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FINAL REPORT

ON EXPLORATION LICENCE 2/72

TASMANIA

Prepared by: I.D. Martin
Australasian Minerals, Inc.

6.3.74.

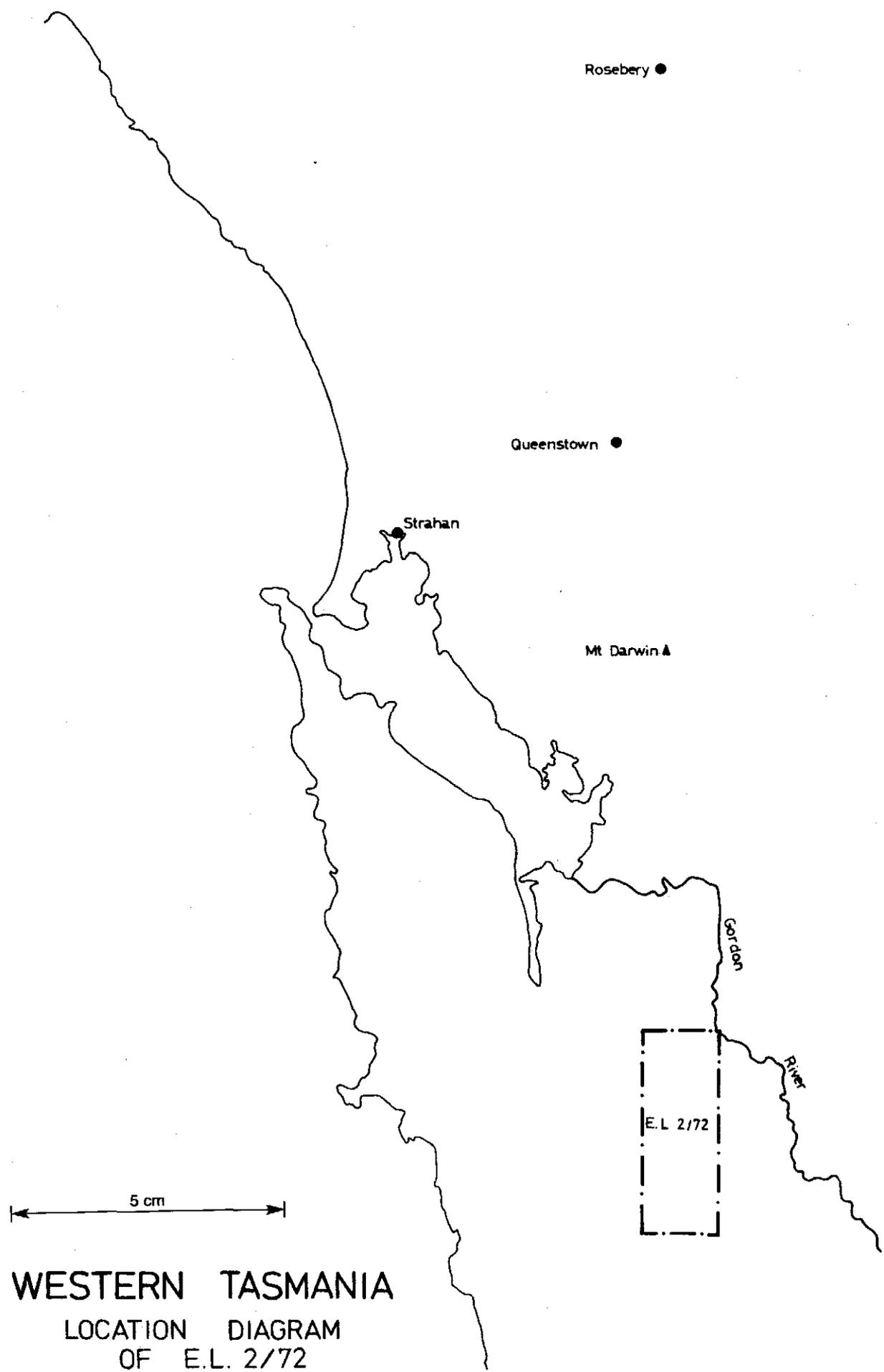
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WESTERN TASMANIA
LOCATION DIAGRAM
OF E.L. 2/72

Scale : 1 : 500,000

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ABSTRACT

Exploration Licence 2/72 lies in an extremely mountainous region of dense forest and alpine moors in southwestern Tasmania. Cambrian, acidic, volcanic rocks, which elsewhere in Tasmania contain base metal deposits, are present.

Reconnaissance geology, soil geochemistry and aerial electromagnetic surveys have been carried out. No significant mineralisation was detected by any of the three methods.

If any ore bodies exist they are not exposed. The current work has not located any areas worthy of drilling. Further exploration would be exceedingly expensive. It is concluded that no further exploration is warranted.

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INTRODUCTION

Western Tasmania is subject to extremely unusual weather conditions by Australian standards, and the field season can be considered to commence in mid-November and last until mid-March. Outside this period, the weather may be fine and clear occasionally, but snow and very heavy rain storms are possible, which make general access and working conditions difficult. The country, being almost totally inaccessible to vehicles, has to be covered by helicopter and by foot. Dense forest covers more than half Exploration Licence 2/72 and the balance is partially glaciated terrain and partially heavy scrub, neither of which is conducive to simple mineral exploration techniques.

The work was carried out by Mr. B.V.H.U. Starke during December 1971 and by Dr. I.D. Martin and Mr. C.A. Chapallaz from November 1972 to March 1973. Petrological work was carried out during April and May 1973 by Dr. I.D. Martin.

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GENERAL DISCUSSION

In Western Tasmania, acidic, volcanic rocks, of presumed lower to middle Cambrian age, carry small-to medium-sized base metal ore bodies. In addition, commercial deposits of tin occur in Upper Proterozoic and Devonian rocks, the Devonian tin ores being associated with granitic bodies.

The Cambrian volcanic rocks are associated with a meridionally-striking ? subduction zone. No volcanic centres have been identified, but the distribution of volcanic agglomerates, lava flows and fine-grained, shaley, tuffaceous, sedimentary rocks indicate at least two separate centres, one close to Mt. Darwin (145° 32' east longitude, 42° 15' south latitude) and one close to Port Davey (145° 45' east longitude, 43° 15' south latitude). There may be other centres further north. Exploration Licence 2/72 is centrally-positioned between the two presumed volcanic centres. There is no record of mineralisation within the Exploration Licence.

A helicopter was employed throughout the survey.

GENERAL GEOLOGY

Colour aerial photographs at scale 1:15,840 were used as a mapping base. The results were plotted on a corrected topographic base of 1:15,840 supplied by the Tasmanian Department of Lands and Surveys. All points marked on the final plan are considered accurate to better than plus or minus 10 metres.

Dense ti-tree and bauera scrub, rain forest and steep slopes make access difficult. Glacial overburden and Tertiary marine sediments cover most of the Exploration Licence where the surface is lower than 370 metres above mean sea level. Other areas are commonly covered by recent talus slopes and flood-plain sediments. Most of the area of Cambrian volcanic rocks is covered by a thin layer of decomposing organic debris derived from "button-grass", a common, low-growing, perennial grass.

Average percentage outcrop would be 1 to 2%, mainly weathered and leached. Fresh exposures are in stream beds and on the crest of ridges. Nearly all outcrops are of massive, ignimbritic and rhyolitic material, which weathers less readily than the more abundant pyroclastic and epiclastic tuffs and sedimentary rocks.

The geological map is, of necessity, somewhat interpretive. Photo-geological trends have been used to correlate the isolated outcrops.

Facings were obtained only on the Ordovician sequence. The structure of the Cambrian sequence cannot be proven because shearing has obliterated evidence of facing.

GEOLOGICAL STRUCTURES

Structures in the Precambrian rocks are complex and suggest at least three periods of folding. No attempt was made to unravel these structures. Faulting in the Precambrian rocks is dominantly meridional and east-dipping.

Observations made on the faulted eastern boundary of the Cambrian volcanic rocks all suggest steep reverse faulting with negligible horizontal movement.

No folds were observed in the Cambrian sequence. Minor structures indicate that isoclinal folds are probably present. Repetition of sequences both in the same order and in reverse order suggest fold repetition. However, no folds could be substantiated in the field.

A large porphyry dome in the southern portion of the Exploration Licence induces a broad fold in the volcanic rocks. Aerial magnetic profiles from the northern part of the area suggest a well-defined, anticlinal structure plunging to the north. Reversal of stratigraphic units in the same area correlates with this interpretation. Despite this, no evidence of folding could be observed on the ground.

The Ordovician sequence shows a faulted, north-striking anticline with steep dips to the west and more gentle easterly dips. The anticline plunges gently to the north at about 15° . The sequence is cut by a number of major strike faults. There is no evidence of horizontal displacement on these faults.

Faulting has occurred in post-glacial times. A major fault trace along the Condor River has cut glacial deposits of Quaternary age. Displacement on the fault is approximately 30 metres vertically with the east block moving southward and down. The amount of horizontal movement cannot be measured.

Many other relatively minor faults are visible on aerial photographs and, very rarely, on the ground. These transect the Tertiary sediments overlying the Cambrian volcanic rocks. Apparent horizontal displacement on these faults exceeds 100 metres in places. Vertical displacement cannot be measured.

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STRATIGRAPHY

No attempt was made to map in detail any units within the Precambrian of post-Cambrian sequences. Separation of the Tertiary and Quaternary formations into topographically-controlled units, and the Ordovician and Silurian rocks into conglomeratic and non-conglomeratic facies was undertaken. Since no fossil evidence was located, the conglomerates are assumed to be the lateral equivalent of the Ordovician Owen Conglomerate known elsewhere in Western Tasmania.

The Cambrian rocks have been sub-divided into the D'Aguilar Group, the Lucas Volcanics and the Thirkell Group. Equivalents to these occur in the Queenstown area.

COMPARISON OF STRATIGRAPHIC UNITS IN THE QUEENSTOWN AREA AND EXPLORATION LICENCE 2/72:

<u>QUEENSTOWN</u>	<u>E.L. 2/72</u>
Owen Conglomerate ▲▲▲▲	Owen Conglomerate
Intrusive porphyry Tyndall Group Dora Conglomerate ▲▲▲▲	Intrusive porphyry Thirkell Group ▲▲▲▲
Crown Andesite Queenstown Pyroclastics Sedgwick Rhyolite	Lucas Volcanics
Darwin Keratophyre	
Lyell Schists Selina Volcanics Sticht Range Beds ▲▲▲▲	D'Aguilar Group ▲▲▲▲
Precambrian	Precambrian

D'Aguilar Group

The contact between the Cambrian sequence and the Proterozoic quartzites and mica schists is a faulted and folded unconformity. The dominant Cambrian rock type near the contact is a polymictic conglomerate of small to large, very well-rounded boulders of chert, quartzite, quartz-mica schist, and very rarely other sedimentary rocks, such as sandstones and limestones. These latter are usually very poorly preserved. There is very little sorting within the conglomerate, and in this way it is quite unlike the Ordovician Owen Conglomerate, which is found further north. Overlying, and interbedded with, the coarse conglomerate are fine-grained, quartz-muscovite sandstone, quartz-mica schist and some bands which are possibly somewhat calcareous. The overall thickness of this conglomeratic zone approaches 300 metres.

Next is a series of epiclastic, volcanic rocks. Most thin sections indicate that these have been reworked and are not true waterlain tuffs. Keratophyres within these are either intrusive rocks or flows, but there is very little evidence for one or the other. In the keratophyre veinlets of hematite and magnetite have not been observed, so it differs from the Darwin Keratophyre, which is further north, particularly in the Queenstown area. The tuffaceous unit thins to the north and is faulted off near the Sprent River.

The topmost unit is a conglomerate about 10 metres thick, which has a few boulders of volcanic material. It is similar to the underlying conglomerate in all but this aspect.

This basal unit provisionally has been called the D'Aguilar Group, as it constitutes a mappable sequence in the D'Aguilar Range, at the eastern fringe of the volcanic rocks. Probably it will eventually be split into two or three sub-units, but there is so little outcrop that it is difficult to sub-divide it. The overall thickness of the unit is approximately 1 kilometre.

Interbedded with these other rocks and in contact with the uppermost unit of the Group is a dark green to black shale, fragments of which show very fine cross-bedding. Unfortunately, it has not been possible to observe this cross-bedding in outcrop, thus it could not be used to indicate facing.

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Lucas River
Lucas Volcanics

*River non-existent
Holes River?
Lewis River*

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The next formation in the succession constitutes the main acidic volcanic unit. This is a sequence of middle Cambrian volcanic rocks, which continues from Exploration Licence 2/72 onto ground held by Broken Hill Proprietary Ltd. The name is from the ~~Lucas~~ ^{Lewis} River, which flows through the exposures there.

The Lucas Volcanics is a succession of rhyolites, ignimbrites, minor ash-fall tuffs and intercalated sedimentary and pyroclastic horizons. There are some intrusive quartz-feldspar porphyries, one of which is large.

The rhyolites vary from white to green, are very porphyritic, and have a fine crystalline ground mass. The phenocrysts are of quartz. The rhyolites are massive in outcrop and appear to withstand shearing better than the ignimbritic and pyroclastic rocks. In places these rhyolites form exposures that appear like large "whalebacks". This is probably a result of glacial erosion, as the main valley in which these rocks have been mapped appears to be a result of glaciation.

The softer and more easily eroded pyroclastic and sedimentary units only rarely outcrop, and as a result cannot be delineated on the geological map accompanying this report. In particular, one area in the central eastern portion of the volcanic belt is almost totally without outcrop, the three minor outcrops there being of ash-fall tuff and sedimentary rocks. It is thought possible that a large portion of this area, which is mapped as alluvium and fluvioglacial sands and silts, is underlain by the sedimentary and pyroclastic units.

Many of the ignimbritic and rhyolitic rocks contain, particularly in the less sheared portions, up to 2% sulphide, which is almost entirely pyrite. Chalcopyrite was detected in one polished section and traces of what may be chalcopyrite were observed in several hand specimens. The fact that the sulphide appears only in the unshaded or weakly-sheared portion of the rock is almost certainly a weathering phenomenon. Fresh samples of more sheared material cannot be obtained.

The sedimentary and pyroclastic rocks that can be seen usually contain a very fine, brown mottling which is interpreted as being due to sulphides. The areas where these are found generally have higher lead and zinc backgrounds, but high copper backgrounds are rather rare. The possibility that the brown mottling is due to the presence of minor amounts of carbonate

minerals, which are being replaced by goethite, cannot be dismissed, but in thin sections carbonate is almost totally absent.

In the southwestern part of Exploration Licence 2/72 is a porphyry, which appears to be petrologically uniform, crystalline, and conceivably is intrusive. It appears identical in texture to an undoubtedly intrusive porphyry in the vicinity of Lake Dora, near Queenstown. That porphyry intrudes the Dora Conglomerate, which is equated with the Thirkell Group. It is thought that the porphyry on Exploration Licence 2/72 is probably intrusive, and it is interesting to note that Broken Hill Proprietary Ltd. have mapped a similar unit to the southeast of Exploration Licence 2/72 as an intrusive porphyry.

The prime target within the Mt. Read Volcanics, a Cambrian volcanic sequence equated with the Lucas Volcanics, is the contact between the rhyolite flows and ignimbrites and the pyroclastic rocks that are either derived from those rhyolites or are the result of separate explosive activity. This contact is not exposed anywhere on Exploration Licence 2/72. In the few places where pyroclastic rocks and porphyritic rhyolites are in contact, geochemical anomalies are obtained. The most important of these is in the area immediately east of the intrusive porphyry, and this can be seen by referring to the geological map.

At Mt. Darwin and in the Mt. Lyell area, the mineralisation is near the contact between the pyroclastic rocks and the rhyolites of the Darwin Keratophyre type. The Darwin Keratophyre has not been identified within Exploration Licence 2/72, but is thought to be beneath the surface in the areas where there are notable magnetic anomalies. Of all the units within the Mt. Read Volcanics, only two show any magnetic expression, these being the Darwin Keratophyre and the Crown Hill Andesite. The andesite has a relatively weak magnetic expression, and only the Darwin Keratophyre has an expression similar to that observed in Exploration Licence 2/72, where outcrops of this particular rock have not been found.

From these indications it is likely that if there is mineralisation on Exploration Licence 2/72, it is blind and does not subcrop. However, because exposures are almost totally lacking in the northern part of Exploration Licence 2/72, it is quite possible that the equivalent of the Darwin Keratophyre subcrops there, and that area was selected for geophysical work.

In the area east of the intrusive porphyry are noticeable geochemical anomalies associated with the rhyolite-pyroclastic rock contact zone and with a magnetic anomaly that is only slightly weaker than that normally associated with the

Darwin Keratophyre. There is a possibility that the Darwin Keratophyre, whilst not actually outcropping there, approaches the surface.

This interpretation requires that the area of volcanic rocks in Exploration Licence 2/72 is a folded sequence.

Thirkell Group

Unconformably overlying the Lucas Volcanics is a sequence of sedimentary rocks of volcanic provenance and pelites, which grade into well-sorted sandstones.

At the base is a polymictic conglomerate that generally contains Precambrian pebbles and boulders, but in various places from 5 to 50 percent of the boulders are volcanic rocks. The matrix in the conglomerate is largely of volcanic derivation and in thin section appears generally to have been derived from tuffaceous material, not from rhyolites and similar massive material.

This conglomerate unit grades upwards into volcanic sandstones; thence into fine-grained chloritic rocks that may be epiclastic tuffs, but appear in thin section to have a complex derivation; and thence into black shales, which carry pyrite and occasional grains of chalcopyrite and sphalerite. Overlying the black shales is a sequence of well-sorted, well-rounded quartz and quartz-mica sandstones, which are similar to the sandstones overlying the Ordovician Owen Conglomerate, but differ from those sandstones in being free of detrital tourmaline.

First it was thought the black shales in the Thirkell Group were equivalent to the black shales near Farrell and Rosebery, two places within the Mt. Read volcanic arc where lead-zinc and copper-pyrite mineralisation have been located. This idea was supported to some extent by the presence of chalcopyrite in small quantities in the black shale. Now it is believed that the black shales of the Thirkell Group are younger than those at Rosebery.

Within some of the pyroclastic material, particularly in the southern part of Exploration Licence 2/72, there are black shales and fine tuffaceous materials similar to those in the Rosebery area. It is thought that the Thirkell Group, particularly the very basal members, represent the very last stages of Cambrian volcanism. All younger units contain no volcanic materials. No mineralisation is reported in them.

Ordovician Sequence

On the western fringe of the volcanic rocks and immediately overlying the Thirkell Group is the Owen Conglomerate, an oligomictic quartz conglomerate, generally well-sorted, but variable in thickness. This unit thins southward and disappears abruptly in the vicinity of Thirkell Hill. At places between Thirkell Hill and Innes Peak the conglomerate appears to be represented by fine quartz sandstone and pebble beds. It seems this is near the southwestern limit of deposition of the Owen Conglomerate. Immediately above the conglomerate are well-rounded, well-sorted and well-bedded quartz-mica sandstones and fine conglomerates, which face westward. No mineralisation has been seen in these rocks.

To the east of the volcanic units, extremely well-bedded, well-rounded, fine quartzites are believed to represent a younger Ordovician unit. These quartzites dip eastward. This material is very close to the volcanic rocks in the northeastern corner of Exploration Licence 2/72. This suggests that the volcanics, at their northern limit, form an anticline, with the Owen Conglomerate dipping to the west and the quartzite unit dipping to the east.

Limestones interbedded with sandstones further northeast have not been mapped, and the Ordovician and Silurian sequences even further east have not been visited.

No rocks younger than Ordovician and older than Quaternary appear in Exploration Licence 2/72. The Quaternary rocks are classed in three units which have no stratigraphic meaning. These are:-

1. Alluvium and fluvioglacial sands and silts that occur sporadically in the drainage basins of the larger streams. To the southwest the streams have cut down through this alluvium and have exposed volcanic rocks, but in the northern, northeastern and eastern fringes this has not occurred.
2. Detritus, coarse and fine scree and some glacial debris on the eastern side of the western flank of the D'Aguilar Range. This detritus covers the Thirkell Group and virtually corresponds in outcrop to that group. In places, the detritus extends over the volcanic rocks but is generally confined to the Thirkell Group.
3. Alluvial fans, mud flows and outwash plains covering the volcanic rocks and making geological observations impossible.

GEOCHEMISTRY

Two types of geochemical sampling were undertaken:-

1. Rock specimens were collected and assayed for copper, lead, zinc, silver and in some cases potassium and sodium.
2. Soil samples were taken on 16 traverses across the Cambrian volcanic rocks. Some of the traverses were incomplete. The soil sampling was so designed that a minimum of 10 samples would be taken over an area equivalent to that mineralised at Mt. Lyell.

Orientation

Soil samples were collected over mineralisation near Mt. Lyell, Lake Dora, Rosebery and Farrell, as well as at six locations in Exploration Licence 2/72. Samples were taken with a specially-designed spade from depths corresponding to visible soil profile zones. The soils were delineated into two distinctive types both on profile and on geochemical response.

Type 1 - Button-grass Plain Soil:

An average profile is:-

- 0 - 4 cm Dry organic debris, rare coarse quartz.
- 4 - 20 cm Moist organic debris, abundant coarse quartz.
- 10 - 20 cm Organic slime, abundant fine to coarse rock fragments.
- 20 - 50 cm Clay-rich organic slime.

The geochemical response for this soil is:-

- 0 - 4 cm Strong response for copper and zinc. No response for lead and silver.
- 4 - 10 cm Fair response for copper, zinc, lead and silver.
- 10 - 20 cm Weak response for copper and zinc. Good response for lead and silver.
- 20 - 50 cm Fair response for copper and zinc. Good response for lead and silver.

In all depth fractions there is no significant change in response to different grain sizes. In the 0 - 4 cm fraction, copper and zinc are concentrated in the organic debris. Analysis showed that copper and zinc accumulate in the stems and seeds of the button-grass.

Type 2 - Forest Soil:

Forest soil is more variable and a typical profile is:-

- 0 - 4 cm Organic debris.
- 4 - 10 cm Roots, leached quartz sand, minor rock fragments.

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- 10 - 50 cm Large roots, yellow clay, many rock fragments.
- > 50 cm Weathered rock.

The geochemical response is relatively constant for all samples taken and is:-

- 0 - 4 cm Very strong response for copper and zinc.
- 4 - 10 cm Weak response for copper, zinc, lead and silver.
- 10 - 50 cm Response of all elements increases with depth.
- > 50 cm Response becomes erratic with depth.

In all depth fractions except 0 - 4 cm, a significant increase in response was noted with decrease in grain size.

Sampling and Analytical Techniques

As a result of the orientation programme, the minus 80 mesh fraction was used. On button-grass plain soil, samples were taken at 30 - 40 cm wherever possible, otherwise against bedrock. On forest soil, samples were taken at 50 - 60 cm. In each case this sampling point corresponded roughly to the interface between the B and C soil horizons.

The analytical method used was:-

1. Apparatus and Reagents

- Beakers (100 ml)
- Torsion balance
- Spatula
- Hotplates
- Dispensers (2, 5 18 ml)
- Oven
- Atomic Absorption Spectrometer
- Hydrochloric acid A.R. grade (Sp. Gr. 1.16)
- Nitric acid A.R. grade (Sp. Gr. 1.42)
- Perchloric acid A.R. grade (Sp. Gr. 1.66)

2. Method

1. Weigh 200 mg of dry sifted sample (105°C. 2 hours) into a 100 ml beaker.
2. Add 5 ml nitric acid (Zippette)
3. Add 2 ml hydrochloric acid (Zippette)
4. Stand 16 hours (overnight)
5. Add 2 ml perchloric acid (Zippette)
6. Evaporate to fumes of perchloric acid at 180°C.
7. Digest for a further 2 hours at 180°C.
8. Dilute to 20 ml (automatic dispenser)

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- 9. Spray on Atomic Absorption Spectrometer for required elements using standards made up in 10% perchloric acid.

Levels of Significance

The orientation indicates the following values are the minimum significant values of the Mt. Read Volcanics:-

	Button-grass soils	Forest soils
Copper	400 ppm	700 ppm
Lead	900 ppm	2600 ppm
Zinc	900 ppm	600 ppm
Silver	5 ppm	5 ppm

With the exception of one zinc and one silver value, no values exceed the levels of significance suggested by the orientation. Cumulative log frequency plots show completely log normal variation with no significant deviations. It is concluded that no significant geochemical anomalies exist.

Visual Examination of the Geochemical Data

All the data has been plotted on semi-log "dot" diagrams. These maps accompany this report. Concentrations of dots indicating relatively high values can be observed. Thorough examinations were made in these areas and in all but two cases the possibility of a large disseminated ore zone can be dismissed on geological grounds. There could be high-grade sulphide bodies that are too small to be economic.

The two zones on concentration where the geology is favourable to mineralisation of economic dimensions are located approximately 10 km on bearing 25° and 7 km on bearing 15° from Innes Peak. Poor outcrop conditions and extremely thick scrub and forest prevent geological examination. A "Turair" electromagnetic survey was made over the interesting areas.

Two other areas of semi-anomalous values are 2 km on bearing 30° and 6 km on bearing 160° from Thirkell Hill. The first corresponds to the subcrop of graphitic chlorite schist and shale of the Thirkell Group, and the latter, to the contact between ignimbritic and pyroclastic volcanic rocks. Outcrop is generally quite good in the latter area and both have been discarded on geological grounds.

GEOPHYSICS

Geochemically anomalous areas were detected in forest country northeast of Innes Peak. Access was very poor, the geological environment good, and aeromagnetic data of other companies showed a well-defined anomaly there.

An electromagnetic, helicopter-borne, geophysical survey was undertaken. Scintrex Pty. Ltd. of Perth, Western Australia, carried out this "Turair" survey and their report, which accompanies this one, includes the geological interpretation of the anomalies.

CONCLUSIONS AND RECOMMENDATIONS

A geological and geochemical study of the Cambrian volcanic rocks on Exploration Licence 2/72 failed to detect any significant evidence of mineralisation. Pyrite was observed in many locations and chalcopyrite was seen in trace amounts at several locations. Comparisons of geochemical values in mineralised fresh rock and in associated soils were in good agreement and any economic ore deposit could be expected to give a definite soil geochemical anomaly.

Orientation soil geochemical surveys in mineralised areas outside Exploration Licence 2/72 indicated limiting values of geochemical significance. On this basis no significant geochemical values were obtained in Exploration Licence 2/72. It was concluded that no significant mineralised zone outcropped.

Possible "blind" ore zones were indicated by geochemistry in geologically interesting areas in the northern part of Exploration Licence 2/72. "Turair", an airborne geophysical technique capable of detecting electrically-massive sulphide bodies was employed to check that part of Exploration Licence 2/72. Two significant anomalies were located. These are designated "E" and "G" in the geophysical report. Both occur at a depth of at least 60 metres. Anomaly "E" appears to be three separate conductors with excellent characteristics but low amplitude. Each conductor is probably narrow. Anomaly "G" is 500 metres long. It corresponds to a well-defined, graphitic, pyritic zone in the Thirkell Group and is therefore downgraded. Only anomaly "E" is considered to represent massive sulphide but the data indicates that the widths are narrow.

It is concluded that the vicinity of anomaly "E" is the most promising part of Exploration Licence 2/72; but the chances of a large ore body there are remote.

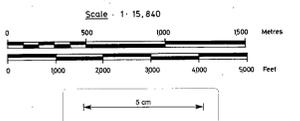
The search for "blind" ore bodies relies on geophysical methods. The method employed has been unsuccessful and no further geophysical work can be contemplated.

It is recommended that Australasian Minerals, Inc. discontinue work on Exploration Licence 2/72.

TASMANIA E.L. 2/72

GEOCHEMICAL SAMPLING

LOCATION NUMBERS



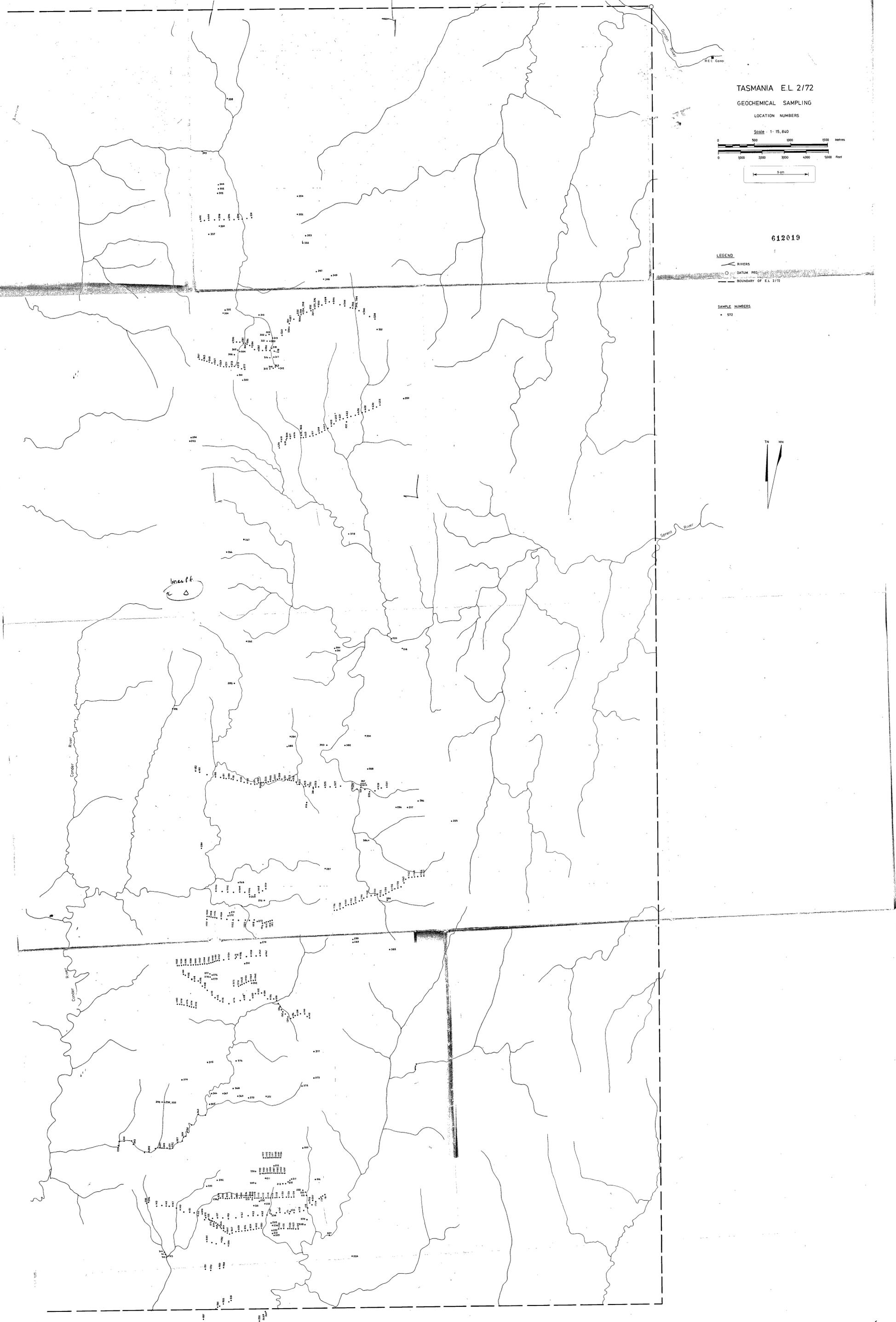
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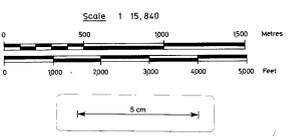
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meat



TASMANIA E.L. 2/72
GEOCHEMICAL SAMPLING
COPPER



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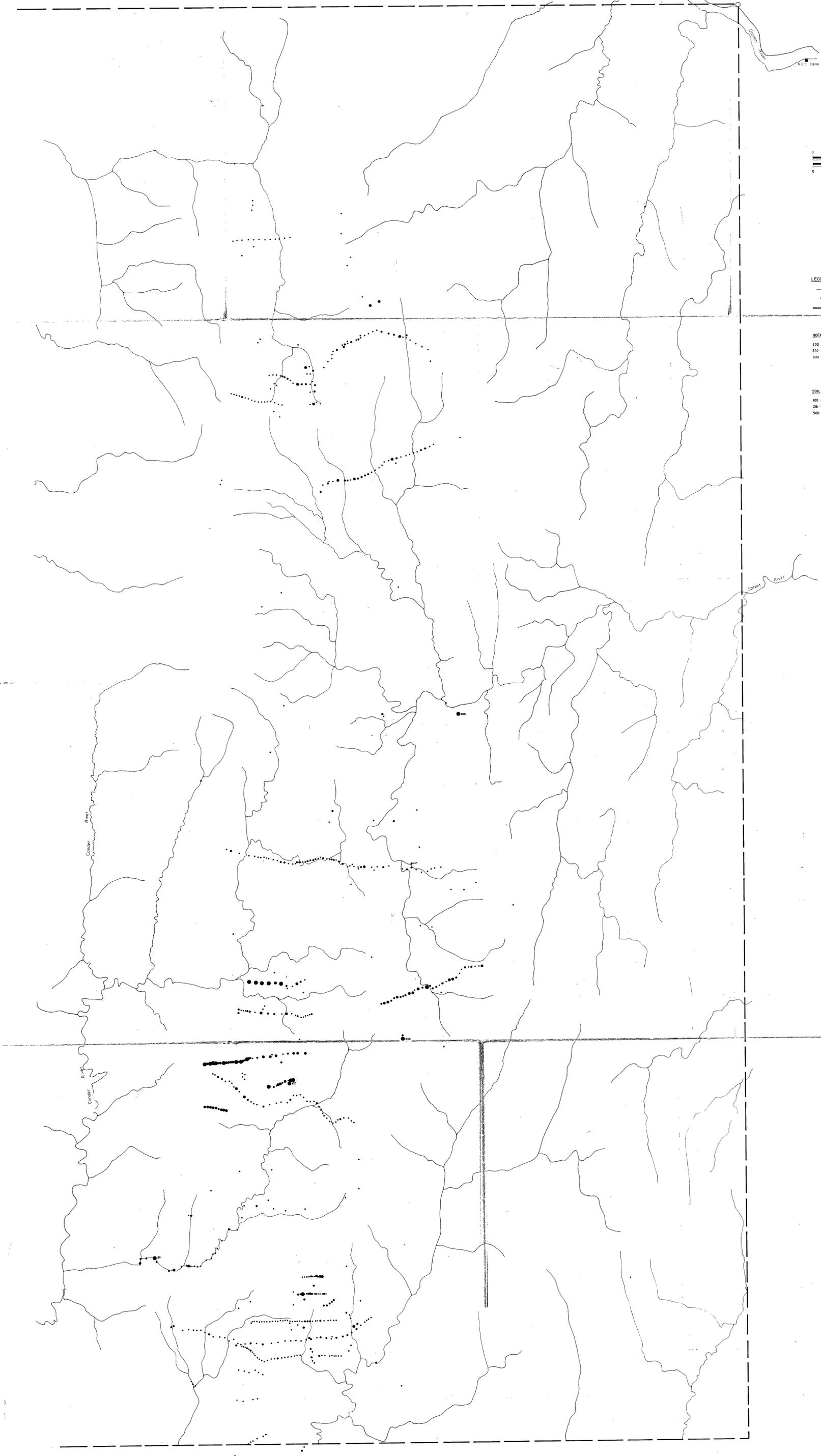
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--- BOUNDARY OF E.L. 2/72

ROCK SAMPLES

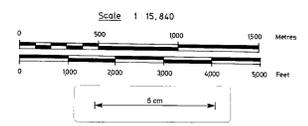
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251 - 295	10 - 30	•
300 - 320	30 - 100	•
321 - 804	100 - 320	• with values

SOIL SAMPLES

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200 - 295	3 - 10	•
300 - 499	10 - 30	•
500 - 699	30 - 100	•



TASMANIA E.L. 2/72
GEOCHEMICAL SAMPLING
LEAD

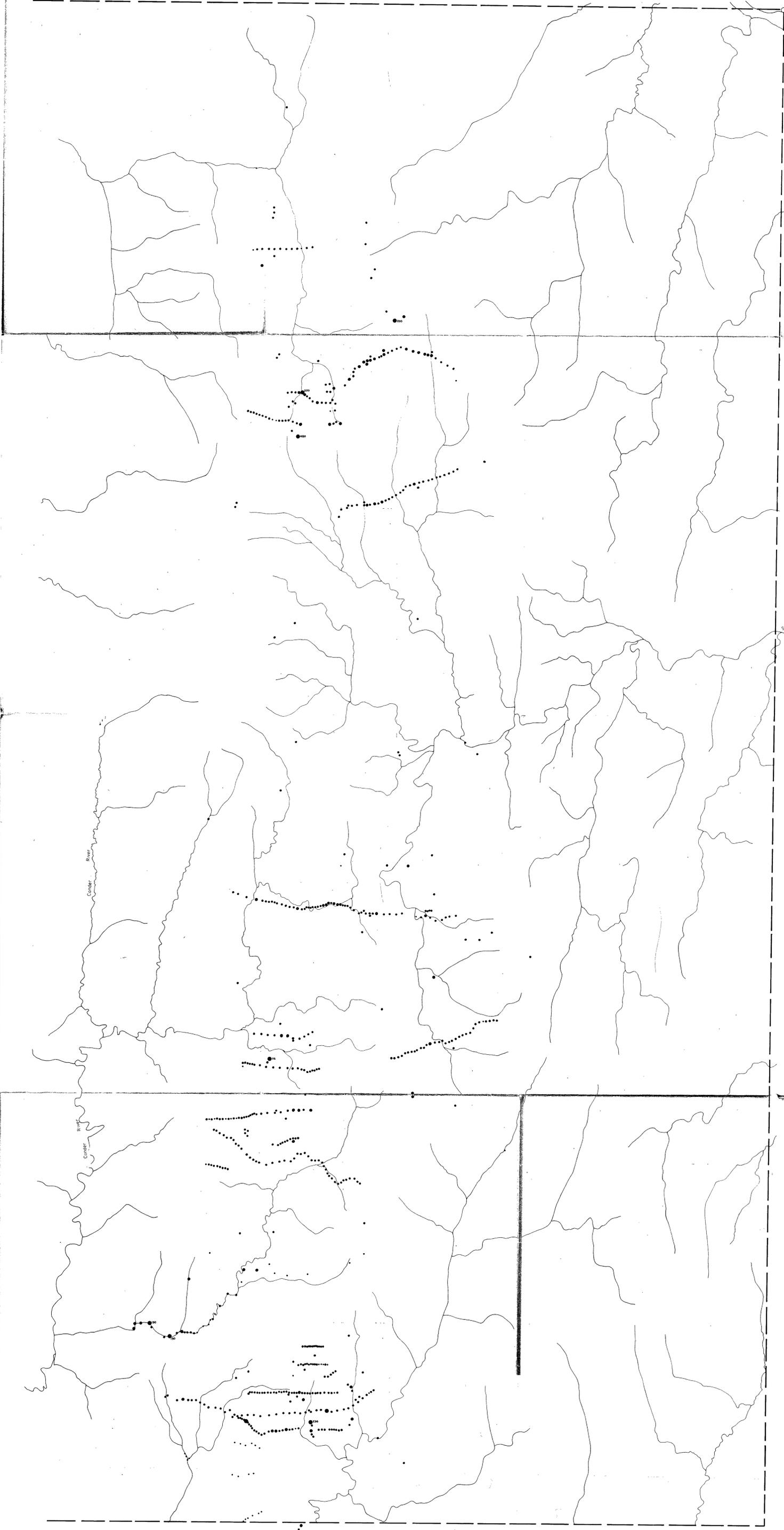


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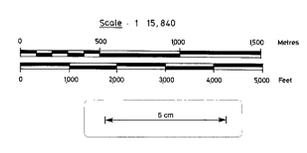
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BOUNDARY OF E.L. 2/72

ROCK SAMPLES
200 - 290 <10
291 - 399 10 - 30
400 - 504 30 - 100
100 - 480 with values

SOIL SAMPLES
100 - 199 <10
200 - 296 10 - 30
300 - 699 30 - 100
700 - 1000 100 -



TASMANIA E.L. 2172
GEOCHEMICAL SAMPLING
ZINC



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LEGEND

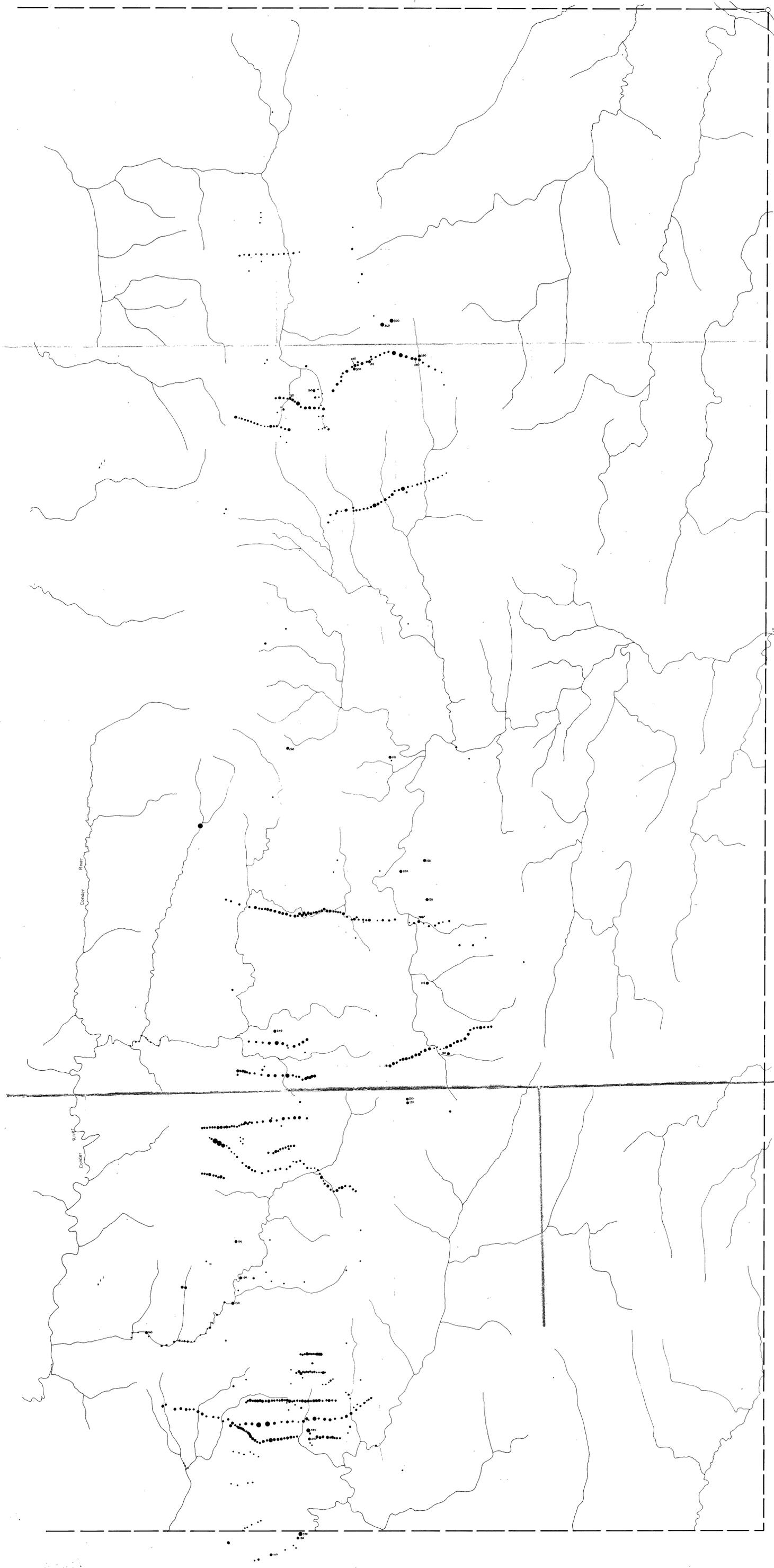
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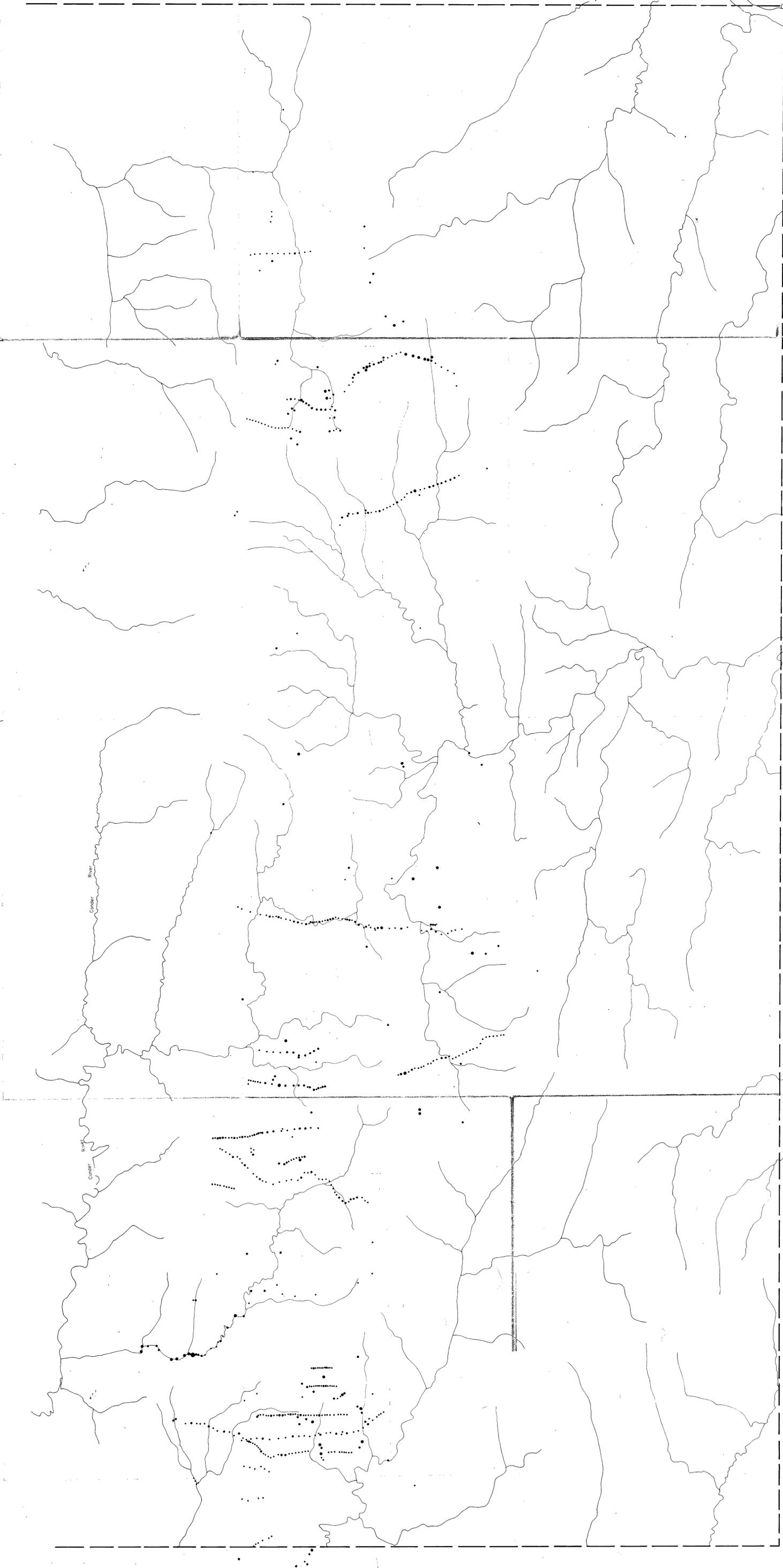
ROCK SAMPLES

- 200 - 290 < 30 ●
- 291 - 399 30 - 100 ●
- 400 - 804 100 - 300 ● with values
- > 300 ● with values

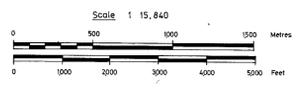
SOIL SAMPLES

- 100 - 199 < 10 ●
- 200 - 299 10 - 30 ●
- 300 - 399 30 - 100 ●
- 400 - 499 100 - 300 ●
- 500 - 599 > 300 ●





TASMANIA E.L. 2/72
GEOCHEMICAL SAMPLING
SILVER



612023

LEGEND

- RIVERS
- DATUM PEG
- BOUNDARY OF E.L. 2/72

ROCK SAMPLES

- 200 - 290 <0.2 •
- 337 - 359 0.2 - 0.5 •
- 800 - 804 0.6 - 1.5 •
- >1.5 • with values

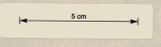
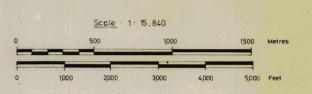
SOIL SAMPLES

- 100 - 199 <0.2 •
- 231 - 256 0.2 - 0.5 •
- 500 - 599 0.6 - 1.5 •
- >1.5 •



AMG391332E
526744N

TASMANIA E.L. 2/72 GEOLOGICAL MAP



C12024

LEGEND

- QUATERNARY
 - Alluvial fans, mud flows, outwash
 - Detritus, coarse to fine tals, glacial debris
 - Alluvium, river bed and fluvio-glacial sands and silts
- JURASSIC
 - Undifferentiated oligomictic quartz conglomerate, conglomeratic quartz-mica sandstone, pyritic sandstone, limestone, basic shale and siltstone horizons, coarse conglomerate
- TRIASSIC
 - Volcanic rich polymictic conglomerate, epiclastic sandstones, siltstones, calcareous siltstones and phylitic schists
 - Miscellaneous sandstone, carbonaceous shale, chert and phylitic schists, carbonaceous shale
 - Volcanic conglomerate
- CAMBRIAN
 - Undifferentiated acidic volcanics, dominantly ignimbrites and ash fall pyroclastics, rhyolite domes and flows, intrusive (?) trachy-andesites, clastic and chemical sediments, chert
 - Epiclastic tuff, sandstone and shale
 - Rhyolite flows and domes, no ferro-magnesian minerals
 - Rhyolite flows, abundant chloritized biotite
 - Igneous necks, some coarse agglomerate and fragmental rhyolite
 - Ash fall tufts with occasional ignimbrite and rhyolite flows
 - Lapilli tuff
 - Trachy-andesite and coarse grained intrusive (?) rhyolites
- PRE-CAMBRIAN
 - Poorly sorted polymictic conglomerate, cross-bedded green and grey shale, epiclastic sandstone and siltstone, occasional lenses of massive and sheared keratophyre. Generally strongly sheared
 - Keratophyre
 - Conglomerate
 - Undifferentiated quartzite, quartz-mica schist, tourmaline-quartz schist, silicified diorite, graphitic schist and chlorite schist

- Unconformity
- Fault (observed or inferred)
- Photo lineament (mostly joints)
- Approximate geological boundary
- Intra-formational boundary
- Strike and dip of stratum
- Prevailing strike and dip of stratum
- Vertical stratum
- Strike and dip of foliation
- Prevailing strike and dip of foliation
- Vertical foliation
- Watercourse

NOTE: Unconformity between Quaternary and older formations not shown

AMG REFERENCE POINTS ADDED

E
N
339/287

AMG38444 E,
5268102N

612025

REPORT ON TURAIR
AIRBORNE ELECTROMAGNETIC-MAGNETIC SURVEY
D'AGUILAR RANGE, QUEENSTOWN,
TASMANIA
ON BEHALF OF
AUSTRALASIAN MINERALS INC.

PRIVATE AND CONFIDENTIAL

REPORT ON TURAIR
AIRBORNE ELECTROMAGNETIC-MAGNETIC SURVEY
D'AGUILAR RANGE, QUEENSTOWN
TASMANIA
ON BEHALF OF
AUSTRALASIAN MINERALS INC.

by

J.G. Linford, B.Sc.(Hons), Ph.D.
Chief Geophysicist.

PERTH, WESTERN AUSTRALIA

APRIL, 1973.

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TABLE I

TABLE 2

PLATES

PLATE 1 Flight path and Anomaly Plan



SUMMARY

With the Turair airborne electromagnetic-magnetic method, about 100 line miles of geophysical traverses were flown at the D'Aguilar Range prospect. An area of 15 square miles was covered.

The anomalous EM responses have been analysed for depth and conductivity-thickness values, but the amplitudes of these distortions are extremely weak and often are near or within the noise level of the system.

The anomalies which are graded by their general characteristics, yield several promising conductors, some having favourable geology, and detailed ground follow-up is warranted.

REPORT ON TURAIR
AIRBORNE ELECTROMAGNETIC-MAGNETIC SURVEY
D'AGUILAR RANGE, QUEENSTOWN
TASMANIA
ON BEHALF OF
AUSTRALIAN MINERALS INC.

INTRODUCTION

A Turair airborne electromagnetic-magnetic survey was carried out by Scintrex Pty. Ltd. between February 7 and February 20, 1973 on the D'Aguilar Range, near Queenstown, Tasmania on behalf of Australasian Minerals Inc.

The purpose of the present airborne geophysical survey was to detect and locate any sub-surface conducting zones which may be indicative of sulphide mineralization. In addition the magnetic and electromagnetic data can aid the interpretation of the geology, and can be especially useful in covered areas.

The present survey area, comprising approximately 15 square miles is located 30 miles south by air from Queenstown, being just north of the Gordon River. The terrain is extremely rugged and access to the survey area was via helicopter.

In total, 46 lines were flown totalling 100 line miles. The flight direct was almost east-west with a nominal interline spacing of 500 ft. and the mean terrain clearance of the EM bird (receiver coils) was several hundred feet. Two lines totalling almost 12 line miles were also flown in a north-south direction as magnetic tie lines.

Measurements of both the electromagnetic and magnetic fields were made and recorded, utilizing a Scintrex Turair-II unit at 400 Hz and a Scintrex MAP-2 nuclear resonance total intensity magnetometer. This equipment, together with all necessary ancillary equipment was installed in a Bell 206A Jet Ranger helicopter.

The reader is referred to Appendix 2 for a general discussion of the Turair method.

GEOLOGY

A limited amount of geological information is available. The general target mineralization is the Rosebery pyritic Zn - Pb - Cu type deposit and to a lesser extent, the Mt. Lyell disseminated deposit type. The mountainous area has a high rainfall and the predominate vegetation is dense rain forest.

The primary target mineralization for the present survey system is massive sulphide mineralization (i.e. interconnection of the conductive sulphide mineralization to form an electrical conductor).

Other potential conductors which may give rise to electromagnetic anomalies are interconnected graphite, mineralization water saturated fault or shear zones or zones of deep differential weathering (perhaps resulting from minor mineralization and alteration). The conductors can, however, often be separated from massive sulphide conductors on the basis of their EM response.

PRESENTATION OF DATA

The original data records are presented in a binder, the data being recorded on a 6 channel, heat sensitive strip chart recorder and operated at a speed of 10 cm per minute. The chart is 38 cm wide with each channel being 5 cm wide. The parameters recorded and their details are as follows:

Altimeter: The altitude of the helicopter above the ground is recorded in an analog form, where approximately 1 cm = 100 ft. The E.M. bird is 100 ft. below the helicopter. Calibration records of the altimeter are presented in the binder.

Amplitude: The amplitude of the signal output from the preamplifiers is recorded in analog form. It shows the automatic switchings that occur to keep the signal within the necessary amplitude range for the equipment operation.

Electromagnetics: The sensitivity of these Turair records is as follows:

Field strength ratio (FSR)	1 cm = 1%
Phase difference	1 cm = 0.50 degrees.

Magnetometer: The magnetic data is recorded on two channels, a detailed channel with full scale deflection (FSD) of 100 gammas, and a second channel with FSD of 1000 gammas.

The fiducial marks are recorded on the event markers, the intervals being 1.6 seconds.

The flight log records are presented in a separate binder, and show the lines surveyed and which lines were recovered.

The survey flight lines and points recovered are shown on the 1 : 16,000 and 1 : 8,000 photographs, these being recovered with the aid of the on-board tracking camera. Central points are numbered with their corresponding fiducial number. Each survey line is given a number, regardless of the interline spacing, and a compass direction to indicate the direction of flight.

The flight lines have been transferred to the 1 : 15,840 (or 20 chains = 1 inch) controlled topographic map. Plate 1 presents an overlay of this topographic map, and shows the recovered points, flight lines, and anomalies. This was necessary because the low level photography and the mountainous terrain produced large distortions.

INTERPRETATION

The electromagnetic records are interpreted to determine the presence of conducting bodies and to obtain some information relating to their character. The intervalometer time marks are synchronized with the positioning camera film strip and thereby permit the relating of the conductors with appropriate ground locations. The terrain clearance is obtained from the altimeter data.

Normally, a plan is prepared, either using a subdued photomosaic or an overlay from a mosaic or topographic plan as base. The flight path of each survey line is obtained by means of "tie points", which are features on the mosaic or topographic plan, identified on the positioning camera film. The flight path is interpolated between these tie points.

Where field distortion occurs the curves indicate the location and the depth of the main current flow. The "current axis" is well defined when the current is concentrated, for instance, in thin, steeply dipping conductors. In wide, banded conductors, or in horizontal conductors such as overburden, the current is usually more dispersed and the anomalies yield less positive information.

(a) Peak Location

The peak location of the amplitude ratio using the horizontal coplanar coils is shown on the plan by a circle in the appropriate location. In the case of broad conductors or closely spaced multiple conductor zones there may be more than one peak, in which event all major peaks are shown. A conductor which is likely man-made is indicated by an X rather than by a circle.

As a rule the current axis is located right below the maximum field strength ratio deflection or the maximum phase anomaly. The depth under the traverse is indicated by the shape of the anomaly.

(b) Depth and Conductor Width

The "Half width", i.e. the distance between the points of half the maximum response amplitude is, for simple line current sources, approximately equal to the depth of the source under the detector.

Flat-lying conductors (e.g. overburden) characteristically give rise to very large half widths, combined with rather irregular curve shapes. Here the half width may reflect the conductor width rather than the depth and the latter can usually not be determined. In cases where the conductivity zone is interpreted to have indicated on the plan by an open bar symbol along the flight line. Well defined peaks within this zone should be marked, and if possible interpreted as individual anomalies. The subsurface depth of the current axis (subtract detector altitude) is marked on the lower left of the peak location circle.

(c) Conductor Grading

Field strength ratio and phase difference anomaly amplitudes are dependent on the overall geometry as well as on target size and σt value. Their primary significance is in the degree of certainty they lend to detectability and quantitative interpretation. For the purpose of amplitude grading three categories are used: Category 1, fully shaded; Category 2, half shaded; and Category 3, unshaded. (See Table 2).

(d) Conductivity-Thickness Factor

The field strength ratios and phase differences provide a measure of the conductivity of the conducting bodies, i.e. good conductors are characterized by field strength distortion combined with relatively little phase shifting, whereas poor conductors affect the phase rather than the strength of the resultant field.

For an accurate grading the conductivity-thickness factor (σt value) of individual conductors can be derived from the calculated in-phase and out-of-phase components, taking into consideration the exciting frequency and the strike length of conductor. The σt value is then marked on the upper-right side of the peak location circle.

Large, highly conducting bodies such as massive sulphides or graphite and seawater, etc., generally have high σt values. Moderate conductors will have σt values between 10 and 100 mhos. Poorly conducting bodies (e.g. most overburden and some sulphide and graphitic zones) will have σt values of less than 10 mhos. In areas where there is a clear differentiation in conductivity between the targets of potential economic interest and other possible conductors, the σt values may form the main basis for discrimination. When the conductivity ranges of economic and non-economic overlap, the σt value cannot, of course, be rigidly relied upon.

(e) Current Pattern

To obtain the projection of the current pattern, the anomalies are connected between lines, using depth *at* values and other characteristics of the curves as criteria. The strike of the formation, if known, is also taken into consideration.

(f) Magnetic Correlation

With magnetic data available, any correlating magnetic expression is noted for the pertinent conductor peak. A conductor peak with direct magnetic correlation is indicated by a double concentric circle.

Location of a conductor on the flank of a magnetic anomaly is indicated by means of one half of a concentric circle on the side of the magnetic high.

The significance of direct or flank correlation depends on the search problem. In the former case the magnetic and conductive properties may be coincident or belong to two narrow adjoining zones. In the latter case the conductor may be located at the contact of a wider magnetic formation.

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DISCUSSION OF RESULTS

One loop, approximately $5\frac{3}{4}$ miles by 2.5 miles was used. Plate 1 and Table I present the interpreted anomalies.

Each electromagnetic anomaly being given a code number, is analysed where possible, for the following:

1. Location.
2. Anomalous field strength ratio in percent.
3. Anomalous phase difference in degrees.
4. Relevant magnetic character.
5. Depth estimation of current axis below the ground.
6. Correlation of anomalies on adjacent lines, being indicated by a common conductor.
7. Conductivity-thickness (σt) product.

The fiducial position of the anomalies as shown on Plate 1 is taken directly from the geophysical data with no adjustment taken into account for any displacement from its true position. A displacement of 100 to 200 ft. often occurs, normally in the direction of flight.

A total of 50 anomalous electromagnetic responses have been interpreted, however these have extremely weak amplitudes and are near or within the noise level. The almost undisturbed FSR and phase traces imply a high resistivity region. The noise level is generally about 0.1 percent and 0.1 degrees, but on some lines more pronounced noise is shown which is related to the tuning of the bird and the signal frequency. Such features have a characteristic distortion and are usually easily recognized although in Table 1 a number of borderline distortions are analysed, being possibly due to a genuine sub-surface conductor. A number of other distortions which are clearly due to noise, are not recorded in Table I, because of their origin.

The terrain is mountainous and its elevation varies from 200 ft. to 2200 ft. The recorded terrain clearance of the helicopter varied between 250 and 600 ft. The weak amplitude of the distortions is probably due in part to the altitude flown because of the mountainous terrain.

In view of the lack of any other anomalies and the potential of the area, these distortions are considered. By considering amplitudes, definition, depth and geological location, it is possible to evaluate the distortions. The strike length of the conductor can also

be of use in evaluating its significance. Several anomalies in sequence, imply a repeatable distortion, whereas an isolated distortion is probably spurious, and of doubtful origin.

The magnetics do not appear to be directly related to the anomalies, and little reference is made to them.

The conductors and anomalies are discussed below. The geological remarks are based on discussions with Dr. Martin of Australasian Minerals.

Conductor A is formed by extremely poor distortions, one being very close to the wire and a phase response and the other, an FSR distortion that indicates a depth of 24 ft. These anomalies geologically correspond to swampy water saturated ground overlying the Gordon Limestone. Of little interest.

Conductor B is defined by two weak distortions which give the conductor a length of 1400 ft., a moderate to high conductivity and a shallow depth.

The conductor lies within 500 ft. of a major fault zone and is probably within the fracture zone of that fault. It lies approximately on the faulted contact between the Caroline Creek Sandstone and the Gordon Limestone. The Caroline Creek Sandstone in this

area is pyritic and zones up to 100 metres thick carry 5 to 25% disseminated framboidal pyrite. Massive and disseminated Pb - Zn - pyrite mineralization has been observed in the basal members of the Gordon Limestone elsewhere, but not in this present area.

In view of reasonable geophysical definition and geological location, the conductor is of secondary interest.

Conductor C has a strike length of 2000 ft., and indicates a possible eastward dip and a high conductivity. Anomaly 22 is particularly well defined while Anomaly 32 is extremely weak. Geologically, it is in the same area as Conductor B, and hence it could be due to massive sulphides.

Conductor D is defined by two weak FSR anomalies, 15 and 19, and indicates high conductivity and a shallow depth of about 70 ft. Possibly it extends to a poor anomaly (28).

Geologically, Conductor D is probably in pre-Cambrian quartzite and hence is of little interest. However its geophysical characteristics are promising, and a confirmation of the geology is probably necessary.

Conductor E is outlined by three possibly isolated anomalies. Anomaly 30 is well-defined with good characteristics, and to a lesser extent, is Anomaly 20.

Both these anomalies indicate a very high conductivity and a source depth of 200 ft. Anomaly 33, which is deeper, is more doubtful.

These three anomalies are in an almost no outcrop area between probable intrusive trachy-andesite to the west and Cambrian conglomerate to the east. This area may be a pyroclastic unit in the same structural situation as at Mt. Lyell, and is geologically extremely interesting. There is an associated geochemical high, making the conductor extremely promising.

Conductor F is defined by some doubtful distortions. It is in the same geological location as Conductor B. Of minor interest.

Conductor G has a strike length of 1500 ft. and indicates a source depth of about 200 ft. and usually a very high conductivity. The dip is possibly westward. Anomalies 29 and 36 are particularly well-defined. Geophysically it is a very promising conductor. Geologically it is over westerly dipping epiclastic tuffs and volcanic conglomerates. The exposures immediately east of the anomaly are of very coarse breccia containing irregular blocks and fragments up to several metres across in a greenish finer volcanic matrix. Limonitic patches and disseminations of secondary iron oxide and manganese oxide are present. Rare pyrite has been seen.

The epiclastic tuffs themselves are not considered a good geological target, but it could relate to possible underlying pyroclastics and be of interest.

Conductor H has an overall strike length of 3300 ft. and is defined by FSR anomalies 16, 17, and 50 and phase anomalies 21, 25 and 26, indicating a variable conductivity. The depth is also variable, but averages about 200 ft. Anomaly 50 is well defined.

It is in a similar environment to Conductor G.

Conductor I is defined by 3 weak FSR anomalies which imply a high conductivity. The source depth is about 200 ft. There is no outcrop here, but deep soil cover, humic and water saturated. Possibly the weak distortions are due to a response from this conductive surface region.

Conductor J is due to an isolated strong FSR response. It shows a high conductivity and a depth of 200 ft.

Conductor K is defined by Anomaly 40, and is a well-defined distortion. Its depth is 240 ft. and *ot* is 35 mhos. Possibly it extends to Anomaly 45, an extremely poor defined distortion.

Conductor L is a distinct and well-defined anomaly. It is of a shallow depth and has a *ot* of 18 mhos. It could extend to Anomaly 47, which has high conductivity.

Conductor M is defined by a distinct and well-defined anomaly having a *ot* of 40 mhos and a depth of 80 ft.

The geology of Conductors K, L and M is uncertain.

Anomalies 9, 10 and 49 have a similar location but are of a doubtful origin. Similarly anomalies 14, 34,

35, 41, 44 and 46 are considered to be due to noise and are of no interest.

Anomalies 23, 24 and 27 are mainly FSR distortions of doubtful origin, being not related to adjacent lines, having poor definition, and being similar to the noise. Anomaly 48 is an isolated phase response.

CONCLUSIONS AND RECOMMENDATIONS

A total of about 46 survey lines were flown, a few of the lines being re-surveyed in opposite directions. Because of the difficulty of navigation - the terrain and photographic distortion - the flight lines are often displaced and angled.

There are a number of weak distortions, which form promising conductors. A majority of the Turair traces are completely free of noise, enabling very weak distortions to be meaningfully considered. That is, distortions of about 0.1% and 0.1 degree can be analysed. However there are a number of lines where instrumental noise is in excess of this level. Some of these distortions can meaningfully be rejected while others have some ambiguity. For this reason, as well as the navigation, numerous reflights were executed, and a number of repeat lines are presented.

The altitude flown was determined by the pilot's safety considerations in this mountainous area.

Both phase and FSR anomalies occur, implying, low and high conductivities. In general the pure FSR anomaly is thought to be more significant because of its high conductivity. In cases where a repeated or overlapping and adjacent line does not show an interpreted anomaly, the possibility of a higher noise level must be considered.

The depths are often quite variable, but this is mainly due to the weakness and hence error in the half widths, and, to a lesser extent, the variable helicopter speed. In this respect the depth determination is only a guide to the likely depth to the conductor. Similarly the conductivity-thickness values cannot really be accurately determined because of the amplitude weakness. Normally if the signal to noise ratio is greater than 2, an accurate and meaningful value can be determined.

In summary, several promising conductors are shown and these are tabulated below:

Of interest: Conductors C, E, G.

Of secondary interest: Conductors B, D, H, K, L, M.

Of minor interest: Conductors F, J.

Of little interest: Conductors A, I.

Of no interest: Anomalies 9, 10, 14, 23, 24, 27,
34, 35, 41, 44, 46, 48, 49.

This evaluation is based mainly on the quality of the anomalies, their geophysical characteristics and in part, the known geology. Favourable detailed geology could significantly upgrade a conductor.

The follow-up procedures which are usually given for most Turair surveys are listed below:

1. Comprehensive geological evaluation of the electromagnetic anomaly environment, perhaps including geochemical sampling.
2. All mainly FSR anomalies to be defined by ground electromagnetics.
 - a) For shallow sources (less than 100 ft.) horizontal or vertical loop methods can be applied.
 - b) For deeper sources, the Turam technique should be used.
3. All mainly phase anomalies should be defined on the ground by induced polarization.
4. Any drilling thought warranted, should be based on ground geophysics. No drill hole should ever be spotted on the basis of the airborne data alone.

We will be pleased to discuss these results at any time especially in the light of any further geological information.

for SCINTREX PTY. LTD.

A handwritten signature in cursive script, appearing to read "Linford".

J.G. Linford, B.Sc.(Hons), Ph.D.
Chief Geophysicist.

PERTH, WESTERN AUSTRALIA

APRIL, 1973.

APPENDIX 2

SURVEY EQUIPMENT AND PROCEDURES

SEMI-AIRBORNE ELECTROMAGNETIC SYSTEM - TURAIR-2

APPENDIX 2SURVEY EQUIPMENT AND PROCEDURESSEMI-AIRBORNE ELECTROMAGNETIC SYSTEM - TURAIR-2

In the application of electromagnetic prospecting methods, it has long been recognized that, other things being equal, much greater exploration depths can be attained with systems employing a fixed source than with systems where both source and receiver are moved in unison. This is an extremely important consideration in Australia where surface weathering may extend to considerable depth.

Most present-day airborne electromagnetic (AEM) systems are of the moving source type, and although such systems have tangible advantages over the ground versions, it appears difficult to increase their useful penetration substantially beyond their present range. Under very favourable conditions the better moving source AEM systems may reach exploration depths of as much as 300 ft. or in exceptional cases 370 ft. below the ground surface. This is sufficient for many search problems but in some areas the geologic and topographic conditions necessitate a much deeper penetration to conduct meaningful mineral surveys.

The foregoing considerations have led to the development of the Turair method for the purpose of deep electromagnetic exploration. The system, which can be described as a fixed source, semi-airborne, gradient measuring device, employs a large transmitting loop on the ground as a primary source. The horizontal gradients of amplitude and phase of the vertical magnetic field are measured from the air, along traverse lines across the source and perpendicular to the regional geological strike.

The Turair method, because of its semi-airborne character, is particularly suitable for the detailed, deep investigation of structures having geologically favourable characteristics or a magnetic expression suggesting favourable geology. Because of its potential depth of exploration, it can be employed in areas of deep sedimentary cover, deep weathering, or tall tree cover (tropical area), or in areas where shallower exploration has established the presence of ore deposits and a deeper search is desired. It is, because of its fixed source configuration, less affected by near-surface conduction and can be applied with a very low exciting frequency (e.g. 200 Hz or less). Finally, as a helicopter-borne system it can operate in mountainous topography. Terrain clearance has far less effect on the exploration depth of the Turair system than it has on moving source methods and it can penetrate deep talus cover and valley fillings.

Economic ore deposits may have strike lengths less than 600 ft. If we want to search for such targets, particularly at greater depths, line spacing should not be much greater and for the average survey a line spacing of one-eighth mile should be considered optimum.

EQUIPMENT

The Scintrex Turair-2 is a fixed source, semi-airborne electromagnetic system designed for helicopter operation.

The system embodies a fixed transmitter on the ground and a receiver carried in the helicopter. The size of the transmitting loop is guided by geological conditions and the character of the survey. A typical loop size is a 2 miles x 2 miles square - other shapes and sizes can be used. The loop is usually laid out from a truck or by helicopter. For airborne placement a special dispensing device is used which feeds out continuously, several miles of wire. The primary field of the present system is excited by means of a 15 Kw motor driven generator which supplies a current of 4-10 amperes into

the transmitting loop. The system can operate at 200 or 400 Hz, the selected frequency depending on the geological conditions in the survey area.

The receiver system comprises 2 horizontal coplanar air-cored coils, rigidly mounted 7 feet apart in a "bird". This bird is towed approximately 100 feet below the helicopter by means of a cable which also carries the electrical signals from the bird. In Australia, measurements are normally taken inside the loop. In environments with more resistive surface layers, such as parts of Canada, measurements are also taken outside the loop, thus greatly increasing area that can be surveyed with one loop.

The quantities measured with this dual coil measuring electromagnetic system are the ratio of the field strength and the phase differences of the alternating magnetic field at the two coils. The changes in field strength ratio and phase difference are expressed in percent and degrees respectively, the noise level being less than 0.1 percent and 0.1 degrees. Both parameters are recorded in analogue form.

Flying towards or away from the loop the amplitude of the field detected at the coils changes gradually but considerably. An automatic switch connected to the signal detector amplifier changes so that the amplified output of the preamplifiers is within the signal strength limitations necessary for the equipment operation. These switching markers are sometimes evident on the recorder charts.

At one or more points during each flight, the scale sensitivities and zero levels are checked by means of calibration and zeroing signals respectively. The reference or zero level for each Turair electromagnetic trace is an arbitrary one, and is obtained empirically from the regional level of each section of a trace.

Since the gradients of the signals recorded within about 600 ft. to the loop sides are too strong, it is not possible to distinguish field changes due to conductors of geologic origin lying in these "blind zone" regions.

The field strength ratio and phase difference are recorded in such a way that flying "towards" the wire of loop's side system, a normal anomaly shows a positive sign (i.e. upward deflection), while flying "away" from the wire the sign is reversed. Reversed anomalies can also be the result of particular geometric situation, e.g. when the source is located on the hanging wall side of a flatly dipping conductor. Man-made disturbances including power lines, pipe lines, metal fences, railways, etc. may cause spurious anomalies. The former are recognizable as such when they appear as cyclic noise of irregular shape and phase relationship. Non-energized, grounded power lines (e.g. 3 phase systems) sometimes give rise to anomalies that are more difficult to identify. Such indications as well as those from pipe lines and metal fences, etc. are however, of short duration and can be distinguished from most geologic sources except for very narrow, near-surface conductors. In some instances, ground investigation may be necessary in order to resolve the ambiguity of possible sources. Although the airborne geophysical crew attempts to note visible man-made conductors of the above type, the ground moves by so rapidly at the low flight elevation employed that 100% recognition of such sources cannot always be expected from the air.

The normal terrain clearance of the bird is 100 - 200 ft. depending on the surface topography, tree cover, etc., with the helicopter 100 ft. above.

The established useful depth of the system for moderate-to-large conducting bodies of 1000 ft. in length, is at least 600 ft. sub-bird under conditions of low extraneous geologic noise, i.e. where the general level of conductivity of the overburden and rock types of the area is low.

TABLE I - TURAK SURVEY

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<u>Line No.</u>	<u>Anomaly No.</u>	<u>Fid. No.</u>	<u>Magnetics</u>	<u>Depth</u>	<u>$\Delta\%/\Delta^\circ$</u>	<u>Conductor Axis</u>	<u>Remarks</u>
46E							Over or about loop wire. Signal saturated. - blind zone.
45E	1.	100	flat	2.4 fids 0'	-/0.1°	⊗ A	very near wire and saturation, probably due to the wire
44E	2.	151	flat	3 fids 25'	0.2/-	---○--- 24' A	very weak FSR, implies a high σt (>100 mhos), shallow, surface conductor; length, possibly 1000'
42E	3.	2144	flat	3.2 fids 200'	-/0.4	---○--- 200' A?	phase response, close to the wire, similar to anomaly 1.
40E	4	419.5	flat	3 fids 100'	0.2/-	---○--- 100' B	very weak FSR, near noise level, but implies a high σt . Length 1400'
40E	5	394	flat	4 fids 200'	0.4/-0.1	---○--- 200' J	strong FSR, implying high σt but in noisy trace doubtful; length 500'
39E	6	476.5	flat	3.5 fids 40'	0.2/0.2	---○--- 40' B	very weak and near noise level. Length 1400'
33W	7.	966	flat	6 fids 230'	0.2/-	---○--- 220' I	weak F.S.R., no phase distortion: length 900'

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TABLE I - TURAIR SURVEY

<u>Line No.</u>	<u>Anomaly No.</u>	<u>Fid. No.</u>	<u>Magnetics</u>	<u>Depth</u>	$\Delta\%/\Delta^\circ$	<u>Conductor Axis</u>	<u>Remarks</u>
33W	42	961	flat	4 fids 110'	0.2/-	---O ^I --- 110'	similar to anomaly 7 (33W)
32 E	8	1005	flat	5 fids 260'	0.3/-	---O ^I --- 260'	very weak and near noise level, similar to anomaly 7 (33W)
32 E	9	1036	on East flank of 25Y max	4 fids 450'	0.4/-0.1	⊗	probably spurious, doubtful
32 E	49	1042	flat	4 fids 400'	0.3/-0.05	⊗	doubtful
31W	10	66.5 -59	over max of 60Y	3.5 fids -60'	0.4/-0.1	⊗	spurious anomaly in noisy trace, as current axis is in the air
31W	11	32	flat	4.5 fids 40'	0.4/-0.1	---O ^F --- 40'	could be spurious
31W	12	39	flat	4 fids -30'	0.4/0.1	⊗	current axis in air
30E	13	195	flat	4.5 fids 150'	0.3/-0.05	---O ^F --- 150'	could be spurious

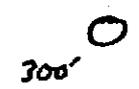
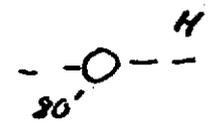
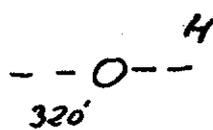
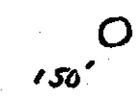
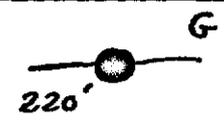
612055

TABLE I - TURAK SURVEY

<u>Line No.</u>	<u>Anomaly No.</u>	<u>Fid. No.</u>	<u>Magnetics</u>	<u>Depth</u>	<u>$\Delta\%/\Delta^\circ$</u>	<u>Conductor Axis</u>	<u>Remarks</u>
29W	14	274	flat	4 fids 280'	0.2/-0.05	⊗	weak and doubtful
27W	15	426	flat	4 fids 70'	0.2/- rev	--O-- ^D 70'	distinct FSR anomaly, no phase, implies a high σt, dips to east
27W	16	490	flat	4 fids 90'	0.2/-	--O-- ^H 90'	distinct FSR, implying high σt > 100 mhos
26E	17	541	flat	6 fids 600'	0.3/-	--O-- ^H	broad weak distortion could related to H, doubtful high σt
25W	18	696.5	flat	4 fids 180'	0.1/0.05	--O-- ^H 180'	very weak, no noise
25W	19	645	flat	4 fids 70'	0.2/-	--O-- ^D 70'	weak, no noise, σt > 100 mhos
24E	20	783	flat	3.6 fids 230'	0.2/-	--O-- ^E 230'	weak, could be on extension of E
24E	21	742	flat	4.5 fids 500'	-10.1	--O-- ^H 500'	very weak, phase, low σt

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TABLE I - TURAIK SURVEY

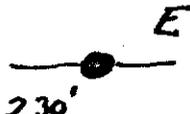
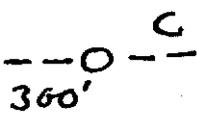
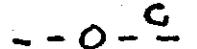
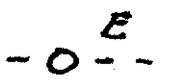
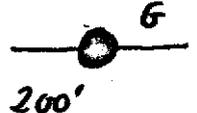
<u>Line No.</u>	<u>Anomaly No.</u>	<u>Fid. No.</u>	<u>Magnetics</u>	<u>Depth</u>	$\Delta\%/\Delta^\circ$	<u>Conductor Axis</u>	<u>Remarks</u>
23W	22	831	flat	4.5 fids 100'	0.4/- new		good FSR anomaly implying high σ_t (>100 mhos) probably dips to east
23W	23	874	over max of 120V	4 fids 300'	0.2/-		very weak and near the noise level, doubtful.
23W	24	889	flat	3.5 fids 260'	0.25/-		very weak, near noise level not on adjacent lines, doubtful
23W	25	910	flat	5 fids 80'	-/0.1		very weak, low σ_t < 1 mho. could be part of H
22W	26	1985	flat	5 fids 320'	-/0.3		weak phase response σ_t < 1 mho.
22W	27	1974	flat	3 fids 150'	0.2/-0.5		weak and near noise level could be related to anomaly 24, but is very doubtful
22W	28	1938	flat	4 fids 0'	0.3/-0.1		could be doubtful, by definition & shallow source
21W	29	1771	flat	5 fids 220'	0.4/-		defined FSR implying σ_t > 100 mhos

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TABLE I - TURAK SURVEY

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5.

Line No.	Anomaly No.	Fid. No.	Magnetics	Depth	$\Delta\%/\Delta^\circ$	Conductor Axis	Remarks
21E	50	1824	flat	5 fids 220'	0.4/-		defined FSR, imply $\sigma t > 100$ mhos could be part of conductor H not on adjacent line.
20E	30	1184	flat	3.5 fids 230'	0.2/-		weak and defined FSR. $\sigma t > 100$ mhos, could be part of conductor E
20E	31	1206	flat	5 fids 300'	0.3/0.1 NW		could be noise, but appears part of conductor C. $\sigma t \approx 25$ mhos.
19E	32	188	flat	-	-		poorly defined, no analysis possible.
17W	33	1650	flat	6 fids 490'	0.7/-15		large FSR, but could be due to noisy trace, doubtful.
17W	34	1611	flat	5 fids 350'	0.2/-25 NW		probably due to noisy trace doubtful
17W	35	1606	flat	5.5 fids 400'	.8/-25		probably noise
17W	36	1586	flat	3.5 fids 200'	.4/- NW		defined but on noisy trace implies $\sigma t > 100$ mhos and probable dip westward.

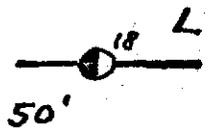
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TABLE I - TURAIK SURVEY

<u>Line No.</u>	<u>Anomaly No.</u>	<u>Fid. No.</u>	<u>Magnetics</u>	<u>Depth</u>	<u>$\Delta\%/\Delta^\circ$</u>	<u>Conductor Axis</u>	<u>Remarks</u>
16W	37	1531	flat	6 fids 280'	-1.25	---○--- 280' G	very broad phase distortion could be conductive region or end of conductor G. $\sigma t < 1$ mks.
15W	38	368	flat	3.5 fids 150'	0.11-	---○--- 150' G	very weak FSR, high σt (> 100 mks)
9E	48	402	flat	2 fids 90'	-1.02	---○--- 90'	isolated phase distortion on poor trace, not on adjacent line 9W.
8E	39	1048	flat	4 fids 80'	0.2/0.5	---○--- 80' 40 M	distinct and defined, and isolated; length 750'. $\sigma t = 40$ mks
5W	45	673	flat	---	---	---○--- K	extremely poorly defined no analysis. possibly on extension of K.
3W	40	515	flat	3 fids 240'	0.2/0.5	---○--- 240' 35 K	weak but distinct distortion, probably a good conductor $\sigma t = 35$ mks, length $\sim 1500'$ adjacent lines too noisy
5W	46	481	on west flank	4 fids 300'	0.7/-0.4	⊗	on a noisy trace, probably noise.
4E	47	629	over max 150'	3.5 fids 150'	0.5/-	150' ●	probably noise, but not noisy trace; FSR implies $\sigma t > 100$ mks not on adjacent lines, could be related to L.

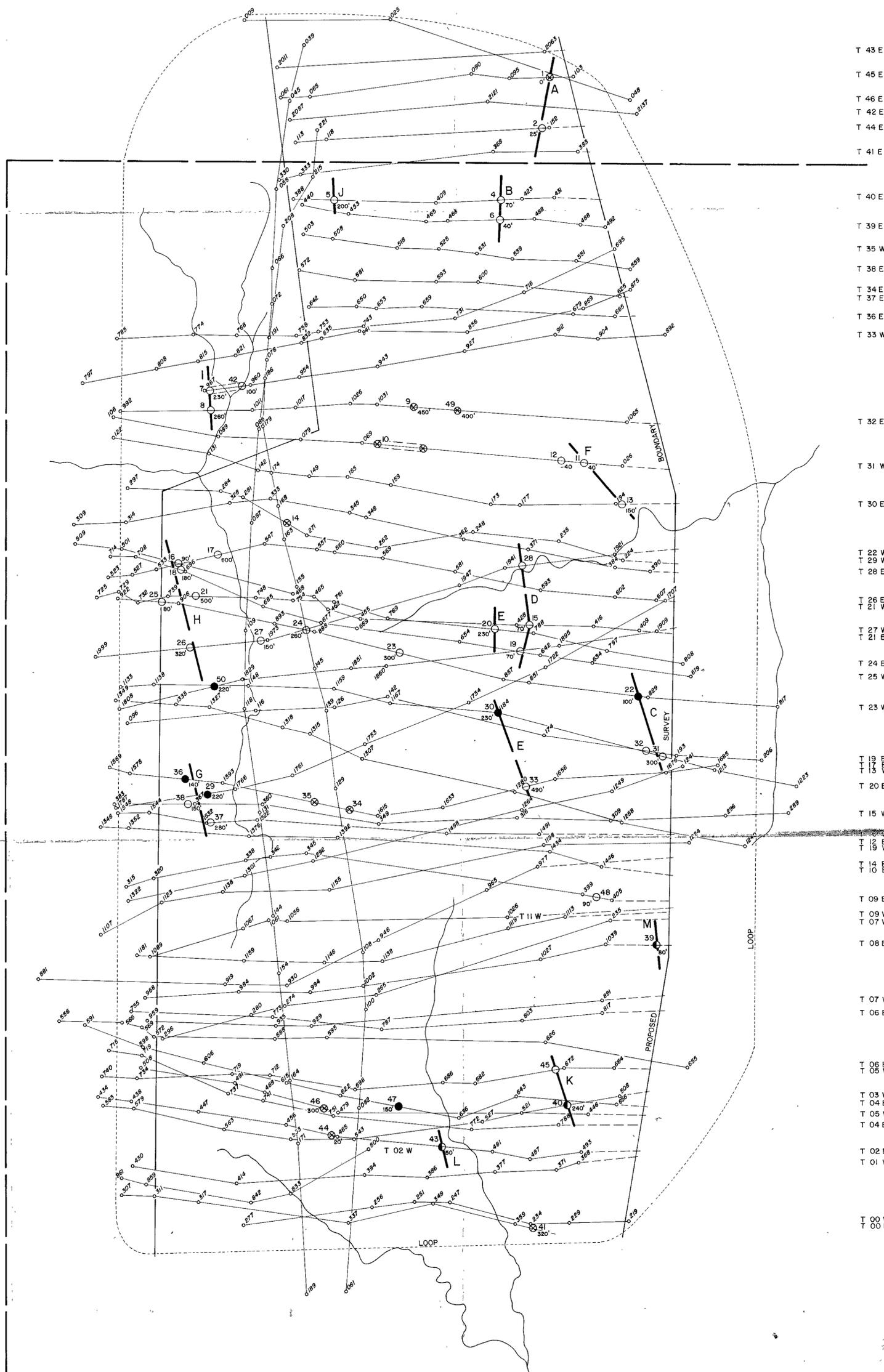
TABLE I - TURAIN SURVEY

7.

<u>Line No.</u>	<u>Anomaly No.</u>	<u>Fid. No.</u>	<u>Magnetics</u>	<u>Depth</u>	<u>$\Delta\%/\Delta^\circ$</u>	<u>Conductor Axis</u>	<u>Remarks</u>
2W	43	476.5	near East flank of 150 γ max	2 fids 50'	0.3/0.2		distinct and defined, isolated response, length 600', $\sigma t = 18$ mhos.
2W	44	464	near West flank of 150 γ max	3 fids -20'	0.4/0.1	⊗	current axis is in the air and is not on adjacent line probably spurious.
OE	41	361	flat	4 fids 320'	0.3/-	⊗	close to the loop wire and not on line OW probably due to wire distortion.

612060

Coding	Category	Signal/ Noise	$\Delta\%/\Delta^{\circ}$ Q	Remarks
	1	>2	>1	Anomaly well defined, good conductivity.
	2	>2	<1	Anomaly well defined, low to medium conductivity.
	3	<2		Anomaly poorly defined, weak. Quantitative determination not possible.
	Conductivity (σ) x thickness (t) of target conductor.			Marked only if Q can be determined with some certainty and no appreciable overburden distortion is present.
	Subsurface depth (a) to current concentration.			Marked on if a can be determined with sufficient certainty, a is maximum depth, current axis 10-15 m below upper edge of body.
	Reversed current flow.			
Magnetic Correlation				
	Direct Coincidence			
	Magnetic high off-set to right.			
	Magnetic high off-set to left.			
	Spurious Anomalies			Mainly man-made conductors.



T 43 E
T 45 E
T 46 E
T 42 E
T 44 E
T 41 E

T 40 E
T 39 E
T 35 W
T 38 E
T 34 E
T 37 E
T 36 E
T 33 W

T 32 E
T 31 W
T 30 E

T 22 W
T 29 W
T 28 E

T 26 E
T 21 W
T 27 W
T 21 E
T 24 E
T 25 W
T 23 W

T 19 E
T 13 W
T 20 E
T 15 W
T 12 W
T 10 E

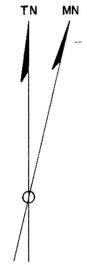
T 09 E
T 09 W
T 07 W
T 08 E

T 07 W
T 06 E

T 05 E
T 03 W
T 04 E
T 05 W
T 04 E

T 02 E
T 01 W

T 00 W
T 00 E



LEGEND

- T 15 W — 158 Flight line showing line number and numbered the points
- Category 1 $\sigma t > 100$ MHOS, signal/noise > 2
- " $2 \cdot 10 \leq \sigma t \leq 100$ MHOS " " > 2
- " $3 \sigma t < 10$ MHOS " " < 2
- ⊗ Spurious anomaly
- 27 Anomaly code number
- 100' Depth to current axis in feet
- C Conductor axis and reference code

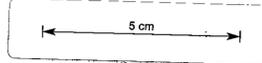
AUSTRALASIAN MINERALS INC.

D'AGUILAR RANGE, QUEENSTOWN
TASMANIA

TURAIR AIRBORNE
ELECTROMAGNETIC SURVEY
FLIGHT PATH AND ANOMALY PLAN

SURVEYED AND COMPILED BY
SCINTREX PTY. LTD.
FEBRUARY 1973

612048



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△ INNES PEAK
TRIG NO 833 2179'

JOB N° T 1035

SHEET 1 OF 1

2147
PLATE 1