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REPORT ON THE COMBINED HELICOPTER MAGNETIC AND ELECTROMAGNETIC SURVEY IN THE MACKINTOSH RIVER AREA TASMANIA FOR PARINGA MINING AND EXPLORATION LIMITED

E.L. 2/70

(20th April 1972)

GENERAL NOTES ON AIRBORNE ELECTROMAGNETIC AND MAGNETIC SYSTEMS

A. EQUIPMENT

The electromagnetic and magnetic units are the primary instruments used in the McPhar combined survey system which is designed for use in a Bell Jet Ranger 206 helicopter. Ancillary equipment consists of a radio altimeter, a frame camera, an intervalometer-fiducial numbering system and a light beam recorder.

I) H-400 Electromagnetic Unit.

The H-400 electromagnetic system is a sequential dual frequency unit 340 Hz and 1070 Hz) that measures the quadrature response of a conductor. In the absence of a conductor the quadrature response is zero. Two iron-cored coils mounted in modified skids of the helicopter are used to create the primary field, which is essentially a forward pointing dipole. A 400 foot cable is used to tow a receiver bird, and gives a transmitter-receiver separation of approximately 300 feet. The dipole of the receiver system is vertical and flown in a position to be maximum coupled to the primary field. The coil configuration can thus be designated as an X-Z skew system,

which is flown In-Line. Sequential dual frequency EM operation is employed, together with time sharing for a proton magnetometer. The operation cycle consists of one third second at each frequency and one third second magnetic readout. The quadrature response of both frequencies is recorded on two channels of the recorder.

II) Proton Magnetometer.

An airborne Barringer proton free-precession magnetometer is used to record the variations in the earth's total magnetic field. The sensing head of this unit is mounted inside a bird towed on 70 feet of cable. In a free-run mode, this instrument has a sensitivity of 1 gamma when pulsed at one second intervals. When used in conjunction with the H-400 electromagnetic system, the magnetometer is pulsed every 1.023 seconds and has a nominal accuracy of plus or minus two gammas. The proton magnetometer reads the absolute value of the earth's magnetic field and is almost completely free of drift or variation due to temperature or environmental changes. The magnetic data is recorded on the same trace as the electromagnetic response, for ease of correlation. The magnetic data is also recorded digitally on film which may later be used for computer processing of the data.

III) Ancillary Equipment.

A Bonzer radar altimeter provides a continuous ground clearance profile. Flight path coverage is obtained by a frame camera driven by the intervalometer-fiducial unit which synchronizes the individual frames with the magnetic and electromagnetic systems. The fiducials are indicated on the recorded analogue charts as vertical bars, every tenth mark being omitted for ease of tabulation. At the standard flying height of 450 feet the camera is programmed to provide approximately 30% overlap on each frame, which results in a continuous record of the flight path. At greater heights, there is proportionally more overlap.

D. DATA RECORDING & COMPILATION.

A light-beam recorder employing photo-sensitive paper is used to record the data. High-sensitivity galvanometers give almost instantaneous response to the incoming signals and the recorder time lag is essentially zero. The recorder normally employed is the Century 444 six channel recorder.

With the actual flight record oriented so that the fiducial numbers increase from left to right, the 3.5 inch trace width has been divided into 100 units with zero at the

bottom and 100 at the top. Fifty horizontal grid lines are used to mark 2 unit intervals. The ten unit intervals are indicated by the thicker grid lines. Except where noted on individual records the traces are identified as follows:

I) 340 Hz and 1070 Hz Quadrature EM Response

The 340 Hz and 1070 Hz quadrature EM responses are the two primary information traces and the background levels are usually centred at 10 and 20 units respectively. Upward excursions represent positive quadrature response, which is normally indicative of the presence of conductors. Negative deflections usually have no interpretational significance.

The electromagnetic responses may be recorded at sensitivity settings of 10 ppt, 20 ppt or 40 ppt as indicated by the local geology and topography. Normally a 10 ppt setting is employed where ppt represents parts per thousand in terms of the primary field strength at the receiver. Anomalies of 2000 ppm or 2 ppt are easily recognised in most conditions. The sensitivity settings are recorded by the operator on the Flight Report and should be noted prior to referring to the actual data strips.

The ratio of the amplitude of the response (low/high) at the two frequencies is characteristic of the "apparent"

conductivity (i.e. size, conductivity-product) of the disturbing body; poor conductors display low to high frequency ratios of 0.7 or less while good to excellent conductors have ratios greater than 1.0.

II) Magnetometer.

The magnitude of the earth's total magnetic field is approximately 62,500 gammas in the Mackintosh River area in Tasmania. The first two digits of the magnetometer reading usually do not vary for any particular area and for this reason they are not recorded on the analog records. In areas where there are magnetic anomalies the last three digits vary continuously. To enable these magnetic variations to be followed on the analog records two traces are recorded. The first trace is the fine scale which has a span of 0 to 99 gammas across the width of the recorder paper. Small magnetic variations (i.e. approximately 100 gammas or less) may be easily followed by this trace. If the deflection of the trace exceeds 100 gammas the trace automatically reappears on the opposite side of the recorder paper. The second trace is the coarse scale which has a span of 0 to 990 gammas across the width of the recorder paper. Large magnetic variations may easily be followed on this trace although it is still necessary

to refer to the fine scale to make accurate measurements from the recording.

III) Fiducials.

Fiducials coincide with the shutter opening of the frame camera and appear as vertical lines across the width of the recorder paper. Every tenth fiducial line has been omitted for ease of tabulation.

IV) Altimeter.

The altimeter scale is non-linear and a calibration scale is recorded periodically on the data strips.

V) Survey Procedure.

Uncontrolled airphoto mosaics usually serve as the base maps for flying the survey and for compilation of the geophysical data. The scale used for this survey was approximately 1200 feet to one inch.

The flight lines are usually oriented perpendicular to the direction of the expected geological strike in the survey area.

Copies of the photo mosaic are given to the flight crew with intended flight lines indicated and numbered. Navigation along these lines is done visually from the physical features of the area. The aircraft is normally flown with a minimum terrain clearance of 450 feet, or in rough terrain, at the lowest altitude feasible for safe operation.

Flight path is recovered from the film as compared to the photo mosaic. Identifiable points are marked on the mosaic and designated by the fiducial numbers which synchronize the camera, recorder and geophysical systems.

C. DATA PRESENTATION.

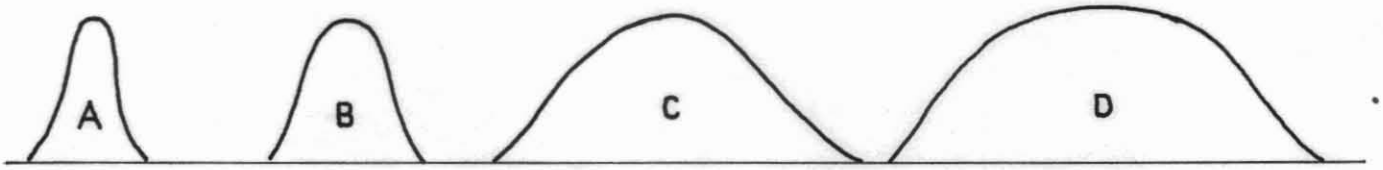
I) H-400 Dual Frequency EM Results.

Electromagnetic anomalies result from electrical conductors located on or below the surface of the ground. Geological sources of conductivity include sulphide mineralization, graphite formations and fault or shear zones which often contain electrolytes. Other sources of conductivity include conductive surface materials such as saline waters, swamps and wet clays. The surface anomalies sometimes extend over large areas and may obscure responses from underlying mineralized zones.

The presentation used for the electromagnetic anomaly maps has been developed to show the three principal characteristics of each individual response. This illustration is accomplished by the numerals and symbols adjacent to each anomaly location. For most purposes these characteristics are sufficient to describe the anomaly but for detailed interpretation it is best to study the actual flight traces.

a) Shape.

The letters A, B, C and D are used to indicate the recorded shape of the EM response which approximates to one of the following curve types. To simplify the presentation, the shape is indicated by symbols as shown in the legend of the anomaly map. The length of the bars either side of the anomaly symbol show the half width of the EM response.



b) Amplitude.

The amplitude of the peak response at 340 Hz is

shown in parts per thousand (ppt). Although various sensitivity settings may be used, resulting in different amounts of deflection on the trace, the amplitude indicated on the map is always in units of parts per thousand.

c) Apparent Conductivity Ratio.

The ratio of the response at 340 Hz compared to the response at 1070 Hz is shown as the third parameter. Generally ratios less than 0.7 indicate poor conductivity while those greater than 1.0 indicate good to excellent conductivity. However, it should be noted that this ratio is a measure of the "apparent conductivity" and varies with the product of the size and conductivity where the size is usually a squared function. The accuracy of the calculated ratio is obviously dependent upon the amplitude of the response, with the reliability decreasing with very small amplitude responses.

d) Evaluation.

The response obtained from a conductive body is influenced by a number of factors which include conductivity, permeability, size, depth and attitude of the body. In addition to the frequencies used, geometry and the angle of flight intersection are also important variables. Consequently, the amplitude and shape of the response cannot be regarded as

absolute interpretational gradings or classifications. However, the parameters do have interpretational value as illustrated in the following examples.

i) A vertical sheet of highly conductive material (such as a vein of massive sulphides) striking perpendicular to the flight line, would give rise to a strong, sharp response with a high conductivity ratio. A typical characteristic would be: A, 15, 1.8.

ii) As the angle of flight intersection decreased, the shape of the response from a vertical sheet would change from type A to type B or even type C; the amplitude of response could increase while the ratio may decrease i.e. C, 20, 1.2.

iii) An extensive flat horizontal sheet will show a response similar to type D. The amplitude and ratio will be a function of the size-conductivity product and can vary over a wide range. A typical response from poorly conductive overburden would be: D, 20, 0.4.

Because of the large number of parameters that influence EM response, the anomalies obtained from airborne surveys should be evaluated taking into account all geological,

geophysical and physiographical data before embarking on field investigations and follow-up work.

II) Magnetic Results.

In the standard presentation of the combined electromagnetic and magnetic survey results, the location and amplitude of magnetic highs which appear to be related to electromagnetic features are indicated on the map as illustrated in the legend. This illustration is in the form of a cross line which indicates the location of the peak (direct correlation or flank correlation) and the value of the amplitude of the response in gammas is noted.

In some cases, it may be of assistance to present all the magnetic data in stacked profile or contour form.

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REPORT ON THE

COMBINED HELICOPTER MAGNETIC AND

ELECTROMAGNETIC SURVEY

IN THE

MACKINTOSH RIVER AREA

TASMANIA

FOR

PARINGA MINING AND EXPLORATION LIMITED

20th April 1972.

1) INTRODUCTION.

At the request of Dr. S.M. Richards of Cominco Exploration Pty. Ltd. acting on behalf of Paringa Mining and Exploration Limited, the McPhar H-400 helicopter electromagnetic system and ancillary equipment was mobilized from Canada. The geophysical equipment was used to map anomalous electromagnetic and/or magnetic responses which might be indicative of the presence of concentrated sulphide mineral deposits. At the completion of the survey in Tasmania, the equipment was returned to Canada.

The helicopter, a Bell Jet Ranger (206) was leased from Bristow Helicopters Pty. Ltd. in Perth. This company has previous experience in geophysical surveying using helicopters. The equipment was installed at Parafield airport, S.A., and the required approvals from the Department of Civil Aviation were obtained. Test flights were made in the Adelaide hills area to check the geophysical system and to familiarize the pilot with the flying techniques. Once the equipment tests were finalised floats were fitted to the helicopter for the ferry across Bass Strait. The electromagnetic transmitting coils, which are mounted in modified skid gear, were refitted in Wynyard, Tasmania.

The survey commenced on 10th February 1972 and was completed on 23rd February 1972. Five days were lost due to bad weather or low cloud. Also the loss of an EM bird and tow cable further delayed the survey by two days. While flying operations were under way, the survey party stayed at Tullah, as this is the closest township to the survey area.

2) SURVEY DETAILS.

A flight line spacing of 1000 feet was maintained wherever possible. The flight line direction was north west or south east. A minimum terrain clearance of 450 feet was maintained except in areas where the terrain was mountainous. It was not possible to maintain an operative forward aircraft speed while climbing out of some of the valleys, thus for safety reasons some of the area was flown at altitudes in excess of 500 feet. This problem was discussed with the client who agreed that the survey should proceed using safest minimum flying altitude.

The principal area to be surveyed formed part of EL 2/70 and covered the Cambrian rocks as outlined on the Mackintosh Map Sheet, Geological Survey of Tasmania. The flight lines were not flown in consecutive order but were initially flown in the relatively flat areas and progressing into the mountainous country.

A photomosaic of the area was prepared by Air Photos Pty. Ltd. of Melbourne. The photography used was purchased from the Lands Department in Tasmania. Most of the area had been photographed in 1971 and although this is low altitude RC5 photography it was felt that the detail would be far superior to the 1954 RC9 coverage.

It became evident during the flying of the survey that the technique used to lay the mosaic was unsatisfactory. Errors of up to 2000 feet in the placement of individual photographs were found, making flight navigation extremely difficult. For accurate flight path recovery and data presentation it was necessary to relay the mosaic and have a new set of screen transparencies prepared.

The instrumentation employed in carrying out this survey is described in the notes attached to this report.

3) PRESENTATION OF RESULTS.

The results of the combined magnetic and electromagnetic survey are shown on the accompanying maps AEM72/005, AEM72/006, AEM72/007 and AEM72/008. The scale of these maps is approximately 1200 feet to one inch and the direction of north as shown is approximate only, as the photomosaics are uncontrolled. The symbols used to present electromagnetic and magnetic anomaly coincidence are described in the notes attached to this report and as indicated in the map legend. The sheet index shows the relative position of the four maps. Where possible line to line correlation of the electromagnetic anomalies has been shown and anomalous zones of particular interest have been marked with an asterisk.

In a number of areas, where the photomosaic joins are poor, flight lines appear to bend sharply. In actual fact, the aircraft remained on a constant heading but the subsequent flight path recovery on the photomosaic shows this as a change in the aircraft's heading.

Because of these photomosaic errors it was difficult to navigate the survey accurately and a constant flight line spacing of 1000 feet was found to be impossible. This problem was discussed with the client before commencing the survey.

As the forward speed of a helicopter can vary greatly, flying up and down hills, the number of recovered points has been increased to eliminate possible positioning errors.

The variations in the terrain clearance limits the effectiveness of the magnetometer. Anomalies evident at low altitude become smoothed and less predominant as the altitude increases. For this reason a contour presentation of the magnetic data from this survey would not be a true representation of the magnetic intensity. However, there is sufficient detail in the magnetic relief to warrant a stacked profile presentation of the magnetic data. On the accompanying maps, magnetic highs are only shown when they coincide with an electromagnetic anomaly.

DISCUSSION OF RESULTS.

A) INTRODUCTION.

The geological information for the area has been taken from the Mackintosh 1 mile series Geological Survey of Tasmania, Sheet 44, published in 1966. In the following discussion of the anomalous electromagnetic zones, the geological environment has been noted.

Where there is an obvious line to line correlation between EM anomalies, a conductor axis has been shown. These zones have been divided into three categories which are as follows:

(1) Definite Conductor. A conducting axis with EM anomalies above average for the area and with obvious line to line correlation.

(2) Probable Conductor. A conducting axis with average EM anomalies and perhaps having limited strike length.

(3) Possible Conductor. A conducting axis with generally poor EM responses possibly due to swamp etc.

There are a number of isolated EM anomalies which only appear on one flight line. These anomalies in a number of cases are supported by a coincident magnetic response and although they are not evident on adjoining flight lines, form a conducting zone warranting investigation on the ground.

B) GENERAL DISCUSSION.

The parameters noted for each EM anomaly are the amplitude of the low frequency EM response, the conductivity ratio (the ratio between the low frequency response and the

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high frequency response) and an anomaly classification. For this survey typical EM responses were less than 10 ppt. Values of the conductivity ratio, which is the more important parameter, were generally less than 1.0.

During the early stages of the survey an EM anomaly was located on the southeast end of Line 89. As it was evident to the operator that it was not going to be possible to maintain 450 feet altitude over the mountainous country, altitude tests were conducted over this anomaly. The results show that at 700 feet the amplitude of the anomaly is reduced to the noise level of the system. The important result derived from these tests is that although the amplitude of the anomaly was reduced, the conductivity ratio remained the same. Therefore, in the interpretation and the discussion of specific anomalies no correction was made for altitude variations. However, where it was felt that altitude variations were significant it has been noted.

C) INTERPRETATION.

ZONE 1 (Sheet 1)

This definite conductivity zone consists of an "A" and "D" category anomaly flanked to the north by a 90 gamma magnetic high and is located in Cambrian acid rocks (Cp). The

conductivity ratio (1.0) for the "A" category anomaly is excellent. This zone warrants following up on the ground.

ZONE 2 (Sheet 1)

This zone consists of four broad low category anomalies forming a possible conductor located in tertiary basalt (Tb). The strike direction of this zone parallels the trend of a flanking magnetic low. Ground follow-up of Zone 2 should be of low priority as the possible source of the zone is a surface conductor.

ZONE 3 (Sheet 1)

This zone has been mapped as a probable conductor in the vicinity of Line 53A and Line 54A with a possible extension to Line 52A and Line 51A. The zone is located in Cambrian sediments (Cms). The anomalies are all "D" category and the conductivity ratios are poor. The zone may be associated with a swamp and ground follow-up is not recommended.

ZONE 4 (Sheet 1)

This probable zone has anomalies with average conductivity ratios located in Cambrian rocks (Cp). The "B" category anomaly on Line 53A warrants following up on the ground.

ZONE 5 (Sheet 1)

This isolated "A" category anomaly in the tertiary basalt (Tb) correlates with a 30 gamma magnetic high. Although the amplitude of the EM response is small, 2 ppt, the conductivity ratio is excellent. The source of this anomaly should be located in the ground.

ZONE 6 (Sheet 1)

Zone 6 is an isolated EM anomaly correlating with a 20 gamma magnetic high in rocks of a similar type to Zone 5. The measured conductivity ratio of 2.0 may in part be due to signal noise. However, this zone should be followed up on the ground.

ZONE 7 (Sheet 1)

Zone 7 is an isolated "B" category anomaly, also in tertiary basalts (Tb), on Line 72A which correlates with a 30 gamma magnetic anomaly. The amplitude of the EM response of this anomaly is small, but the conductivity ratio (1.0) is good. Ground follow-up is warranted, although it should be of low priority.

ZONE 8 (Sheet 1)

This isolated "A" category anomaly on Line 43A does not correlate with any magnetic feature. However, it is located

in the Cambrian porphyries (Cp) and should be investigated to check the source of the anomalous response.

ZONE 9 (Sheet 2)

This probable conductivity zone consists of two "B" category anomalies on Line 97 and Line 98 located in an area of alluvium cover almost certainly overlying the Cambrian porphyries (Cp). The poor conductivity ratios together with the small amplitude of the EM responses suggests that ground follow-up should be of low priority.

ZONE 10 (Sheet 2)

This probable conductivity zone, with a possible extension to Line 96, has only average conductivity ratios. The zone is located in an area of alluvial cover overlying Cambrian porphyries (Cp) and Precambrian pelitic rocks (pCp). Ground follow-up should be of low priority.

ZONE 11 (Sheet 2)

The definite conductivity zone extents from Line 91 to Line 86. The position of Line 90 has been checked in the vicinity of this zone and there is no doubt as to its

position. As no anomaly was recorded on Line 90, the extension of the conductivity axis to Line 91 may be questionable. The zone is located in an area of periglacial cover (Qg) overlying Pelitic Precambrian rocks (pCp).

Zone 11 has been extended to the south as a probable conductor, intersecting Line 82 and Line 84. Both anomalies were recorded outside the proposed survey area, however it was felt that as their position was known they warranted plotting on the map. The important feature of this southern extension is that the two anomalies correlate with a magnetic high with the same geological strike direction. This coincidence is not the case with the northern section of this zone.

Ground follow-up should take high priority to map the full extent of this zone, especially to the south where it correlates with a magnetic response.

ZONE 12 (Sheet 2)

This possible conducting zone consists of two "D" category anomalies with average conductivity ratios located in an area of alluvial cover almost certainly overlying Cambrian acid rocks (Cp).

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The anomaly on Line 95 correlates with a 16 gamma magnetic high, warranting further investigation.

NOTE.

To this stage in the interpretation all of the zones discussed were recorded at an altitude of approximately 450 feet or less. No correction has been necessary to assess the relative merits of each zone. However, for Zone 13 and Zone 14, the altimeter traces show that the aircraft altitude was changing rapidly while flying these lines. As mentioned earlier, this variation will affect the amplitude and possibly the classification of the individual anomalies. For the following two zones, had it been possible to maintain a constant altitude, the results would almost definitely have been up-graded.

ZONE 13 (Sheet 3)

This isolated "B" category anomaly is on the northern side of a ridge and appears to be on the contact between the Precambrian Pelitic rocks (pCp) and the Cambrian porphyries (Cp). The anomaly correlates with a 100 gamma magnetic high. The source of this zone should be located and investigated by ground follow-up.

ZONE 14 (Sheet 3)

Zone 14 is an isolated "A" category anomaly located in Precambrian Pelitic rocks (pCp). Unfortunately when the screen transparency was prepared this portion of the map was not shown. However, fiducial 286 has been located on a small lake or swamp which is shown as a cultural detail. The classification, the amplitude of the EM response and the conductivity ratio for this anomaly are excellent. Correlating with the anomaly is a 15 gamma magnetic high. The source of this anomaly should definitely be determined.

ZONE 15 (Sheet 4)

Zone 15 is a possible conductivity zone consisting of two "D" category anomalies located in alluvial swamps overlying Gordon limestones (Og). Ground follow-up is not recommended.

ZONE 16 (Sheet 4)

This probable conductivity zone consists of two "B" category anomalies with excellent conductivity ratios. It is located in alluvial swamps overlying Gordon limestones (Og).

ZONE 17 (Sheet 4)

Zone 17 is a possible conductivity zone located in an area of above average background response. The source of the responses probably is a surface conductivity change. Ground follow-up should be of low priority.

D) FURTHER RECOMMENDATIONS.

Throughout the area survey there are a number of isolated EM anomalies which have not been discussed. Some of these anomalies have good conductivity ratios and correlate with magnetic anomalies (i.e. Sheet 1 Line 58A fiducial 2208 Line 61A 2920 Sheet 4 Line 32 fiducial 3477 Line 12 fiducial 849). These anomalies should be followed up if the results from similar anomalies are encouraging.

CONCLUSIONS AND RECOMMENDATIONS.

Seventeen zones of anomalous electromagnetic response have been mapped from the results of the helicopter magnetic and electromagnetic survey. The most prominent conductivity zone is Zone 11. In the classification of the results this zone has been used as a yard stick. Depending upon the results of the initial ground follow-up and as more geological information becomes available, it may be necessary to re-evaluate the other anomalous responses for possible sources of economic metallic mineralisation.

It is possible that some of the electromagnetic anomalies recorded are due to highly conductive or saline regions lying within the weathered surface zone.

It is recommended that initial ground follow-up include geochemistry, electromagnetics and magnetics. Interesting areas should then be covered with Induced Polarization by which it is possible to distinguish between electronic conductors such as metallic sulphide and ionic conductors. Such follow-up work is essential to properly locate and identify airborne geophysical anomalies on the ground.

McPHAR GEOPHYSICS PTY. LTD.

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MACKINTOSH

Geological Survey of Tasmania
Department of Mines—Hobart

GEOLOGICAL ATLAS 1 MILE SERIES
8014-N-1S IV - ZONE 7 SHEET NO. 44

FIRST EDITION 1966 T.I. 63360

REFERENCE

Alluvium and swamp deposits
River terrace sediments
Talus deposits of basalt (Qtb), dolerite (Qtd), sandstone (Qts), porphyry (Qtp)
Moraine — Qg includes periglacial deposits
Fluvioglacial deposits
Siliceous conglomerate, grit & occasional fossiliferous sandstone and clay
Unconformity
Sandstone and shale (Ferntree Group)
Mt. Inglis Sandstone
Warrenfall Valley Siltstone
Benson Peak Sandstone
Cradle Cirque Siltstone
Lake Holmes Coal Measures
Lake Will Pebbly Siltstone
Barn Bluff Conglomerate
Bluff River Pebbly Siltstone
Unconformity
Siltstone (Dau Austral Creek Siltstone)
Quartzite (Dk Keel Quartzite)
Fossiliferous shale (Du Amber Slate)
Quartzite (Dcr Crotty Quartzite)
Gordon Limestone
Correlate of Owen Conglomerate; sequences of predominantly quartz sandstone (Oos) or Siliceous conglomerate (Ooc) indicated
Conglomerate, including pebbles of Cambrian porphyries
Undifferentiated Ordovician - Silurian siltstone and sandstone
Unconformity
Mudstone and slate with sandstone (s)
Mudstone, quartzite and greywacke sequence with conglomerate (c) horizons and thicker mudstone (m) layers indicated
Greywacke and mudstone sequence of the Hatfield River
Greywacke conglomerate - sandstone and mudstone sequence
Limestone conglomerate
Mudstone and greywacke sequence of the Coldstream River with bedded limestone localities indicated (l)
Undifferentiated igneous and sedimentary rocks
Unconformity
Shales, siliceous sandstone - siltstone
Quartzite and platy quartzite with subordinate pelitic layers
Pelitic sequence of phyllite and micaceous schist with subordinate quartzite

Igneous Rocks

TERTIARY Basalt
JURASSIC Dolerite
DEVONIAN Granite
CAMBRIAN Predominantly quartz and quartz felspar porphyries. Occasionally with flow banding (€pf), sedimentary inclusions (€ps) porphyry inclusions (€pi)

Geological boundary — observed
Geological boundary — position approximate
Geological boundary — inferred
Geological boundary — observed and concealed
Geological boundary — aerphoto interpretation
Aerphoto lineation
Strike and dip of beds — tops known, overturned
Vertical and horizontal bedding
Strike and dip of beds — tops unknown
Strike and dip of banding in gneissic rocks, vertical banding
Dip slope
Direction
Strike and dip of dyke
Minor fold, direction and plunge (note kink bands on inset)
Fault, inverted (downthrown side indicated)
Fault — position approximate (downthrown side indicated)
Fault — position inferred (downthrown side indicated) and concealed
Shatter zone
Strike and dip of cleavage; vertical cleavage
Strike and dip of joint; vertical joint
Landslip
Mineralogical locality
Fossil locality
Mine or prospect
Mineralisation (pyrite, galena, tetrahedrite)

Schistose structures in Lower Palaeozoic rocks of N.E. quadrant

Strike and dip of earlier, and probably earlier schistosity and cleavage, vertical schistosity and cleavage
Strike and dip of later, and probably later schistosity and cleavage; vertical schistosity and cleavage

Structures in Precambrian rocks

S_1 Strike and dip of platy parting, partly bedding in quartzitic layers and lithological banding in pelitic rocks, vertical S_1
S_2 Strike and dip of axial slip cleavage in quartzitic layers and transposition surface in pelitic rocks believed equivalent, vertical S_2
S_3 Strike and dip of closely spaced planes in quartzitic layers and schistosity in pelitic rocks believed possible equivalent, vertical S_3
Strike and dip of unidentified surfaces; vertical surfaces
L_1 Direction and plunge of early lineation in quartzitic layers and intersection of S_1 & S_2 in pelitic rocks, associated with minerals of retention
L_2 Direction and plunge of intersection S_1 and S_2 & S_2
L_3 Direction and plunge of strong crenulation, mineral linear in quartzitic rocks. Crenulation lineation on S_3 in pelitic rocks with axial plane dip indicated where known
L_4 Crenulation lineation on S_4 in pelitic rocks with axial plane dip indicated where known
Direction and plunge of earliest minor folds associated with L_1
Direction and plunge of later minor folds associated with an omitted crenulation
Direction and plunge of later minor folds associated with L_3
Direction and plunge of latest minor folds associated with L_4

RED OUTLINE COVERS AREA FLOWN.

SCALE 1 MILE TO 1 INCH

CONTOUR INTERVAL 25 FEET

Crown Copyright

5 cm

ADJOINING SHEETS

RALPH	ST. VALENTINES	SHEFFIELD
STORMS	MACKINTOSH	MOORES
HERON	MURCHISON	BECKMAN

Geological Responsibility Diagram
Initials of Geologists responsible for information given in areas indicated

Geology by C. M. Barton, B.Sc. Ph.D. F.G.S. & D. Burns B.Sc. (Hons.) Ph.D. F.G.S. (Hons.) A.R.C.S. (Lond.) F. Jennings B.Sc. (Hons.) M. I. Longman B.Sc. A.M.I.E.E. I. Morse B.Sc. Ph.D. A.R.C.S. F.G.S. W. L. Mottershead B.Sc. W. A. Moore B.A. (Hons. Tas., Hons.) B.Sc. (Hons.) Y. M. Threader B.Sc. G. Unwin B.Sc. with acknowledgments to C. Brooks B.Sc. (Hons.) (University of Tasmania) and Rio Tinto Australian Exploration Pty. Ltd.

Base map compiled from 6" Photos on 1 inch manuscripts produced by the Lands and Surveys Department, Hobart.
Geological Map production by the Drawing Office, Department of Mines, Hobart.
E. Williams B.Sc. Ph.D. F.G.S. Senior Geologist in charge of Regional Mapping.
J. B. Jennings B.Sc. (Hons.) Chief Geologist.
Compiled under the direction of J. G. Symons, B.E. Director of Mines.
Issued under the authority of the Honourable Eric E. Reece, Minister for Mines.
Tasmania 1966

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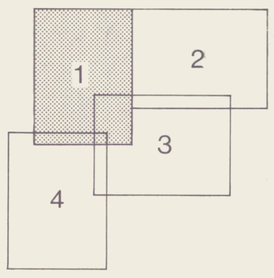
McPHAR GEOPHYSICS PTY. LTD.

LOCALITY MAP

SHEET INDEX



PARINGA MINING AND EXPLORATION LTD.

MACKINTOSH RIVER AREA

TASMANIA

AIRBORNE ELECTROMAGNETIC ANOMALY MAP

5 cm

SCALE (APPROX.)

FEET 1000 0 1000 3000 5000 FEET

E.M. CLASSIFICATIONS

A
B
C
D

SYMBOLS SHOW LENGTH, SHAPE AND PEAK OF ANOMALY
340 Hz AMPLITUDE
ANOMALY SHAPE — 3,0.8
RATIO – 340/1070 Hz

MAGNETIC CORRELATION

DIRECT CORRELATION — 80
FLANK CORRELATION — 80 / LOW
FIDUCIAL MARK — X 2150

CONDUCTOR AXIS

DEFINITE
PROBABLE
POSSIBLE

McPHAR

NOTE: This Helicopter electromagnetic and magnetometer survey was flown maintaining wherever possible an average terrain clearance of 450 feet

The following geophysical equipment was installed in a Bell Jet Ranger 206:
(1) A McPhar H-400 Electromagnetic System
(2) A Barringer Proton Precession magnetometer

The Survey was conducted in February 1972

DRAWN: J.R.G. & R.D.N.
DATE: MARCH '72
APPROVED: A.C.S.

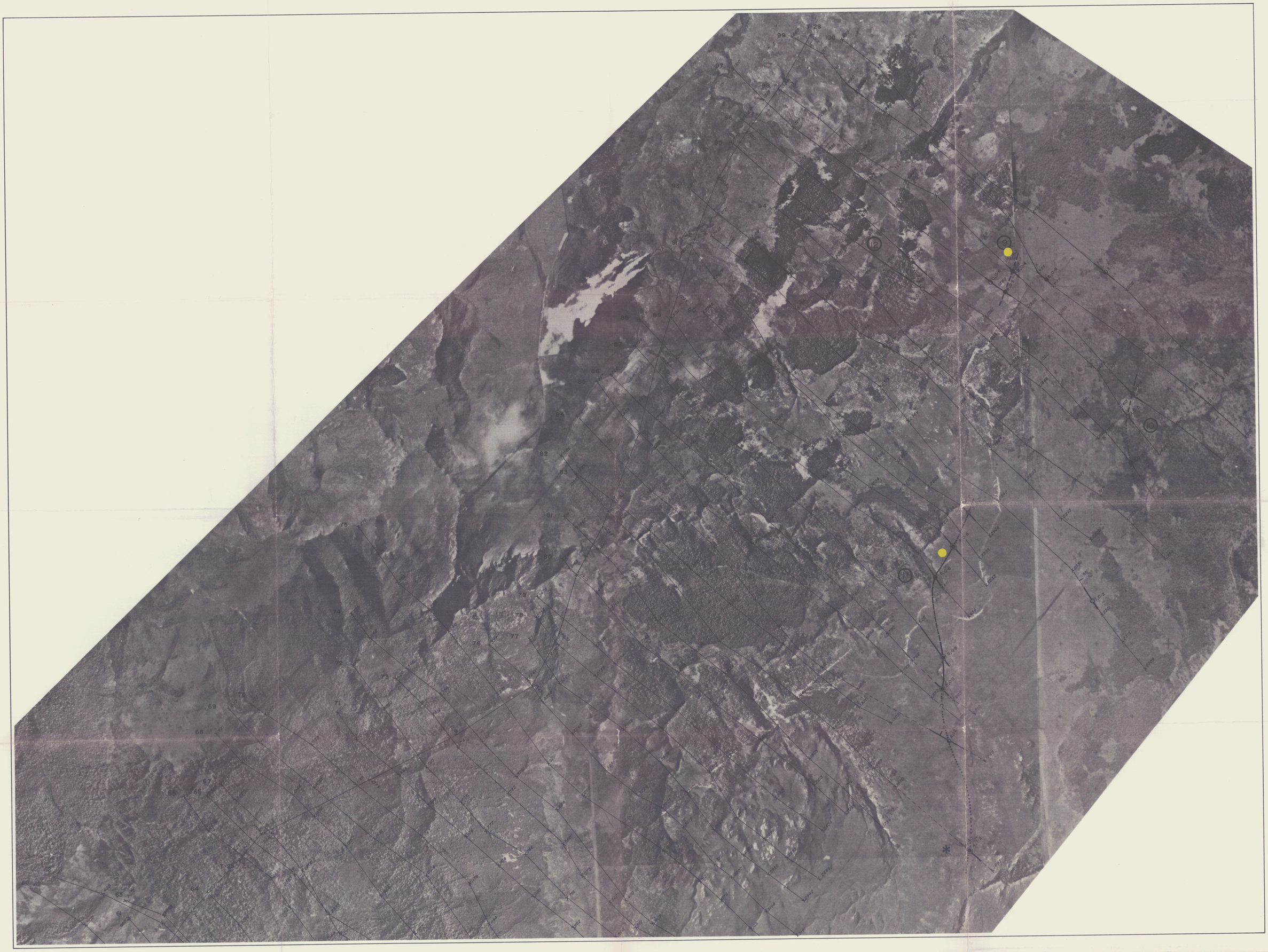
DATE: APRIL '72

72-863

766030
002

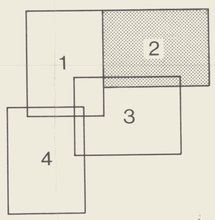
DWG: AEM 72/005A

McPHAR GEOPHYSICS PTY. LTD.



LOCALITY MAP

SHEET INDEX



PARINGA MINING AND EXPLORATION LTD.

MACKINTOSH RIVER AREA

TASMANIA

AIRBORNE ELECTROMAGNETIC ANOMALY MAP

SCALE (APPROX.)

FEET 1000 0 1000 3000 5000 FEET

5 cm

E.M. CLASSIFICATIONS

A — SYMBOLS SHOW LENGTH, SHAPE
B — AND PEAK OF ANOMALY
C — 340 Hz AMPLITUDE — ANOMALY SHAPE — 3,0.8
D — RATIO – 340/1070 Hz

MAGNETIC CORRELATION

DIRECT CORRELATION — 80

FLANK CORRELATION — 80 — LOW

FIDUCIAL MARK — X 2150

CONDUCTOR AXIS

DEFINITE
PROBABLE
POSSIBLE

McPHAR

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(2) A Barringer Proton Precession magnetometer

The Survey was conducted in February 1972

766031

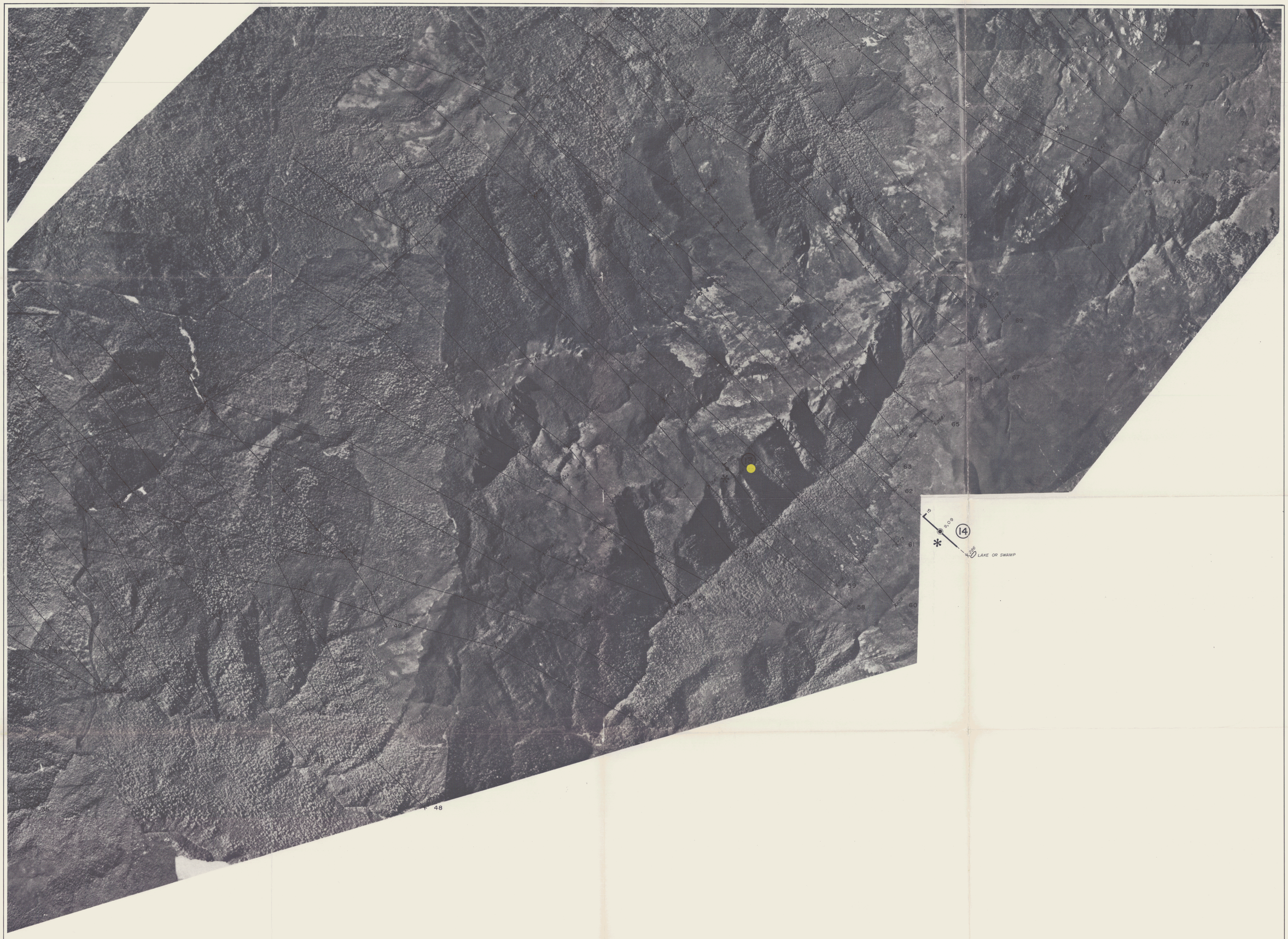
DRAWN: J.R.G. & R.D.N.
DATE: MARCH '72
APPROVED: J.C.S.

DATE: APRIL '72

72-863 003

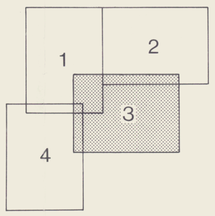
DWG: AEM 72/006A

McPHAR GEOPHYSICS PTY. LTD.



LOCALITY MAP

SHEET INDEX



PARINGA MINING AND EXPLORATION LTD.

MACKINTOSH RIVER AREA

TASMANIA

AIRBORNE ELECTROMAGNETIC ANOMALY MAP

SCALE (APPROX.)

FEET 1000 0 1000 5000 5000 FEET

5 cm

E.M. CLASSIFICATIONS

A — SYMBOLS SHOW LENGTH, SHAPE
B — AND PEAK OF ANOMALY
C — 340 Hz AMPLITUDE / ANOMALY SHAPE (3,0,8)
D — RATIO – 340/1070 Hz

MAGNETIC CORRELATION

DIRECT CORRELATION — 80
FLANK CORRELATION — 80 / LOW
FIDUCIAL MARK — X 0150

CONDUCTOR AXIS

DEFINITE
PROBABLE
POSSIBLE

McPHAR

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(2) A Barringer Proton Precession magnetometer

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DRAWN: J.R.G. & R.D.N.
DATE: MARCH '72
APPROVED: J.C.S.
766632
DATE: APRIL '72

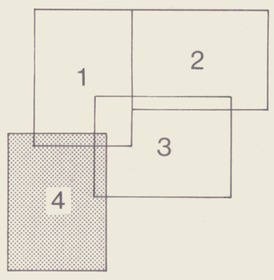
72-863 004

DWG. A.E.M. 72/007A

McPHAR GEOPHYSICS PTY. LTD.

LOCALITY MAP

SHEET INDEX



PARINGA MINING AND EXPLORATION LTD.

MACKINTOSH RIVER AREA

TASMANIA

AIRBORNE ELECTROMAGNETIC ANOMALY MAP

5 cm

SCALE (APPROX.)

FEET 1000 0 1000 3000 5000 FEET

E.M. CLASSIFICATIONS

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B — AND PEAK OF ANOMALY
C — 340 Hz AMPLITUDE
D — ANOMALY SHAPE — 3,0.8
RATIO – 340/1070 Hz

MAGNETIC CORRELATION

DIRECT CORRELATION — 80
FLANK CORRELATION — 80
LOW
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CONDUCTOR AXIS

DEFINITE
PROBABLE
POSSIBLE

McPHAR

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The Survey was conducted in February 1972

766033

DRAWN: J.R.G. & R.D.N.
DATE: MARCH '72
APPROVED: J.C.S.

DATE: APRIL '72

72-863

005

DWG: AEM 72/008A