REPORT ON E.L. 12/77

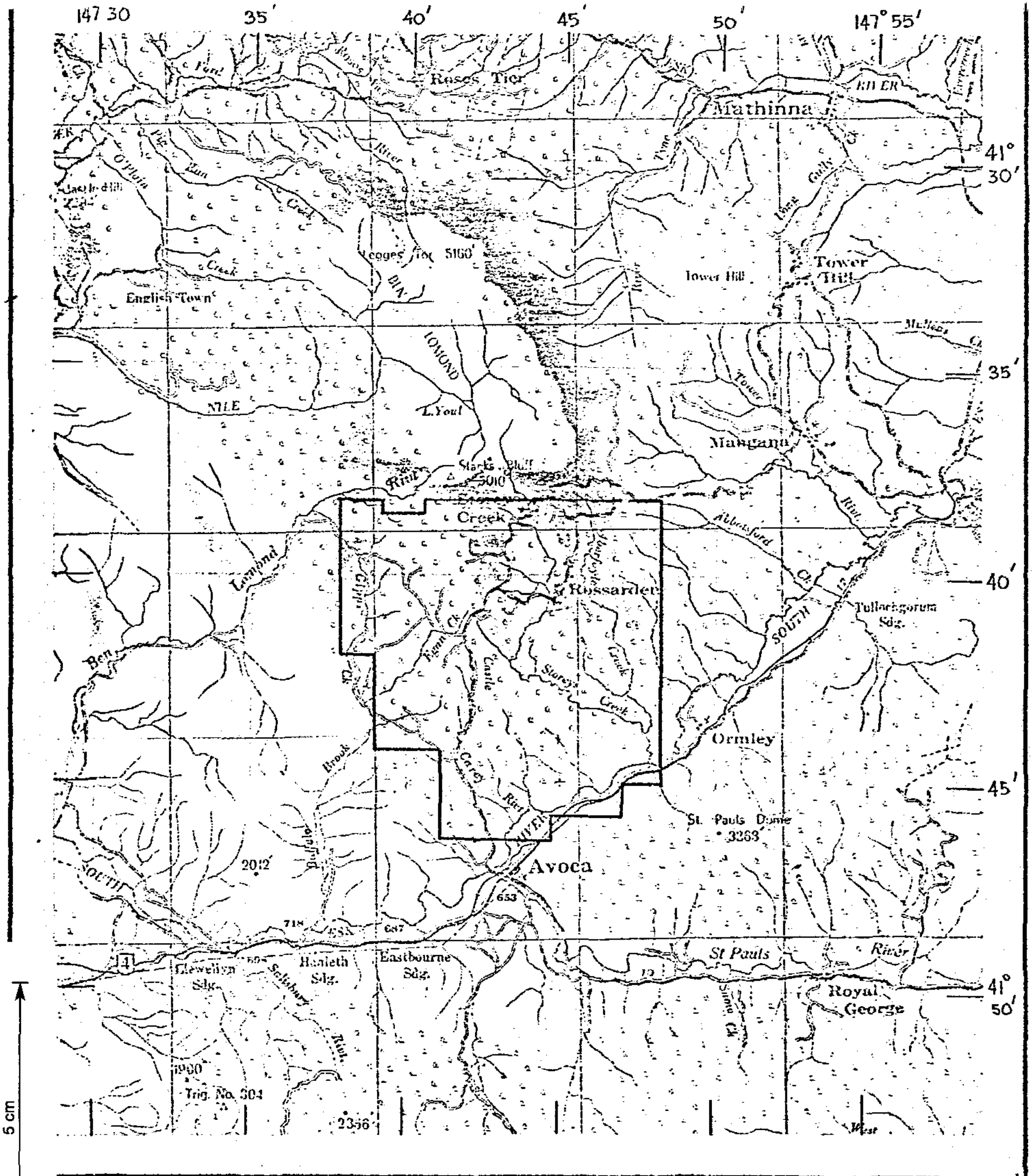
D.C. Pohl,
Geologist

April 13, 1978

J01

CONTENTS

LIST OF PLATES



5 cm

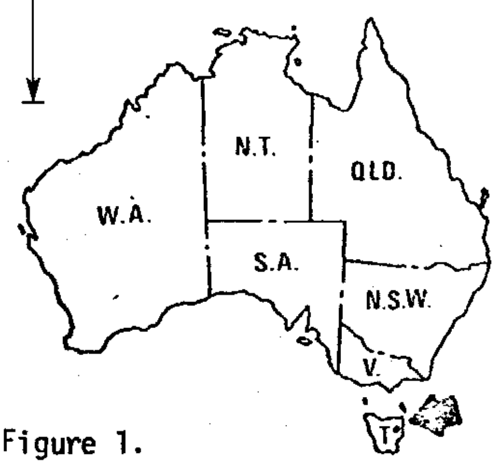


Figure 1.

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

ROSSARDEN- 014

TASMANIA

EXPLORATION LICENCE 12/77

MAP USED: Launceston 1:250,000

.03

260004

SUMMARY

The exploration of E.L. 12/77 (Figure 1) has been discouraging. Although the airborne radiometric survey disclosed an unusually high level of activity on the uranium channel over the Ben Lomond granite, ground follow-up of the best radiometric anomalies failed to show any anomalies not directly caused by a combination of outcrop, topography and lithological factors. Sampling of various radiometric "highs" showed uranium geochemical values of a maximum of 130ppm U. These geochemical results were derived from fresh, fine-grained and coarse-grained granites and not associated with any visible structures of alteration zones.

All the uranium mineralization in the E.L. lies within the southwestern extension of the Aberfoyle Fault System which forms the boundary of an upthrown block of granite in the south east of the E.L. The higher radioactivity of this block is directly attributable to greater dissection and better outcrop, and the high degree of unroofing of this block of granite makes it an unlikely site of a major uranium deposit. The known uranium shows are in post-granite emplacement features and too patchy and localised to provide viable exploration targets.

GEOLOGY

The geology (Plate 1) of E.L. 12/77 consists of a Devonian granite, the Ben Lomond Granite intruded into a sequence of folded Silurian shales, sandstones and greywackes known as the Mathinna Beds. After peneplanation, Permian marine sandstones and shales were laid down over the granite and Mathinna Beds. Terrestrial and marine sediments of Triassic age crop out on the western and southern margins of the E.L.

Tin-tungsten mineralization is associated with the Ben Lomond granite and is mined at the Aberfoyle and Storeys Creek Mines. The mineralization is hosted by both the granite and Mathinna sediments and occurs in pre-intrusive structures such as the Aberfoyle Fault system. Elsewhere mineralization occurs in structures directly related to the intrusion. A small uranium prospect variously known as Stops, Poreeres, Chwalzycks and Tasmania United Uranium as well as several small radioactive occurences are known in the granite to the south-west of Rossarden village.

Mathinna Beds - In the E.L. these rocks consist of sub-greywackes, siltstones and protoquartzites. Bedding surfaces are usually distinguishable and bed thicknesses are variable. The sediments have been asymmetrically folded with fold axes trending 162^{o} with axes generally plunging shallowly to the south (Legge, 1968).

Metamorphism of the Mathinna Beds is of low greenschist facies and thermal effects caused by the intrusion of the Ben Lomond granite are not marked. Slate horizons become spotted and chiastolite-rich and sandstones are hornfelsed as the granite contacts are approached. This is indicative of high level of emplacement of the granite.

Ben Lomond Granite - This granite has been dated at an approximately 370 m.y. B.P. (McDougall & Leggo, 1965) and forms a discrete stock of about 100 square kilometres between Avoca and the Ben Lomond Plateau. The eastern contacts are discordant to the Mathinna Beds and in the west the contacts are faulted against Permo-Triassic rocks.

The Ben Lomond Granite consists largely of porphyritic coarse-grained leucogranite with phenocrysts up to 4cm long. Second in abundance is a medium to fine-grained granite with orthoclase phenocrysts. This type often contains quartz phenocrysts which may be dominant over the feldspar phenocrysts. Biotite is the common femic mineral and muscovite is a common accessory particularly in the finer grained phases. Other rock types but of lesser abundance are microgranites, greisens, pegmatites and aplites.

The geographic relationship of finer-grained phases to the coarse-grained granites is uncertain. However, they generally occur in the following form.

i. Irregular dykes with well defined sharp contacts.

ii. Tabular and straight sidedsills and dykes with short gradational contacts and internal variation to coarser granite. The contacts may show tourmaline pods.

iii. Irregular bodies with diffuse contacts commonly marked by concentration of feldspar and tourmaline.

.../3

Flat lying microgranite dykes are common in the southeastern portion of the E.L. They vary in thickness from 30cm to 3m and their frequency is variable being from 3 to 20m apart. Texturally they vary from even-grained to porphyritic in quartz and/or orthoclase. The former are often dark, particularly where radioactivity is 2-3x background. However, no fracturing or alteration is associated with these slightly more radioactive patches which are rarely more than 15-20cm in diameter and occur most frequently near the upper margins of the sills. The dykes and sills appear to have been injected into an incipient flat-lying joint set late in the cooling history of the granite possibly in response to a sudden lithostatic pressure release.

Generally the Ben Lomond granite is massive and poorly jointed but flow-banding is evident in some of the finer grained porphyritic phases. Extensive shearing and fracturing is uncommon with small scale vertical fracturing being most commonly developed in weathered microgranite dykes. Occasionally small 2-3mm joints are filled with chalcedonic quartz, sericite and a fine grained dark mineral. Such mineralized joints are best developed near Stops Prospect.

Permian Sediments - The Permian consists ofa sequence of marine shales and sandstones and thin limestones forming a patchy cover over the Mathinna Beds and Ben Lomond Granite. The maximum thickness is about 150m in the Prospect Creek Trough but is generally less than 30m.

Black shales form bands up to 3m thick in the basal Permian and very locally uranium values up to 1400ppm U_3O_8 have been noted in these units. However, the mineralization appears to be too erratic and patchy to be of more than academic interest.

Mesozoic Rocks - Triassic sediments are confined to the west side of the Castle Carey Fault where they are downthrown against the Ben Lomond Granite. Dolerite scree from the large Jurasaic dolerite sill which forms the Ben Lomond Plateau covers the Triassic sediments in the northern portions of the E.L.

The Triassic rocks are apparently conformable with the Permian and consist of sandstones, felspathic sandstones and minor coal seams. The sequence is generally less than 200m thick.

STRUCTURE

Apart from folding of the Mathinna Beds along NNW trending axes, structures in the area are confined to normal faulting, jointing and very minor shearing.

The major faults in the E.L. strikes NNW about 320° - 350°. They are parallel to the tectonic grain of the region and divide the western portion of the A.L. into a series of elongate tectonic slices. They are post-intrusive and probably post-Permian in age. Faults in this group are the Eastern and Western Prospect Faults, Egan Creek Fault and Gipps Creek Fault. Numerous photolinears in the Area A anomalous zone trend parallel to these faults

.../4

The other major direction of faulting and jointing trends NNE (0-025°) and includes the Aberfoyle Fault System which hosts the tin-tungsten mineralization in the Aberfoyle mine. The south-westerly extension of this Fault System is marked by a strong se of parallel photolinears which terminate against the Eastern Prospect Fault. This zone of photolinears is about 800m wide and contains all the known uranium shows. It marks the boundary of a relatively low-relief down-block to the north and a highly dissected up-block to the south. This southern block shows much higher background radioactivity on the uranium channel of the airborne spectrometer survey and area A, B, and C anomalous zones fall within it.

It appears that the Aberfoyle fault system is of pre-intrusive age but most movement on the faults has been post-mineralization in the Aberfoyle mine. Joints and photolinears parallel to this fault system are common in the uplifted block of granite to the south. None of these linears could be correlated with specific airborne radiometric anomalies.

Another set of photolinears which appears to be distributed evenly across the E.L. trends 270° to 295°. It appears to have no known parallelism with major faults though flexures in the major NNW faults are frequently sub-parallel to this trend. Parallel joints and photolinears also occur in the Mathinna Beds in the southeast of the E.L. but no specific age can be attributed to this joint set.

The circular structure which is visible on the aerial photographs in the south of the area appears on closer inspection to be made up of a series of tangential photolinears rather than a set of ring fractures. There may be a relationship with the higher incidence of microgranite sills in this area. A similar, but more weakly developed structure occurs near Anomaly #2.

AIRBORNE SPECTROMETER SURVEY

A 1500 line kilometre survey was carried out over those parts of E.L. 12/77 where the Devonian Ben Lomond granite cropped out. Lines were flown in two directions, bearing 040° and 130° and 200m apart with a mean terrain clearance of 50m.

The radiometric detection system was mounted in a helicopter and consisted of an Exploranium DGRS-1002 four channel analog, differential gamma ray spectrometer with 2916cc (452 cu. in) of detector crystals and a tracking camera.

Flight lines were recovered from the photostrips and plotted on an uncontrolled photomosaic at 1:20,000 scale. However due to the uniformly forested country to the north, difficulties occured in accurately plotting the position of some flight lines and off-line errors in position up to 100m may occur on a few lines in the northern portion of the flight block. In the southern portion of E.L. 12/77 the highly dissected nature of the country affected the flight speed of the helicopter as it attempted to maintain a constant terrain clearance. Consequently there was a concertina effect on fiducial plotting and lateral errors in position of up to 50m along line is present on some lines.

.../5

260008

The analog records for each flight line were inspected and any obvious peaks in the uranium channel records recovered and plotted on the photomosaics. The uranium channel values were then smoothed and average valves plotted. A contour map of the composite values of the uranium channel of the NE and NW flight directions as well as a contour map of average uranium values for the NW flight direction have been prepared (Plates 2 and 3).

Two major point source uranium Anomalies Nos. 1 and 2 and four broad areas known as A, B, C and Line 12 anomalies were picked from the records and contour maps for further ground follow up. The known uranium shows of Stops (Chwalzycks) and Hughes Prospects gave anomalies of 1.5-2 x background on the uranium channel on individual flight lines. Radiometric activity on the uranium channel however was such that these anomalies were not particularly obvious. However when the uranium channel data was contoured these prospects stood out as distinct local highs. All such areas of local highs were inspected on the ground.

GROUND FOLLOW-UP SURVEYS

ANOMALY #1 - LINE 69SW FIDUCIAL 134.1

A ground spectrometer grid 400 x 400m was laid out, traverses being 50m apart with a sample interval of 20m. Uranium channel readings taken on GR410 spectrometer showed an even spread of high values ranging from 100cps-172cps, correlating directly with massive, poorly-jointed coarse to medium grained leucogranite. The airborne anomaly was due to a combination of topographic and outcrop effects. Fifteen rock chip samples #60191-60115 taken from spot highs on the ground spectrometer survey were sent for U and Th analyses. The highest geochemical values were 35ppm U and 100ppm Th with average values for the fifteen samples being 20ppm and 74ppm respectively. Handheld scintillometer readings on a BGS-ILS instrument gave readings of 560-700cps over outcrops which were sampled.

ANOMALY #2 - LINE 45NW, FIDUCIAL 400.9

This airborne anomaly is also the result of a combination of topographic and outcrop effects being caused by a cliff of massive coarse-grained leucogranite. A ground spectrometer and scintillometer survey over a grid 600 x 400m showed fairly uniform readings on both the total count and uranium channels, any radiometric contrast being due to outcrop effects. Since the overall values of the ground spectrometer survey were generally lower than on Anomaly #1 and the geology very similar, rock chip sampling was considered unnecessary.

LINE 12NW ANOMALY - FIDUCIAL 284.5 - 289.0

This broad airborne anomaly was used as a test area to give some control data for the interpretation of the airborne spectrometer records. A grid 200m x 1000m with traverse lines trending 040^{o} every 50m was laid out. Ground spectrometer readings on the Tc, K, U and Th channels were taken on this grid every 25m and over some sections at 10m intervals. Rock chip samples #60001-60078 were taken at various points along the grid and analysed for U and Th.

Contour maps of total count and uranium channels of the ground spectrometer survey have been prepared. (Plates 4 & 5). All anomalous areas can be correlated to various granite outcrops. The highest uranium analysis was 130 ppm from a porphyritic microgranite with a mean of 37 ppm U for all analyses. Thorium analyses

.../6

showed a geochemical high of 135ppm with a mean of 76ppm. Though the geochemical values are high for the uranium content of a granite, they are too scattered and individually the occurrences are of such small areal extent that no viable exploration target can be delineated. The granite is only poorly jointed and quite fresh and unaltered in the area, the airborne anomalous zone being the result of better outcrop in the area.

AREA A ANOMALOUS ZONE

A contour map of the average uranium values of the airborne spectrometer survey revealed several areas of high values in the south of the survey area. These have been designated Areas A. B and C respectively.

The Area A Anomalous Zone contains spot highs as well as a generally higher background on the uranium channel of the airborne radiometric records. A closed scintillometer traverse of 1000m x 200m as well as a number of random traverses have been conducted across the area.

This survey indicates that here again the anomalies are caused by a combination of topographic and outcrop effects. The terrain is highly dissected with steep gullies having cliff-like walls and the summits of the hills strewn with large rounded granite tors. In addition the higher overall radioactivity appears to be caused by numerous flat-lying microgranite sills, which vary in texture from hipidiomorphic granular to porphyritic in quartz and/or orthoclase. These sills vary in thickness from 20cm to 3m and locally may show readings of 2-3 x background on a scintillometer. Normal background in these sills is 600-800 cps compared to 400-600 in granites. The "hot" areas are generally confined to the contacts of the sills and are rarely more than 30cm across. Twenty rock chip samples #60161 - 60180 have been collected from anomalously radioactive zones and submitted for analysis of U and Th. Geochemical results from these samples averaged 45ppm and 109ppm Th. Average values for fine-grained phases and coarse grained granites were 52ppm U and 119ppm Th. and 25ppm U and 80ppm Th respectively. The frequency of the sills in outcrop varies from one every metre to one per 20m with 4-5m being an average value. "Hot" areas in any one sill are erratically distributed.

AREA B ANOMALOUS ZONE

This broad radiometric anomaly as defined by the contour maps of the airborne uranium channel has been covered by a closed scintillometer traverse of 2000m x 400m with readings taken every 10m and several random inspection traverses. The anomalous zone is readily attributable to topographic and outcrop effects coupled with the intrusion of slightly more radioactive microgranite sills and dykes into the coarse-grained Ben Lomond leucogranite. The overall airbome and ground radiometric survey results show a lower level of radioactivity compared to Area A Anomalous Zone and consequently no further work is recommended on this zone.

260010

AREA C ANOMALOUS ZONE

This is a small isolated "bull's-eye" high on the airborne uranium contour map just south of Rossarden village. A ground check revealed a cliff of coarse-grained leucogranite with background counts of 400-500 cps. This anomaly is also due to outcrop and topography. The "bull's-eye" effect is due to only slightly radioactive Permian scree and sediments surrounding the granite outcrop.

SUMMARY OF RADIOMETRIC SURVEY RESULTS

The airborne spectrometer survey did not reveal any anomalies related to uranium mineralization other than the known shows at Stops and Hughes Prospects. The potassium channel records sharply define the Ben Lomond granite as distinct from the Mathinna Beds and Permian sediments. Although there was considerable activity on the uranium channel records, the most active areas could all be accounted for by a combination of topographic, lithological and outcrop factors. Sampling of the granite did confirm a higher than normal concentration of uranium in the rocks.

The radiometric response of the sediments in the survey area was uniformly flat which downgrades the possibility of finding a viable uranium target around the Ben Lomond granite. Hand-held scintillometer sampling of the dumps of the Aberfoyle and Storeys Creek mines did not reveal any anomalous radioactivity associated with these rocks, further downgrading the potential of the Mathinna Beds as a uranium host.

CONCLUSIONS

Although the Ben Lomond granite appears to have an abnormally high uranium content, though this fact may be due to biased sampling, the prospects for finding a large or even moderate sized uranium deposit associated with it does not appear to be good.

General considerations leading to this conclusion are set out below.

1. The radiometric response over the Mathinna Beds has been uniformly flat as is the response over the mine waste from the various tin-tungsten mines in Silurian → the Siburian sediments. No uranium mineralization has ever been recorded from these mines. Thus the possibility for an exogenous uranium vein deposit related to the Ben Lomond Granite is severely reduced. Evidence of hydrothermal activity other than tin-tungsten mineralization is also lacking.

2. The known uranium shows in the Ben Lomond Granite are of very limited areal extent. The structures with which they are associated are discontinuous and very narrow. Even the smaller tin mines have clearly discernible vein structures that are over 100m long in outcrop and several metres wide. The uranium mineralization on the other hand appears to be joint controlled.

.../8

3. With the exception of Stops Prospect all the uranium shows are in greisenised granite, usually along joints. They appear to be very localised, late deuteric alteration zones caused by small "pockets" of residual volatiles trapped or channelled along joints. They clearly resemble the smaller sub-economic tin shows in the Ben Lomond Granite such as the Rex Hill and Great Republic mines. Their potential both in terms of size or possible reserves appears to be very limited.

4. In general, when uranium mineralization occurs in granites it occurs either in the hood zone or in post-intrusive structures. The area of the Ben Lomond Granite showing the best radiometric response is in an uplifted fault block. The massive and poorly jointed appearance and lack of numerous xenoliths indicate a considerable amount of unroofing. Furthermore, the flat-lying microgranite sills and dykes usually have gradational contacts with the coarses phases indicating possible freezing of the magma along incipient joint planes in response to a pressure drop in contradistinction to injection of magma into fractures of an already brittle rock. The accumulation of numerous tourmaline nodules and higher radioactivity along the upper margins of the sills would also indicate accumulation of volatiles in situ rather than channeling into fractures. Such conditions would preclude the channeling of uranium-bearing volatiles and concentration in suitable trap structures.

5. The Permian sediments overlying the granite are fine-grained calcareous marine sandstones and shales and thus poor hosts for a sandstone-uranium deposit. The sediments are thin and in those areas where reasonable thicknesses have been protected from erosion the fault blocks are too narrow to provide a viable exploration target. The troughs in which these sediments occur are post-depositional and thus the likelihood of pene-contemporaneous uranium deposition is further reduced.

References:

Blisset, A.H. 1959	The Geology of the Rossarden-Storeys Creek District. Tasmania Geol. Surv. Bull. 46
Legge, J. 1968	The Geology and Joint Analysis of the Ormley-Avoca-Rossarden Area. Unpubl. Hons. Thesis, Univ. Tasmania, Hobart.
McDougall, I & Leggo, P.J.	Isotopic Age Determinations on granitic rocks from Tasmania, Jour. Geol-Soc. Aust., 12, 2, 295-332


Q48/22 78-1266
260013 1203 Dwg. 014-12
LEGEND
M UNDIFFERENTIATED MESOZOIC SEDIMENTS
J JURASSIC DOLERITE AND DOLERITE SCREE
P UNDIFFERENTIATED PERMIAN SEDIMENTS
D DEVONIAN BEN LOMOND GRANITE
S UNDIFFERENTIATED SILURIAN SEDIMENTS
GEOLOGICAL CONTACT
FAULT POSITION KNOW
FAULT POSITION INFERRED
PHOTOLINEAR
PROSPECT
SHAFT
ROAD
TRACK
STREAM
H.E.C. TRANSMISSION LINE
AREA OF AIRBORNE SPECTROMETER SURVEY
ABERFOYLE TIN N.L. LEASE AREA
AREA COVERED BY DETAILED GROUND SURVEY
PLATE 1
MINERALS DEPARTMENT, ESSO AUSTRALIA LTD.
ROSSARDEN PROJECT 014, TASMANIA
GEOLOGICAL MAP
SCALE 1:20 000
0 1 2 km
DRAWN BY D.C. POHL, APRIL 1978
GEOLOGY AFTER A.H. BLISSET 1959 AND
P.J. LEGGE 1968
TOPOGRAPHIC DETAIL FROM UNCONTROLLED
AERIAL PHOTOMOSAIC.
5 cm
CASTLE CAREY FAULT
GIPPS CREEK FAULT
EGAN CREEK FAULT
EGAN CREEK
WESTERN PROSPECT FAULT
EASTERN PROSPECT FAULT
BURNS MARSH FAULT
ABERFOYLE #3 FAULT
#1 FAULT
#2 FAULT
BUFFALO BROOK
STOREYS CK. SHAFT
MAMMOTH
Story's Creek
BROCKS UNDERLAY SHAFT
SHAFT
McDONNELL LODE
SPARTAN SHAFTS
SPIER SHAFT
BRANDON SHAFT
Rossarden
AREA 'C' ANOMALOUS ZONE
(POOREERES) (CHWALZYCK) STOP's PROSPECT
HUGHES Pb-Zn PROSPECT
KELLETS PROSPECT
STORYS CREEK
RIVULET
LINE 12 ANOMALY
CASTLE CAREY CK.
AREA 'A' ANOMALOUS ZONE
AREA 'B' ANOMALOUS ZONE
ANOMALY #1
ABERFOYLE
ANOMALY #2
SOUTH ESK RIVER
Avoca
M/N

78-1266 Q48/22

EL 12-77

1204 Dwg. 014-14

260014

PLATE 2

MINERALS DEPARTMENT , ESSO AUSTRALIA LTD.

ROSSARDEN PROJECT 014 , TASMANIA

AIRBORNE SPECTROMETER SURVEY

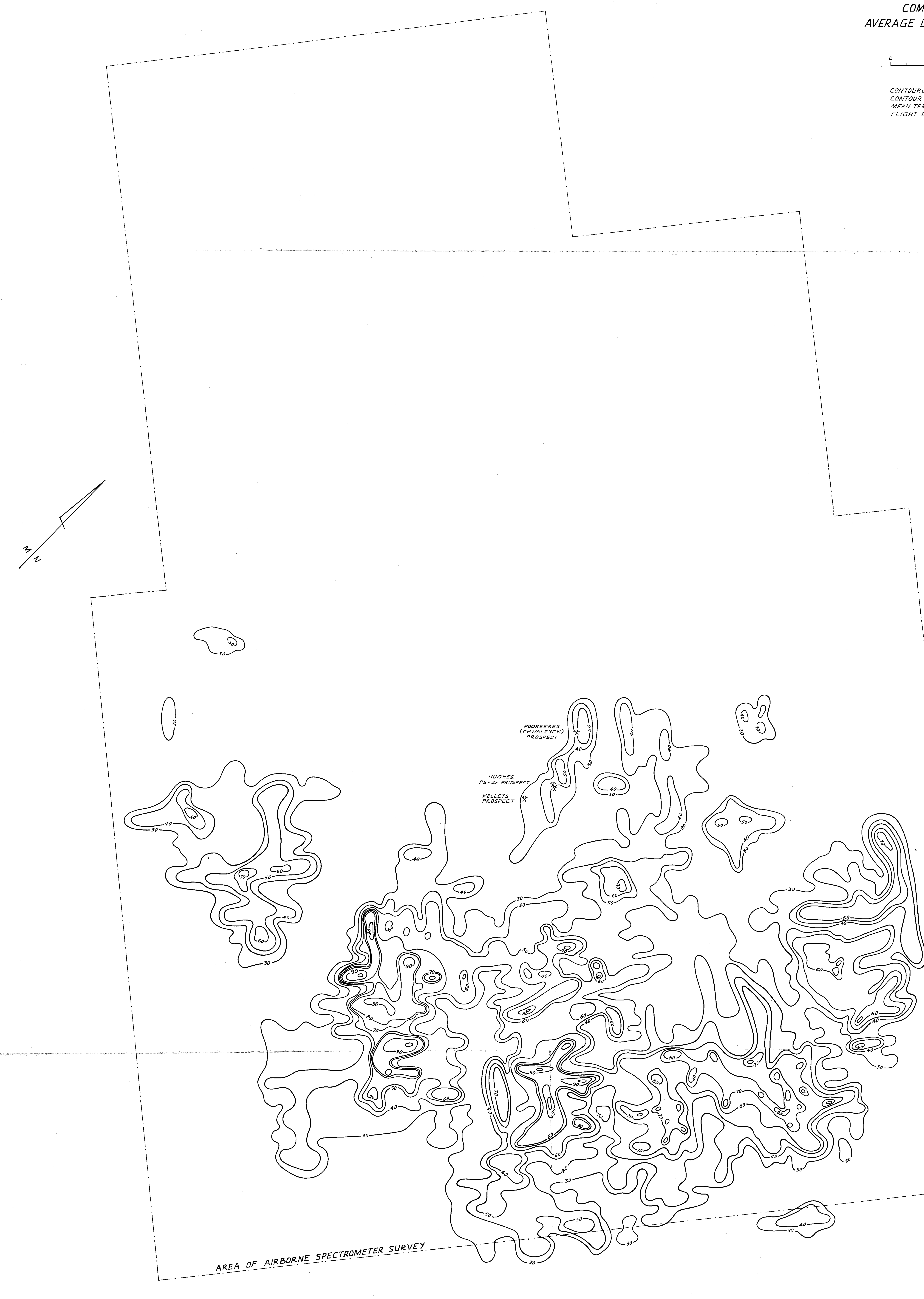
COMPOSITE CONTOURS
AVERAGE URANIUM CHANNEL VALUES

SCALE 1: 20000

0 1 2 km

CONTOURED BY R. NEWPORT , FEB. 1978
CONTOUR INTERVAL 10 CPS
MEAN TERRAIN CLEARANCE 50 METRES
FLIGHT DIRECTIONS 130° AND 040°

5 cm



78-1266 Q48/22

260015 1205 Dwg. 014-13

PLATE 3

MINERALS DEPARTMENT , ESSO AUSTRALIA LTD.

ROSSARDEN PROJECT 014 , TASMANIA

AIRBORNE SPECTROMETER SURVEY

URANIUM CHANNEL AVERAGE VALUE CONTOURS

SCALE 1: 20000

0 1 2 km

CONTOURED BY PAUL TREDGETT , MARCH 1978
CONTOUR INTERVAL 10 CPS
MEAN TERRAIN CLEARANCE 50 METRES
FLIGHT DIRECTION 130°

5 cm

PLATE 4

MINERALS DEPARTMENT, ESSO AUSTRALIA LTD.

ROSSARDEN PROJECT 014, TASMANIA

GROUND SPECTROMETER SURVEY
LINE 12 ANOMALY

TOTAL COUNT CONTOURS

SCALE 1:2500

CONTOUR INTERVAL 500 CPS
CONTOURED BY D.C. POHL, MARCH '78
INSTRUMENT: GR 410 DIFFERENTIAL SPECTROMETER

Dwg. 014-8 1206 260016

PLATE 5

MINERALS DEPARTMENT, ESSO AUSTRALIA LTD.

ROSSARDEN PROJECT 014, TASMANIA

GROUND SPECTROMETER SURVEY
LINE 12 ANOMALY

URANIUM CHANNEL CONTOURS

SCALE 1:2500

CONTOUR INTERVAL 20 CPS
CONTOURED BY PAUL TREDGETT, MARCH '78
INSTRUMENT: GR 410 DIFFERENTIAL SPECTROMETER

Dwg. 014-7 1207 260017