CONTENTS ENVELOPE 998 DOCKETS 1123/65

TENEMENT: S.M.L. 220

TENEMENT HOLDER: Carpentaria Exploration Co. Pty. Ltd

REPORTS:

SMITH, W,D, 1969 Report for six months ended 22/1/69 for S.M.L. 220 - Mt. Crocker. (pg. 3-4)

Plans:

Ground scintillometry S.M.L. 220 showing counts per second at each station at threshold energy level of 0.3million electron volts, (998-5)

Ground scintillometry S.M.L. 220 showing counts per second at each station at threshold energy level of 5.0 million electron volts. (998-6)

Ground scintillometry S.M.L. 220 showing counts per second at each station at threshold energy level of 7.65 million electron volts. (998-4)

REPORT:

SEVERNE, B.C., 1969
Technical report No.166- S.M.L. 220 final report. (pgs. 5-24)

Plans)

Figure 1 Locality map of S.M.L. 220 (998-3)

Figure 2 Mount Crocker S.M.L. 220- geology and results of the reconniaissance spectrometry. (998-2)

Figure 3 Mt. Crocker S.M.L. 220 - Ground spectrometer survey -detailed work with anomaly G. (998-1)

ENV 998

CARPENTARIA EXPLORATION COMPANY PTY. LTD.

WDS:SF

567 South Road,
EVERARD PARK. S.A. 5035.

21st February, 1969.

The Director of Mines,
Department of Mines,
Box 38, Rundle Street P.O.,
ADELAIDE. S.A. 5001.

Dear Sir,

Report for 6 Months ended 22.1.69
for S.M.L.220 - Mount Crocker

Work completed to date in relation to S.M.L.220 is outlined below.

1. Aerial reconnaissance for familiarisation purposes, and for reconnaissance measurements with our Mount Sopris scintillometer. The scintillometer became unserviceable before reaching S.M.L.220, so no information of this sort was obtained.

2. Preparation of a photo-map by Queensland Aerial Survey Company Pty. Ltd. This was intended to serve as a guide for flight lines for a proposed aerial scintillometer survey. However, owing to the size of the lease and the nature of the terrain, it was considered better to test the lease in general and the target area in particular by ground scintillometry.

A copy of the photo-map is supplied with this report.

3. Preparation of a base map by enlargement of the appropriate part of the Umberatana Sheet.

4. Ground scintillometry using a Scintrex G1S-2 spectrometer. Three plans showing measurements made to date are supplied with this report.

These plans show the counts per second recorded at stations shown as circles, using an extended time constant of 60 seconds. The lines linking stations were measured continuously during foot traversing, using the short time constant of 2 seconds. The plans show the counts per second recorded at each station using the three discriminatory energy levels (thresholds) of 0.3, 5.0 and 7.65 million electron volts.

Insufficient measurements have been made so far to permit sound interpretation of anomalous areas. This will be delayed until further measurements are made, especially along the target structure.

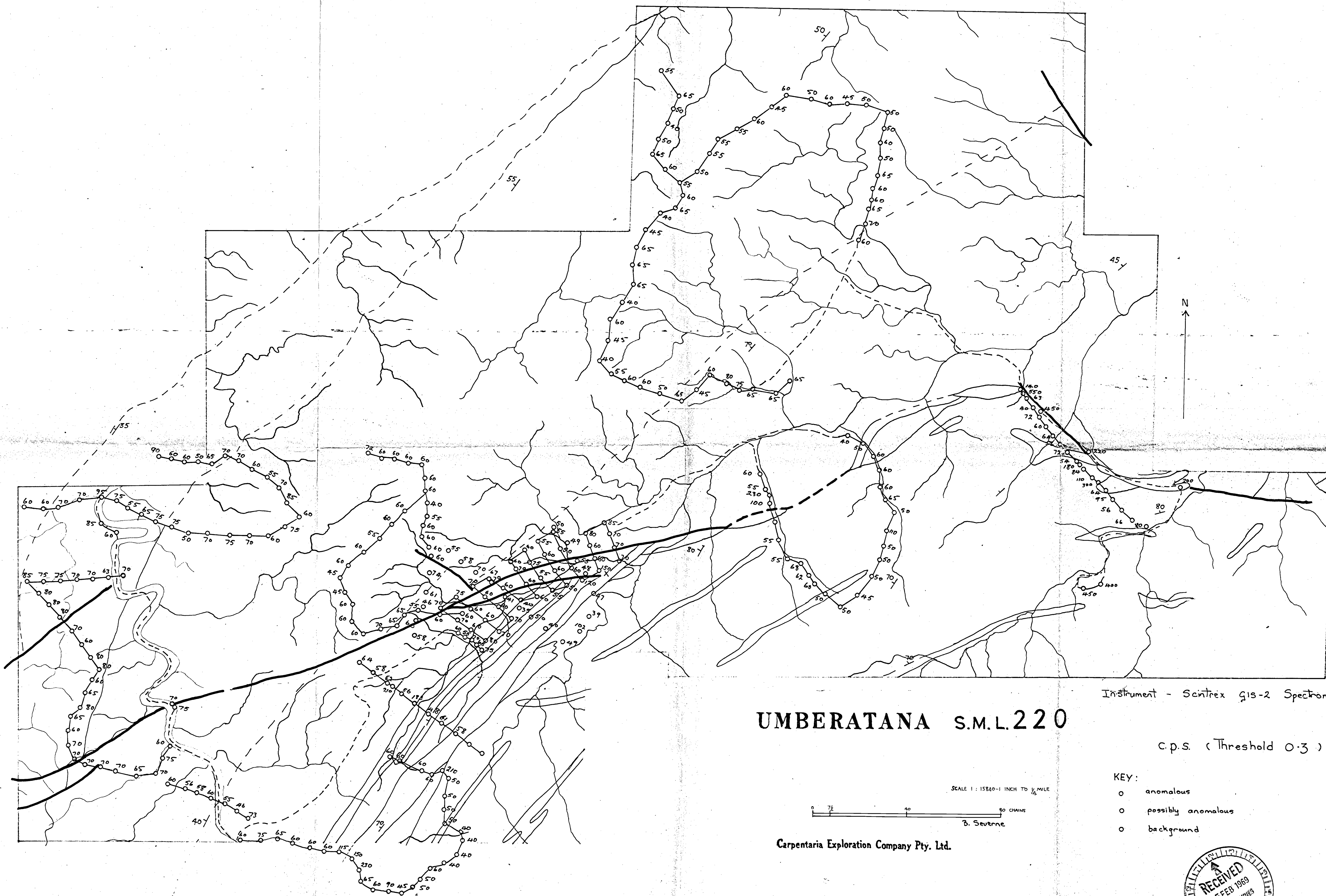
A financial statement is appended.

Yours faithfully,

Walter D. Smith

WALTER D. SMITH

Party Leader (S.A.)



Instrument - Scintrex GIS-2 Spectrometer.

UMBERATANA S.M.L. 220

C.P.S. (Threshold 0·3)

KEY:

o anomalous

o possibly anomalous

o background

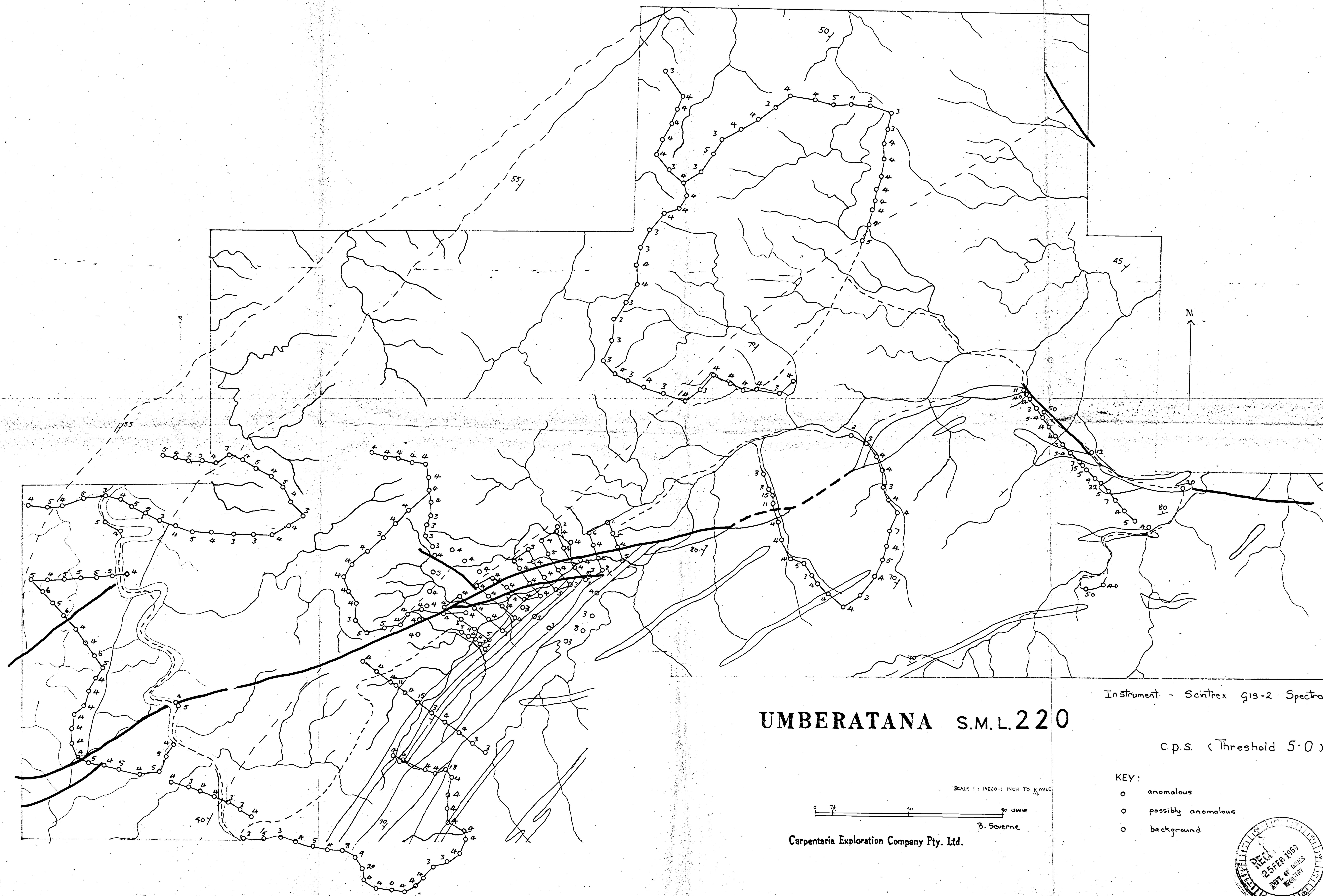
SCALE 1 : 15840 - 1 INCH TO 1/4 MILE

0 7½ 40 80 CHAINS

B. Severne

Carpentaria Exploration Company Pty. Ltd.

ENV 998-5



UMBERATANA S.M.L. 220

Instrument - Scintrex GIS-2 Spectrometer.

C.P.S. (Threshold 5·0)

KEY:

o anomalous

o possibly anomalous

o background

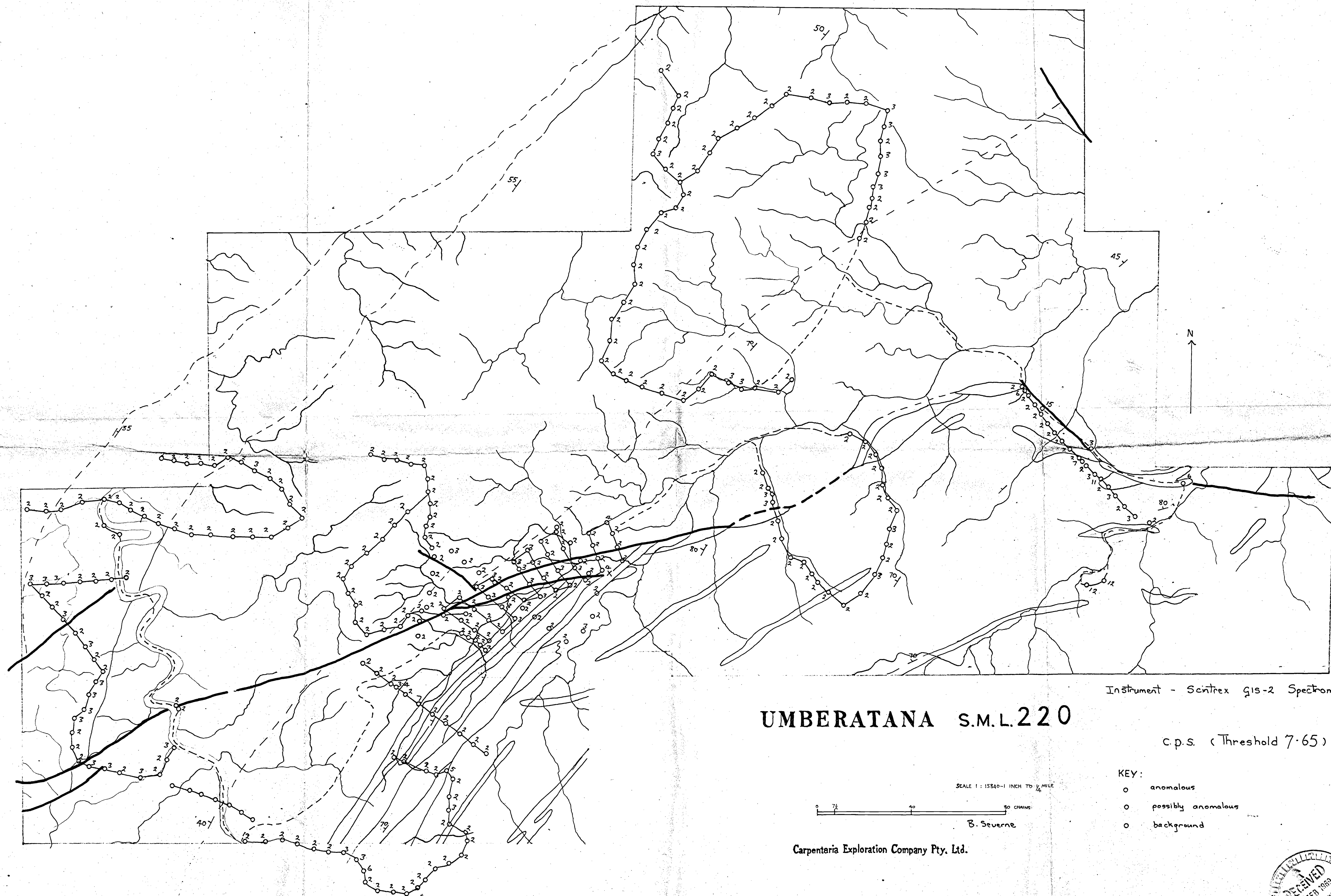
SCALE 1 : 15840 - 1 INCH TO 1/4 MILE

0 7½ 40 80 CHAINS

B. Severne

Carpentaria Exploration Company Pty. Ltd.

ENV 998-6



UMBERATANA S.M.L. 220

Carpentaria Exploration Company Pty. Ltd.

ENV 998-4

ENV 998

005

C.E.C.81

CARPENTARIA EXPLORATION COMPANY PTY. LTD.

TECHNICAL REPORT No. 166

Title S.M.L. 220 FINAL REPORT

Author B.C. SEVERNE

Investigations Conducted By B.C. SEVERNE B.C. Severne

Submitted By W.D. SMITH

Date September, 1969

DISTRIBUTION

1. Carpentaria Exploration Company Pty. Ltd. - Brisbane

2. Carpentaria Exploration Company Pty. Ltd. - Adelaide

3. Department of Mines - South Australia

4. ASARCO

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7. Spare

CONTENTS

SUMMARY

Cbject

To evaluate Special Mining Lease 220 with respect to uranium mineralisation.

Precis

S.M.L. 220 was selected for the following reasons:

(i) several occurrences of uranium mineralisation had been reported in the area.

(ii) the Bureau of Mineral Resources had recorded an airborne anomaly over part of the area.

(iii) the synchronous Shanahan Fault offered promise as a large structure predating uranium mineralisation.

The lease was investigated by ground spectrometry, rather than airborne as originally planned, because of its small size and rugged nature.

The spectrometer gave misleading information, both qualitatively and quantitatively, and was useful only in a comparative manner.

Conclusion

No instances of economic or sub-economic grades were located. It seems very unlikely that uranium ore exists on this lease.

Recommendation

Relinquish S.M.L. 220.

1. INTRODUCTION

1.1 POSITION AND TENURE

The position of the lease is plotted on the current Mines Department one mile geological sheet of the area (Figure 1). Access to the lease is by a rough track from Umberatana H.S. via Daly Bore and Tindelpina Hut to Green Hill Hut.

S.M.L. 220 was granted for 12 months commencing 22nd July, 1968, and was subsequently extended for a short period. This report covers the investigation and conclusions.

1.2 GEOLOGY OF THE LEASE AREA

The lease is divisible into two main zones geologically. The older and south-eastern zone is part of the Mount Painter Complex of Carpentarian age. The younger and north-western zone comprises an Adelaidean sedimentary sequence dipping and younging towards the north-west at about 60°. There is only a slight angular unconformity between the two systems in the lease area.

Granites intrude the Mount Painter Complex, which is bordered by an extensive metamorphic aureole. This is suggested by Coats (1966) to reflect granitic influences at depth. The entire area was affected by a Lower Palaeozoic Orogeny.

1.3 SUMMARY OF RELEVANT PREVIOUS WORK

Hughes (1957) records three occurrences of uranium mineralisation but all appear to be very small.

Coats (1964) has recognized the existence of two temporally distinct granites in the area, and Blissett (1964) attributes uranium mineralisation to the younger (Lower Palaeozoic) of these two.

Young and Gerdes (1966), during a B.M.R. airborne radiometric survey of the area, recognized several restricted anomalies, one of which falls partly within S.M.L. 220.

1.4 INSTRUMENTATION

The instrument used was a Scintrex G1S-2 spectrometer. This is essentially a scintillometer with provision for discrimination of gamma radiation according to energy level. The crystal has a volume of 6.3 cubic inches, and the discrimination is claimed to permit some conclusions concerning the source of the radiation, i.e. K, U, or Th.

According to the makers, discrimination of gamma rays according to energy level is achieved by recording measurements at three thresholds selected within a continuous range. These thresholds are chosen in relation to characteristic peaks of the radio-elements, and also in relation to the higher energy representatives of thorium and uranium gamma radiation.

The instrument settings, relevant thresholds in Mev., and radiation measured are shown in the table below: (Note - 1 Mev = 1 million electron volts)

Instrument Setting	Threshold in Mev.	Radiation measured
0	0.3	K, U and Th radiation between 0.3 and 3.0 Mev. including the K peak at 1.46 Mev.
5.0	1.65	U and Th radiation between 1.65 and 3.0 Mev. including the U peak at 1.76 Mev.
7.65	2.5	Th radiation between 2.5 and 3.0 Mev., including the Th peak at 2.62 Mev.

By means of equations given by the makers, grades of U and Th may be calculated, though it is warned that factors used in the equations may vary from one environment to another. The equations recommended are:

$$(1)\quad U\ ppm = \left[\frac{(\text{c.p.s. at 1.65 Mev.} - \text{background at 1.65 Mev.}) - 2.7\,(\text{c.p.s. at 2.5 Mev.} - \text{background at 2.5 Mev.})}{830}\right] .10^{4}$$

(2) $\text{Th ppm} = \left[\frac{\text{(c.p.s. at 2.5 Mev. - background at 2.5 Mev.)}}{250}\right] 10^4$

Background values used in this province were 3 and 1 at the 1.65 and 2.5 Mev. levels respectively.

(Note c.p.s. = counts per second)

2. RECONNAISSANCE GROUND WORK

Orientation work involved traversing the lease to obtain average values for gamma-ray activity over the different rock units. The raw data is shown in Figure 2 and averages for particular rock types are shown in the chart in Figure 2. Spectrometer readings were taken at 500 foot intervals with the probe placed on the ground. Readings were taken at the three energy levels with either an 8 or 60 second time-constant. Between spectrometer stations the instrument was operated continuously, hand-held, on 0.3 Mev. and a 2 second time-constant, in order that the meter could respond rapidly to any radiation above background level.

Background was determined in areas of deep overburden and values are reported in the chart on Figure 2.

Considerable ground traversing was performed besides the orientation work shown but this was not recorded except where anomalous values were indicated.

Reconnaissance work disclosed several very small radiometric anomalies located either on or near the Shanahan Fault and the B.M.R. anomaly, which was considerably larger than any of the other anomalies within the lease. The small anomalies called A to F are shown along the Shanahan Fault, and the large anomaly G is shown near the south-eastern corner of the lease, in Figure 2.

3. DETAILED GROUND WORK

As the main target was the synchronous Shanahan Fault structure, a zig-zag traverse was completed over 6½ miles of its length. This enabled detailed assessment of anomalies A to F. About 20 spectrometer readings were recorded over each of the anomalies using the 60 second time-constant.

Only one anomaly (B) showed any visible sign of uranium mineralisation (splashes of torbernite).

The average spectrometer readings for the anomalies (A to F) are given in Table I together with calculated and assay grades.

Because of its size, work was progressively focused on anomaly G which is confined to an apophysis of the Mundawatana Granite. Xenoliths of the Freeling Heights Quartzite occur within it.

Spectrometer traverses to delineate this anomaly were generally confined to the ridge tops because of the rugged terrain. A large grid (approximately 1600 feet by 1300 feet) was laid out over a ridge in the central part of anomaly G with a small grid (200 feet square) to the west. (See Figure 2 for grid positions.) The grids were laid out for the purpose of detailed spectrometry and rock-chip sampling. The spectrometer readings are shown in Figure 3 together with positions of the rock-chip samples.

Certain areas (Figure 3) were subjected to closer sampling and spectrometry to provide greater confidence in the grades determined by spectrometric calculations and by assay.

The spectrometer readings at 1.65 Mev. have been divided into groups and contoured to illustrate the variation of data (viz. U, Th jointly). See Figure 3.

There was no significant increase in gamma-ray activity towards the margins of this or any of the other anomalies. The southern margin of anomaly G is beyond our lease boundary as shown in Figure 2.

All of the U, Th values reported here are expressed as ppm, because no economic or sub-economic grades were encountered. To convert U ppm and Th ppm to U_3O_8 ppm and ThO_2 ppm respectively the conversion factor is approximately 1.2 Economic grades are usually expressed as lb./ton U_3O_8 where 375 ppm U is equivalent to 1 lb./ton U_3O_8.

4. SAMPLING

Thirty eight bulk samples were collected for laboratory radiometric assay by the Australian Mineral Development Laboratories, Adelaide. The sampling method was to collect about four rock chips from each spectrometer station and combine them into bulk samples weighing about 7-8 lbs.

4.1 SAMPLING OF SMALL ANOMALIES

Five samples were taken from the small anomalies (B to F) and one from a black micaceous rock between C and D. (See Table I.) The average U, Th values, calculated from the spectrometer readings using equations (1) and (2), of these anomalies are 710 ppm U, 520 ppm Th. The corresponding assay results are 90 ppm U and 320 ppm Th. (Note the change in proportions of U and Th.)

The rest of the thirty eight samples were all collected from anomaly G.

4.2 LINE SAMPLING ON ANOMALY G.

Nine fresh rock-chip samples were collected from grid-lines L.171 to L.179 and in most cases fresh rock chips were readily obtained using a sledge hammer. The average calculated U, Th grades over the grid-lines, using equations (1) and (2), are 460 ppm U and 270 ppm Th. (See Table II.) The corresponding assay results are 40 ppm U and 250 ppm Th. (Note the change in proportions of U and Th)

4.3 200 FOOT SQUARE SAMPLING ON ANOMALY G

Six fresh rock-chip samples were collected from the 200 foot squares (shown in Figure 3) positioned within the grids.

Results from the five contiguous 200 foot square samples (see Table III) indicate average calculated grades of 680 ppm U, 300 ppm Th and average assay values of 30 ppm U, 350 ppm Th. (Note the change in proportions of U and Th.)

The other 200 foot square sample (S.185) taken from the small grid (Figure 2) has a lower average calculated Th grade (160 ppm Th) than the above samples, but the average assay value for Th (300 ppm Th) and the U grades are comparable with them.

In each of the three cases mentioned above spectrometric calculations indicated an anomaly due principally to uranium whereas assay values showed that the principal source was not uranium but thorium. Moreover the absolute amounts of U indicated by the two methods were markedly different.

4.4 RADIOMETRIC VERSUS FLUORIMETRIC ASSAY CHECK

Due to the large discrepancies between calculated grades and assay results for U,the radiometric assay method was checked with a fluorimetric method (both by AMDEL). This check (Table IV) shows very good agreement between the two assay methods.

4.5 FRESH ROCK VERSUS WEATHERED ROCK COMPARISON

To test whether uranium may have been leached out of the surface exposures weathered rock-chip samples were collected in exactly the same way as the fresh samples from grid-lines L.171 to L.179 (Figure 3). The assays of these pairs of samples are compared in Table V. As there is no significant difference in the U and Th assay results between the weathered and fresh samples it is concluded that weathering has not altered U, Th contents. This conclusion is supported by the fact that U and Th are in radiochemical equilibrium with their daughter products in all samples.

4.6 COMPARISON OF RIDGE AND VALLEY SAMPLES

In this area of the lease the ridges coincide with a former peneplain. Three line samples were taken over the same ridge on which the large grid was laid out (Figure 3); the central line running along the crest of the ridge with two flanking valley lines about 150 feet below. The data (Table VI) suggests that there is no significant difference in U, Th contents between the topographically high and low samples.

4.7 HIGH SPOT SAMPLING

Figure 3 illustrates how small radiometric "high spots" could have been swamped by the bulk sampling technique. To provide an indication of the highest values occurring locally, samples[1] QS43 to QS47 were collected from five of the high spots. Assay results as shown in Table VII confirm that the best values (100 ppm U, 400 ppm Th) likely to be encountered in this or any of the other anomalies within this lease are well below interesting levels.

Footnote 1. Sample QS 46 was taken from the ridge east of the large grid (Figure 2).

5. DISCUSSION OF RESULTS

Both qualitative and quantitative conclusions drawn from measurements with the GlS-2 spectrometer depend upon formulae involving factors. All calculated U, Th grades given above were based on the formulae and factors given in the maker's instruction manual, and (in this report) as formulae (1) and (2) above. Dependent upon the assumptions implicit in these formulae, three main conclusions may be drawn from the present work.

(1) Indicated thorium grades are approximately correct.

(2) Indicated uranium grades are erroneous by a factor of about 10 - 20.

(3) Due to conclusion (2) above, the relative significance of U and Th contributions to the anomaly are wrongly indicated.

Thus in this case, the spectrometer has failed to discriminate between anomalies due principally to uranium and those due principally to thorium, and has given very poor quantitative estimates of uranium values.

The assay data (presented in Tables I to VII) are considered to be correct and any data based on spectrometric calculations which differ from the above are incorrect. According to the assay data, no attractive areas were isolated.

Conclusions drawn from within S.M.L. 220 accord with the generalisation by Everhart (1968) as follows:
"The most radioactive known granite bodies contain less than 150 ppm U_3O_8 and to date have nowhere been a productive source of ore."

Considering the above information it is concluded that the existence of a uranium orebody on S.M.L. 220 is unlikely.

REFERENCES

Blissett, A.H. 1964. The geology and mineralisation of the Daly-Yudnamutana copper field. Dept. of Mines, S. Aust., Rept. Bk. No. 59/140.

Coats, R.P. 1966. Notes on the Copley 1.250,000 sheet area. Dept. of Mines, S. Aust., Rep. Bk. No. 62/78

Everhart, D.L. 1968. Geology of Uranium Deposits.

Hughes, F.E. 1957. Mount Shanahan Uranium Prospect. Min. Rev., Adelaide 102, pp. 113-117

Young, G.A. and Gerdes, R. 1966. Central South Australia Airborne Magnetic and Radiometric Survey. B.M.R. Record 1966/224.

TABLE I

Showing the spectrometry results and laboratory assays of the small radiometric anomalies plotted in Figure 2.

Anomaly	Average[1] counts per second Mev. 0.3, 1.65, 2.5	Sample Number	Uranium		Thorium	
			Calculation U ppm	Assay U ppm	Calculation Th ppm	Assay Th ppm
A	150, 9, 3	-	20	-	80	-
B	290, 40, 5	QS.42	310	200	160	120
C	440, 130, 23	179	910	70	880	350
C_1	460, 140, 13	QS.40	1240	100	480	350
D	450, 120, 24	QS.41	660	100	920	450
E	420, 75, 8	180	630	< 30	280	350
F	430, 80, 11	181	600	50	400	300
Average[3]	415, 99, 14	-	710	90	520	320

Footnotes:

1. These are the arithmetic means of about 20 spectrometer readings.
2. C_1 is an outcrop (3 foot square) of black micaceous rock between anomalies C and D.
3. These averages exclude anomaly A.

TABLE II.

Showing comparison of spectrometric calculations with radiometric assays of fresh rock-chips (Line Samples).

Uranium		Sample Number	Thorium	
Calculation ppm	Assay ppm		Calculation ppm	Assay ppm
370	<30	S171	240	200
320	<30	S172	320	260
490	30	S173	320	260
300	<30	S174	320	260
590	60	S175	200	260
490	40	S176	200	240
550	30	S177	280	260
400	30	S178	240	260
670	90	S179	280	180
460	40	Average[1]	270	250

Footnote:

1. Weighted in accordance with length of sample line as showh in Fig. 3.

TABLE III.

Showing comparison of spectrometric calculations with radiometric assays of fresh rock-chips. (200 foot square Samples)

Uranium		Sample Number	Thorium	
Calculation U ppm	Assay U ppm		Calculation Th ppm	Assay Th ppm
630	<30	S.182	360	400
700	30	S.183	280	300
720	50	S.184	240	350
650	<30	S.186	240	350
720	<30	S.187	360	350
680	30	Average[1]	300	350

Uranium		Sample Number	Thorium	
Calculation U ppm	Assay U ppm		Calculation Th ppm	Assay Th ppm
600	<30	S.185	160	300

Footnote:

1. Samples given equal weight.

TABLE IV

Showing comparative assay[2] results of fresh samples by radiometric and fluorimetric methods.

Sample Number	Radiometric Assay U ppm	Fluorimetric Assay U ppm
S.171	<30	10
S.179	70	80
S.180	<30)	)
	) 40	) 40
S.181	50)	)
S.172	<30	
S.173	30	
S.175	60	
S.176	40	
S.177	30	
	} 35	} 40
S.178	30	
S.182	<30	
S.183	30	
S.184	50	
S.185	<30	
S.186	<30	
S.187	<30	

Footnotes:

1. Individual assays and arithmetic means given in the radiometric column; assays of individual and composite samples given in the fluorimetric column.

2. All assays by the Australian Mineral Development Laboratories, Adelaide.

TABLE V

Showing assay comparisons of fresh rock-chip samples with matching weathered ones.

Uranium		Sample Numbers	Thorium	
Fresh U ppm	Weathered U ppm	Fresh - Weathered	Fresh Th ppm	Weathered Th ppm
<30	<30	S.171 - QS.49	200	240
<30	50	S.172 - QS.52	260	220
30	<30	S.173 - QS.53	260	300
<30	80	S.174 - QS.54	260	240
60	50	S.175 - QS.56	260	300
40	<30	S.176 - QS.57	240	260
30	<30	S.177 - QS.58	260	260
30	<30	S.178 - QS.59	260	240
90	50	S.179 - QS.60	180	200
40	40	Average[1]	250	250

Footnote:

1. Weighted in accordance with length of sample line as shown in Figure 3.

TABLE VI.

Showing assay comparisons of ridge-top sample with valley samples

URANIUM			THORIUM		
Western Valley Sample	Central Ridge Sample	Eastern Valley Sample	Western Valley Sample	Central Ridge Sample	Eastern Valley Sample
QS.51 U ppm	QS.48 U ppm	QS.50 U ppm	QS.51 Th ppm	QS.48 Th ppm	QS.50 Th ppm
<30	50	80	400	180	180

Uranium: Average[1] Valley Sample	Uranium: Ridge Sample	Thorium: Average[1] Valley Sample	Thorium: Ridge Sample
55	50	290	180

Footnote:

1. Samples given equal weight.

TABLE VII.

Showing comparison of spectrometric calculations with radiometric assays for the "high-spot" samples

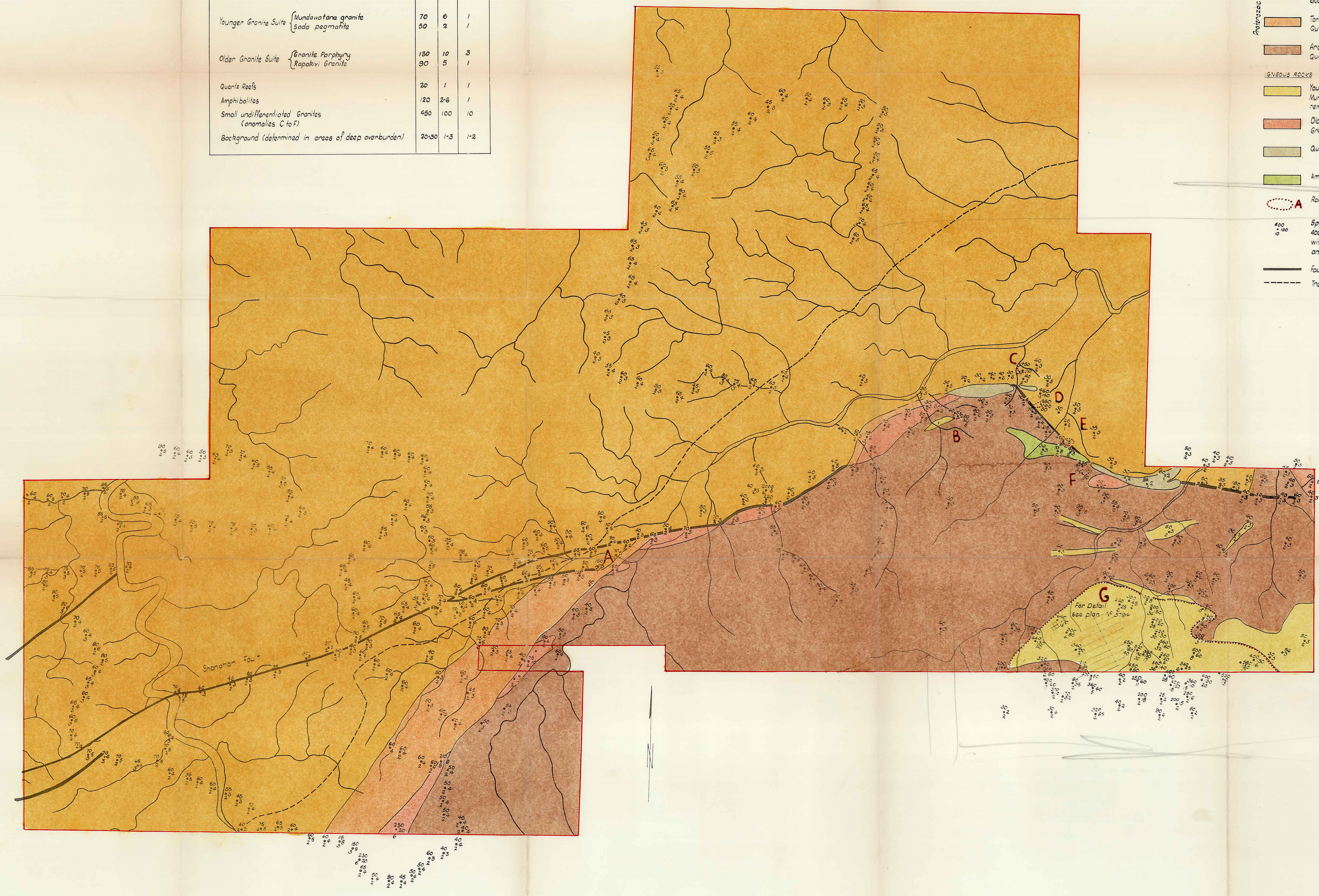
Uranium		Sample Number	Thorium	
Calculation U ppm	Assay U ppm		Calculation Th ppm	Assay Th ppm
1100	100	QS.43	800	350
1000	80	QS.44	400	300
1050	<30	QS.45	360	400
1000	80	QS.46	480	240
1000	90	QS.47	320	220
1030	80	Average[1]	470	300

Footnote:

1. Each sample given equal weight.

AVERAGE GAMMA RAY ACTIVITY

ROCK UNIT	AVERAGE COUNTS PER SECOND		
	Mev 0·3	1·65	2·5
Sturtian sediments	63	3	2
Torrensian - Willouran sediments	65	3	2
Archaean quartzites	50	3	2
Igneous Rocks			
Younger Granite Suite { Mundawatana granite	70	6	1
Younger Granite Suite { Soda pegmatite	50	2	1
Older Granite Suite { Granite Porphyry	130	10	3
Older Granite Suite { Rapakivi Granite	90	5	1
Quartz Reefs	20	1	1
Amphibolites	120	2-6	1
Small undifferentiated Granites (anomalies C to F)	450	100	10
Background (determined in areas of deep overburden)	20-30	1-3	1-2



REFERENCE

Proterozoic
- Sturtian — Boulder Tillite, Quartzites, Shales.
- Torrensian-Willouran — Quartzites, marble, calc-silicate rocks.

- Archaean — Quartzites

IGNEOUS ROCKS
- Younger Granite Suite — Mundawatana Granite locally with sedimentary remnants, No pegmatites
- Older Granite Suite — Granite Porphyry, Rapakivi Granite.
- Quartz Reefs
- Amphibolites
- A — Radiometric anomaly A (Refer to text)
- 400 / 10 / 100 — Spectrometer reading site. 400, 100, 10 are the c.p.s. obtained with energy threshold at 0·3, 1·65, and 2·5 Mev. respectively
- Fault
- Track.

NOTE
Fig 2 S.M.L. 220 - Generalized geology, spectrometer stations, radiometric anomalies and grid positions.

FIG 2

CARPENTARIA EXPLORATION COMPANY PTY. LTD.		
MOUNT CROCKER S.M.L. 220 (South Australia) GEOLOGY AND RESULTS OF THE RECONNAISSANCE SPECTROMETRY		
SCALE: 4" = 1 mile	GEOL.: B.C.S.	DATE: August 69
CHECKED: [signature] 29/8/69	DRAWN: 3.M.C.H	3796

ENV 998.-2

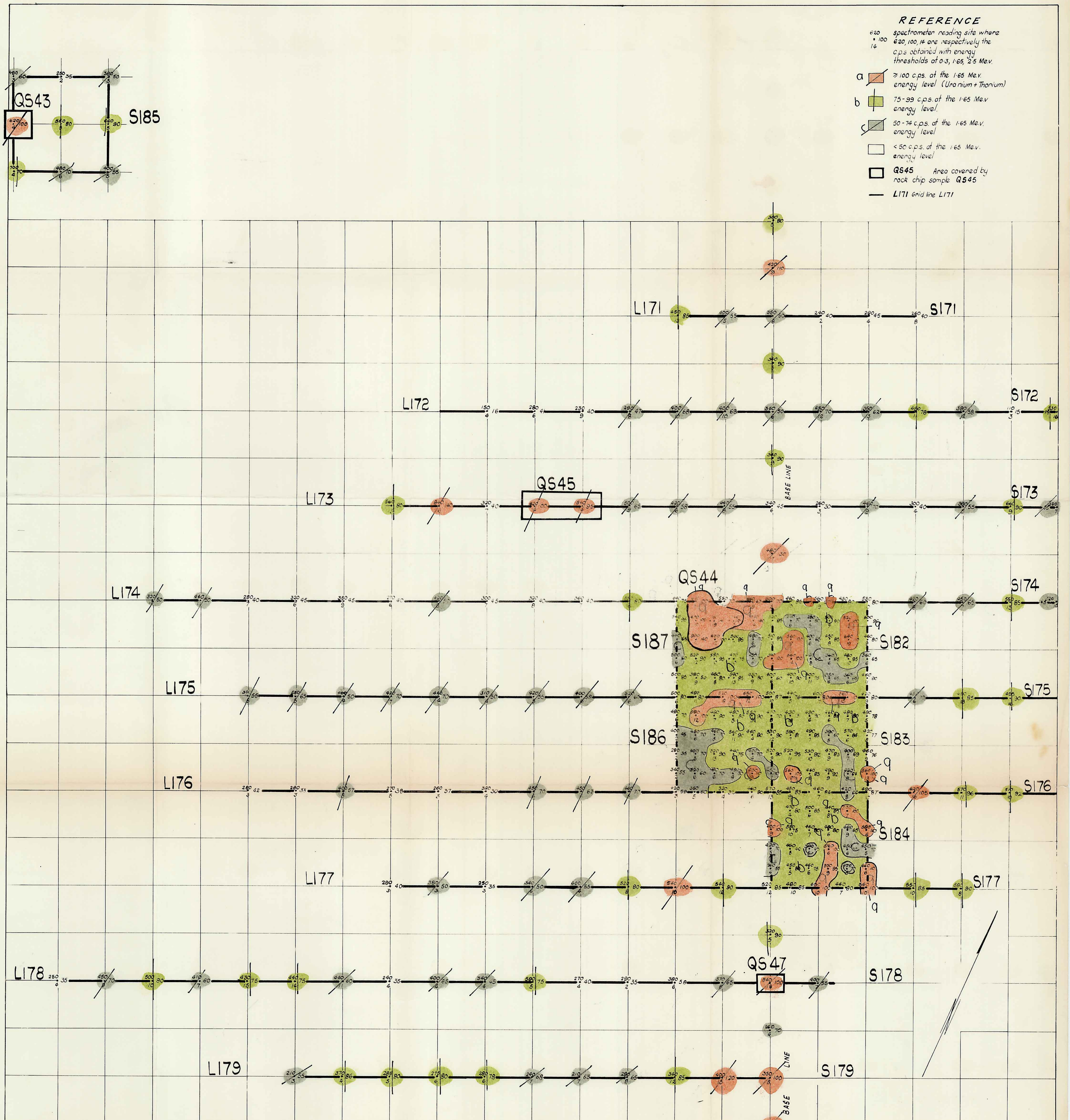


FIG 3

NOTE

Fig 3: Showing results of ground spectrometry on grids with Anomaly G. Fresh rock chip samples were taken from the nine grid lines (S.171 to S.179), the six, 200 foot squares (S.182 to S.187) and four of the 'high spots' as shown.

ENV 998-1

CARPENTARIA EXPLORATION COMPANY PTY. LTD.

MOUNT CROCKER SML 220
(South Australia)

GROUND SPECTROMETER SURVEY
DETAILED WORK WITH ANOMALY G

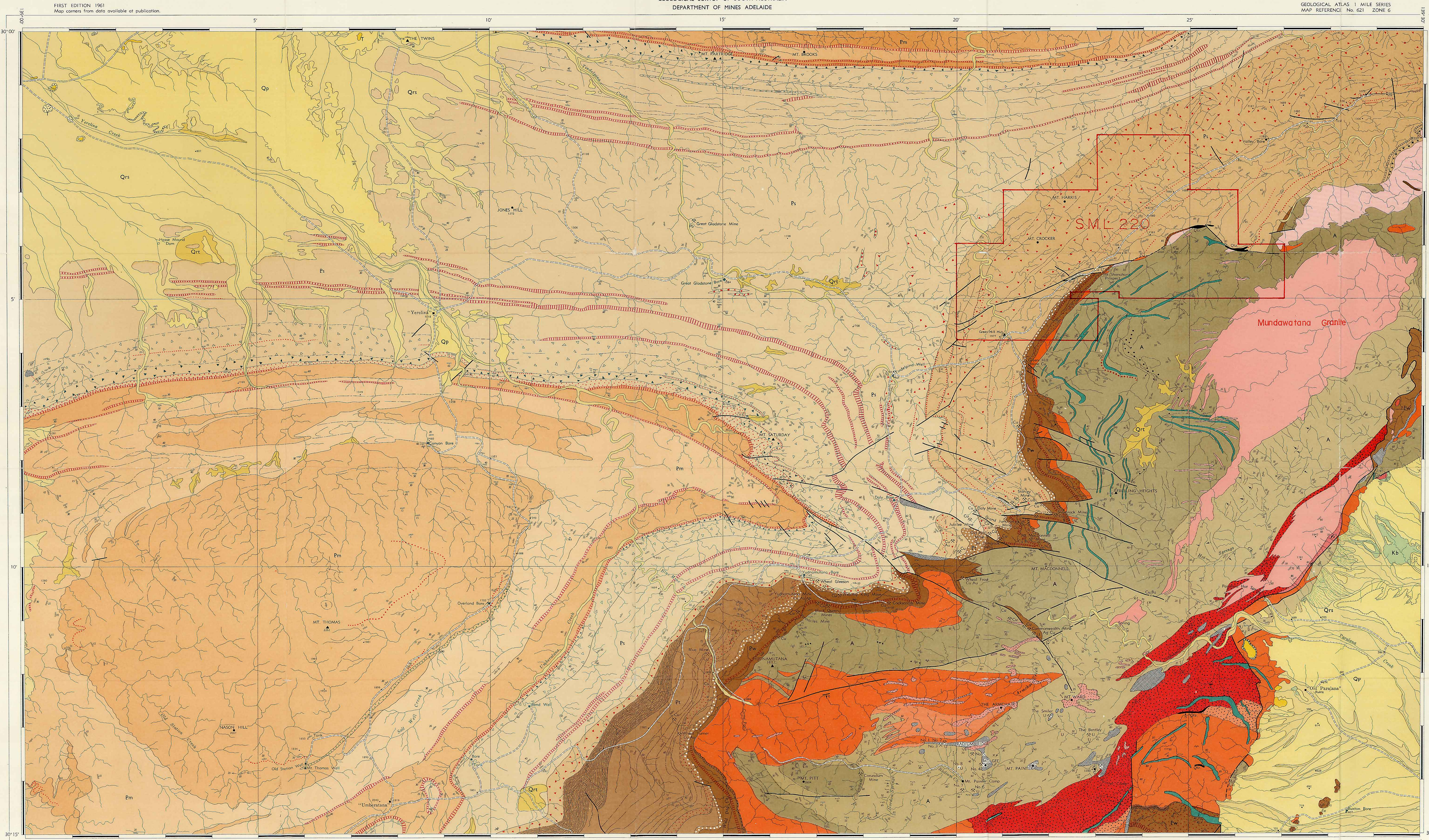
SCALE: 1" = 100'	GEOL.: B. C. S.	DATE: August 69
CHECKED: [illegible]	DRAWN: B.M.C.H	3794

UMBERATANA

FIRST EDITION 1961
Map corners from data available at publication.

GEOLOGICAL SURVEY OF SOUTH AUSTRALIA
DEPARTMENT OF MINES ADELAIDE

GEOLOGICAL ATLAS 1 MILE SERIES
MAP REFERENCE No. 621 ZONE 6



REFERENCE

CAINOZOIC

- QUATERNARY, RECENT — Talus.
- Qrs — Alluvium and piedmont gravels.
- Qrt — High level alluvium and pediment.
- PLEISTOCENE? — Qp — High level piedmont gravels.
- UPPER TERTIARY — Duricrust. Surface of silicification affecting Tertiary and (locally) older rocks, usually forming cappings; sometimes in two bands.
- TERTIARY — T — Knobbly calcareous sandstone and grit. Cross bedded arkosic sandstone, thin conglomerate at base with quartz, agate, etc.

MESOZOIC

- CRETACEOUS — Kb — Arkosic sandstone. Quartz conglomerate. (Blythesdale Group.) (Neocomian.)

PROTEROZOIC — ADELAIDE SYSTEM

- MARINOAN — Pm
  - Green siltstones with slump structures.
  - Quartzite.
  - Boulder bed with slump structures.
  - Calcareous siltstones with dolomites.
  - Green siltstones.
  - Well bedded yellow weathering dolomites.
- STURTIAN — Ps
  - UPPER GLACIAL
    - Well bedded quartzites.
    - Massive boulder tillite.
    - Quartzite.
    - Laminated tillitic calcareous siltstones.
    - Flaggy dolomite.
  - INTER GLACIAL
    - Well laminated calcareous siltstones.
    - Flaggy dolomite.
    - Well laminated calcareous siltstones, finely laminated carbonaceous shales at base, recurrence of tillite.
  - LOWER GLACIAL
    - Tillitic siltstones and slates, quartzites.
    - Massive boulder tillite with quartzites.
    - Tillitic siltstones, amphibolites, quartzites.
    - Arkose.
    - Granite tillite.
- TORRENSIAN — Pt
  - Well bedded siltstones with sand lenses.
  - Tremolitic calc silicate rocks, green shales, cherts.
  - Quartzite and arkosic quartzite.
  - Arkose.
- WILLOURAN — Pw
  - Actinolitic calc silicate rocks, dark spotted schists.
  - Brown weathering marble.
  - Basal quartzite and conglomerate, locally ferruginous.

ARCHAEAN? — A

- Cross bedded sericitic quartzite with heavy mineral lamination.
- Quartz pebble horizon.
- Quartzite pebble horizon.
- Pellety schists, mica schists, felspathized metasediments.
- Mica schists and skarns.

IGNEOUS ROCKS

YOUNGER GRANITE SUITE

- Red pegmatitic granite, potassic pegmatites (Mt. Painter Granite).
- Granodiorite, soda pegmatites. (Mundawatana Granite). Locally with metasedimentary remnants.
- Soda leucogranite.

OLDER GRANITE SUITE

- Granite porphyry.
- "Rapakivi" granite.
- Coarse granodiorite of Radium Creek.
- Medium grained granodiorite.
- Granite gneiss.
- Green quartz-felspar porphyry (Pepegoona Porphyry).

- Amphibolites
- Qtz. — Quartz reefs.
- Breccia

GEOLOGICAL BOUNDARIES
- OBSERVED
- INFERRED

FAULTS
- OBSERVED
- INFERRED
- THRUST

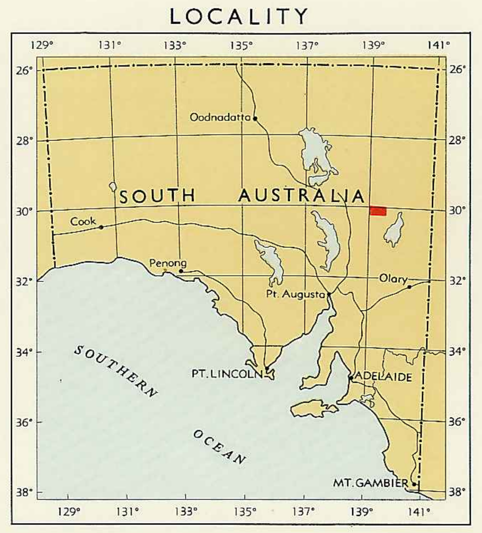
BEDDING
- STRIKE AND DIP — 45
- VERTICAL
- HORIZONTAL
- OVERTURNED — 80
- STRUCTURE FORM LINE

SEDIMENTARY FACING
PLUNGE — 75
CLEAVAGE — 60
GNEISSOSITY, SCHISTOSITY — 70
- VERTICAL

FLOW STRUCTURE — 70
EROSIONAL SCARP
ROAD
TRACK
EPHEMERAL STREAM
TRIANGULATION STATION
MINE
MINERAL OCCURRENCE — x Cu
SPOT HEIGHT IN FEET (ANEROID) — •1947

COPPER	Cu	GOLD	Au
LEAD	Pb	SILVER	Ag
BARIUM	Ba	BISMUTH	Bi
URANIUM	U		

LOCALITY



INDEX TO ADJOINING SHEETS

APOLLINARIS	GARDINER	MOOLAWATANA
LYNDHURST	**UMBERATANA**	PARALANA
SERLE	WOOLTANA	CALDINA

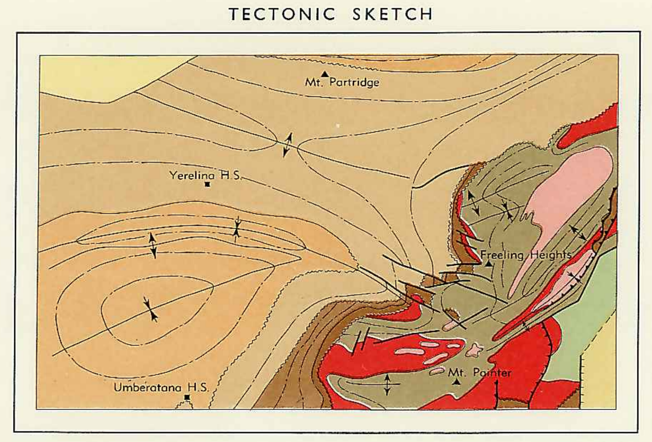
SCALE 1 : 63360 – 1 INCH TO 1 MILE

CHAINS 80 60 40 20 0 1 2 3 4 5 6 7 8 9 MILES

METRES 1000 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 KILOMETRES

H. J. WALL GOVERNMENT PHOTOLITHOGRAPHER ADELAIDE

TECTONIC SKETCH



- Quaternary
- Tertiary
- Cretaceous
- Adelaide System
- Archaean or Lower Proterozoic
- Younger Granite Suite
- Older Granite Suite
- Fault or Monoclinal Fold (Cainozoic)
- Fault (Palaeozoic)
- Thrust (Palaeozoic)
- Pre-Palaeozoic Unconformity
  - Major
  - Minor
- Anticline
- Syncline

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Fig. I