007ENV 913 ~~144~~

REPORT FOR 6 MONTHS ENDED 31st DECEMBER, 1967.

S.M.L. - - 118.

1966

This period was largely occupied by:-

(a) the establishment of an office in Adelaide,

(b) the study and assessment of available data (as required by Section 5 (a) of the terms and conditions of the Lease),

(c) the Laying our of a program of exploration for the following 6 months.

In addition, survey work leading to the establishment of a grid over portion of the Crocker Well area was commenced during December, 1966.

(a) Establishment of office:

An office was established within a house at 30 Montrose Avenue, Netherby. Furniture and equipment was purchased.

(b) Study and Assessment of Available Data:

All available files, reports and plans within the Department of Mines were culled through, and the more important were read and noted.

All published reports were obtained and studied. Discussions were held with persons who had participated in the exploration of the area.

Collection of copies of reports and plans necessary to the further exploration of the area was begun.

Some investigation of radiometric equipment available and techniques of use was carried out.

A study of background information - estimated world reserves, projected world requirements, etc. was undertaken.

(c) 6 Months exploration program:

From the study and assessment it became obvious that the best place to commence exploration was in the Crocker Well area. Here is a concentrated area (some 15 sq. miles) in which Mines Dept. exploration had delineated a number of bodies of uranium mineralisation which are of or approach ore grade. This previous work had covered exploration of the surface of the area fairly

-cont'd-

thoroughly; however, the prospects of finding further bodies with little or no surface expression seemed fairly attractive. It seemed desirable also to carry out further investigations on the grade of the known ore bodies. Additionally, the area was well suited to the development of methods and the evolvement of and training in techniques of exploration for uranium. Accordingly a program was drawn up with these ends in view.

Survey:

It was obvious that if effective work was to be done over the whole of the Crocker Well area, a survey control over the area was necessary.

Accordingly, in December, 1966, the establishment of a survey grid over the area was commenced. Fortunately, sufficient of the old Mines Department grid at Crocker East remained to enable re-establishment of that grid. Thus the new grid was commenced using the same azimuth and co-ordinate system as the old one.

ENV 744
9/13

Noted [illegible] 13.6.69

Electrolytic Zinc Co. of A/Asia Ltd.

009

31st March, 1967.

EXPLORATION of SPECIAL MINING LEASE

No. 118.

Report for the three months ending - 31st March, 1967.

Summary : The exploration work carried out during this period has consisted in a number of largely independent phases and has been treated as such in this report. Thus this report is divided into the following :-

Section A : Surveying.

Section B : Ground Radiometric Survey.

Section C : Auger Drilling (Gemco).

Section D : Petrological Study.

Section E : Radon Determination.

Of these, Sections A, B & C have been satisfactorily completed as planned.

A major grid, covering the whole of the surface exposure of adamellite in the Crocker Well area has been surveyed in. This grid has been used for location of subsequent programs in the area and will be throughout the exploration of the area.

The ground radiometric survey covered a section of the Crocker East deposits. Some small areas of anomalous radioactivity were revealed.

The auger drilling has given a picture of the depth of cover in the alluvial flat between Original Crocker and Crocker East deposits. Some indication of the geology of the bedrock has been gained.

Section D, the petrological study has commenced and is proceeding well. Most of the rock specimens needed for the study have been collected.

Development of equipment and some preliminary testing of the radon determination method have commenced.

Arrangements have been completed for the rotary - percussion drilling program to commence early in April.

Electrolytic Zinc Co. of A/Asia Ltd.

31st March, 1967. 010

E X P L O R A T I O N of S. M. L. 118.

SECTION A : SURVEYING.

As mentioned in the Exploration Program for the 6 months ending 30th June, 1967 and in the Report for the 6 months ending 31st Dec., 1966 survey work at Crocker Well commenced during the month of December, 1966. However, this work has not been previously fully described and so is included in this report.

The first stage of the survey was to attempt to re-establish the Mines Department grid on the Crocker East Prospect. We were fortunate to discover a concrete plug at 5,200 N, 5,000 E and an obviously undisturbed wooden peg at 5,200 N, 4,100 E. These two pegs gave us a very good azimuth and co-ordinate datum to work from. On extending the grid from this base, a number of old stakes were encountered which confirmed the validity of the accepted base as a datum. The azimuth was very carefully carried across from the 5,200 N line to the 5,000 N line, it being the intention to extend the 5,000 N line East and West as the major base line for the major grid. Concrete plugs were installed at - 5,000 N, 5,000 E

and 5,000 N, 3,000 E.

The line between these two plugs is now accepted as the azimuth datum for the grid system. The plug, 5,000 N, 5,000 E is accepted as the co-ordinate position datum.

The Baseline :

The 5,000 N baseline was extended westwards from 5,000 E to 14,000 W by theodolite and 500' chain. Wooden pegs with marker stakes were installed at each 500'. This work was done carefully and may be regarded as being reliable.

Further concrete plugs were installed at - 5,000 N, 4,500 W
5,000 N, 10,500 W
5,000 N, 13,000 W

Section A (continued)

The Grid : The grid was then extended North and South from the base line by theodolite. Pegs were placed at each 500', the distances being measured by stadia. East - West tie lines with pegs at 500' intervals were surveyed in by stadia at appropriate places to provide a check on the accuracy of the laying out of the grid. The 5,000 N base line was extended from 5,000 E to 9,500 E again by stadia.

All stations installed on this grid are marked by pegs painted red with marker stakes painted red and streamers attached. Metal tags with co-ordinates marked are attached to each peg.

A list of all stations installed giving co-ordinates and reduced levels of stations is attached herewith.

Electrolytic Zinc Co. of A/Asia Ltd.

012

31st March, 1967.

EXPLORATION of S. M. L. 118.

SECTION B : GROUND RADIOMETRIC.

Introduction : The geology of the Crocker Well East Prospects was mapped in detail by the Mines Department. (see Plan US. 268) Two portions (one at each end) of the area mapped had been covered by ground Radiometric Surveys (with Phillips Monitor) - (see plans Nos. LUS 206 & US 225) It was felt desirable that the remainder of the mapped area should be covered by a radiometric survey.

In preparation for this radiometric survey, a 100' grid was laid out by tape, ranging poles and optical square, working from the surveyed grid. This grid approximated to the previous Mines Department grid. (1½" square pegs painted yellow were used for this grid).

Equipment : A Technical Associates scintillometer (PUG - 1 ratemeter + PGS - 3 gammaprobe) was used to conduct the survey.

Personnel : The survey was carried out by Geology students Messrs R. Cambrell and R. Read, and M. Sibly working under the guidance of Mr. J. Webb, Consultant Geophysicist.

Procedure : Procedure for carrying out the survey was as follows :-

The ratemeter was carried in the hand with the probe suspended from the belt at a height of approx. 2' above the ground. North - South grid lines were walked over the full area. In sections, where significant changes in radioactivity occurred, East - West grid lines were walked, and if further detail was thought desirable, intermediate lines were walked. Where there was little change in radioactivity, readings were averaged over 50'. Where significant variations of radioactivity occurred, readings were averaged over smaller distances down to say 10' and at peak values, spot readings were taken.

Background reading was taken at a standard place at 8 a.m. and 6 p.m. each day. Readings taken during each day were modified to some extent to allow for the change in background.

EXPLORATION of S.M.L. 118.

Section B. - Procedure (continued)

Figures selected for contouring were 100, 200, 300, 500, 1,000 counts per minute.

Program : In order to provide a basis for comparison this survey was commenced by overlapping a section which had been covered by the Mines Dept. radiometic survey. This section is bounded by co-ordinate lines 3,600 E, 4,100 E and 4,700 N, 5,500 N, and included the Central Prospect. Correlation between the two radiometric surveys was quite good.

The program carried out covered mainly the area bounded by 4,200 N and 6,000 N and 2,000 E and 3,600 E co-ordinates. As was to be expected there were no areas of high radioactivity in the area. However, there are some small areas which show radioactivity that is significantly higher than background. In the large body of the area activity lies below 100 c.p.m. or between 100 and 200 c.p.m. However, small areas show in the 200 - 300 c.p.m. range. These areas merit some attention. Plan No. CW 4 shows the results of the work.

This program was useful in gaining experience in the use of this method.

Electrolytic Zinc Co. of A/Asia Ltd.

31st March, 1967.

EXPLORATION of S. M. L. 118.

Section C : Auger Drilling (Gemco).

Introduction : The surface of areas of exposed rock in the Crocker Well area was fairly thoroughly prospected for uranium by the Mines Department. However, little work was done on areas with alluvial cover. Thus, these latter areas must be regarded as favourable for new discoveries of uranium mineralisation. As the initial stage in the exploration of these areas, an auger drilling program was laid out with the objects.

(a) to establish depth of alluvial cover.

(b) to give an insight into the geology of the rocks under the alluvial cover.

Equipment : Trailer-mounted Gemco auger drill, towed by four-wheel drive 5 ton International truck. Rods used were 3½" solid centre in 6' flights. 3¾" dia. 2 prong (fork) and 3 prong, bits were used, prong being faced with tungsten carbide slugs.

Personnel : The drill was operated by P.Davis, , who was borrowed (with the drill) from the N.S.W. section of E.Z.'s Exploration Department. Students R. Cambrell and R. Read operated as sampler-offsiders.

Program : The main aim of the program was to provide a coverage of the alluvial flat between Crocker East and Original Crocker. The program also covered the area of probable adamellite to the North and West of Original Crocker. One exploratory line of holes was drilled North and South of Victoria Hut.

The drilling commenced with an "orientation" line of holes running East-West across the centre of the alluvial flat. On this line, on the 4,000 N co-ordinate line holes were drilled at 200' intervals, extending from 3,000 W to 600 E. On the results of this drilling it was decided to carry out the drilling program on North-South lines, spaced 1,000' apart, holes to be drilled at 200' spacing along these lines.

Exploration of S. M. L. 118.

Section C : Auger Drilling (Gemco) continued.

Procedure : Holes were drilled through the alluvial cover, through decompased bedrock into solid bedrock.

While significant penetration into the harder bedrock was not possible, bedrock chips sufficient for recognition purposes were often obtained. In the earlier stages of the program, considerable time and effort was expended in attempting to obtain better chips, by deeper penetration into the bedrock. Considerable damage to bits resulted. The conclusion was finally reached that the rewards of this extra effort were very slight, and that drilling should stop virtually as soon as the bit touched hard bedrock.

Cuttings from each 3' run of drilling were laid out in line near the hole. From examination of these cuttings, a log of the hole was obtained and entered on the Drilling Record Sheets.

A scintillometer or Geiger Counter was run over the cuttings to check for any anomalous radioactivity. (Very little was found).

A sample of the cuttings from the bottom of the hole was placed in a bag and labelled, for future examination.

Results : (a) Depth of cover : The drilling showed the alluvial cover to be generally less than 30 feet in the flat between Crocker East and Original Crocker. Further west, depths of cover were found to increase. The drilling carried out was adequate to give a good general picture of the profile of the bedrock in the area.

On the Victoria Hut line, depth of cover varied up to a maximum of somewhat more than 50 feet.

Plan No. CW 5 which overlays the Mines Department plan No. 55-78 shows the position of holes and the thickness of alluvial cover at each hole in the Crocker Well area.

Plan No. C. W. 6 gives the same information for the Victoria Hut line.

(b) Geology : While an attempt at recognition of bedrock cuttings and chips was made during the progress of the drilling, the personnel available were not sufficiently familiar with the local rock types to make positive identifications. However, a later inspection of the bagged samples, Exploration of S. M. L. 118.

Section C : Auger Drilling (Gemco)

(b) Geology (continued)

with the participation of Mr. T. Liverton, who is carrying out a petrological study of the area, yielded more positive information. From this information, a broad picture of the underlying rock types may be drawn. The Northern portion of the central flat appears to be largely adamellite; however, in the Southern section an area of amphibolite, an area of metasedimentary schist and gneiss and an area which may be a breccia show up. No plan is submitted at this stage as later work will probably further clarify the geology. Some information on this problem will result from the petrological study, and further drilling may be warranted to more completely define the boundaries of the various rock types.

Performance of Drill.: In the Crocker Well alluvial flat, 148 holes were bored for a total footage of 3, 150 feet (average depth 21 feet). Average footage drilled per day was approx. 120 feet.

In the Victoria Hut line 16 holes were drilled for a total depth of 564 feet (average depth 35 feet). Average footage drilled per day was approx. 100 feet. (Daily hours worked average a little over 9).

These rates of drilling are moderate only due partly to the material drilled and partly to time spent trying to obtain chips from the bed-rock. Drilling rates in the sandy soil of the area were fairly good, but patches of gravel, travertine limestone and clay caused considerable slow downs. Attempts to penetrate further into and obtain better chips from the bedrock caused considerable loss of time. Three-pronged bits and a three-pronged bit with attached pilot bit were tried out - with little success. Additionally, it was found that the three-pronged bit was slower in the alluvium. The conclusion was reached that the normal two-pronged was best suited for this drilling.

Electrolytic Zinc Co. of A/Asia Ltd.

31st March, 1967.

EXPLORATION of S. M. L. 118.

Section D : Petrological Study.

Preliminary : Petrological work carried out by the Mines Department indicated that the adamellite surrounding the breccia zone at Original Crocker is enriched in sodium. It was suggested that the uranium mineralisation is associated with metasomatism ("albitisation") of the rocks. If it can be shown that this relationship between uranium mineralisation and metasomatism does exist, sodium geochemistry could be employed to locate possible uranium-bearing rocks. A study of the mineralogy of the ore bodies may also reveal an accessory mineral useful for tracing mineralisation.

In order to investigate these questions, it was decided to provide a Scholarship during 1967 to enable a graduate to proceed to an Honours degree within the Department of Economic Geology, University of Adelaide using this study as his thesis. Mr. T. Liverton, a Sydney graduate with two years field experience accepted this Scholarship.

Outline of the Study : The work to be performed may be considered under the following headings:-

(a) literature study.

(b) field work.

(c) laboratory studies.

(a) Literature Study :

Prior to carrying out any new work on the area, it was ofcourse necessary for Mr. Liverton to become familiar with the previous work done. Liverton commenced work on the project in early January and spent the first fortnight in studying available reports and plans, particular attention being paid to Department of Mines Bulletin No. 34. Further study of literature, including study of general literature on metasomatism will be undertaken during the year.

Section D : ~~[illegible]~~ Petrological Study. (continued)

(b) Field Work : Due to the requirements of the Honours course it was necessary for the major part of the field work to be completed prior to the commencement of the academic year i.e. in January, February and early March. An initial period was spent in familiarisation with the regional rock types in particular the regional granites. During this period, collection of a set of specimens representative of the regional rock types was commenced. Some 40 specimens were collected.

A brief return to Adelaide was made prior to the main field period. While in Adelaide, a visit to Amdel proved fruitful in the obtaining of a large number of thin sections and polished sections, which had been prepared during the period of exploration by the Mines Department.

During the main period of field work (in February and early March), Liverton completed the collection of the bulk of rock samples required for the study. The conclusion had been reached that in order to obtain relatively unweathered specimens it was necessary to bore and fire at many of the selected sites. An Atlas "Cobra" rock drill was hired for the boring of the holes. In all some 50 shots were fired, and more than 70 samples were obtained.

In addition to the examination of rocks and collection of specimens on the surface, an examination of the upper (33') level of the underground working at the Main Eastern Deposit was undertaken. (The lower (103') level was flooded). Measurements of joint patterns and sampling of adamellite at varying distances from the ore zone were carried out. A fan was hired for the ventilation of these workings. Other shafts at Crocker East and Original Crocker were inspected with the aid of rope ladders.

A theodolite traverse was carried around the Southern contact of the adamellite to serve as a base for mapping of that portion of the area. From this base, Liverton carried out some mapping. An area about 1,500 feet by 900 feet in extent was mapped to show a typical contact area. (Plan No. C.W 1) A larger area (some 3,500 feet by 1,200 feet) immediately to the West of the camp was also mapped (Plan No. C.W. 2). This area had been shown on some plans as encompassing some areas of breccia.

Exploration of S.M.L. 118.

Section D : Outline of the Study - Field Work (continued).

The present mapping shows that there is no true breccia in the area - or at least nothing that is comparable to the Original Crocker breccia.

Plans of this mapping are in course of preparation and will be supplied later.

(c) Laboratory Work:

By the end of March, preparation of thin sections from the rock specimens was well under way, but little examination of specimens had taken place. The examination will involve petrographic, structural and chemical work on the rocks.

Modal analysis of the rocks to determine the variation in feldspar content (i.e. ratio of albite to other feldspars) will occupy a considerable amount of time. Some petrofabric work around the breccia zones to investigate any preferred orientation of minerals will be carried out. Some chemical analysis of rocks will be included.

Observations : From the previous work and from the study of thin slides it is apparent that the granitic rocks surrounding the adamellite are all quite potassium rich and commonly show evidence of considerable stress effects. Potassium feldspars are the predominant mineral constituent of these rocks, occurring as orthoclose and perthitic microcline. Plagioclose is very subordinate and is commonly oligoclase of around A_n 15% composition. Biotite present is a red-brown variety.

The adamellite contains a considerably higher proportion sodium and is a relatively unstressed rock. Orthoclase is the predominant potash feldspar and occurs in sub-equal proportions to the plagioclase which is largely oligoclase of A_n 12% composition. Biotite in the adamellite is a pale golden variety.

In the area immediately surrounding the breccia zone at Original Crocker the adamellite is richer in sodium and here the plagioclase is albite with A_n 6% - 8% composition. Stress effects are virtually absent. Biotite in this rock is much paler than elsewhere.

Exploration of S.M.L. 118.

Section D : Petrological Study (continued)

Prior to the commencement of Liverton's work, arrangements had been made for Amdel to re-examine a batch of eight thin sections (T.S. 3120-3127). (Deptl. Sample No. P.439/57) These thin sections were cut from samples selected in 1957 by Mr. N. Hiern from the core of D. D. hole No. E.C. 61 on the Main Eastern Deposit. Amdel was asked to examine the slides for percentages and relationships of rutile, apatite and any brannerite. A copy of Amdel's report is appendixed to this report.

Electrolytic Zinc Co. of A/Asia Ltd.

31st March, 1967.

EXPLORATION of S. M. L. 118.

Section E: Radon Determination.

Preliminary : One possible method of exploring areas covered by alluvium is by determining the radon content of air in short holes in the alluvial cover. Investigation of the applicability of this method to the Crocker Well area, and, if proved successful, the subsequent use of the method, has been planned as part of the exploration program. During the period covered by this report, the work done has been confined to the initial development of equipment and the preliminary testing of this equipment within the Adelaide area.

Development of Equipment :

In the method proposed, radon content is to be determined by an "alpha-chamber" technique, whereby a sample of air is sucked into a small chamber which is attached to the face of an alpha probe, and the alpha activity is recorded on a ratemeter attached to the probe.

The equipment selected is based upon that discribed in the paper : "Radon Determination as a Prospecting Technique"

by - J. D. Peacock and R. Williamson.

-- Transactions Vol. 71, 1961 - 62, Part 2.

The Institution of Mining and Metallurgy - (Bulletin No. 660 - November, 1961).

The alpha-counting equipment selected for our work is :

Technical Associates - - Alpha Scintillation Probe type P - AS - 2

and Universal Ratemeter type PUG - 1.

The alpha probe has a 4½" square zinc sulphide phosphor, protected by a aluminium coating.

An aluminium block and base plate have been attached to the face of the alpha probe to form a chamber approx. 4½" square x ⅜" deep. Spacers may be inserted to deepen the chamber if considered necessary.

Section E : Radon Determination - Development of Equipment (continued).

Air is drawn into the chamber by means of a hand pump. (A normal garden spray pump has been used for the initial testing although the volume of this pump is too small, two or three strokes being necessary to draw in the sample. A more suitable pump will be obtained if the method appears promising).

Valves (Schrader tyre valves with modified springs) have been installed on the pump so that air drawn is drawn in only through the chamber and is expelled only to atmosphere.

$\frac{1}{4}$" plastic tubing is used to connect the pump to the chamber and the sample inlet to the chamber. Replaceable cotton or rock wool filters are installed at the sample inlet and the inlet to the chamber to filter out dust and daughter products.

Preliminary Testing :

Using a quantity of brannerite within a covered vessel as a source, some "laboratory" testing of the equipment was carried out.

This testing showed that reading of the instrument could be carried out acceptably although a difficulty existed in that readings below 100 C.P.M. were best made by counting individual pulses by ear, while above 100 c.p.m. readings would have to be taken by averaging the needle position on the dial. This test work also indicated that contamination of the chamber by daughter products would probably remain within acceptable limits. One feature, which was noted during this work, was the consistantly rapid fall off of activity in the chamber. This is probably due to the presence of thoron which has a half-life of only 54.5 secs.

In order to carry out some field testing of the equipment, a visit was paid to a known uranium deposit at Houghton. It was hoped that a test area could be found where a moderate alluvial cover overlaid a known or inferred radioactive deposit. A small number of holes were bored with hand auger, but the area proved disappointing in that alluvial cover was small to non-existant. However, experience was gained in the technique of sample taking, the reading of the instrument, and the variability of readings with time.

Exploration of S.M.L. 118.

Section E : Radon Determination - Preliminary Testing (continued).

Testing was next carried out over a small area of ground close to Adelaide. A pattern of some 15 holes (2" dia. by 3 feet deep) was bored, (mainly by means of tubes driven in by Atlas "Cobra" drill). Covers were placed on the holes. Readings were taken of alpha activity in the holes on a number of days over a period of a fortnight. A considerable variation in activity was observed from day to day, but the readings were all rather low (mainly less than 50 c.p.m.) probably below the significant level. A source (Crocker Well concentrates) was buried in the centre of the pattern in the hopes that in time radon would emanate through to the holes and raise the level of activity in them.

By the end of this period, it had become apparent that little was to be gained by continuing testing in Adelaide, and that the scene of activities should be shifted to Crocker Well.

Electrolytic Zinc Co. of A/Asia Ltd.

31st March, 1967.

E X P L O R A T I O N of S. M. L. 118.

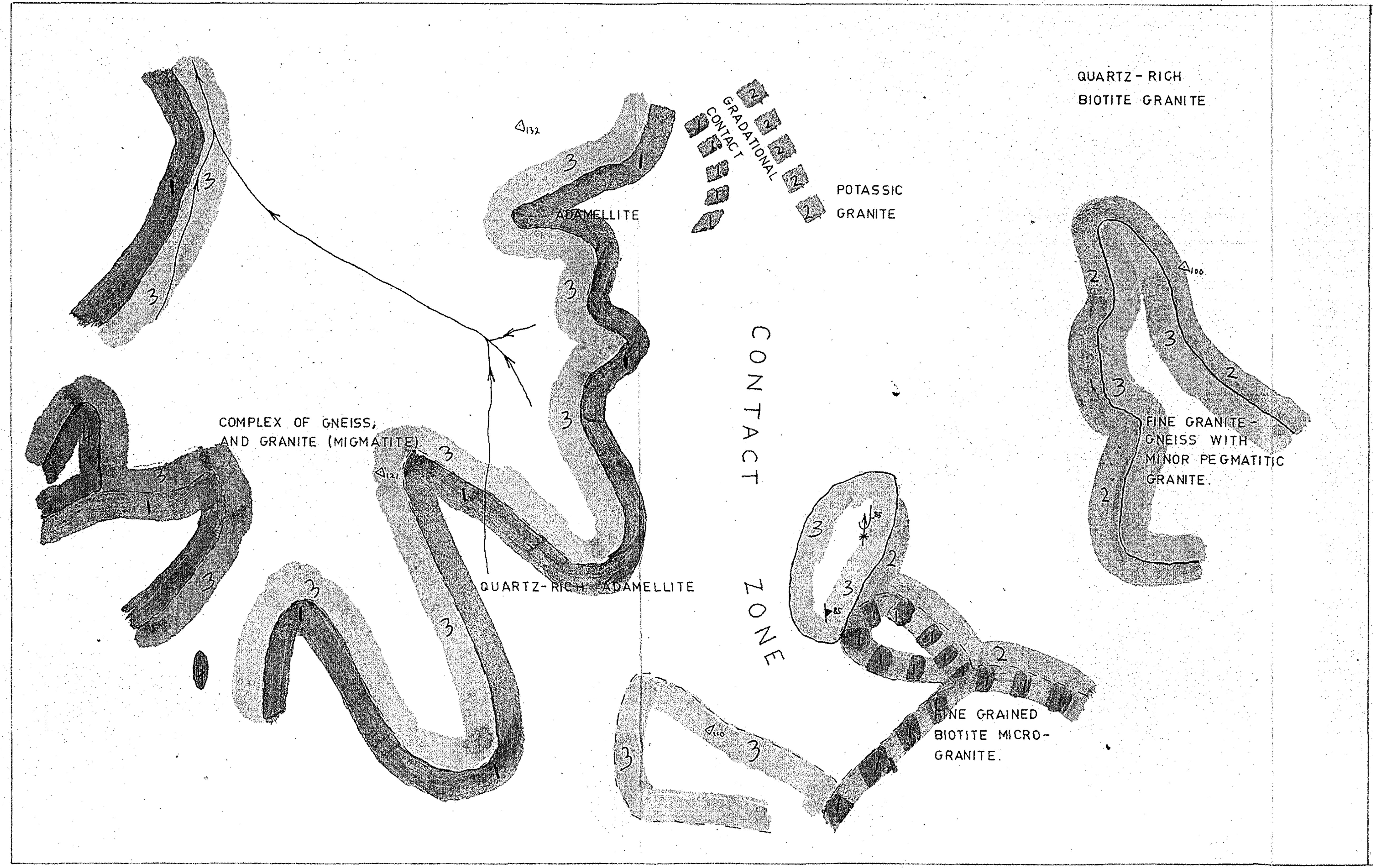
Continuation of the Program :

As at the end of March, certain aspects of the program were proceeding and arrangements had been made for further steps. The petrological study is proceeding satisfactorily. This is a long term program and effective results will not be available for some months. The radon determination will continue with field testing of equipment and method at Crocker Well. Arrangements had been completed and preparations made for the rotary - percussion drilling program to commence early in April. Initial steps had been made to ensure that equipment would be ready and the helicopter available for the helicopter radiometric survey.

As the program has proceeded, it has become more obvious, that there is no quick or simple way of exploring the Crocker Well deposits and other sections of the lease area. Effective exploration will necessarily be a long term project, largely by methods which cannot be compressed into a concentrated short-term effort.

C. L. Maynard

PROJECT ENGINEER.



LEGEND.

PLANE TABLE SURVEY STATION

CREEK

GEOLOGICAL CONTACT
ACCURATE & APPROXIMATE

STRIKE & DIP OF FOLIATION

ATTITUDE OF FOLDS.

1 ADAMELLITE.

2 REGIONAL GRANITE.

3 GNEISS AND MIGMATITE.

4 PEGMATITE.

MN

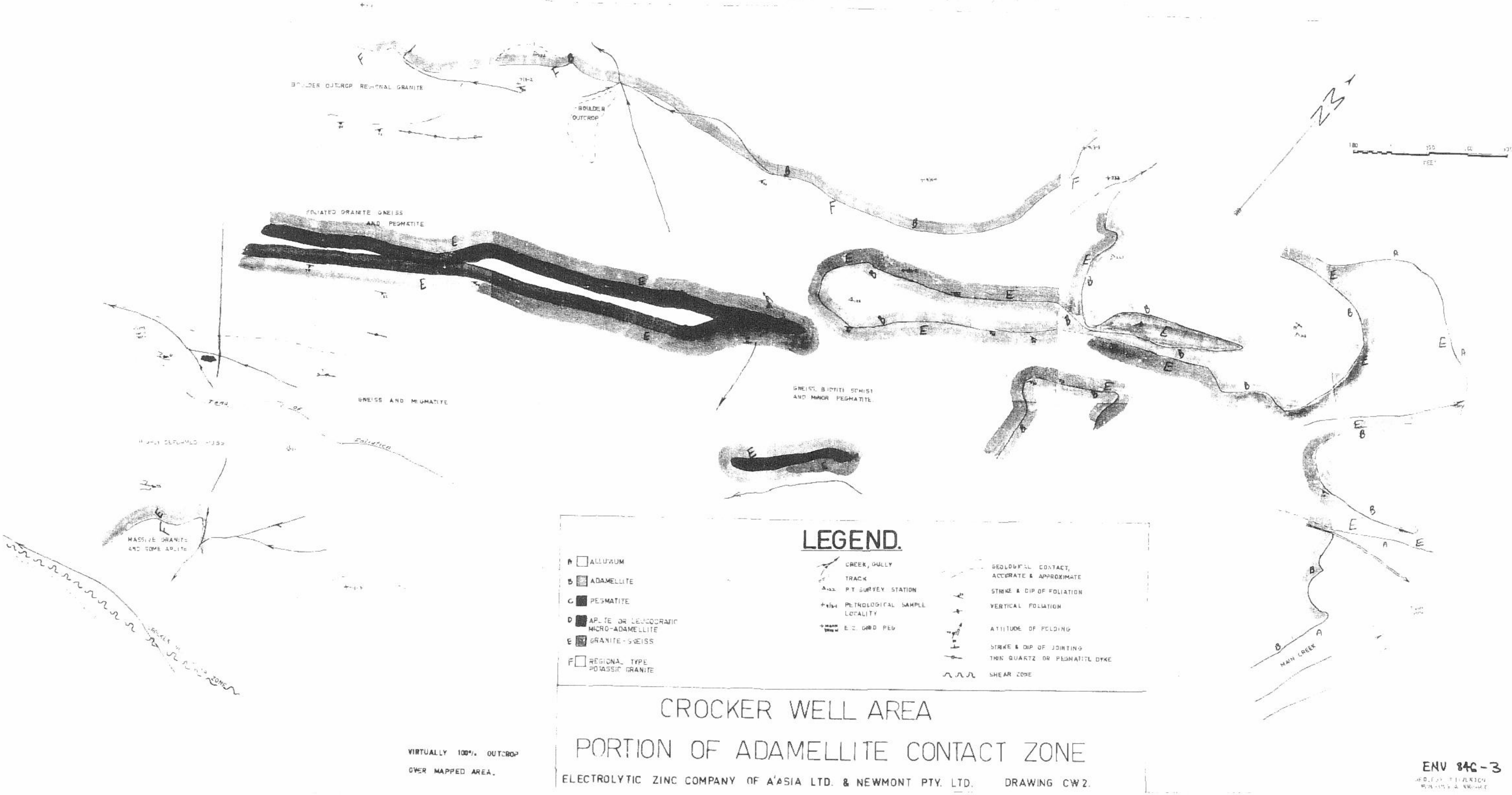
0 100
FEET

ELECTROLYTIC ZINC CO. of A/ASIA LTD.

CROCKER WELL
PORTION OF SOUTH
CONTACT OF ADAMELLITE.

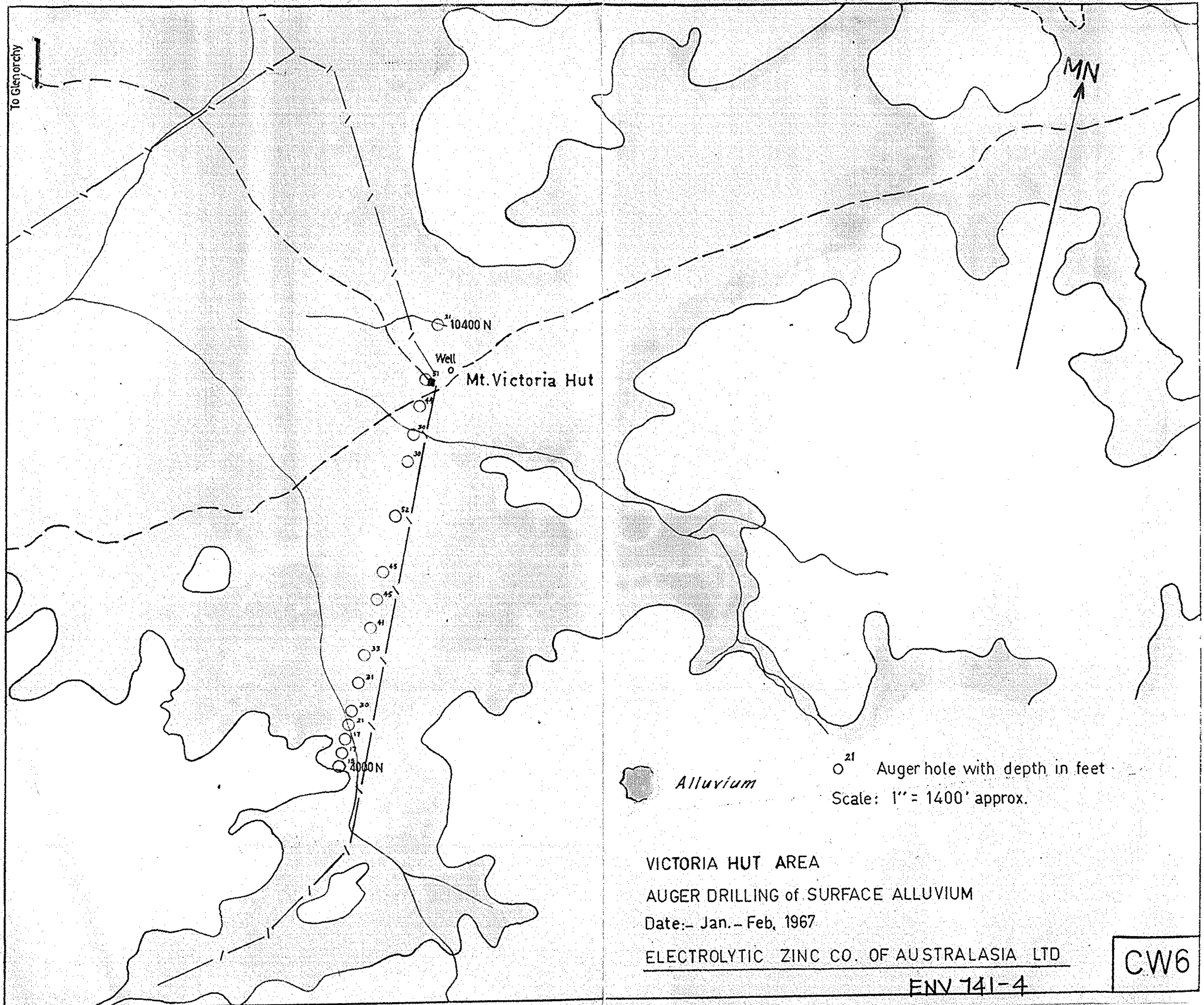
CW1 ENV 846-2

GEOLOGY: T.LIVERTON MARCH 1967.
SURVEYING: A.WRIGHT.


BOULDER OUTCROP REGIONAL GRANITE
BOULDER OUTCROP
FOLIATED GRANITE GNEISS AND PEGMATITE
GNEISS AND MIGMATITE
GNEISS, BIOTITE SCHIST AND MINOR PEGMATITE
MASSIVE GRANITE AND SOME APLITE
MAIN CREEK
FEET
LEGEND.
A ALLUVIUM
B ADAMELLITE
C PEGMATITE
D APLITE OR LEUCOCRATIC MICRO-ADAMELLITE
E GRANITE-GNEISS
F REGIONAL TYPE POTASSIC GRANITE
CREEK, GULLY
TRACK
P.T. SURVEY STATION
PETROLOGICAL SAMPLE LOCALITY
E.Z. GRID PEG
GEOLOGICAL CONTACT, ACCURATE & APPROXIMATE
STRIKE & DIP OF FOLIATION
VERTICAL FOLIATION
ATTITUDE OF FOLDING
STRIKE & DIP OF JOINTING
THIN QUARTZ OR PEGMATITE DYKE
SHEAR ZONE
VIRTUALLY 100% OUTCROP OVER MAPPED AREA.
CROCKER WELL AREA
PORTION OF ADAMELLITE CONTACT ZONE
ELECTROLYTIC ZINC COMPANY OF A'ASIA LTD. & NEWMONT PTY. LTD. DRAWING CW2.
ENV 846-3


BOULDER OUTCROP REGIONAL GRANITE
BOULDER OUTCROP
FOLIATED GRANITE GNEISS AND PEGMATITE
GNEISS AND MIGMATITE
Trend of Foliation
HIGHLY DEFORMED GNEISS
MASSIVE GRANITE AND SOME APLITE
CROCKER WELL SHEAR ZONE
GNEISS, BIOTITE SCHIST AND MINOR PEGMATITE.
MAIN CREEK
100 0 100 200 300
FEET.
LEGEND.
1 ALLUVIUM
2 ADAMELLITE
3 PEGMATITE
4 APLITE OR LEUCOCRATIC MICRO-ADAMELLITE
5 GRANITE-GNEISS
6 REGIONAL TYPE POTASSIC GRANITE
CREEK, GULLY
TRACK
P.T. SURVEY STATION
PETROLOGICAL SAMPLE LOCALITY
E.Z. GRID PEG
GEOLOGICAL CONTACT, ACCURATE & APPROXIMATE.
STRIKE & DIP OF FOLIATION
VERTICAL FOLIATION
ATTITUDE OF FOLDING
STRIKE & DIP OF JOINTING
THIN QUARTZ OR PEGMATITE DYKE
SHEAR ZONE.
CROCKER WELL AREA
PORTION OF ADAMELLITE CONTACT ZONE
ELECTROLYTIC ZINC COMPANY OF A'ASIA LTD. & NEWMONT PTY. LTD. DRAWING CW2.
ENV 741-2
GEOLOGY: T. LIVERTON
SURVEYING: A. WRIGHT.

ELECTROLYTIC ZINC CO. of A/ASIA LTD.
CROCKER WELL EAST PROSPECT
Ground Radiometric Survey
RADIOMETRIC SURVEY :- Under direction of J. Webb, Consultant.
DATE :- January 1967.
INSTRUMENT :- Technical Associates Scintillometer PUG-1 monitor with PGS-3 gamma probe.
DRAWING BY :- R.P. Cambrell.
CW4
Legend
1 UNDER 1000 c.p.m.
1000 to 2000 c.p.m.
2 2000 to 3000 c.p.m.
3 3000 to 5000 c.p.m.
4 5000 to 10000 c.p.m.
5 OVER 10000 c.p.m.
Scale : 1" = 100'
ENV 741-3


To Glenorchy
MN
10400 N
Well
Mt. Victoria Hut
4000 N
Alluvium
Auger hole with depth in feet
Scale: 1" = 1400' approx.
VICTORIA HUT AREA
AUGER DRILLING of SURFACE ALLUVIUM
Date:- Jan. - Feb. 1967
ELECTROLYTIC ZINC CO. OF AUSTRALASIA LTD
CW6
ENV 741-4

LEGEND

- DOLERITE DYKES
- 1 — PREDOMINANTLY ADAMELLITE
- COMPLEX OF GRANITE, GRANITE GNEISS AND MIGMATITE
- 3 — METASEDIMENTARY GNEISS AND SCHIST
- APPROXIMATE GEOLOGICAL BOUNDARIES
- SHEARED ZONES
- SHATTERED ZONES
- OBSERVED ABSITE OCCURRENCE AND CONCENTRATION
- •Davidite — OTHER MINERAL OCCURRENCES
- ROADS AND TRACKS
- BOUNDARIES OF AREAS MAPPED IN DETAIL

SCALE

CHN. 20 10 0 1/4 1/2 3/4 1 MILE

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LTD.
ADDITIONS TO PLAN
(a) Baseline 5000N & line 5000E for location of overlay.
(b) Position of geological plans CW1, CW2.

S.A. DEPARTMENT OF MINES

Associated Drawing	No.	No.	Amendment	Exd.	Date	Req. No. / D.M. / Compiled from Originals by D. King and J. Johnson	CROCKER WELL URANIUM DEPOSITS GEOLOGICAL LOCALITY MAP	Approved / Director of Mines	Passed	Drn. / Tcd. K / Ckd. / Exd.	Scale: 4 INCHES TO 1 MILE / 55·78 / Fg (ESB) / Date 25·3·55

ENV 141-5

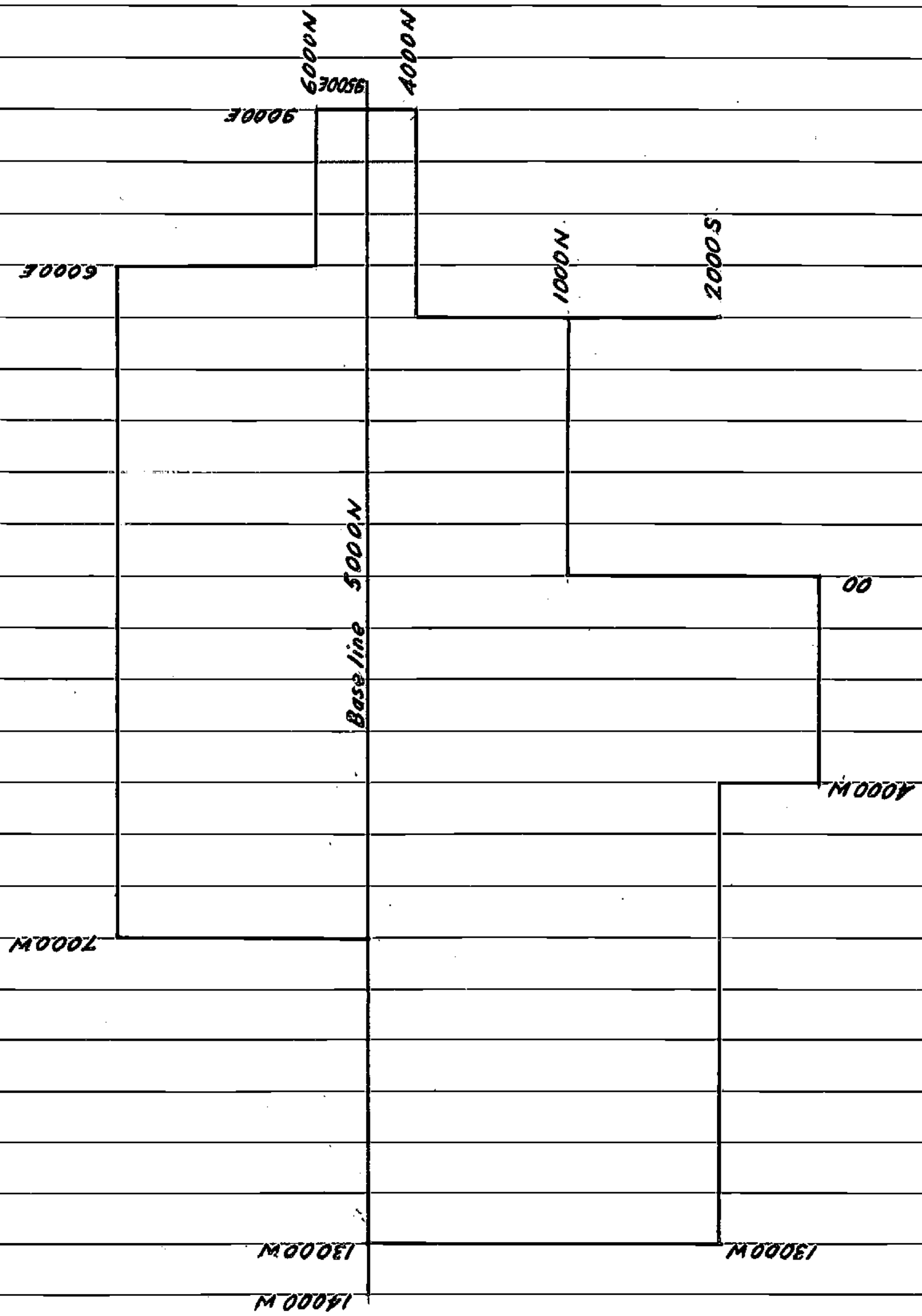
ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LTD.

ENV 741
913
028

EXPLORATION OF SML 118.

REPORT FOR 3 MONTHS ENDING 31ST Mar. 1967.

DIAGRAM SHOWING LIMITS OF INSTALLATION OF MAJOR SURVEY GRID AT CROCKER WELL



ACW

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

Azimuth Datum: Line from peg 5000N, 5000E - peg 5000N, 3000E taken as bearing 270°.

Position Datum: Peg 5000N, 5000E accepted as point of commencement.

Level Datum: Mines Dept. plug (in concrete) 5200N, 5000E.

R.L. 994·75

BASE LINE

Coordinates		R.L.	Coordinates		R.L.
5000N	14000W	805.8	5000N	2000W	876.4
"	13500W	809.2	"	1500W	879.2
"	13000W	812.2	"	1000W	882.0
"	12500W	815.2	"	500W	886.6
"	12000W	819.4	"	000	891.7
"	11500W	824.9	"	500E	893.0
"	11000W	839.0	"	1000E	902.6
"	10500W	840.2	"	1500E	904.4
"	10000W	842.6	"	2000E	929.5
"	9500W	843.7	"	2500E	937.3
"	9000W	844.4	"	3000E	963.1
"	8500W	848.4	"	3500E	936.7
"	8000W	852.7	"	4000E	943.2
"	7500W	857.9	"	4500E	967.7
"	7000W	864.7	"	5000E	1000.6
"	6500W	865.6	"	5500E	1010.0
"	6000W	864.3	"	6000E	1008.4
"	5500W	863.9	"	6500E	996.1
"	5000W	863.3	"	7000E	1050.3
"	4500W	863.6	"	7500E	1046.9
"	4000W	866.1	"	8000E	1021.9
"	3500W	869.5	"	8500E	1010.6
"	3000W	865.2	"	9000E	991.2
"	2500W	873.1	"	9500E	1016.7

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

NORTH OF BASE LINE

Coordinates	R.L.	Coordinates	R.L.
7000 W 10000 N	851.9	5000 W 10000 N	910.5
" 9500 N	848.0	" 9500 N	917.7
" 9000 N	844.7	" 9000 N	883.8
" 8500 N	843.8	" 8500 N	901.1
" 8000 N	844.1	" 8000 N	912.3
" 7500 N	845.0	" 7500 N	879.1
" 7000 N	847.2	" 7000 N	861.4
" 6500 N	849.7	" 6500 N	858.2
" 6000 N	853.4	" 6000 N	857.7
" 5500 N	859.8	" 5500 N	859.9
....		....	
6500 W 9000 N	850.2	4500 W 9000 N	898.4
....		....	
6000 W 10000 N	865.5	4000 W 10000 N	943.9
" 9500 N	860.3	" 9500 N	924.8
" 9000 N	856.0	" 9000 N	907.6
" 8500 N	859.3	" 8500 N	894.6
" 8000 N	856.0	" 8000 N	891.8
" 7500 N	852.0	" 7500 N	918.8
" 7000 N	852.3	" 7000 N	918.7
" 6500 N	853.7	" 6500 N	890.8
" 6000 N	856.7	" 6000 N	864.7
" 5500 N	860.3	" 5500 N	862.1
....		....	
5500 W 9000 N	891.6	3500 W 9000 N	927.7
....		....	

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

NORTH OF BASE LINE

Coordinates	R.L.
3000 W 10000 N	1046.2
" 9500 N	1008.5
" 9000 N	977.8
" 8500 N	946.1
" 8000 N	950.4
" 7500 N	941.6
" 7000 N	909.2
" 6500 N	877.3
" 6000 N	874.2
" 5500 N	867.3
....	
2500 W 9000 N	919.0
....	
2000 W 10000 N	1002.9
" 9500 N	935.6
" 9000 N	909.2
" 8500 N	904.3
" 8000 N	901.4
" 7500 N	894.5
" 7000 N	889.1
" 6500 N	884.4
" 6000 N	884.5
" 5500 N	876.2
....	
1500 W 9000 N	922.8
" 8500 N	926.2
" 8000 N	924.8
" 7500 N	918.0

Coordinates	R.L.
1500 W 7000 N	905.3
" 6500 N	890.3
" 6000 N	886.3
" 5500 N	884.6
....	
1000 W 10000 N	945.6
" 9500 N	932.3
" 9000 N	925.0
" 8500 N	953.6
" 8000 N	948.1
" 7500 N	911.3
" 7000 N	901.0
" 6500 N	913.2
" 6000 N	906.4
" 5500 N	907.3
....	
500 W 9000 N	993.1
....	
000 E/W 10000 N	1026.4
" 9500 N	1021.6
" 9000 N	1022.9
" 8500 N	1023.9
" 8000 N	1010.5
" 7500 N	941.0
" 7000 N	944.1
" 6500 N	930.3
" 6000 N	925.0
" 5500 N	905.0
....	

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

NORTH OF BASE LINE

Coordinates		R.L.
500 E	9000 N	1019.2
1000 E	10000 N	
"	9500 N	
"	9000 N	1020.8
"	8500 N	986.5
"	8000 N	982.4
"	7500 N	972.5
"	7000 N	929.1
"	6500 N	916.4
"	6000 N	909.8
"	5500 N	931.5
1500 E	10000 N	987.0
"	6000 N	913.0
"	5500 N	906.7
2000 E	10000 N	983.0
"	9000 N	998.5
"	8500 N	990.9
"	8000 N	976.5
"	7500 N	964.3
"	7000 N	935.6
"	6500 N	938.2
"	6000 N	910.5
"	5500 N	912.5

Coordinates		R.L.
2500 E	10000 N	998.3
"	6000 N	913.1
"	5500 N	947.9
3000 E	10000 N	1048.2
"	9500 N	1052.6
"	9000 N	995.5
"	8500 N	940.5
"	8000 N	939.0
"	7500 N	926.5
"	7000 N	920.1
"	6500 N	916.6
"	6000 N	918.5
"	5500 N	952.0
3500 E	10000 N	1056.2
"	6000 N	923.7
"	5500 N	937.6
4000 E	10000 N	1035.8
"	9500 N	1005.9
"	9000 N	984.7
"	8500 N	992.6
"	8000 N	971.5
"	7500 N	931.4
"	7000 N	960.2
"	6500 N	929.2
"	6000 N	927.7
"	5500 N	938.8

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

NORTH OF BASE LINE

Coordinates	R.L.	Coordinates	R.L.
4500 E 10000 N	1077.1	6000 E 10000 N	986.9
" 6000 N	956.8	" 9500 N	1052.2
" 5500 N	945.7	" 9000 N	1058.7
....		" 8500 N	1028.9
5000 E 10000 N	1083.4	" 8000 N	1043.6
" 9500 N	1052.0	" 7500 N	1068.8
" 9000 N	1011.4	" 7000 N	1034.5
" 8500 N	968.6	" 6500 N	967.5
" 8000 N	986.4	" 6000 N	959.0
" 7500 N	1003.6	" 5500 N	964.0
" 7000 N	1034.3	....	
" 6500 N	972.0	7000 E 6000 N	1035.8
" 6000 N	982.0	" 5500 N	1082.9
" 5500 N	989.1	....	
....		8000 E 6000 N	1109.6
5500 E 10000 N	1034.6	" 5500 N	1059.4
" 6000 N		....	
" 5500 N		9000 E 6000 N	1097.4
....		" 5500 N	1043.0
		....	

Electrolytic Zinc Co. of A/asia Ltd.

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

SOUTH OF BASE LINE

Coordinates		R.L.
13000 W	4500 N	814.5
"	4000 N	832.7
"	3500 N	874.8
"	3000 N	837.5
"	2500 N	836.9
"	2000 N	839.6
"	1500 N	841.9
"	1000 N	845.4
"	500 N	849.6
"	000	855.6
"	500 S	862.1
"	1000 S	868.3
"	1500 S	874.7
"	2000 S	880.5
....		
12500 W	000 N/S	859.1
....		
12000 W	4500 N	822.7
"	4000 N	828.1
"	3500 N	858.3
"	3000 N	845.8
"	2500 N	848.5
"	2000 N	869.0
"	1500 N	896.5
"	1000 N	865.6
"	500 N	867.7

Coordinates		R.L.
12000 W	000 N/S	864.2
"	500 S	871.0
"	1000 S	906.1
"	1500 S	971.1
"	2000 S	975.6
....		
11500 W	000 N/S	866.4
....		
11000 W	4500 N	893.4
"	4000 N	917.0
"	3500 N	907.5
"	3000 N	976.5
"	2500 N	979.9
"	2000 N	965.9
"	1500 N	946.7
"	1000 N	879.1
"	500 N	882.3
"	000	871.8
"	500 S	926.5
"	1000 S	981.5
"	1500 S	1017.5
"	2000 S	1053.0
....		
10500 W	000 N/S	905.0
....		

Electrolytic Zinc Co. of A/asia Ltd.

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

SOUTH OF BASE LINE

Coordinates		R.L.
10000 W	4500 N	854.4
"	4000 N	854.7
"	3500 N	862.1
"	3000 N	894.4
"	2500 N	882.2
"	2000 N	900.6
"	1500 N	886.4
"	1000 N	882.8
"	500 N	921.5
"	000	929.9
"	500 S	976.3
"	1000 S	1025.8
"	1500 S	1109.1
"	2000 S	1209.0
....	....	....
9500 W	000 N/S	978.6
....	....	....
9000 W	4500 N	848.7
"	4000 N	852.9
"	3500 N	859.0
"	3000 N	881.1
"	2500 N	892.0
"	2000 N	921.4
"	1500 N	897.5
"	1000 N	953.5
"	500 N	964.7

Coordinates		R.L.
9000 W	000 N/S	952.8
"	500 S	1031.0
"	1000 S	1059.6
"	1500 S	1074.7
"	2000 S	1099.3
....	....	....
8500 W	000 N/S	967.1
....	....	....
8000 W	4500 N	855.6
"	4000 N	859.2
"	3500 N	866.0
"	3000 N	908.5
"	2500 N	914.1
"	2000 N	901.1
"	1500 N	919.0
"	1000 N	917.7
"	500 N	966.9
"	000	975.1
"	500 S	959.1
"	1000 S	961.3
"	1500 S	968.7
"	2000 S	1016.8
....	....	....
7500 W	000 N/S	936.1
....	....	....

Electrolytic Zinc Co. of A/asia Ltd.

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

SOUTH OF BASE LINE

Coordinates		R.L.	Coordinates		R.L.
7000 W	4500 N	868.7	6000 W	1500 N	985.9
"	4000 N	919.2	"	1000 N	997.7
"	3500 N	918.1	"	500 N	963.5
"	3000 N	902.3	"	000	949.2
"	2500 N	903.6	"	500 S	944.4
"	2000 N	914.8	"	1000 S	924.4
"	1500 N	934.7	"	1500 S	942.8
"	1000 N	966.9	"	2000 S	978.8
"	500 N	961.3	....		
"	000	949.2	5500 W	2500 N	901.0
"	500 S	917.1	"	000 N/S	960.5
"	1000 S	975.8	....		
"	1500 S	1021.9	5000 W	4500 N	874.7
"	2000 S	1049.6	"	4000 N	892.9
....			"	3500 N	922.4
6500 W	4500 N	870.9	"	3000 N	916.3
"	4000 N	876.0	"	2500 N	
"	3500 N	880.3	"	2000 N	941.5
"	3000 N	886.9	"	1500 N	954.8
"	2500 N	894.9	"	1000 N	985.5
"	000 N/S	1008.1	"	500 N	972.0
....			"	000	938.2
6000 W	4500 N		"	500 S	943.3
"	4000 N		"	1000 S	947.5
"	3500 N		"	1500 S	995.2
"	3000 N		"	2000 S	1007.9
"	2500 N		....		
"	2000 N	945.5			

Electrolytic Zinc Co. of A/asia Ltd.

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

SOUTH OF BASE LINE

Coordinates		R.L.
4500 W	2500 N	893.2
"	000 N/S	925.3
....		
4000 W	4500 N	882.3
"	4000 N	928.8
"	3500 N	896.4
"	3000 N	886.9
"	2500 N	891.7
"	2000 N	899.5
"	1500 N	904.1
"	1000 N	909.7
"	500 N	929.9
"	000	946.3
"	500 S	935.7
"	1000 S	957.6
"	1500 S	979.4
"	2000 S	1005.9
"	2500 S	1005.0
"	3000 S	1063.8
"	3500 S	1084.8
"	4000 S	1057.9
....		
3500 W	2500 N	891.1
"	000 N/S	921.3 ?
"	4000 S	1098.2
....		

Coordinates		R.L.
3000 W	4500 N	873.4
"	4000 N	877.9
"	3500 N	880.0
"	3000 N	884.8
"	2500 N	890.3
"	2000 N	894.7
"	1500 N	897.0
"	1000 N	922.2
"	500 N	911.3
"	000	934.2
"	500 S	922.7
"	1000 S	929.5
"	1500 S	937.4
"	2000 S	945.7
"	2500 S	1008.2
"	3000 S	1046.3
"	3500 S	1052.6
"	4000 S	1112.7
....		
2500 W	2500 N	886.7
"	000 N/S	972.5
"	4000 S	1113.3
....		

Electrolytic Zinc Co. of A/asia Ltd.

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

SOUTH OF BASE LINE

Coordinates		R.L.	Coordinates		R.L.
2000 W	4500 N	873.9	1000 W	4500 N	~~882.4~~
"	4000 N	877.2	"	4000 N	~~883.4~~
"	3500 N	880.8	"	3500 N	~~886.1~~
"	3000 N	885.8	"	3000 N	~~890.9~~
"	2500 N	891.4	"	2500 N	~~902.0~~
"	2000 N	895.9	"	2000 N	927.6
"	1500 N	913.4	"	1500 N	922.8
"	1000 N	946.9	"	1000 N	926.7
"	500 N	981.0	"	500 N	931.4
"	000	998.8	"	000	954.0
"	500 S	1008.8	"	500 S	967.5
"	1000 S	942.9	"	1000 S	989.6
"	1500 S	946.4	"	1500 S	1000.3
"	2000 S	1042.0	"	2000 S	1044.1
"	2500 S	1040.8	"	2500 S	1071.2
"	3000 S	1005.4	"	3000 S	1042.7
"	3500 S	1074.8	"	3500 S	1106.4
"	4000 S	1096.6	"	4000 S	1119.9
1500 W	2500 N	897.0	500 W	2500 N	928.0
			"	4000 S	1083.7

038

Electrolytic Zinc Co. of A/asia Ltd.

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

SOUTH OF BASE LINE

Coordinates		R.L.
000 E/W	4500 N	
"	4000 N	
"	3500 N	
"	3000 N	
"	2500 N	
"	2000 N	979.8
"	1500 N	974.3
"	1000 N	998.1
"	500 N	1010.8
"	000	1021.3
"	500 S	1012.5
"	1000 S	1034.8
"	1500 S	1011.4
"	2000 S	986.7
"	2500 S	977.6
"	3000 S	993.0
"	3500 S	1039.9
"	4000 S	1022.3
500 E	2000 N	943.2
"	1000 N	1016.2

Coordinates		R.L.
1000 E	4500 N	
"	4000 N	908.2
"	3500 N	942.8
"	3000 N	915.4
"	2500 N	939.9
"	2000 N	936.3
"	1000 N	989.1
1500 E	4500 N	928.2
"	2000 N	929.7
"	1000 N	1010.9
2000 E	4500 N	
"	4000 N	982.5
"	3500 N	982.1
"	3000 N	982.4
"	2500 N	971.6
"	2000 N	984.0
"	1000 N	1047.2
2500 E	4500 N	946.6
"	2000 N	999.9
"	1000 N	1071.2

CROCKER WELL AREA

LIST OF SURVEY STATIONS INSTALLED

December 1966 - March 1967

SOUTH OF BASE LINE

Coordinates		R.L.
3000 E	4500 N	
"	4000 N	
"	3500 N	1031.2
"	3000 N	987.5
"	2500 N	983.6
"	2000 N	1016.8
"	1000 N	1083.3
....	....	....
3500 E	2000 N	1035.4
"	1000 N	1063.6
....	....	....
4000 E	4500 N	
"	4000 N	
"	3500 N	1081.6
"	3000 N	1031.9
"	2500 N	1038.0
"	2000 N	1064.6
"	1000 N	1021.3
....	....	....
4500 E	2000 N	1016.1
"	1000 N	1028.6
....	....	....
5000 E	4500 N	
"	4000 N	
"	3500 N	1252.6

Coordinates		R.L.
5000 E	3000 N	1150.1
"	2500 N	1068.6
"	2000 N	1017.4
"	1500 N	1008.6
"	1000 N	999.4
"	500 N	981.9
"	000	981.7
"	500 S	965.3
"	1000 S	959.6
"	1500 S	919.1
"	2000 S	946.5
....	....	....
6000 E	4500 N	1050.3
"	4000 N	1122.8
....	....	....
7000 E	4500 N	1096.6
"	4000 N	1129.6
....	....	....
8000 E	4500 N	1019.3
"	4000 N	1051.5
....	....	....
9000 E	4500 N	985.7
"	4000 N	976.8
....	....	....

Appended to Report for 3 months ending 31st Mar. 1967.
Exploration of SML 118.

RESEARCH FOR INDUSTRY

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA
TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:
MP 3/30/0

21st December, 1966.

Your reference:

Mr C.C. Maynard,
Electrolytic Zinc Co. of Aust. Ltd,
30 Montrose Avenue,
NETHERBY, S.A.

REPORT MP1470/67 AND 1121/67

YOUR REFERENCE:	Letter dated 26/11/66
MATERIAL:	Original Thin Sections
LOCALITY:	Crocker Well
IDENTIFICATION:	TS 3120 - TS 3127
DATE RECEIVED:	5/12/66
WORK REQUIRED:	Examination of percentages and relationships of rutile, apatite and any brannerite and reappraisal of the rock types

Investigation and Report by: I.F. Scott

Officer in Charge, Mineralogy Section: H.W. Fander

for H.W. Fander
P.A. Young
Director.

GRANODIORITIC ROCKS FROM CROCKER WELL

DESCRIPTIONS

TS 3120 - TS 3127

These rocks are granodiorites with the exception of TS 3123 which approaches an adamellitic composition. The plagioclase is An_{10-15} in composition and usually occurs as coarse crystals with inclusions of crystallographically oriented microcline. Small randomly oriented microcline crystals also occur along margins of the plagioclase grains.

Plagioclase crystals frequently contain quartz inclusions and in TS 3120 myriads of very fine white micaceous inclusions are common.

The mica minerals generally form less than 10% of the rocks. Of these biotite, with pleochroic haloes around zircon inclusions, is by far the most abundant. Minor chloritization has taken place within the biotite.

Recrystallization of much of the rock has taken place in all samples. This is especially obvious in the mosaic-like quartz areas and also along granulated grain boundaries.

POINT COUNT RESULTS

A quantitative examination for rutile, apatite and uranium minerals was carried out on thin sections TS 3120 to TS 3127.

The results of a point count (1000 points) on each sample are presented in Table 1.

TABLE 1: POINT COUNT ANALYSES

Mineral	% Mineral in Thin Sections							
	3120	3121	3122	3123	3124	3125	3126	3127
Rutile	-	0.2	0.4	-	1.0	0.4	-	0.4
Apatite	3.3	0.6	0.6	1.5	0.7	0.8	0.3	1.2
Brannerite	-	-	-	?0.2	-	-	-	-
Opaques	3.2	-	-	0.1	0.1	-	-	3.6
Others	93.5	99.2	99.0	98.2	98.2	98.8	99.7	94.8

The identification of brannerite in TS 3123 was not conclusive although the few optical properties observable correspond to brannerite. (High refractive index (high relief), prismatic blocky crystals, ?isotropic, brownish inclusions).

MINERAL ASSOCIATIONS

Apatite crystals (up to 0.85 mm in diameter) are most commonly associated with the recrystallized quartz mosaics which frequently include plagioclase crystals. In TS 3123 and TS 3120 apatite is associated with the biotite and in the latter, with opaques, all of which occur in the deformed zones.

In TS 3121, apatite actually forms an intergrowth around rutile, both of which are present in recrystallized quartz-feldspar associations.

In TS 3123 which contained two grains of suspected brannerite, the apatite was closely associated with this mineral.

Rutile occurs in crystals up to 2 mm in length (TS 3124) and has similar associations to apatite. It is frequently associated with biotite and with quartz and is also present within coarse plagioclase crystals.

jsv:2

Enclosure 813

EXPLORATION of S. M. L. 118.

082

Report for 3 monthly Period ended - - - 30th September, 1967.

Summary :

This period marked the commencement of the further exploration of the Mt. Victoria Uranium Mine area.

In preparation for exploration, an extended survey grid was installed.

A magnetometer and a ground scintillometer survey were carried out over the gridded area.

In the Crocker Well area, a magnet~~r~~ometer survey was carried out over the gridded area.

The geophysical work mentioned above was carried out by S. Webster (E.Z. Geophysicist) and is described in his report which is appended herewith.

A structural photogeological interpretation of the Crocker Well - Mt. Victoria Area was commenced.

Radon determination investigations were suspended pending further investigation of the method.

Mr. W. Johnson commenced operations as a Geological Consultant to the project.

Survey - Mt. Victoria :

A grid was laid out to cover an area approx. 2200' x 1600'. This grid is a re-establishment and extension of the old Mines Department grid and covers the area from 200 E to 2000 W and from 500 N to 1100 S. A base line was laid out by theodolite and chain along the 300 N line. From this base, pegs were laid out by stadia theodolite on a 200' square grid. The intermediate 100' pegs on the E - W lines were later installed by chaining between the 200' pegs.

Magnetometer Survey - Mt. Victoria :

The magnetometer survey showed an envelope of high magnetic activity surrounding and extending to the South of the known lodes. This conformed moderately well with the magnetic pattern shown by Mumme's survey for the Mines Department. (plan No. 55 - 241)

While this anomaly does not line up exactly with the lodes, there is little doubt that there is some connection. A stong compact anomaly stri~~k~~king E - W over a length of 150' - 200' was defined to the S W of the "lode anomaly". Its axis lies along the 600 S co-ordinate line and from east of 400 W to west of 500 W. Other possibly interesting anomalies show up further out in the area. The contour plan provided by Mr. Webster was at 100 ft / inch with coarse contour intervals. To provide further details, the magnetic information has been recontoured by Mr. J. Webb on a 50 ft./inch base with contour intervals of 200 γ. This plan will be submitted when complete.

Scintillometer Survey - Mt. Victoria.

The scintillometer survey showed there to be little activity in the area other than in the vicinity of the lodes. One small anomalous area to the North of the lodes seemed to correspond with a band of metasediments, and this could prove to be of interest.

It is proposed to carry out some fill-in work on the anomalous areas to enable contouring of the radiometrics to be carried out. It is also proposed to extend the radiometric coverage to the east of the present area.

In order to complete the picture prior to investigating drilling programs at Mt. Victoria, a geological mapping of the area is to be carried out.

Magnetometer Survey - Crocker Well :

This survey showed that there exists a highly - disturbed magnetic field in the Crocker Well area. The profiles (on 1000' to the inch) provided in Mr. Webster's report show a number of most significant trends and also appear to pick up a number of shears. To provide further details the magnetic results have been re-contoured by Mr. J. Webb on a scale of 500 ft. to the inch and at a smaller contour interval. This re-contouring will be submitted when complete. It seems certain that the magnetics will assist considerably in resolving the geology of the Crocker Well area.

Structural photo-geological interpretation - Crocker Well.

This interpretation is being carried out on 10 chain enlargements of the 20 chain Crocker Well Special low-level photography. The photography covers the bulk of the western granitic block which includes the Crocker Well - Mt. Victoria area. The work is being carried out in Perth by Mrs. E. Summers (Geologist on E.Z. Staff). Mrs. Summers worked on the Crocker Well area in the early fifties. She paid a visit to Adelaide in August to discuss ~~xhx~~ with Mr. Johnson the carrying out of the work.

Radon Determination :

After considerable experimentation, a set of equipment has been evolved which operates very satisfactorily. However, we have been unable to obtain a sufficient degree of reproducibility of results to enable the method to be used satisfactorily. Factors of up to 5 to 1 have been recorded in the activity of one hole measured on a number of days over a period. A French Atomic Energy Commission report (1963) indicated that the open hole method had been tried by them and discarded for the same reason, but that they had had considerable success with a probe forced into the ground. We are now examining the possibilities of using this method.

McPhar T V - 3 Scintillometer :

Some work was carried out largely to become familiar with and investigate the use of the 3 - threshold scintillometer. While some interesting results were shown by the tests, it is obvious that a lot more work is needed to determine how to obtain the best value out of the instrument.

- - - - oooOooo - - - -

A Report by Mr. S. S. Webster entitled "Report on Geophysical Surveys at Crockers Well and Mt. Victoria - South Australia " is appended herewith.

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

EXPLORATION DEPARTMENT

Report on Geophysical Surveys at Crockers Well and Mt. Victoria - South Australia

by

S. S. Webster

LIST OF CONTENTS

Abstract

A regional magnetometer survey of the Crockers Well Uranium Prospect showed the presence of several major structural features. However, the absence of a good geological plan precludes the assessment of the sources of the intense anomalies encountered.

The magnetometer and scintillometer survey of the Mt. Victoria area showed the absence of an intimate association between the magnetic and economic minerals. The survey, however, outlined promising magnetic anomalies, which should be geologically investigated.

Location and Access

The Mt. Victoria and Crockers Well Uranium Prospects are situated in South Australia about 100 miles west of Broken Hill. The prospects may be located on the Glenorchy and Plumbago 1 mile geological sheets, respectively.

Access is available for most of the year via gravel road from Olary or Yunta, a distance of 40 miles. These roads may be temporally impassable after heavy rains. A small aerodrome is available at Plumbago Homestead for light aircrafts.

The hilly country of the prospects is well serviced by dry weather roads.

History and Previous Work

The Mt. Victoria and Crockers Well areas were the subject of an intensive exploration programme in 1952 by the South Australian Mines Department. Both prospects were examined by geological, scintillometer, magnetic (aero and geo) and drilling programmes. Several uneconomic ore bodies were delineated and the results published.

The Glenorchy 1 mile area has been flown several times with the airborne magnetometer and the information published by the South Australian Department of Mines. The Plumbago aero-magnetic sheet is also available, but the coverage does not include the Crockers Well Prospect.

Survey Methods

The geophysical work covered by this report includes ground magnetometer and scintillometer surveys and a well-logging programme.

Crockers Well This area was covered by a regional magnetometer survey to compensate for the missing aeromagnetic coverage of the Plumbago sheet. Traverse lines were 1,000 feet apart with station spacing of 100 feet. The magnetic data is presented as profiles of vertical magnetic intensity.

The well-logging programme carried out by the South Australian Mines Department will not be discussed in this report as a detailed analysis of the data is being made by J. Webb. Several interesting correlations have been noted,however, and these may be the subject of a future memo.

Mt. Victoria A detailed magnetic and scintillometer survey was conducted on a grid established over the old survey grid but extended to the north and west.

Line spacing was 100 feet with a station spacing of 50 feet on north-south lines. The magnetic results are presented as a contour plan of vertical magnetic intensity. The scintillometer survey was carried out by averaging the counts per minute (c.p.m.) readings over 100 feet distances in relatively undisturbed areas. In anomalous areas the c.p.m. is usually averaged over 5 feet distances.

Interpretation

Crockers Well The magnetic data from Crockers Well shows an intensely disturbed magnetic field with many anomalies in excess of 3,000 gammas. The anomalies vary from sharp narrow (less than 100 feet wide) peaks to broad highs, but all exhibit characteristics of shallow sources. There is a marked contrast between the anomalous areas and the undisturbed background field.

The traverse line spacing is too large (1,000 feet) to allow detailed correlation between lines, but the intensity and width of the anomalies is of a sufficiently high order to allow good regional correlation. This regional correlation allows the area to be subdivided into zones of high and low intensities which may correspond with rock types.

Prominant zones of shearing (i.e. the Crockers Well shear) are readily discernable as small highs appearing on several traverses and forming a linear trend. The continuity of these structures is quite marked, thus ensuring the validity of their interpretation.

The preliminary interpretation sheet shows how the subdivision of the surveyed area was made and the anomalous areas are lettered A to I. Areas B and E are seen to form a prominent east-west trend, which is displaced at 3000N/3000W. This displacement combined with the sudden cut-off shown by areas H and G suggests a northwest-southeast trending fault. The trend suggested by zones B and E is generally in an area of alluvial cover, and no evidence for its presence can be suggested.

The other anomalous zones are of such lateral extent that, unless the data is influenced by unmapped N-S structures, their sources must be assigned as broad geological features.

The above conclusions may be suspect to re-interpretation when an accurate geological map is available.

<u>Mt. Victoria Prospect</u> The magnetic contour plan of the Mt. Victoria prospect shows a distinctly anomalous area in the vicinity of the shaft and uranium lode outcrops. There are very sharp cut-off gradients to the north, east and south of this anomaly grading to a low background field. The edges of the anomaly thus agree with the lode cut-offs as outlined by drilling. However, the magnetic anomalies do not appear to be as intimately associated with the uranium mineralisation as the above would suggest. The highest order anomalies are away from the lode positions,as determined by drilling, and do not trend parallel to or towards these positions.

Surrounding this anomalously high area are several moderate magnetic anomalies in an otherwise undisturbed background field. These anomalies are limited in extent and do not form into any particular trend.

The scintillometer survey of Mt. Victoria showed little or no response over the area, except for the intense disturbance in the vicinity of the mine and lode outcrops. A reading of 500 c.p.m. was chosen as background intensity and only readings above this value were recorded as significant. The 500 c.p.m. background was chosen after reading several traverses away from known mineralisation, the meter was also unsteady below this value.

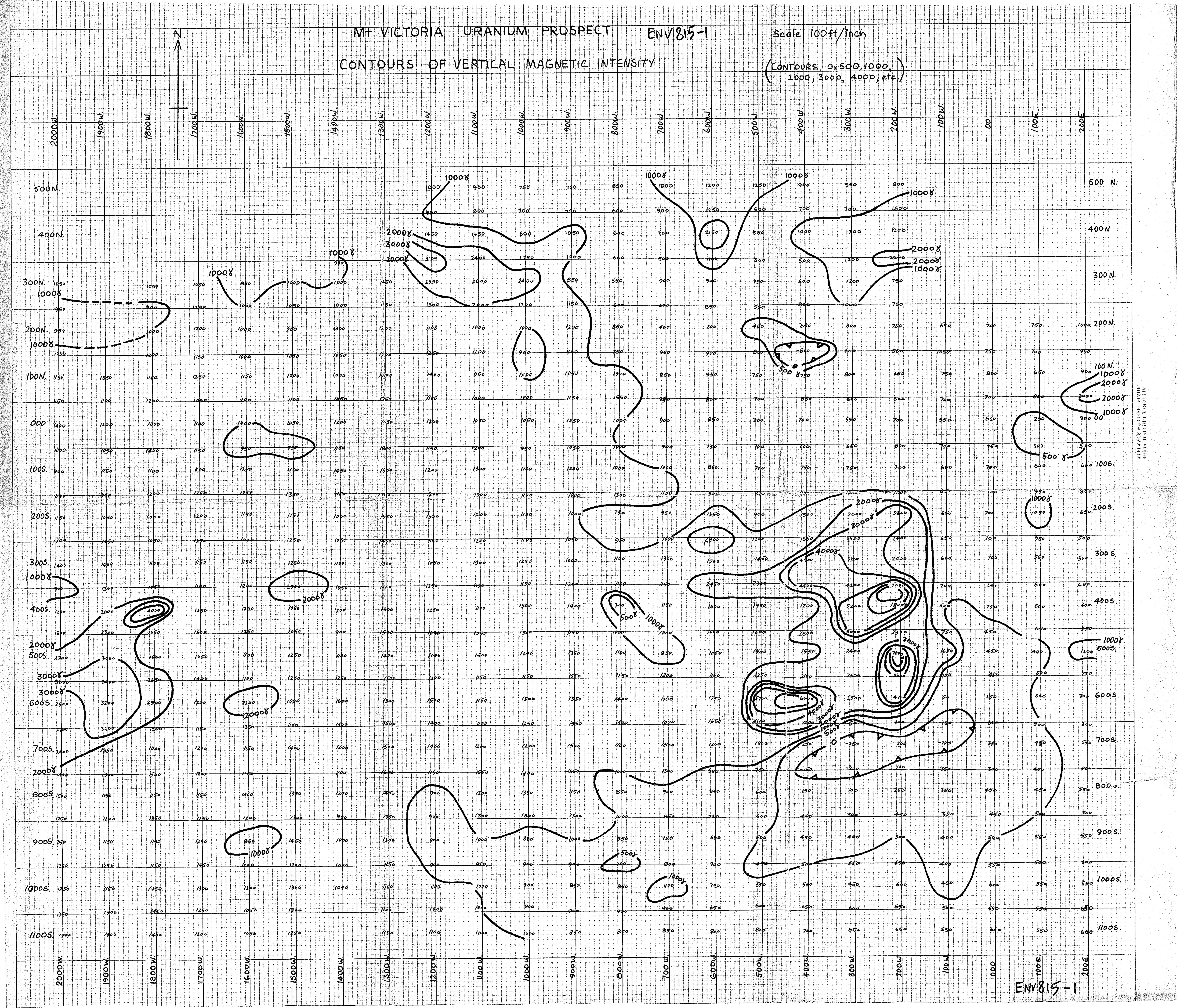
The geological investigation of Mt. Victoria recommended by W. Johnson, should also be directed to finding a source for the several magnetic anomalies scattered about the grid area. The magnetic anomaly at 600S/400-500W should especially be examined as it falls over an area of alluvial cover and could represent unexposed ore lenses, as found in a similar position between 250W and 150W on line 600S.

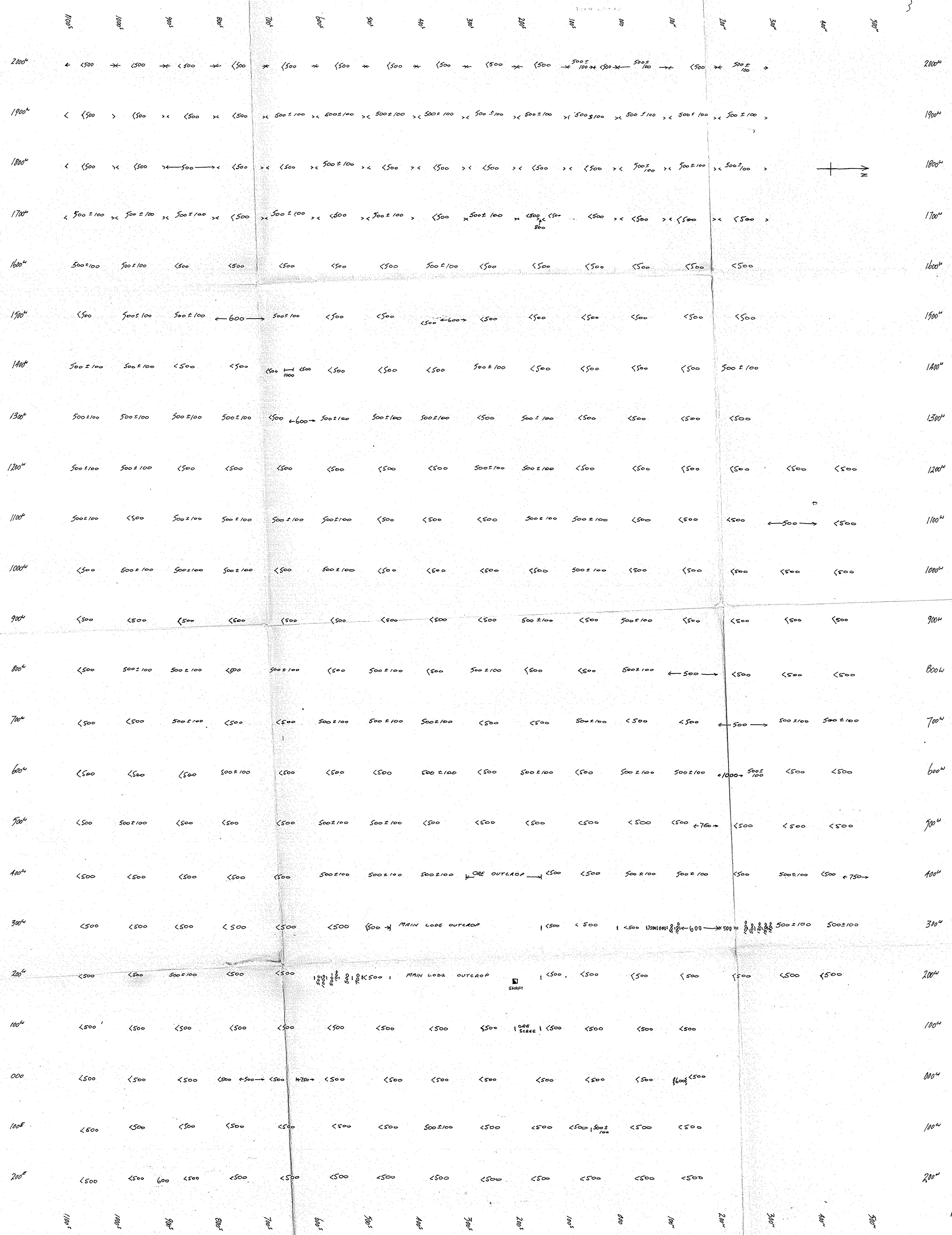
Conclusion

There are several interpretations that can be made of the magnetic data from Crockers Well. The subdivision of the area into zones of high and low magnetic intensity is the simplest interpretation and the easiest for attempted correlations with geology.

The area should be remapped geologically to determine the source of the magnetic disturbances as this is not apparent from the previous mapping. The airborne scintillometer (and aeromagnetic?) survey should help in establishing if any correlation exists between the magnetic anomalies and the uranium mineralisation.

The magnetic and scintillometer survey of the Mt. Victoria grid showed the lack of an intimate association between the magnetite and uranium mineralisation. However, the new magnetic anomalies should be checked for the presence of an unexposed lens of mineralisation.


Mt VICTORIA URANIUM PROSPECT
ENV815-1
Scale 100ft/inch
CONTOURS OF VERTICAL MAGNETIC INTENSITY
(CONTOURS 0, 500, 1000, 2000, 3000, 4000, etc.)
N.
2000W. 1900W. 1800W. 1700W. 1600W. 1500W. 1400W. 1300W. 1200W. 1100W. 1000W. 900W. 800W. 700W. 600W. 500W. 400W. 300W. 200W. 100W. 00 100E 200E
500N. 400N. 300N. 200N. 100N. 000 100S. 200S. 300S. 400S. 500S. 600S. 700S. 800S. 900S. 1000S. 1100S.
ENV815-1



Mt. Victoria Uranium Prospect

Scintillometer Survey.

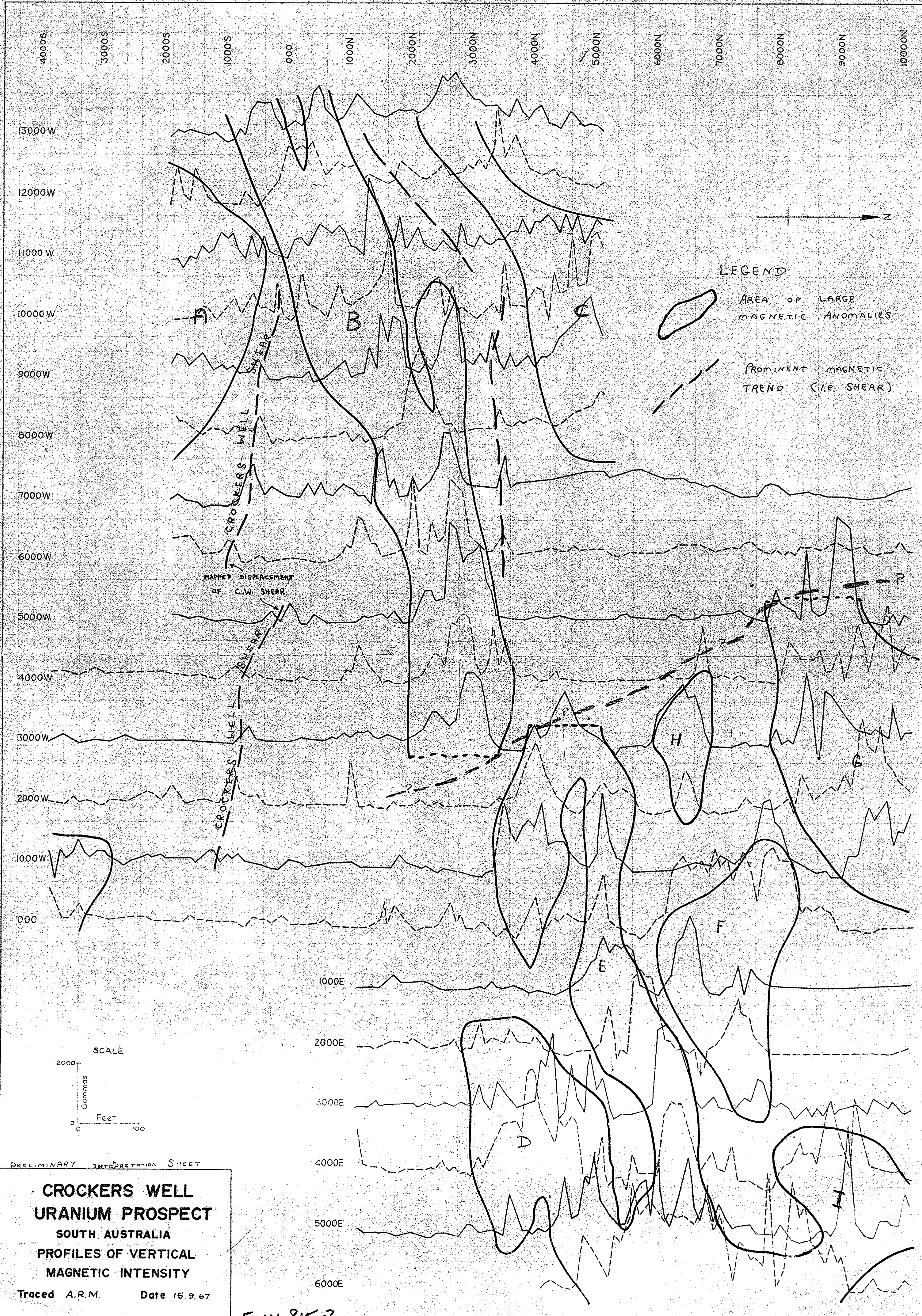
Horizontal Scale 100 feet/inch

(Plot of average count per minute over 100 ft except where shown.)

Mt Victoria Uranium prospect

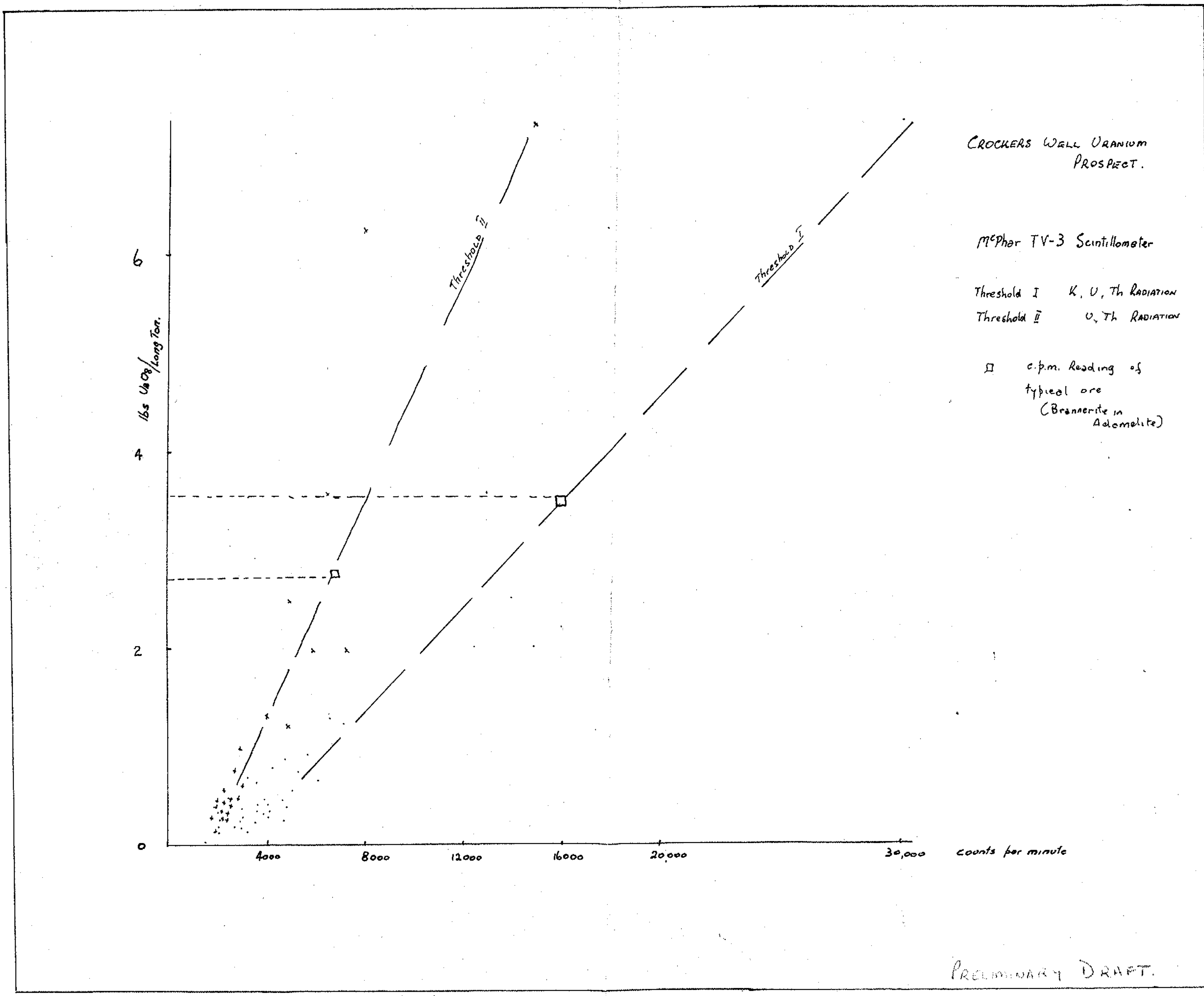
Scintillometer Survey

ENV 815-2



E.Z. Co Expln Dept BM27 — A

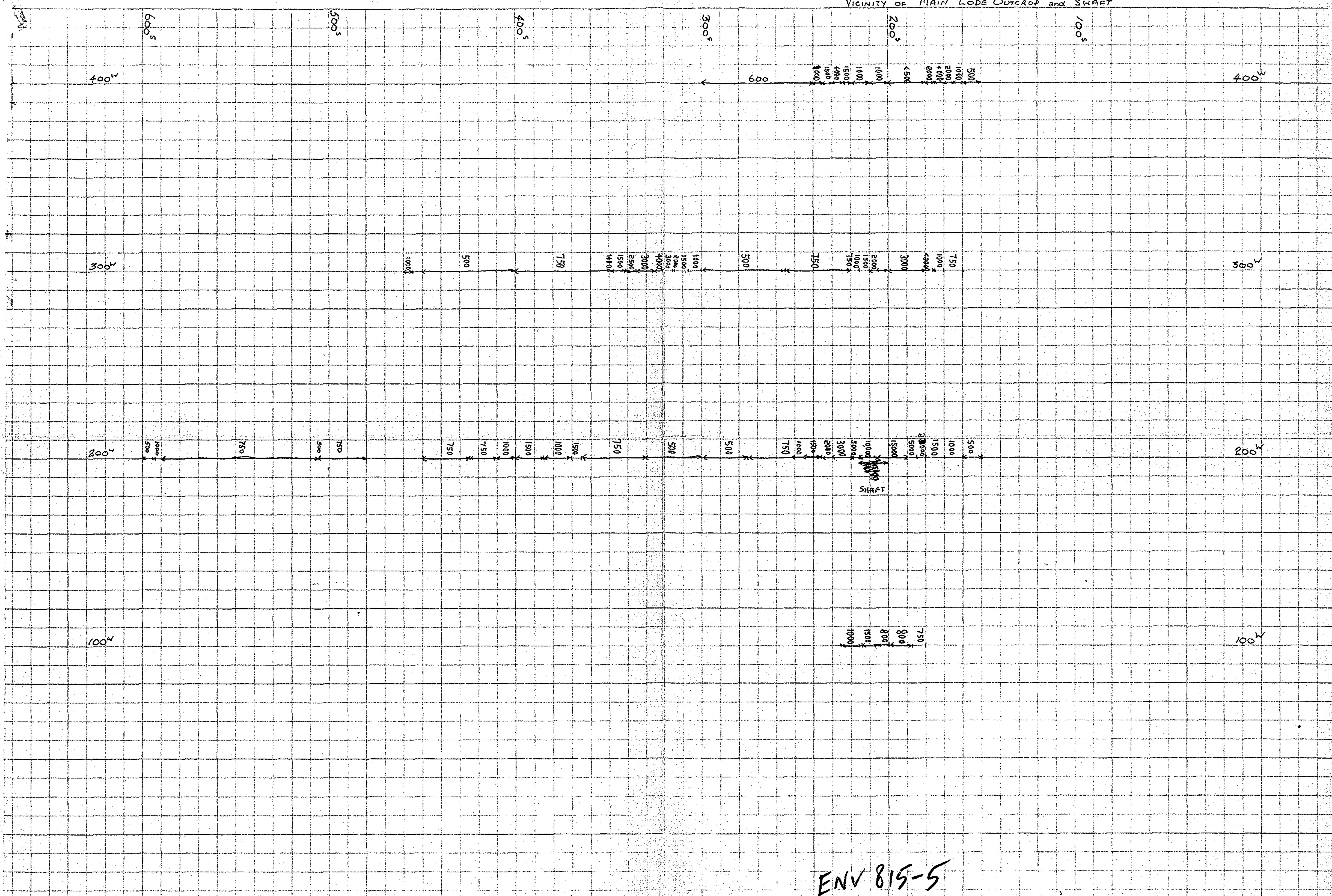
ENV 815-3



E. Z. Expln. Dept. AeM

ENV 815-4

RADIOMETRIC SURVEY (40 ft/inch)
Mt VICTORIA PROSPECT
VICINITY OF MAIN LODE OUTCROP and SHAFT



ENV 815-5

<u>Appendix</u>

The McPhar TV-3 Scintillometer distinguishes between gamma radiation emitted from Potassium, Uranium and Thorium by measuring a characteristic energy level of that minerals radiation. The energy of radiation is distributed over a continuous spectrum, but with greater intensity at particular levels. Such levels are the Potassium 1.46 Mev, Uranium 1.76 Mev and Thorium 2.52 Mev. It is at these levels that the evergy is integrated over certain ranges.

Several CEZ bore hole chip samples were tested with the scintillometer and the intensity of the radiation checked for the three available energy levels. The accompanying graphs were computed showing the measured intensity plotted against the respective U_3O_8 chemical assay values.

The radiation intensity of typical ore (Brannerite in Adamelite) was measured and also plotted on the graphs. It can be seen that the u_3O_8 chemical equivalent for the two thresholds is not equal. This information could suggest a significant amount of radiation from activated Potassium in the Adamelite.

The above conclusion could explain the problems encountered by the South Australian Mines Department in establishing a relationship between total gamma radiation and U_3O_8 chemical assays.

The McPhar TV-3 scintillometer is an important addition to equipment available for radioactive mineral exploration. Its ability to distinguish between radioactive minerals removes the necessity of many chemical assays and enables one to evaluate a prospect in the field.

References

Mero, J. L. 1960 "Uses of Gamma-Ray Spectrometer in Mineral Exploration"

Geophysics Vol. XXV No. 5 pp 1054-1076

Horwood, J. L. 1960 "A Graphical Determination of Uranium and Thorium in Ores from their Gamma-Ray Spectra."

Int. Jnl. App. Rad. & Isotopes Vol. 9 Page 16-26

Hurley, P. M. 1956 "Direct Radiometric Measurement by Gamma-Ray Scintillation Spectrometer"

Part I and II: Bull G.S.A. Vol. 67 pp 395-412

Seigel, H. O. 1966 "Airborne Radioactivity Tests - Elliot Lake Area, Ontario."

Canadian Mining Journal Page 81-87.

ENV 913

132

ELECTROLYTIC ZINC CO. A/ASIA LTD.

and

NEWMONT (AUST.) PTY. LTD.

MINERALISATION, GEOLOGY, AND STRUCTURE,

S.M.L. 118

OLARY PROVINCE, SOUTH AUSTRALIA.

by

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MINERALISATION, GEOLOGY, AND STRUCTURE, S.M.L. 118 OLARY PROVINCE, SOUTH AUSTRALIA.

TABLE OF CONTENTS

PLANS TO ACCOMPANY REPORT

(In separate folder)

SUMMARY AND RECOMMENDATIONS

Evidence is advanced to suggest an association of uranium mineralisation with a regional fracture pattern whose main elements trend north-east, north-west and east-west. Meagre evidence also suggests some stratigraphic control.

Igneous plutonic and metamorphic history of the Glenorchy-Plumbago region is more complex than previously suggested, with rocks of probable widely differing age at present classified as "adamellite" and "regional granites". Differentiation of the stratigraphy within the migmatised crystalline basement by careful mapping is believed possible.

Previous exploration, though extensive, was deficient in the examination of prospects whose outcrop manifestations were weak and little attention was paid to concealed prospects.

Aeromagnetic patterns can be related to lithology and structure and can be used to assist selection of exploration targets.

It is recommended :-

1. That Electrolytic Zinc/Newmont continue active exploration for uranium in S.M.L.118.
2. That the targets listed on pages 15-17 be explored and tested by drilling, where justified, in order of priority.
3. That concurrently with this exploration, a detailed regional mapping programme of the Glenorchy-Plumbago Region be organised and initiated.
4. That the area of the Glenorchy-Plumbago Region between lat. 31^{o} 48' S, and lat. 32^{o} 8' S, and longitude 139' 32^{o} E, and longitude 140^{o} 00' E, (approximately 630 sq. miles) be flown aeromagnetically to a specification to be drawn up by the Company's consultant geophysicist.

MINERALISATION, GEOLOGY, AND STRUCTURE,

S.M.L.118

OLARY PROVINCE, SOUTH AUSTRALIA.

INTRODUCTION

This report discusses a regional study of the relationship between radioactive mineralisation, structure, and geology in the western half of S.M.L.118, Olary Province, South Australia, made on behalf of the Electrolytic Zinc Co. of A/Asia Ltd., in response to a request for advice by Mr. R.D. Pratten in a letter dated 12th July, 1967.

The scope and objective of the study as set out by Mr. Pratten were:-

(a) "To re-study and re-investigate the structure and tectonics of the western granitic block and surrounding areas, and, in particular, the possible relationship of such to uranium mineralisation at Crocker Well and other prospects within the area; from this work, to advise on selection of favourable sites for prospecting within the area."

To complete the study within the limits of time and budget allotted and available, I have found it necessary to rely heavily on published data and restrict the gathering of additional information. However, preliminary enquiry soon revealed serious deficiences in existing information, lack of which would have seriously hampered the attainment of the main objective of the study. Notable deficiences were:-

1. A gap in the aeromagnetic data 22 miles long by 6 miles deep on the northern margin of the Plumbago 1 mile map sheet, centred about and covering the Crocker Well uranium bearing adamellite complex.

2. Lack of a reasonably accurate structure map of the region of study.

3. Lack of important geologic detail in the Crocker Well area and on a regional scale.

The deficiencies were partially remedied by:-

1. A ground magnetometer survey at 1 mile line spacing to simulate aeromagnetic coverage of the gap on the Plumbago sheet.

2. A structural photo-interpretation on a scale of approximately 1" = 10 chains of a 120 square mile area of the Mt. Victoria/Ethiudna region.

3. Geologic mapping on enlarged aerial photographs at approximately 1" = 10 chains scale of an area of 15 square miles surrounding and including the Crocker Well uranium deposits.

These projects were recommended after joint discussions with Messrs. C. Maynard and John E. Webb, and were organised by Maynard. Completion of the projects has delayed presentation of this report.

Also used in the study were:-

1. The results of auger drilling to basement through alluvium in the Crocker Well region.

2. Downhole hammer drilling in the Crocker East Prospect.

3. The results of a helicopter scintillometer survey of the Crocker Well region.

These exploration projects were initiated and organised wholly by Maynard and it is understood that he has submitted reports on the first two projects and will be submitting one on the radiometric survey when final maps are completed.

The principal original sources of information used in the present study were:-

1. Regional Geology and Mineral Resources of the Olary Province by B. Campana and D. King. Bull.No.34, Geol. Surv. S.Aust. 1958.

2. Uranium Deposits in South Australia by S.B. Dickinson et al. Bull. No.30, Geol. Surv. S.Aust. 1954.

3. Glenorchy, Plumbago, Kalabity, Olary, Ballara, Sheets of the 1 mile Geological Atlas.Geol. Surv. S.Aust.

4. Glenorchy and Plumbago Aeromagnetic Maps of Total Intensity. Scale 1 mile to 1 inch. Geol. Surv. of S. Aust.

5. Curnamona and Olary Aeromagnetic Maps of Total Intensity. Scale 1 inch to 4 miles. Geol. Surv. S.Aust.

6. Glenorchy and Plumbago Air Photo Mosaics. Scale 1 inch to 1 mile. Dept. Lands S.Aust.

7. Various unpublished maps and reports in the files of The Geological Survey of South Australia.

Additional information used in the study is contained in the maps accompanying this report, the radiometric contour plan of Crocker Well prepared under Maynard's direction, the photogeologic interpretation report with maps by E.B. Summers of Electrolytic Zinc, the Honours thesis of

T. Liverton entitled "The Petrology of a Uranium Bearing Adamellite at Crocker Well, Olary Province, South Australia" and the maps accompanying my reports on Crocker Well and Mt. Victoria uranium deposits.

It is assumed in the discussion which follows that the reader has access to items 1 - 5 in the above list, the radiometric contour plan, and Mrs. Summers' photogeologic report and maps, and to my other two reports.

The present report is confined to a discussion of the regional aspects of radioactive mineralisation in the Glenorchy-Plumbago region, which occupies most of the western half of S.M.L.118, in the Olary Province. Detailed discussion of radioactive mineralisation in the Crocker and Mt. Victoria Uranium Mine areas is presented in two separate reports with appropriate plans and recommendations. These are entitled respectively "Exploration for New Uranium Ore Bodies, Crocker Well Area, South Australia" and "Ore Prospects, Mt. Victoria Uranium Mine, South Australia".

General information on the geography and geomorphology, regional geology, mineral prospects and evaluation of the various mineral deposits, within S.M.L.118, is given in Bulletin 34 of the Geological Survey of South Australia.

OLARY PROVINCE

B. Campana (Bull.34 pp. 38-42) proposed a mechanism of structural evolution for the Olary Province primarily powered by compressional forces in the crystalline basement with folding the dominant structural expression, and shears, faults and other torsional and tensional breaks being "derived tectonic effects", constituting the subordinate expression of the tectonic forces at work in the region.

This analysis of the structure of the Olary Province differed strongly in emphasis from Sprigg (Bull.30) who gave much greater weight to the processes of crustal dislocation in the structural evolution of the Province. Both recognised the fundamental relation of mineral genesis to the structural evolution, hence a necessity for a greater understanding of its nature.

In the present study time did not allow a primary re-analysis of structure, involving as it would, a lengthy accumulation of data in the field and laboratory, but it has been possible to recognise and plot a series of "lineaments" or straight line features which can be seen on photo mosaics, supported by aeromagnetic, geomorphologic and photo-interpretative data, and the distribution of the major and minor rock groups.

The major lineaments are shown on Figure 1 where they form a well defined pattern which is repeated in greater detail on Fig. 2 accompanying this report, and on the maps accompanying Summers' report.

This pattern is one recognisable on a world wide scale* and was discussed by Hills in his paper "Morphotectonics of Australia" (Geol. Soc. Aust. Vol.3 pp. 1-16). Elsewhere in the world the fundamental crustal dislocations of the type reflected in the pattern are believed by many geologists to have contributed to the control of mineralisation and ore deposition. Certainly a spatial relationship can be demonstrated in many parts of the world. In the Olary Province some of the lineaments are coincident with mapped faults and shears; others can be seen on photo-mosaics and an expression on the ground has not yet been mapped. Others are interpreted from rock distributions and their inferred position on the ground is obscured by surficial deposits.

The cause of those lineaments in outcrop areas which cannot be referred to the traces on the ground of mapped dislocatory features must remain conjectural but the demonstrated association of radioactive mineral deposits with them hopefully offers an exploratory guide for the indication of areas of prospective mineralisation under cover.

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*Vening Meinesz, F.A., 1947. Shear Patterns in the Earths Crust. Trans Amer. Geophys. Union. 28, pp. 1-61.

One of the major lineaments of the Olary Province is Spriggs' MacDonald Hill Fault (Bull.30 Geol. Surv. S.Aust. pp. 18, 19) now re-established as a valid structural entity. This fault is one of the north-westerly trending set of Australia-wide validity and its mapped exposure of 4 miles length on the Ballara 1 mile Geological Sheet is probably only one of a series of individual faults forming part of an ancient fault zone stretching for scores and possibly hundres of miles, which in the Boolcoomatta/MacDonald Hill region is the present site of a narrow tongue of Adelaide system rocks, in-folded and in-faulted into crystalline basement. The western bordary of this zone is the Bimbowrie Lineament. Radium Hill davidite lodes are adjacent to the MacDonald Hill Fault and numerous mines and prospects are clustered around it in the Bimbowrie Boolcoomatta region but its role in mineral genesis appears to have been control of major geologic evolutionary events rather than providing the direct channelway for mineralising solutions.

In the Glenorchy-Plumbago region a structural feature comparable in geological significance to the MacDonald Hill Fault, has now been recognised and named the Killawarren Lineament. It has no mappable exposure as it traverses alluvium covered areas and has been deduced from photo-lineaments, aeromagnetic data, drainage alignment, and rock distribution. Like the MacDonald Hill Lineament, it trends N.35^{o}W. and forms a well defined boundary between Adelaide System rocks on the west and crystalline basement on the east.

A third major structure controlling the distribution of Adelaide System rocks in relation to crystalline basement has given rise to a lineament (designated Alconie) trending N.60^{o}E. between Alconie Hill and Antro Woolshed. This lineament marks the virtual southern limit of the Mt. Victoria/Crocker Well crystalline basement complex and is offset in the vicinity of Plumbago Homestead. It is a member of the lineament set of which the Anabama and Darling Lineaments (Hills op. cit.) are the most notable representatives in eastern Australia.

The Killawarren, Alconie and MacDonald Hill Lineaments exert major control on present day outcrop distribution of Adelaide System rocks in the Olary Province, and as they are ancient features predating Adelaide System time, almost certainly exerted some control on deposition of those rocks through their influence on basin formation.

They also delimit the areas containing significant radioactive mineral deposits. With the exception of Radium Hill significant uranium deposits are confined to the Glenorchy-Plumbago region and specifically that area of outcrop north of the Alconie Lineament, and between the Killawarren Lineament and the northerly extension of the Bimbowrie Lineament.

GLENORCHY-PLUMBAGO REGION

Regional Aspects

Within this area numerous lineaments have been identified which have a close spatial relationship with the radioactive mineral deposits. The major ones, indicated on Figs. 1 and 3, belong to three sets:-

1. With a north-westerly trend parallel to the Killawarren Lineament; e.g. Spring Hill, Ethiudna, Weekeroo, Plumbago, Mt. Victoria/ Mindamereeka, Billeroo, Windamerta.
2. With a north-easterly trend parallel to the Alconie Lineament; Tombstone, Victoria Hut, Black Hill, Lively, Billeroo Mine, Mt. Victoria Mine.
3. With a mean trend about N.80°W. e.g. Crocker, Crocker East and Arkarula/Outalpa Lookout.

When these lineaments are compared with the geology, mineralisation, and aeromagnetic data, some interesting and significant associations emerge.

The most obvious is the lineament controlled essentially rectangular or rhomboidal pattern of the migmatised portion of the crystalline basement exposed in the Glenorchy-Plumbago region, which is plainly indicated on Figs. 1 and 2. Not quite so obvious is the lineament control of:-

(i) location of anatectic "regional granite" masses.

(ii) Soda metasomatism leading to "adamellite".

(iii) Intrusion of remobilised "granites" "adamellites" and other acid igneous types of rock.

This control is better illustrated by Fig. 2 (this report), by Wilson's geological maps of Crocker Well and Mt. Victoria (Fig. 1, Crocker Well Report, Fig. 1 Mt. Victoria Report), and by the composite map accompanying Summers' photo-interpretation. On these maps, anatectic granite, adamellite, and remobilised and intrusive granitic rocks can be related to mapped shears and faults as well as inferred lineaments.

From this evidence it can be inferred that the lineaments, or structures, were in existence when metamorphism began in the region and were one of the controls of metamorphic processes which were basic causative factors in the formation of some, if not all, the radioactive mineral deposits of the region.

Specific Lineament Associations

Specific associations observed are as follows:-

1. "Anatectic Granites"

(i) Talbot Gum Creek, Mt. Victoria Central, Mt. Victoria East, and Tombstone Hill, "Plutons" with the major Mt. Victoria/ Mindamereeka Lineaments and complementary lesser magnitude north-easterly trending lineaments.

(ii) Windamerta "Pluton" with Windamerta, Windamerta West and Mine Lineaments.

(iii) Ethiudna "Pluton" with Ethiudna and Lookout major northwest lineaments and lesser north-east lineaments.

(iv) Plumbago "Plutons" with Lookout Lineament.

(v) Mindamereeka "Pluton" with Mindamereeka Lineament.

(vi) Weeroopie Hill and Tombstone Hill "Plutons" with Weeroopie and South Weeroopie Lineaments.

(vii) Jagged Rocks "Pluton" with Black Hill and Jagged Rocks Lineaments.

2. "Adamellite"

Boundaries of the adamellite "envelope", within which adamellitic rocks have been formed by metasomatism from, or have intruded migmatite and meta-sediment, are closely associated with the Crocker Well and Crocker East shears and are possibly controlled by the Crocker North, Crocker Well, Tombstone ~~West~~ North and Airstrip Lineaments.

3. "Radioactive Mineralisation"

Zoning of mineralisation in the Plumbago-Glenorchy district was noted by King (Campana & King, op. cit. pp. 57, 58) and explained by him as resulting from the influence of geology allied with temperature of deposition. King's causes of zoning are not entirely satisfactory when examined closely (e.g. the "plutons" of Talbot Gum Creek and Windamerta have little or no "high temperature" minerals of Zone II associated with them).

However, addition of a structural factor clarifies, empirically at least, the zones of radioactive minerals.

Thorium and Uranium/Thorium Zone:- The absite/samarskite and purely thorium associated minerals (monazite, thorite, orthite, xenotime) are practically confined to the rhomb delineated by the Victoria Hut, Tombstone, Ethiudna and Mindamereeka Lineaments, with a minor extension northeast of the Mindamereeka Lineament as far as the Weeroopie Lineament.

Subzones within this larger zone are:-

(i) Absite-brannerite confined to the rhomb delineated by Crocker Well, Crocker North, Airstrip West and Tombstone North ~~West~~ Lineaments.
This Crocker Well absite bearing adamellitic envelope is also the area of intersection of a large number of structures, lineaments and shears, belonging to the three sets noted previously.
Some close control of mineralisation in the Crocker Well area by shears has been noted by previous workers and is further confirmed by Wilson's mapping. This control is discussed in the Crocker Well report.

(ii) The monazite mineral association west of Mt. Victoria confined between Glenorchy East, Mt. Victoria, Camp North and Windamerta South Lineaments.

(iii) Monazite association east of Mt. Victoria confined between Mindamereeka, Victoria Hut, Billeroo and Camp North Lineaments.

(iv) Monazite association of Tombstone Hill confined between Mindamereeka, Weeroopie, Camp Main and Tombstone Lineaments.

Uranium Zone:- Davidite occurs in minor amounts in the Victoria Hut, Mindamereeka, Tombstone, Ethiudna Lineament rhomb chiefly south of the Crocker and west of Ethiudna Hill Link shear but is mainly found north of the Victoria Hut Lineament, east of the Mindamereeka Lineament and south of the Tombstone Lineament.

The bulk of the discovered davidite and secondary pure uranium deposits are within the block outlined by the Black Hill, Victoria Hut, Spring Hill and Billeroo Lineaments. The davidite occurs in lodes and the biggest deposit, Mt. Victoria, is the focus of a large number of lineaments and shears.

The other davidite occurrences are:-

(i) In the block between the Spring Hill and Billeroo Lineaments north of the Black Hill Lineaments.

(ii) Intermixed with the thorium and thorium/uranium minerals in the block defined by the Victoria Hut, Billeroo, Tombstone North and Mindamereeka Lineaments.

(iii) In the Mindamereeka Hill block between the Plumbago East, Mindamereeka Lineaments and two unnamed north-easterly trending lineaments passing through the Mindamereeka Hill "Pluton".

Many of the radioactive mineral deposits are located directly on or straddle identifiable lineaments. Examples are:-

DEPOSIT	MINERAL	LINEAMENT
Spring Hill	Davidite	Spring Hill (main) Spring Hill Terminal 1
Jagged Rocks	Davidite	Jagged Rocks 1
Windamerta North	? Secondary Uranium	Windamerta West Windamerta South
Windamerta South	Secondary Uranium	Glenorchy East
Talbot Gum Creek	Secondary Uranium	Mt. Victoria Talbot Creek
Mt. Victoria	Davidite	Mt. Victoria Magnetic Lineament A
Crocker South	Absite	Crocker Link
" Original	Absite Davidite	Airstrip
Crocker East	Absite	East Crocker
" Central	Absite	East Crocker
" West	Absite	East Crocker
" South-West	Absite	~~3500N. 2000E.~~ Shear 3500N. 2000E

4. "Other Minerals"

Copper has been found erratically wide spread in the Glenorchy-Plumbago region associated in places with minor nickel cobalt and tungsten.

The majority of occurrences are concentrated in three sectors:-

(i) West of Spring Hill and north of Black Hill Lineament.

(ii) East of Billeroo Lineament between Black Hill and Weeroopie Hill Lineaments.

(iii) In the block between Tombstone, Plumbago, Alconie and Arkarula/Outalpa Lineaments.

A notable feature of these three areas is the total absence of recorded uranium mineralisation.

IGNEOUS ROCKS AND MINERALISATION

The principal features to be discussed under this heading are the genesis and emplacement of the Crocker Well absite bearing "adamellite", and of the regional "granite", and their relation to the uranium/thorium mineralisation of the Glenorchy-Plumbago region.

Adamellite has been differentiated as such on published maps at only two other places in the Olary Province; Triangle Hill/Bimba Hill and 4 miles south of Kalabity. At these localities the adamellites differ petrographically from the Crocker Well adamellite and no absite has been found in them. Airborne radioactive anomalies found over Bimba Hill by

Harris* and ground checked by H. Campana, showed higher than background radioactivity, source not identified, which occurred in a biotite schist. Elsewhere "adamellite" according to the legends of published maps is included in the areas differentiated as anatectic granites.

Though the self-evident uniqueness of the Crocker Well adamellite is not explicable from present available evidence some new facts and inferences from them are worth recording here. Wilson's mapping and observations (Crocker Well Report Appendix and Fig. 1) have strengthened my view that the whole "granitic" type rock sequence in the Plumbago Glenorchy region could result from a long, continuous, igneous evolutionary process, including magmatic differentiation, the end products of which may be the unstressed leucogranitic intrusives mapped by Wilson and the amphibolitic basic dykes occupying some shears or faults. Certainly at Crocker Well there are unstressed and stressed "adamellites", obvious intrusive "adamellites" and "adamellites" obviously formed by replacement of pre-existing rocks, all forming part of a continuous or discontinuous record of igneous evolution, and possibly representing events separated by hundreds of millions of years.

Only two supported radioactive datings are available to assist elucidation of igneous evolution and mineral genesis. One is an age of 1580 million years for the adamellite® from Binberrie Hill on the Outalpa 1 mile sheet, shown as an area of anatectic granite. The other is a determination of the absite at Crocker Well at 580 $\pm$ 30 million years (Campana & King, op. cit. p.28).

These do not help very much as the dated adamellite cannot be correlated positively with the Crocker Well adamellite. However, if the two are coeval then it seems possible that the absite-brannerite mineralisation was much younger than part or most of the "adamellite" and may be related to the intrusion of the unstressed "leuco-granite" mapped by Wilson between grid lines 2 W, 2 E, 9 N and 11 N. In fact the radiometric survey shows the leuco-granite to be relatively "hot" and the adamellite mass to the south-east of the shear to be practically "dead" (Crocker Well Report Fig.1 and radiometric map, Maynard's Report) which is consistent with the leuco-granite being a source.

---

*Harris, J.L., 1956, Airborne Radiometric Survey of Portions of the Olary Province. UNPUB. REP. GEOL. SURV. S.AUST. G.S. 544 REP. BK 43/25.

®Compston, W., Crawford, A.R., Bofinger, V. 1966. A Radiometric Estimate of the Duration of Sedimentation in the Adelaide Geosyncline, South Australia. <u>JOURN. GEOL. SOC. AUST.</u>, 13 Pt.1 pp. 237, 238, 272.

The absite age may, of course, be that of the latest metamorphism in the area. Supporting this inference is the lack of uranium mineralisation in Sturtian and Torrension rocks all of which are as old, or older than, the absite age.

It is obvious that the sequence of formation of all the rocks of igneous appearance in the Plumbago-Glenorchy region, which is one key to mineral genesis, is much more complicated than would appear from B. Campana and King's account, and can be unravelled only by a combined petrologic and radioactive dating investigation.

The detailed maps of the various daviditic or secondary uranium mineral occurrences show that these too are spatially associated with leuco-granitic rocks. In marked contrast to the absite mineralisation, davidite tends to occur in veins and lodes, rather than disseminated in joint cracks and fractures. The principal known davidite deposit at Mt. Victoria Uranium Mine is a "lode" which may be a particular metasedimentary horizon. The "lode" is in a metasedimentary sequence containing conglomerates (Mt. Victoria Report Fig.1 Appendix 1). Similar meta-conglomerates were observed by me 2 miles east of Antro Woolshed on the Olary Plumbago road. These observations emphasise the possibility of stratigraphic control of uranium mineralisation in the Glenorchy-Plumbago region of "crystalline basement", analogous to the uranium mineralisation of the Blind River conglomerates and the Rand "banket", which has not been recognised owing to insufficient detail in the mapping.

I am of the opinion that the stratigraphic control of the davidite ore bodies is worth investigating.

* MAGNETIC FEATURES

On a regional scale many of the major and minor lineaments shown on Figs. 1 and 2 are supported by aeromagnetic data as displayed on the composite magnetic contour map*, (Fig. 4 accompanying this report). Examples are the Killawarren, Ethiudna, Spring Hill (in part) Glenorchy West and Black Hill Lineaments.

Other lineaments such as Victoria Hut and Tombstone do not have a magnetic counterpart and conversely magnetic lineaments have been noted (A, parts of B, D and E) which cannot be matched with photo/geologic lineaments.

---

* Prepared from the two separately flown aeromagnetic sheets, Glenorchy and Plumbago, and the ground magnetic map prepared by John Webb from ground magnetometer traverses run to fill the gap on the Plumbago sheet.

Many of the uranium deposits fall directly on magnetic lineaments and others have the consistent spatial relationships with certain magnetic features described below:-

1. The imperfect but marked peripheral distribution of davidite around the oval shaped magnetic lows centred:-

   (i) 1 mile south of Jagged Rocks.
   (ii) 1 mile E.S.E. of Windamerta Hill.
   (iii) 1½ miles S.E. of Mt. Victoria Trig.

2. The peripheral distribution of complex pegmatitic uranium thorium minerals around the ovoid low centred close to Ninnerie Dam.

3. The containment of Crocker Well absite/brannerite deposits between two magnetic lineaments, and chiefly in the eastern quadrant of a crudely X-shaped magnetic pattern (the western quadrant of this pattern is occupied by alluvium suspected to be covering adamellite in part).

4. The location of original Crocker absite bearing "pseudo-breccias" at the intersection of four magnetic high trends.

5. The location of a number of the "pure" uranium (davidite, secondary uranium minerals, etc.) deposits on the steeper magnetic gradients between "highs" and "lows" e.g. Jagged Rocks, Windamerta North, Mt. Victoria, Billeroo.

The basic significance of these associations has not been determined but they can be used to delineate prospective areas for further uranium search.

EXPLORATION PROSPECTS

REVIEW OF PREVIOUS EXPLORATION

Exploration over an extensive period by the Department of Mines consisted of three major lines of attack:-

1. Dectection of areas of anomalous radioactivity by airborne scintillometer surveys and ground search by prospectors using radiation detectors under geological direction. Part of the ground search force was diverted to identifying and testing the sources of air detected anomalies.
   The airborne scintillometer surveys were done in two stages. The first survey was by the Bureau of Mineral Resources in 1953, flown at a height of 500 ft., and the second was by the Department of

Mines in 1955/56, flown at a height of 100 ft. or less on lines spaced 150' - 200' apart.

2. Concurrent regional mapping and geologic studies to delineate the basic geology of the region and determine its geologic history. Geologists engaged on regional mapping also reported radioactive mineral finds.

3. Detailed mapping and testing of radioactive areas found by original ground search and by identification of air detected anomalies.

A strong mineralogic and petrologic laboratory investigation and a metallurgical research programme supported the field work.

This exploration resulted in numerous discoveries of radio-active occurrences including the major finds of Crocker Well and Mt. Victoria. The success of the exploration programme could easily obscure its deficiencies.

Prominent among these was the difficulty of identifying on the ground the source of airborne anomalies. Harris (op. cit.) attributes most of the anomalies to the mass effects of high background radiation, and, in fact, none of the anomalies found in the second stage airborne survey were tested by grid pattern ground radiometric surveys or drilling.

It should be noted too that with the exception of the Crocker Well, Mt. Victoria and Spring Hill deposits, none of the other prospects found by ground search, e.g. Jagged Rocks, Windamerta South and North, Billeroo, Mindamareeka and Talbot Gum Creek, were detectable from the air, except by special traverses employing the knowledge of their location. (Harris op. cit. p.11)

The implication of this is that the flying of traverses with the scintillometer is effective only in discovering large deposits which have either an extensive area of outcrop such as Original Crocker and East Crocker, or intense radioactivity such as Mt. Victoria.

The previous exploration can be assumed to have discovered all the surface deposits of any economic magnitude and the new exploration must concentrate on deposits completely concealed under soil, alluvium, or rock cover or deposits whose surface expression is a small area of strong radioactivity, or that "higher background radio-activity" which was the inferred cause of most of Harris' air-detected anomalies.

NEW EXPLORATION PROGRAMME

The new exploration targets are to be sought in areas where the study reported in the previous pages indicates insufficient previous work or a lithologic and structural environment favourable for uranium mineralisation. This search will be possible using existing data but the prospects of success will be greatly enhanced if the investigation of the proposed target areas is accompanied by renewed gathering of regional information. In particular, mapping within the "migmatitic" areas of the crystalline basement at a scale large enough to determine stratigraphy and fold structures in the metasediments would assist the investigation of structural control of the uranium mineralisation which is at present dependent entirely on relating the deposit to fault and shear structures.

A new aeromagnetic survey of the Glenorchy-Plumbago crystalline basement area is advised also to give a map with aeromagnetic data on a consistent basis over the whole area. This will assist both the study of uranium deposits in relation to the magnetic features and the basement mapping programme.

The radioactive rock dating programme recommended for the Crocker Well area (Report "Exploration for New Uranium Ore Bodies, Crocker Well Area, South Australia by W. Johnson) should be extended to assist in the basement mapping programme.

Exploration Targets

1. Previously known mineralisation

(i)	Billeroo	(Davidite)
(ii)	Talbot Gum Creek	(Uranophane)
(iii)	Jagged Rocks	(Davidite)

Discussion: All of these occurrences are uranium mineralisation associated with regional granite "plutons" and on the gradients between magnetic lows and magnetic lineaments. The Billeroo occurrences are compound, being on either side of an irregular easterly extension of the marked "high" centred one mile east of Mt. Victoria Uranium Mine.

All the occurrences offer a prospect of concealed ore bodies of which the surface radioactivity could be a reflection. Billeroo and Jagged Rocks adjoin alluvium covered prospective area.

2. <u>Disseminated absite/brannerite in adamellite</u>

An alluvium concealed

(i) Magnetic low centre near Ninnerie Dam and Bore.
(ii) Low centred $1\frac{1}{2}$ miles south-east of Mt. Victoria Trig.
(iii) Magnetic low centred 2 miles south-east of Marshes Dam.

Rock concealed

(i) Magnetic low centred $1\frac{1}{2}$ miles south of Old Station Dam.
(ii) Magnetic low centred one mile south of Neville's Bore (Jagged Rocks area).
(iii) Ill-defined magnetic low centred 3 miles due north of Mt. Victoria Trig.

<u>Discussion</u>: No authenticated absite is reported in the Glenorchy-Plumbago Region outside the Crocker Well area nor is any sizeable adamellite mass shown on the 1 mile map sheets, though adamellite has been reported in the detailed mapping of individual prospects. In spite of this discouragement the prospects for finding a repetition of the Crocker Well geologic environment some distance away are considered to be good enough to warrant spending some exploration money on searching for a similar uranium bearing adamellite in concealed areas or area considered to be inadequately mapped and explored.

The targets suggested above are based on the demonstrated low magnetic susceptibility of the adamellite and structure patterns similar to those controlling Crocker Well.

The area of the ill-defined magnetic low centred about 3 miles due north of Mt. Victoria Trig has many similarities with the Crocker Well area. It is magnetically a crude mirror image of Crocker Well in that it is on the opposite side of Magnetic Lineament A in the same relative position to a well-defined magnetic "high" (that centred $1\frac{1}{2}$ miles NNW of Mt. Victoria Trig) and a magnetic low (that centred 1 mile west of Mt. Victoria Uranium Mine) as is Crocker Well to the "high" centred 2 miles south-west of Victoria Hut and the low centred around Ninnerie Dam and Bore. It is also bounded by two lineaments, one of which has been mapped in part as a shear, to the north and south, having the same south of east trend as the East Crocker and Crocker Well Shears.

3. Davidite Prospects

(i) Area extending 2 miles S.40° W. from Mt. Victoria Uranium Mine along the north-western side of Magnetic Lineament A.

(ii) The alluvium covered area extending 1 mile south from the Windamerta North uranium prospect.

Discussion: Tfhe magnetic low centred 1 mile west of Mt. Victoria Uranium Mine has numerous davidite or secondary uranium occurrences distributed peripherally around it. Mt. Victoria Uranium Mine is situated on a relatively high magnetic gradient between the "low" and Magnetic Lineament A, and it is suggested that repetitions can be sought in other positions around the "low" where the magnetic gradient is similarly high.

The suggested order of priority of exploration for the above targets is as follows:-

1 (i)	Billeroo (Davidite) Low.
2 B (iii)	Magnetic low centred 3 miles north of Mt. Victoria Trig.
1 (ii)	Talbot Gum Creek.
1 (iii) & 2 B (ii)	Jagged Rocks.
2 B (i)	Magnetic low centred on migmatite outcrops 1½ miles south of Old Station Dam.
2 A (ii)	Magnetic low centred 1½ miles south-east of Mt. Victoria.
2 A(i)	Magnetic low centred near Ninnerie Dam and Bore.
2 A(iii)	Magnetic low centred 2 miles south-east of Marsh's Dam.
3 (i)	Area 2 miles south-west from Mt. Victoria Uranium Mine.
3 (ii)	Alluvium covered area extending 1 mile south from Windamerta North Uranium Prospect.

CONCLUSIONS AND RECOMMENDATIONS

The study reported in the previous pages has shown that there is at least a discernible empirical relationship between mineralisation, lithology structures of the dislocatory type, and magnetic features and it is concluded:-

1. That continued regional exploration for uranium deposits in the Glenorchy-Plumbago Region based on these empirical relationships is justified.

2. It is also concluded that the prospects of finding additional uranium deposits in the area will be greatly enhanced by a programme of regional mapping supported by appropriate laboratory studies and a new aeromagnetic map of the Glenorchy-Plumbago region.

It is recommended:-

1. That Electrolytic Zinc/Newmont continue active exploration for uranium in S.M.L.118.

2. That the targets listed in the previous section be explored and tested by drilling, where justified, in order of priority.

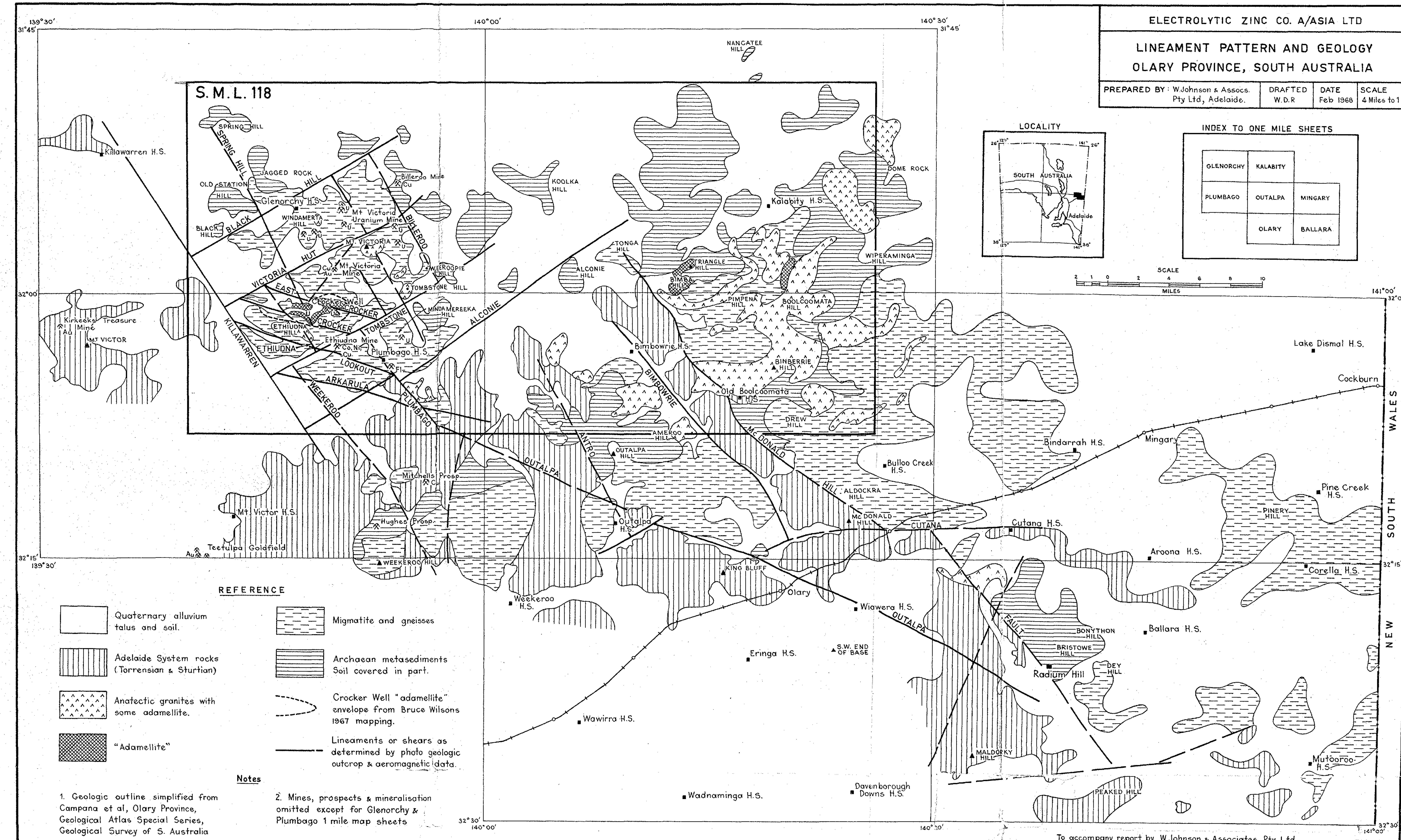
3. That concurrently with this exploration a detailed regional mapping programme of the Glenorchy-Plumbago Region be organised and initiated.

4. That the area of the Glenorchy-Plumbago Region between lat. 31^{o} 48'S, and lat. 32^{o} 8' S, and longitude 139' 32^{o} E, and long. 140^{o} 00' E, (approximately 630 sq. miles) be flown aeromagnetically to a specification to be drawn up by the Company's consultant geophysicist.

W. Johnson

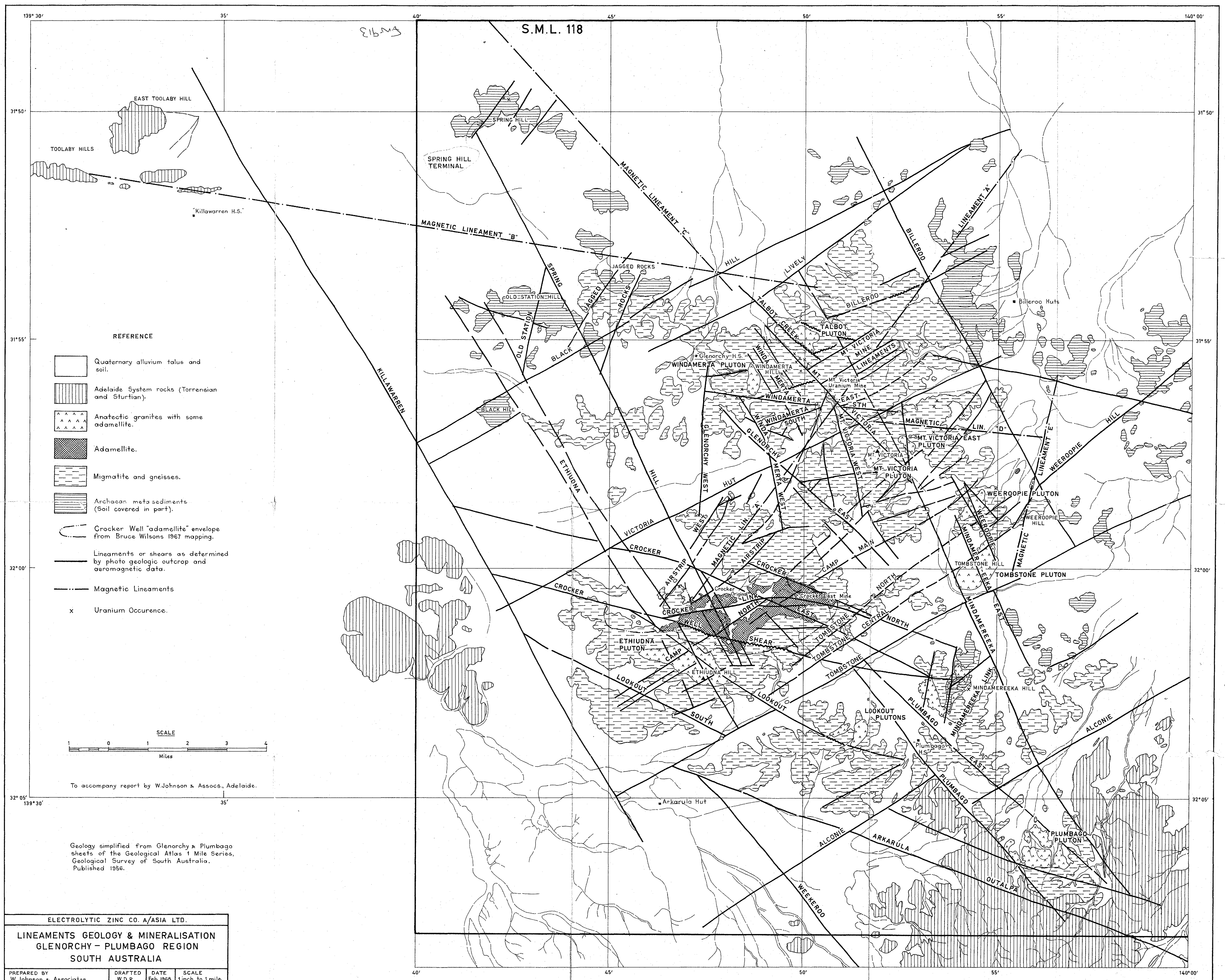
W. JOHNSON
CONSULTING GEOLOGIST

23rd February, 1968.



...ERALISATION, GEOLOGY, & STRUCTURE,
SPECIAL MINING LEASE 118,
OLARY PROVINCE SOUTH AUSTRALIA

ENV 848-1



REFERENCE

- Quaternary alluvium talus and soil.
- Adelaide System rocks (Torrensian and Sturtian).
- Anatectic granites with some adamellite.
- Adamellite.
- Migmatite and gneisses.
- Archaean meta sediments (Soil covered in part).
- Crocker Well "adamellite" envelope from Bruce Wilsons 1967 mapping.
- Lineaments or shears as determined by photo geologic outcrop and aeromagnetic data.
- Magnetic Lineaments
- x Uranium Occurence.

SCALE

1 0 1 2 3 4

Miles

To accompany report by W.Johnson & Assocs., Adelaide.

Geology simplified from Glenorchy & Plumbago sheets of the Geological Atlas 1 Mile Series, Geological Survey of South Australia. Published 1956.

ELECTROLYTIC ZINC CO. A/ASIA LTD.

LINEAMENTS GEOLOGY & MINERALISATION GLENORCHY – PLUMBAGO REGION SOUTH AUSTRALIA

PREPARED BY	DRAFTED	DATE	SCALE
W.Johnson & Associates	W.D.R	Feb 1968	1 inch to 1 mile

MINERALISATION, GEOLOGY, & STRUCTURE,
SPECIAL MINING LEASE 118,
OLARY PROVINCE SOUTH AUSTRALIA

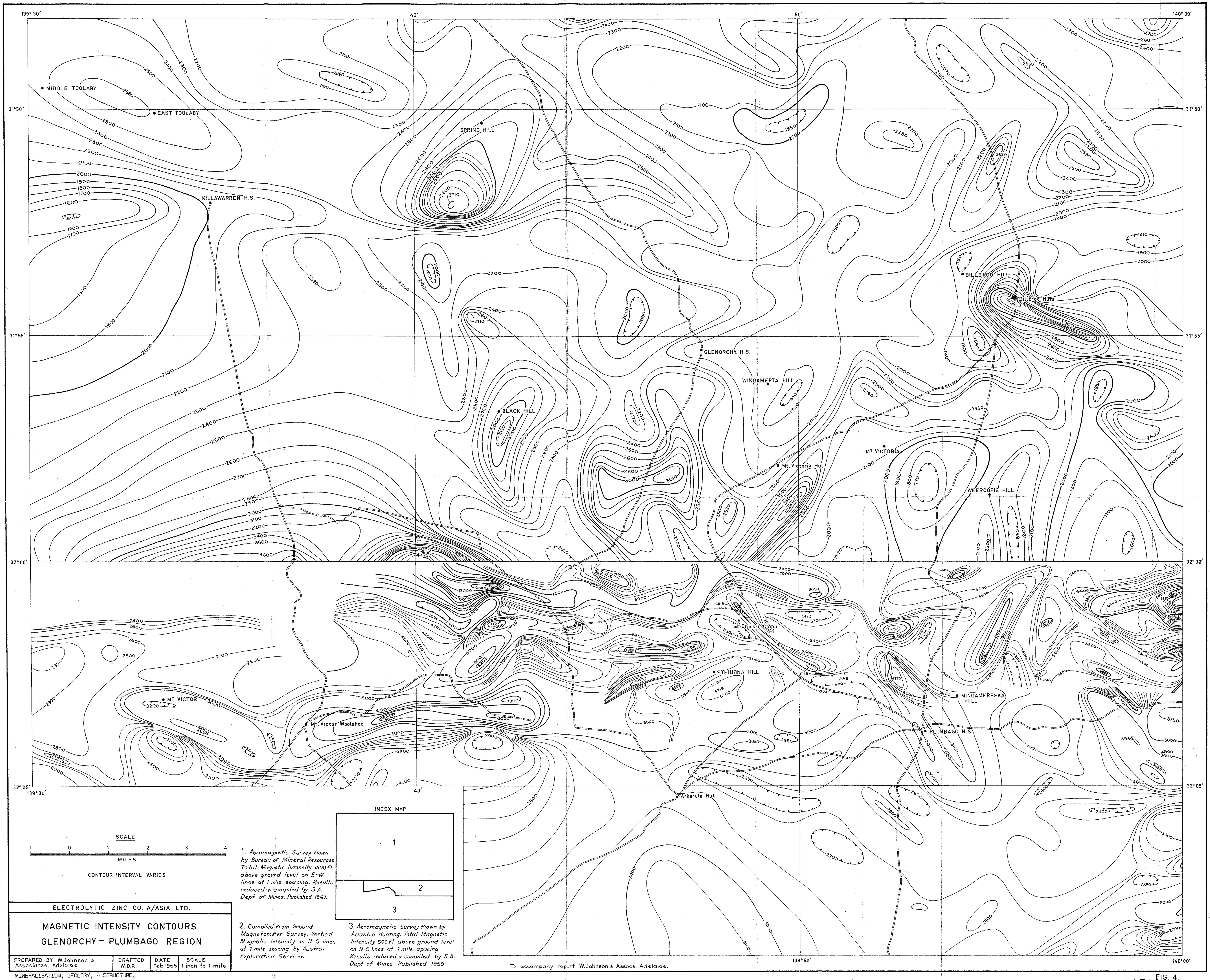
ENV848

ENV 848-2

FIG. 2

ENV 84

LEGEND
GEOLOGICAL BOUNDARY
FAULT OR SHEAR OR DISRUPTION OF THE NATURAL SEQUENCE
BASIC LINEAMENT (DARK PHOTO PATTERN)
LINEAMENT (UNKNOWN ORIGIN)
JOINT
ACID LINEAMENT (LIGHT PHOTO PATTERN)
QUARTZ ?
BASIC ROCK COMPARED WITH SURROUNDING
"NAKED" GRANITE OUTCROP
ROAD OR TRACK
FENCE
PHOTO CENTRE
Sub-outcrop
Joint controlled
? Basic dykes
? Better vegetation
Intrusive
Lineation less strong than
Mixed intrusives gneiss strong lineation parallel boundaries
Lineation Meaning?
Lineation less strong than
Almost not lineated
Int.
Int. M.S.
Smooth
Sub outcrop
This boundary is on a change in direction of lineation
Open Veg.
Smooth fine grained darker
Smoother slighty darker c.f. adjacent rocks
Darker c.f. surround, bigger trees, less undergrowth
Pale
Open
CROCKER EAST
CROCKER COSTEANS
Smooth treeless intermed
This shear runs north of the original Crocker and finishes up as the basic dyke just south of Crocker East and is lost both ends in alluvium
It shows no recent movement through the alluvium, but the drainage between Crocker and Crocker East is obviously controlled by it.
Contorted
Open large trees
Open large trees
Open vegetation bigger trees
SCALE
0 500 1000 2000 3000 4000 5000
FEET
CROCKER CAMP
Same rock
This A would appear to be post shear
Friable "putty" rock
Naked qtz.
Open vegetation bigger trees
Trend
Relict
Intrusive Joint bounded
Smooth
ELECTROLYTIC ZINC Co. (A'SIA) Ltd. & NEWMONT Pty. Ltd.
CROCKER WELL AREA
SOUTH AUSTRALIA
PHOTOINTERPRETATION MAP
by
E.B.SUMMERS
OCT. 1967
ENV 848-3
MINERALISATION, GEOLOGY, & STRUCTURE, SPECIAL MINING LEASE 118, OLARY PROVINCE SOUTH AUSTRALIA
TO ACCOMPANY REPORT BY W. JOHNSON & ASSOCIATES, ADELAIDE
FIGURE 3



1. Aeromagnetic Survey flown by Bureau of Mineral Resources. Total Magnetic Intensity 1500 ft. above ground level on E-W lines at 1 mile spacing. Results reduced & compiled by S.A. Dept. of Mines. Published 1967.

2. Compiled from Ground Magnetometer Survey. Vertical Magnetic Intensity on N-S lines at 1 mile spacing by Austral Exploration Services

3. Aeromagnetic Survey flown by Adastra Hunting. Total Magnetic Intensity 500 ft above ground level on N-S lines at 1 mile spacing. Results reduced & compiled by S.A. Dept. of Mines. Published 1959

ELECTROLYTIC ZINC CO. A/ASIA LTD.

MAGNETIC INTENSITY CONTOURS
GLENORCHY - PLUMBAGO REGION

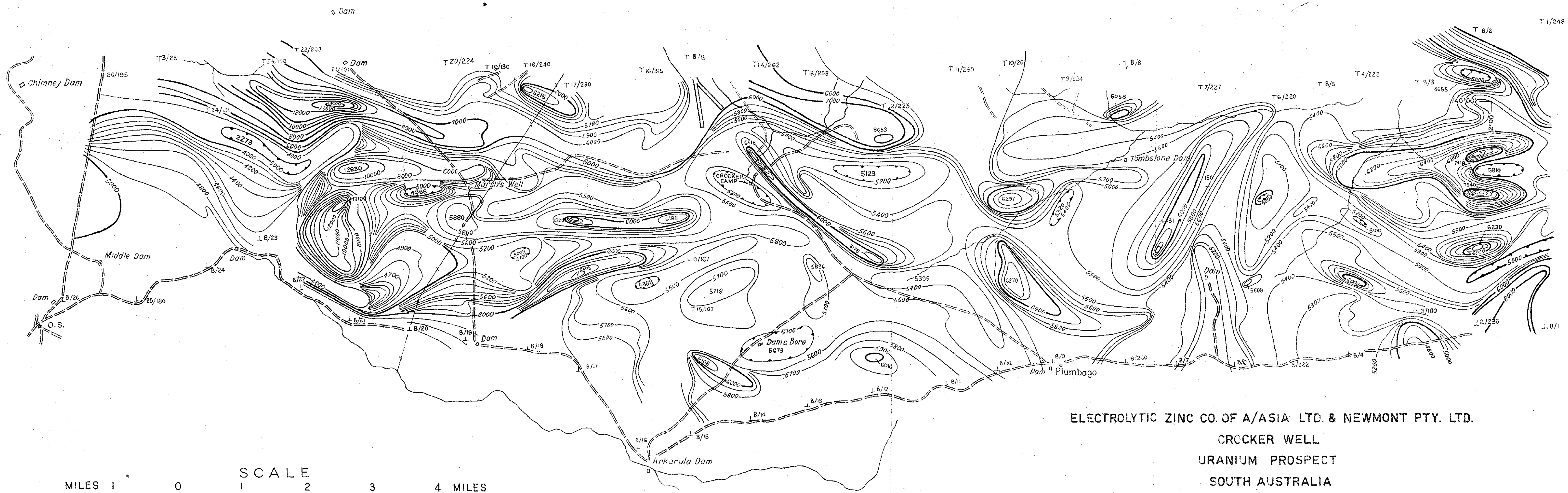
PREPARED BY	DRAFTED	DATE	SCALE
W.Johnson & Associates, Adelaide	W.D.R.	Feb 1968	1 inch to 1 mile

To accompany report W.Johnson & Assocs. Adelaide.

MINERALISATION, GEOLOGY, & STRUCTURE,
SPECIAL MINING LEASE 118,
OLARY PROVINCE SOUTH AUSTRALIA

FIG. 4

ENV 848-4 ENV 848



ELECTROLYTIC ZINC CO. OF A/ASIA LTD. & NEWMONT PTY. LTD.

CROCKER WELL

URANIUM PROSPECT

SOUTH AUSTRALIA

CONTOURS OF VERTICAL MAGNETIC FORCE

NORTH PLUMBAGO AREA

Plotted from field data obtained by P. Woyzbun Austral Exploration Services

68 MAG 01920

To accompany report by W. Johnson & Assocs., Adelaide. ENV 848-5

MINERALISATION, GEOLOGY, & STRUCTURE,
SPECIAL MINING LEASE 118,
OLARY PROVINCE SOUTH AUSTRALIA

FIG. 5

ENV 848

ENV ~~850~~ 913

115

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and

NEWMONT (AUST.) PTY. LTD.

EXPLORATION FOR NEW URANIUM ORE BODIES, CROCKER WELL AREA, SOUTH AUSTRALIA.

by

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EXPLORATION FOR NEW URANIUM ORE BODIES, CROCKER WELL AREA, SOUTH AUSTRALIA.

TABLE OF CONTENTS

APPENDIX

PLANS TO ACCOMPANY REPORT

SUMMARY

In the Crocker Well adamellitic complex the absite/brannerite mineralisation is disseminated in alaskitic pegmatitic veins and lenses occupying fractures and replacing the adamellite. The ages of adamellite formation and uranium ore emplacement are not known with any certainty and several generations of leuco-granitic rocks of widely separate age are probably present.

The uranium ore bodies are spatially controlled by the East Crocker and Crocker Well east west shears and intersecting prominent north-easterly trending shears and are in zones of intensive minor shearing and fracturing in the adamellite. No other controls are recognised.

Adamellite masses and the dislocatory major structures, shears and faults have a predictable magnetic response which can be used on an exploration technique to outline adamellite in favourable structural situations.

RECOMMENDATIONS:

It is recommended that :-

1. Exploration for fracture disseminated absite/brannerite uranium deposits in the Crocker Well area be continued.

2. That exploration be concentrated in the target areas outlined on pages 9 and 10, using ground magnetometer surveys as a preliminary exploration tool to define favourable host rocks and structures.

3. That a concurrent comprehensive petrologic and radioactive dating investigation be commenced of the granitic sequence in the Crocker Well area with close field control of the sampling programme.

EXPLORATION FOR NEW URANIUM ORE BODIES, CROCKER WELL AREA, SOUTH AUSTRALIA.

INTRODUCTION

This report discusses the radioactive mineralisation in the Crocker Well complex in the light of re-appraisal of existing information, and study of new information obtained from the geologic mapping, auger hole drilling, ground magnetic surveying, and helicopter scintillometer survey completed in the Crocker Well area during 1967.

It is one of three reports submitted in accordance with the request of Mr. R.D. Pratten, in his letter of 12th July, 1967, engaging the writer to advise on uranium exploration within S.M.L.118. The other two reports are; one on the regional relationship of structure and mineralisation in the western half of S.M.L.118, entitled "Mineralisation, Geology and Structure, S.M.L.118, Olary Province, South Australia"; and one on the prospects of discovery of extension of the Mt. Victoria Uranium Mine ore body entitled "Ore Prospects Mt. Victoria Uranium Mine, South Australia".

The present report results directly from the early studies of the problems of finding further radioactive (uranium) deposits in the Glenorchy-Plumbago region when it became obvious that the Crocker Well area possessed some unique geologic features unlikely to be repeated elsewhere in the region and as such merited a special study and a separate report.

While the South Australian Department of Mines extensive work in the area provided a solid base for further investigations, it was recognised in early discussions with Mr. Maynard that there were several deficiencies in basic data which if remedied would greatly assist the study. Chief of these were :-

1. A geologic base map at appropriate scale covering the whole of the Crocker uraniferous "adamellite" area.

2. A ground magnetometer survey of the same area.

3. An aerial scintillometer survey on a close grid basis of the same area.

These projects have now been completed and maps and plans resulting from 1. and 2. are submitted with this report. The aerial scintillometer survey results have been used in the study but the plan is being submitted by Mr. Maynard with his report. Other Electrolytic Zinc data sources used in the study were :-

1. Auger drilling of alluvium with bottom hole sample logs by T. Liverton and C.C. Maynard.

2. Down hole hammer drilling results East Crocker Main Eastern Prospect.

3. A thesis by T. Liverton with plans entitled "The Petrology of a Uranium Bearing Adamellite at Crocker Well, Olary Province, South Australia".

Basic regional geology, geology of the Crocker Well area and evaluation of the uranium deposits of Crocker West and Crocker East are contained in Bulletins 30 and 34 of the Geological Survey of South Australia, entitled "Uranium Deposits in South Australia" by S.B. Dickinson et al, 1954, and "Regional Geology and Mineral Resources of the Olary Province" by B. Campana & D. King, 1958, respectively, and numerous unpublished reports of the South Australian Department of Mines.

The reader is referred to those reports for relevant details of geography, access, climate, mineral resources, and human occupation in the area.

Exploration recommendations are confined to concealed targets as it is assumed that the radioactive "highs" indicated by the helicopter scintillometer survey will be automatically tested.

GEOLOGY, STRUCTURE, AND MINERALISATION

REVIEW OF PREVIOUS INVESTIGATIONS.

King in his account of the geology of Crocker Well (Campana & King, op. cit., pp.60-63) recognised six principal groups in the rocks outcropping within the area mapped by him in detail, which he separated into two main subdivisions based on the presence or absence of regional stress effects. The groups are as follows :-

OLDEST	Metasediments Graymafic granodiorite Adamellite	PRE-SHEARING
YOUNGEST	Alaskite & Alaskite Pegmatite Granodiorite Dykes Granite	POST-SHEARING

King (op. cit. Fig.47) identified only an insignificant outcrop as regional granite in his map area (Ai 5450 N, 3800 E, described as "Porphyritic Coarse Grained Pink Granite (Ethiudna Hill type) in the legend) but suggests in the text that the adamellite is a "mobilised phase of the regional granite".

No absolute time scale can be allotted to these rocks because of the absence of reliable radioactive dating. King describes the alaskite and alaskite pegmatite as "late stage differentiates of the adamellite" and ascribes the graymafic granodiorite to hybridisation of regional granite by contamination with metasediments. This would put the major time breaks between the metasediments and the graymafic granodiorite at the lower end of the time sequence and between the alaskite pegmatites and the granodiorite dykes at the upper end, with possibly the only substantial break in the evolutionary sense, between the end of deposition of the sediments and the commencement of metamorphism.

The picture as presented in Bulletin 34 is a little confused by the mapping of "gray granodiorite" at Crocker Well, Original Prospect, (Fig.44) as a member of the post-shearing subdivision, which later inspection indicates should rather be "graymafic granodiorite" of the pre-shearing subdivision.

The sequence of geologic events represented more by the rocks of the crystalline basement up to, and including, the granodiorite dykes, is intimately connected with the genesis of the uranium mineralisation and consequently there is strong economic justification for its unravelling.

Prior to the present investigation and accepting, as is reasonable, King's general explanation of geologic events, the following generalised facts had been established in the Crocker Well area :-

1. "Adamellite" is the host of all important absite deposits.
2. Alaskites carry absite as a minor accessory.
3. Absite occurs in bulk in alaskite veins occupying fractures within, and replacing, the adamellite.

4. Metasediments and regional granite contain minor radioactive mineralisation.

5. Hybrid granodiorite is apparently barren of mineralisation.

6. The granodiorite dykes and "granite" pegmatites are post-absite mineralisation.

7. Brannerite becomes important as an ore mineral in depth at Crocker East.

8. No metasedimentary stratigraphy or structure had been mapped within the area.

9. The main uranium deposits are spatially associated with the East Crocker Shear and north-easterly shears intersecting it.

The source of the uranium mineralisation was postulated by Campana & King to be a late stage differentiate of the adamellite with the age of mineralisation $580 \pm 30 \times 10^6$ years, fixed by radioactive dating of the absite.

Doubt is now thrown on this hypothesis by Compston et als.* dating of adamellite at Bimbowrie at 1700×10^6 years. If the adamellite at Crocker Well is co-eval with that at Bimbowrie then either the absitic/branneritic uranium mineralisation is of a completely different epoch, or the radioactive age is that of the latest metamorphism to which the area has been subjected. With the alaskite pegmatites, in which the absite-brannerite occurs, being comparatively unstressed and of primary igneous nature, without identifiable metamorphic minerals, evidence favours the mineralisation as being introduced at a late date by a period of "granitic" plutonic activity represented mainly by the alaskite pegmatites and perhaps the unstressed leucocratic acid intrusive mapped by Wilson (Fig.1, 10,000 N, 00 to 1000 E). The "granite" pegmatites and granodioritic dykes could then be much closer in age and parentage to the alaskite pegmatites than the latter are to the adamellite. This hypothesis of rock evolution would relegate the "adamellite" to the rôle of a favourable host. The problems of igneous evolution require for their solution a laboratory petrologic investigation, combined with careful field identification of rock types, and closer field study of their intrusive and contact relationships, assisted by comprehensive radioactive dating of the various rock types whose sequence of formation or intrusion can be ascertained clearly in the field.

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*Compston, W., Crawford, A.R., Bofinger, V., 1966. A radiometric Estimate of the Duration of Sedimentation in the Adelaide Geosyncline, South Australia. JOURN. GEOL. SOC. AUST. 13, Pt.1, pp. 237, 238, 272.

The economic pay-off for this work would be some decision on the question of adamellite-source or host and hence a surer guide as to where to search for repetition of the Crocker Well type uranium deposit.

CURRENT INVESTIGATIONS.

General Discussion.

The current work whose practical results are depicted on the geologic map, magnetic and radiometric contour plans and the magnetic profiles, has given a clearer understanding of the relations of adamellite and regional granite to the metasedimentary zones and to structure.

Wilson has mapped a roughly rhomb-shaped zone of intertonguing and interconnected adamellite, regional granite and migmatite extending from 10,000 W to 6,000 E and 1,000 S to 10,000 N, whose boundaries are controlled by shears, or faults, of the dominant three regional sets trending north-east, north-west and easterly, respectively.

Outside this central area the adamellite, and adamellitic/migmatitic masses appear to be more isolated, although recognisable zones extend eastwards from the central area along the East Crocker and Crocker Well shears.

Within the central area both the original Crocker Prospect (identified as Main Crocker Prospect on Fig.1) and the East Crocker Prospects, are predominantly adamellitic. To the south of both Prospects, where shear zones are particularly abundant, many regional granite masses outcrop which are elongated parallel to the north-easterly shear trend. In these parts of the area, shears in places form part of the boundaries of the adamellite masses; e.g. 2700 S, 3000 W, 1000 S, 1000 to 2000 W, 3500 N, 3000 E.

Outside the central area structure control of intrusive rock boundaries or boundaries of metasomatic transformation is seen at 7500 N, ~~2000~~ 3000 to ~~3000~~ 4000 W, 4000 N, 9000 E, 4500 N, 10500 E, 5000 N, 12000 E, 0900 S, 10000 to 11000 W.

Structure control of adamellitic intrusion or the metasomatic transformation whose end product was "adamellite" is thus amply demonstrated. Renewed movement of post "adamellite" age along the structures can be demonstrated also by the shearing of the edges of the adamellite masses reported by Wilson (Appendix I) and some of the present outcrop distribution of the rocks is undoubtedly due to translation along faults.

Some adamellite masses are remarkably free of shears and lineaments, e.g. that centred on 8500 N, 1700 E, implying either intrusion or formation subsequent to the major part of the intense tectonic activity in the district.

This particular mass has very low radioactivity and a flat magnetic response also which emphasises its difference from other "adamellite" masses in the Crocker Well area and lends credence to the view that rocks of differing age and parentage have been wrongly classified together in the past by reason of their petrographical similarities.

The metasedimentary bands mapped by Wilson are all shown as zones of shearing. None of the workers in the area have mapped consistent sedimentary bedding, and as it seems unlikely that the bands along shear zone represent bedding trends, or are the only remnants of sediments remaining ungranitised, I suggest that the sedimentary character of the bands is due to a combination of dynamic and retrograde metamorphism.

Structure and Magnetics.

Various structures in the Crocker Well area are shown on Wilson's geologic map (Fig.1 this report) and Summers' photo-interpretation map (Fig.3 of report: Mineralisation, Geology and Structure, Olary Province, South Australia). They comprise recognised shears, faults and joints, and lineaments whose basic cause cannot be discerned. Ground magnetic traverses were done in a north-south direction over the area to assist in structural interpretation and to determine if there was a recognisable magnetic pattern directly associated with uranium mineralisation.

Magnetic susceptibility measurements on East Crocker diamond drill core confirmed a low susceptibility for the "adamellite" and regional granite and relatively high susceptibility for the hybrid granodiorite and the metasediments.

The magnetic data maps when compared with the geologic and photo-interpretation maps show that some magnetic trends can be matched with recognised shear zones. This can be done with confidence for part of the East Crocker and Crocker Well Shears, and the Crocker Link Shear (extending from 2700 N, 5700 W to 4000 N, 3300 W, in outcrop at the south-east side of the original Crocker Prospect).

Other mapped shears or photo-interpreted lineaments for which magnetic trends can be matched, within the limits of accuracy of all data, are as follows (co-ordinates refer to mapped structures matched by magnetic trends. Mapped structures may extend further than co-ordinates listed) :-

FROM		TO	
0300 N	10000 W	2400 N	5550 W
0300 S	9800 W	1600 S	8000 W
3200 N	1000 E	3400 N	2000 E

Other magnetic trends shown on Fig.4 have no mapped or photo-interpreted structural counterpart. Conversely many of the structures cannot be matched confidently with magnetic trends. This is mostly due to the complexity of the magnetic data in certain areas, combined with the wide spacing (1000') of the north-south traverses.

Sufficient correlation is shown between magnetic trends and structure to support the opinion that individual structures could be traced under alluvial cover by magnetic methods if required. An example is the magnetic trend continuing westwards along the projected westerly extension of the East Crocker Shear.

Lithology and Magnetics.

A reasonable correlation is shown between lithology and the magnetic data. The low susceptibility of the adamellite measured in the East Crocker drill core is confirmed by the magnetic profile and contour maps. Original Crocker Prospect occupies a conspicuous low, as does the large adamellite mass centred at 8300 N, 1700 E. Most of the adamellite at East Crocker is outlined by magnetic lows and low magnetic values have been measured over the majority of the other adamellite masses. High magnetometer readings within the adamellite boundaries can be correlated in many instances with shear zones, and where no structures have been indicated on the map, one might suspect that this occurs undetected.

Using the above correlations it can be inferred that the rocks under alluvial cover north of Original Crocker Prospect between 5000 N and 7000 N and 7000 W to 2000 W are largely adamellitic as are the sub-alluvial rocks in the magnetic low areas centred at 4500 N, 1700 W, 3500 N, 2800 W, and the area between 2000 N to 3000 N, 1000 W to 2000 W. This inference is supported by the results of auger drilling to basement in both areas.

It will be feasible also to use more detailed magnetometer surveys to outline adamellite masses under alluvial cover.

MINERALISATION.

The uranium deposits which have been explored by drilling are the West Crocker group of Crocker Original and Crocker South Prospects and the East Crocker group of Main Eastern Prospect, Western Prospect, South-Western Prospect and Central Prospect.

The Main Eastern and Central Prospects are in adamellite on the north side of the East Crocker Shear, cut off on the northern side by two north-east trending shears. The South-Western and Western Prospects are on the south side of the East Crocker Shear. The South-Western Prospect is cut off to the west by alluvial cover and to the south by a north-east trending shear. It is tempting to speculate that the South-Western and Western Prospects are the displaced continuations of the Central and Main Eastern Prospects on the opposite side of the East Crocker Shear.

The Original Crocker deposit is cut off to the south by the Crocker Link Shear and may also be related spatially to an easterly trending shear passing under alluvium just north of the adamellite/alluvium northerly boundary.

The only other areas of relatively high radioactivity detected by the helicopter scintillometer survey are :-

(i) in the adamellite on the north-western side of a shear trending north-east from 4000 S, 5000 W to 1600 S, 1700 W, the "high" area being confined to a 300-400 wide band extending from 2600 S, 3300 W to 1800 S, 2000 W, with an outlying high centred at 2700 S, 4000 W ;

(ii) a small high centred at 9200 N, 0500 W, at the south-western corner of the leucocratic granitic intrusive.

Neither of these occurrences have been tested by drilling though absite was found at the first of them.

EXPLORATION GUIDES AND TARGET AREAS

Though no recognisable distinguishing characteristics have been found in the absite-bearing adamellite, some empirical controls of uranium mineralisation can be discerned and used to guide further exploration.

Firstly, although the East Crocker and Crocker Well Shears are not themselves uranium bearing, they seem to have acted in some way to localise and control uranium mineralisation in the adamellite, and the adamellite masses immediately to the north and south of these shears or their projected continuation under cover become first priority exploration targets.

Secondly, the uranium mineralisation favours adamellite situated close to north-easterly trending shears, on their north-westerly side south of the Main East Crocker and Crocker Well Shears, and on their south-easterly side north of the same two main shears.

Thirdly, the strongest absite mineralisation occurs in areas of adamellite magnetically weaker than that to the east and west.

Fourthly, the mineralisation favours areas of strong minor structure.

Using these empirical criteria as guides, certain areas can be selected which should be explored after further definition by ground magnetic surveys.

The target areas defined in the following list are considered to be concealed targets, either by alluvium or unmineralised rock, and are in order of priority :-

1.	(i)	4000 N	to	6000 N	7000 W	to	10000 W
	(ii)	5000 N	to	7500 N	5000 W	to	7000 W
	(iii)	3500 N	to	5000 N	7000 W	to	10000 W
	(iv)	5000 N	to	6500 N	3000 W	to	5000 W
2.	(i)	750 S	to	1500 N	9000 W	to	12000 W
	(ii)	1000 S	to	2000 N	12000 W	to	16000 W
		(alluvium and adamellite outcrop only)					
3.	(i)	3500 N	to	6000 N	00	to	2000 E
	(ii)	4500 N	to	7000 N	00	to	3000 W
4.	(i)	500 S	to	1200 S	1000 E	to	3000 E
		(adamellite outcrop only)					

Each of these target areas requires further ground magnetometer surveys to define subsurface structure and adamellite subcrop with reconnaissance auger drilling to obtain reliable basement samples for confirmation of subsurface rock types.

Definition of a favourable adamellite structure geometrical relationship should be followed by closely spaced auger drilling to allow radiometric probing of suballuvial basement. Reliable basement samples should also be taken from these holes for further radiometric testing.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS.

Exploration to date in the Crocker Well area has further defined the potential target areas in which to concentrate search for uranium mineralisation and from the results obtained and from re-appraisal of earlier work it is concluded :-

1. That continued exploration for repetitions of the absite brannerite fracture disseminated uranium deposits is justified.

2. That several generations of leucocratic granitic rocks, some of which are all lumped together as "adamellites", occur in the Crocker Well area and that they cannot all be assigned positively to their correct position in the plutonic evolutionary sequence in the area by present known field and laboratory criteria.

3. That this problem can be solved only by a combined petrologic and radioactive dating investigation in which the emphasis should be on the dating. If this investigation is successful radioactive dating could be used to identify the host and source rocks of the absitic uranium mineralisation and would be a potent exploration tool to locate the favourable target masses of "adamellite".

4. That absite brannerite type uranium mineralisation in the "adamellite" is controlled by the East Crocker and Crocker Well Shears and north-easterly trending shears intersecting them in an empirical fashion whose basic cause is not yet determined, but which can be used for directing further exploration.

5. That magnetometer surveys can be used to define "adamellite" masses and structure below alluvial cover.

RECOMMENDATIONS.

It is recommended that :-

1. Exploration for fracture disseminated absite/brannerite uranium deposits in the Crocker Well area be continued.

2. That exploration be concentrated in the target areas outlined in the previous section using ground magnetometer surveys as a preliminary exploration tool to define favourable host rocks and structures.

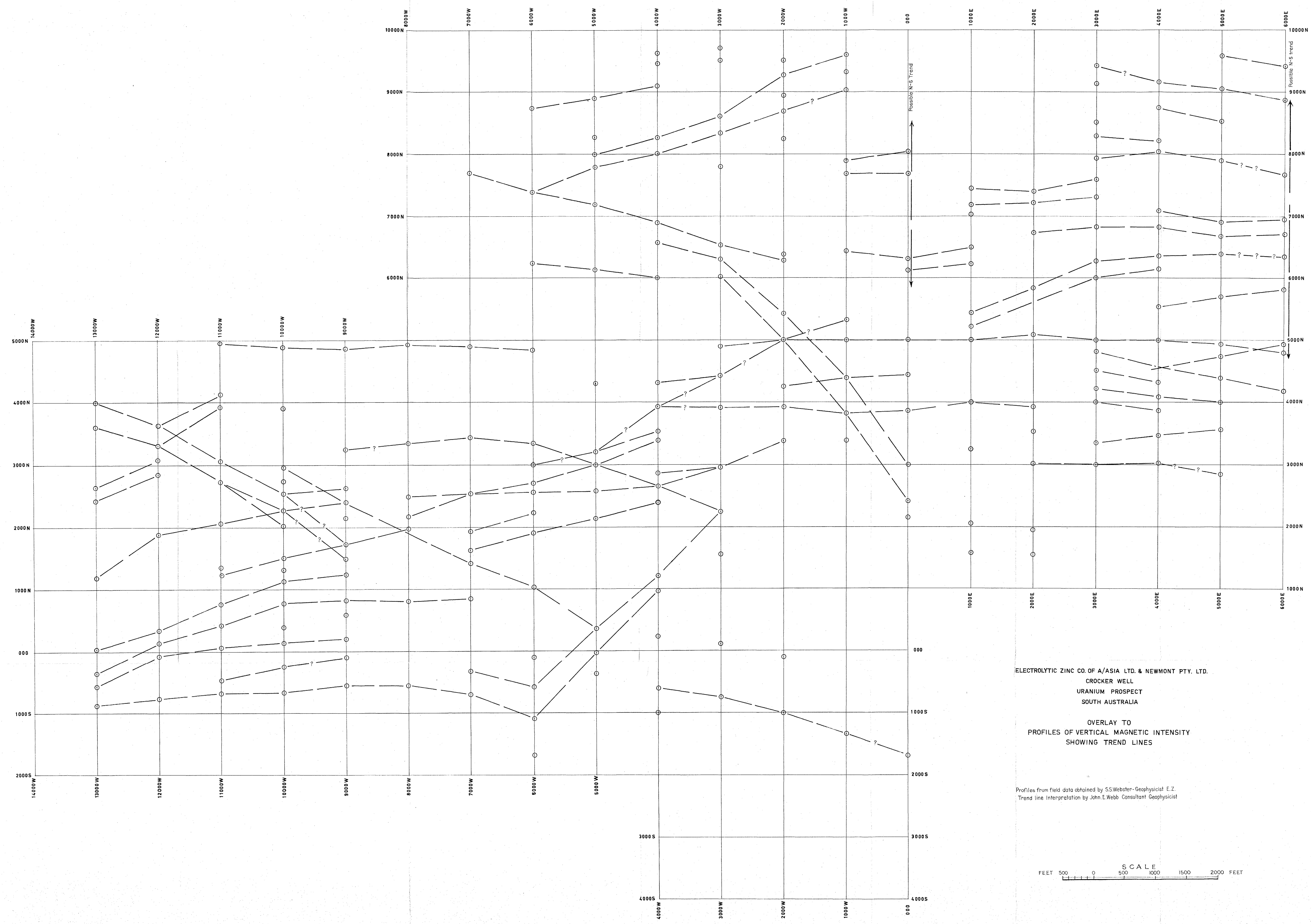
3. That a concurrent comprehensive petrologic and radioactive dating investigation be commenced of the granitic sequence in the Crocker Well area with close field control of the sampling programme.

W. Johnson

W. JOHNSON.
CONSULTING GEOLOGIST.

23rd February, 1968.


LEGEND
ALLUVIUM
Silt clay sand gravel & kunkar (travertine).
ADAMELLITE – Varying from leucocratic white feldspar- blue quartz rock without ferromagnesians- to "East Crocker" type with abundant ferromags.
Becomes aplitic with pink feldspar in some areas. Shows cross-cutting intrusive relationships with regional granite. Often foliated, usually massive.
Ad
REGIONAL GRANITE
Potassic, lineated, often porphyritic granite; may sometimes include lineated granodioritic rocks. Also includes some unstressed intrusive granite (not distinguished on map).
Reg Gr
MIGMATITE & REGIONAL GRANITE
Complex areas of migmatised gneiss and granitic gneiss with intrusive regional granite (lineated).
Migm. Reg Gr
MIGMATITE & ADAMELLITE
Complex areas of migmatised gneisses with small adamellitic intrusions, veins, dykes etc. (? may represent areas of original gneisses only partially adamellitised in place ?)
Migm. Ad
COMPLEX UNMAPPABLE AREAS
Migmatised gneiss, regional granite with small adamellitic intrusions etc. Generally unmappable at this scale.
Migm, Ad, Reg Gr.
LEUCOCRATIC (?) APLITIC to ADAMELLITIC ROCKS
Of uncertain affinities. Probably related to adamellitic phase of intrusion? Includes many leucocratic rocks of unknown designation.
GRANODIORITIC ROCKS
Generally foliated, dark grey, fine to medium grained, fair percentage of mafics. Maybe intrusive in places? but usually associated with hybrid zones near adamellite contacts.
Gde
UNSTRESSED LEUCOCRATIC INTRUSIVES
Massive, leucocratic medium to coarse grained rocks of uncertain composition. Show ~~intrusive~~ relationships to regional granite in vicinity of coordinates 10,000 North, 1,000 East.
METASEDIMENTS
Meta-quartzite, schist, amphibolite, etc. of major shear zones.
MAIN CROCKER PROSPECT
MAIN EASTERN PROSPECT
CENTRAL PROSPECT
EAST CROCKER SHEAR
MAIN CROCKER SHEAR
CROCKER WELL
Sheared metasediments
TO MT VICTOR
ELECTROLYTIC ZINC Co. (A'SIA) Ltd. & NEWMONT Pty. Ltd.
CROCKER WELL AREA
SOUTH AUSTRALIA
SEMI-DETAILED GEOLOGY
by
R.B. WILSON
Geosurveys of Australia Pty. Ltd.
NOVEMBER 1967
COMPILED FROM ENLARGED AERIAL PHOTOGRAPHS (10 chain)
with detail controlled by surveyed grid
Extent of surveyed area (1,000 foot grid)
Feet 0 500 1000 2000 3000 4000 5000
TO ACCOMPANY REPORT BY W. JOHNSON & ASSOCIATES, ADELAIDE.
EXPLORATION FOR NEW URANIUM ORE BODIES, CROCKER WELL AREA, SOUTH AUSTRALIA.
ENV 850-1
FIGURE I
Misc. 250



ELECTROLYTIC ZINC CO. OF A/ASIA LTD. & NEWMONT PTY. LTD.
CROCKER WELL
URANIUM PROSPECT
SOUTH AUSTRALIA

OVERLAY TO
PROFILES OF VERTICAL MAGNETIC INTENSITY
SHOWING TREND LINES

Profiles from field data obtained by S.S.Webster - Geophysicist E.Z.
Trend line Interpretation by John.E.Webb Consultant Geophysicist

SCALE
FEET 500 0 500 1000 1500 2000 FEET

To accompany report by W.Johnson & Assocs., Adelaide.

EXPLORATION FOR NEW URANIUM ORE BODIES,
CROCKER WELL AREA,
SOUTH AUSTRALIA.

ENV ~~850~~-4 FIG. 4
913

EXPLORATION FOR NEW URANIUM ORE BODIES,
CROCKER WELL AREA,
SOUTH AUSTRALIA.

APPENDIX I

LETTER REPORT ON CROCKER WELL GEOLOGY

by

R.B. WILSON

CHIEF GEOLOGIST,

GEOSURVEYS OF AUSTRALIA PTY. LTD.

18th December, 1967.

Messrs. C. Maynard & W. Johnson,
Electrolytic Zinc Co. (Australasia) Pty. Ltd.,
30 Montrose Avenue,
NETHERBY, S.A. 5062.

Dear Sirs,

This letter is to advise you that the semi-detailed geological mapping of the Crockers Well Area and also detailed mapping of the Mt. Victoria Area have been completed. Drafting of the former map is now complete and the original has been sent to Harding & Halden for enlargement to 1" = 500 feet scale, as per Mr. Johnson's instructions. A colour-rough of the Mt. Victoria map was supplied to Mr. Johnson on 8.12.67 and this is currently being final-drafted by his draftsman.

At Mr. Johnson's suggestion, in lieu of a report, I offer the following :-

1. ADAMELLITE - rather than one simple intrusion elongated in an east-west direction, as generalized by the S.A. Department of Mines 4" = 1 mile map, the adamellite consists of a large number of separate intrusive bodies of irregular shape and dimensions. Those bodies of mappable dimensions at photoscale (10 chain), are shown on the accompanying map. The general area of "(?) adamellitisation", appears to be controlled by several major zones of sheared metasediments. Individual adamellite bodies show definite cross-cutting and intrusive relationships to both the regional granite and migmatite zones. In a few cases, adamellite bodies appear to have intruded tight anticlinal "cores" in either regional granite or migmatite-metasediment zones. This is evidenced by steep outward dips in the host-rock, concordant with the "nosings" of the adamellite contacts.

The present mapping has indicated that the general zone of adamellites extends further west, north and east from their previously-mapped limits. Most of these outlying intrusions consist of white feldspar and the usual bluish opalescent quartz, with little or no ferromagnesian minerals, while pink-feldspar is often present in significant amounts.

The adamellite is usually massive but in many areas shows weak foliation, the direction of which coincides with that of the regional granite.

2. REGIONAL GRANITE

The regional granite is a generally foliated to lineated medium to coarse grained, often porphyritic, granite which has probably formed by granitisation or anatexis of the meta-sediments. However, it could also be intrusive into the metasediments and stressed by later shear-movements.

3. COMPLEX ZONES

Large areas within the general adamellitic zone, contain migmatites, which in the field, appear to consist of gneiss-schist (metasediment) with adamellitic bands and veins. Other areas consist of regional granite with some adamellite, while complex areas of meta-sediment, regional granite and adamellite were also observed. Some attempt was made to subdivide these complex areas into :-

(a) Migmatite + Adamellite - "adamellitised" metasediments, interpreted to have formed "in place" by "adamellitisation" (c.f. granitisation), or anatectic processes.

(b) Regional Granite + Adamellite
These zones are dominantly regional granite with small adamellite intrusions, bands, veins etc., interpreted to have formed by "adamellitisation" of regional granite.

(c) Complex of Migmatite, Regional Granite and Adamellite
These zones are taken to represent areas of metasediments which were incompletely granitized and then later affected by "adamellitisation".

4. GRANODIORITE

Many small areas of granodioritic rocks were observed, particularly around the contact-zones between adamellite and regional granite. One of these (near Coords 4,400 N. 1,800 E.), was inspected in company with Mr. Johnson. Although the contacts between the enclosing adamellite and the small, irregular-shaped granodioritic mass, are quite sharp, we were by no means certain as to which rock had intruded the other. In fact, in this locality, the granodioritic rock has a well-marked foliation (usually the case in the whole area), whereas the adamellite is relatively massive and unstressed. This suggests that the granodiorites may be hybrid rocks (between granite and adamellite) formed by incomplete (?) replacement or (?) absorption of regional granite, by the adamellitic magma.

5. LATER INTRUSIVES

Various unstressed granitic to (?) leucocratic rocks of unknown classification, were observed to intrude the regional granite. These may be associated with, or later than, the adamellitic phase of intrusion.

6. SHEAR ZONES

The major shear zones have 3 principal trends, approximately eastwest, northeast and northwest. These main shears are zones of metasediment which include some migmatite (feldspathisation), but mainly schist, meta-quartzite and amphibolitic rock-types.

The latest phase of movement along these shears is post-adamellite intrusion, as evidenced by highly jointed and sheared adamellite along the edges of the shear-zones. In some places, particularly along the Crocker Well Shear to the east, the actual shear zone itself is quite narrow, suggesting that the adamellite may have intruded partly across the shears. However, post-adamellite shearing is indicated by its highly jointed and sheared nature near the shear-zones.

The area, some ½ mile west of Crockers Well, mentioned by Mrs. Summers, is rather puzzling. The Crocker Well Shear appears to be offset by cross-shearing with a west-block-north relative movement. There is no evidence of the main shear (+metasediments) continuing across the "island outcrop" (coords 500 S., 7,500 W.). There is a strong shear coming-in to join the main shear, from the southwest. There are signs of deflection of the main shear to the north from west of this "island-outcrop". In any event a contact between adamellite and migmatite (+ adamellite) appears to coincide with the projected east-west trend of the main Crocker Well Shear. There does not appear to be any evidence of a later intrusive cutting across the actual shear as suggested by Mrs. Summers, but rather a displacement of the main Crocker Well Shear.

It appears from the mapping that the geometry of the adamellitic zone is controlled by several major shear-zones. From the original Department of Mines map (4" = 1 mile), considerable lateral displacement of the adamellite contacts along the Crocker Well and East-Crocker shears, respectively, could be interpreted. However, such an interpretation now seems doubtful, in the light of the extensions of the adamellitic zone, mapped during this survey.

7. RELATIONSHIP TO MINERALISATION

The present mapping (at 700 feet = 1 inch) has not defined any new concepts relating the main mineralized zones to geology. The most obvious point from the mapping is that both East Crocker and Original Crocker deposits occur adjacent to major shear zones with many more minor shears in close proximity. The East Crocker deposits consist of disseminated pellets and sporadic veinlets along foliation or joint planes, containing absite, while the Original Crocker Deposit is a lenticular mineralized zone of brecciated adamellite.

8. GEOLOGICAL HISTORY

From the mapping and without being a petrologist, I would envisage the following approximate order of events :-

(a) Metamorphism and granitization with perhaps some mobilization and intrusion of the original metasediments, with the formation of the granite. The metasediments of the shear zones were not so highly metasomatised. Large areas of unreplaced or intruded metasediments remaining.

(b) Renewed period of shearing etc. before "adamellitisation" of the province, again excluding, but controlled by, the major shear-metasediment zones. Mobilization and intrusion by many smaller adamellitic bodies, which show definite cross-cutting and intrusive relationships to the pre-existing metasediment-migmatite-regional granite complex. Many of the smaller adamellitic bodies and tongues show approximate concordance with the foliation ofthe regional granite.

(c) Period of post-adamellite shearing with development of foliation or "fracture-cleavage" parallel to foliation of the regional granite (i.e. NE-SW).

(d) Intrusion of unstressed leucocratic rocks, such as those near coordinates (9,000 N. to 11,000 N.; 500 W. to 1,500 E.) and including "alaskites" etc. Mineralization of favourable fractured and jointed zones in the adamellite.

As both events under (d) would appear to be post-adamellite in age, it may be worth investigating whether absite-mineralization may be related to this presumably latest intrusive-phase of leucocratic (?) rocks.

The whole sequence of events may be related to one major intrusive phase with differentiation proceeding toward the adamellitic-type magma as the later intrusives.

Signed: R.B. Wilson.

ENV ~~849~~

913

152

ELECTROLYTIC ZINC CO. A/ASIA LTD.

and

NEWMONT (AUST.) PTY. LTD.

RECEIVED
21 MAR 1968
DEPT. OF MINES
REGISTRY

ORE PROSPECTS
MT. VICTORIA URANIUM MINE
SOUTH AUSTRALIA

by

W. JOHNSON
CONSULTING GEOLOGIST

W. Johnson & Associates Pty. Ltd.,
323 Wakefield Street,
Adelaide, South Australia. 5000.

ORE PROSPECTS

MT. VICTORIA URANIUM MINE

SOUTH AUSTRALIA

TABLE OF CONTENTS

APPENDIX

PLANS TO ACCOMPANY REPORT

SUMMARY

Mt. Victoria geology and lode behaviour is re-interpreted in the light of new geologic mapping and ground magnetometer results.

It is suggested that lode outcrop pattern, drill hole intersections, of lode and magnetic pattern are all consistent with a theory that the separate lodes are all part of one lode contorted by folding and dislocated and displaced by faulting and granitic intrusion or assimilation.

The folding and a westerly pitch of the ore shoots in conjunction would create substantial ore positions at depth west of the most westerly intersection, and in the keels and noses of folds along 200 W.

The known lodes are associated with magnetic anomalies and those which are in prospective geologic situations should be tested for ore.

Mapping has shown a meta-conglomerate north of the mine associated with radiometric anomalies.

RECOMMENDATION

It is recommended that exploration be continued at Mt. Victoria and that the ore prospect be tested according to the drilling and costeaning programme outlined in the body of the report.

It is recommended further that the meta-conglomerate horizon north of the mine be carefully delineated by more detailed mapping.

ORE PROSPECTS

MT. VICTORIA URANIUM MINE

SOUTH AUSTRALIA

INTRODUCTION

This report is submitted in accordance with the proposal by Mr. R.D. Pratten, in his letter of 12th July, 1967, requesting me :-

"(b) to investigate and advise on prospecting for a possible extension of the Mt. Victoria lode."

The investigation consisted of a review of existing information, geologic re-mapping and a ground magnetometer and scintillometer survey of an area 2200 feet by 1600 feet, surrounding the mine, completed in accordance with my interim recommendations of 2nd August, 1967.

Following completion of the mapping, magnetometer and scintillometer surveys, a test drilling programme confined to the immediate vicinity of the mine was recommended and submitted on 21st December, 1967, at the request of Mr. C.C. Maynard. This present report expands and amplifies the basis of selection of the test drill sites and reviews and discusses the geology of the mine area and the ore bodies in the light of new information got from the mapping and ground magnetic work.

LOCATION, HISTORY, AND PREVIOUS WORK

Mt. Victoria Uranium Mine is situated 2 miles N.30°W. from Mt. Victoria Trig and 38 miles N.W. of Olary, a township on the Adelaide Broken Hill Railway Line. Its location is shown on the Glenorchy Sheet of the Geological Atlas 1 mile Series and the Olary Province Sheet of the Geological Atlas Special Series.

The deposit was found in 1954 by a prospecting team of the South Australian Department of Mines and an intensive programme of mapping, drill testing and metallurgical investigations was commenced which extended through to 1956.

The geological investigations are summarised in the publication "Regional Geology and Mineral Resources of the Olary Province" by B. Campana & D. King, Bull. No.34 Geological Survey of South Australia 1958, pp. 71-79, and described in greater detail in various unpublished reports on the files of the Department of Mines, notably the report "Geological Report on Completion of Drilling at the Mt. Victoria Uranium Deposit" by D. King & W. Paterson. Unpub. Rep. Dept. Mines. S.Aust. C.W. 38, G.S. 308, June 1955.

GEOLOGY

Mt. Victoria Uranium Mine is shown on the Glenorchy 1 mile geological sheet situated in a mass of undifferentiated rocks described in the legend as "migmatite, granite gneisses with pegmatites, granitised terranes undifferentiated".

In limited areas at least the migmatite can be resolved into meta-morphic rock types in which sedimentary characteristics can be recognised, e.g. the meta-conglomerates, quartzite, meta-amphibolites, depicted on Wilson's geological map (Fig.1 this report). This map shows the outcropping Mt. Victoria uranium "lode" situated at the south-western corner of a mass of predominantly amphibolitic mafic metasediments, south-south-west and south-east of the mafic metasediments, the meta-sediments are quartzitic mica schists, quartzites and other felds-pathised pelitic metasediments. Red and pink coarse grained granite intrudes the metasediments from the west and outliers of the same granite are present in masses of varying size in the mafic metasediments. These granitic masses may be apophyses from the main intrusive mass on the western side of the map sheet or may be small centres of palingenetic "granite" formed by granitisation of the sediment in situ.

No structures as such were mapped by Wilson but the irregular zone of mica schist 50' - 250' wide extending E.N.E. from 600 S, 2000 W to 00 : 900 W is undoubtedly a zone of shearing. This direction is parallel to one of the observed major regional shearing and lineament directions noted on Figs. 1 and 2 accompanying my report "Mineralisation, Geology and Structure, Special Mining Lease 118, Olary Province, South Australia".

Some amphibolitic schist occurs at the south-west end of this shear zone with a prominent magnetic anomaly, centred at 400 S, 1800 W, situated at the contact between it and the quartz mica schist. The intersection of shear or fault structures with magnetite bearing veins probably account for the magnetic contour pattern in the mine area. The strong north-south magnetic trend 50 feet east of the mine shaft could be due to a north-striking fault and displacement along a north-east trending shear zone, may explain the strong double "highs" at 400 S, 200 W and 500 S, 200 W.

ORE BODIES

The Mt. Victoria "lodes" were interpreted by King (op. cit. pp.74 and 75) as being of granitic parentage. The chief gangue mineral is biotite with subordinate albite and apatite which occur parallel to the foliation of the country rock. The "lodes" are considered by King to be localised along a system of south dipping sub-parallel and branching fracture zones. He does not state whether he considers them replacement lodes or veins deposited in openings. The walls are described as shear contacts implying post-ore deposition movement.

The outcrop pattern of the lodes mapped by Wilson, differing somewhat from that shown on the published surface geological plan (Fig. 52 King op. cit.), suggests a double fold, perhaps dislocated by an east-west shear and Wilson (Appendix this report) suggests that the ore might be confined to a particular folded metasedimentary horizon.

This suggestion of a folded lode could explain the magnetic pattern in the area of the mine and could be a valid explanation for the convolutions of the lode(s), since movement later than the period of lode formation is proved.

The nature of the "buried davidite lodes" (the low grade lodes shown on the cross section) encountered in drill holes VH 27, 28 and 29, and their (or its, if the intersections represent one lode) relation to the outcropping lodes, are not discussed by King. The positions as shown on the surface geological plan (Fig. 32, Bull. 34) are vertical projections to the surface of the intersection in the drill holes. Projected upwards parallel to the dip of the foliation of the host gneiss and metasediments the lodes would have the following positions at the surface :-

VH 30	600 S
VH 28	500 S
VH 27	650 S

This difference in position in such a short distance is, in fact, similar to that shown by the South, Central and Main Lodes in outcrop further north, and it is obvious that further definition of the low grade lode positions and attitude is required.

An interesting characteristic of the low grade lode positions is their occurrence at the rise in the magnetic profile from south to north. Magnetite is reported as frequently associated with the davidite/biotite lodes and in one of the cross-sections accompanying King's unpublished report (Plan US.474/1) the low grade "lode" intersection in VH 30 is shown as pyrite/magnetite. Unfortunately this hole was apparently not logged radiometrically nor was a chemical assay done on the core.

Magnetite bearing rocks were mapped in outcrop by Pitman, King & Peterson and later by Wilson, who also indicates heavy magnetite scree in the vicinity of 500 S, 200 W. This scree seems insufficient to account for the very strong, sharp, magnetic anomaly at this point, which is probably due to a buried magnetite vein or seam. The magnetite rocks are also in areas showing strong surface radioactivity and it seems that the outcropping magnetite bearing rocks might be correlated in part with the low grade "buried" davidite lodes. All magnetite "seams" should be tested for U_3O_8 content.

Magnetite bearing schist outcrops in the gully at 600 S, 600 W, according to Wilson and is apparently only weakly radioactive at the surface. The schist could account for the magnetic anomaly whose axis trends east-west along 600 S, between 300 W and 600 W. This anomaly could be associated also with an extension westward of the low grade lode ? cut in VH 30.

ASSESSMENT OF ORE PROSPECTS

EXISTING LODE SYSTEM

King has calculated ore reserves at a total of 107,900 long tons at a grade of 6lb. U_3O_8/long ton, of probable and possible ore, in the Main, Central and South Lodes. This calculation assumes continuity of ore between all drill hole intersections on the main lode.

The lode intersections above R.L. 675 (Fig.56, Bull.34) are sufficiently close to define, at least, the Main Lode with some certainty. Down to VH 21 - 65°D (intersection at R.L. 645) the main lode thickens and becomes shorter and richer. Below VH 21 there are only seven intersections to define the lode down to R.L. 300, between 150 W and 400 W. The most westerly intersections are as follows :-

	R.L.	Thickness Ft.	Grade lb.U_3O_8/long ton
VH 23 - 70°D	570	7.4 (Two splits)	3.7
VH 23 - 90°D	450	11.0 (Two splits)	6.4
VH 24 - 90°D	375	7.2	5.9

VH 24 is the most westerly of these intersections, on 400 W, and above it the next intersection is in VH 17 (45°D), 2.3 feet thick of a grade 2.92 lb.U_3O_8/long ton at R.L. 745. V 17 (70°D) did not cut lode at the expected position at R.L. 675. This hole is 450 feet inclined distance in the plane of the lode above the VH 24.

The drill hole information, therefore, definitely leaves open an untested ore position west of 400 W below R.L. 650. The absence of ore at R.L. 675 in V 17 - 70°, and in the holes west of 450 W at higher levels, does not exclude the possibility of a strong shoot of ore extending west of VH 23 - 70° and 90° and VH 24 - 90°. The intersections in these holes are strong and of reasonable high grade. An ore shoot, 500 ft. inclined length down dip, 350 ft. along strike and 7 ft. thick, would yield 100,000 long tons of ore, doubling the present reserves. The potential grade of this ore could be 6 - 7 lb. U_3O_8/long ton.

The second ore position which requires further definition and testing is that under the gully at about 600 S to 650 S, 150 W to 250 ft. The shallow lodes cut in drill holes VH 30 - 45°, VH 28 - 45°, VH 27 - 70°, if projected upwards at the average lode or foliation dip, intersect the surface in positions which indicate separate lodes, or the one lode dislocated by faulting or displaced by folding. The thickness of the lodes and their shallow depth makes them an open cut mining prospect if they have sufficient continuity and depth down dip. They may extend also westwards under cover to 600 W where a prominent magnetic anomaly has been measured. Existing drill holes do not test this possibility. The present average thickness of the three intersections is 20 ft. A lode, or lodes, of this thickness totalling 400 ft. length and 250 ft. down dip would yield 165,000 long tons of ore.

A third interpretation of ore body behaviour which should be tested is the possibility that the relatively sharp cut-off east of 150 W is due to repeated folding of the lodes rather than a north trending fault. In this interpretation the thicker intersections in VH 15, 16 and 17, could be due to the drill cutting the lode obliquely near the nose of a fold. A multiply folded lode could account quite satisfactorily for the magnetic pattern. Under this interpretation the Main, South, Central and low grade lodes could all be part of the one lode displaced by folding, dislocated by faulting and disturbed by granitic replacement. Such folding could account also for the absence of lode in holes VH 17 - 70°, VH 18 - 45°, VH 22 - 45°.

If this interpretation of lode behaviour is correct, further reserves of ore would be available in the steep westerly pitching keels of synclines and noses of anticlines which should reach the surface along 200 W.

NEW LODES

No positively identified outcropping lodes have been found in the mapped area of Fig.1 outside the original mine grid and the prospects of finding new ore bodies depends on discovery of concealed lodes, with search concentrating on geologic situations with analogies to the existing mine lodes.

In the map area north of grid line 00 the recent (January, February, 1968) radiometric re-survey has shown several small areas of higher than background radioactivity. These are located as follows :-

	CO-ORDINATES CENTRE		MAXIMUM COUNT	AREA 1000 c.p.m. CONTOUR
1.	375 N	1200 W	1300 c.p.m.	9000 sq. ft.
2.	260 N	1100 W	1000 "	25 sq. ft.
3.	215 N	990 W	750 "	-
4.	200 N	695 W	1000 "	-
5.	290 N	690 W	700 "	-
6.	200 N	615 W	2400 "	500 sq. ft.
7.	335 N	300 W	1000 "	100 sq. ft.
8.	265 N	300 W	1700 "	300 sq. ft.
9.	200 N	320 W	2900 "	825 sq. ft.
10.	120 N	300 W	1100 "	300 sq. ft.
11.	075 N	320 W	1400 "	750 sq. ft.

All are in the feldspathised amphibolitic hornfels rocks. Anomalies 1, 2, 3, 4 and 6 are associated with the meta-conglomerate.

No.1 is on the eastern edge of an extensive mass of red granite and at the western side of a magnetic anomaly. Nos. 2-6 are associated with magnetic lows. Nos. 4 and 6 are within 50 ft. of the northern edge of a granite mass. Nos. 9, 10 and 11 are all around the periphery of a small magnetic high and between several masses of granite. No.7 is more or less isolated.

All anomalies should be tested by taking surface samples and Nos. 1, 4 and 6, 9 and 10, should be tested by drilling after some more detailed mapping to determine rock types and foliation, or bedding if discernible.

The association of radioactivity with the meta-conglomerate should be investigated further by careful tracing and delineation of the conglomerate band, or lenses, at a large map scale and detailed radiometric traversing of the bed.

The only other areas where concealed ore might occur are beneath the magnetic highs centred at :-

(i)	400 S	1800 W
(ii)	250 S	1500 W
(iii)	250 S	600 W

Of these, (i) occurs in a quartz mica schist shear zone near 80 ft.-100 ft. wide between two masses of red granite and near a contact with amphibolite and has no obvious surface source. On Webster's earlier radiometric map (1967) the scintillometer count is shown at 500 ± 100 at the south-eastern edge of the magnetic anomaly. As this is a higher reading than was measured by him for the anomaly at 400 N 1200, which Maynard and Liverton found to have a peak of 1300 c.p.m., it is quite possible that a radiometric anomaly also occurs in the vicinity of the magnetic anomaly. Source for the magnetic anomaly could quite easily be magnetite bearing seams associated with uranium mineralisation. Shallow drill testing is justified.

Magnetic anomaly (ii) is centred over granite near a contact with mica schist and gneiss and no obvious surface source was found. The anomaly is weak and regular slightly higher than background radioactivity was detected by Webster near the south-eastern periphery. Drilling would be justified only if testing at No. (i) anomaly found a lode or strong uranium mineralisation.

The magnetic anomaly (iii) is at the triple contact of red or pink and white granite with feldspathised amphibolitic hornfels on the east and migmatite on the west. It is on the projected continuation west of the South Lode and has slightly higher than background radioactivity centred over it and 150 ft. to the north and south along line 600 W. This anomaly should be tested by drilling.

OTHER MINERALS

Attention is drawn here to the high vanadium, chromium and lanthanide content of Mt. Victoria davidite as shown by the analysis quoted in TableII, p.53, Bull.34.

All assays run for uranium on future samples should also be examined by spectrographic methods for vanadium, chromium and rare earths and assayed by more accurate methods if warranted.

Copper should also be determined spectrographically.

EXPLORATION PROGRAMME

In my letter of 21st December, 1967, a test drilling programme in the mine area was recommended to seek extensions of existing ore bodies. This programme is now expanded to incorporate additional holes designed to test the ore controls advanced in this report. Outside the mine area some drilling is proposed to test magnetic anomalies and combined magnetic and radiometric anomalies.

Some trenching and surface sampling is proposed also.

DRILLING PROGRAMME

Hole No.	Co-Ordinates incl. Grid Bearing.				Depth	
Extensions known lodes						
(a)	680 S	450 W	D45°	North	375'	
(b)	650 S	350 W	52°	North	140'	
(d)	610 S	200 W	45°	North	120'	
(e)	550 S	250 W	40°	East	220'	
(h)	750 S	150 W	70°	North	100'	
(j)	700 S	550 W	75°	North	475'	
(k)	360 S	060 W	55°	West	300'	
(l)	370 S	600 W	45°	North	190'	1900
New Lodes						
(m)	445 S	1785 W	55°	N.20W.	120'	
(n)	320 N	1200 W	55°	North	120'	
(o)	205 N	625 W	70°	North	100'	
(p)	150 N	350 W	45°	N.10E.	150'	490
					Sub-Total	2390
Contingent Holes						
(c)	650 S	250 W	90°	-	120'	
(f)	575 N	200 W	45°	South	100'	
(g)	650 N	150 W	90°	-	50'	
(i)	730 N	200 W	90°	-	300'	570
					Grand Total	2960

Note

1. The targets for the various drill holes are as follows :-

(a) Magnetic anomaly, down dip extension of South Lode, westerly extension of Main Lode below R.L. 675.

(b) Magnetic anomaly, west extension of shallow low grade lode.

(d) Shallow thick low grade lode cut in VH 28.

(e) Fold keel or nose Main Lode.

(h) Lode cut in VH 27.

(j) Deep westerly extension Main Lode ore shoot.

(k) Fold keel or nose Main Lode.

(l) Magnetic anomaly and west near surface extension South and Main Lodes.

New Lodes

(m) Magnetic anomaly.

(n) Magnetic and radiometric anomalies.

(o) Magnetic and radiometric anomalies.

(p) Magnetic and radiometric anomalies.

Contingent Holes

(e) Testing magnetite lode indicated in VH 30.

(f) Test northerly dip of shallow lode cut in VH 28. Only required if hole (d) does not intersect lode.

(g) Test shallow lode cut in VH 27.

(i) Test shallow lode cut in VH 28 at depth.

2. All holes should be radiometrically probed.

SURFACE EXPLORATION

Mine Area

Cut costeans across soil and alluvium in southern gully, and on slope, as follows :-

ALONG	FROM	TO	LENGTH FEET
000 W	630 S	700 S	70
100 W	610 S	670 S	60
150 W	550 S	650 S	100
200 W	550 S	650 S	100
250 W	500 S	650 S	150
515 S	130 W	260 W	130
		TOTAL	610

Note

These costeans should be radiometrically probed, and chip or trench sampled if radioactive.

Discovery of lode at surface in them would alter drilling requirements for holes (e), (d), (f), (g) and (h).

New Radiometric Anomalies

Costean across strike probe radiometrically and assay as follows :-

	ALONG	FROM	TO	LENGTH FEET
3	1000 W	190 N	225 N	35
4 & 6	700 W	190 N	215 N	25
	650 W	190 N	230 N	40
	600 W	215 N	260 N	35
9	325 W	175 N	215 N	40
11	325 W	60 N	100 N	40
			TOTAL	215

Note

This costeaning could alter requirements for drilling holes 10 (o) and (p). Drilling should be done in the order set out and costeaning should commence at same time, or prior to drilling, if convenient.

CONCLUSIONS AND RECOMMENDATION

CONCLUSIONS

It is concluded that previous exploration at Mt. Victoria has not tested, or not thoroughly tested, the following possibilities :-

(i) Westerly extensions of the Main Lode at depth.

(ii) A folded ore body (i.e. Main, South and Central Lodes being folded and faulted parts of the same lode).

(iii) The shallow thick low grade lode cut in VH 27, 28 and 30.

(iv) Westerly shallow extension of Main and South Lodes near 250 S - 250 S, 500 W - 650 W.

The potential ore tonnages which could be available in these situations would be of the order of :-

(i) 100,000 - 150,000 long tons grade 5-6 lb.U_3O_8/long ton down to R.L.
(iii) 150,000 long tons grade 2-3 lb.U_3O_8/long ton.
(ii)&(iv) Say + 20,000 long tons.

It is concluded also that above background radioactivity is associated with the meta-conglomerate noted by Wilson north of the mine area and that this may be the surface expression of mineable ore.

The magnetic anomaly and geologic situation at 400 S, 1800 W, ~~is~~ sufficiently analogous with the mine situation as to warrant testing.

Attention is drawn also to the high vanadium and lanthanide content of Mt. Victoria davidite as shown by the analysis quoted in Bull. 34.

RECOMMENDATION

It is recommended that the ore prospects at Mt. Victoria be tested by the drilling and costeaning programme outlined in the previous section.

W. Johnson

W. JOHNSON
CONSULTING GEOLOGIST

23rd February, 1968.

ELECTROLYTIC ZINC (A'SIA) CO. LTD.
AND NEWMONT PTY. LTD.

MT VICTORIA URANIUM DEPOSIT
SOUTH AUSTRALIA
DETAILED GEOLOGICAL MAP

(N.B. SOME SCREE & ALLUVIAL AREAS INTERPOLATED IN THE FIELD)

By R.B.WILSON Geosurveys of Aust. Pty Ltd

PREPARED BY W. JOHNSON & ASSOCS. 323 WAKEFIELD STREET, ADELAIDE.	SCALE 50 FEET TO 1 INCH	DATE DECEMBER '67

ORE PROSPECTS
MT. VICTORIA URANIUM MINE
SOUTH AUSTRALIA

ENV 849-1

FIGURE 1

ENV849

ELECTROLYTIC ZINC (A'SIA) CO. LTD.
AND NEWMONT PTY. LTD.

MT. VICTORIA URANIUM DEPOSIT
SOUTH AUSTRALIA

CONTOURS OF VERTICAL MAGNETIC INTENSITY & RADIOMETRIC ANOMALIES

PREPARED BY W. JOHNSON & ASSOCS. 323 WAKEFIELD STREET, ADELAIDE.	SCALE 50 FEET TO 1 INCH	DATE MARCH 68

To accompany report by W. Johnson & Associates

ORE PROSPECTS
MT. VICTORIA URANIUM MINE
SOUTH AUSTRALIA

ENV 849-2 FIG. 2

ENV 849

ORE PROSPECTS
MT. VICTORIA URANIUM MINE
SOUTH AUSTRALIA

APPENDIX

Letter Report on Geology
by
R. B. Wilson

The Mt. Victoria area is a complex zone of metasediments migmatite and granite, with all gradations between. The orebody itself is a mineralized biotitic rock which, in surface outcrop pattern, appears folded. General foliation trends in the area vary from 110° in the southeast to 055° toward the west.

The southeastern part of the area consists largely of mica schist (with relics of metaquartzite), partly migmatized, with some white sericitic granite intrusions. Migmatisation increases rapidly westward with several smaller and finally a large body of massive pink-red intrusive granite, which dominates the western part of the area.

North of about Co-ordinate 400 S, the migmatized metasediment includes increasing proportions of a dark green amphibolitic to hornfelsic rock (including some meta-grit and meta-conglomerate) until north of 100 S, a large area of these dark-coloured, relatively un-migmatized metasediments are preserved about the main creek. Migmatization increases rapidly both to the west and the east of the main creek, with the intrusion of many bodies of pink to white massive-granite bodies.

Exposures of migmatite along the creek-bed often show complexly drag-folded banding as compared to the east-northeast-trending foliation which dips consistently to the south-southeast. This would indicate that the major preserved schist and darker metasedimentary bands show trends and drag-folding of foliation or schistosity, rather than of original bedding.

If the ore-zone was confined to a particular meta-stratigraphic horizon, than it could possibly be drag-folded in a pattern independent of the present east-northeast trend of remnant metasedimentary, non-granitized, bands.

The main positive magnetic anomalies can be related to outcropping (or near-outcropping) magnetite or else to magnetite screes. The magnetite appears to occur as magnetite schist. No magnetite could be found to account for the sharp positive anomaly centered at co-ordinates 400 S; 1800 W.

Unfortunately the 10-chain aerial photographs of the Mt. Victoria area were not available at the time of the survey. I feel that a more regional survey of a few square miles in this area may be warranted at some future date.

Signed: R.B. Wilson.

100 ENV 847

John E. Webb
Consultant Geophysicist

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REPORT ON

AN AIRBORNE GAMMA RAY SCINTILLATION SURVEY

of the

CROCKER WELL AREA

by

J.E. Webb

Consulting Geophysicist

INTRODUCTION

This report covers the results obtained from the airborne gamma ray scintillation survey of a section of the Crocker Well Area immediately surrounding the known mineral occurrences.

The survey was under the control of the Electrolytic Zinc Co. of A/Asia. Ltd., and a description of the navigational control and overall purposes of the survey is contained in a report by C.M. Maynard.

The author was responsible for the examination and plotting of the results.

DESCRIPTION OF EQUIPMENT

The scintillometer used in the survey comprised a 4½ inch diameter by 2 inch thick thallium activated sodium iodide crystal coupled to a 5 inch photo multiplier tube. The ratemeter was designed and constructed by the S.A. Department of Mines and the readings were recorded on an Esterline-Angus chart recorder.

The speed of the paper through the recorder was varied between 10 and 13 inches per minute to match the helicopter's speed for plotting purposes. The scintillometer recorded total gamma ray intensity so that signals recorded included gamma rays from all radioactive mineral such as potassium and thorium in addition to uranium. Cosmic rays could also be expected to affect the results. Daily checks of background count taken on the instrument showed that this did not vary appreciably and no corrections were made.

..2/

The ratemeter was used on the 2000 count per second range throughout the survey and no attempt was made to record signals which exceeded full scale deflection. The 2000 gamma contour recorded in the centre of the higher intensity anomalies is therefore not necessarily the maximum value of that anomaly.

The equipment was installed in a Bell 47 G-FIVE helicopter owned by Australian Helicopters. The survey was flown with a nominal ground clearance of 30 feet and every effort was made to control this clearance and also the lateral variations from the intended flight path.

DESCRIPTION OF RECORDS

The records were in the form of curvilinear paper chart and had a nominal full scale deflection of 2000 counts per second for the equipment used. The calibration is relative and no attempt was made to obtain an absolute calibration in milli-rontgens per hour. A radioactive sample was used to keep the calibration constant.

As the main purpose was to locate areas of increased radioactivity however small, the most sensitive scale was used.

The charts were examined for two types of anomalies:-

1. Those of sufficient intensity to be contoured. The minimum contour value was taken as 600 counts/second with a contour interval of 200 counts/second.

2. Those peaks which although very small could be seen to stand out from the general background signal (called noise). These were too small to be recorded as an intensity above background and were designated by their peaks value on the chart. As the background varied, these anomalies are of equal interest irrespective of their designated value.

A third type of anomaly has still to be examined. That of changes of background intensity which could indicate geological changes.

DISCUSSION OF RESULTS

Contoured values of radioactivity

The results have been contoured at 200 count per second (cps) intervals. The levels are above instrumental zero. The background varies over different rock outcrops and this will have an effect on the absolute value of some contour values. The anomalous level is also affected by soil or rock cover so that no relationship between anomaly intensity and uranium content can be assigned. There is, therefore, very little value to be derived from background corrections.

why?

A value of 600 counts/second has been chosen as the first significant level of intensity and all closed contours of 600 c.p.s. and above must be considered as potential targets. This means that all outcrop areas are potential targets, an impossible axiom for investigation so, for this discussion a level of 1000 c.p.s. has been taken as an indication of possible radioactive centres. Even this criterion gives up to 20 targets. These centres are listed later with comments.

In addition to areas of high gamma ray intensity, there are areas of low intensity and several of these are worthy of comment.

The adamellite outcrop centred around 8000N 2000E is devoid of contourable activity and is magnetically undisturbed (see results of Webster's survey). However the rim of this outcrop is outlined by anomalies. Many other areas of adamellite are also devoid of activity and this greatly reduces their value as targets. Some reserve must be exercised as the "current bun" type of occurrence of brannerite (abscite) does not necessarily give anomalies at the surface.

The majority of the anomalies lie over adamellite or regional granite with a few over migmatite-adamellite. Further thought is necessary on what is the control on the occurrence of radioactivity. Although adamellite appears to be the most favourable host rock, it need not be the only host. Also it is obvious that some adamellites are devoid of activity.

The soil covered areas are particularly lacking in anomalies and other means of prospecting in these areas are needed.

Many of the anomalous areas were previously known and some have been investigated either on the surface or by drilling. It is not proposed to discuss in any detail the results of previous investigations, this being left to Messrs. Johnson & Maynard.

The position of the anomalies will be shifted slightly in the direction of the helicopters flight due to instrumental time delays. As the direction of flying was varied during the survey some allowance must be made for the shift in ground location of the anomalies. The plan in the upper left hand corner of plan No. 1 gives the direction of flight.

..5/

This discussion assumes that the contour plan is examined in conjunction with the geological plan compiled by R.B. Wilson of Geosurveys.

Anomaly A (Main Crocker Prospect).

The intensity here is well above 2000 cps in two areas with a low in between. The area covered by the anomaly is more extensive than that originally investigated by ground surveys. Some caution should be expressed here as the surface has been exposed by trenching and the contours should not be taken as a true indication of the area of outcrop. The anomaly lies partly over adamellite and partly over Mignatite-adamellite. There is an extension of the anomaly to the north along the line 5200N. This could be due to drainage from the outcrop on to the alluvium. Ground inspection of this anomaly is recommended accompanied by scintillometer surveys over areas where the surface has not been disturbed.

Anomaly B (Crocker South Prospect).

This is a small anomaly with two centres of 1600 c.p.s. It lies over adamellite and regional granite and is in close proximity to a fault.

Anomaly C (Main Eastern Prospect).

A large anomaly of greater than 2000 c.p.s. intensity. This area has been investigated by drilling. Anomaly is mainly over adamellite.

Anomaly D (Crocker East Central Prospect).

This is a small intense anomaly which is known and has had some investigation. There are southward extensions of both anomalies C & D as outlined by the 1000 c.p.s. contours into the regional granite. These could be due to drainage but require checking.

..6/

Anomalies E & F (Crocker East, Western Prospect).

Anomaly E is a small intense anomaly over the previously known Western Prospect and is closely related to anomaly F over the South-Western Prospect. These are over adamellite and follow around edge of an outcrop where it abuts mixed adamellite and mignatite.

The whole group of Crocker East anomalies are in close proximity to shear zones. Again there are extensions of these anomalies to the south as outlined by the 1000 c.p.s. contours (Over regional granite but near adamellite outcrops).

All Crocker East anomalies need further consideration in the light of the present survey.

Anomaly G (1600N - 4000W)

This is a small anomaly of 1200 c.p.s. centred over adamellite. Several occurrences of abscite have been reported from this area. Further investigation is recommended.

Anomaly H (3000N - 9000W)

This is a small anomaly of 1000 c.p.s. centred over a shear zone. Uraninite has been reported here. Two other centres of 800 c.p.s. are centred on the same shear and the contour pattern is parallel to the shears. Further investigation of this area is recommended.

Anomaly Group 1 (500N to 1500N and 8000W to 9000W)

This group has three centres above 1000 c.p.s. along a E-W line of shear. The strike of the anomalies is North-South. They all lie over adamellite. One occurrence of davidite has been reported to the east of this group.

..7/

Anomaly Group J (2000S to 1000S and 1080W to 1180W).

This group of three centres of 1000 c.p.s. is over regional granite. The group lies well to the south of adamellite outcrops.

Ground checking is recommended as a first step.

Anomaly Group K (1000S - 4300W)

There is a small group of 1000 c.p.s. centres over adamellite and in close proximity to a shear zone at 700S and a fault at 1200S. The group lies several hundred feet to the east of an orthite occurrence. Ground checking is recommended.

Anomaly Group L (2000S and 4000 to 5000W)

A group of 1000 c.p.s. centres over adamellite and possibly associated with group L.

Group M (2000-3000S and 4000-2000W)

Two large anomalies on an NE-SW strike with a low in between. M1 has an intensity of 1200 c.p.s. and as it extends outside the survey area it could have a higher centre.

M2 has a peak intensity of over 1400 c.p.s. and together the two anomalies have an area approaching that of the main Crocker Prospect and Crocker East. The anomalies are over adamellite and are contained between two shear zones. Several occurrences of abscite have been reported in the area.

Ground scintillometer traverses and geological inspection are recommended and even at this stage some drilling should be anticipated.

..8/

Group N (2000S and 1000-2000W)

This is a group of three centres of 1000 c.p.s. and possibly is a continuation of group M. They overlie regional granite and are contained between two shear zones.

Ground inspection is recommended with the suggestion that the survey of group M be extended to cover this area.

Group O (3000S-2000W)

A group of 1000 c.p.s. anomalies lying mainly along a NE-SW shear zone through regional granite. Ground checking is recommended.

Group P (00N-1000W)

A small peak of 1000 c.p.s. surrounded by a larger area of 800 c.p.s. It is over regional granite but extends over mignatite, adamellite. Ground inspection is recommended.

Group Q (1000N-3000W)

An elongated 1000 c.p.s. centre over regional granite-adamellite. Ground inspection is recommended.

Group R (00N-3000W)

Small 1000 c.p.s. centre over regional granite, adamellite. Ground inspection is recommended.

Group S (9000-1000N 500W-4000E)

An extensive group of 1000 c.p.s. anomalies grouped around the northern eastern and western edges of an extensive adamellite outcrop. They lie generally on regional granite.

..9/

This group is interesting in that they are in an area not previously considered favourable. Also the adamellite outcrop around whose edge they lie is without any radioactivity (and is also magnetically quiet - see magnetic plan of area by S. Webster).

Close inspection of this area is recommended.

Sundry anomalies

There are a few isolated anomalies of 1000 c.p.s. marked T to W which all require ground checking.

Many areas of an intensity of 800 c.p.s. and in some cases 600 c.p.s. should be considered as possible targets. It is possible that areas of radioactivity are masked by soil or rock cover and are not reflected in the results.

Minor Anomalous Trends

In addition to contouring the scintillometer charts were examined for all minor peaks and these were plotted and examined for line-ups or continuity. These trends are shown on plan No. 2 . Anomalous areas are excluded from this examination.

The trend patterns reflect the contour pattern, in that areas of few contours also have few trends, however some trends do exist in areas of low contour activity and can be used as guides in these areas. In particular some trends are present in the alluvial areas and the adamellite outcrop in the North East corner of the area. Because of the North South flight lines there will be a preference for East West trends as North South trends would be reflected as changes of profile level. The trends are based on lineups of minor anomalies and cannot be accepted as the only possible interpretation.

..10/

They are presented as a guide in investigations and no comment is made on the directions at this time.

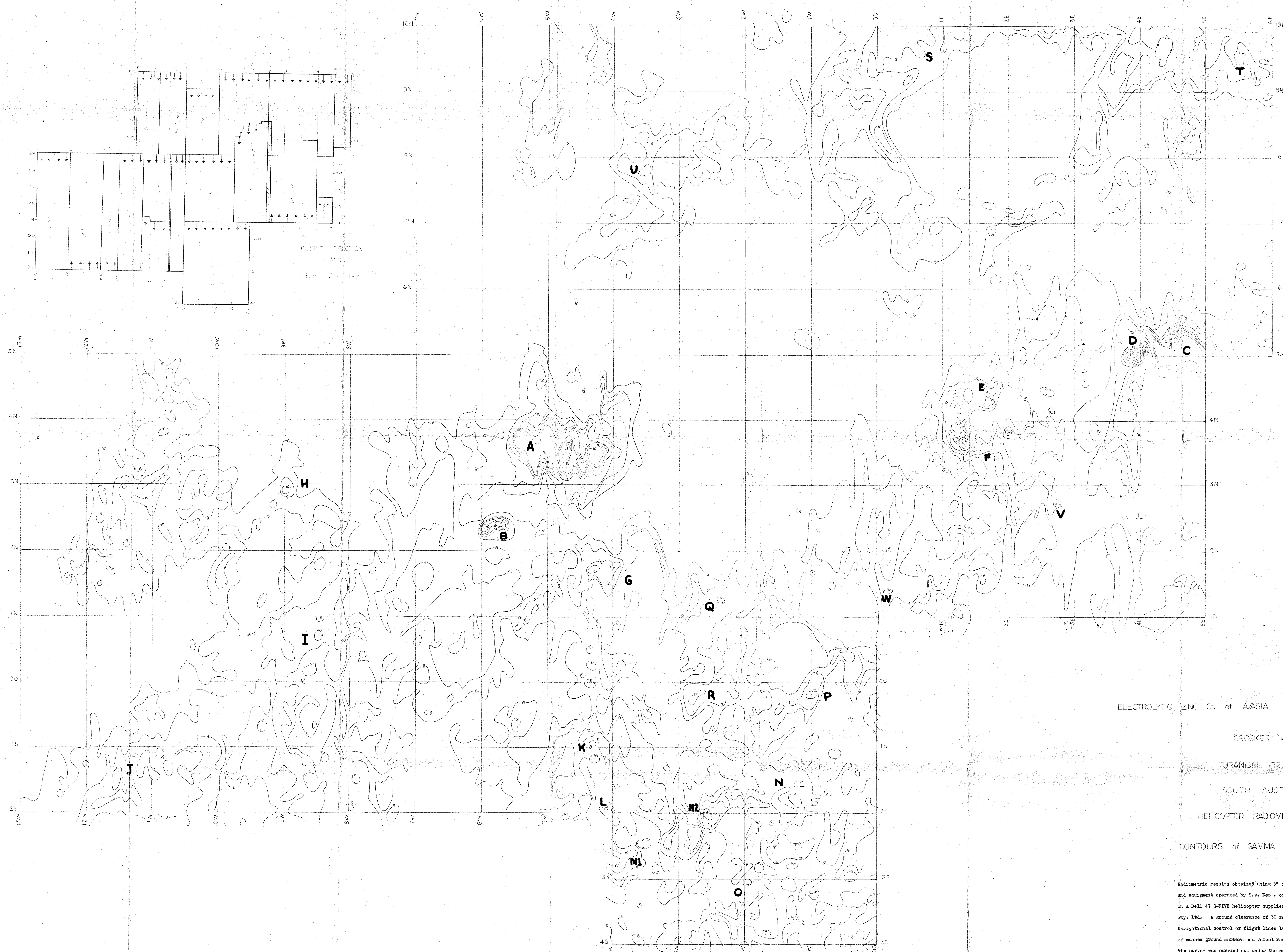
CONCLUSIONS & RECOMMENDATIONS

Individual recommendations have been made for each anomaly discussed. Generally, all anomalies listed should be examined by a geologist with the assistance of a scintillometer. Unless the anomaly can be accounted for definitely as a non economic source the inspection should be followed ground surveys.

Some ground scintillometer tests should be carried out over trend lines especially in alluvium covered areas to assist in the evaluation of the trends.

The results show that the use of airborne scintillometry at a ground clearance of 30 to 50 feet can be very valuable in the location of radioactive centres providing extreme care is taken in control of the flight path of the helicopter.

John E. Webb



ELECTROLYTIC ZINC Co. of A/ASIA LTD. & NEWMONT Pty. Ltd.

CROCKER WELL

URANIUM PROSPECT

SOUTH AUSTRALIA

HELICOPTER RADIOMETRIC SURVEY

CONTOURS of GAMMA RAY INTENSITY

Radiometric results obtained using 5" diameter x 2" thick crystal and equipment operated by S.A. Dept. of Mines personnel , installed in a Bell 47 G-FIVE helicopter supplied by Australian Helicopters Pty. Ltd. A ground clearance of 30 feet was maintained visually. Navigational control of flight lines 100 feet apart was by means of manned ground markers and verbal radio directions. The survey was carried out under the control of Electrolytic Zinc Co. personnel.

CONTOUR INTERVAL - 200 counts per sec.

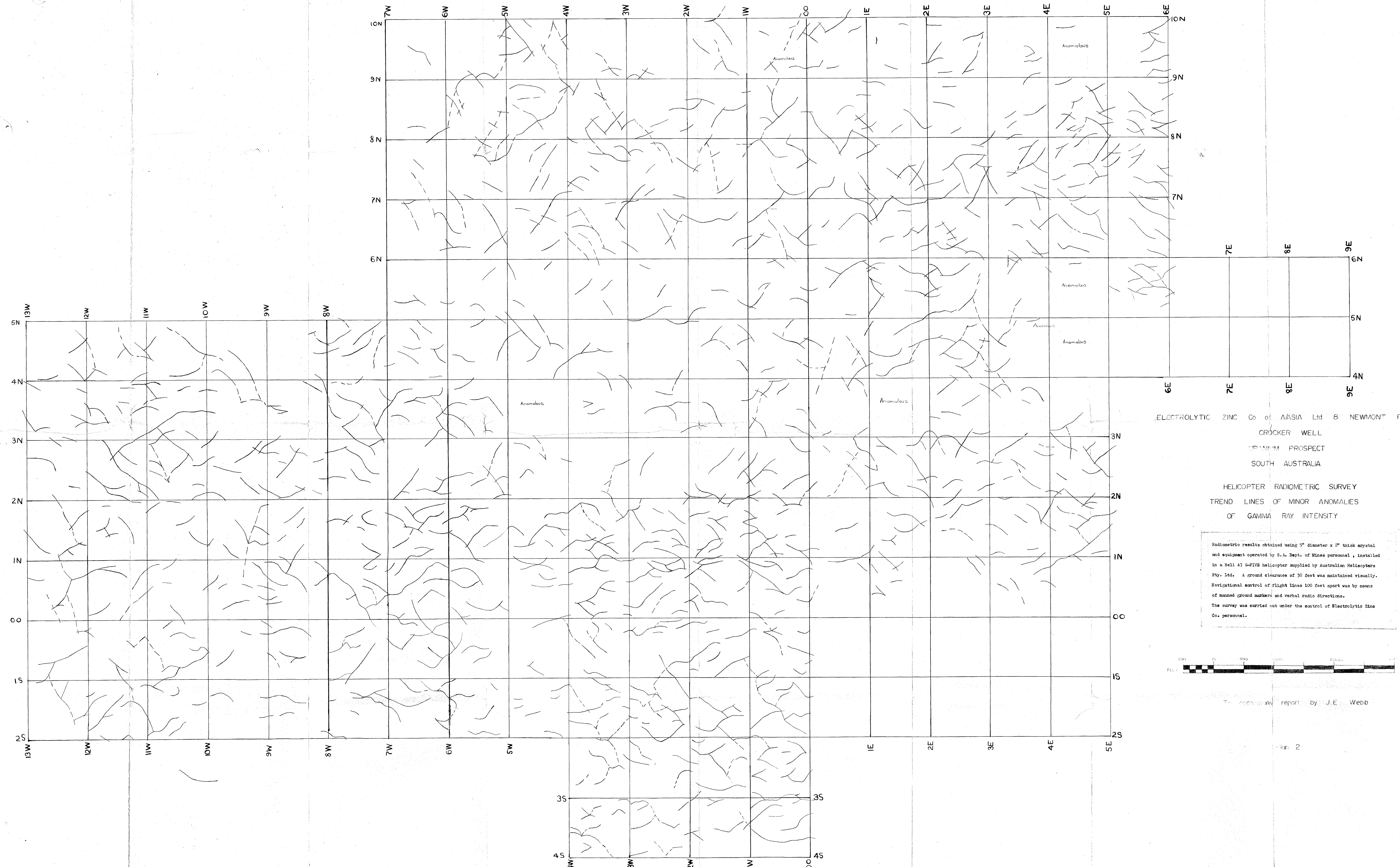
FEET 500 0 500 1000 2000 3000 4000

To accompany report by J.E. WEBB

CW 13

PLAN 1

ENV 847-1



ELECTROLYTIC ZINC Co of A/ASIA Ltd & NEWMONT Pty Ltd

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The survey was carried out under the control of Electrolytic Zinc Co. personnel.

To accompany report by J.E. Webb

Plan 2

ENV 847-2

Envelope ~~315~~ 913

040

EXPLORATION of S. M. L. 118.

Summary of Rotary - Percussion Drilling carried out during April - May, 1967.

A total of 2379' of 6" diam. holes were drilled by an Ingersoll - Rand "Drillmaster" with down-the-hole hammer. All holes were vertical. The drilling was divided into two sections:

(i)	Valuation Comparison Drilling.	10 holes	(1869')
(ii)	Test drilling.	10 holes	(510')

(i) Valuation Comparison Drilling:

These ten holes were drilled at 25' spacing along the 3800 E co-ordinate line from 4725 N to 4950 N. The drilling covered the mineralised section of the 3800 E cross-section across the Central Deposit at East Crocker. Each 5' section of the holes was sampled and the samples sent to AMDEL for assay for uranium. Assaying was carried out by the fluorimetric method. In addition each sample was tested for Titanium, Phosphorus, Boron and Zirconium by means of the semi-quantitative spectrographic method.

The 3800 E section had been previously drilled by the Mines Department. (Diamond Drill Holes-E C 12, E C 11, E C 50, E C 66, E C 75). All holes were drilled in a N - S direction and dipped 45° to the North. For valuation comparison purposes a block was selected on the cross-section~~s~~, bounded by the ground surface, the "hanging-wall" and "footwall" of the adamellite and a line drawn half way between the two lowest diamond drill holes (E C 66, E C 75).

A calculation of the valuation of this block from Mines Department values was made by taking the valuation of the section of hole used in the Mines Department ore reserve calculations and spreading this over the full length of intersection of the hole within the selected block. This in effect allots a nil value to the sections of hole outside the Mines Department ore reserves, and thus results in a slightly low valuation. A valuation of the block was also obtained from the results of the rotary-percussion drilling.

A comparison of the valuations is as follows :-

	Mines Dept. Diamond Drilling	E.Z. Rotary-Percussion drilling.
	(values in lbs. U_3O_8 per long ton)	
Valuation from chemical or radiometric assaying.	1 . 12	0 . 94
Valuation from radiometric probing of holes.	1 . 52	1 . 52

Thus it is seen that a fairly close agreement exists between the valuations by radiometric probing of the two sets of holes. The assay results do not show as close an agreement. However, it must be remembered that the spacing of the D. D. holes was about 70' as compared to the 25' of the rotary-percussion holes.

A secondary purpose of the drilling was to find what spacing of holes would be necessary to adequately test an area. To check this, valuations of the block were made using only some of the holes.

Thus : (valuation by chemical assays, lbs. U_3O_8 / long ton)

(a) taking every second hole (i.e. 50' spacing of holes)

1st set	2nd Set
0.95	0.92

0.935

(b) taking every third hole (i.e. 75' spacing of holes)

1st set	2nd set	3rd set
0.71	1.09	1.04

0.945

(c) taking every fourth hole (i.e. 100' spacing of holes)

1st set	2nd set	3rd set	4th set
1.31	1.13	0.58	0.66

0.92

From these calculations, it would seem that to obtain satisfactory valuation of an area, spacing of the holes should not be much more than 50'. (b) above corresponds roughly in spacing to the D.D. holes. Thus the valuation by the D.D. holes could well be comparable to that by the rotary-percussion drilling.

(ii) Test Drilling:

Two short (approx. 50') holes were drilled on each of two small radiometric anomalies in the East Crocker area. Very little uranium was found.

Five short holes were drilled on an area under alluvial cover where apparently anomalousconcentrations of radon had been found in Gemco holes. Again, very little uranium was found.

One 85' hole bored on the alluvial flat towards Victoria Hut remained in alluvium to 75', but secured a flow of water of 2000 gals. per hour.

C. J. Sullivan

ENV 850

Electrolytic Zinc Co. of A/Asia. Ltd.

043

EXPLORATION of SPECIAL MINING LEASE No. 118

REPORT ON

ROTARY PERCUSSION DRILLING

AT

CROCKER WELL

(April - May 1967)

AND

GRADE EVALUATION

of

EAST CROCKER DEPOSITS.

by

C. C. MAYNARD.

Project Engineer.

May 1968.

TABLE OF CONTENTS.

SUMMARY

A program of rotary - percussion drilling was carried out at the Crocker Well deposits during April - May 1967. Assaying of samples from the cuttings and gamma probing of the holes followed the drilling. The major portion (lo holes, 1869') of this program of drilling consisted of one line of holes spaced at 25' intervals and was designed to value a section in the Crooker Well deposits which had previously been valued by Mines Dept. diamond drilling. This line of drilling provided a very good basis for valuation of the 3800 E cross-section of the Central Deposit at East Crocker. A small amount of drilling (10 holes, 510') in previously untested areas failed to disclose any significant uranium mineralisation.

Comparisons have been drawn between the valuation of the 3800 E section from this drilling and valuation by the Mines Dept. diamond drilling. These comparisons show that the method of valuation used by the Mines Department (gamma probing of D.D. holes) has considerably overvalued this section.

Valuation by means of gamma probing of holes is investigated and conclusions drawn which have an important bearing on the valuation of the East Crocker deposits, and probably on the valuation of other deposits.

From the comparisons and investigations, conclusions have been drawn which indicate that the uranium content of the East Crocker Deposits is considerably lower than that determined by the Mines Department. Some important reservations exist in respect of these conclusions; means of investigating these are suggested.

D R I L L I N G XXXXXXXXX.

(a) Valuation Comparison Drilling : 046

The 3800 E cross-section across the Central Deposit of the East Crooker was chosen as the site for the comparison of valuations as this section seemed to embrace the most consistent and concentrated mineralisation and some of the highest values encountered by the Mines Department drilling. The Mines Dept. drilling of this section consisted in 5 diamond drill holes (EC 12, EC 11, EC 50, EC66, EC 75) on a N-S bearing, all angled at a dip of 45° to the North. The collars of the holes were spaced at intervals of 90' to 100' thus giving a hole spacing of some 60' to 70'. (see plan 55-261)

The present drilling consisted of 10 (6"dia.) vertical rotary-percussion holes, with collars set at 25' spacing along the section.

Position and depths of holes were as follows:-

All holes were placed along the 3800 E co-ordinate line :-

Hole No.	North Coord.	Depth of hole. (feet)	Depth of Water. (approx.)
C E Z - 2	4725	321	94
3	4750	220½	74
4	4775	221	82
5	4800	221	121
6	4825	196½	97
7	4850	196½	72
8	4875	146	63
9	4900	145½	66
10	4925	105½	59
C E Z - 11	4950	95½	82
Totals - - 10 holes		1869'	

047

(b) Test Drilling :

Positions and depths of test holes were as follows :-

Hole No.	Coords.	Depth. (feet)
C E Z - 12	4411 N; 4011 E	48
13	4436 N, 3874 E	48
14	5708 N, 2443 E	47½
15	5617 N, 2329 E	47½
16	4000 N, 1400 W	47½
17	4000 N, 1600 W	47½
18	4000 N, 1800 W	47½
19	4050 N, 1600 W	47
20	3950 N, 1600 W	47
C E Z - 21	*	82½
Totals - - 10 holes		510

* This hole was collared in alluvium at a position approx. 1 mile due South of Victoria Hut.

CEZ - 12 and CEZ - 13 were drilled on a small anomalous area shown up by a ground radiometric survey. - - (see E.Z. plan CW 4)

CEZ - 14 and CEZ - 15 were drilled on another similar anomaly.

CEZ - 16, CEZ - 17, CEZ - 18, CEZ - 19 and CEZ - 20 were drilled on alluvium covered area, where radon concentrations in Gemco auger holes had appeared to be anomalously high.

CEZ - 21 was virtually a "wild-cat" hole which proved to be largely in alluvium. It did, however, achieve a flow of water of some 2,000 gals/hour.

(c) Drilling Equipment ~~sampling procedure etc.~~ 043

The drilling was carried out by means of an Ingersoll-Rand "Drillmaster" rig with I - R and Mission down-the-hole hammers and bits. A 1200 c.f.m. (100 p.s.i.) compressor provided air for drilling and for carrying the cuttings to the surface. Bits used were 6" dia. tungsten-carbide tipped 4-point star bits. Drill rods were 25' in length.

The drilling was carried out on contract by Dalnit Pty. Ltd.

(d) Sampling :

For all holes samples were collected over each 5' interval. Sample collection was carried out by two methods -

(a) for dry drilling, (b) for wet drilling

In dry drilling, the complete cuttings from the 5' interval (approx. 170lbs.) were caught in a cyclone, which was incorporated with the drilling plant. The cuttings were drawn off from the cyclone into calico bags 36" x 19". The cuttings were then either immediately passed through a 12 slot splitter, with a throat opening approx. 13½" x 10" (each slot approx. 1" wide x 10" long) or put aside for later splitting. The cuttings were split down to give a final sample approx. 1/16 of the original bulk. (i.e. a 10 - 11 lb. sample). In wet drilling, the cuttings were brought to the surface by an air-water mixture and allowed to flow through a wet splitting trough - a long shallow flat bottomed trough with a number of splitting vanes. The vanes were set in the trough so that approx. ¼ of the total cuttings was caught as a sample. The remainder was allowed to flow away. The sample was caught in a calico bag which was sufficiently porous to allow the water to seep through. The bags of wet samples were then put aside to air dry. Dependent largely on the fineness of the cuttings, drying took from one day to a week. When dry the samples were split twice through the dry splitter, thus reducing the final sample to ¼ (or to approx. 1/16 of the original cuttings).

In both cases the final sample was bagged in plastic-lined calico bags.

The reject material from the sampling was laid out in order in lines.

In a few cases, the full cuttings from a 5' run was bagged off and kept for sizing tests.

(e) Water :

Water was encountered in all holes at depths varying from 59' (approx.) in CEZ 10 to 121' (approx.) in CEZ 5). Water flow varied from an estimated 2000 gals./hr. down to a few gals. per hour. The first two holes drilled (CEZ 11 and CEZ 10) obviously cut the same water-bearing shear and a good flow of water was maintained to the bottom of the hole. The remainder of the holes were bored in the order CEZ 4, 3, 2, 9, 8, 7, 6, 5. It was obvious with these holes that the country surrounding was being drained by the water removed from the holes. A good flow of water was encountered in hole CEZ 4, but by the time drilling had progressed to the deeper section of hole CEZ 2 the water flow had reduced very considerably. A good flow was again encountered in hole CEZ 9, but by the time holes CEZ 6 and CEZ 5 were drilled water flow had dropped to a trickle and it was necessary to add water to the hole to bring the sample up. It was noticable that the water table dropped with these later holes.

(a) ASSAYING & PROBING OF HOLES.

Assaying : All samples were sent to AMDEL for assaying. At AMDEL, all (approx.) 10lb. samples were fed through rolls to ensure that all the larger chips were reduced to less than $\frac{1}{8}$". A 100 gram sample was then riffled out. ~~XXXX~~ This 100 gram sample was then ground in a SIEB TECHNIK mill to a nominal 200 mesh. From this sample a 1 gram sample was taken out for uranium analysis. The 1 gram sample was taken into solution and uranium determined fluorimetrically.

Portion of the remainder of the 100 gram sample was used for spectrographic anolysis for Boron, Phosphorus, Titanium, Zirconium and Yttrium in an attempt to find a geochemical indicator for uranium mineralisation. The remaining portion of the 100 gram samples have been retained by Amdel.

The remainders of the original (10 lb.) samples were returned to Electrolytic Zinc and are held in store.

(b) Assay Results :

Assay results are recorded In Appendix A (appended to this report).

Location of holes and samples, and sample values for holes CEZ 2 to CEZ 11 are also shown on plan No. C.W. 7. This plan shows the section of 3800 E and overlays the Mines Department plan No. 55 - 261. Assay values have also been plotted on plan No. CW 8. On this plan, the vertical scale is the same as for plan No. CW 7 (1 inch = 20 feet) but the holes have been moved apart to allow room for plotting the values on a suitable scale. Assay values varied up to a maximum of 18.1 lbs. U_3O_8 per long ton. The assay results in this section tend to confirm the Mines Dept. experience that uranium values are largely confined to the "Adamellite" and to a lesser extent to the "Pink pegmatitic granite and equivalents". (It seems probable that the latter rock type may be equated to the adamellite). Very little values occur within the "Schist and meta-sediments - schistose granites" or the "hybrid granite - granodiorite - migmatite etc." The results also confirm the picture, within the adamellite, of high grade patches of limited extent separated by wide areas of low grade material. One feature shown up by the plotting is that the high values appear in near horizontal bands across the holes, thus suggesting some near-horizontal control to mineralisation in this section.

In the exploratory holes CEZ-12 to CEZ-21, no significant uranium mineralisation was discovered - all assay values being at or below the minimum determinable. These assyas are recorded in Appendix B.

(c) Probing of Holes :

In order : (i) to investigate the use of probing for valuation of Crocker Well deposits, (ii) to examine the relationship between gamma probing of holes and chemical assay of samples, (iii) to attempt to tie in the valuation by these holes to the Mines Department valuation of the section, it was decided to log the holes radiometrically.

Logging was carried out in August, 1967, using the Mines Dept. Neltronic Model 1 K Type D Logging Unit. Mines Dept. technician, R. Turner, operated the equipment.

For radiometric logging this unit is equipped with a scintillation probe measuring total gamma counts, the counts being recorded on a pen - recorder chart.

While the equipment is designed essentially for logging of petroleum and water bores, it was a relatively simple matter for the technician to alter the circuitry of the probe to measure the much higher gamma counts of uranium deposits.

The cable which supports the probe and carries the signals, passes over a movable pulley, set at the collar of the hole, thence over a pulley attached to the equipment and thence to a winding drum which is hand wound. The second pulley (which is carefully machined to minimise slippage between the cable and the pulley) drives the pen-recorder chart through a gear chain. The gears may be set to give chart scales of linch = 20 feet or linch = 50 feet. (In this case the 1 inch = 20 feet scale was selected, this being the scale of the Mines Dept. cross sections). This pulley also drives a depth counter, which records distance travelled by the probe in feet.

Summary of operating procedure adopted.

(i) The depth counter was set at 10 feet when a marker on the cable 10 feet from the probe crystal was at the collar (i.e. counter should read zero when the crystal was at the collar.)

(ii) The rate meter was switched on (chart drive disconnected) and the probe wound down the hole. Gamma-count readings were observed while the probe was lowered. This allows the operator to observe where to expect high readings and what magnitude to expect, and thus plan what scale or scales will be used.

(iii) On reaching the bottom of the hole the ratemeter was switched to the appropriate scale. The pen-recorder chart was connected in and the pen moved across the chart to score a line representing the bottom of the hole (or rather the position of the probe crystal when the end of the probe is touching the bottom of the hole.). The reading on the depth counter was also recorded.

(iv) Winding was commenced and carried on at a steady pace until the probe was near the top of the hole. Speed of winding depends on the time constant chosen. In this case, a time constant of 2 secs. was used and winding was carried out at 10 to 15 feet per minute (well within the recommended maximum speed).

The height of the collar pulley was not sufficient to allow the probe crystal to be wound up to the collar. It was thus necessary to lift the probe out of the hole for the last couple of feet. At the estimated zero position, a line was scored across the chart.

(v) The probe was then placed in the Mines Department (red) calibration tube. With the chart drive disconnected, the chart was moved a couple of inches to provide a record of the reading given by the calibration tube.

VALUATION :

Selected area "A" - In order to provide a basis for comparison of the valuation from this drilling and the valuation from the Mines Dept. diamond drilling, a suitable area of the 3800 E cross-section was selected. This area was boundedby the ground surface, the "hanging wall" and "footwall" of the adamellite and a line drawn midway between the Mines Department D. D. holes EC 66 and EC 75. This area was selected on the basis that the mineralisation is largely confined to the adamellite and that both the Mines Department D.D. holes (EC 12, EC 11, EC 50, EC 66) and the rotary percussion holes CEZ - 2 to CEZ - 11 are spread fairly evenly over the area and thus may be regarded as sampling the area ona fairly systematic basis.

Mines Department Selected Area "B"

So that a second comparison may be made, the area selected for valuation by the Mines Dept. has been made use of, by valuing this area by means of the rotary-percussion holes and comparing this with the Mines Dept. valuations.

(a) Valuation by chemical assays of samples from rotary-percussion drilling :

This valuation was effected in both cases by simply taking the arithmetic mean of all samples included within the selected area. (virtually all samples were of equal size - 5 feet of drilling)

Notes : (1) Where holes crossed the boundary of the selected area, whole samples only were used in the calculation - the effect of this approximation on the final result is insignificant due to the large total number of samples.

(2) In the few cases where assays of samples were missing, values were attributed to the samples based on a consideration of :

(i) the magnitude of the gamma probe record at that point

(ii) an approximate knowledge of the gamma count of the sample

(iii) the value of adjacent samples.

Calculation of the mean valuation for the selected section of each hole is included in Appendix A.

Calculation of the mean value for the whole of the selected area is shown in Table 1.

The mean value for the selected area "A" is calculated at 0.964 lbs. U_3O_8 per long ton. Valuation of the selected area by using every second, every third and every fourth hole (i.e. at hole spacings of 50', 75' and 100') is also included in Table 1.

The mean value for the Mines Dept. selected area "B" is calculated at 1.369 lbs. U_3O_8 per long ton. In Table 2 the results for the Mines Department selected area are treated in a similar manner to the results for the selected area in Table 1.

(b) Valuation by gamma probing of the rotary-percussion holes :

In making the valuation by this method, the Mines Department method of valuation has in effect been used.

The deflection recorded when the probe was in the calibrating tube was taken as representing the value attributed to the tube by the Mines Dept. The mean deflection recorded over the selected interval of the hole was then determined. The mean valuation of the hole has been taken as

$$\frac{\text{Mean deflection over the selected interval}}{\text{deflection due to the calibrating tube}} \times \text{value attributed to the calibrating tube.}$$

It is inherent in this calculation that over any length of a hole, the uranium content of the rock surrounding that length is taken as being directly proportional to the mean deflection recorded by the probing over that length. It will be shown later that this is not the case and that serious errors may result from using this method of valuation.

The deflection due to the calibrating tube (the mean of seven readings taken with the probing of seven of the holes) was measured as 2.65 inches. The value attributed to the calibrating tube (the red Mines Dept. tube) was quoted to me as being 7lbs. U_3O_8 per long ton. On this basis, the probe logs were thus calibrated as - 1 inch $= \frac{7}{2.65}$ lbs. U_3O_8 per long ton

$= 2.64$ lbs. U_3O_8 per long ton

Table 3 summarises the valuation of the selected area "A" on this calibration basis. Mean valuation of the area on this basis is seen to be 1.524 lbs. U_3O_8 per long ton. (See Table 3)

Later examination of Mines Department probe logs suggest that value attributed to the red tube by the Mines Department was 7.8 and not 7 lbs. U_3O_8 per long ton. If this value had been used in the calculations, the calibration would have given a ~~fx~~ figure of 1 inch = 2.94 lbs. U_3O_8 per long ton and a mean valuation for the selected area of

$$\left(1.524 \times \frac{7.8}{7.0}\right) \text{ lbs. } U_3O_8 \text{ per long ton}$$

$$= \underline{\underline{1.698}} \text{ lbs. } U_3O_8 \text{ per long ton.}$$

Valuation from the probing of the rotary-percussion holes was not carried out on the area selected by the Mines Department.

(c) Valuation by assays of Mines Department diamond drill core

The weighted average grade has been calculated for the selected area "A" by

(i) accepting the weighted average grades of the sections of holes within the Mines Department selected area and weighting these by the lengths of the sections.

(ii) adding to these the chemical assay grades as shown on the cross-section (Mines Dept. plan No. 55-261) weighted by their respective lengths for the remaining sections of the D.D. holes which lie within the selected area.

Thus the final weighted grade for the selected area was calculated at 1.27 lbs. U_3O_8 per long ton

Note : An approximate calculation of this grade was quoted in earlier communications.

("Summary of Rotary - Percussion Drilling carried out during April to May, 1967" - forwarded 21st December, 1967).

This figure (1.12 lbs. U_3O_8 per long ton) was obtained by using (i) above and weighting the remaining portion of the holes with zero value.

Valuation of the Mines Department selected area "B" has been taken from the summary report :

"Report on North East Uranium Exploration -

Crocker Well Area"

by - - - - W. R. Peterson.

The mean value shown there for this area is 1.98 lbs. U O per long ton.

(d) Valuation by the Mines Dept. gamma probing of D.D. holes.

Valuation of the selected are "A" has been effected here in a similar manner to that used in the assay valuation.

Thus a mean figure of 4325 counts per minute has been calculated for the selected area "A".

Using the Mines Dept. calibration figure of 2600 cpm = 1 lbs. U_3O_8 per lon ton, a valuation for the area of 1.66 lbs. U_3O_8 per long ton is obtained.

Valuation of the Mines Dept. selected area "B" is again taken from the report above. This is given as 7026 counts per minute, which at the 2600 calibration figure gives a valuation of 2.70 lbs. U_3O_8 per long ton

COMPARISON OF VALUATIONS:

The selected area "B" does not provide as good a basis of comparison as area "A", as the distribution of values shown by the rotary percussion drilling would have led to the seledtion of a different area had this information been available to the Mines Department.

TABLE - 4.

Method of Valuation	Mean Value Calculated	
	Selected Area "A"	Selected Area "B"
(a) chem. assay of rotary percussion holes.	0.96	1.37
(b) gamma probing of " " "	* 1.70	- - -
(c) assay of Mines Dept. D.D. holes.	1.27	1.98
(d) gamma probing of Mines Dept. D.D. holes.	1.66	2.70

* This value has been calculated using the more probable assigned value for the red calibration tube (7.8 lbs.)

(1) Adequacy of sampling methods.

There can be no doubt that method (a) - chemical assay of the rotary percussion holes - gives by far the most reliable valuation of the selected areas as :

(i) with the rotary-percussion drilling a very much larger proportion of the rock is taken as a sample per foot of drilling than with the diamond drilling.

For assaying, the ratio of size of sample is of the order of

$$6^2 : \frac{1}{2} \times 1.16^2$$

$$\doteqdot 36 : 0.67$$

$$\doteqdot 54 : 1$$

(diam. of rotary - percussion holes $\doteqdot$ 6"

diam. of D.D. core $\doteqdot$ 1.16"

Core is split and ½ taken for assay .. ..)

In probing, the ratio of amount of rock "sampled" is very much smaller, being somewhat less than the ratio of the circumferences (i.e. of the diameters) of the holes.

i.e. somewhat less than $\frac{6''}{1.89''}$

i.e. less than 3.2 : 1

(ii) The spacing of the rotary percussion holes is much closer (25') than that of D. D. holes (approx. 70')

(iii) In rotary - percussion drilling, the whole of the cuttings are collected as the sample, so that there is no loss equivalent to core less in diamond drilling, which was claimed by the Mines Dept. to cause serious undervaluing of the deposits. Some loss of sample may occur in fractured ground, but the weights of the samples actually collected indicate that in this case such loss was very slight.

(iv) While (in common with any method of sampling) there are certain difficulties and uncertainties in the collection of the sample and splitting the sample down to suitable size with rotary - percussion drilling, it is felt that the effect of these would be slight. Certainly, with dry drilling collection was excellent, and splitting good. With wet drilling, collection and splitting were less satisfactory. However, the observation that correlation between chemical assays and probing of holes was equally good above and below the water tables indicates that the wet samples were almost equally as satisfactory asthe dry samples.

(v) There is nothing to indicate that the assaying of the samples was anything other than very satisfactory. In order to provide some type of check on the assaying, the gamma activity of all the higher grade samples was measured by a Technical Associates scintillometer. In this test, a small plastic container (approx. 2½" diam. x 2¼" deep) was filled to the top with portion of the crushed sample, the lid was replaced and gamma activity measured by placing the end face of the gamma probe on the lid of the container. The readings thus obtained showed a good correlation to the chemical assays. (See Fig. 1.) It would thus appear that the chemical assays are substantially correct relative to one another. For there to be any serious error in the chemical assays, it would be necessary for there to be a consistent error. This is unlikely.

(vi) From Table 1, we find that the average valuation for the selecte area "A" using all holes (i.e. 25' spacing) is 0.964 lbs. U_3O_8 per long ton, while for alternate holes (i.e. 50' spacing) valuations of 0.975 and 0.952 are obtained. The closeness of these results indicates that 25' spacing of the rotary-percussion holes provides a more than adequate sampling of the area.

Conversely the wide spread of values (0.739, 1.092, 1.093) taking every third rotary-percussion hole (i.e. 75' spacing) indicates that the (approx.) 70' spacing of the diamond drill holes provides inadequate sampling of the area.

(2) Comparison of assay valuations (a) and (c).

In making comparisons between the ~~x~~ two methods, it is only fair that hole spacing should be similar. Thus for area "A", the Mines Dept valuation of 1.27 should be compared with the range 0.739, 1.092, 1.093. None the less, the valuations by method (a) all lie below the valuation by method (c). At first sight, this would appear to be evidence against the Mines Department claim that chemical assays of diamond drill cores under — values the deposits, however, I believe it to be rather a reflection of the inadequacy of the relatively small diamond drill core to take a representativ sample of this type of mineralisation. The grain size of the valuable mineral is too large relative to the split diamond drill core to allow of adequate sampling. On the other hand the very much larger rotary-percussion hole do provide adequate sampling. This contention is supported by the fact that a good correlation is shown to exist between the probing of the rotary-percussion holes and the chemical assyas of the cuttings (compare plans CW 9 and CW 8), whereas correlation between the probing of the diamond drill holes and assays of core is poor.

(3) Comparison of Probe valuations (b) and (d).

Again hole spacing should be similar.

Thus, valuation (d) 1.66 should be compared with the range 1.502, 1.739, 1.875 (see Table 3). There is seen to be a fairly good corresponce between these two valuations - as indeed one would expect. The hole size difference affects the adequacy of "sampling" by probing to a very much smaller extent than with assaying - perhaps by a factor of about 2. Differences in valuation due to the use of different probe equipment would be slight.

(4) Comparison of Probe Valuations (b) and (d) with assay valuations (a) and (c).

It is noted that in all cases, probe valuations are considerably higher than assay valuations. It is proposed to demonstrate that the method by which probe charts have been used to make valuations makes use of an assumption which is incorrect and which may lead - and has lead in this case - to serious errors in valuation.

It is inherent in the method that a linear relationship is assumed between the probe deflection and the uranium content of the rock surrounding the probe.

~~XXPX~~ An examination of the relationship between the probing of the rotary-percussion holes and the chemical assays of the cuttings shows that this relationship is not linear, but is in the form of a curve, in which the ratio $\left(\frac{\text{probe deflection}}{\text{uranium assay}}\right)$ continually decreases with increasing uranium content of the cuttings. For low uranium assays, the average probe deflection per unit of uranium content is much greater than that for high uranium content. This is demonstrated in figs. 2 & 3.

It is apparent from the earlier discussion and from the good correlation of the probing of the rotary-percussion holes and the chemical assays of the cuttings that the assays of the cuttings may be taken as representing the uranium content of the surrounding rock. Thus it may be conclude that the relationship between the probing and the uranium content of the surrounding rock is in the form of a curve very similar to that demonstrated by probe deflection v.s. chemical assay of cuttings.

In Fig. 2, the mean probe deflection over 10 feet lenths of hole has been plotted against the mean uranium assay value over the same intervals. 10 feet lengths were chosen initially because it was felt that the positional accuracy of the probe data relative to the sample position data was not sufficiently good to allow effective comparison at the 5' sample length - the 10 feet lengths would partly "iron out" discrepancies due to positional inaccuracies. The plotted points in this figure are taken from assay and probe data on holes CEZ-4, 5, 6, 7, 8, 9, and 11. In all cases except hole CEZ-6, the zero mark on the ~~xx~~ probe charts has been taken as being at the collar of the hole. Consecutive pairs of 5' assay samples been averaged, and the average probe deflection over the equivalent interval determined.

It had been noticed that by moving the probe charts ~~xx~~ a small distance vertically relative to the plot of the chemical assays, (cf. Plan CW 9 to CW 8), a somewhat better correlation could be obtained with some holes. In general, it is necessary only to move the probe chart a scale distance of 0 to 2 feet to obtain the "best-fit" position. This positional displacement is probably brought about by

(i) slight differences in the collar positions as chosen in the two measurements.

(ii) small errors in the marking of collar positions on the probe charts.

(iii) probe cable stretch (probably insignificant)

(iv) probe chart stretch or shrinkage.

One other possible source of displacement is that at times removal of cuttings by "blowing out" the hole at the end of a 5' run may not have been complete, thus allowing some carry-over into the next 5'. This would be insignificant in dry sections of the holes and wet sections, where water flow is high, but may have some effect in wet sections where water flow is low.

Hole CEZ - 6 provides an exception to the general experience. In this case it was necessary to move the probe chart a scale distance of some 7 feet in order to reach the "best-fit" position, where correlation is very good. 2 to 3 feet of this positional discrepancy may be attributed to error in marking the collar position of the hole on the probe chart. The chart record measures 191 feet as compared to 194 feet recorded on the depth counter (193½ feet and 193 feet respectively on the S.P. - Resistivity chart). One is forced to the conclusion, despite some evidence to the contrary, that remainder of the discrepancy must be caused by a 5' foot (one sample) displacement in the recording of sample numbers against hole depth while drilling.

Fig. 3 demonstrates that by using "best-fit" position for relating probe data to chemical assays, most of the plotted points lie close to a smooth curve (which is very close to the mean curve for the 10 foot plot in fig. 2). Results from holes CEZ-6, 7, 11.

That there are a few points which do not lie close to the mean curve is probably due to:

(i) the nature of the mineralisation is such that one would expect to find exceptions to the contention that the uranium content of the samples closely represents the uranium content of the surrounding rock.

(ii) In cases where within a sample interval the probe deflection (and the uranium content of the surrounding rock) ranges from very high to very low values, the plotted point for the interval will tend to lie below the mean curve.

This is demonstrated by the following table :

(using probe deflections taken from fig. 3)

5' Sample - A		Adjacent 5' Sample - B		10' sample (A + B)	
Assay	Probe deflection	Assay	Probe deflection	Mean Assay	Mean Probe deflection
10	2.80"	0	0" *	5	1.40"
9	2.70"	1	0.75"	5	1.725"
7	2.37"	3	1.47"	5	1.92"
5	1.97"	5	1.97"	5	1.97"

* Not quite true as there would be a "background" due to the unmineralised rock.

This would suggest that the "theoretical" curve would lie above any practical curve obtained.

In order to obtain the "best-fit" positions, the probe charts of holes CEZ-6, 7, and 11 have been moved down 7', $3\frac{1}{2}$' and $1\frac{1}{2}$' respectively relative to the chemical assays plot,

Calibration tube :

On both Figs. 2 and 3, the mean deflection due to the red calibration tube (2.65") has been plotted against the assigned value of the tube (accepting 7.8 lbs. U_3O_8 per long ton as the assigned value of the tube. This value is in accord with the factor of 2600 counts per min. used by the Mine Dept.) A straight line drawn through the origin and this point would thus provide a calibration equivalent to that used by the Mines Dept. in their evaluation. A study of figs. 2 & 3 shows that the straight line crosses the curve at approx 2.35" mean probe deflection (approx. 7lbs. U_3O_8 per long ton);

below this point use of the straight line will give serious over valuation as compared to the curve;

(e.g. a mean probe deflection of 0.5" indicates a value of 1.5 lbs. using the straight line as compared to only 0.5 lbs. using the curve)

above the intersection point, use of the straight line will give serious undervaluation as compared to the curve. (how much is much less certain as the position of the curve is based on far too few points above the intersection point.)

In both selected areas A & B, the bulk of the mean probe deflections lie below 2.35". Thus it is evident that valuation of the sections by method (b) (gamma probing of the rotary percusion holes using the straight line calibration) must result in serious overvaluation of the selected areas.

It is more than probable that there exists a similar relationship between the probing of the Mines Department diamond drill holes and the uranium content of the rock surrounding the holes, to that demonstrated to exist between the probing of the rotary-percussion holes and the uranium content of the rock surrounding the holes. It must therefore, be concluded that method (d) - (gamma probing of the Mines Dept. diamond drill holes using the straight line calibration) must result in serious overvaluation of the selected areas.

Thus, no true "comparison" can be made between the probe valuations and the assay valuations.

(5) Summary of Conclusions re Valuation of Selected Areas A & B.

(i) The chemical assays of the samples from the rotary - percussion drilling give a very reliable valuation of the selected areas.

(ii) The assays of split diamond drill core (Mines Dept. drilling) give a much less reliable valuation of these areas due to

(a) the inadequacy of the size of the samples.

(b) too wide a spacing of holes.

This valuation is however better than those obtained by gamma probing of holes.

(iii) The method used to obtain valuations of the selected areas from the gamma probing of holes relies on a incorrect assumption, namely, that the relationship between mean probe deflection and uranium content of rock surrounding holes is linear. Use of this method with both sets of probe data leads to very considerable overvaluing of the selected areas.

VALUATION OF EAST CROCKER DEPOSITS:

(a) General :

The conclusions reached from a consideration of the various methods of valuation of the 3800 E section of the Central Crocker Deposit are in general valid with respect to the whole of the East Crocker Deposits - with some important reservations. In particular, the conclusion that valuation of the deposits by probing of the diamond drill holes using the linear Relationship between probe deflection and uranium content of the rock surrounding holes leads to serious over-valuation of low grade sections of the deposit, and serious undervaluation of high grade sections, is valid. The overall effect on valuation depends on the proportion of low grade to high grade sections within the selected areas.

Valuation by assay of diamond drill core again leads to unsatisfactory results, due largely to inadequacy of sampling, and probably leads to some undervaluation.

(b) Valuation by Probing :

It has been demonstrated that the Mines Department valuation by use of probing data is unsatisfactory due to unsatisfactory calibration between probe deflection and uranium content of rock surrounding the holes. It should be pointed out here that insufficient data was available to the Mines Dept. to obtain a satisfactory calibration :

(1) the diamond drill holes could not provide a basis for calibration because sampling by this method was inadequate to allow good correlation between probing and assays.

(2) the data, from which the linear calibration figure of 2600 c.p.m = 1 lbs U_3O_8 per long ton was determined, was inadequate. This calibration figure was obtained from a statistical analysis of gamma ray logging of face shot holes versus bulk assaying of the material broken in the face. Unfortunately, only two of the faces tested gave bulk assays greater than 3 lbs. U_3O_8 per long ton. Had a sufficient number of higher grade faces been tested it is ~~xxx~~ probable that the calibration obtained would have had the form of a

curve somewhat similar to that obtained from the rotary-percussion holes. J. E. Webb indeed draws conclusions which would be consistent with this, in his 1966 report - - "A Re-examination of Borehole Logging Probe Calibration at Crocker Well, South Australia."

While it has been shown that the valuation made using this probing data is unsatisfactory, this does not discredit probing as a method of valuation.

This valuation was unsatisfactory only because the calibration was unsatisfactory. The probing of the rotary - percussion holes shows that a satisfactory calibration graph can be determindd. In fact, the curves in fig. 2 & fig. 3 (with deflection scale cohverted to the Mines Dept "counts per minute" basis) would probably be sufficiently close to use as a calibration graph. However, it would be desirable that some further test work be carried out to confirm and refine the calibration curve.

Thus, if a complete revaluation of the deposits, using largely the existing information, were warranted, I would suggest the following additional work to more reliably determine the calibration curve :

(i) Re-log the existing rotary-percussion holes with particular emphasis on positional accuracy and zero gamma count position.

(ii) Determine mean probe deflections over 5' lengths corresponding to the chemical assays.

(iii) plot calibration graph.

(iv) bore a new set of holes (50' spacing) on a suitable section of the Main Eastern Crocker Deposit.

(v) Carry out logging etc. as above.

If the two calibration curves so obtained show fairly close correspondence, the combination of the two should provide a very satisfactory calibration curve which could be converted for use on the diamond drill hole information. If not, the separate curves could be used for Central and Main Eastern deposits respectively.

In one respect, however, the probing would still fail to provide a valuation which was completely satisfactory.- where narrow extremely high uranium values occur, instrumental and computation limitation would prevent the probe chart from giving an adequate representation of the value.

Some of these narrow high-grade bands do exist (e.g. on Main Eastern Deposit 4800 E Section, hole EC 1

39'.6" - 40'.0 assays 287.0 lbs. U_3O_8 per long ton over 6"

55' - 60' assays 56.9 lbs " " " " over 5'

Shaft No. 2. was also sunk on a 5" high grade vein).

The gamma probe log in each of the first two cases fails to adequately represent the value - over the 55' - 60' interval, the mean deflection is 14,600 counts per minute (i.e. 5.6 lbs. U_3O_8 per long ton on the linear calibration).

However, the evidence suggests that these "sweeteners" are not sufficiently common to have a major effect on the overall grade of the deposits :

(i) the number of moderately high gamma peaks, which could conceivably coincide with extremely high grade veins, is limited.

(ii) very few very high grade values have been recorded in the assays of D.D. core - if very high grade veins were plentiful, one would expect to find more recorded - at least in the deeper, unaltered brannerite zone.

(iii) the highest 5' sample assay value encountered with either drilling method in the 3800 E Section was 18.1 lbs/per long ton.

(c) <u>Valuation by assay of diamond drill core</u> :

It has been shown above that the diamond drill core does not adequately sample the deposits.

Again, it was contended by the Mines Dept. investigators that the assays of diamond drill core undervalued the deposits, due to break up and loss of the valuable mineral. While there were sound reasons for this contention, I must conclude from my investigations, that this effect applies in only part of the deposits, and thus affedts the overall grade to a much lesser extent than suggested by the Mines Department investigators.

D. King states in his report -

"Summary Geological Report"

on

Crocker Well Uranium Deposits" - Aug. 1955.

"Assay results thus obtained are known to be consistently lower than the true grade because of the unavoidable loss of the ore mineral during actual drilling due to its highly brittle nature and its usual occurrence as weekly bonded grains in natural fractures. In almost all cases the core is found to be broken at intersections of absite slugs, with only remmants of the mineral adhering to the fracture" and again :

"Sludges recovered from bore holes were assayed in bulk for each hole and show at least 50% higher uranium values than the split core samples. Even these results are believed to be conservative as in general there is a considerable loss of water (and sludge) in the fractured rock where the mineral generally occurs."

These observations would be of particular importance where extremely high grade veins exist. However from my observation of the mineral, examination of the drill core, and examination of broken rock from underground work, I believe these conclusions to be sound for the upper (near -surface) position of the deposits, where the hydrated (absite) variety of the valuable mineral occurs, but I do not believe them to be valid in the deeper portions of the deposits, where the more competent unaltered brannerite exists.

In the overall picture, I believe the chemical assays of diamond drill cores have undervalued the deposits - particularly the Main Eastern - but not to the extent suggested by the Mines Department investigators.

(d) Reservations.

Some reservations are held with regard to the applicability to the whole deposits of the conclusions reached in respect of the 3800 E section.

(i) The existence of some narrow veins carrying extremely high values, and the fact that these could have been greatly undervalued by both the assaying of the diamond drill core and the probing of the diamond drill holes, has been mentioned above. If these very high grade veins were plentiful, the effect on the overall grade of the deposits would be very considerable. However, I believe that the evidence indicates that such veins are not plentiful.

(ii) The bulk sampling from the underground workings at the Main Eastern Deposit appear to suggest a higher grade for the deposits than that indicated by the diamond drilling. However, a close examination of this work in relation to diamond drilling shows that the higher grades exposed in the underground work are not necessarily inconsistent with the overall pattern of values indicated by the diamond drilling.

Thus the 4575 E cross cut South on the 33 feet level (see Mines Department plan No. 56-161) averages more than 14 lbs. U_3O_8 per long ton over a 33 foot section.

A section of D.D. hole EC 3 on 4600 E probably represents the extension of this high grade zone.

From 65' - 80', the core assay was 5.4 lbs. U_3O_8 per long ton.
From 80' - 93', " " " " 3.3 " " " " "

From 55' - 85', the mean probe deflection gave a figure of 11,400 cpm. (or 4.4 lbs per long ton on the 2600 calibration figure) While it may be contended that these figure undervalue the section, it is certainly true that within 25 feet values can drop dramatically.

The high grade zone appears to be limited in extent. - on the 103 feet level no values were encountered comparable to the high grade zone on the 33 foot level.

Other sections of the underground development showed low uranium values. Thus the section of the East drive from 75' - 123' gave average face counts of 500 to 600 c.p.m. While this would represent 0.2 or more lbs. per long ton on the linear calibration, it could represent almost zero value if the calibration curves of Figs. 2 & 3 are representative.

King quotes the test drilling at Main Eastern Crocker. Here four vertical diamond drill holes were put down within an area 6' x 4', and a shaft (No. 1 shaft) then sunk over this area. Weighted average grade value of the ore broken in the shaft was determined by three methods :

Drill core assays	0.2 lbs.	U_3O_8	per	long	ton.
Radiometric borehole logging	1.1 "	"	"	"	"
Bulk assay of broken rock	1.7 "	"	"	"	"

Close examination of the basis for these figures again shows that the discrepancies could be contained within the limits of the experience with the remainder of the deposits.

Nonetheless, sufficient doubt is brought in by these two examples to warrant some further investigations.

The following tests should be carried out :-

(i) Bore one vertical rotary - percussion hole to intersect the high grade zone delineated by the 4575 E cross cut. This hole should pass close (a few feet) to the cross cut but not intersect it.

(ii) Bore one vertical rotary - percussion hole at 5200 N, 4600 E to intersect the moderately high grade zone showing in D.D. hole EC 3.

(iii) Choose say two further apparently high grade zones as indicated by probing of the diamond drill holes and bore a rotary - percussion hole to intersect each.

In each case 5' samples should be taken and assayed and the holes should be probed.

(e) Summary of conclusions re grade of Crocker East deposits.

(i) Valuation of the deposits by gamma probing of diamond drill holes as accepted by the Mines Dept. has probably overvalued them to a considerable extent, due to an incorrect calibration of the probe results. However, an acceptable calibration could be determined with some further work and the Mines Dept. probing could then be used to obtain a satisfactory valuation.

(ii) Valuation of the deposits by assay of split D.D. core as carried out but not accepted by the Mines Dept., is inadequate due to insufficient sampling of the deposits. When considering valuation of the whole of the deposits, the inadequacy of the sampling is probably less than in the case of the valuation of the single section.

This method probably appreciably undervalues the deposits - particularly in near surface portions.

(iii) The conclusion is reached that the true grade of the deposits probably lies between that determined by probing and that determined by assays of D.D. core, - and is probably closer to the latter.

(iv) The high grades encountered in the underground workings at the Main Eastern deposit and the very high grades of the few narrow veins recorded leave some doubts that the conclusions drawn above are applicable throughout the deposits. These doubts may be investigated by a relatively small amount of rotary-percussion drilling and associated assaying and probing.

(v) From a consideration of the factors discussed above, a rough re-assessment of grade of the East Crocker deposits have been made. It must be stressed that these figures are estimated only from broad generalisations.

These rough estimates appear in Table 5 below together with the Mines Dept. estimates.

TABLE - - - 5

(all grades are quoted in lbs. U_3O_8 per long ton)

Prospect	Tons.	Mines Dept. Estimates.		Rough Estimates based on present investigation
		Grade Indicated by radiometric probe results.	Grade Indicated by core assays	
Main Eastern	409,000	1.63	0.69	1.0
Central	599,000	1.94	1.18	1.2
South Western	175,000	1.27	0.64	0.7
	1,183,000	1.73	0.93	1.05

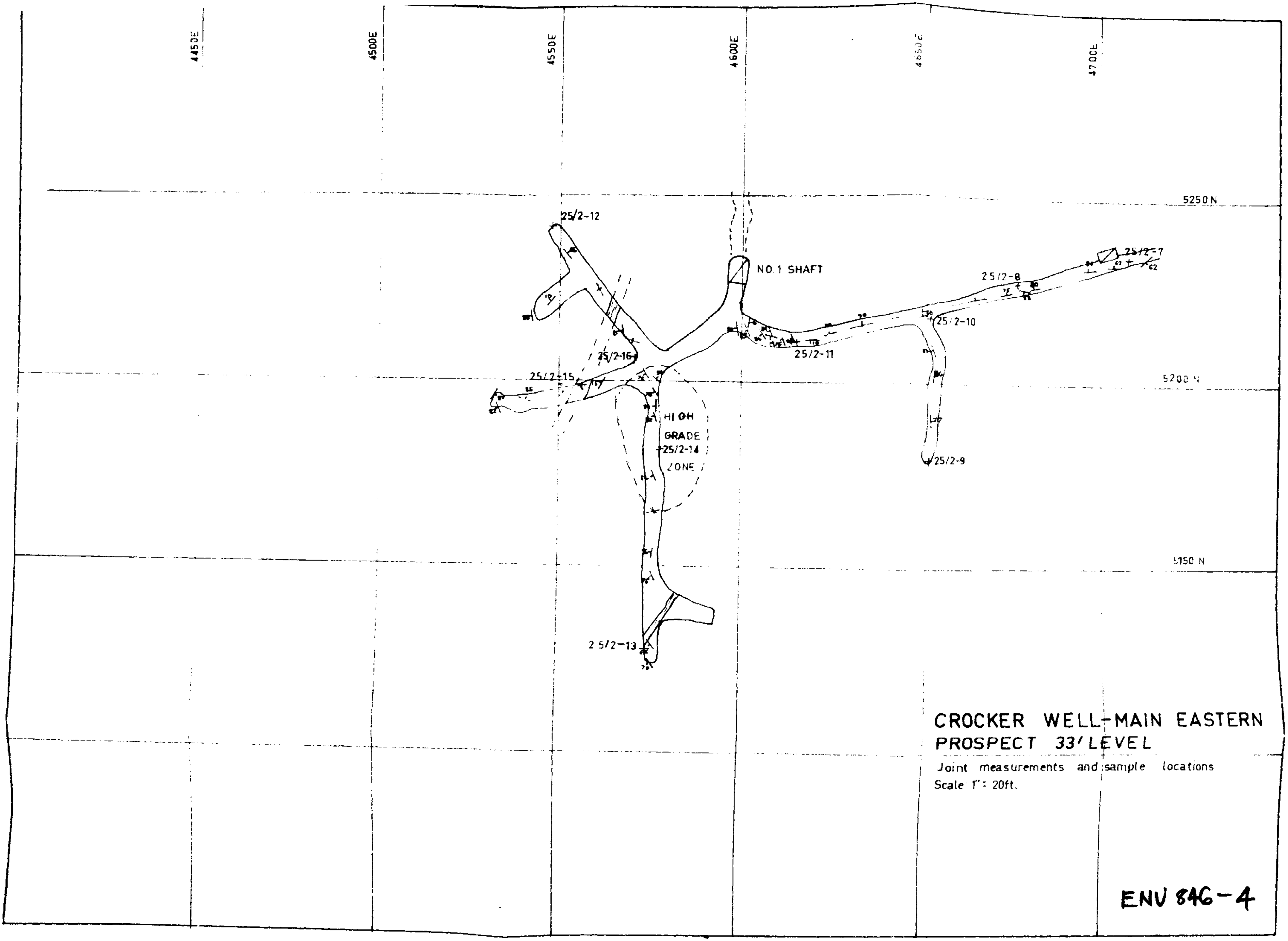
It must be pointed out here that these figures are "geological" estimates, unaffected by practical mining considerations.

In a practicable mining program (open cut)

(i) tonnage would be reduced due to inaccessibility of some portions

(ii) grade would be reduced by dilution (the diluting material would of course increase the tonnage)

(iii) A quantity of "overburden", probably at least as large as the ore bodies, would have to be mined ("the term "overburden" is used loosely here to mean all rock mined separately as waste)



CROCKER WELL-MAIN EASTERN PROSPECT 33' LEVEL

Joint measurements and sample locations

Scale 1" = 20ft.

ENU 846-4

815-6

TABLE - 1.

EAST CROCKER - - 3800 E SECTION.

Selected Area "A"

Rotary - Percussion Drilling - Apr.-May 1967

VALUATION OF SELECTED AREA and EFFECT OF HOLE SPACING ON VALUATION

Chemical Assays - Values in lbs. U_3O_8 per long ton.

Hole No.	Interval (1) (feet from Collar)	Mean Value (2) of interval	Hole Spacing. 25' A	25' B	50' A	50' B	50' A	50' B	75' A	75' B	75' A	75' B	75' A	75' B	100' A	100' B	100' A	100' B	100' A	100' B	100' A	100' B
CEZ-11	0-63	1.66	13	21.63	13	21.63			13	21.63					13	21.63						
CEZ-10	0-91	0.98	18	17.55			18	17.55			18	17.55					18	17.55				
CEZ- 9	0-114	0.64	23	14.55	23	14.55							23	14.55					23	14.55		
CEZ- 8	0-138	0.73	27	19.81			27	19.81	27	19.81											27	19.
CEZ- 7	0-164	1.63	33	53.91	33	53.91					33	53.91			33	53.91						
CEZ- 6	0-190	1.65 ~~1.53~~	38	62.80 ~~58.21~~			38	62.80 ~~58.21~~					38	62.80 ~~58.21~~			38	62.80 ~~58.21~~				
CEZ- 5	12-221	0.63 ~~0.56~~	42	26.32 ~~23.32~~	42	26.32 ~~23.32~~			42	26.32 ~~23.32~~									42	26.32 ~~23.32~~		
CEZ- 4	43-203	0.60	32	19.21			32	19.21			32	19.21									32	19.
CEZ- 3	70-180	0.61	22	13.33	22	13.33							22	13.33	22	13.33						
CEZ- 2	89-155	0.19	13	2.45			13	2.45	13	2.45							13	2.45				
TOTALS			261	251.56 ~~243.97~~	133	129.74 ~~126.74~~	128	121.82 ~~117.23~~	95	70.21 ~~67.21~~	83	90.67	83.	90.68 ~~86.09~~	68	88.87	69	82.80 ~~78.21~~	65	40.87 ~~37.87~~	59	39.
MEAN VALUES.				0.964 ~~0.935~~		0.975 ~~0.953~~		0.952 ~~0.916~~		0.739 ~~0.707~~		1.092		1.093 ~~1.037~~		1.307		1.200 ~~1.134~~		0.629 ~~0.583~~		0.66

(A) Number of samples accepted as representing the selected interval.

(B) Sum of values " " " " " " " "

(All samples represent a 5' length of hole)

(1) The Interval is that portion of the hole which lies within the area selected for valuation (Plan No. CW 7)

(2) The Mean Value of the Interval = $\frac{\text{Sum of values of samples}}{\text{Number of samples}} = \frac{B}{A}$

Alterations to the values shown in the Table have been brought about largely by a reconsideration of the estimated value of samples which were not assayed. The earlier figures are shown because they have been quoted in earlier communications.

815-7a

TABLE - 2.

EAST CROCKER - - 3800 E SECTION.

Selected Area "B"

Rotary - Percussion Drilling - Apr. - May 1967

VALUATION OF AREA SELECTED BY MINES DEPT.

and EFFECT OF HOLE SPACING ON VALUATION

Chemical Assays - Values in lbs. U_3O_8 per long ton.

Hole No.	(1) Interval (feet from Collar)	(2) Mean Value of interval	Hole Spacing. 25'		50'		50'		75'		75'		75'	
			A	B	A	B	A	B	A	B	A	B	A	B
CEZ-11	0-45	0.56	9	5.03	9	5.03			9	5.03				
CEZ-10	22-69	0.51	10	5.05			10	5.05			10	5.05		
CEZ- 9	46-92	1.17	9	10.52	9	10.52							9	10.52
CEZ- 8	68-120	1.52	11	16.66			11	16.66	11	16.66				
CEZ- 7	26-34 89-144	3.54	13	46.02	13	46.02					13	46.02		
CEZ- 6	0-24 57-65 69-153	2.09	24	50.19			24	50.19					24	50.19
CEZ- 5	24-162	0.86	28	24.19	28	24.19			28	24.19				
CEZ- 4	53-153	0.88	20	17.68			20	17.68			20	17.68		
CEZ- 3	91-129	0.68	8	5.42	8	5.42							8	5.42

5	12-221	1.13	209	234.6	209	234.6			209	234.6				
4	43-203	1.18	160	189.0			160	189.0			160	189.0		
CEZ)-3	70-180	1.10	110	121.1	110	121.1							110	121.1
2	89-155	0.58	66	38.1			66	38.1	66	38.1				
Totals.			1303	1986.3	660	995.2	645	991.1	476	641.6	415	648.0	414	696.7
* Mean Values (using 7.0 lbs. assigned value)				1.524		1.508		1.533		1.348		1.561		1.683
* Mean Values. (using 7.8 lbs. assigned value)				1.697		1.680		1.708		1.502		1.739		1.875

815-7b

(A) Interval of hole in feet.

(B) Mean value for interval X length (in feet) of interval.
[Actually is the sum of (mean values for 5' or smaller interval X 5' or smaller interval]

(1.) The Interval is that portion of the hole which lies within the area selected for valuation (Plan No. CW 7)

(2) Mean value of the Interval = mean deflection for the interval X $\frac{\text{assigned value for Red Calibration tube}}{\text{mean deflection " " " "}}$

X Note : The assigned value for the Red calibration tube was quoted as being 7.0 lbs U_3O_8 per long ton.
This value has been used in computing Mean Values in Table 3.
However an examination of Mines Dept. records indicates that 7.8 lbs. U_3O_8 per long ton is a more likely assigned value.
Thus an extra line "(Mean Values using 7.8 lbs. assigned value)" has been added to the table.
These latter values were obtained by multiplying "Mean Values using 7.0 lbs. assigned value" by $\frac{7.8}{7.0}$

132	180.76	67	91.18	65	89.58	48	45.88	43	68.75	41	66.13
	1.369		1.360		1.378		0.956		1.599		1.613

815-7c

A. Number of samples accepted as representing the selected interval.

B. Sum of values " " " " " " " "
(All samples represent a 5' length of hole)

(1) The interval is that portion of the hole which lies within the area selected for valuation (See Mines Dept. Plan No. 55-261)

(2) The mean value of the interval $= \dfrac{\text{Sum of Values of samples}}{\text{Number of samples}} = \dfrac{B}{A}$

TABLE - 3.

EAST CROCKER - - 3800 E SECTION.

Selected Area "A"

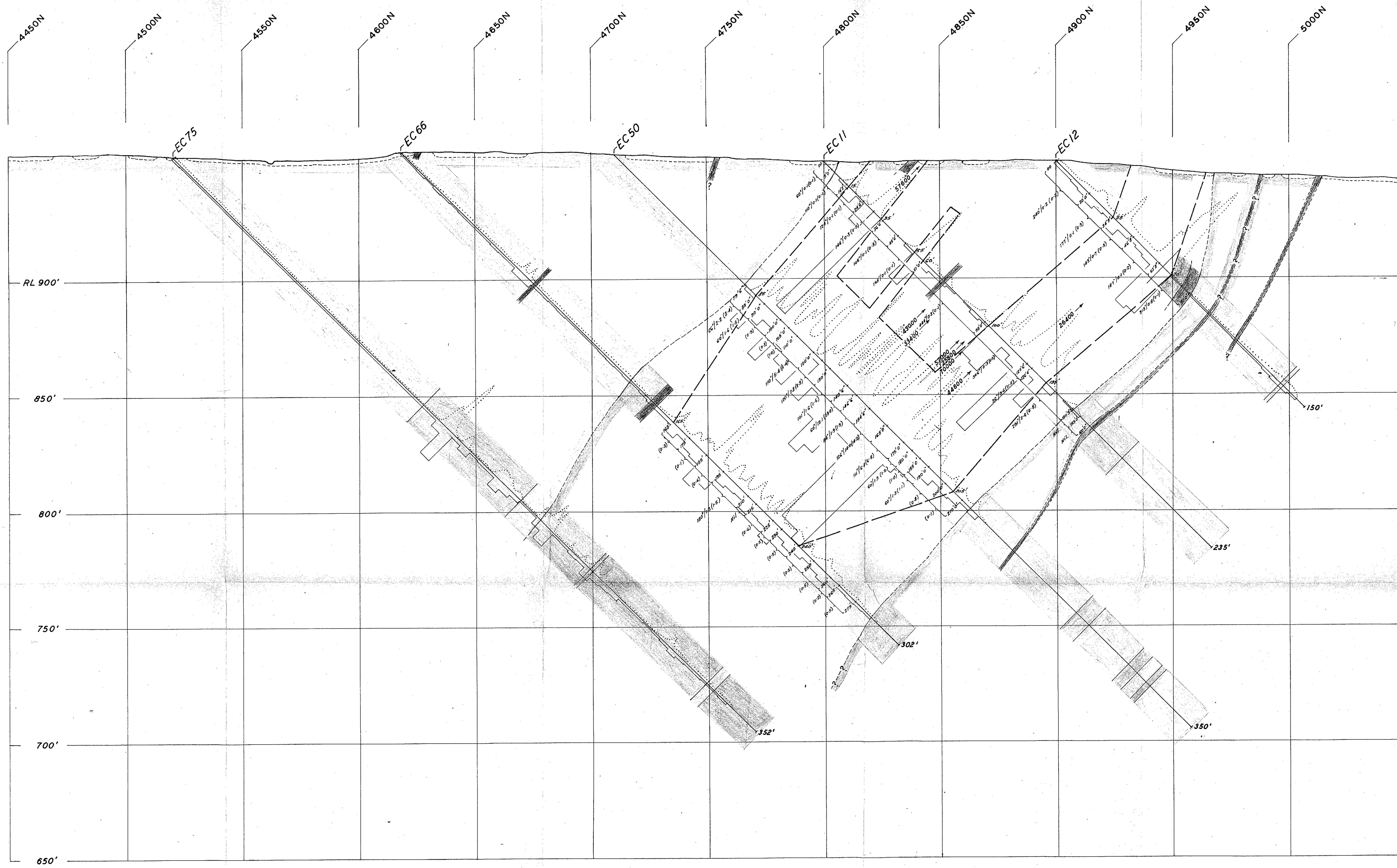
Rotary - Percussion Drilling - Apr. - May 1967.

VALUATION OF SELECTED AREA and EFFECT of HOLE SPACING on VALUATION.

Mean Probe Deflections converted to lbs. U_3O_8 per long ton using linear calibration.

Calibration by Mines Department Red Calibration tube *

Hole	(1) Interval (feet from Collar)	(2) Mean Value of Interval	Hole Spacing											
			25'		50'		50'		75'		75'		75'	
CEZ-11	0-63	2.46	63	153.7	63	153.7			63	153.7				
10	0-91	1.79	91	162.7			91	162.7			91	162.7		
9	0-114	1.66	114	189.5	114	189.5							114	189.5
8	0-138	1.56	138	215.2			138	215.2	138	215.2				
7	0-164	1.81	164	296.3	164	296.3					164	296.3		
6	0-190	2.03	190	386.1			190	386.1-					190	386.1



3800E

SELECTED LODE AREA

12950 Sq. Ft. at 7026 C.M.

RADIOMETRIC BOREHOLE PROBE DATA

BOREHOLE	FROM	TO	FEET	COUNTS/MIN.	CORE ASSAY
11	15'	35'	(20')	9193	0·21
11	55'	60'	(5')	7560	0·20
11	100'	135'	(35')	7135	1·17
12	35'	70'	(35')	4517	0·75
50	85'	205'	(120')	9926	3·85
66	165'	240'	(75')	2903	0·56

------ Lode outline selected for estimate.

------ Graphic borelog probe – counts/minute. Amplitude scale 1" = 10000 c.m.

------ Graphic borelog probe – counts/minute over 5' intervals from which averages were computed. Amplitude scale 1" = 10000 c.m.

— LEGEND —

- ---- Alluvium
- ---- Adamellite & leuco-adamellite
- ---- Pink pegmatitic granite & equivalents
- ---- Hybrid granite – granodiorite – migmatite etc.
- ---- Schist & meta-sediments – schistose granites
- ---- Pegmatite

CORE ASSAY DATA

(0·6) { ---- Radiometric – pounds U_3O_8/long ton.

60'/1·2 { ---- Chemical —— pounds U_3O_8/long ton.

Geology by W.R. Peterson. Geologist.

S. A. DEPT. OF MINES

CROCKER EAST URANIUM DEPOSIT
CENTRAL PROSPECT
CROSS-SEC. 3800E — AREA SELECTED FOR LODE TONNAGE ESTIMATE

Associated Drawing	No.	No.	Amendment	Exd.	Date
			Plan Revised		8·6·56

Req. No.
D.M.
Compiled from originals by W.R. Peterson.

Approved | Passed | Director of Mines

Drn. R.G.C.
Tcd.
Ckd.
Exd.

Scale 20 feet to 1 inch.
55 – 261
Date 21-11-55 Fg. (E5·2)

ENV 850-9

ENV 850
913

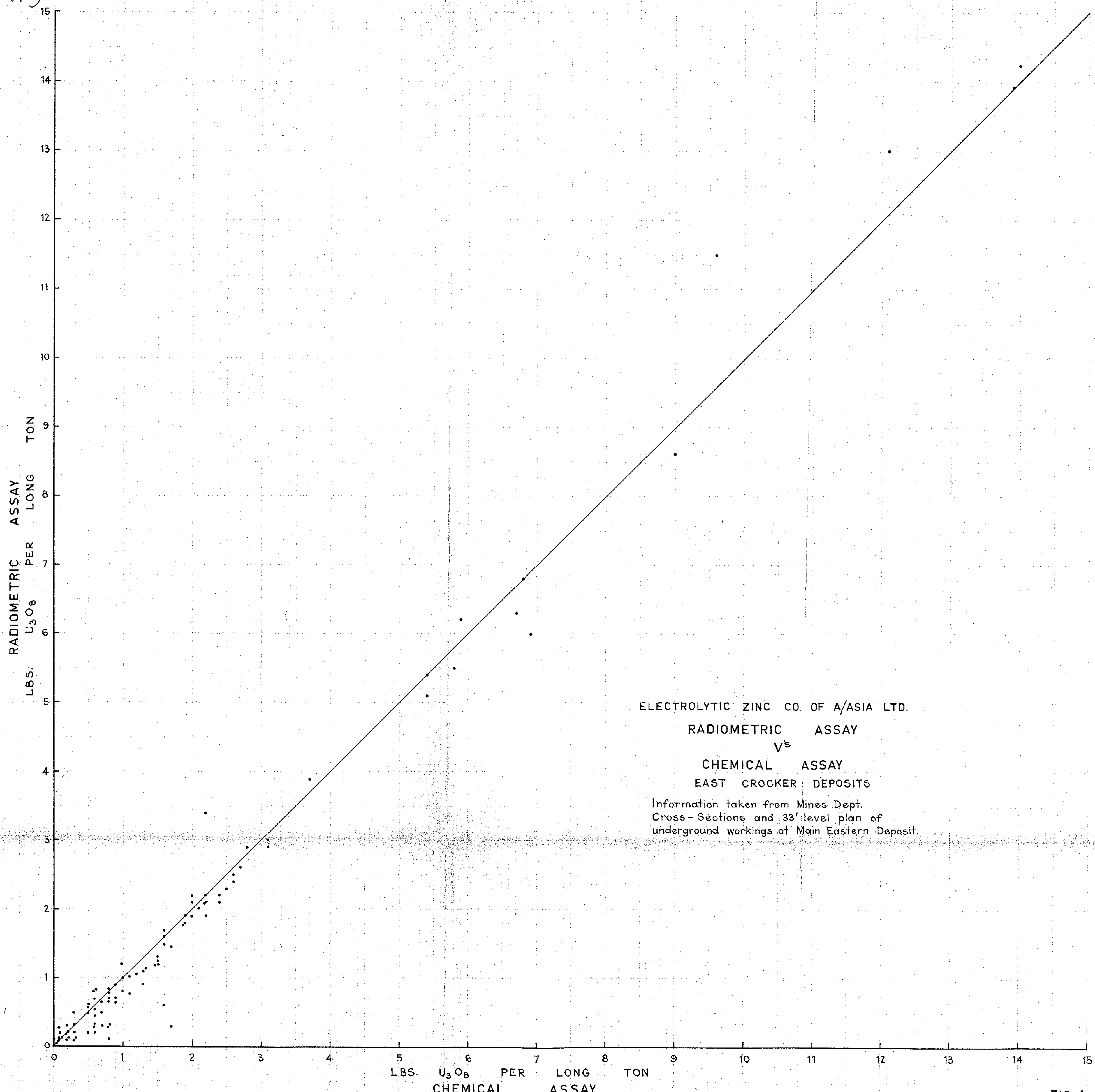


FIG. 4

ENV850 - 8

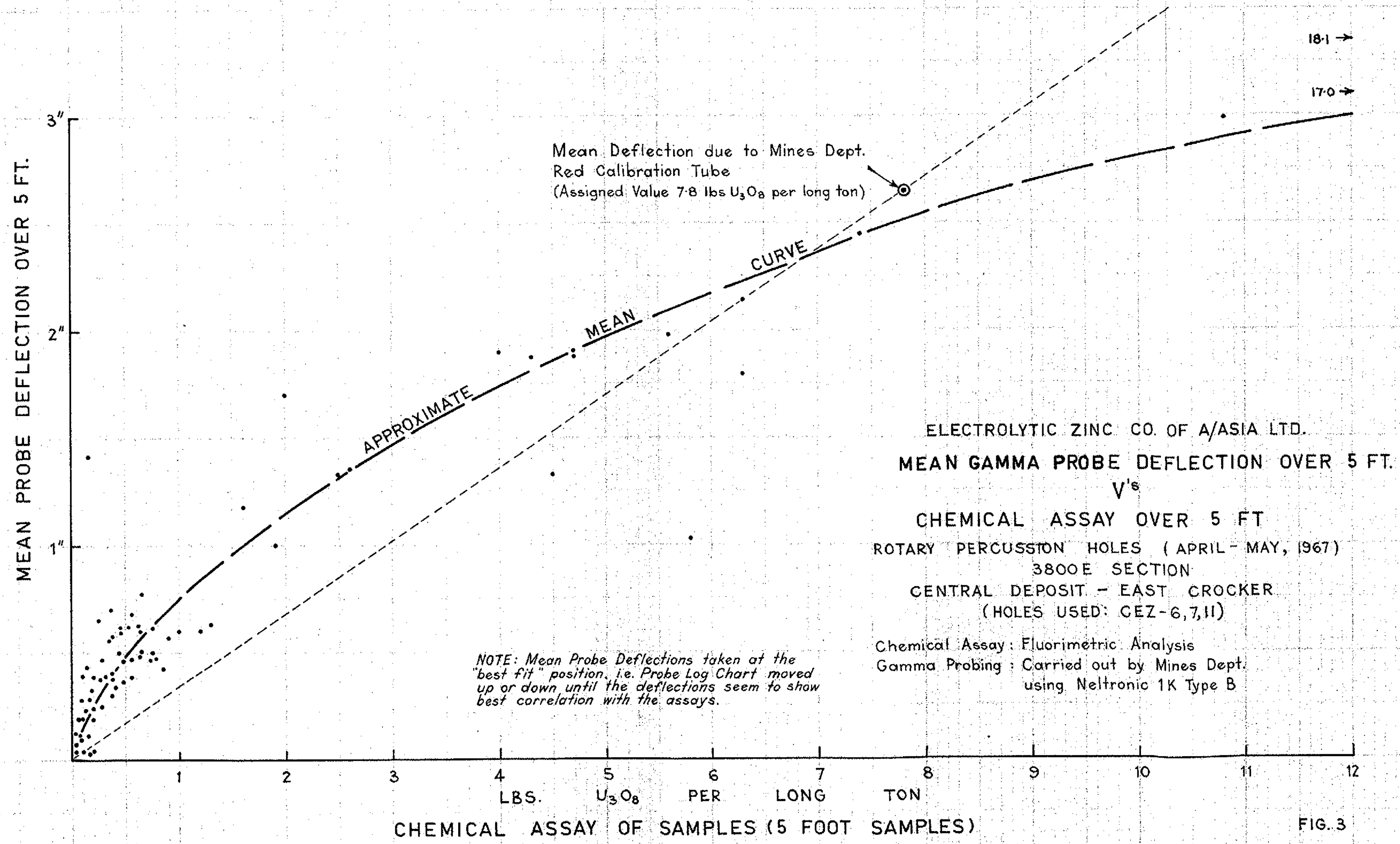


FIG. 3

ENV 850

913

ENV ~~850-7~~

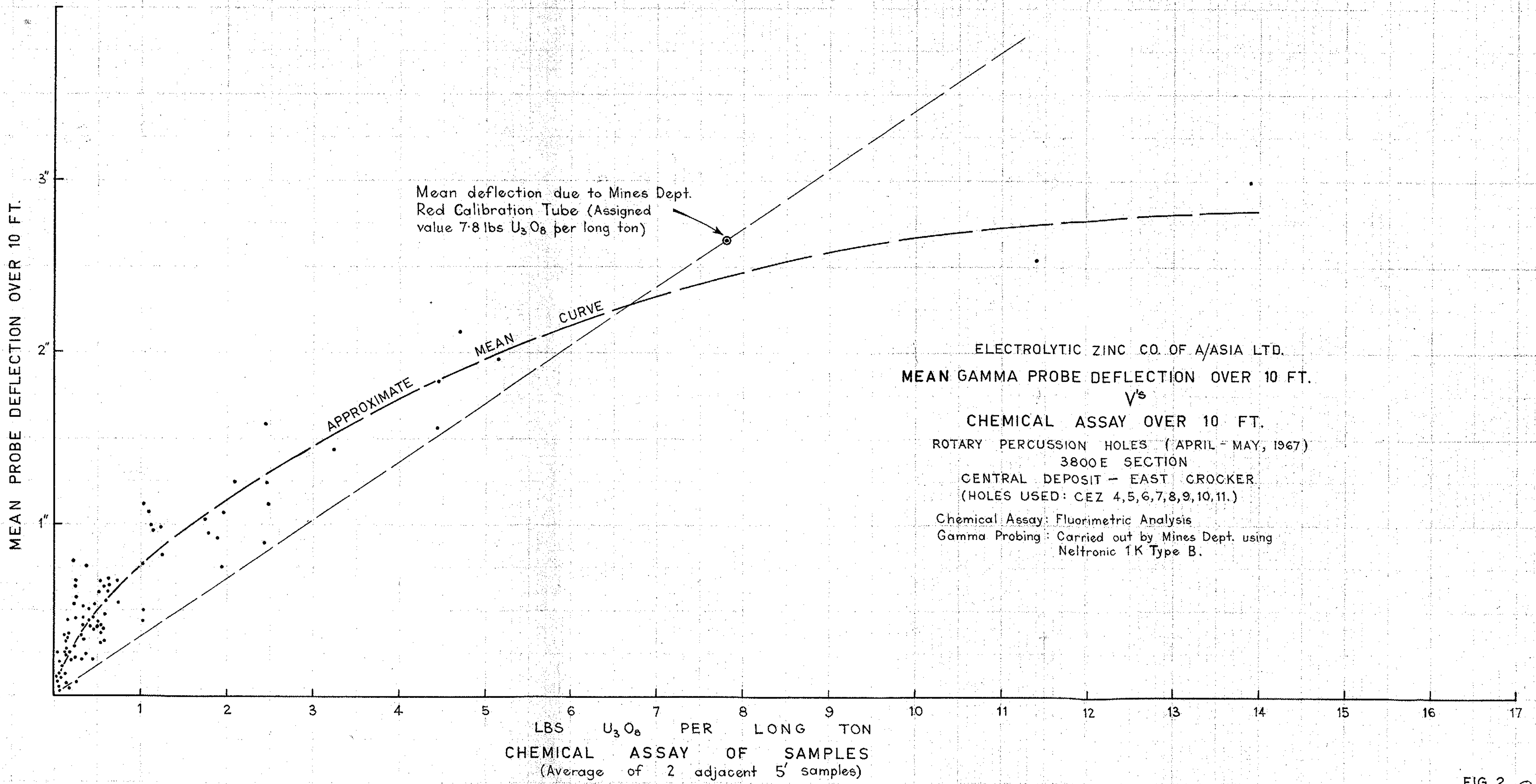
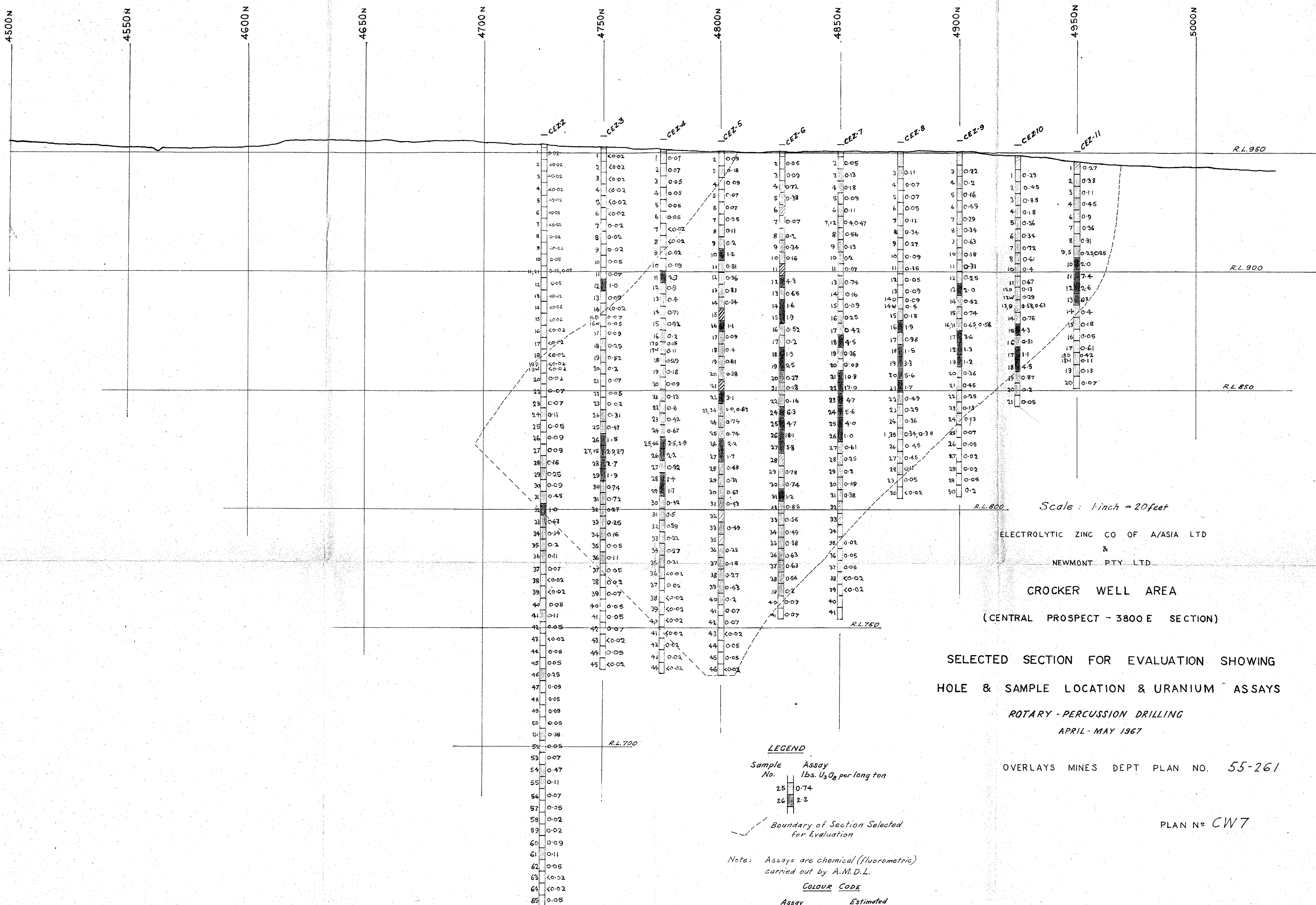


FIG. 2 913

ENV 850-6


CEZ-2
CEZ-3
CEZ-4
CEZ-5
CEZ-6
CEZ-7
CEZ-8
CEZ-9
CEZ-10
CEZ-11
18·1
17·0
VERT SCALE 1inch = 20'
HORIZ SCALE 1inch = 4lbs U_3O_8 per, long ton
ELECTROLYTIC ZINC CO OF A/ASIA LTD
&
NEWMONT PTY LTD
CROCKER WELL AREA
(CENTRAL PROSPECT - 3600E SECTION)
ASSAY OF SAMPLES
FROM
ROTARY PERCUSSION DRILLING
(APRIL - MAY 1967)
URANIUM
METHOD; FLUOROMETRIC ANALYSIS
(A.M.D.L.)
PLAN No. CW8
DATE: Oct. 1967

ENV 850-11



Scale : 1 inch = 20 feet

ELECTROLYTIC ZINC CO OF A/ASIA LTD
&
NEWMONT PTY LTD

CROCKER WELL AREA

(CENTRAL PROSPECT – 3800 E SECTION)

SELECTED SECTION FOR EVALUATION SHOWING
HOLE & SAMPLE LOCATION & URANIUM ASSAYS

ROTARY - PERCUSSION DRILLING
APRIL - MAY 1967

OVERLAYS MINES DEPT PLAN NO. 55-261

PLAN No. CW7

LEGEND

Sample No.	Assay lbs. U_3O_8 per long ton
25	0·74
26	2·2

Boundary of Section Selected for Evaluation

Note: Assays are chemical (fluorometric) carried out by A.M.D.L.

COLOUR CODE

Assay		Estimated
	>4·99	
	1·00 → 4·99	
	0·10 → 0·99	
	<0·10	

ENV 850-10

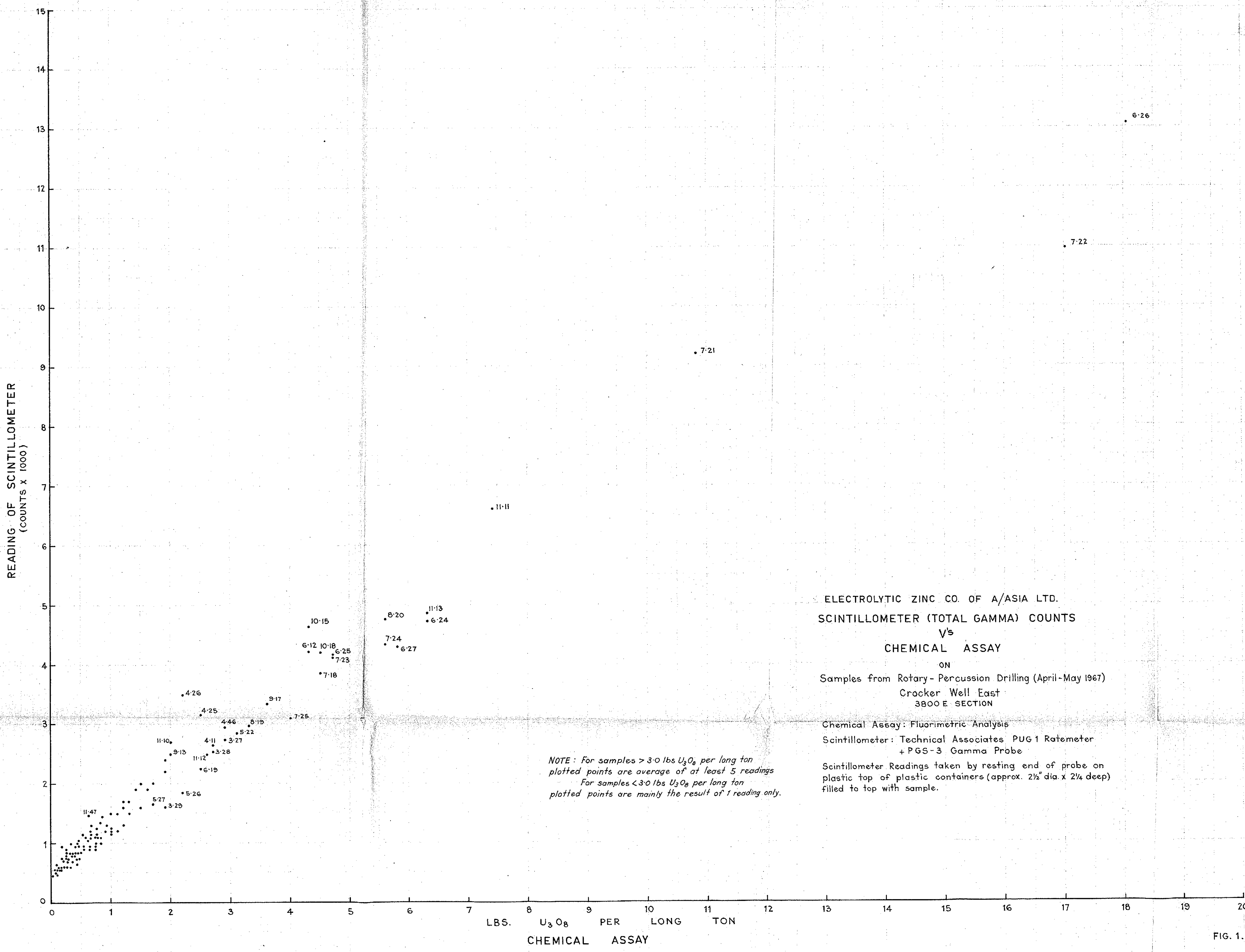


FIG. 1.

ENV 850-5

VERT. SCALE : 1 inch = 20 feet

HORIZ. SCALE : See Note

Note: "D" is a measure of the deflection due to the Mines Dept. Red Calibrating Tube and thus gives a tie-in between this logging and the Mines Dept. logging. However, an investigation shows the relationship between this logging and the chemical assays for these holes to be a curve, whereas the Mines Dept. valuation by logging was based on the assumption that such relationships are linear.

ELECTROLYTIC ZINC CO OF A/ASIA LTD

NEWMONT PTY LTD

CROCKER WELL AREA

(CENTRAL PROSPECT 3600E SECTION)

RADIOMETRIC BOREHOLE LOGGING

FROM

ROTARY PERCUSSION DRILLING

(APRIL - MAY 1967)

DATE.: Oct. 1967

PLAN NO. CW9

A607

APPENDIX A

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL - MAY 1967)

HOLE NO CEZ '11' Height of platform 4'-6"

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Selected Area "A" Accepted Assay Value.	Selected Area "B" Accepted Assay Value.
4½- 5		(1)	(2)	(2)
5 - 10(3)	1	0.27	0.27	0.27
10 - 15	2	0.38	0.38	0.38
15 - 20	3	0.11	0.11	0.11
20 - 25	4	0.45	0.45	0.45
25 - 30	6	0.9	0.90	0.90
30 - 35	7	0.36	0.36	0.36
35 - 40	8	0.31	0.31	0.31
40 - 45	5	0.25	0.25	0.25
	9	0.25		
45 - 50	10	2.0	2.00	2.00
50 - 55	11	7.4	7.40	
55 - 60	12	2.5	2.50	
60 - 65	13	6.3	6.30	
65 - 70	14	0.4	0.40	
70 - 75	15	0.18		
75 - 80	16	0.05		
80 - 85	17	0.61		
85 - 86½	18 D	0.42		
86½- 90	18 W	0.11		
90 - 95	19	0.13		
95 - 100	20	0.07		
		Total	21.63	5.03
Average Value of Selected Interval			$\frac{21.63}{13}$ = 1.66	$\frac{5.03}{9}$ = 0.56

(1) Not sampled
(2) Neglected in valuation
(3) Actual sample 8'-10'

APPENDIX A

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL-MAY 1967)

HOLE NO CEZ '10' Height of platform 4'-6"

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Selected Area "A" Accepted Assay Value	Selected Area "B" Accepted Assay Value
4½- 5		(1)	(2)	
5 - 10		(1)	0.20(3)	
10 - 15	1	0.29	0.29	
15 - 20	2	0.45	0.45	
20 - 25	3	0.85	0.85	
25 - 30	4	0.18	0.18	0.18
30 - 35	5	0.56	0.56	0.56
35 - 40	6	0.34	0.34	0.34
40 - 45	7	0.72	0.72	0.72
45 - 50	8	0.61	0.61	0.61
50 - 55	10	0.4	0.40	0.40
55 - 60	11	0.67	0.67	0.67
60 - 63	12 D	0.13	0.21	0.21
63 - 65	12 W	0.29		
65 - 70	9	0.63	0.60	0.60
	13	0.58		
70 - 75	14	0.76	0.76	0.76
75 - 80	15	4.3	4.30	
80 - 85	16	0.81	0.81	
85 - 90	17	1.1	1.10	
90 - 95	18	4.5	4.50	
95 - 100	19	0.87		
100 - 105	20	0.2		
105 - 110	21	0.05		
		Total	17.55	5.05
Average Value of Selected Interval			$\frac{17.55}{18}$	$\frac{5.05}{10}$
			= 0.98	= 0.51

(1) Not sampled
(2) Neglected in valuation
(3) Estimated

APPENDIX A

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL-MAY 1967)

HOLE NO CEZ '9' Height of platform 4'-6"

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Selected Area "A" Accepted Assay Value	Selected Area "B" Accepted Assay Value
4½- 5		(1)	- (2)	
5 - 10		(1)	0.20(4)	
10 - 15(3)	3	0.22	0.22	
15 - 20	4	0.2	0.20	
20 - 25	5	0.16	0.16	
25 - 30	6	0.49	0.49	
30 - 35	7	0.29	0.29	
35 - 40	8	0.34	0.34	
40 - 45	9	0.63	0.63	
45 - 50	10	0.18	0.18	
50 - 55	11	0.31	0.31	0.31
55 - 60	12	0.25	0.25	0.25
60 - 65	13	2.0	2.00	2.00
65 - 70	14	0.52	0.52	0.52
70 - 75	15	0.74	0.74	0.74
75 - 80	16	0.65	0.60	0.60
	31	0.56		
80 - 85	17	3.6	3.60	3.60
85 - 90	18	1.3	1.30	1.30
90 - 95	19	1.2	1.20	1.20
95 -100	20	0.36	0.36	
100 -105	21	0.45	0.45	
105 -110	22	0.25	0.25	
110 -115	23	0.13	0.13	
115 -120	24	0.13	0.13	
120 -125	25	0.07		
125 -130	26	0.05		
130 -135	27	0.02		
135 -140	28	0.02		
140 -145	29	0.05		
145 -150	30	0.2		
		Total	14.55	10.52
Average Value of Selected Interval			$\frac{14.55}{23}$	$\frac{10.52}{9}$
			= 0.64	= 1.17

(1) Not Sampled
(2) Neglected in valuation
(3) Actual sample 11'-15'
(4) Estimated.

APPENDIX A

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL-MAY 1967)

HOLE NO CEZ '8' Height of platform 4'

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Selected Area "A" Accepted Assay Value	Selected Area "B" Accepted Assay Value
4 - 5		(1)	(2)	
5 - 10		(1)	0.10 (3)	
10 - 15	3	0.11	0.11	
15 - 20	4	0.07	0.07	
20 - 25	5	0.07	0.07	
25 - 30	6	0.05	0.05	
30 - 35	7	0.11	0.11	
35 - 40	8	0.34	0.34	
40 - 45	9	0.27	0.27	
45 - 50	10	0.09	0.09	
50 - 55	11	0.15	0.15	
55 - 60	12	0.05	0.05	
60 - 65	13	0.09	0.09	
65 - ?	14 D	0.09	0.24	
? - 70	14 W	0.4		
70 - 75	15	0.18	0.18	0.18
75 - 80	16	1.9	1.90	1.90
80 - 85	17	0.98	0.98	0.98
85 - 90	18	1.5	1.50	1.50
90 - 95	19	3.3	3.30	3.30
95 - 100	20	5.6	5.60	5.60
100 - 105	21	1.7	1.70	1.70
105 - 110	22	0.49	0.49	0.49
110 - 115	23	0.29	0.29	0.29
115 - 120	24	0.36	0.36	0.36
120 - 125	1	0.34	0.36	0.36
	25	0.38		
125 - 130	26	0.45	0.45	
130 - 135	27	0.85	0.85	
135 - 140	28	0.11	0.11	
140 - 145	29	0.05		
145 - 150	30	<0.02		
		Total	19.81	16.66
Average Value of Selected Interval			$\frac{19.81}{27}$ = 0.73	$\frac{16.66}{11}$ = 1.52

(1) Not sampled
(2) Neglected in valuation
(3) Estimated.

APPENDIX A

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL-MAY 1967)

HOLE NO CEZ '7' Height of platform 3'

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Selected Area "A" Accepted Assay Value	Selected Area "B" Accepted Assay Value
3 - 5		(1)	(2)	
5 - 10(3)	2	0.05	0.05	
10 - 15	3	0.13	0.13	
15 - 20	4	0.18	0.18	
20 - 25	5	0.09	0.09	
25 - 30	6	0.11	0.11	
30 - 35	7	0.4	0.43	0.43
	12	0.47		
35 - 40	8	0.56	0.56	0.56
40 - 45	9	0.13	0.13	
45 - 50	10	0.2	0.20	
50 - 55	11	0.07	0.07	
55 - 60	13	0.74	0.74	
60 - 65	14	0.16	0.16	
65 - 70	15	0.09	0.09	
70 - 75	16	0.25	0.25	
75 - 80	17	0.42	0.42	
80 - 85	18	4.5	4.50	
85 - 90	19	0.36	0.36	
90 - 95	20	0.09	0.09	
95 - 100	21	10.8	10.80	10.80
100 - 105	22	17.0	17.00	17.00
105 - 110	23	4.7	4.70	4.70
110 - 115	24	5.6	5.60	5.60
115 - 120	25	4.0	4.00	4.00
120 - 125	26	1.0	1.00	1.00
125 - 130	27	0.61	0.61	0.61
130 - 135	28	0.25	0.25	0.25
135 - 140	29	0.2	0.20	0.20
140 - 145	30	0.49	0.49	0.49
145 - 150	31	0.38	0.38	0.38
150 - 155	32		0.10(4)	
155 - 160	33		0.10(4)	
160 - 165	34		0.10(4)	
165 - 170	35	0.02	0.02	
170 - 175	36	0.05		
175 - 180	37	0.05		
180 - 185	38	< 0.02		
185 - 190	39	< 0.02		
190 - 195	40			
195 - 200	41			
		Total	53.91	46.02
Average Value of Selected Interval			$\frac{53.91}{33}$	$\frac{46.02}{13}$
			= 1.63	= 3.54

(1) Not sampled
(2) Neglected in valuation
(3) Actual Sample 7'-10'
(4) Estimated.

APPENDIX A

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL-MAY 1967)

HOLE NO CEZ '6' Height of platform 3'

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Selected Area "A" Accepted Assay Value	Selected Area "B" Accepted Assay Value
3 - 5		(1)	(2)	(2)
5 - 10	2	0.05	0.05	0.05
10 - 15	3	0.09	0.09	0.09
15 - 20	4	0.72	0.72	0.72
20 - 25	5	0.38	0.38	0.38
25 - 30	6		0.40 ~~1.00~~(3)	0.40(3)
30 - 35	7	0.07	0.07	
35 - 40	8	0.2	0.20	
40 - 45	9	0.34	0.34	
45 - 50	10	0.16	0.16	
50 - 55	11		4.00 ~~1.00~~(3)	
55 - 60	12	4.3	4.30	
60 - 65	13	0.65	0.65	0.65
65 - 70	14	1.6	1.60	1.60
70 - 75	15	1.9	1.90	1.90
75 - 80	16	0.52	0.52	0.52
80 - 85	17	0.2	0.20	0.20
85 - 90	18	1.3	1.30	1.30
90 - 95	19	2.5 ~~0.11~~	2.50 ~~0.11~~(4)	2.50
95 - 100	20	0.27	0.27	0.27
100 - 105	21	0.18	0.18	0.18
105 - 110	22	0.16	0.16	0.16
110 - 115	23			
110 - 115	24	6.3	6.30	6.30
115 - 120	25	4.7	4.70	4.70
120 - 125	26	18.1	18.10	18.10
125 - 130	27	5.8	5.80	5.80
130 - 135	28		0.80 ~~1.00~~(3)	0.80(3)
135 - 140	29	0.78	0.78	0.78
140 - 145	30	0.74	0.74	0.74
145 - 150	31	1.2	1.20	1.20
150 - 155	32	0.85	0.85	0.85
155 - 160	33	0.56	0.56	
160 - 165	34	0.49	0.49	
165 - 170	35	0.38	0.38	
170 - 175	36	0.63	0.63	
175 - 180	37	0.63	0.63	
180 - 185	38	0.56	0.56	
185 - 190	39	0.2	0.20	
190 - 195	40	0.09	0.09	
195 - 200	41	0.07		
		Total	62.80	50.19
Average Value of Selected Interval			$\frac{62.80}{38}$ = 1.65	$\frac{50.19}{24}$ = 2.09

(1) Not sampled
(2) Neglected in valuation
(3) Estimated
(4) Error Corrected.

APPENDIX A

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL-MAY 1967)

HOLE NO CEZ '5' Height of platform 4'

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Selected Area "A" Accepted Assay Value	Selected Area "B" Accepted Assay Value
4 - 5		(1)		
5 - 10	2	0.09		
10 - 15	3	0.18		
15 - 20	4	0.09	0.09	
20 - 25	5	0.07	0.07	
25 - 30	6	0.07	0.07	0.07
30 - 35	7	0.05	0.05	0.05
35 - 40	8	0.11	0.11	0.11
40 - 45	9	0.2	0.20	0.20
45 - 50	10	1.2	1.20	1.20
50 - 55	11	0.81	0.81	0.81
55 - 60	12	0.36	0.36	0.36
60 - 65	13	0.83	0.83	0.83
65 - 70	14	0.54	0.54	0.54
70 - 75	15		1.00 (2)	1.00(2)
75 - 80	16	1.1	1.10	1.10
80 - 85	17	0.09	0.09	0.09
85 - 90	18	0.4	0.40	0.40
90 - 95	19	0.81	0.81	0.81
95 - 100	20	0.38	0.38	0.38
100 - 105	21		4.00 ~~1.00~~(2)	4.00(2)
105 - 110	22	3.1	3.10	3.10
110 - 115	23	1.0	0.83	0.83
	34	0.67		
115 - 120	24	0.74	0.74	0.74
120 - 125	25	0.74	0.74	0.74
125 - 130	26	2.2	2.20	2.20
130 - 135	27	1.7	1.70	1.70
135 - 140	28	0.63	0.63	0.63
140 - 145	29	0.31	0.31	0.31
145 - 150	30	0.67	0.67	0.67
150 - 155	31	0.43	0.43	0.43
155 - 160	32		0.40(2)	0.40(2)
160 - 165	33	0.49	0.49	0.49
165 - 170	35		0.40(2)	
170 - 175	36	0.25	0.25	
175 - 180	37	0.18	0.18	
180 - 185	38	0.27	0.27	
185 - 190	39	0.43	0.43	
190 - 195	40	0.2	0.20	
195 - 200	41	0.07	0.07	
200 - 205	42	0.07	0.07	
205 - 210	43	< 0.02	-	
210 - 215	44	0.05	0.05	
215 - 220	45	0.05	0.05	
220 - 225	46	< 0.02	-	
		Total	26.32 ~~23.32~~	24.19
Average Value of Selected Interval			26.32 ~~23.32~~ / 42	24.19 / 28
			= 0.63 ~~0.56~~	= 0.86

(1) Not sampled
(2) Estimated.

APPENDIX A

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL-MAY 1967)

HOLE NO CEZ '4' Height of platform 4'

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Selected Area "A" Accepted Assay Value	Selected Area "B" Accepted Assay Value
4 - 5		(1)		
5 - 10(2)	1	0.07		
10 - 15	2	0.07		
15 - 20	3	0.05		
20 - 25	4	0.05		
25 - 30	5	0.05		
30 - 35	6	0.05		
35 - 40	7	< 0.02		
40 - 45	8	< 0.02		
45 - 50	9	0.02	0.02	
50 - 55	10	0.09	0.09	
55 - 60	11	2.7	2.70	2.70
60 - 65	12	0.9	0.90	0.90
65 - 70	13	0.4	0.40	0.40
70 - 75	14	0.71	0.71	0.71
75 - 80	15	0.92	0.92	0.92
80 - 85	16	0.2	0.20	0.20
85 - ?	17 D	0.15	0.13	0.13
? - 90	17 W	0.11		
90 - 95	18	0.29	0.29	0.29
95 - 100	19	0.18	0.18	0.18
100 - 105	20	0.09	0.09	0.09
105 - 110	21	0.13	0.13	0.13
110 - 115	22	0.6	0.60	0.60
115 - 120	23	0.42	0.42	0.42
120 - 125	24	0.67	0.67	0.67
125 - 130	25	2.5	2.70	2.70
	46	2.9		
130 - 135	26	2.2	2.20	2.20 →
135 - 140	27	0.92	0.92	0.92
140 - 145	28	1.4	1.40	1.40
145 - 150	29	1.7	1.70	1.70
150 - 155	30	0.42	0.42	0.42
155 - 160	31	0.5	0.50	
160 - 165	32	0.29	0.29	
165 - 170	33	0.22	0.22	
170 - 175	34	0.27	0.27	
175 - 180	35	0.31	0.31	
180 - 185	36	< 0.02	-	
185 - 190	37	0.02	0.02	
190 - 195	38	< 0.02	-	
195 - 200	39	< 0.02	-	
200 - 205	40	< 0.02	-	
205 - 210	41	< 0.02		
210 - 215	42	0.02		
215 - 220	43	0.02		
220 - 225	44	< 0.02		
		Total	19.21	17.68

Average Value of Selected Interval

$$\frac{19.21}{32} = 0.60 \qquad \frac{17.68}{20} = 0.88$$

(1) Not sampled
(2) Actual sample 8'-10'

APPENDIX A

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL-MAY 1967)

HOLE NO CEZ '3'

Height of platform 4"-6"

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Selected Area "A" Accepted Assay Value	Selected Area "B" Accepted Assay Value
4½- 5		(1)		
5 - 10	1	< 0.02		
10 - 15	2	< 0.02		
15 - 20	3	< 0.02		
20 - 25	4	< 0.02		
25 - 30	5	< 0.02		
30 - 35	6	< 0.02		
35 - 40	7	0.02		
40 - 45	8	0.02		
45 - 50	9	0.02		
50 - 55	10	0.05		
55 - 60	11	0.07		
60 - 65	12	1.0		
65 - 70	13	0.09		
70 - 75	14	< 0.02		
75 - 78	16 D	0.07	0.06	
78 - 80	16 W	0.05		
80 - 85	17	0.09	0.09	
85 - 90	18	0.29	0.29	
90 - 95	19	0.52	0.52	
95 - 100	20	0.2	0.20	0.20
100 - 105	21	0.07	0.07	0.07
105 - 110	22	0.05	0.05	0.05
110 - 115	23	0.02	0.02	0.02
115 - 120	24	0.31	0.31	0.31
120 - 125	25	0.47	0.47	0.47
125 - 130	26	1.5	1.50	1.50
130 - 135	15	2.7	2.80	2.80
	27	2.9		
135 - 140	28	2.7	2.70	
140 - 145	29	1.9	1.90	
145 - 150	30	0.74	0.74	
150 - 155	31	0.72	0.72	
155 - 160	32	0.27	0.27	
160 - 165	33	0.25	0.25	
165 - 170	34	0.16	0.16	
170 - 175	35	0.05	0.05	
175 - 180	36	0.11	0.11	
180 - 185	37	0.05	0.05	
185 - 190	38	0.02		
190 - 195	39	0.07		
195 - 200	40	0.05		
200 - 205	41	0.05		
205 - 210	42	0.07		
210 - 215	43	< 0.02		
215 - 220	44	0.05		
220 - 225	45	< 0.02		
		Total	13.33	5.42
Average Value of Selected Interval			$\frac{13.33}{22}$	$\frac{5.42}{8}$
			= 0.61	= 0.68

(1) Not sampled.

APPENDIX A

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL-MAY 1967)

HOLE NO CEZ '2' Height of platform 4'

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Selected Area "A" Accepted Assay Value	Selected Area "B" Accepted Assay Value
4 - 5		(1)		
5 - 10(2)	1	0.02		
10 - 15	2	< 0.02		
15 - 20	3	< 0.02		
20 - 25	4	< 0.02		
25 - 30	5	< 0.02		
30 - 35	6	< 0.02		
35 - 40	7	< 0.02		
40 - 45	8	0.02		
45 - 50	9	< 0.02		
50 - 55	10	0.05		
55 - 60	11	0.05		
	21	0.02		
60 - 65	12	0.05		
65 - 70	13	< 0.02		
70 - 75	14	< 0.02		
75 - 80	15	< 0.02		
80 - 85	16	< 0.02		
85 - 90	17	< 0.02		
90 - 95	18	< 0.02		
95 - ?	19 D	< 0.02		
? - 100	19 W	< 0.02		
100 - 105	20	0.02	0.02	
105 - 110	22	0.07	0.07	
110 - 115	23	0.07	0.07	
115 - 120	24	0.11	0.11	
120 - 125	25	0.05	0.05	
125 - 130	26	0.09	0.09	
130 - 135	27	0.09	0.09	
135 - 140	28	0.16	0.16	
140 - 145	29	0.25	0.25	
145 - 150	30	0.09	0.09	
150 - 155	31	0.45	0.45	
155 - 160	32	1.0	1.00	
160 - 165	33	0.63		
165 - 170	34	0.34		
170 - 175	35	0.2		
175 - 180	36	0.11		

EAST CROCKER - 3800 E SECTION

CHEMICAL ASSAY RESULTS

ROTARY PERCUSSION DRILLING (APRIL-MAY 1967)

HOLE NO CEZ '2' Height of platform 4'

Assay Values in lbs. U_3O_8 per long ton

Depth from Platform	Sample No.	Assay Value	Accepted Assay Value Selected Section	Comments
180 - 185	37	0.07		
185 - 190	38	<0.02		
190 - 195	39	<0.02		
195 - 200	40	0.05		
200 - 205	41	0.11		
205 - 210	42	0.05		
210 - 215	43	<0.02		
215 - 220	44	0.05		
220 - 225	45	0.05		
225 - 230	46	0.25		
230 - 235	47	0.09		
235 - 240	48	0.05		
240 - 245	49	0.09		
245 - 250	50	0.05		
250 - 255	51	0.38		
255 - 260	52	0.05		
260 - 265	53	0.07		
265 - 270	54	0.47		
270 - 275	55	0.11		
275 - 280	56	0.07		
280 - 285	57	0.05		
285 - 290	58	0.02		
190 - 295	59	0.02		
295 - 300	60	0.09		
300 - 305	61	0.11		
305 - 310	62	0.05		
310 - 315	63	<0.02		
315 - 320	64	<0.02		
320 - 325	65	0.05		
			2.45	

Average Value of Selected Interval $\frac{2.45}{13}$ = 0.19

(1) Not sampled
(2) Actual sample 8-10'.

APPENDIX "B"

CROCKER WELL DEPOSITS - EXPLORATORY DRILLING.

CHEMICAL ASSAY RESULTS.

ROTARY PERCUSSION DRILLING (APRIL - MAY, 1967)

Hole No.	Height of Platform above collar	Depth from platform (feet)	Sample No.	Assay Value (lbs. U_3O_8 per long ton)
CEZ - 12	2' - 0"	10 - 15	3	< 0.02
		20 - 25	5	< 0.02
		35 - 40	8	< 0.02
		45 - 50	10	< 0.02
CEZ - 13	2' - 0"	10 - 15	3	< 0.02
		20 - 25	5	< 0.02
		30 - 35	7	< 0.02
		40 - 45	9	< 0.02
CEZ - 14	2' - 3"	10 - 15	3	< 0.02
		15 - 20	4	0.02
		25 - 30	6	< 0.02
		35 - 40	8	< 0.02
CEZ - 15	2' - 6"	5 - 10	2	< 0.02
		15 - 20	4	0.02
			11	< 0.02
		25 - 30	6	< 0.02
		35 - 40	8	< 0.02
CEZ - 16	2' - 6"	25 - 30	2	< 0.02
			7	< 0.02
		40 - 45	5	< 0.02
CEZ - 17	2' - 6"	30 - 35	3	< 0.02
			7	< 0.02
		40 - 45	5	< 0.02
		45 - 50	6	< 0.02
CEZ - 18	2' - 6"	30 - 35	2	0.02
		45 - 50	5	< 0.02
			7	< 0.02
CEZ - 19	2' - 6"	25 - 30	3	0.02
		40 - 45	6	< 0.02
CEZ - 20	2' - 6"	25 - 30	2	< 0.02
		40 - 45	5	< 0.02

ENU 913

111

ELECTROLYTIC ZINC CO. OF AUSTRALASIA LTD.

AND

NEWMONT PTY. LTD.

EXPLORATION OF SPECIAL MINING LEASE NO. 118.

REPORT FOR 3 MONTHS PERIOD ENDED 30th JUNE, 1968.

EXPLORATION OF S.M.L. 118

REPORT FOR 3 MONTHS PERIOD ENDED 30th JUNE, 1968

SUMMARY.

The early part of this period was devoted to a consideration of the exploration carried out during the currency of the lease and to a re-assessment of the potential of the area.

During the latter part of the period, ground radiometric surveys were carried out over two anomalous areas shown up by the helicopter radiometric survey, as a preliminary to test drilling in the areas.

CONSIDERATION AND RE-ASSESSMENT.

The results of the investigations to date have been somewhat disappointing.

(1) A Major re-assessment of the grades of the Crocker Well Deposits (Report - May 1968 by C.C. Maynard) suggests that grades are lower than formerly indicated.

(2) Investigations to date suggest that further ore bodies are to be found in the adamellitic area of the Crocker Well Deposits, but that these are unlikely to be individually of much larger dimensions than the known bodies. Nevertheless, some further exploration for such bodies is warranted - the ground radiometric surveys described later in this report have this aim.

(3) Exploration and investigation carried out so far suggests that major extensions or repetitions of the Mt. Victoria ore deposits are unlikely.

(4) The present (and past) exploration and investigation has suggested some geological guides to exploration of the wider area of the Olary Province, but none is sufficiently positive or selective to suggest that further deposits may be simply found by their use.

(5) No new techniques of exploration, applicable to exploration of large areas have been evolved.

Despite the disappointing results so far, some further exploration is warranted (and is proceeding);

(i) Further study of the economics and possible bi-products from the known deposits is called for.

(ii) Some further investigation of other known mineralisation and air-borne anomalies will be made.

(iii) A further study of the geological environment and its relationship to mineralisation is proceeding.

GROUND RADIOMETRIC SURVEYS.

The helicopter radiomentric survey revealed a number of minor anomalies. Two areas which appeared to show most promise were selected for closer investigation - and to serve as test areas.

The areas selected are:--

(1) a block about 1000 ft. square lying adjacent to and to the East of the Original Crocker Deposit.

(2) a block of some 2500 ft. x 1500 ft. which lies some half mile South of the Crocker Well camp.

Preparatory to carrying out the ground radiometric surveys, the areas were pegged at much closer spacing - all 1000 ft. and 500 ft. N-S and E-W grid lines were pegged at 100 ft. spacing and intermediate 100 ft. lines pegged at 200 ft. spacing.

The radiometric surveys were carried out by Mr. John Bishop, Geophysicist with Austral Exploration Services, assisted by E.Z. field assistants. Mr. Bishop's description of the survey is included herewith, together with the contour plans.

These ground surveys further delineated the anomalies revealed by the helicopter survey. A drilling program is being laid out to test these anomalies.

CC Maynard per RBirchon

C.C. Maynard.

Austral[illegible]ation Services Pty Ltd
905 SOUTH ROAD, CLARENCE GARDENS, SOUTH AUSTRALIA
P.O. Box 16, Edwardstown, South Australia 5039
Phone 53 5676, 53 5916 After Hours 76 4022

Incorporating
AUSTRAL INSTRUMENTS

COMMENTS ON

GROUND SCINTILLOMETER SURVEY

at

CROCKER WELL

for

Electrolytic Zinc Co. of Australasia Ltd.

and

Newmont Pty. Ltd.

by

John R. Bishop

CROCKER WELL

GROUND SCINTILLOMETER SURVEY

A ground scintillometer survey was carried out over two areas which a previous helicopter survey had shown to be of interest. A Technical Associates PUG-1 scintillometer with a 1" x 1" crystal was used. The areas were surveyed on lines one hundred feet apart. The radiation intensity was continuously recorded along the survey lines with an accuracy of 500 counts per minute (c/m). The two areas were mapped at a contour interval of 1000 c/m.

DISCUSSION OF RESULTS

It was found that the ground survey agreed quite well with anomalies indicated by the helicopter survey. The broad anomalies of the aerial survey were separated into discrete, more intense anomalies.

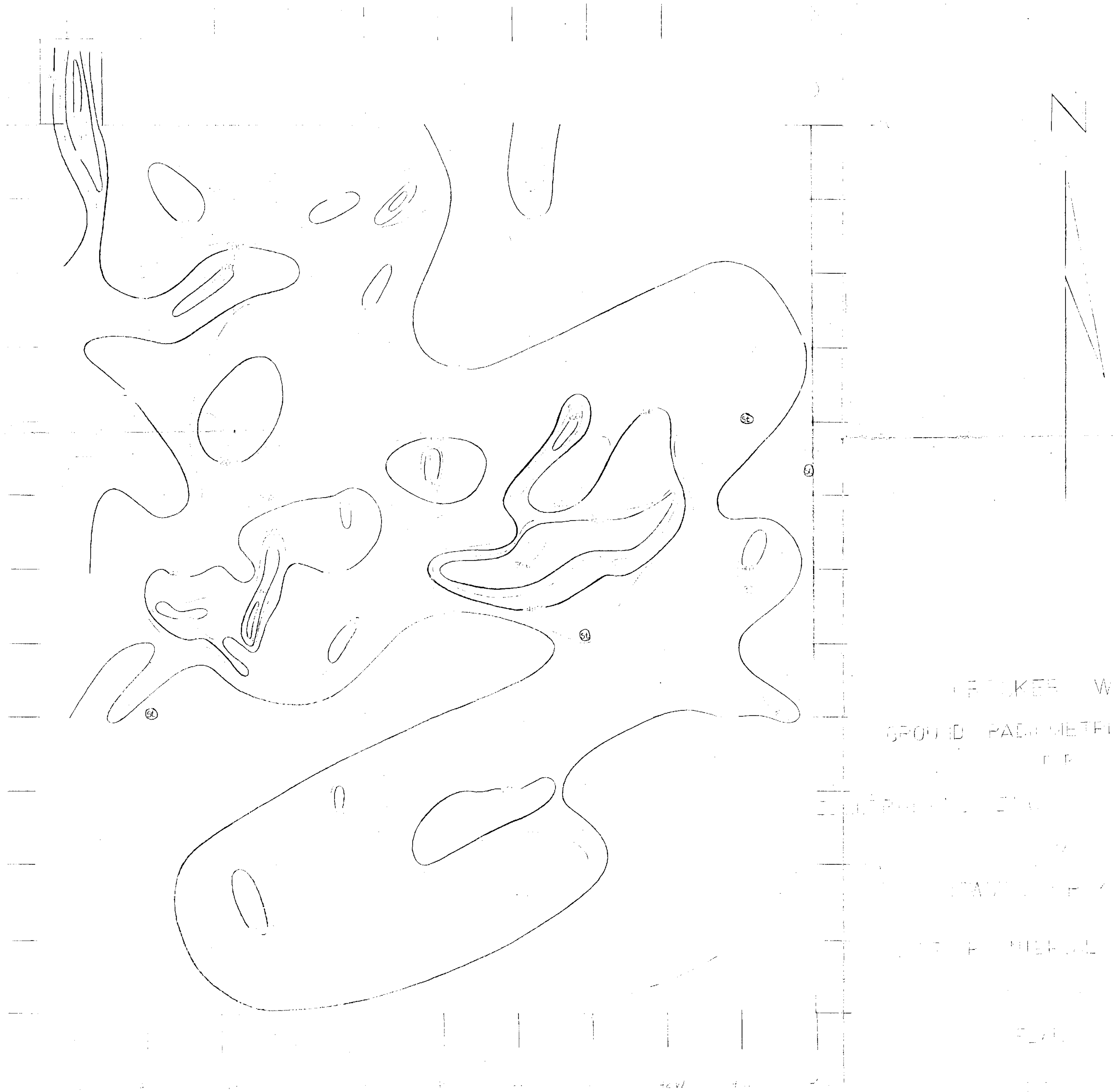
The drainage systems often contained a relatively higher concentration of radioactive minerals, however these higher levels have only been noted where a survey line crossed a stream and no attempt was made to record the actual level of intensity. The one exception is the intense anomaly occurring in the north-west corner of plan 1. This anomaly is caused by the washout from the nearby old workings. These workings occur northwards from about 34N; consisting in this region of trenches and dumps, they extend eastwards into the surveyed areas as far as 48W on some lines.

..2/

Thus the anomalies outlined over these workings are not indicative of the originally undisturbed radioactive mineralisation.

It is thought that vertical drilling into the more intense anomalies would be the best method of testing the area.

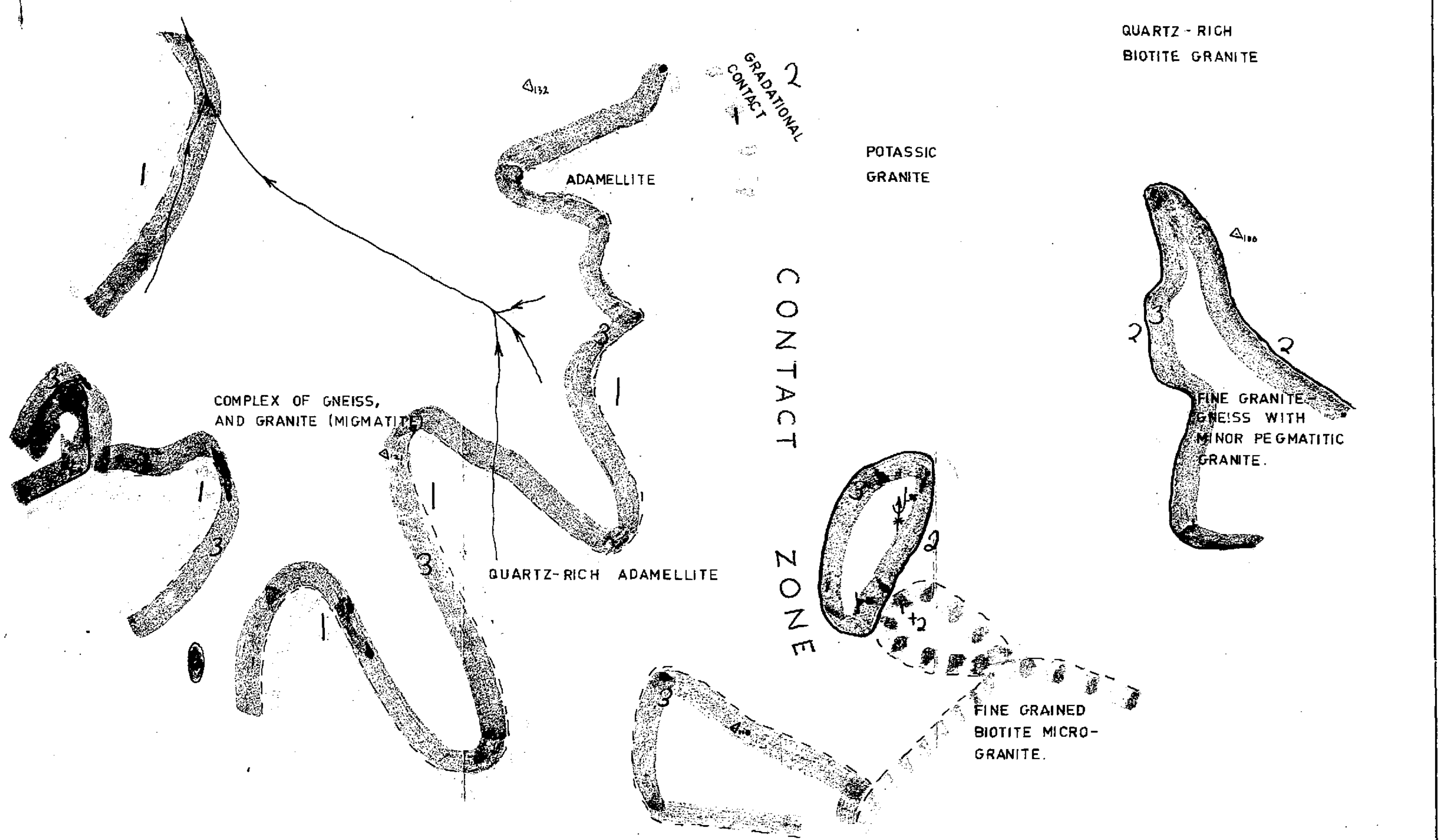
John Bishop
John R. Bishop.



INSTRUMENT USED : TECHNICAL ASSOCIATES
PUG 1 SCINTILLOMETER

SURVEY BY J.R. BISHOP

913-1



LEGEND.

PLANE TABLE SURVEY STATION

CREEK

GEOLOGICAL CONTACT ACCURATE & APPROXIMATE

STRIKE & DIP OF FOLIATION

ATTITUDE OF FOLDS.

1 ADAMELLITE.

2 REGIONAL GRANITE.

GNEISS AND MIGMATITE.

PEGMATITE.

MN

0 100

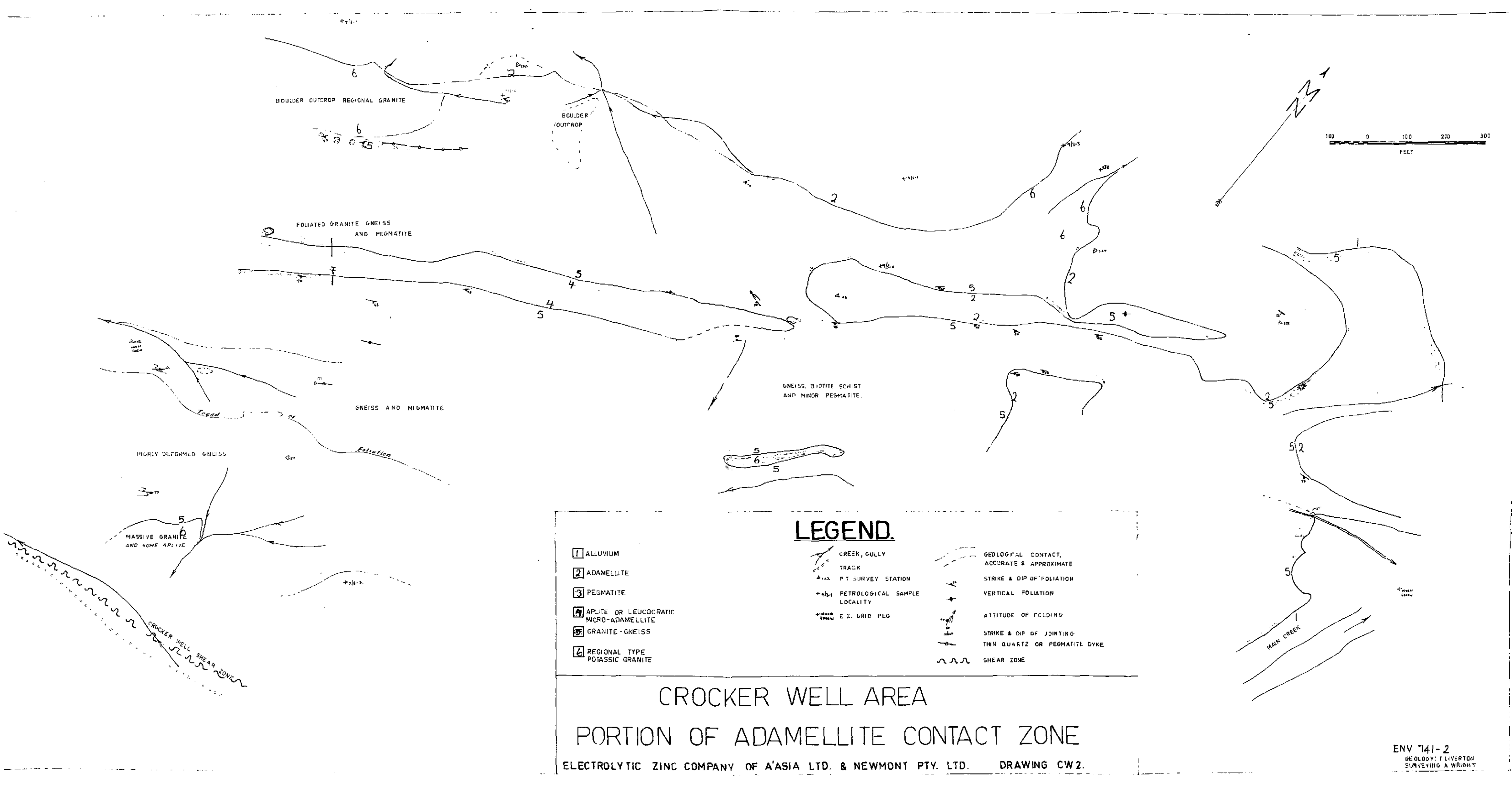
FEET

ELECTROLYTIC ZINC CO. of A/ASIA LTD.

CROCKER WELL PORTION OF SOUTH CONTACT OF ADAMELLITE.

CW1

GEOLOGY: T.LIVERTON MARCH 1967.
SURVEYING: A.WRIGHT. ENV 741-1



CROCKER WELL AREA

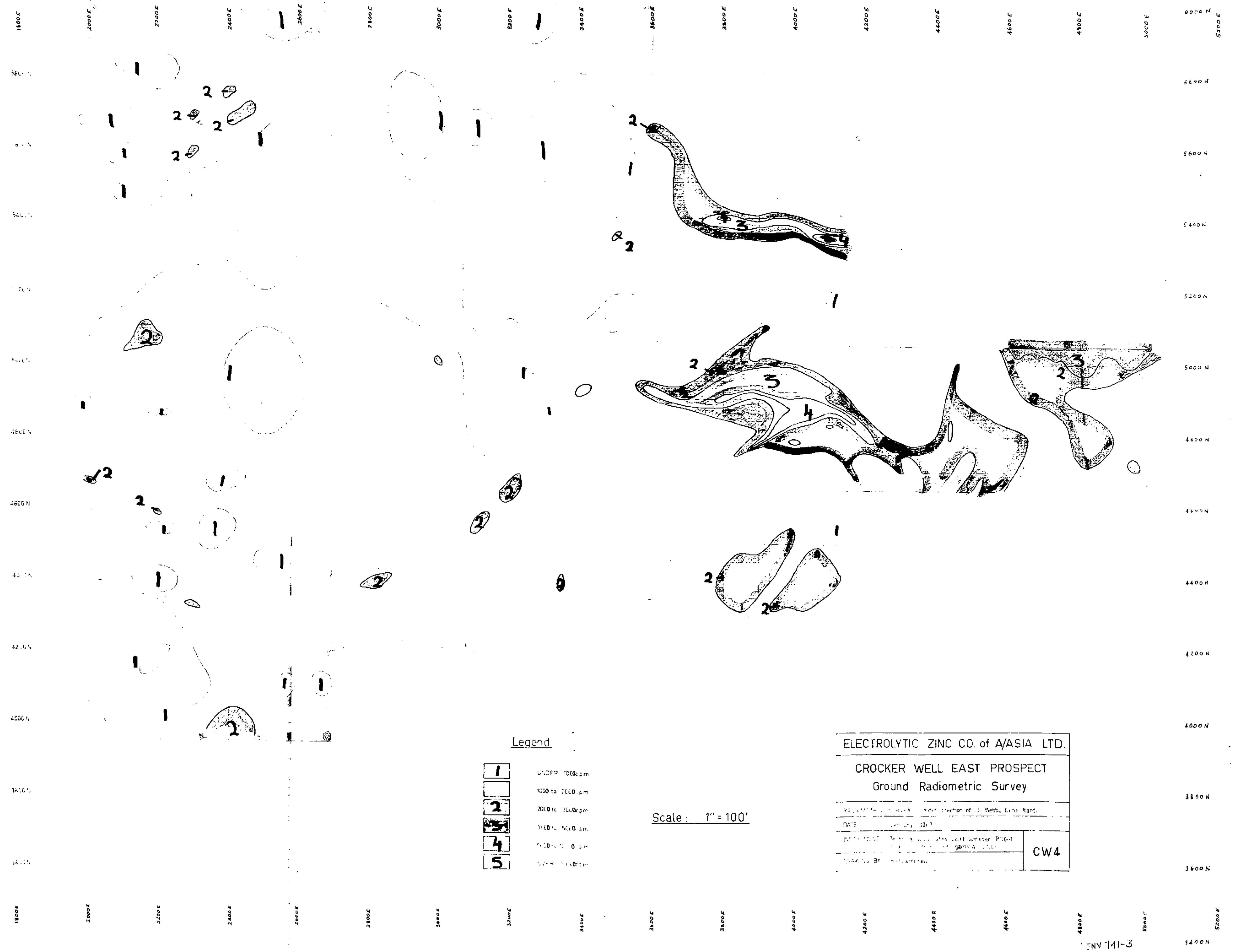
PORTION OF ADAMELLITE CONTACT ZONE

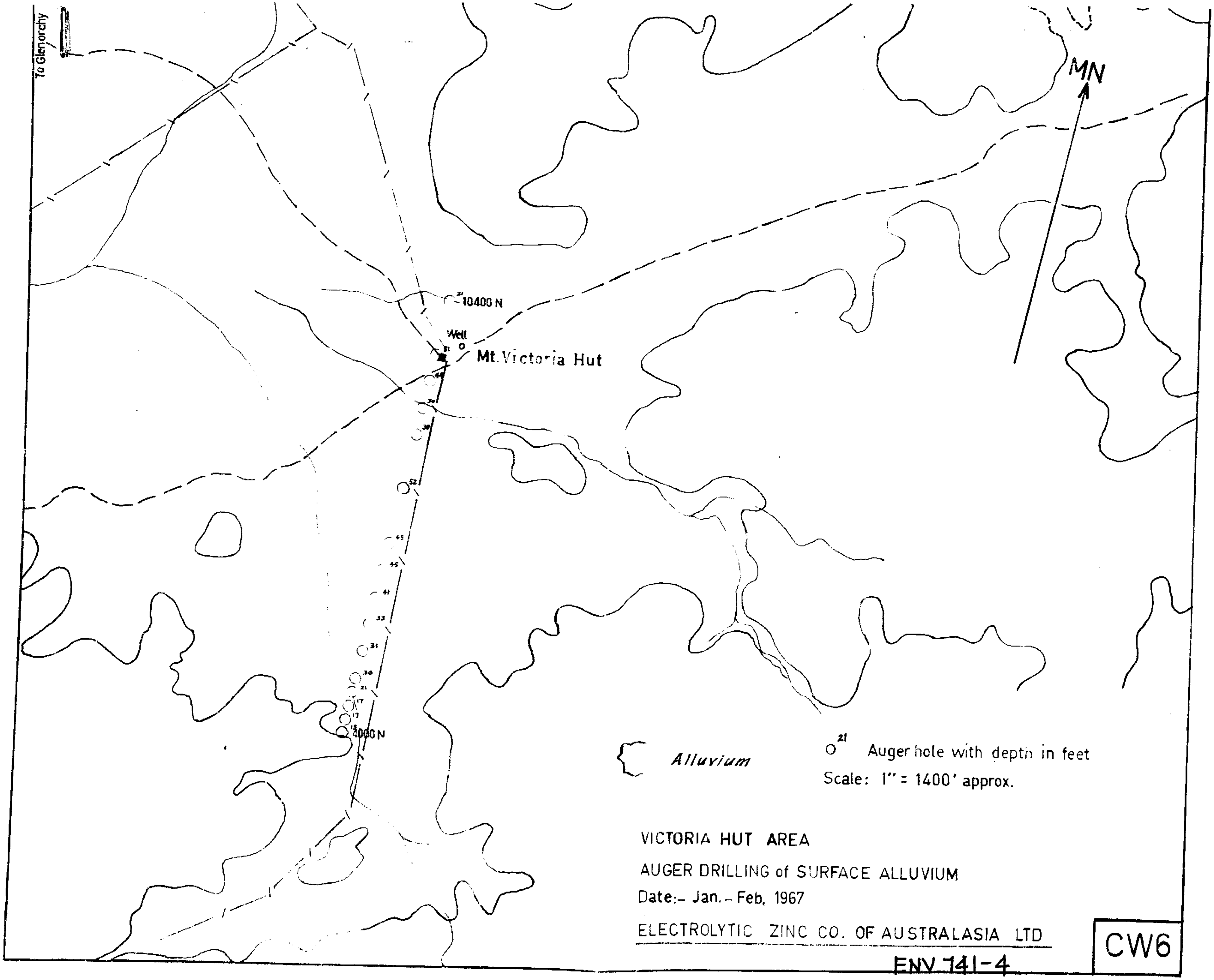
ELECTROLYTIC ZINC COMPANY OF A'ASIA LTD. & NEWMONT PTY. LTD. DRAWING CW 2.

ENV 741-2

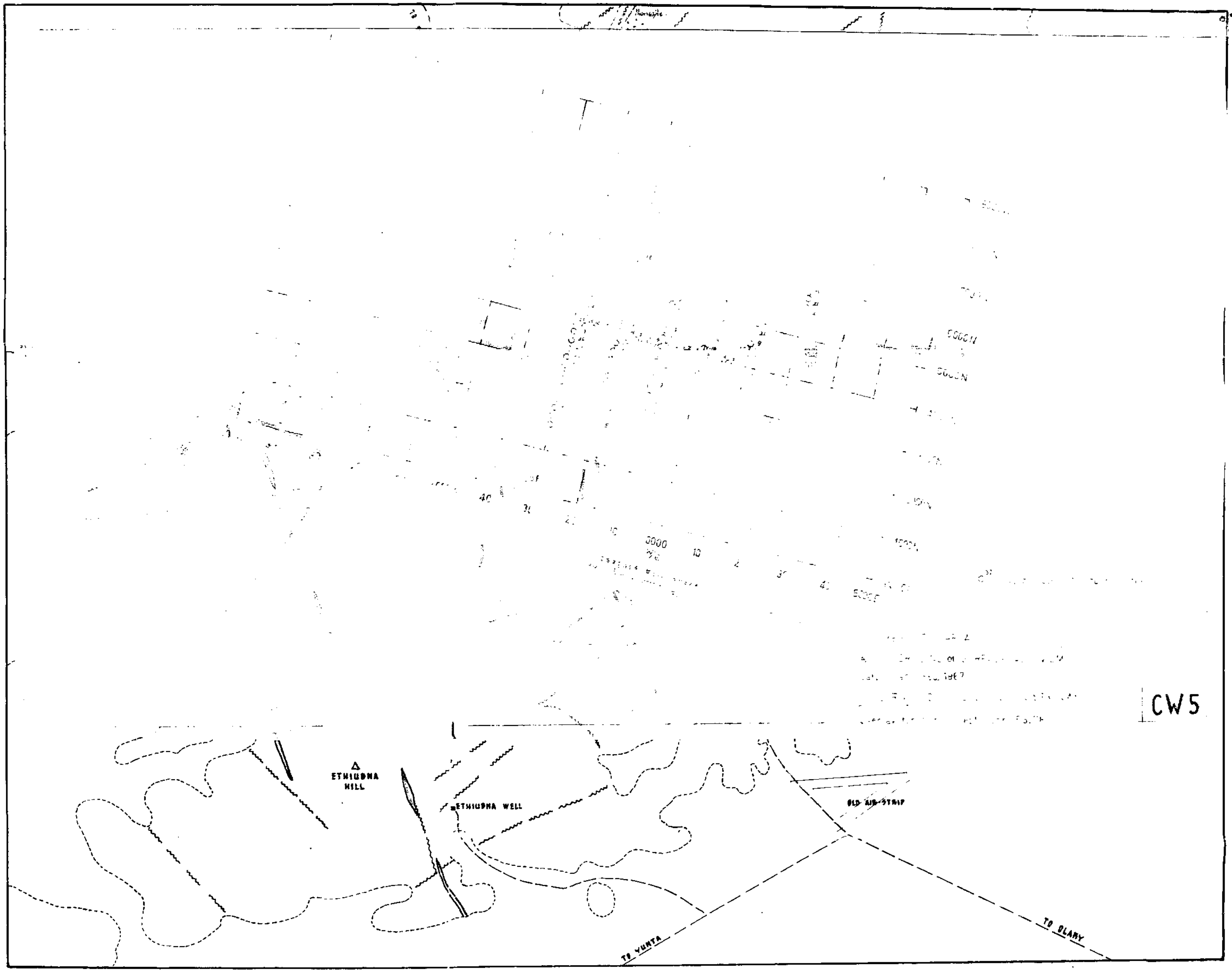
GEOLOGY: T. LIVERTON

SURVEYING: A. WRIGHT


Legend
1000 to 2000
2000 to 3000
Scale : 1" = 100'
ELECTROLYTIC ZINC CO. of A/ASIA LTD.
CROCKER WELL EAST PROSPECT
Ground Radiometric Survey
CW4



To Glenorchy
MN
10400 N
Well
Mt. Victoria Hut
4000 N
Alluvium
Auger hole with depth in feet
Scale: 1" = 1400' approx.
VICTORIA HUT AREA
AUGER DRILLING of SURFACE ALLUVIUM
Date:- Jan. - Feb. 1967
ELECTROLYTIC ZINC CO. OF AUSTRALASIA LTD
CW6
ENV 141-4



LEGEND

- DOLERITE DYKES
- 1 — PREDOMINANTLY ADAMELLITE
- COMPLEX OF GRANITE, GRANITE GNEISS AND MIGMATITE
- 5 — METASEDIMENTARY GNEISS AND SCHIST
- APPROXIMATE GEOLOGICAL BOUNDARIES
- SHEARED ZONES
- SHATTERED ZONES
- OBSERVED ABSITE OCCURRENCE AND CONCENTRATION
- Dendrite — OTHER MINERAL OCCURRENCES
- ROADS AND TRACKS
- BOUNDARIES OF AREAS MAPPED IN DETAIL

SCALE

CHN. 20 10 0 ¼ ½ ¾ 1 MILE

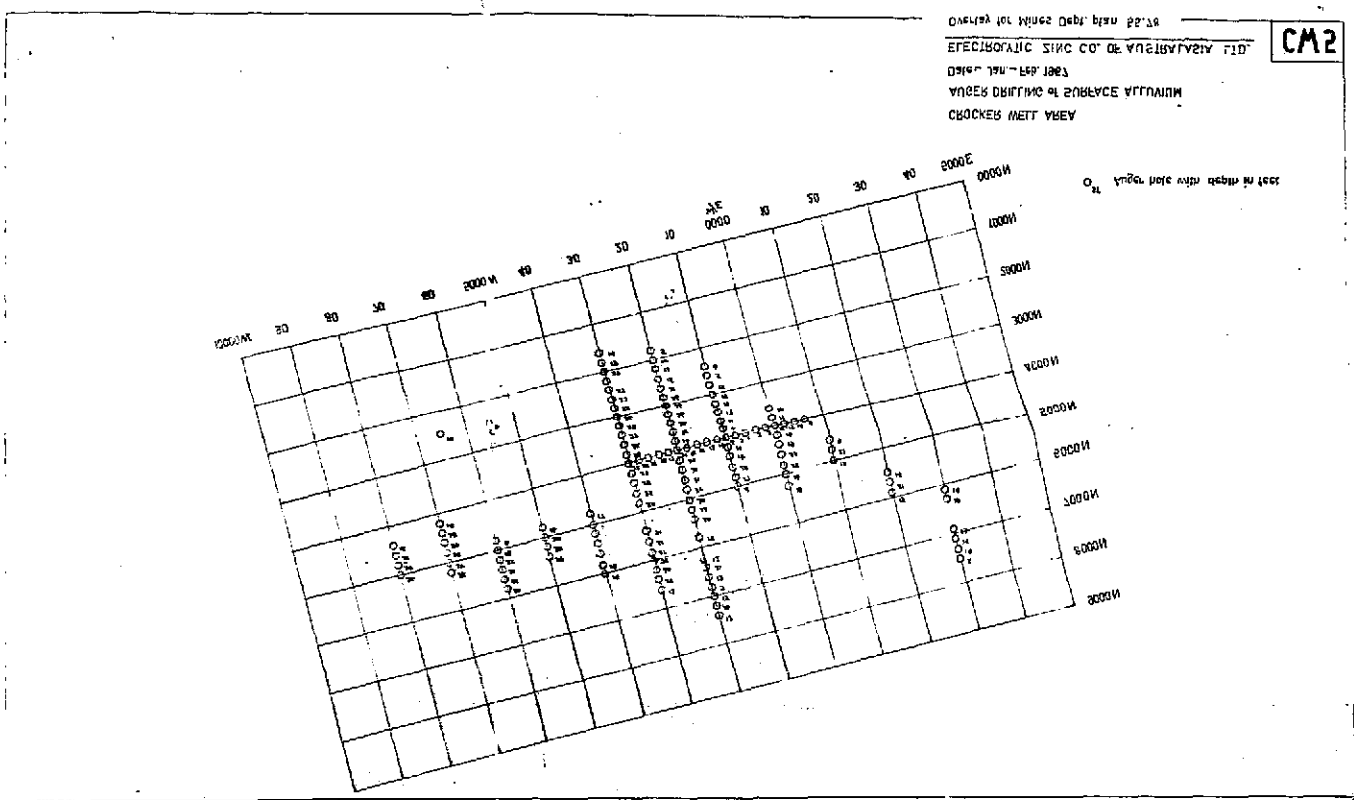
S.A. DEPARTMENT OF MINES

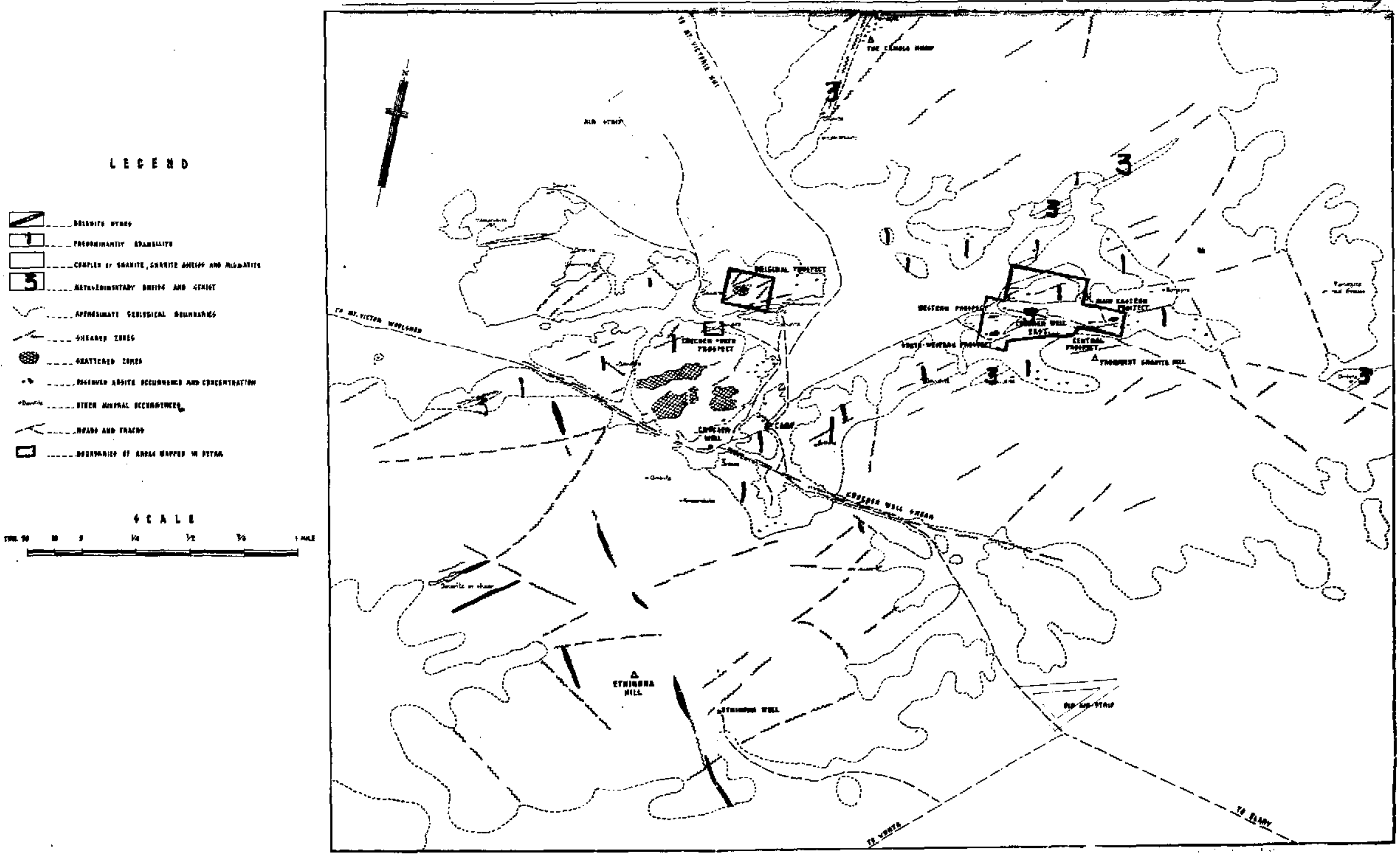
CROCKER WELL URANIUM DEPOSITS

GEOLOGICAL LOCALITY MAP

Associated Drawing / No. / Amendment / Ext. / Date	D.M. Compiled from Originals by D. King and J. Johnson	Approved / Passed / Director of Mines	Drn. / Tcd. / Ckd. / Exd.	Scale 4 INCHES TO 1 MILE 55·78 Fg Date 25·3·55

ENV 141·5





S.A. DEPARTMENT OF MINES

Associated Drawing No. / No. Amendment Fcd. Date	Ref. No. D.M. Compiled from Originals by D.King and J. Johnson	CROCKER WELL URANIUM DEPOSITS GEOLOGICAL LOCALITY MAP	Approved / Passed / Director of Mines / Drn. Fcd. Ckd. Exd.	Scale 4 INCHES TO 1 MILE 55·78 F8 Date 25·5·55

ENV 741 5

815-7

TABLE - 2.

EAST CROCKER - - 3800 E SECTION.

Selected Area "B"

Rotary - Percussion Drilling - Apr. - May 1967

VALUATION OF AREA SELECTED BY MINES DEPT.

and EFFECT OF HOLE SPACING ON VALUATION

Chemical Assays - Values in lbs. U_3O_8 per long ton.

Hole No.	(1) Interval (feet from Collar)	(2) Mean Value of interval	Hole Spacing. 25' A	B	50' A	B	50' A	B	75' A	B	75' A	B	75' A	B
CEZ-11	0-45	0.56	9	5.03	9	5.03			9	5.03				
CEZ-10	22-69	0.51	10	5.05			10	5.05			10	5.05		
CEZ- 9	46-92	1.17	9	10.52	9	10.52							9	10.52
CEZ- 8	68-120	1.52	11	16.66			11	16.66	11	16.66				
CEZ- 7	26-34 89-144	3.54	13	46.02	13	46.02					13	46.02		
CEZ- 6	0-24 57-65 69-153	2.09	24	50.19			24	50.19					24	50.19
CEZ- 5	24-162	0.86	28	24.19	28	24.19			28	24.19				
CEZ- 4	53-153	0.88	20	17.68			20	17.68			20	17.68		
CEZ- 3	91-129	0.68	8	5.42	8	5.42							8	5.42
			132	180.76	67	91.18	65	89.58	48	45.88	43	68.75	41	66.13
				1.369		1.360		1.378		0.956		1.599		1.613

A. Number of samples accepted as representing the selected interval.

B. Sum of values " " " " " " " "
(All samples represent a 5' length of hole)

(1) The interval is that portion of the hole which lies within the area selected for valuation (See Mines Dept. Plan No. 55-261)

(2) The mean value of the interval $= \frac{\text{Sum of Values of samples}}{\text{Number of samples}} = \frac{B}{A}$

815-8

TABLE - 3.

EAST CROCKER - - 3800 E SECTION. Selected Area "A"

Rotary - Percussion Drilling - Apr. - May 1967.

VALUATION OF SELECTED AREA and EFFECT of HOLE SPACING on VALUATION.

Mean Probe Deflections converted to lbs. U_3O_8 per long ton using linear calibration.

Calibration by Mines Department Red Calibration tube *

Hole	(1) Interval (feet from Collar)	(2) Mean Value of Interval	Hole Spacing 25'		50'		50'		75'		75'		75'	
CEZ-11	0-63	2.46	63	153.7	63	153.7			63	153.7				
10	0-91	1.79	91	162.7			91	162.7			91	162.7		
9	0-114	1.66	114	189.5	114	189.5							114	189.5
8	0-138	1.56	138	215.2			138	215.2	138	215.2				
7	0-164	1.81	164	296.3	164	296.3					164	296.3		
6	0-190	2.03	190	386.1			190	386.1					190	386.1
5	12-221	1.13	209	234.6	209	234.6			209	234.6				
4	43-203	1.18	160	189.0			160	189.0			160	189.0		
CEZ)-3	70-180	1.10	110	121.1	110	121.1							110	121.1
2	89-155	0.58	66	38.1			66	38.1	66	38.1				
Totals.			1303	1986.3	660	995.2	645	991.1	476	641.6	415	648.0	414	696.7
* Mean Values (using 7.0 lbs. assigned value)				1.524		1.508		1.533		1.348		1.561		1.683
* Mean Values. (using 7.8 lbs. assigned value)				1.697		1.680		1.708		1.502		1.739		1.875

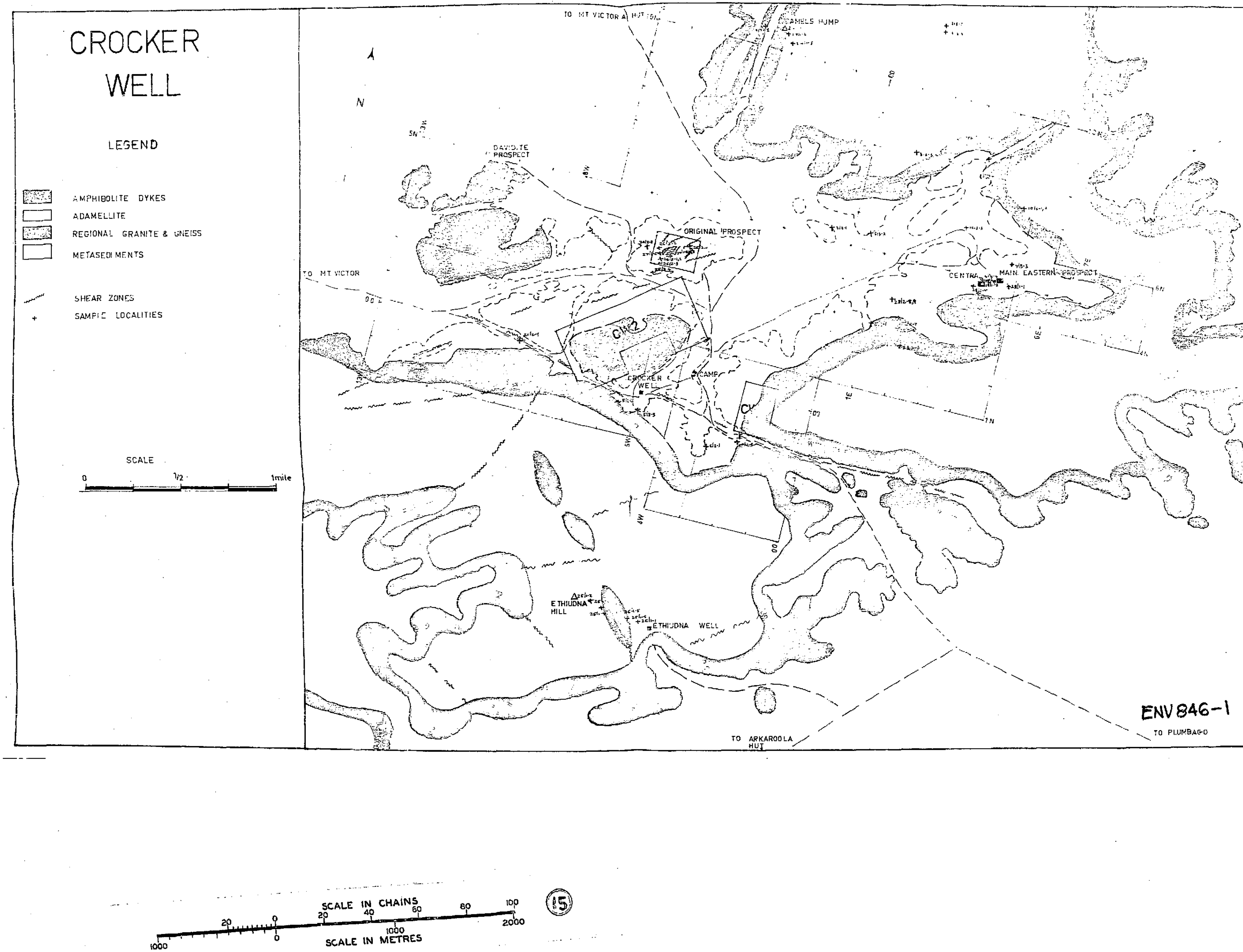
(A) Interval of hole in feet.

(B) Mean value for interval X length (in feet) of interval.
[Actually is the sum of (mean values for 5' or smaller interval X 5' or smaller interval]

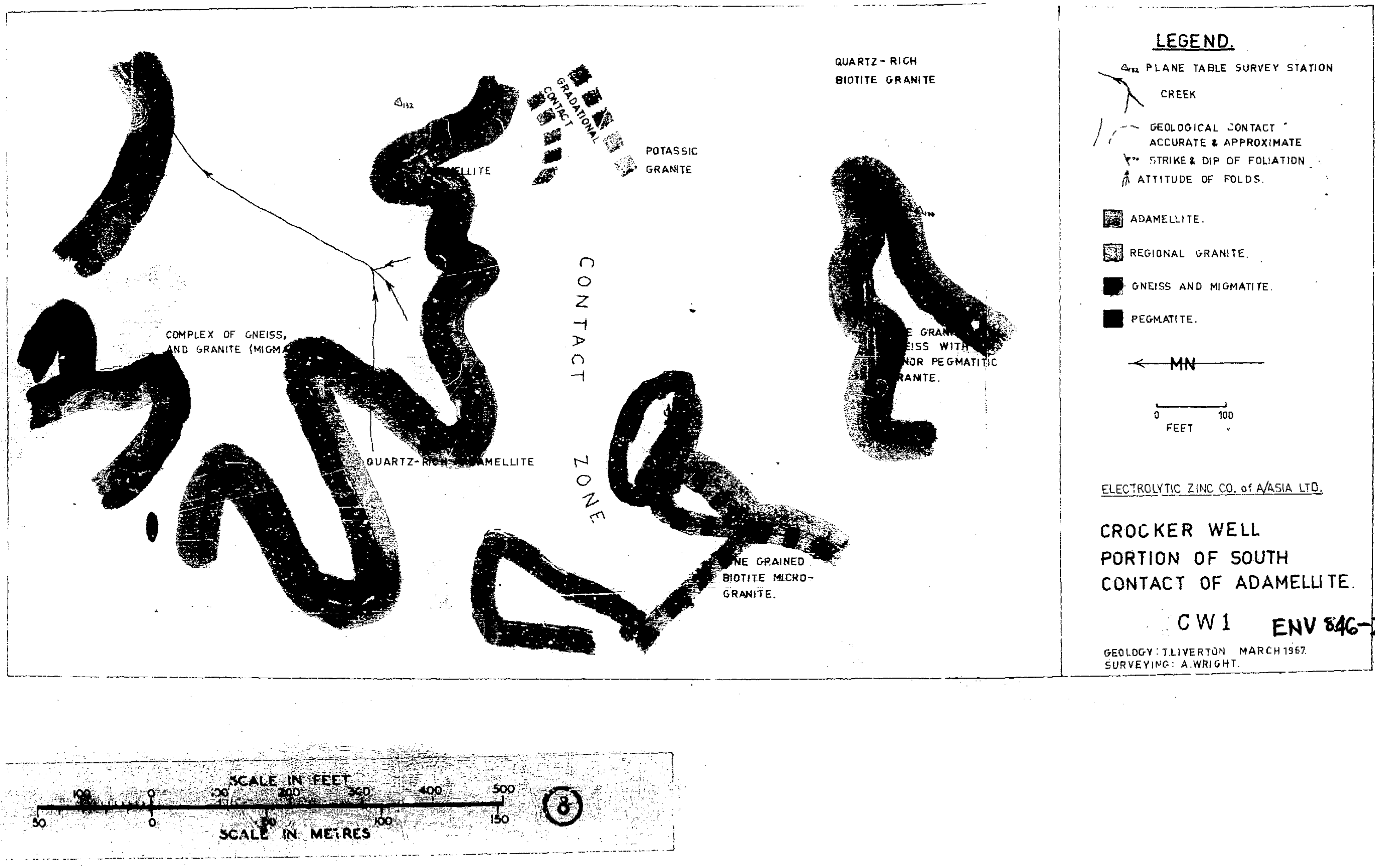
(1.) The Interval is that portion of the hole which lies within the area selected for valuation (Plan No. CW 7)

(2) Mean value of the Interval = mean deflection for the interval X $\frac{\text{assigned value for Red Calibration tube}}{\text{mean deflection " " " "}}$

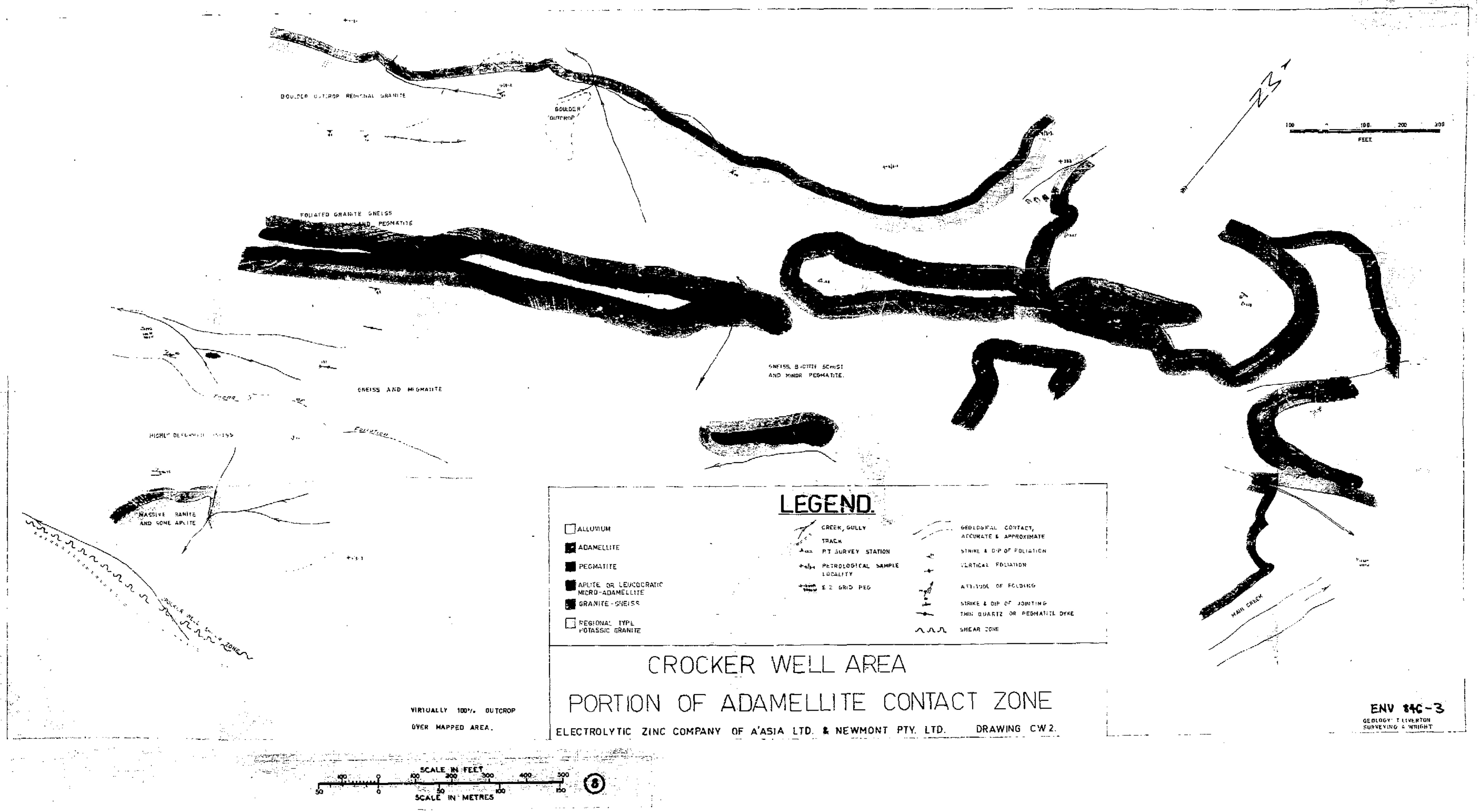
X Note : The assigned value for the Red calibration tube was quoted as being 7.0 lbs U_3O_8 per long ton.
This value has been used in computing Mean Values in Table 3.
However an examination of Mines Dept. records indicates that 7.8 lbs. U_3O_8 per long ton is a more likely assigned value.
Thus an extra line "(Mean Values using 7.8 lbs. assigned value)" has been added to the table.
These latter values were obtained by multiplying "Mean Values using 7.0 lbs. assigned value" by $\frac{7.8}{7.0}$


CROCKER WELL
LEGEND
AMPHIBOLITE DYKES
ADAMELLITE
REGIONAL GRANITE & GNEISS
METASEDIMENTS
SHEAR ZONES
SAMPLE LOCALITIES
SCALE
0
1/2
1mile
N
TO MT VICTOR A HUT
CAMELS HUMP
DAVIDITE PROSPECT
ORIGINAL PROSPECT
TO MT VICTOR
CW2
CROCKER WELL
CAMP
CENTRAL
MAIN EASTERN PROSPECT
ETHIUDNA HILL
ETHIUDNA WELL
TO ARKAROOLA HUT
TO PLUMBAGO
ENV 846-1
SCALE IN CHAINS
20
0
20
40
60
80
100
1000
0
1000
2000
SCALE IN METRES

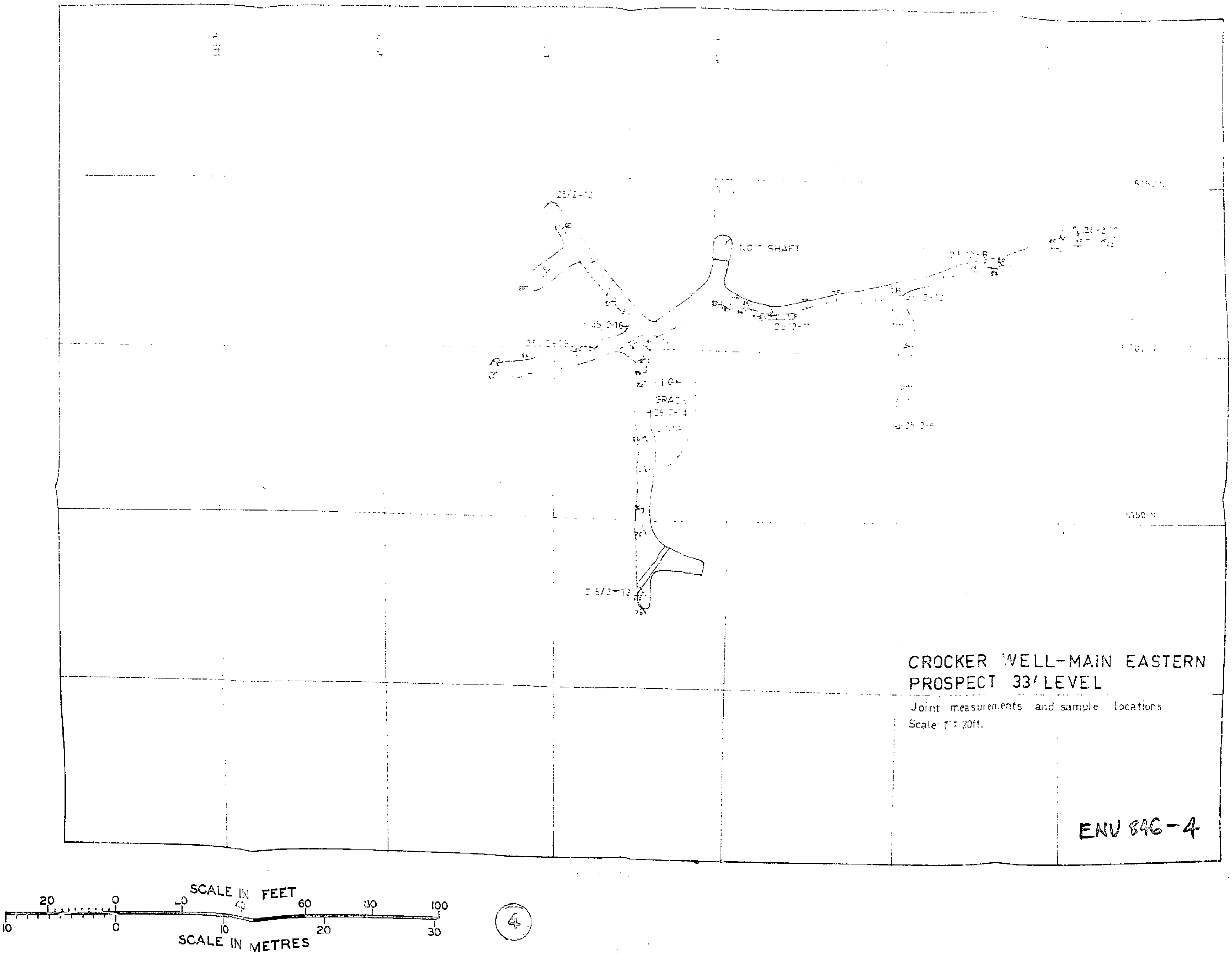
15



LEGEND.
PLANE TABLE SURVEY STATION
CREEK
GEOLOGICAL CONTACT ACCURATE & APPROXIMATE
STRIKE & DIP OF FOLIATION
ATTITUDE OF FOLDS.
ADAMELLITE.
REGIONAL GRANITE.
GNEISS AND MIGMATITE.
PEGMATITE.
MN
0 100
FEET
QUARTZ-RICH BIOTITE GRANITE
GRADATIONAL CONTACT
POTASSIC GRANITE
CONTACT ZONE
COMPLEX OF GNEISS, AND GRANITE (MIGMA
QUARTZ-RICH AMELLITE
NE GRAINED BIOTITE MICRO-GRANITE.
ANOR PEGMATITIC
ELECTROLYTIC ZINC CO. of A/ASIA LTD.
CROCKER WELL
PORTION OF SOUTH
CONTACT OF ADAMELLITE.
CW1
ENV 846-2
GEOLOGY: T.LIVERTON MARCH 1967.
SURVEYING: A.WRIGHT.
SCALE IN FEET
100 0 100 200 300 400 500
50 0 50 100 150
SCALE IN METRES
8
1171

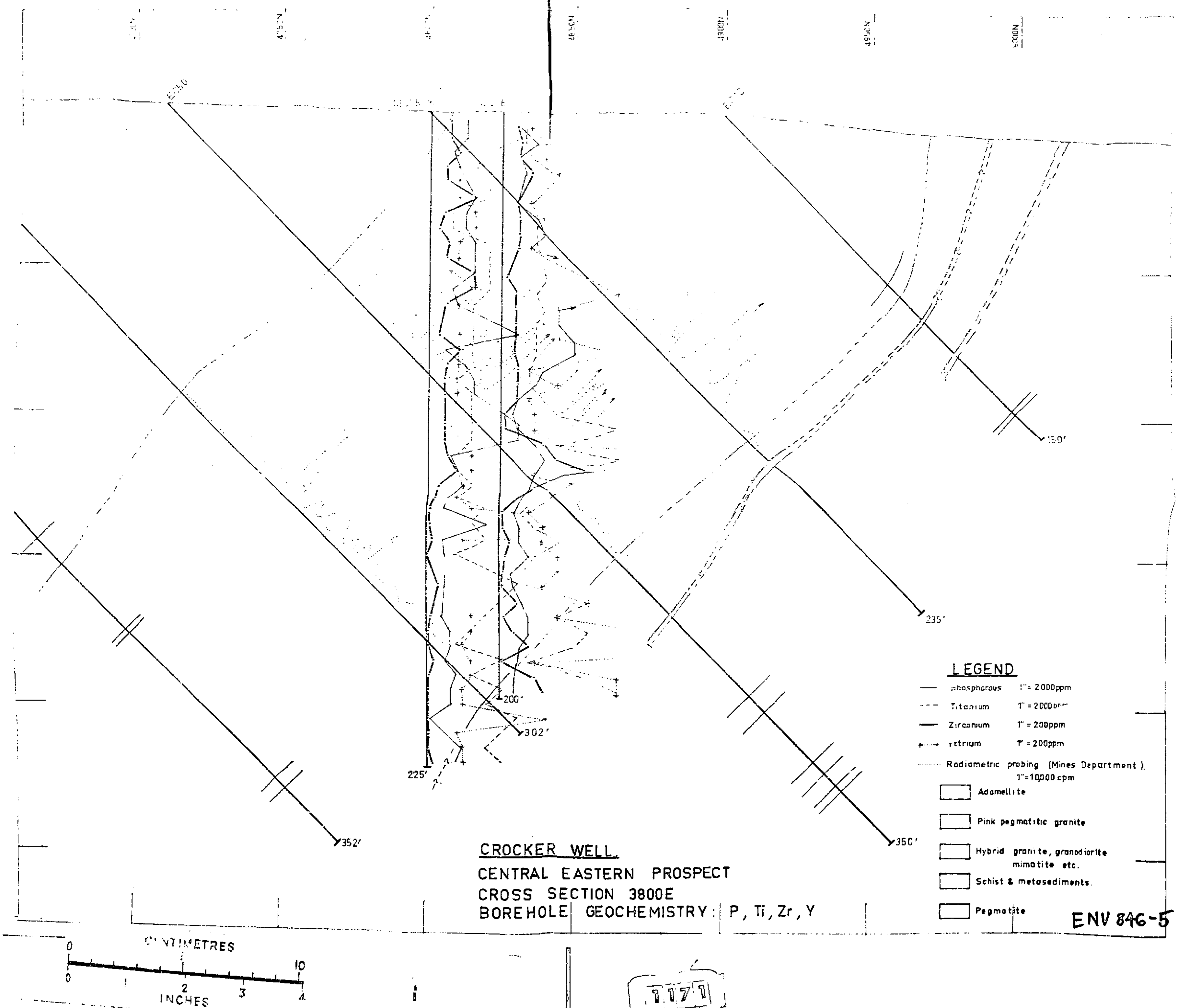


BOULDER OUTCROP REGIONAL GRANITE
BOULDER OUTCROP
FOLIATED GRANITE GNEISS
PEGMATITE
GNEISS AND MIGMATITE
HIGHLY DEFORMED GNEISS
GNEISS, BIOTITE SCHIST AND MINOR PEGMATITE.
MASSIVE GRANITE AND SOME APLITE
CROCKER WELL SHEAR ZONE
MAIN CREEK
FEET
VIRTUALLY 100% OUTCROP OVER MAPPED AREA.
LEGEND.
ALLUVIUM
ADAMELLITE
PEGMATITE
APLITE OR LEUCOCRATIC MICRO-ADAMELLITE
GRANITE-GNEISS
REGIONAL TYPE POTASSIC GRANITE
CREEK, GULLY
TRACK
P.T. SURVEY STATION
PETROLOGICAL SAMPLE LOCALITY
E.Z. GRID PEG
GEOLOGICAL CONTACT, ACCURATE & APPROXIMATE
STRIKE & DIP OF FOLIATION
VERTICAL FOLIATION
ATTITUDE OF FOLDING
STRIKE & DIP OF JOINTING
THIN QUARTZ OR PEGMATITE DYKE
SHEAR ZONE
CROCKER WELL AREA
PORTION OF ADAMELLITE CONTACT ZONE
ELECTROLYTIC ZINC COMPANY OF A'ASIA LTD. & NEWMONT PTY. LTD.
DRAWING CW2.
ENV 84C-3
GEOLOGY: T LIVERTON
SURVEYING: A WRIGHT
SCALE IN FEET
100 0 100 200 300 400 500
50 0 50 100 150
SCALE IN METRES
8



NO 1 SHAFT
CROCKER WELL-MAIN EASTERN
PROSPECT 33' LEVEL
Joint measurements and sample locations
Scale 1" = 20ft.
ENU 846-4
SCALE IN FEET
20
0
20
40
60
80
100
10
0
10
20
30
SCALE IN METRES

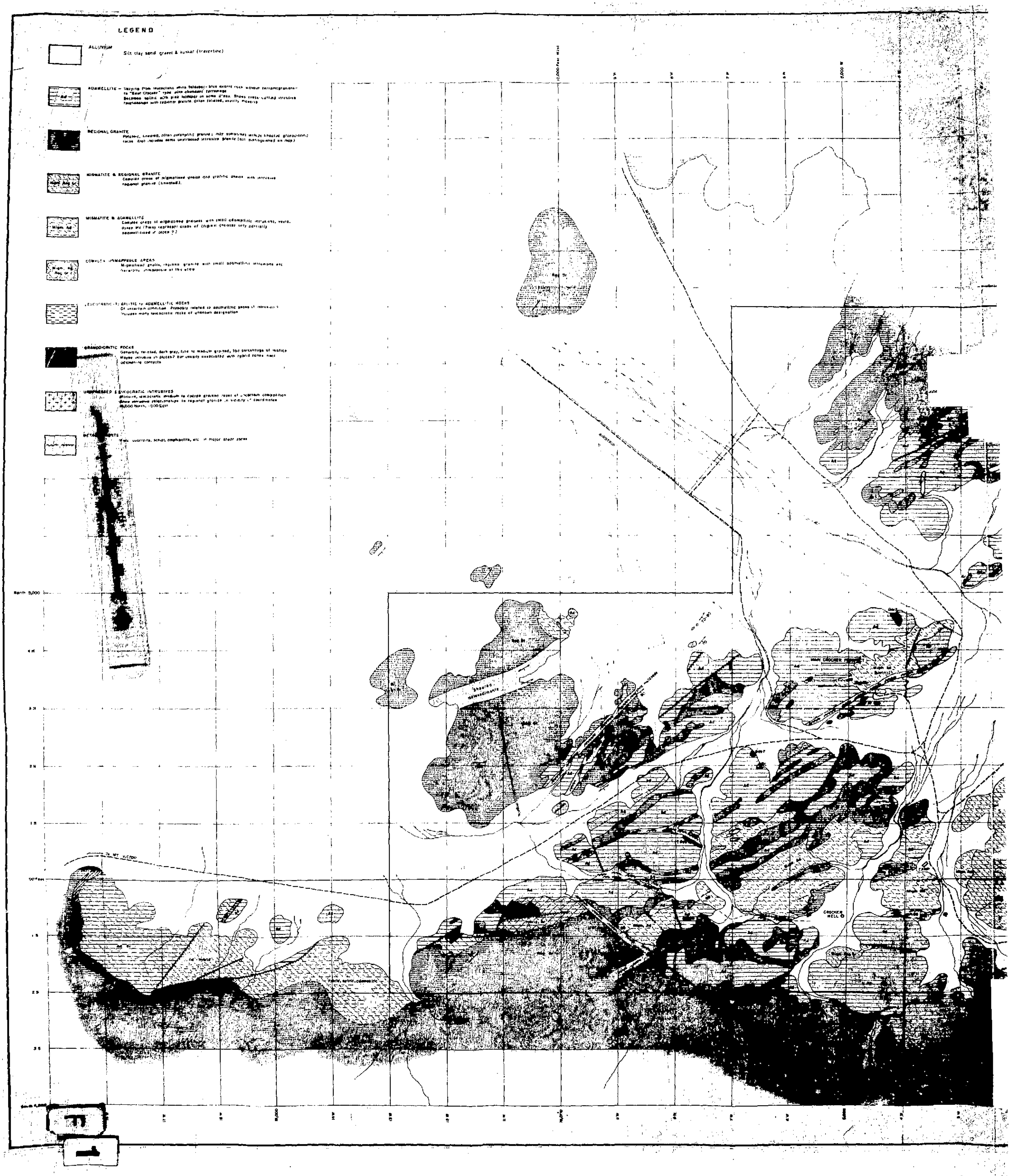
4



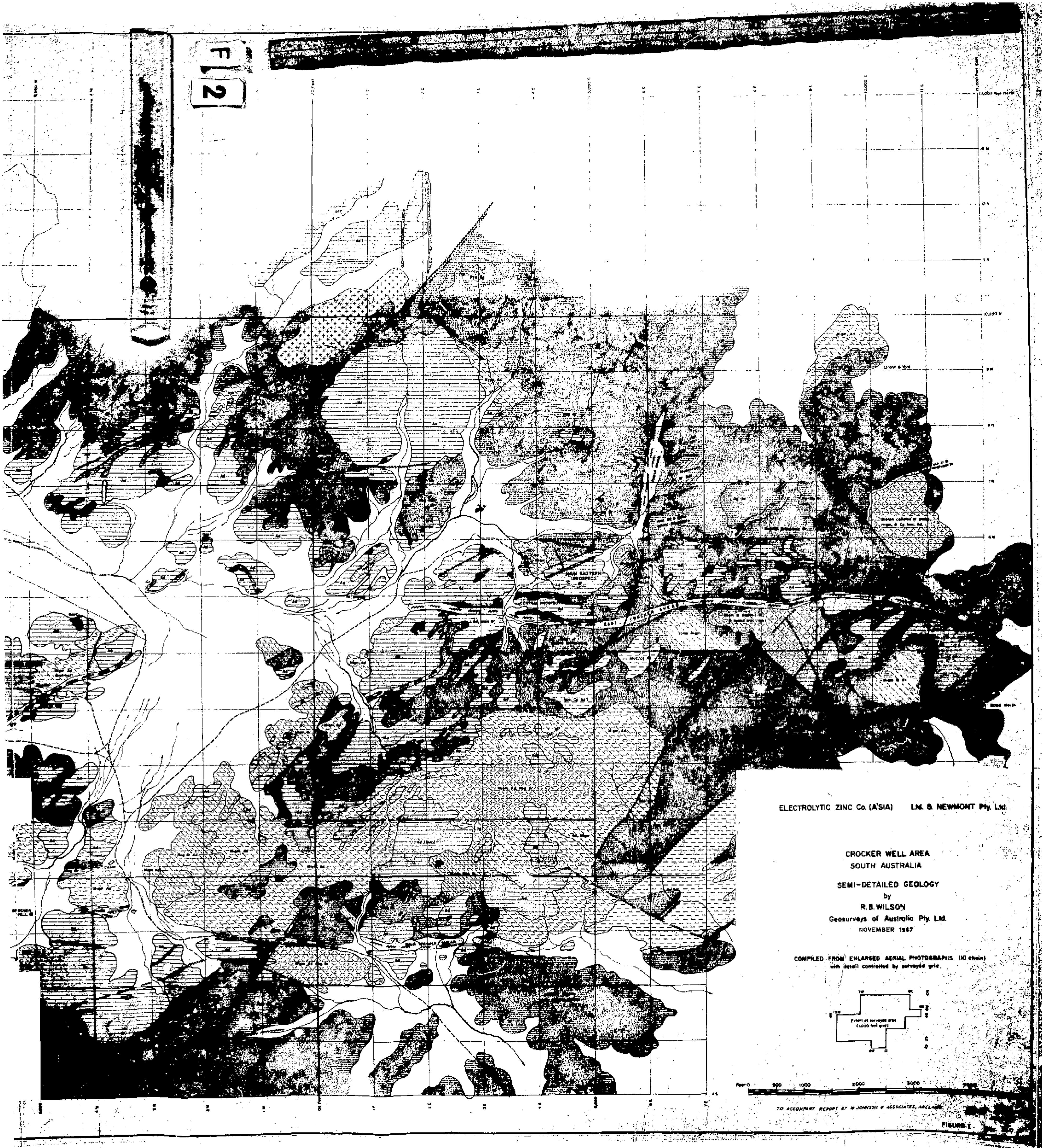
CROCKER WELL.
CENTRAL EASTERN PROSPECT
CROSS SECTION 3800E
BOREHOLE GEOCHEMISTRY: P, Ti, Zr, Y

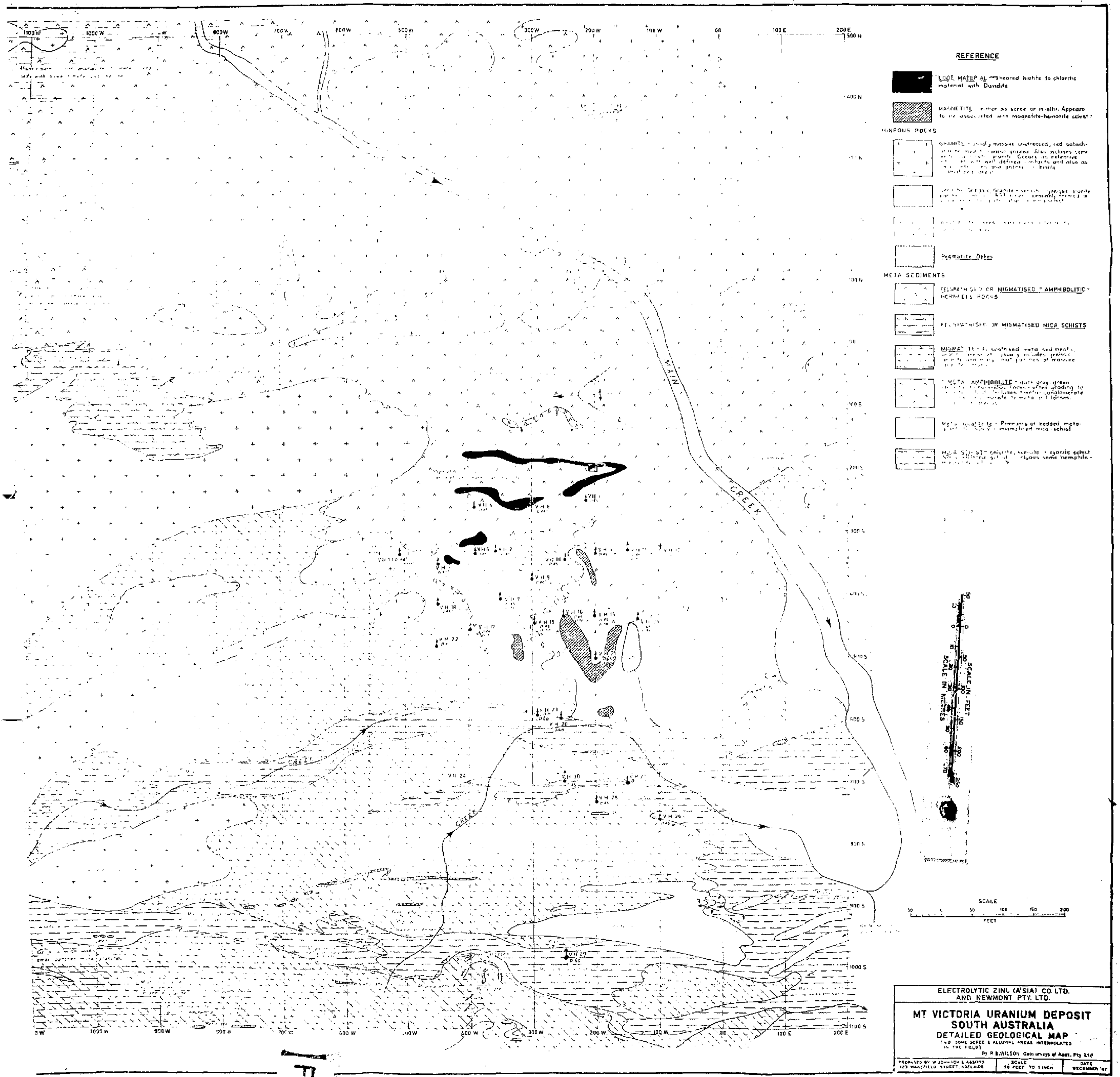
ENV 846-5

1171



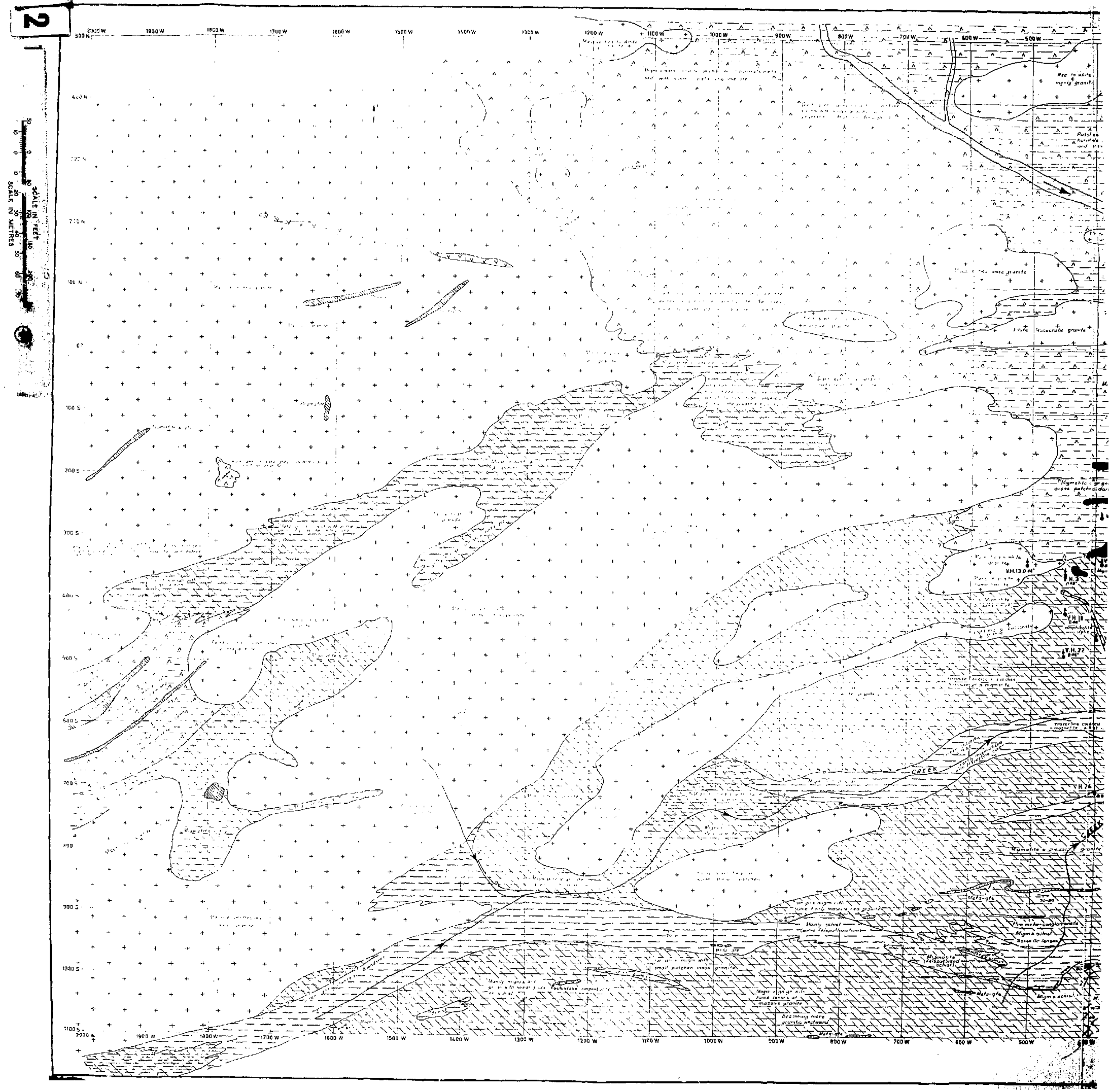
LEGEND
ALLUVIUM
Silt clay sand gravel & kunkar (travertine)
ADAMELLITE
REGIONAL GRANITE
MIGMATITE & REGIONAL GRANITE
MIGMATITE & ADAMELLITE
COMPLEX UNMAPPABLE AREAS
APLITIC to ADAMELLITIC ROCKS
GRANODIORITIC ROCKS
LEUCOCRATIC INTRUSIVES
CROCKER WELL
North 5,000
F
1

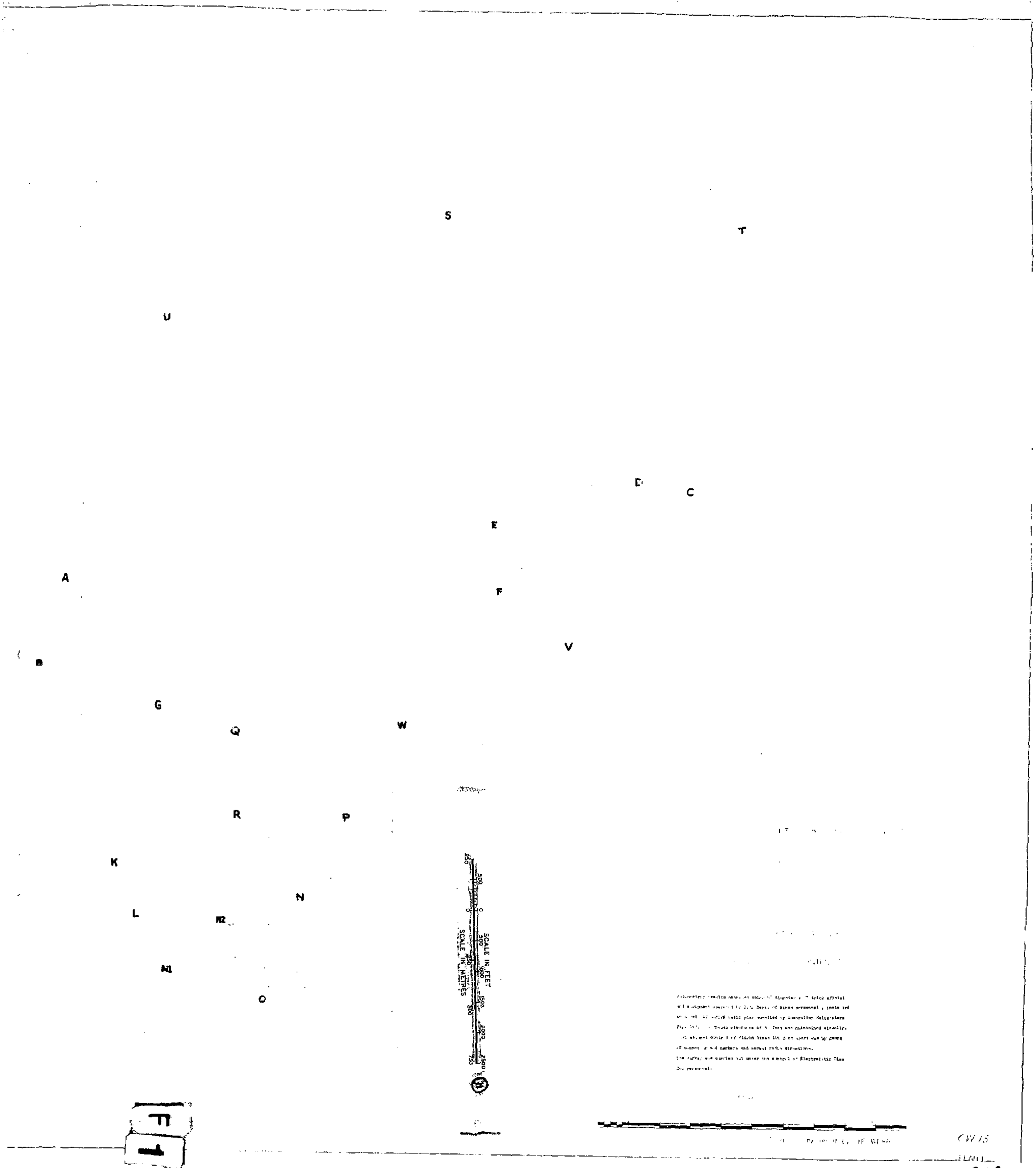

F 2
MAIN EASTERN PROSPECT
EAST CROCKER SHEAR
MAIN CROCKER
ELECTROLYTIC ZINC Co. (A'SIA) Ltd. & NEWMONT Pty. Ltd.
CROCKER WELL AREA
SOUTH AUSTRALIA
SEMI-DETAILED GEOLOGY
by
R.B. WILSON
Geosurveys of Australia Pty. Ltd.
NOVEMBER 1967
COMPILED FROM ENLARGED AERIAL PHOTOGRAPHS (10 chain)
with detail controlled by surveyed grid.
Extent of surveyed area
(1,000 feet grid)
Feet 0 500 1000 2000 3000
TO ACCOMPANY REPORT BY W JOHNSON & ASSOCIATES, ADELAIDE
FIGURE 1



REFERENCE
LODE MATERIAL – sheared biotite to chloritic material with Davidite
MAGNETITE – either as scree or in-situ. Appears to be associated with magnetite-hematite schist?
IGNEOUS ROCKS
GRANITE
Pegmatite Dykes
META SEDIMENTS
FELSPATHISED OR MIGMATISED ? AMPHIBOLITIC – HORNFELS ROCKS
FELSPATHISED OR MIGMATISED MICA SCHISTS
MIGMATITE
? META AMPHIBOLITE – dark grey-green
MICA SCHIST
MAIN CREEK
CREEK
SCALE IN FEET
SCALE IN METRES
SCALE
FEET
ELECTROLYTIC ZINC (A'SIA) CO. LTD.
AND NEWMONT PTY. LTD.
MT VICTORIA URANIUM DEPOSIT
SOUTH AUSTRALIA
DETAILED GEOLOGICAL MAP
(N.B. SOME SCREE & ALLUVIAL AREAS INTERPOLATED IN THE FIELD)
By P.B. WILSON Geosurveys of Aust. Pty Ltd
SCALE
50 FEET TO 1 INCH
DATE
ENV 846-7

F 2


SCALE IN FEET
SCALE IN METRES
2000 W
1900 W
1800 W
1700 W
1600 W
1500 W
1400 W
1300 W
1200 W
1100 W
1000 W
900 W
800 W
700 W
600 W
500 W
500 N
400 N
100 S
200 S
300 S
400 S
500 S
700 S
800
900 S
1000 S
1100 S
Red to white mg-lg granite
White leucocratic granite
Migmatite, granite
VH.13
VH.18
VH.22
VH.26
CREEK
Migmatite & gneiss granite
Meta-gte
70-80
Thin meta-conglomerate
Migma schist
Some Gr lenses
Mainly schist
Migmatite (felspathised schist)
Migma schist
Small patches mass. granite
Some lenses of massive granite
Becoming more granitic westward



CW 15
ENV 847-1