR           | PARTICLE<br>SIZE | OXID. | CARBON | PYRITE | FELDS.                   | SRAT | REMARKS                | SAMPLE<br>NO. |
| 0                | 1.5  | Soil      | Red-<br>brown    |                  | V.St  | -      | -      | -                        |      |                        |               |
| 1.5              | 12.2 | Silcrete  | brown            |                  | St    | -      | -      | -                        |      |                        |               |
| 12.2             | 16.8 | Silcrete  | p.brown          |                  | w     | -      | -      | -                        |      |                        |               |
| 16.8             | 19.8 | Sltst     | m. grey          |                  | -     | -      | -      | -                        |      | Cemented               |               |
| 19.8             | 21.3 | Clay      | p. pink          |                  | -     | -      | -      | -                        |      |                        |               |
| 21.3             | 32.0 | Clay/Sand | white            | v.cg             | -     | -      | -      | -                        |      | Algebuckina Formation  |               |
| 32.0             | 44.2 | Clay/Sand | p.grey<br>yellow | cg-<br>vcg       | tr    | -      | -      | -                        |      |                        |               |
| 44.2             | 51.8 | Clay      | dark<br>grey     |                  | -     | V.St   | -      | -                        |      | Permian                |               |
|                  |      |           |                  |                  |       |        |        |                          |      | Water table 18.3m.     |               |
|                  |      |           |                  |                  |       |        |        |                          |      | Air drilling to 18.3m. |               |

052

# DRILL HOLE RECORD

Uranerz (Australia) Pty. Ltd.

| PROJECT: 2r      |      |                    |                   | HOLE NO: 17      |             |        |        | DRILLER: Gordon Sadler   |      |                                                        |               |
|------------------|------|--------------------|-------------------|------------------|-------------|--------|--------|--------------------------|------|--------------------------------------------------------|---------------|
| TENEMENT: EL 157 |      |                    |                   | DEPTH: 65.5m     |             |        |        | DATE: 3.12.74            |      |                                                        |               |
| LOCATION: Line 5 |      |                    |                   | ELEVATION:       |             |        |        | LOGGED BY: R.H. Dewhurst |      |                                                        |               |
| DEPTH<br>FROM    | TO   | LITHOLOGY          | COLOUR            | PARTICLE<br>SIZE | OXID.       | CARBON | PYRITE | FELDS.                   | SRAT | REMARKS                                                | SAMPLE<br>NO. |
| 0                | 1.5  | Soil               | brown             |                  | V.St        | -      | -      | -                        |      |                                                        |               |
| 1.5              | 6.1  | Calc//Sltst        | p.grey            |                  | -           | -      | -      | -                        |      |                                                        |               |
| 6.1              | 15.2 | Clay/Silt/<br>Sand | white             | vfg-cg           | -           | -      | -      | -                        |      |                                                        |               |
| 15.2             | 19.8 | Sand               | white-<br>grey    | mg-cg            | -           | -      | -      | -                        |      |                                                        |               |
| 19.8             | 36.6 | gn clay            | white             | vfg              | -           | -      | -      | -                        |      | White and dark grey quartz grains<br>in kaolin matrix. |               |
| 36.6             | 50.3 | gn clay            | white             | vfg              | Mod         | -      | -      | -                        |      | Algebuckina Fmtn                                       |               |
| 50.3             | 51.8 | gn clay            | pink              | vfg              | Haem        | -      | -      | -                        |      | Fe stained quartz crystals                             | "             |
| 51.8             | 65.5 | Clay               | wh pink<br>yellow | vfg              | Mod<br>Haem | -      | -      | -                        |      | "                                                      | "             |
|                  |      |                    | black             | -                | -           | V.St   | -      | -                        |      | Permian                                                |               |
|                  |      |                    |                   |                  |             |        |        |                          |      | Air drilling to 15.2m.                                 |               |
|                  |      |                    |                   |                  |             |        |        |                          |      | Water table 19.8m.                                     |               |

# DRILL HOLE RECORD

053

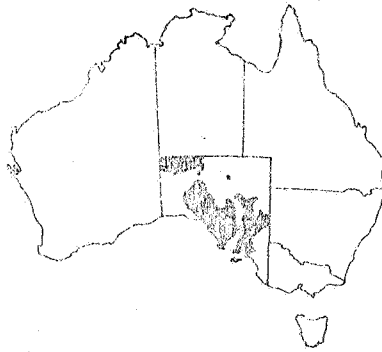
Uranerz (Australia) Pty. Ltd.

| PROJECT: 2r      |       |                      | HOLE NO: 18   |                  |                       |        |        |        | DRILLER: Gordon Sadler   |                                                                                                     |               |
|------------------|-------|----------------------|---------------|------------------|-----------------------|--------|--------|--------|--------------------------|-----------------------------------------------------------------------------------------------------|---------------|
| TENEMENT: EL 157 |       |                      | DEPTH: 260.6m |                  |                       |        |        |        | DATE: 3/12 - 5/12 1974   |                                                                                                     |               |
| LOCATION: Line 5 |       |                      | ELEVATION:    |                  |                       |        |        |        | LOGGED BY: R.H. Dewhurst |                                                                                                     |               |
| DEPTH<br>FROM    | TO    | LITHOLOGY            | COLOUR        | PARTICLE<br>SIZE | OXID.                 | CARBON | PYRITE | FELDS. | SRAT                     | REMARKS                                                                                             | SAMPLE<br>NO. |
| 0                | 1.5   | Soil                 | brown         |                  | St                    | -      | -      | -      |                          |                                                                                                     |               |
| 1.5              | 12.2  | Clay/Silt            | white         |                  | -                     | -      | -      | -      |                          | Kaolin                                                                                              |               |
| 12.2             | 64.0  | gn, sand<br>clay     | white         | mg-vcg           | -                     | -      | -      | -      |                          | Algebuckina Formation                                                                               |               |
| 64.0             | 204.2 | Shale<br>(clay-silt) | dark<br>grey  | -                | St                    | -      | -      | -      |                          | Slightly fissile                                                                                    |               |
| 204.2            | 256.0 | Clay                 | med<br>grey   | -                | -                     | -      | -      | -      |                          |                                                                                                     |               |
| 256.0            | 260.6 | Sst                  | p.brown       | fg               | mod<br>(Haem<br>&Lim) | -      | -      | -      |                          | Few fragments<br>recovered. Possible boulder bed<br>overlying basement.<br>Mud drilling throughout. |               |

054

APPENDIX 5

Letter from S.A. Department of Mines  
dated 10-1-75 - Palynology of Core  
Samples, Bore 18, EL 157.



DEPARTMENT OF MINES  
SOUTH AUSTRALIA

169 RUNDLE ST. ADELAIDE

Box 38 Rundle St. P.O. S.A. 5000  
Phone: ~~23 0461~~ Telegrams: Domex  
223 0461

OUR REF. EL.157 WKH:PAL

10th January 1975

055

Mr. R.H. Dewhurst,  
Uranerz (Australia) Pty. Ltd.  
37 Taunton Avenue,  
ENFIELD. 5085

Dear Sir,

Palynology of Core Samples, Bore 18, EL.157

Three core samples from this borehole (locality TARCOOLA 196235) have yielded the following results.

Core 1 at 246ft 9 ins. and at 252ft. 6 ins. (sample Nos. S3265, S3266) - abundant carbonaceous matter with spores indicative of the Early Permian Stage 3 microfloras. Lithologically and palynologically the samples correlate with the Stuart Range Beds (high in the section of this unit) of the Arckaringa Basin. The samples however appear to be non-marine.

Core 2 at 817ft 9 ins (sample No. S3267) - sparse organic matter in the bottom of the core (top of core badly contaminated) with palynomorphs indicative of early Stage 2 (early Permian - late Carboniferous) microfloras. This core, a diamictite, correlates with the Boorthanna Formation of the Arckaringa Basin. Marine influence is not indicated.

Yours faithfully

*BP Well*

DIRECTOR OF MINES *perms*

056

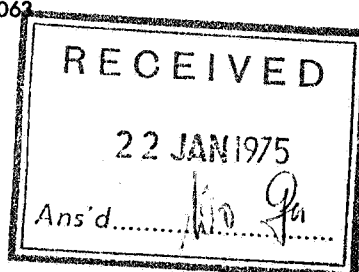
APPENDIX 6

Petrographical Report MP2550/75, AMDEL.

**amdel**

Flemington Street, Frewville, South Australia 5062  
Phone Adelaide 79 1662, telex AA82520

Please address all correspondence to Frewville,  
In reply quote: MP 3.782.0



057

17 January 1975

Uranerz Aust. Pty. Ltd.,  
37 Taunton Avenue,  
ENFIELD, S.A. 5085

REPORT MP2550/75

YOUR REFERENCE: Amdel application of 2/1/75.  
MATERIAL: 4 rocks.  
IDENTIFICATION: #2, #3, #7.  
DATE RECEIVED: 2/1/75.  
WORK REQUIRED: Brief petrographic descriptions.

Investigation and Report by: Dr. B.G. Steveson.

Officer in Charge, Mineralogy Section: Dr. K.J. Henley

*K.J. Henley*

for F.R. Hartley  
Director.

BRIEF DESCRIPTIONS OF FOUR SILTSTONES

058

Sample #2 70 - 75 TS 33352

## Hand Specimen:

Chips of a very fine grained buff coloured rock which is friable in the hand. The sample is clearly very fine grained and no individual crystals can be seen in the specimen.

## Thin Section:

The thin section contains several chips but these all belong to the same lithology and they will be described together. For the most part the rock consists of a brown clay material which probably comprises more than 85% the volume of the sample. Randomly dispersed within this material are detrital grains of quartz and mica. Most of the quartz grains are of silt grade and they range in size from 0.02 to 0.2 mm. Some of the larger quartz grains have detrital shapes but the smallest quartz grains are distinctly angular. In one or two of the chips small detrital mica flakes are present and the parallel orientation of these gives the rock a slight foliation.

In summary the rock is a clay-rich sediment which consists largely of a brown clay with minor amounts of detrital quartz and mica.

Sample #3 90 - 95 TS 33353

## Hand Specimen:

The sample consists of a very fine grained and friable grey to brown rock.

## Thin Section:

This rock is a siltstone or very fine grained sandstone which contains of the order of 40% detrital fragments and 60% clay matrix.

Many of the detrital grains and single quartz crystals range in size from 0.05 - 0.1 mm and grains of this type comprise at least 30% of the volume of the rock. For the most part these grains are equant but show considerable angularity. Also present are accessory amounts of detrital potassium feldspar and muscovite.

The clay matrix has a pale brown colour in transmitted polarised light but under crossed nicols the matrix is dark and clearly consists of very fine grained clays which have a low birefringence. In some of the chips there is dusty brown material within the matrix which is probably either limonitic or titaniferous material.

059

The rock is therefore an argillaceous siltstone consisting very largely of quartz and fine grained clays.

Sample #3 40 -45 TS 33354

Hand Specimen:

The sample consists of friable chips of a fine grained grey rock.

Thin Section:

The chips of this rock are similar in mineralogy and texture and they consist of a siltstone or very fine grained sandstone with a dark, abundant matrix.

Detrital grains of quartz constitute 25 - 30% of the volume of this rock and there are, in addition, accessory amounts of detrital muscovite and feldspar; the remainder of the rock comprises clayey matrix material. The quartz grains range in size up to about 0.15 mm and hence fall very largely within the silt grade. The largest quartz grains are unusually well rounded but there is a gradation from these grains to smaller, distinctly angular grains. One or two grains of potash feldspar are present but these comprise less than 2% the volume of the sample. Muscovite is present as very thin elongate flakes the largest of which is 0.2 mm in length.

The matrix material is rather dark and indefinite in thin section; the colour of the matrix ranges in different chips from almost black to a rather pale brown. Clay minerals probably constitute the largest part of the matrix but there is probably also some limonitic material and possibly some very fine grained quartz also.

This rock contains a greater proportion of detrital material than sample #2 and the detrital grains have a slightly larger average grain size than in that sample.

Sample #7 35 - 40 TS 33355

069

Hand Specimen:

A grey aphanitic rock which is massive and friable.

Thin Section:

This sample is slightly different than the three described above in that it contains quartz crystals ranging in size of up to about 0.4 mm, the detrital material has a much wider grain size range and the clay matrix is more highly birefringent than in those samples. Detrital quartz constitutes approximately 65% of the volume of this rock and the grains range in size from less than 0.02 mm to approximately 0.4 mm. Most of the quartz grains are about 0.05 - 0.1 mm in size and are distinctly angular. Thin flakes of muscovite are the only other detrital components visible in the thin section and these comprise no more than 2 - 3% of the sample. The remainder of the rock consists of clays which show in many of the chips an indefinite preferred orientation which can be recognised from the diffuse bulk extinction of the clay flakes. The clay is somewhat more birefringent than in the samples described above and it is possible that the clay in this rock (#7) is significantly different than the clays in samples 2 and 3.

This sample, like the others in this collection, is a weathered and clayey fine grained sediment best described as an argillaceous siltstone.

# URANERZ (AUSTRALIA) PTY. LTD.

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061

U A L REPORT NO. 43

EXPLORATION 1974 ON EL 157

IN THE TARCOOLA AREA,

SOUTH AUSTRALIA

COMPILED BY

R. DEWHURST

Env 2472 Vol 1  
(for plans see Vol 2)

Perth

March 1975

# URANERZ (AUSTRALIA) PTY. LTD.

DE/CBB March 1975

062

## S U M M A R Y

Tertiary sediments overlying a Lower Permian palaeochannel, the Mulgathing Trough, were investigated within the area of Exploration Licence 157. The Permian palaeochannel, whose depth was unsuspected prior to geophysical surveys, was considered likely to contain basal arkosic sediments which could host uranium mineralization.

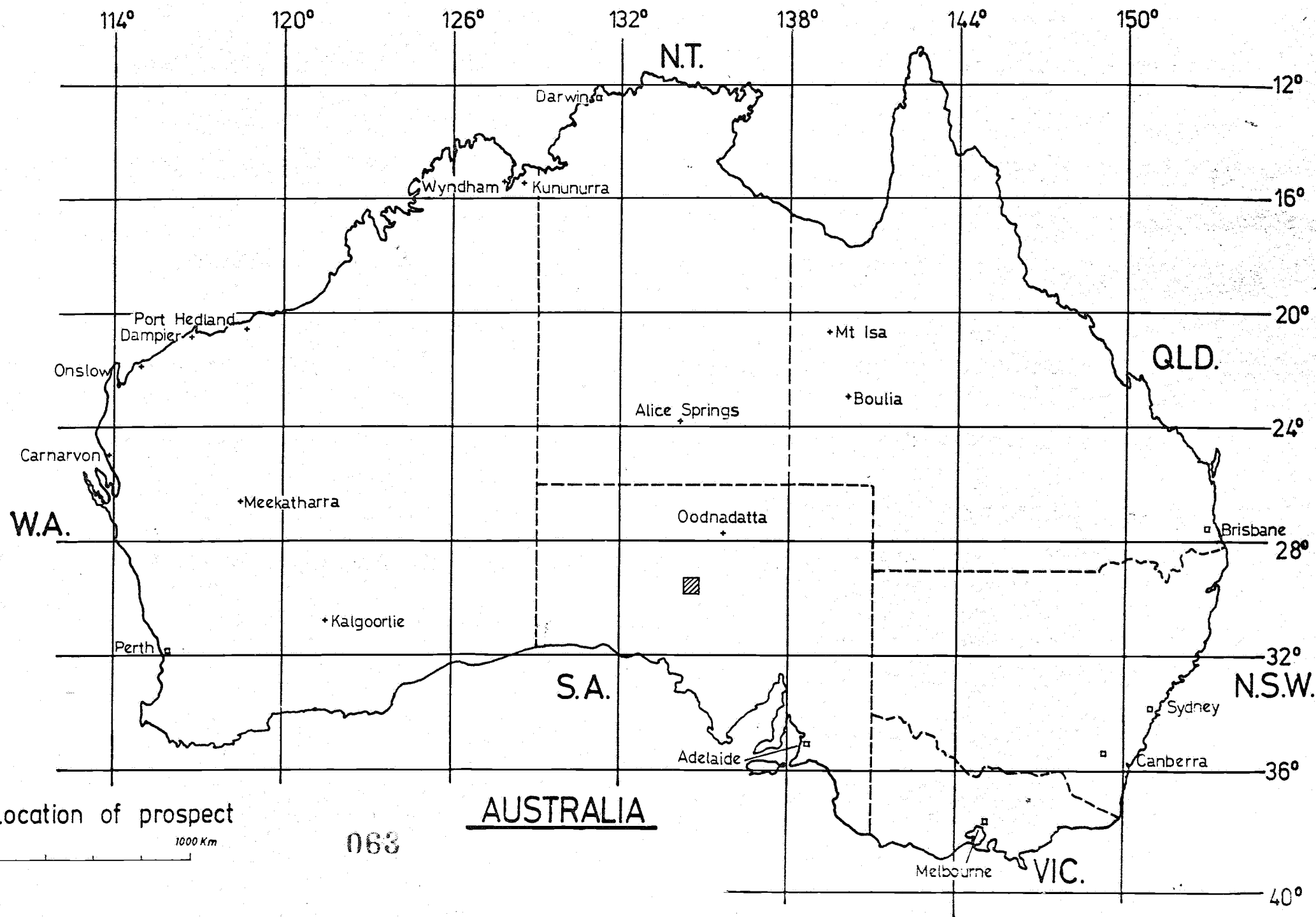
A short reconnaissance survey in October 1974 was followed by refraction seismic and gravity surveys and an eighteen (18) hole rotary drilling and down-hole logging programme.

The geophysical work showed that the Permian sediments reach a thickness of up to 450m.

No radiometric anomalies either on the surface or in drillholes have been discovered.

In view of the lack of gamma anomalism in the holes drilled, low gamma background, low uranium analysis and lack of favourable characteristics of the Tertiary sediments, the area is regarded as of insufficient potential to warrant further work.

It is suggested EL 157 be relinquished.



R E P O R T    43    E L 157    T A R C O O L A    A R E A,    S.A.

I N D E X

Page

S U M M A R Y

|     |                                                                                                          |    |
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R E P O R T    43    E L 157    T A R C O O L A    A R E A ,    S . A .

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- Appendix   1.        Progress Report on Geophysical Survey  
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                      R.G. Nelson 1975.    Rept. Bk. No. 75/5.
2.        Report on Geophysical Survey in EL 157,  
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                              Text of Report not yet to hand - seismic  
                              and gravity sections are included as  
                              Maps 4, 5, 6, 7 and 8.
3.        Geophysical Logs - Drillholes 1 - 18.  
                              Geoscience.
4.        Lithological Logs - Drillholes 1 - 18.
5.        Letter from S.A. Department of Mines  
                              dated 10-1-75 - Palynology of Core  
                              Samples, Bore 18, EL 157.
6.        Petrographical Report MP2550/75, AMDEL.

1. I N T R O D U C T I O N

1.1 A R E A \_ O F \_ I N V E S T I G A T I O N

The area investigated is covered by Exploration Licence (EL) 157 which covers part of Mulgathing Station north-west of Tarcoola in South Australia. The EL lies on the north-western edge of the Gawler Block.

1.2 P U R P O S E \_ O F \_ I N V E S T I G A T I O N

The object of the investigation was to discover sandstone-type uranium deposits in sediments overlying a Lower Permian palaeochannel. Work in the area followed a reconnaissance survey in 1972 (L. Geidans, 1972).

The existence of the palaeochannel was indicated by the work of a previous explorer (Nissho-Iwai Co. (Aust) Ltd., EL 48) who carried out a wide spaced scout drilling programme in the area.

1.3 T I M E \_ O F \_ I N V E S T I G A T I O N

Field work took place in two stages between October 2nd and December 5th, 1974.

## 2. GENERAL INFORMATION

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### 2.1 LOCALITY

EL 157 is bounded by latitudes 30°10'S and 30°28'S and longitudes 133°37'E and 134°04'E. It is 650km NW of Adelaide and 80km WNW of Tarcoola by road.

### 2.2 COMMUNICATIONS AND ACCESS

EL 157 is accessible by road from Adelaide via Kingoonya and Tarcoola. Roads north of Port Augusta are normally passable by two wheel drive vehicle but may be closed even to four wheel drive vehicles. Roads on EL 157 are well maintained and are normally passable with two wheel drive vehicles.

The Trans-Australian Railway passes through Tarcoola and provides an alternative means of access in the event of bad weather.

There are no airports in the area open for scheduled flights, though there are airstrips at Mulgathing Rocks, Commonwealth Hill and Tarcoola which are normally open.

Supplies may normally be obtained at Tarcoola.

During the field work daily radio schedules were kept with the company's Perth office using the 11,000 or 9,000 Hz frequency.

### 2.3 TOPOGRAPHY

The average elevation of EL 157 is 150 metres and the highest peak 215 metres. There are no permanent watercourses or waterholes within the EL and the intermittent streams flow rarely. Drainage is south-westerly in the southern part of the EL and northerly in the remainder.

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#### 2.4 CLIMATE

The climate is dry sub-tropical, with winds and rain influenced by the northern sections of cyclonic weather patterns and local thunderstorms. The annual rainfall is about 150mm normally falling in a limited number of showers or thunderstorms. Showers associated with cold fronts and low pressure areas tend to occur in the cooler months, whereas thunderstorms occur in the warmer months.

#### 2.5 VEGETATION

The vegetation is savannah type with light to moderate wattle and eucalypt scrub.

#### 2.6 POPULATION AND LAND USE

Population in the area is restricted to sheep station employees and transients. Sheep "farming" is the only agricultural activity and form of land use.

#### 2.7 WATER RESOURCES

Natural surface water is absent throughout the year except, briefly, following heavy rain. Such water as is available is bore water stored in concrete or stone tanks. The salinity of this water is estimated to be of the order of 10%. It is acceptable for sheep but is not regarded as potable by man. Wells in the area normally draw water from depths of 25 to 55 metres. Many wells penetrate little below the water table and are liable to run dry in periods of low rainfall.

#### 2.8 MAGNETIC DECLINATION

The magnetic declination is 5°13' East increasing 02' annually.

3. P R E V I O U S   A N D   C U R R E N T  
S U R V E Y S   A N D   A C T I V I T I E S

3.1 T O P O G R A P H I C   M A P P I N G

The area is covered by the 1:250,000 Tarcoola topographic map, SH 53-10, of 1960. The area is also covered by Department of Lands airphotographs with a scale of 1:87,500 taken in January 1972.

3.2 G E O L O G I C A L   M A P P I N G

The Department of Mines Tarcoola preliminary Geological map at a scale of 1:250,000 covers the area. It is not regarded as reliable. A final geological map is being prepared.

3.3 G E O P H Y S I C A L   S U R V E Y S

Regional 1:250,000 scale gravity and aeromagnetic surveys have been carried out by State and Federal Authorities. The gravity map is only available as a preliminary edition. Sections of these maps covering the area of EL 157 are included as Maps 1 and 2 (pages 16 and 17).

A coloured Bouger Gravity Anomaly Map of the Great Artesian Basin and South Australia is available at a scale of 1:1,000,000.

3.4 E X P L O R A T I O N   A N D   M I N I N G

No mining developments exist/existed in the area. Limited exploration for base metals and iron ore was carried out in the general area.

Uranium exploration in the area has been carried out by Nissho-Iwai on EL 48 covering the central section of EL 157 and areas to the south.

Analysis of water samples and ground scintillometer surveys were followed by a 38 hole drilling programme indicating the presence of a Lower Permian Palaeochannel which subsequently became the focus of further exploration by Uranerz (Australia) Pty. Ltd. An account of the exploration carried out by Nissho-Iwai is on open file in the South Australian Mines Department (Envelope 2390).

4. MINERAL TENEMENTS

The area of 787km<sup>2</sup> covered by EL 157 was applied for on July 30th, 1974 by this company for a period of six months. EL 157 was granted, subject to an expenditure commitment of \$20,000, by the South Australian Department of Mines on October 21st, 1974.

EL 157 is defined by the co-ordinates:

| Latitude | 30°10'S | longitude | 133°37'E |
|----------|---------|-----------|----------|
|          | 30°10'  |           | 133°45'  |
|          | 30°12'  |           | 133°45'  |
|          | 30°12'  |           | 133°50'  |
|          | 30°16'  |           | 133°50'  |
|          | 30°16'  |           | 133°58'  |
|          | 30°20'  |           | 133°58'  |
|          | 30°20'  |           | 134°04'  |
|          | 30°28'  |           | 134°04'  |
|          | 30°28'  |           | 133°52'  |
|          | 30°23'  |           | 133°52'  |
|          | 30°23'  |           | 133°45'  |
|          | 30°19'  |           | 133°45'  |
|          | 30°19'  |           | 133°37'  |

## 5. GENERAL GEOLOGY

### 5.1 STRATIGRAPHY/LITHOLOGY

Banded ironstone, granite gneiss and granite basement rocks of the Gawler Platform outcrop around the margins of the EL. The age of the basement rocks varies between 1600 and 1900<sup>m</sup> years. Within the EL upper Tertiary and Quaternary aeolianites predominate at the surface with subordinate areas of calcrete and middle Tertiary silcrete. These sediments overlie strongly kaolinized gneiss and schist to the south, granite and banded ironstone in the north and Lower Permian, Jurassic and Tertiary sediments in the central areas.

### 5.2 STRUCTURE AND TECTONICS

Magnetic and gravimetric maps (Maps 1 and 2) show a major NE trending lineament which is likely due to lithological changes within the Gawler Block basement rocks. Around the northern edge of the Block two basinal structures are apparent, the Wallira and Phillipson Troughs, which are in-filled with Permian and Permian to Mesozoic sediments. Other smaller and shallower sedimentary basins are likely to exist within the northern part of the Gawler Block. In fact, the investigation described below showed the area of EL 157 to be underlain by such a depression which was subsequently called the Mulgathing Trough.

### 5.3 ECONOMIC GEOLOGY

Economic mineral deposits are not known to occur within the immediate vicinity of the EL, though gold mineralization occurs at Tarcoola to the south-east and iron ores are known to the south.

30°15' —

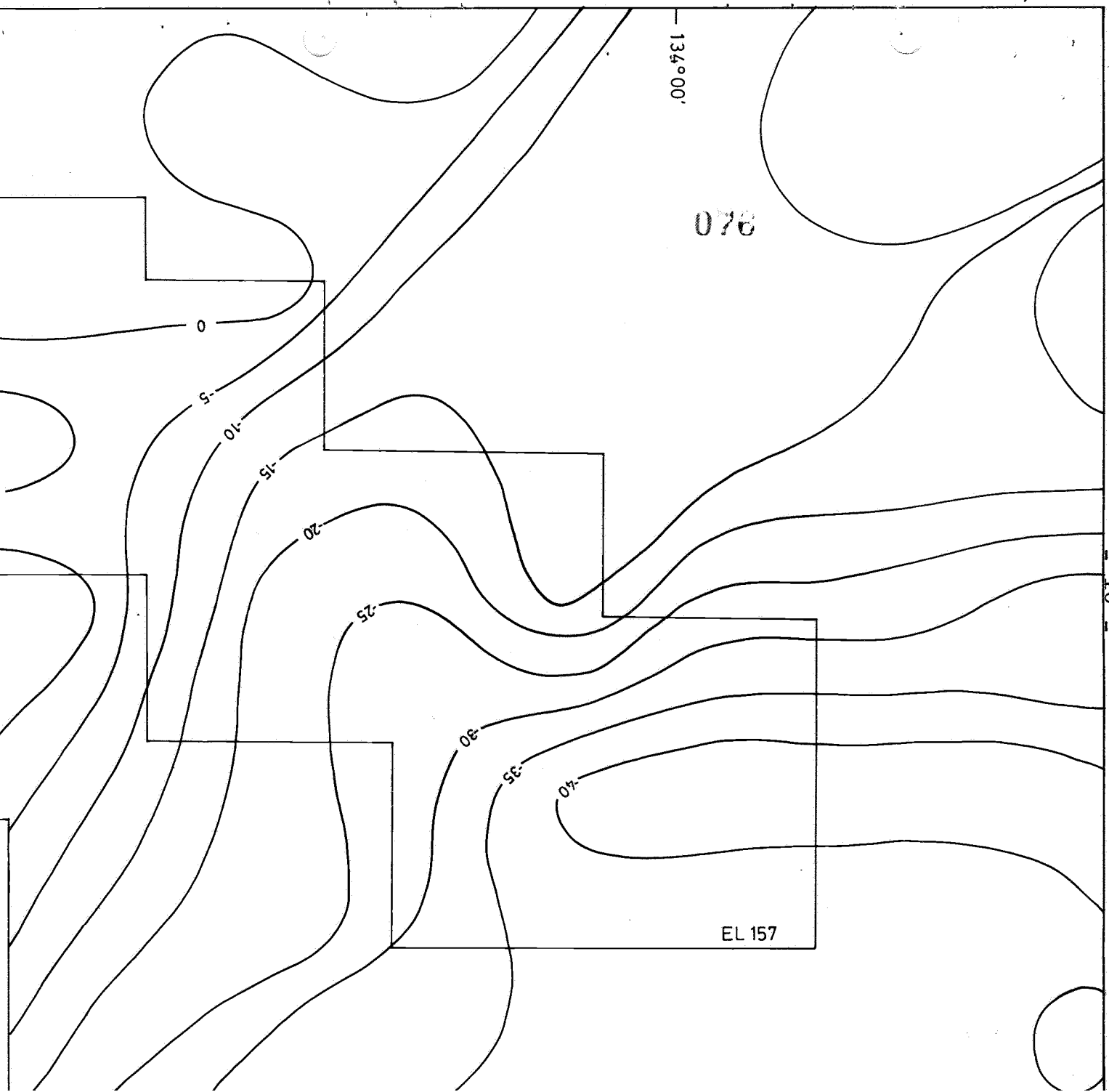
134°00'

078

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EL 157

TARCOOLA, E.L.157  
Gravity contours based on 4 mile grid  
(Section of BMR 1:250.000 sheet)  
Contour interval 5 milligals  
MAP 1



Mulgathing

13400'

077

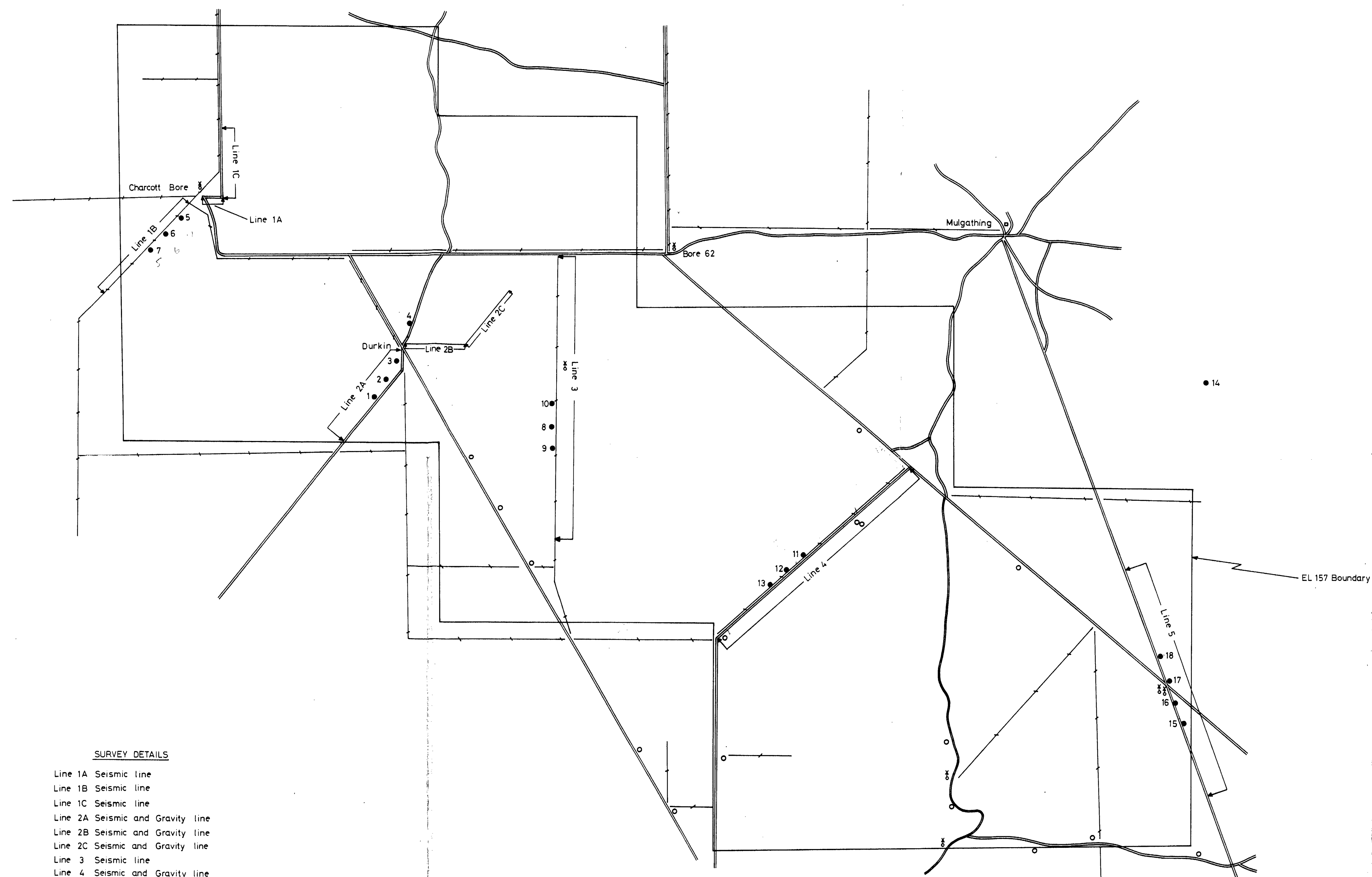
171

Coates

TARCOOLA, E.L.157

Magnetic Total Intensity Contours  
(Section of BMR 1:250,000 sheet)

MAP 2



#### SURVEY DETAILS

Line 1A Seismic line  
 Line 1B Seismic line  
 Line 1C Seismic line  
 Line 2A Seismic and Gravity line  
 Line 2B Seismic and Gravity line  
 Line 2C Seismic and Gravity line  
 Line 3 Seismic line  
 Line 4 Seismic and Gravity line  
 Line 5 Seismic and Gravity line

#### LEGEND

○ Drill hole of former explorer  
 ● Uranerz drill hole

1 0 2.5 5 km  
 1:100 000

**URANERZ AUSTRALIA PTY. LTD.**

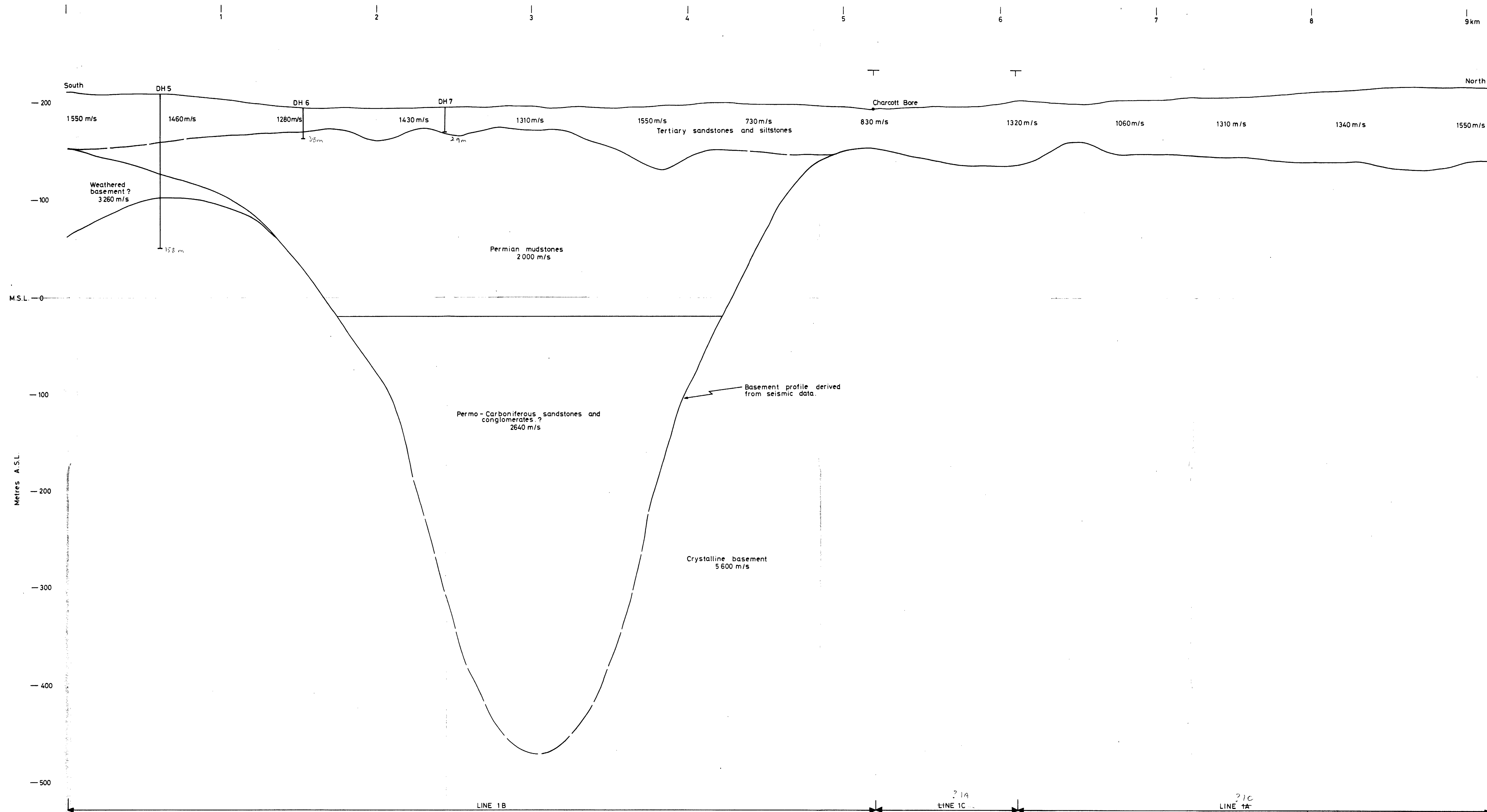
MAP 3

TARCOOLA AREA EL157

LOCATION OF SEISMIC AND GRAVITY PROFILES  
 AND DRILLHOLES

|                |              |                    |                  |
|----------------|--------------|--------------------|------------------|
| COMPILED: DE   | DATE: NOV 74 | TENEMENT: EL157    | MAP No: 3        |
| DRAWN: EA      | DATE: DEC 74 | PLAN No: S-1192-2r | REPORT No: FR 43 |
| LAST REVISION: |              | SCALE: 1:100 000   | PROJECT No: 21   |
| T.C. TO BONN:  |              | REF:               |                  |

**ENVU 2477(11)-15**



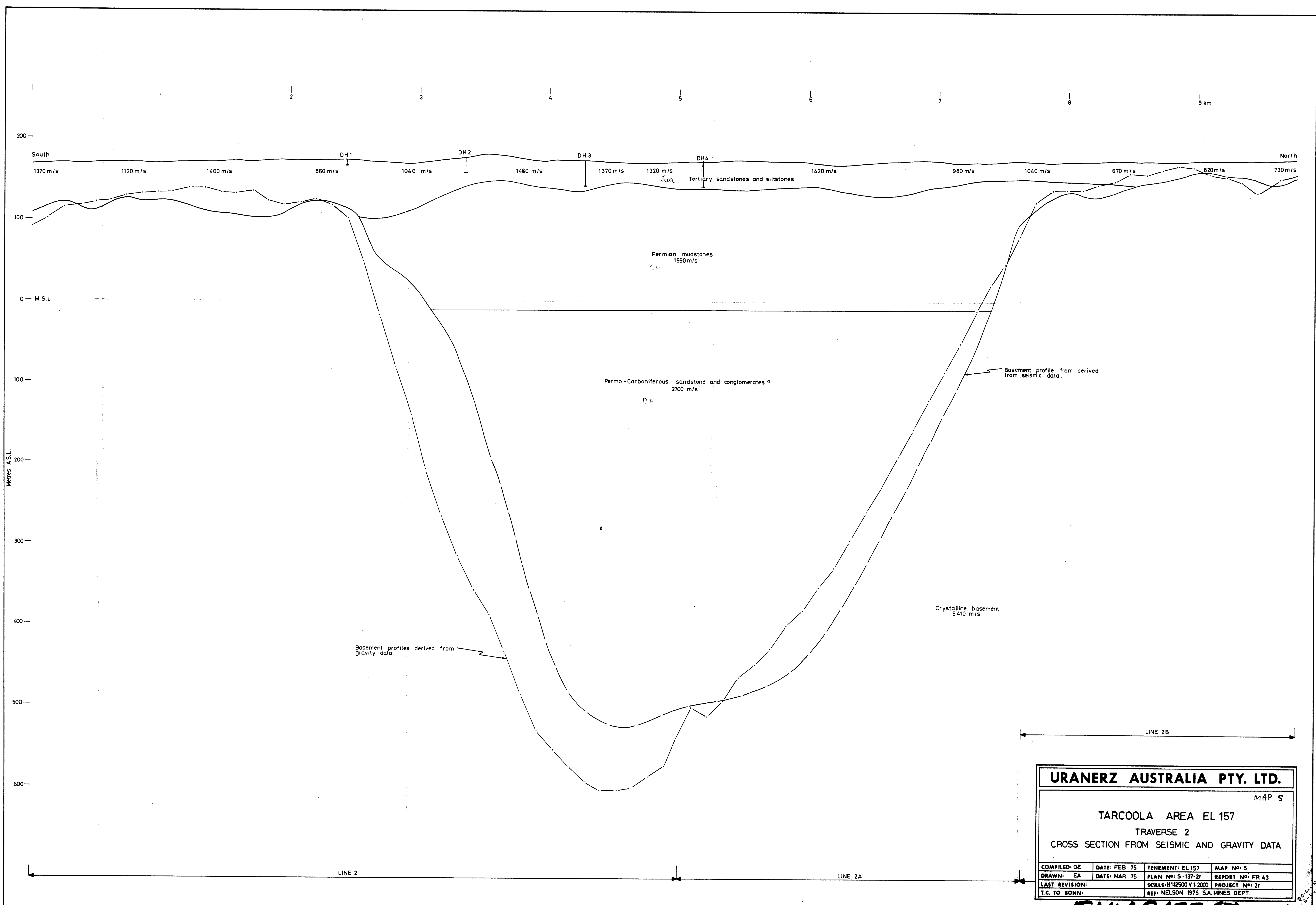
**URANERZ AUSTRALIA PTY. LTD.**

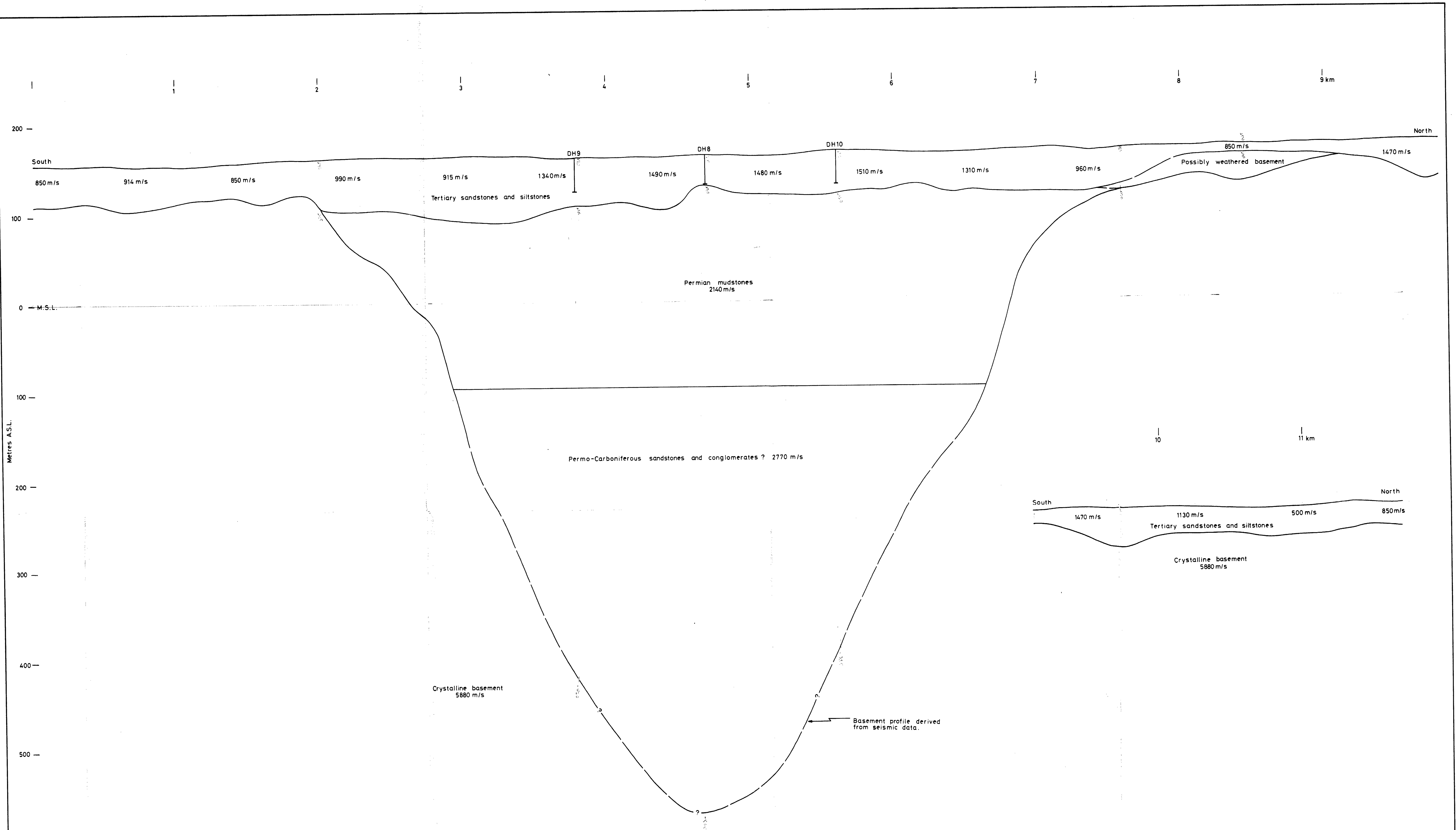
MAP 4

TARCOOLA AREA EL 157  
TRAVERSE 1  
CROSS SECTION FROM SEISMIC DATA

|                |                                   |                   |                  |
|----------------|-----------------------------------|-------------------|------------------|
| COMPILED: DE   | DATE: FEB 75                      | TENEMENT: EL 157  | MAP No: 4        |
| DRAWN: EA      | DATE: MAR 75                      | PLAN No: S-136-2r | REPORT No: FR 43 |
| LAST REVISION: | SCALE: H12500 V 1:2000            | PROJECT No: 2r    |                  |
| T.C. TO BONN:  | REF: NELSON 1975 S.A. MINES DEPT. |                   |                  |

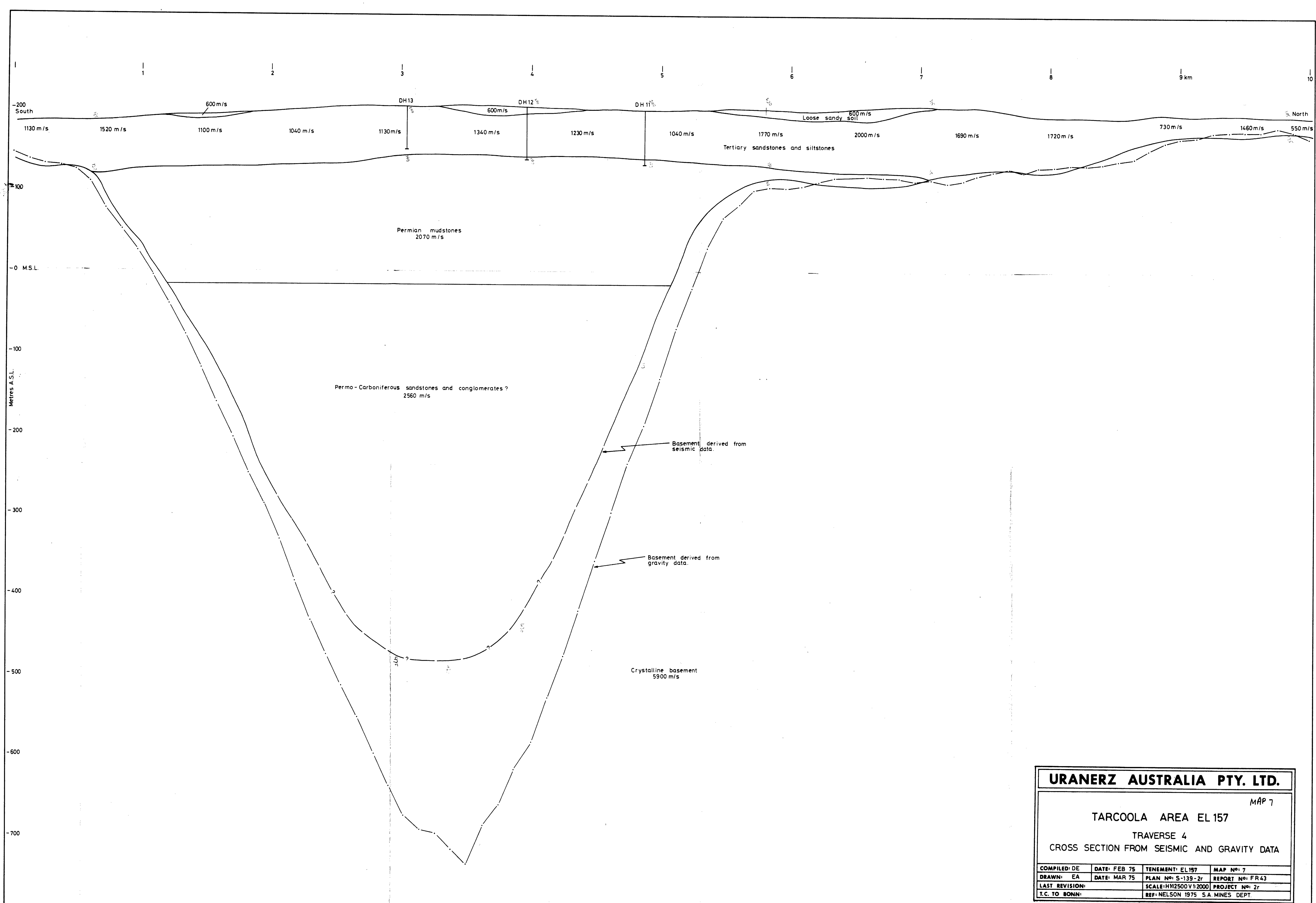
ENV 2477 (II) - 10





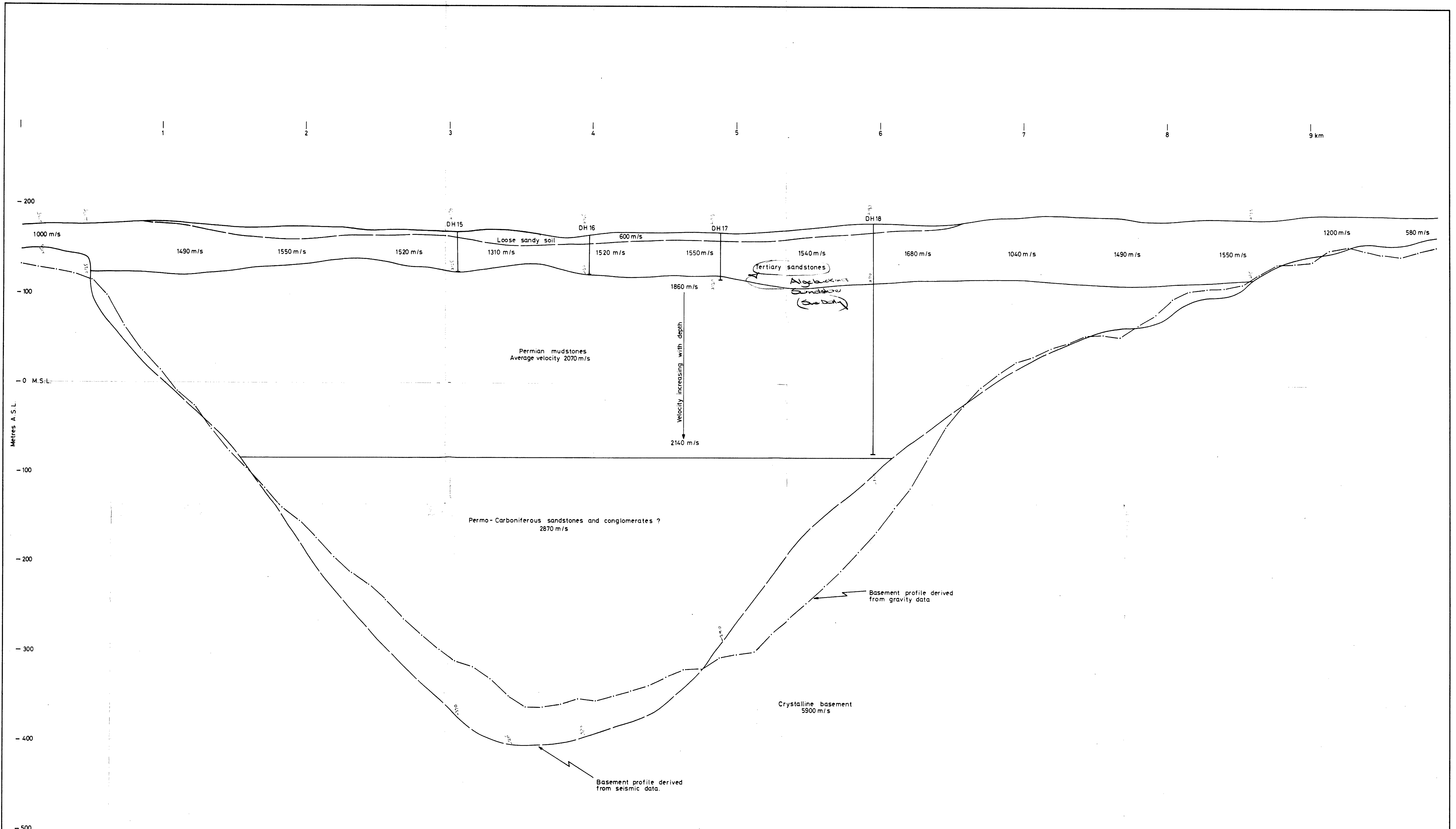
| URANERZ AUSTRALIA PTY. LTD.     |              |                                 |                  |
|---------------------------------|--------------|---------------------------------|------------------|
|                                 |              |                                 | MAP 6            |
| TARCOOLA AREA EL157             |              |                                 |                  |
| TRAVERSE 3                      |              |                                 |                  |
| CROSS SECTION FROM SEISMIC DATA |              |                                 |                  |
| COMPILED: DE                    | DATE: FEB 75 | TENEMENT: EL 157                | MAP No: 6        |
| DRAWN: EA                       | DATE: MAR 75 | PLAN No: S-138-2r               | REPORT No: FR 43 |
| LAST REVISION:                  |              | SCALE: H1:2500 V1:2000          | PROJECT No: 2r   |
| T.C. TO BONN:                   |              | REF: NELSON 1975 SA MINES DEPT. |                  |

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|                                             |                                   |                   |                  |
|---------------------------------------------|-----------------------------------|-------------------|------------------|
| <b>URANERZ AUSTRALIA PTY. LTD.</b>          |                                   |                   |                  |
| MAP 7                                       |                                   |                   |                  |
| TARCOOLA AREA EL 157                        |                                   |                   |                  |
| TRAVERSE 4                                  |                                   |                   |                  |
| CROSS SECTION FROM SEISMIC AND GRAVITY DATA |                                   |                   |                  |
| COMPILED: DE                                | DATE: FEB 75                      | TENEMENT: EL 157  | MAP No: 7        |
| DRAWN: EA                                   | DATE: MAR 75                      | PLAN No: S-139-2r | REPORT No: FR 43 |
| LAST REVISION:                              | SCALE: HH2500 V1:2000             |                   | PROJECT No: 2r   |
| T.C. TO BONN:                               | REF: NELSON 1975 S.A. MINES DEPT. |                   |                  |

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| URANERZ AUSTRALIA PTY. LTD.                 |              |                                   |                  |
|---------------------------------------------|--------------|-----------------------------------|------------------|
| TARCOOLA AREA EL 157                        |              |                                   | MAP 8            |
| TRAVERSE 5                                  |              |                                   |                  |
| CROSS SECTION FROM SEISMIC AND GRAVITY DATA |              |                                   |                  |
| COMPILED: DE                                | DATE: FEB 75 | TENEMENT: EL 157                  | MAP No: 8        |
| DRAWN: EA                                   | DATE: MAR 75 | PLAN No: S-140-2r                 | REPORT No: FR 43 |
| LAST REVISION:                              |              | SCALE: H:12500 V:12000            | PROJECT No: 2r   |
| T.C. TO BONN:                               |              | REF: NELSON 1975 S.A. MINES DEPT. |                  |

ENV 2477 (II) - 1A

6. P R O S P E C T I V E   T A R G E T S  
A N D   A R E A S

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Tertiary sediments overlying a Lower Permian Palaeochannel, the Mulgathing Trough, located by a previous explorer, were expected to be carbonaceous and to contain any accumulations of uranium derived from surrounding granitic rocks. The Permian Palaeochannel, whose depth was unsuspected prior to the seismic surveys, was considered likely to contain basal arkosic sediments which could also host uranium mineralization.

## 7. I N V E S T I G A T I O N S   A N D   R E S U L T S

### 7.1 O P E R A T I O N A L   D E T A I L S

A reconnaissance survey carried out in October 1974 was followed up with a more detailed programme of geophysical work and drilling in November and December 1974. All operations were based on Durkin camp on Mulgathing Station.

R. Dewhurst, Regional Geologist South Australia, supervised and co-ordinated the work done by the various contractors.

#### 7.1.1 C o n t r a c t o r s

Officers of the South Australian Department of Mines, Geophysical Branch, carried out refraction seismic and gravity surveys.

Thompson Drilling Company of Millicent carried out the drilling programme.

Geoscience Associates of Adelaide probed all holes providing gamma-single point resistivity and self potential (SP) logs.

The Australian Mineral Development Laboratories (AMDEL) carried out chemical assaying and petrological work.

#### 7.1.2 I n s t r u m e n t s / V e h i c l e

The project geologist used a SRAT SPP2 scintillometer for measurements of surface gamma radioactivity and for checking drillhole cuttings.

The South Australian Mines Department used a Texas Instrument Co. 7000B 24 channel recording seismograph interfaced with a Geospace R1801 electrostatic camera for the refraction seismic survey. For the gravity survey a La Coste and Romberg gravity meter was used. (See Appendix 1 - pages 2 - 4).

Thompson Drilling Co. used a Mayhew 1000 rig equipped for HQ wireline coring.

Geoscience Associates used for downhole logging a Geoscience - Ortec truck-mounted logging unit and, at the start of the programme, a Well Reconnaissance Suitcase logging unit.

The company vehicle used in this project was Toyota Landcruiser XGJ 259.

## 7.2 GROUND SURVEYS

Radiometric readings were taken with a SRAT scintillometer over soil and rock adjacent to tracks and roads and, in particular, along all geophysical traverses. No anomalous radioactivity was encountered.

## 7.3 REFRACTION SEISMIC SURVEYS

Surveys, as summarized in Table 1, were carried out over five lines crossing the palaeochannel position inferred from work done by a previous explorer and regional gravity maps (Map 1).

The twenty-four channel vehicle mounted recorder operated in the centre of 4,800ft. (1,463m) spreads with geophones spread at 200ft. (61m) intervals. Shots were fired at each end of the spread to allow corrections for dip to be made. The widespread occurrence of silcrete and calcrete at or near the surface precluded the use of a Gemco drill to prepare shot holes. As a result, charges of 1.6kg of gelignite were fired in pits of 0.6m to 1.0m depth.

Spreads were moved 2,400ft. (732m) after each pair of shots, maintaining a constant overlap of 2,400ft. (732m).

Sections were drawn in the field, based on spot depth estimates. The final interpretation of the data was carried out in Adelaide and was completed late in February 1975.

A total of 50.4 line km was covered (Table 1).

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The distribution of velocities within the various rock types is shown in Table 2. Results of the seismic work indicate an up to 450m deep channel with an average width of 5600m in high seismic velocity basement rock, believed to be granite (Maps 4-8). The channel is largely filled with medium seismic velocity sediments which are of Lower Permian age. A 2870 m/s refractor was recognized below the Permian mudstone during the final reduction and interpretation of the data. This possibly represents weathered basement or a lower member in the Permo-Carboniferous Series. The Tertiary sediments overlying the Permian have a thickness of 30 to 100m. Good resolution was obtained for the boundary between Tertiary and Permian.

# DETAILS OF SEISMIC AND GRAVITY TRAVERSES

Table 1

| <u>Line</u> | <u>Direction</u> | <u>Seismic<br/>(km)</u> | <u>Gravity<br/>(km)</u> |
|-------------|------------------|-------------------------|-------------------------|
| 1A          | E-W              | 2.8                     | -                       |
| 1B          | NE-SW            | 5.0                     | -                       |
| 1C          | N-S              | 1.3                     | -                       |
| 2A          | SW-NE            | 5.0                     | 5                       |
| 2B          | E-W              | 2.7                     | 2.7                     |
| 2C          | SW-NE            | 2.1                     | 2.1                     |
| 3           | N-S              | 11.6                    | -                       |
| 4           | SW-NE            | 10.1                    | 10.1                    |
| 5           | NW-SE            | 9.8                     | 9.8                     |

ROCK TYPES AND VELOCITIES ACCORDING TO  
INTERPRETATION OF SEISMIC DATA

| <u>Rock Type</u>                    | <u>Velocity(m/s)</u> | <u>Remarks</u>                                                            |
|-------------------------------------|----------------------|---------------------------------------------------------------------------|
| Sandy soil                          | 330-450              | up to 2m thick                                                            |
| Silcrete                            | 2000-2700            |                                                                           |
| Tertiary Sandstone<br>and Siltstone | 1000-1700            |                                                                           |
| Permian Mudstone                    | 2040                 | 2130 in deeper<br>sections                                                |
| Beneath Permian<br>mudstone         | 2870                 | Weathered basement<br>or lower member in<br>Permo Carboniferous<br>Series |
| Crystalline basement                | 5600                 |                                                                           |

Further details are given by Nelson (see Appendices 1 and 2).

7.4 GRAVITY SURVEYS

Gravity surveys were carried out over 5 traverses (Table 1), a total of 250 stations. The calculated Bouger gravity values plotted along the traverses confirm largely the results of the refraction seismic survey (Maps 4-8). For details see Appendices 1 and 2.

7.5 LEVELLING

Levels were carried from Bench Mark No. 4528, on Commonwealth Hill Station north-west of Tarcoola, to and along all lines on which seismic and gravity surveys were carried out. Also, the gravity value of this station was used as reference.

7.6 DRILLING

Eighteen open holes were drilled. Details of the holes are given in Table 3. Their location is marked on Map 3. A large water truck and Toyota Landcruiser were used as support

vehicles. The crew operated on a seven day week 12 hour shift basis, drilling a total of 1,307m in eight days and averaging 163m per day. The average output was diminished by long distances between lines and between drill locations and water supplies. Two coring runs delayed the completion of the final hole by 1½ days.

Drilling results tended to confirm the position of the basement Permian contact with considerable accuracy except on the shallow flanks of the basement depression. Estimates of thickness of the Tertiary sediments on the basis of seismic data tended to exceed the actual thicknesses though it should be emphasized that the predictions were based on a seismic programme planned to locate the basement depression at depths of 150m or more.

# DETAILS OF DRILLHOLES

Table 3

| <u>Hole#</u> | <u>Line#</u>                 | <u>Position<br/>on line</u> | <u>Drilled<br/>depth</u> | <u>Probed<br/>depth</u> | <u>Core</u> |
|--------------|------------------------------|-----------------------------|--------------------------|-------------------------|-------------|
| DDH1         | 2A                           | 2,438m                      | 44m                      | (41)m*                  |             |
| 2            | 2A                           | 3,353                       | 120                      | (119)                   |             |
| 3            | 2A                           | 4,267                       | 46                       | (46)                    |             |
| 4            | 200m north of Durkin Bore    |                             | 47                       | (46)                    |             |
| 5            | 1B                           | 610                         | 158                      | (157)                   |             |
| 6            | 1B                           | 1,524                       | 38                       | (37)                    |             |
| 7            | 1B                           | 2,438                       | 29                       | (25)                    |             |
| 8            | 3                            | 7,010                       | 38                       | (37)                    |             |
| 9            | 3                            | 7,925                       | 43                       | (41)                    |             |
| 10           | 3                            | 6,096                       | 43                       | (42)                    |             |
| 11           | 4                            | 4,877                       | 75                       | (73)                    |             |
| 12           | 4                            | 3,962                       | 75                       | 60m(73)                 |             |
| 13           | 4                            | 3,048                       | 61                       | 60                      |             |
| 14           | Adjacent to Snake Rocks Bore |                             | 50                       | 49 (49)                 |             |
| 15           | 5                            | 3,048m                      | 61                       | 60 (59)                 |             |
| 16           | 5                            | 3,962                       | 52                       | 50                      |             |
| 17           | 5                            | 4,877                       | 66                       | 64                      |             |
| 18           | 5                            | 5,944                       | 261                      | 261                     | 3.35m       |

\* Probe depths in parenthesis indicate use of suitcase logging unit.

### 7.7 PROBING

Gamma, resistivity (R) and self potential (SP) logging was carried out by Geoscience Associates of Adelaide. At the start of the programme a portable suitcase logging unit was used in the absence of a new vehicle mounted logging unit which was being prepared for the contract. Towards the end of the programme the new unit was used. Eleven holes were probed with the suitcase unit, three holes with both units and four holes with the vehicle mounted unit.

Gamma logs were obtained in each drillhole. The maximum radioactivity, in weathered granite in Hole 14, was 40cps (vehicle mounted unit) estimated to be equivalent to 28ppm  $eU_{308}$  in the absence of thorium. In general, radioactivity varied from 4 to 20cps which can be regarded as low background activity.

No significant gamma peaks were noted at the interface between Tertiary and Carbonaceous Permian sediments. Such peaks would be expected if significant amounts of uranium were contained in the groundwater.

Resistivity and self-potential logs proved generally unsuccessful in this environment with the exception of Holes 12 and 13. The writer believes that the generally saline groundwater, estimated to contain about 1% salt, reduced the formation resistivity to uniform levels of about 5 ohm-metres. The self-potential logs were also affected by the salinity but the use of drilling water drawn from the formations being logged probably contributed to the lack of definition to a greater extent. Copies of the geophysical logs are included in Appendix 3.

### 7.8 LOGGING

Samples were recovered at 5ft. (1.52m) intervals and lithologically logged on site. Special attention was paid to

lithology, particle size, colour, oxidation and presence of carbon, pyrite and feldspar (see lithological logs Appendix 4).

Middle Tertiary silcrete and calcrete of varying thickness occur at or near the surface throughout the area. These are frequently overlain by red-brown wind-blown sands and silts. The calcrete or calcareous sand normally underlies the silcrete and grades downward into silts, sands and kaolinitic clays largely of granitic origin and immediate provenance.

Towards the edges of the basement depression the Tertiary sequence tends to become clayey. Coarse granules and fine gravels, considered to be Jurassic Algebuckina Formation derived from locally outcropping kaolinized granites, are present in restricted zones in the Post Permian sequence. These may represent infill deposits in channels cut in a predominantly fine grained Tertiary sequence. However, lack of evidence renders this somewhat speculative.

At the base of the Tertiary sequence pink or yellow-grey clays occasionally underlie white quartz granite and kaolin deposits, sometimes showing a gradational colour change into typical dark grey to black, occasionally fissile, Permian mudstone and shale. Lower Permian age for these sediments had already been established, by a palynologist of the South Australia Mines Department, working on material provided by Nissho-Iwai. This was confirmed by palynological investigations carried out on core from Hole 18 (see Appendix 5). The shale extends to a depth of about 450m in the centre of the depression but it is believed that an increase in grain size is likely to occur and that coarse grained and possibly arkosic sediments may occur at the bottom of the depression. Staff of the South Australian Mines Department have postulated the presence of Lower Permian glacial deposits. The 2900 m/s refractor could possibly be correlated with such a horizon.

Permian coal deposits are known to occur in the Phillipson Trough some distance to the north. However, they are believed to be Upper Permian in age and younger than the sediments occurring in the Mulgathing Trough.

Pink orthoclase granite outcrops at Mulgathing Rocks and at Snake Rocks south-east of Mulgathing Homestead. At Snake Rocks it is associated with a white kaolinized, possibly originally leucocratic, granite. This granite also outcrops south-west of Charcott Bore near the south-west end of seismic line 1B. It is this kaolinized granite that is believed to have contributed the kaolin and sub-angular coarse grained to fine gravel-sized quartz appearing in the Tertiary sequence.

The evidence of sand and clay banding in the electric logs of Holes 12 and 13 suggests that the clay and sand fractions were distinct before transport and therefore that kaolinization of arkosic sediments in situ is less probable than the erosion and transport of kaolinized granite.

That the pink orthoclase granite and the kaolinized granite are distinct lithological units is indicated by the contact located in Hole 14 and their surface appearance at Snake Rocks.

The presence of banded ironstone formations to the north, and weathered schistose rocks to the south, has been referred to above.

#### 7.9 SAMPLING/LABORATORY WORK

Sixteen (16) selected dust samples were collected from those holes drilled with air, entirely or in part. The samples were analyzed for uranium by AMDEL using the fluorimetric method and the results are listed in Table 4.

It should be noted that all uranium values are extremely low, being well below those that might be expected in an environment hosting sedimentary uranium deposits.

The results of petrographical examinations of 4 selected dust samples are given in Appendix 6.

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ASSAY RESULTS OF DRILLHOLE SAMPLES

Table 4

| <u>Hole No.</u> | <u>Depth<br/>(ft.)</u> | <u>U<sub>3</sub>O<sub>8</sub><br/>(ppm)</u> |
|-----------------|------------------------|---------------------------------------------|
| 1               | 10 - 15                | 1.2                                         |
|                 | 25 - 30                | 1.4                                         |
|                 | 40 - 45                | 1.1                                         |
|                 | 55 - 60                | 0.8                                         |
|                 | 95 - 100               | 1.3                                         |
|                 | 100 - 105              | 1.4                                         |
|                 | 115 - 120              | 1.1                                         |
|                 | 140 - 145              | 1.8                                         |
| 2               | 70 - 75                | 3.2                                         |
|                 | 100 - 105              | 3.6                                         |
|                 | 285 - 290              | 2.9                                         |
| 3               | 40 - 45                | 1.2                                         |
|                 | 60 - 65                | 1.4                                         |
|                 | 90 - 95                | 3.2                                         |
| 7               | 35 - 40                | 1.4                                         |
|                 | 65 - 70                | 2.0                                         |

The results of palynological examinations of core samples from Hole No. 18 are included as Appendix 5. It should be noted that the Lower Permian sediments referred to are younger than the Permian glacial deposits occurring in South Australia and that these may well be included in the basal sediments of the Mulgathing Trough which may be of glacial origin.

8. S U M M A R Y   O F   R E S U L T S  
A N D   D I S C U S S I O N

The results of the programme have been disappointing. No radiometric anomalies, either on the surface or at depth, have been discovered. The methods applied during the investigations were found efficient and adequate, though a more detailed field interpretation of seismic data would have enabled a better siting of drillholes.

9. A S S E S S M E N T

The surface background gamma activity in the area is low and does not increase significantly over the orthoclase granites in and around the EL. Gamma anomalism is absent in the holes drilled both by this company and by previous explorers. The sediment characteristics are considered unfavourable, particularly the absence of arkoses, lack of pyrite and biogenic carbon. The thicknesses of post-Permian sediment indicate, to the writer, little erosion of suitable source rocks at a rate which would allow the retention of uranium within the area of deposition. Long periods of sub-aerial erosion compiled with the corrosive effects of saline groundwater have tended to weather rock forming minerals to kaolinitic clays and residual quartz, further diminishing the chances of retention of uranium within the environment.

10. R E C O M M E N D A T I O N S

No further work is recommended and it is suggested Exploration Licence 157 be relinquished.

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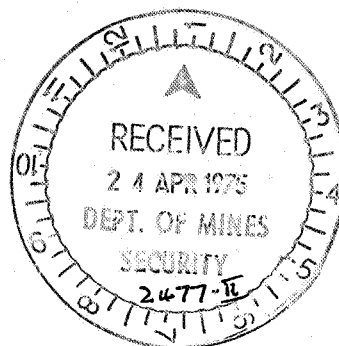
B I B L I O G R A P H Y

Geidans, L.        1972 : Radiometric, Airborne and Ground  
Reconnaissance Survey in Central  
Australia.  
UAL Report No. 3.

L I S T   O F   A P P E N D I C E S

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- Appendix    1.            Progress Report on Geophysical Survey  
                                 in EL 157, Mulgathing Area.  
                                 R.G. Nelson 1975.    Rept. Bk. No. 75/5.
2.                        Report on Geophysical Survey in EL 157,  
                                 Mulgathing Area.    R.G. Nelson 1975.  
                                 Text of Report not yet to hand - seismic  
                                 and gravity sections are included as  
                                 Maps 4, 5, 6, 7 and 8.
3.                        Geophysical Logs - Drillholes 1 - 18.  
                                 Geoscience.
4.                        Lithological Logs - Drillholes 1 - 18.
5.                        Letter from S.A. Department of Mines  
                                 dated 10-1-75 - Palynology of Core  
                                 Samples, Bore 18, EL 157.
6.                        Petrographical Report MP2550/75, AMDEL.

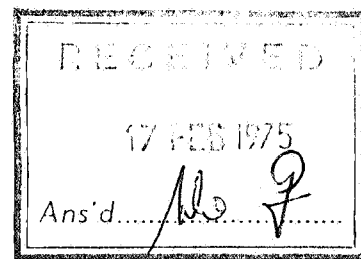


APPENDIX 1

Progress Report on Geophysical Survey  
in EL 157, Mulgathing Area.

R.G. Nelson 1975. Rept. Bk. No. 75/5.

REPT.BK.NO. 75/5



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PROGRESS REPORT ON GEOPHYSICAL SURVEY  
IN E.L. 157, MULGATHING AREA.

R.G. NELSON

Department of Mines  
South Australia —