

# Open File Envelope

NUMBER 399

OEL 28

OFFICER BASIN

1964-1965 GILES AEROMAGNETIC SURVEY

REPORTS FOR THE PERIOD 17/9/64 TO 12/10/65

Submitted by

Exoil Pty Ltd  
1965

© 6/2/98

**MINES and ENERGY**  
**RESOURCES** SOUTH  
AUSTRALIA



This report was supplied as part of the requirement to hold a mineral or petroleum exploration tenement in the State of South Australia.

MESA accepts no responsibility for statements made,

or conclusions drawn, in the report or for the quality of text or drawings.

All rights reserved under the copyright. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without the written permission of

Mines and Energy Resources South Australia, PO Box 151, Eastwood, SA 5063

**Enquiries: Customer Services**

Mines and Energy Resources South Australia  
191 Greenhill Road, Parkside 5063

Library

Telephone: (08) 8274 7522

General Enquiries

Telephone: (08) 8274 7500

Facsimile: (08) 8272 7597

## ENVELOPE 399

**TENEMENT:** OEL 28; Officer Basin

**TENEMENT HOLDER:** Exoil Pty Ltd

### CONTENTS

|                    |                                                                                                                                                                                                                                                                        |                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| <b>REPORT:</b>     | <b>Chambers, S.S., 1964.</b> Application for [Petroleum Search Subsidy Act 1959-1964] subsidy, Giles Aeromagnetic Survey, OEL 28, South Australia (Exoil Pty Ltd submission to Commonwealth Department of National Development, Bureau of Mineral Resources, 17/9/64). | <b>MESA NO.</b><br><b>399 R 1</b><br>Pgs 3-52B |
| <b>PLANS</b>       | <b>Scale</b>                                                                                                                                                                                                                                                           |                                                |
| Exhibit 2          | Regional geology.                                                                                                                                                                                                                                                      | 399-1                                          |
| Exhibit 4          | Condensed profile, seismic line "A".                                                                                                                                                                                                                                   | 399-2                                          |
| Exhibit 5          | Condensed profile, seismic line "B".                                                                                                                                                                                                                                   | 399-3                                          |
| Exhibit 6          | Gravity and magnetic profiles along 131 degrees meridian of longitude.                                                                                                                                                                                                 | 399-4                                          |
| <br><b>REPORT:</b> | <br><b>Adastra Hunting Geophysics Pty Ltd, 1965.</b> Final operations report, [Giles] Airborne Magnetometer Survey, eastern Officer Basin OEL 28, South Australia (contractor's report for Exoil, 26/10 - 22/12/64 and 14/1 - 17/4/65).                                | <br><b>399 R 2</b><br>Pgs 53-57                |
| <b>APPENDIX:</b>   | Index to flight lines and tie lines.                                                                                                                                                                                                                                   | Pgs 58-78                                      |
| <b>PLANS</b>       | <b>Scale</b>                                                                                                                                                                                                                                                           |                                                |
| Plate 1            | Locality map.                                                                                                                                                                                                                                                          | Pg. 79                                         |
| Plate 2            | Least squares adjustment of magnetic closure errors and distribution of residual error.                                                                                                                                                                                | 399-5                                          |
| Plate 3            | Specimen aeromagnetic profile with annotations.                                                                                                                                                                                                                        | Pg. 80                                         |
| Plate 4            | Specimen radio altimeter profile with annotations.                                                                                                                                                                                                                     | Pg. 81                                         |
| Plate 5            | Specimen storm monitor profile.                                                                                                                                                                                                                                        | Pg. 82                                         |
| Plate 6            | Specimen 35mm film strip.                                                                                                                                                                                                                                              | Pg. 83                                         |
| Plate 7            | Diagram of flight pattern.                                                                                                                                                                                                                                             | Pg. 84                                         |
| Plate 8            | Base maps and mosaic coverage.                                                                                                                                                                                                                                         | Pg. 85                                         |
| <br><b>REPORT:</b> | <br><b>Steenland, N.C., 1965.</b> Interpretation report, Giles Aeromagnetic Survey, eastern Officer Basin, SA (Geophysical Associates Pty Ltd consultant's report for Exoil, 12/10/65).                                                                                | <br><b>399 R 3</b><br>Pgs 86-113               |
| <b>PLANS</b>       | <b>Scale</b>                                                                                                                                                                                                                                                           |                                                |
| Encls 1-4          | Observed magnetic field contours:                                                                                                                                                                                                                                      |                                                |
|                    | Sheet 1.                                                                                                                                                                                                                                                               | 399-6                                          |
|                    | Sheet 2.                                                                                                                                                                                                                                                               | 399-7                                          |
|                    | Sheet 3.                                                                                                                                                                                                                                                               | 399-8                                          |
|                    | Sheet 4.                                                                                                                                                                                                                                                               | 399-9                                          |
| Encls 5-8          | Magnetic basement depth contours:                                                                                                                                                                                                                                      |                                                |
|                    | Sheet 1.                                                                                                                                                                                                                                                               | 399-10                                         |
|                    | Sheet 2.                                                                                                                                                                                                                                                               | 399-11                                         |
|                    | Sheet 3.                                                                                                                                                                                                                                                               | 399-12                                         |
|                    | Sheet 4.                                                                                                                                                                                                                                                               | 399-13                                         |

### END OF CONTENTS

E X O I L . P T Y . . L T D .

APPLICATION FOR SUBSIDY

GILES AEROMAGNETIC SURVEY

O . E . L . 28 , SOUTH AUSTRALIA

Mines & Energy SA

R96/00713



00130975

SR 11/5/29  
Envelope 399

000003

EX O I L P T Y . L T D .  
(Incorporated in Western Australia)

REGISTERED OFFICE:  
2nd Floor, T. & G. Building  
137 Queen Street, BRISBANE.  
AUSTRALIA.

17th September, 1964.

The Secretary,  
Department of National Development,  
Bureau of Mineral Resources,  
P. O. Box 378,  
CANBERRA CITY.  
A. C. T.

Dear Sir,

Petroleum Search Subsidy Act, 1959-1964  
Application for Subsidy - Giles Aeromagnetic  
Survey, O.E.L.28, South Australia.

Application is hereby made under Section 7 of the Petroleum Search Subsidy Act 1959-1964 for grant of subsidy for an airborne magnetometer geophysical survey to be conducted in Oil Exploration Licence No. 28, South Australia.

In support of our application, the following information is submitted, as required under the provisions of the Act: the supplementing Memorandum of Administrative Procedure relating to Geophysical Surveys, and Appendix 6, Airborne Magnetic Surveys:

- A. As operator, the applicant is EXOIL PROPRIETARY LIMITED incorporated under the laws of the State of Western Australia with office C/- Messrs. Hiley, Jarrott and Doggett, 137 Queen Street, Brisbane, Queensland, and whose registered office in South Australia is C/- Messrs. Spry, Walker & Co., 20 Grenfell Street, Adelaide.

The applicant's technical office address is 1st floor, Perry House, Elizabeth and Albert Streets, Brisbane, Queensland. The person to whom all communications in respect of the operation should be forwarded is S. S. Chambers, Chief Geophysicist of the same address, telephone number 2 3914, telegraphic address "Exoil".

The Secretary,  
Department of National Development.

- B. An audited balance sheet and statement from the Company's Secretary that funds are available for the full performance of the operation are attached (Attachment No. 1). Funds available for the proposed geophysical survey are not less than Sixty Thousand Pounds (£60,000).
  - C. Attached hereto is a detailed summary of Oil Exploration Licence No. 28 which includes the area to be surveyed (Attachment No. 2).
  - D. The location of the proposed aeromagnetic survey is shown on the attached plan marked Figure I. A detailed description of the flight pattern and number of line-miles is shown in Schedule "A", Attachment No. 3.
  - E. A "Form of Contract" with Adastra Hunting Geophysics Pty. Ltd. for flying, full reduction and fairline drafting is attached (Attachment No. 3).
  - F. A "Form of Contract" with Geophysical Associates Pty. Ltd. for the interpretation of results and presentation of the final report is attached (Attachment No. 4).
- We hereby state that the programme, as set out in this application, will be undertaken.
- G. A Lockheed Hudson aircraft will be employed for this survey using survey instruments as described in Section 2.7 of the contract with Adastra Hunting Geophysics Pty. Ltd. (see Attachment No. 3). No additional equipment will be furnished by Exoil Pty. Ltd..
  - H. A detailed cost estimate for the survey is attached (Attachment No. 5).
  - I. A summary of the proposed survey, together with an estimated timetable for its various phases is attached (Attachment No. 6).
  - J. A detailed schedule of personnel to be employed is included in Section 2.12 of Attachment No. 3.

The Secretary,  
Department of National Development,

- K. A detailed schedule of techniques to be employed is attached (Attachment No. 7).
- L. A discussion of the survey objectives, contribution to oil search in Australia, regional geology and existing geophysical data is attached with the exhibits listed (Attachments Nos. 8, 9 and 10).
- M. The Company agrees to present progress reports and final reports in accordance with the requirements set out in Appendix 6 - Airborne Magnetic Surveys - accompanying Memorandum of Administrative Procedure relating to Geophysical Surveys, the Petroleum Search Subsidy Act, 1959-1964.
- N. Attached hereto, in addition to Figure I and Schedules "A", "B", "C", "D" of Attachment 3, are the following illustrations:

Exhibit 1: Block diagram of the survey area showing Military 4-Mile Sheets, Base Maps and Method of Navigation.

Exhibit 2: Regional Geology.

Exhibit 3: Diagrammatic Cross-Section across O.E.L. 28 along 131° meridian.

Exhibit 4: Condensed profile seismic line "A".

Exhibit 5: Condensed profile seismic line "B".

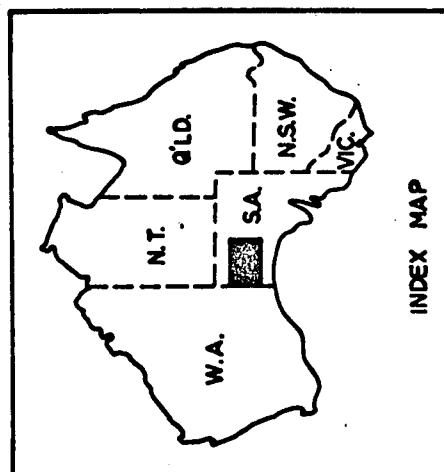
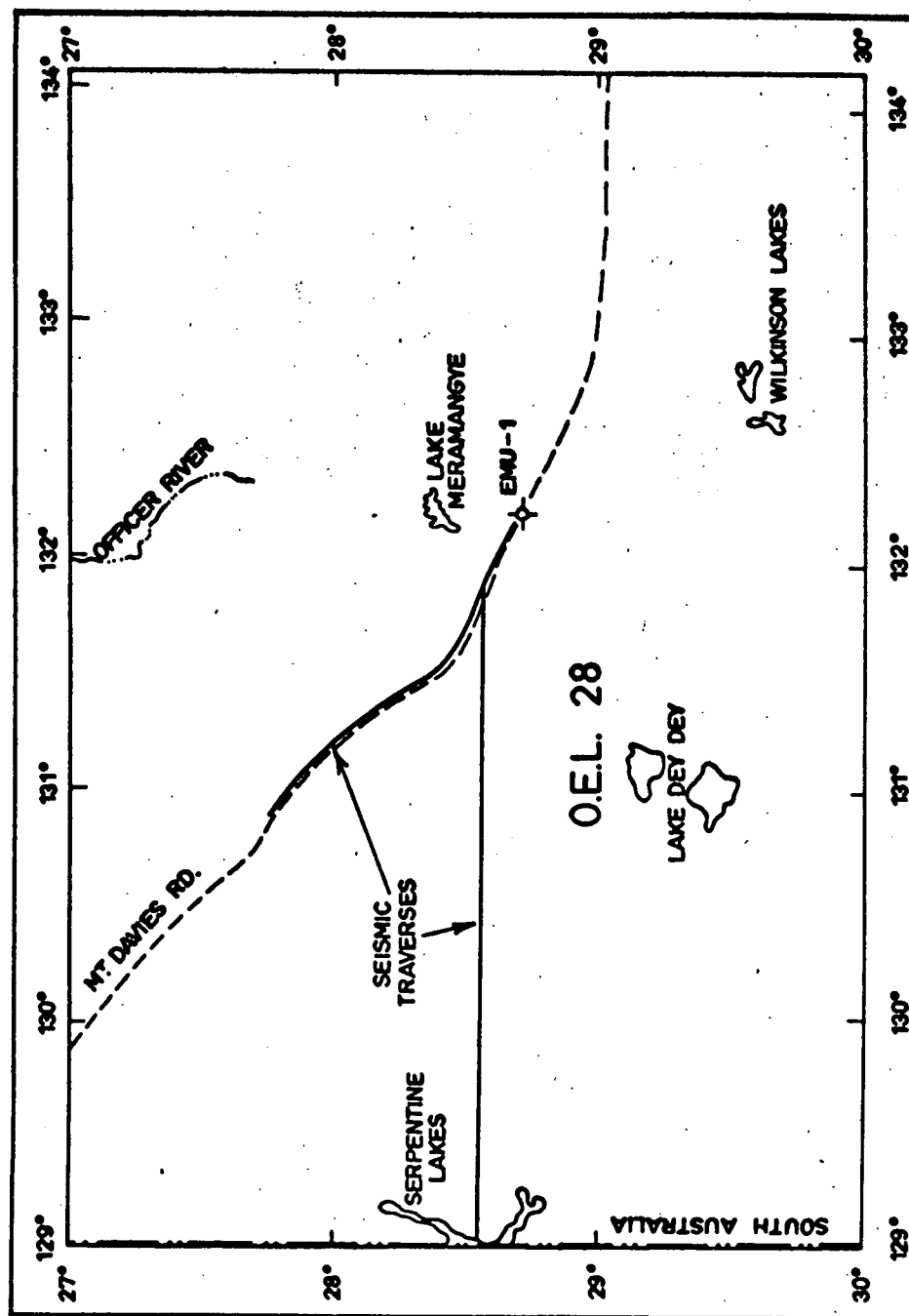
Exhibit 6: Gravity and aeromagnetic profiles along 131° meridian.

Yours faithfully,

for EXOIL PTY. LTD.

  
(S. S. Chambers)  
Chief Geophysicist

000006



EXOIL PTY. LTD.  
**PROPOSED AEROMAGNETIC SURVEY**  
**O.E.L. 28-SOUTH AUSTRALIA**  
**LOCALITY PLAN**

Figure I

OIL EXPLORATION LICENCE No. 28

SOUTH AUSTRALIA

Summary of Provisions of the Permit

Description  
of Permit:

Commencing at a point which is 129 degrees longitude, 27 degrees latitude; thence running east for a distance of approximately 305 miles to 134 degrees longitude; thence running south for a distance of approximately 205 miles to 30 degrees latitude; thence running west for a distance of approximately 305 miles to 129 degrees longitude; thence running north to the point of commencement.

Term:

Period ending 1st October, 1967.

Agreements  
affecting  
Tenure:

Nil.

000008

AN AGREEMENT

between

ADASTRA HUNTING GEOPHYSICS PTY. LTD.

41-45 Vickers Avenue,

Mascot, New South Wales

and

EXOIL PTY. LTD.

Perry House,

131-145 Elizabeth Street,

Brisbane, Queensland

for an

AEROMAGNETIC SURVEY

over

OIL PERMIT OIL.28

in the State of

South Australia,

Australia.

LIST OF CONTENTS

|                  |                                                                    |                                |
|------------------|--------------------------------------------------------------------|--------------------------------|
| <b>Section 1</b> | <b><u>INTRODUCTION</u></b>                                         | <b><u>Page</u></b><br><b>3</b> |
| <b>Section 2</b> | <b><u>AEROMAGNETIC PROGRAMME</u></b>                               |                                |
| 2.1              | Description and Location of the Area<br>to be Surveyed.....        | 4                              |
| 2.2              | Object of the Survey.....                                          | 4                              |
| 2.3              | Details of Traverses to be Flown.....                              | 5                              |
| 2.4              | Survey Altitude.....                                               | 5                              |
| 2.5              | Base Maps.....                                                     | 6                              |
| 2.6              | Method of Navigation.....                                          | 6                              |
|                  | 1) Aids to Navigation                                              |                                |
|                  | ii) Criteria for Rejection.                                        |                                |
| 2.7              | Description of Survey Instruments.....                             | 6                              |
|                  | i) G.M.2 Compass.....                                              | 6-7                            |
|                  | ii) Bendix B.3 Drift Meter.....                                    | 7                              |
|                  | iii) Doppler.....                                                  | 7-8                            |
|                  | iv) Magnetometer.....                                              | 9                              |
|                  | v) Radio Altimeter.....                                            | 9                              |
|                  | vi) Recording 35mm Camera.....                                     | 10                             |
|                  | vii) Storm Monitor.....                                            | 10                             |
| 2.8              | Instrumental Control and Criteria for<br>Rejection of Records..... | 10                             |
|                  | i) Magnetometer.....                                               | 10-11                          |
|                  | ii) Radio Altimeter.....                                           | 11                             |
|                  | iii) Recording Camera.....                                         | 11                             |
|                  | iv) Storm Monitor.....                                             | 12                             |
|                  | v) Doppler.....                                                    | 12-13                          |
| 2.9              | Synchronisation of Records.....                                    | 13-14                          |
| 2.10             | Reduction of Recorded Data.....                                    | 14                             |
| 2.11             | Materials to be Supplied.....                                      | 14-16                          |
| 2.12             | Key Personnel.....                                                 | 16-17                          |
| 2.13             | Timing                                                             |                                |
|                  | i) Field Work (Flying).....                                        | 17                             |
|                  | ii) Reduction of Data.....                                         | 18                             |
|                  | iii) Preliminary Results.....                                      | 18                             |

|                                                 | <u>Page</u> |
|-------------------------------------------------|-------------|
| <b>Section 3</b> <u>PAYMENT</u>                 |             |
| 3.1    Aeromagnetic Survey.....                 | 19          |
| 3.2    Base Maps.....                           | 19          |
| 3.3    Photostrips.....                         | 19          |
| 3.4    Positioning of Survey Aircraft.....      | 20          |
| 3.5    Additional Material.....                 | 20          |
| 3.6    Standby Time.....                        | 20          |
| <b>Section 4</b> <u>SCHEDULE OF PAYMENTS</u>    |             |
| 4.1    Base Maps.....                           | 21          |
| 4.2    Positioning of Aircraft.....             | 21          |
| 4.3    Field Work (Flying).....                 | 21          |
| 4.4    Materials for Interpretation.....        | 21-22       |
| 4.5    Fairline Drawings.....                   | 22          |
| 4.6    "Xerox" Copies.....                      | 22          |
| 4.7    Standby Time.....                        | 22          |
| <b>Section 5</b> <u>GENERAL PROVISIONS</u>      |             |
| 5.1    Fidelity Guarantee.....                  | 23          |
| 5.2    Personal Injury and Property Damage..... | 23          |
| 5.3    Insurance.....                           | 23-24       |
| 5.4    Expedition of Contract.....              | 24          |
| 5.5    Conduct of Survey.....                   | 24          |
| 5.6    Patents.....                             | 24          |
| 5.7    State and Commonwealth Laws.....         | 25          |
| 5.8    Force Majeure.....                       | 25          |
| <b>Section 6</b> <u>PATENTS AND LICENCES</u>    |             |
| 6.1    Airborne Magnetometer.....               | 26          |

DIAGRAMS INCLUDED WITH THIS AGREEMENT

- Schedule "A" Flight Plan
- " " "B" Flying Heights
- " " "C" Navigation Maps etc.
- " " "D" Sheet Layouts.

AGREEMENT

Section 1.

INTRODUCTION

(a) THIS AGREEMENT made the fourteenth day of September, 1964 between ADASTRA HUNTING GEOPHYSICS PTY. LIMITED, the registered office of which is at 41-45 Vickers Avenue, Mascot, in the State of New South Wales (hereinafter called "the CONTRACTOR") of the one part and EXOIL PTY. LTD., the registered office of which is at 131 Elizabeth Street, Brisbane, in the State of Queensland (hereinafter called "The COMPANY") of the other part WITNESSETH that CONTRACTOR agrees to conduct for COMPANY upon execution of this Agreement certain operations and surveys as hereinafter described.

(b) The CONTRACTOR agrees to supply all aircraft, instruments, vehicles and personnel necessary for the supervision and conduct of these operations and surveys.

(c) The CONTRACTOR agrees to assume full responsibility for the payment of the cost of such operations as hereinafter described.

Section 2.

AEROMAGNETIC PROGRAMME

2.1 Description and location of the area to be surveyed.

(a) The area to be surveyed is fully described by the following co-ordinates:- from geographical position  $129^{\circ}00'E$  and  $27^{\circ}00'S$  due east to longitude  $134^{\circ}00'S$  thence due south to latitude  $30^{\circ}00'S$  thence due west to longitude  $129^{\circ}00'E$  thence due north to the position of origin  $129^{\circ}00'E$  and  $27^{\circ}00'S$ .

(b) The area thus described covers approximately sixty-three thousand (63,000) square miles.

(c) The co-ordinates described above form the legal boundaries of Petroleum Exploration Lease OEL.28 in the State of South Australia.

The accompanying diagram marked Schedule 'A', is the intended flight pattern. On this pattern is shown an area to the north where the Archean rocks are known to outcrop, therefore this section of the area will not be covered with Aeromagnetics.

2.2 Object of the Survey.

The object of the survey is to provide, by the interpretation of the Aeromagnetic Profiles and Total Magnetic Intensity contour maps compiled therefrom, information for use in planning further exploration work in the search for oil.

It is expected, from the analysis of these profiles, to obtain estimates of depth to basement and its possible configuration by interpolation of spot depths. This information will be presented as basement spot depths with inferred contours of basement where continuity allows.

Additional information such as structure, faulting, intrusions, changes in composition of basement, magnetic susceptibilities etc. will be included where possible.

**2.3 Details of traverses to be flown**

(a) This agreement provides for approximately sixteen thousand (16,000) statute linear miles of standard aeromagnetic surveying plus or minus ten (10) per cent.

The planned programme is as follows:-

**2.3 (b)** Sixty-nine (69) flight lines of various lengths to be flown in a north/south direction. These lines will be flown in bands of three (3) with one and a half (1½) miles between individual lines and approximately ten (10) miles between each group, as shown on the attached flight diagram, totalling approximately thirteen thousand two hundred and sixty (13,260) line miles.

**2.3 (c)** Thirteen (13) tie lines (single) of various lengths mainly flown in an east/west direction, as shown on the attached flight diagram, totalling approximately three thousand one hundred and sixty (3,160) line miles.

**2.3 (d) Summary**

69 flight lines totalling approx. 13,260 line miles

13 tie-lines totalling approx. 3,160 " "

16,420 " "

The above programme will be subject to slight alteration depending upon the progressive interpretation, but at no stage will this programme deviate from 16,000 line miles by more than plus or minus 10%, as stated elsewhere in this section of the Agreement.

**2.4 Survey Altitude**

(a) The aircraft will fly at altitudes as shown on the attached block height diagram marked Schedule 'B'.

(b) If it is found necessary to deviate from this altitude for any reason, e.g., safety of the aircraft and crew, flying over restricted areas where increase of altitude is required by regulation, decrease in altitude to obtain greater magnetic definition, the COMPANY will be advised.

## 2.5 Base Maps

(a) The base scale will be taken from available maps and photomosaics shown on the attached diagram marked Schedule 'C'.

(b) In addition to the above maps/mosaics, etc., individual photographs at a scale of approximately 1:50,000 will be obtained and used as visual aids to navigation.

(c) 35 m/m recovered stations will be plotted directly on to one inch to one mile and four miles to one inch photomosaics where these are available (see Schedule 'C'). The 35 m/m stations plotted on these mosaics for which National Mapping have plotted corner co-ordinates, will be transferred by scale to a prepared base map on a Transverse Mercator Projection.

## 2.6 Method of Navigation

1) The survey aircraft will be navigated visually by reference to photomosaics and where necessary by Doppler Navigator alone or in conjunction with the small scale photomosaics. The aircraft will also be fitted with the following:-

- i) A Kelvin Hughes G.M.2 Compass or similar.
- ii) A Bendix B.3 Drift Meter or similar.
- iii) Automatic Pilot.
- iv) Individual Photographs.
- v) Photomosaics.
- vi) Doppler.

### ii) Criteria for Rejection

No flight line or tie-line is to deviate from its planned position by more than plus or minus one half (½) mile.

## 2.7 Description of Survey Instruments

### i) G.M.2 Compass (Kelvin Hughes)

The G.M.2 Compass is a navigational aid using the output of sensitive elements suitably amplified to monitor

2.7 an electrically driven directional Gyro. The system provides accurate compass indications in which turning, acceleration and Gyro wander errors are almost eliminated.

Heading information in the form of a synchronous output is provided at the amplifier to feed a synchronous repeater or any of the following equipment, radio compass, electro-mechanical flight computer or automatic dead reckoning instrument system. The power supply required to operate the system is 115V 3 phase 400 c/s; 27.5V D.C.

The following units are used in this compass:-

|           |       |
|-----------|-------|
| Detector  | ..... |
| Gyro      | ..... |
| Amplifier | ..... |
| Resolver  | ..... |

The manufacturing accuracy of this compass is such that when tested in a magnetic field of  $H = 0.06$  to  $0.4$  Oersteds it is within  $\pm 0.5^\circ$  on any heading and is maintained over a voltage variation  $115V \pm 10\%$  and frequency  $400 \text{ c.p.s.} \pm 5\%$  and D.C.  $22V - 30V$ . The G.M.2 system complies with British Standards Specification G.122.

2.7 11) Bendix B.3 Drift Meter

This instrument is basically a Gyro stabilised graticule from which a navigator can obtain drifts to an accuracy of  $\frac{1}{2}^\circ$ .

Drifts can be accurately obtained for aircraft manoeuvre up to  $20^\circ$  roll and  $15^\circ$  pitch.

2.7 111) Doppler

The instrument which will be used on this survey is a Marconi CMA623 series Doppler Navigator.

With this equipment accurate ground speed of aircraft and its drift is electronically computed to an accuracy of approximately  $\pm 0.8\%$  of the along track distance flown and drift angle to

2.7

The Doppler Navigation system is based on the well known phenomenon "Doppler Effect" which is the change in frequency ( $f$ ) between the transmitted signal from a stationary transmitter ( $F$ ) and the signal frequency received by a moving receiver ( $F+f$ ).

Knowing the transmitted frequency and measuring the received frequency the velocity of the moving receiver may be calculated simply by multiplying the change in frequency ( $f$ ) by  $\lambda$ , where  $\lambda$  is the wavelength of the transmitted signal ( $F$ ).

In order to adapt this principle to an aircraft the following basic equipment is required:-

i) A transmitter, which will also act as a receiver for the reflected waves from the ground.

ii) A sensor which will detect the frequency variation ( $f$ ) of the returned signal and present this information in terms of ground speed and the distance travelled along a selected track.

iii) A sensor which will detect the slight variation in frequency between the two forward and two aft beam return signals and by electronic equalisation rotate the transmitting/receiving antenna until the signals are balanced. This angular rotation will then be a measure of the aircraft drift.

The CMA 623 series Doppler to be used on this survey uses frequency modulated (FM) continuous wave (CW) transmissions at a nominal frequency of 9830 megacycles (Mc/s)  $\pm$  30 Mc/s resulting in a wavelength of approximately 3 centimetres which a power output of  $\frac{1}{2}$  watt.

The equipment can be operated within the following limits:-

2.7

- (i) Height.....50 to 50,000 feet.
- (ii) Drift Angle.....  $\pm$  40 degrees
- (iii) Groundspeed..... 100 to 1,000 m.p.h.
- (iv) Pitch Range.....  $\pm$  20 degrees
- (v) Roll Range.....  $\pm$  15 degrees

2.7

iv) Magnetometer

(a) The Magnetometer to be used on this survey will be a Gulf Research and Development Corporation Total Magnetic Field saturable core magnetometer Mark 3, recording through a Gulf 7-1 recording potentiometer.

The sensing, or detecting head will be attached to or towed by a Lockheed Hudson aircraft.

(b) Technical Data

Sensitivity

The instrument will be set to record a full scale deflection (f.s.d.) of 300 or 600 gamma for a complete excursion across a Leeds and Northrup ten (10) inch chart, depending upon operational conditions. The recorder will run at three (3) inches per minute.

Noise Level

The noise level of the recorded magnetic field profiles shall at no time exceed a two (2) gamma envelope.

Instrument Drift.

The maximum allowable instrument drift for this instrument is guaranteed by the manufacturer not to exceed six (6) gammas per hour.

Calibration.

The sensitivity of the measuring fluxgate circuit will be checked before the survey using a standard 'Helmholtz' coil.

The total recorded field as shown on the measuring circuit Veeder counter will be used to detect any errors in the datum step range resistors.

2.7

v) Radio Altimeter

An APN-1 Radio Altimeter will be used for recording the height of the aircraft above terrain. An Esterline Angus recording potentiometer running at three (3) inches per minute will continuously record the terrain clearance.

2.7 vi) Recording 35 m/m Camera.

(a) A Vinton camera will be used to record the actual flight path of the aircraft over the terrain, and the exposure interval between successive exposures will be set to maintain continuous and uninterrupted photography.

(b) Technical Data

Lens: 12 Cook Speed Panchro  
Focal Length: 28 m/m  
Format: 18 m/m x 25 m/m  
Shutter Speed: 1/250 sec. (set)  
Magazines: 400 ft.

vii) Storm Monitor

Magnetic field variations will be monitored by a Gulf Research & Development Corporation single fluxgate saturable core magnetometer recording on to a 5" curvilinear chart using an Esterline Angus recorder, running at 1 1/2 inches per minute during sorties, and 1 1/2 inches per hour at all other times.

2.8 Instrumental Control and Criteria for Rejection of Records

1) Magnetometer

Observations of the recorded Total Force Magnetic Field will be reduced to a standard datum, and an unlooped flight line/tie line intersection control circuit will be used to correct and distribute errors.

Distribution of errors will be based on a "least squares" principle using successive approximations.

Combined instrument and battery drift shall not exceed six (6) gammas per hour using standard mercury cell batteries (the rate of drift is essentially linear until the batteries begin to deteriorate, which in the case of mercury cells is easily identified by the sharp fall-off in voltage).

2.8

(a) Lag Tests

Lag, which is essentially the difference between the recorded and actual position of the magnetic field as detected by the magnetometer head, will be checked over a known magnetic object prior to commencement of the survey and included in the Final Report.

ii) Radio Altimeter

A standard set of testing equipment is used to calibrate the APN-1 radio altimeter and both the Pilot's and Magnetometer Operator's height indicator are checked and aligned.

In addition to this electronic test a daily check is made before and after each sortie over the base aerodrome.

The expected accuracy of this instrument is  $\pm 100$  ft.

Accuracy varies according to the nature of the ground over which the aircraft is flying.

A calibrated chart will be included with the Final Report.

Rejection Criteria

Radio altimeter records will be rejected only where noise level is excessive, but not if the ground itself is the cause of poor recordings.

2.8

iii) Recording Camera

The recording 35 m/m camera is controlled by an electronic intervalometer. The aperture of the diaphragm is controlled manually by the operator by reference to a photo-electric cell exposure meter.

Daily tests are carried out to ensure the proper functioning of the camera and test strips are processed in the field.

2.8

### Rejection Criteria

If it is not possible to clearly identify ground features on the 35 m/m photography either because of under-exposure or underdevelopment of the latent image all lines or sections of lines so affected shall be re flown. The only exception to this will be where Doppler Navigator co-ordinates are available when run in conjunction with the 35 m/m photography.

#### iv) Storm Monitor

This instrument is calibrated prior to the survey using standard Helmholtz coils and the full scale deflection (f.s.d.) across the Esterline Angus recorder chart (4½ inches) noted.

The f.s.d. is normally between 240 to 250 gammas but varies according to the individual instrument.

The instrument and its recorder are constantly attended whilst the survey aircraft is operating and time intervals of approximately ten (10) minutes are recorded on the chart by the storm monitor operator.

The speed of the recorder is set at a speed of one and a half (1½) inches per minute whilst the aircraft is on survey and one and a half (1½) inches per hour at all other times. The monitor will be operated 24 hours per for the duration of the survey.

### Rejection Criteria

Where non-linear variations of the magnetic field are in excess of five (5) gammas in five (5) minutes, lines or parts of lines flown during these periods shall be re flown.

2.8

#### v) Doppler Navigator

This equipment will be fully checked on a standard grid pattern near Sydney before departing for the survey area.

Whilst in the Field periodic checks will be made by flying along the Trans-Continental Railway if recognisable

check points can be located.

#### Criteria for Rejection

Where the Doppler information is the only available check on the ground position of the aircraft all magnetic profiles or parts of profiles will be reflight where the unit malfunctions or is suspected of being in error.

#### 2.9 Synchronisation of Records

Synchronisation of the records taken during the survey is achieved by the use of Veeder counters and an electronic intervalometer which controls the elapsed time between successive exposures of the 35 m/m recording camera.

An electrical pulse from the intervalometer operates the shutter of the camera and at the same time moves the camera Veeder counter up one unit.

The magnetometer recorder and the radio altimeter recorder are each fitted with a fiducial marking pen and a Veeder counter which are also operated by signals from the intervalometer. At every tenth camera exposure both pens, which are operated by solenoids, place marks on their respective charts.

The magnetometer operator annotates each record at every hundredth camera exposure by reference to the Veeder counters. These counters are checked regularly throughout the survey for alignment of numbers between each tenth exposure. Using this technique the numbers appearing on the edge of the 35 m/m tracking film may also be identified by interpolation on both the magnetometer and radio altimeter records. Thus the ground position of any anomaly, and the height of the aircraft above ground at that point may be easily ascertained.

The storm monitor and airborne magnetometer record are related by reference to time only, and are synchronised by time checks prior to and at the end of each sortie.

Correlation between the Aeromag Profile, Radio Altimeter and the Doppler Co-ordinates is achieved in a similar way by

2.9 using the 35 m/m camera pulse.

This pulse actuates the solenoid of a fiducial marking pen on the recorder used to obtain a continuous record of the "along" and "across" track Doppler counters.

In addition to this recorder a 16 m/m camera will photograph at intervals of approximately ten (10) seconds the full Doppler Instrument panel which includes:-

- (a) Ground Speed and Drift Indicator
- (b) Directional Compass Indicator
- (c) "Across Track" and "Along Track" counters
- (d) A Veeder counter operating from the 35 m/m camera showing identical exposure number.

2.10 Reduction of Recorded Data

(a) Field and reduction procedures shall result in observations capable of being reliably contoured at an interval of five (5) gammas.

(b) Properly reduced data shall be presented in the form of Total Magnetic Intensity Contours with a minimum contour interval of ten (10) gammas. Where individual lines only are available, such as the east-west tie lines between groups of flight lines, magnetic values only shall be plotted.

(c) Total Magnetic Intensity maps will be presented at a scale of two (2) miles to one (1) inch covering one (1) degree of latitude and one (1) degree of longitude each of which there will be fifteen (15) sheets.

(d) Total Magnetic Intensity maps which will be photographically reduced from the above sheets to a scale of four (4) miles to one (1) inch covering one and a half (1½) degrees of latitude and two and a half (2½) degrees of longitude each of which there will be four (4) sheets.

2.11 Materials to be Supplied

(a) The following is a complete list of reports, charts, films, mosaics, maps etc. which will be supplied to the COMPANY during or after the completion of the Aeronagnetic

Survey described above:-

- 2.11 1) All original magnetometer profiles, annotated with 35 m/m identified positions, intersections of flight and tie lines, and suitably titled with line numbers, date flown, direction etc.
- ii) One "Xerox" copy of all the above magnetometer profiles for supply to the Bureau of Mineral Resources.
- iii) One "Xerox" copy similar to (ii) above for supply to COMPANY for interpretation facilitation.
- iv) All original radio altimeter profiles annotated similarly to the magnetometer profiles in (i) above.
- v) All original Doppler navigation charts properly annotated with synchronisation marks and counter numbers.
- vi) All original storm monitor profiles for each day of the survey marked with time intervals of ten (10) minutes when the aircraft was on survey, also start and end fiducial numbers for each line and scrubbed line flown during the whole survey.
- vii) Copies of all daily flight logs which list line numbers flown during any one sortie, start and end 35 m/m fiducial numbers for each line flown, line directions, times of start and end of lines flown together with any pertinent operational notes.
- viii) Original 35 m/m tracking film for all successful and scrubbed lines flown during the survey.
- ix) Original 16 m/m film of the Doppler navigator instrument panel where this navigational aid is used on the survey.
- x) Plotted 35 m/m recovered flight paths showing station numbers at intervals of approximately one (1) to two (2) miles on one (1) inch to one (1) mile, four (4) miles to one (1) inch, or individual aerial photographs whichever is available.
- 2.11 xi) Two (2) copies each of the fifteen (15) Total Magnetic Intensity contour maps at a scale of two (2) miles to one (1) inch (1:128,720) on 'Cronaflex' or similar stable base

- 2.11 material together with two (2) dyeline copies of each sheet. The dimensions of these sheets are described in Section 2.10 (c) of this Agreement. In addition to the contours these sheets will show skeleton planimetric or topographic detail and recovered 35 m/m stations at intervals of approximately two (2) miles along each line or tie line with every fifth station numbered.
- xii) Two (2) copies each of four (4) Total Magnetic Intensity contour maps compiled at a scale of four (4) miles to one (1) inch (1:253,440) from the fifteen (15) original sheets described in Section 2.11 (xi) above on 'Cronaflex' or similar stable base material together with three (3) dyeline copies of each sheet.
- xiii) An operational report on the Flying and Reduction of Data including all pertinent statistics suitable to meet the requirements of the Petroleum Search Subsidy Act 1959-64 (Revised September, 1964) Appendix 6, "Airborne Magnetometer Surveys".

2.12 Key Personnel

(a) Captain K. Rowlands, (Pilot)

Mr. Rowlands joined "Adastral" staff in July, 1956 directly from the R.A.A.F. with over 8,000 hours pilot time. During his service with the Company he has been engaged on photographic and geophysical survey flying. He has flown over 40,000 line miles of aeromagnetic and electromagnetic surveying.

(b) W. Henderson (Navigator)

Mr. Henderson joined "Adastral" staff in August, 1963 directly from the R.A.A.F. where he held an "A" category navigational certificate. He joined the Royal Canadian Air Force in October, 1953 where he did his initial navigational training. During the next five years he logged over 1500 hours as a first class navigator. He joined the R.A.A.F. in August, 1959 and after a short familiarisation course was assigned to Canberra Bomber/Photo-reconnaissance aircraft.

During his service with us he has mainly been engaged engaged on photographic survey navigation, however he has successfully flown over 3,000 line miles of aeromagnetic surveys.

2.12

(c) A. Bringolf (Elec. Tech.)

Mr. Bringolf joined "Adastral" staff in February, 1963 directly from the P.M.G. Department where he had served for six (6) years as a Technician.

He was trained at the Company's premises at Mascot under the guidance and supervision of Mr. M.Y. Miller, our Senior Technician, and has successfully completed approximately 7,000 line miles of aeromagnetic surveying.

(d) B.A. Howe (Aeromagnetics Manager)

Mr. Howe joined "Adastral" staff in June, 1949 where he was trained as a photogrammetrist.

He transferred to the Geophysics section in January, 1955.

During his service with the Company he has been engaged on the Reduction and Planning of geophysical surveys both ground and airborne.

He was in charge of all geophysical reduction including magnetic, seismic, gravity and E.M. until his recent appointment.

The Planning, Reduction and Presentation of Results from this survey will be under his supervision.

2.13 Timing

1) Field Work (Flying)

Field work shall progress at approximately two thousand (2,000) line miles per week, and is expected to take approximately ten (10) weeks to complete, provided the weather conditions are favourable and the diurnal magnetic gradient, described in Section 2.8 (iv) of this Agreement, is suitable for recording the magnetic data, and also provided the Weapons Research Establishment Authorities do not interrupt operations.

2.13 11) Reduction of Data

Full reduction of the magnetic data as previously described herein shall proceed at approximately fifteen hundred (1,500) line miles per week provided this data is received from the field on a continuous basis.

iii) Preliminary Results

Preliminary results in the form of pencil working copies of the Total Magnetic Intensity contours will be made available to COMPANY at a scale of two (2) miles to one (1) inch (1:126,720) on a progressive basis immediately they become available to facilitate the interpretation of the results.

iv) Fairline Drawing

Fairline drawing of the results at scales of two (2) miles to one (1) inch and four (4) miles to one (1) inch as described in Section 2.11 parts (xi) and (xii) of this Agreement shall be made available approximately fourteen (14) weeks after the completion of the Field Work as described in Section 2.14 (a) of this Agreement.

v) Operational Report

A Report on the operation and reduction of the survey as described in Section 2.11 part (xiii) shall be made available approximately ten (10) weeks after the completion of the Field Work.

Section 3.

PAYMENT

**3.1 Aeromagnetic Survey**

(a) In consideration of the survey operations and services as herein described COMPANY agrees to pay CONTRACTOR at the following rates:-

(b) For Flying, Reduction of Data and Presentation of results as herein described of approximately sixteen thousand (16,000) statute linear profile line miles, a charge of Two Pounds Fifteen Shillings (£2.15.0) per line mile.

**3.2** All topographic and/or planimetric maps, photomosaics, individual aerial photographs, photoidentifications of "Astrofixes" and Geodetic control points required for the accurate navigation and subsequent compilation of base maps for the proper plotting and contouring of the magnetic data, shall be obtained by CONTRACTOR on behalf of COMPANY at cost plus freight and handling charges.

**3.3. Photostrips**

For the preparation of base photostrips, which will be controlled from existing planimetric control, for the area bounded by the following co-ordinates:-

From geographical position 133 degrees 30 minutes east and 28 degrees 00 minutes south, a line due east to 134 degrees 00 minutes east, thence due south to 30 degrees 00 minutes south, thence due west to 133 degrees 30 minutes east, thence due north to the origin 133 degrees 30 minutes east and 28 degrees 00 minutes south.

This will involve the laying at a mean photoscale (1:50,000) of approximately eighteen (18) strips of photographs each thirty (30) miles in length and semi-controlled. For this service an all-in charge of.....£2150. These strips will be used for providing check points for Doppler navigation.

**3.4 Positioning of Survey Aircraft**

For positioning of the survey aircraft, crew, equipment, and necessary supplies from Sydney aerodrome to Maralinga aerodrome in South Australia and return.....£1,200.

**3.5 Additional Materials**

"Xerox" copies of magnetometer profiles as described in Section 2.11 items (ii) and (iii) of this Agreement will be charged at two shillings and sixpence per foot run of chart.

**3.6 Standby Time**

When operations over the Restricted Zones of the W.R.E. are cancelled by the Authorities a daily standby rate of Eighty Pounds (£80) per day will be charged where such cancellation is in excess of two (2) consecutive days.

Section 4.

SCHEDULE OF PAYMENTS

4.1 Base Maps

Items under Section 3.2 of this Agreement obtained by CONTRACTOR on behalf of COMPANY shall be paid by COMPANY on presentation by CONTRACTOR of account or accounts for such items obtained.

4.2 Positioning of Aircraft

Positioning charges as described in Section 3.4 of this Agreement shall be paid by COMPANY to CONTRACTOR on the arrival of the aircraft at Maralinga, or alternate operating base adjacent to the survey area.

4.3 Field Work (Flying)

At the end of each calendar month a charge of fifty (50) per cent of the unit cost per line mile listed under Section 3.1 of this Agreement shall be paid by COMPANY to CONTRACTOR, for all successfully surveyed line miles during the month.

4.4 Materials for Interpretation

On supply to COMPANY of all necessary materials for the proper interpretation of the aeromagnetic data namely:-

(a) 1 only "Xerox" copy of all original aeromag profiles suitably edited.

(b) All original Radio Altimeter charts with calibration charts.

(c) Copies of all Daily Flight Logs.

(d) 1 only dyeline each of the fifteen (15) maps at a scale of two (2) miles to one (1) inch (1:126,720) taken from the original pencil working drawings of the Total Magnetic Intensity contour maps as described in Section 2.11 part (xi) of this Agreement.

(e) 1 only 'Cronaflex' or similar stable base material copy of each Total Magnetic Intensity contour sheet (4) at a scale of four (4) miles to one (1) inch (1:253,440) compiled from the two (2) mile to one (1) inch (1:126,720)

sheets described in Section 4.4 part (d) above.

COMPANY shall pay CONTRACTOR thirty (30) per cent of the unit cost per line mile listed under Section 3.1 of this Agreement.

**4.5 Fairline Drawings**

On delivery of the Fairline Drawings of the Total Magnetic Intensity contour sheets as described in Section 2.11 parts (xi) and (xii) of this Agreement, and the Operational Report described in Section 2.11 part (xiii) of this Agreement COMPANY shall pay CONTRACTOR twenty (20) per cent of the unit cost per line mile listed under Section 3.1 of this Agreement

**4.6 "Xerox" Copies**

On delivery to COMPANY of all "Xerox" copies of aeromag profiles as described in Section 3.5 of this Agreement COMPANY shall pay CONTRACTOR for all footage supplied at the listed cost per foot.

**4.7 Standby Time**

At the successful completion of the Field Work described herein COMPANY shall pay to CONTRACTOR all charges incurred under Section 3.6 of this Agreement for Standby Time.

Section 5.

GENERAL PROVISIONS

**5.1 Fidelity Guarantees**

The CONTRACTOR agrees that neither he nor any of his agents, servants or employees shall divulge to any person other than COMPANY, any information concerning the results of this aeromagnetic survey provided for herein, and CONTRACTOR acknowledges that his fiduciary capacity in respect to such information requires the highest degree of trust and confidence. The CONTRACTOR further agrees that he shall take no advantage of any kind of information from the aeromagnetic survey under this Agreement and that all information obtained from the survey shall be for the exclusive use and benefit of the COMPANY during the term of this Agreement and at all times thereafter.

**5.2 Personal Injury and Property Damage**

The CONTRACTOR shall indemnify and hold and save harmless the COMPANY from each and every claim, suit, action or demand whatsoever for damage to or loss of property, or for injury or death of any person or persons:-

- (a) Arising from injuries to employees, servants and agents of the CONTRACTOR or arising from injuries to any subcontractor or his employees, servants or agents in performance of anything done under or pursuant to this Agreement not due to the negligence of the COMPANY, its employees, servants or agents.
- (b) Arising from injuries to employees of the COMPANY, third persons or the public, or their property, in performance of anything done under or pursuant to this Agreement not due to the negligence of the COMPANY, its employees, servants or agents.

**5.3 Insurance**

The CONTRACTOR shall carry with responsible carriers, and maintain in force during the continuance of this contract,

the following listed insurance:-

- (a) Employer's Liability Insurance: unlimited.
- (b) Aircraft Public Liability and Property Damage Insurance, insuring the CONTRACTOR against any liability or injury to, or death of, persons, including employees of the COMPANY, or for loss or damage to property of the COMPANY, maximum limits which shall be as follows: Five hundred thousand pounds Australian (£A.500,000) total limit per accident.
- (c) Automobile Public Liability Damage Insurance with maximum limits as follows:-  
Automobile Third Party Insurance (compulsory) covering bodily injury or death: together with Comprehensive Motor Car Insurance covering value of vehicle(s) and property damage to unlimited amount.

The CONTRACTOR shall, if requested, furnish certificates of insurance for the coverage hereinafter specified.

5.4 The CONTRACTOR agrees, upon commencement of the survey to prosecute the same with due diligence, and to complete such surveys as soon as possible.

5.5 Conduct of Survey

It is further understood and agreed that COMPANY shall have no power of authority to direct, supervise, or control the CONTRACTOR in the means, manner, or method of performance of the work or services which form the subject matter hereof, and that the CONTRACTOR shall, in the exercise of his independent employment, select the means, manner and method of performance hereof, being responsible to the COMPANY only for the results obtained.

5.6 Patents

The CONTRACTOR hereby indemnifies and saves the COMPANY harmless against all and any claims and demands which may be made against the COMPANY in respect of infringement of patent or trade mark rights arising out of the performance by the CONTRACTOR of the terms of this Agreement.

5.7 The provisions of this Agreement shall be subject to and all operations hereunder shall be conducted in full compliance with any and all laws, rules, orders and regulations of the State of South Australia and/or the Commonwealth of Australia.

5.8 Force Majeure

If either party is prevented from performance of its obligations under this Agreement by Act of God or of the Queen's enemies, wars, riots, strikes, lockouts, rebellions, civil commotions, storms, earthquakes, floods, tempests, breakdowns or stoppages of means of transportation, Government action or lack of action, or any other matters beyond the control of the parties, which could not have been prevented by the reasonable diligence of the party affected and so prevented from performance, this Agreement shall thereupon be terminated, in which event, however, the CONTRACTOR shall be entitled to retain or recover any portion of the contract price which at the time of termination may have become due and payable and with respect to any part of the total contract price which has not become due and payable at the time of termination the CONTRACTOR shall be paid by the COMPANY any expenses incurred either in the performing of or for the purposes of performing the agreement and not previously included in any payments already made by the COMPANY to the CONTRACTOR.

Section 6.

PATENTS AND LICENSES

6.1 Airborne Magnetometer

The magnetic survey operations will be conducted under licence from the Gulf Research and Development Company.

During the period that the CONTRACTOR is engaged on work in the project area under this contract, the COMPANY shall have the right to request additional work of a similar nature in the project area. Requests for such extra work shall be delivered to the CONTRACTOR in writing, and if of the same nature as noted in MATERIALS TO BE SUPPLIED above, the prices stated herein shall prevail. If the requested extras are of a different nature, the prices shall be subject to separate negotiations of adequate prices if these factors are significant.

All taxes and duties shall be paid by the CONTRACTOR.

IN WITNESS WHEREOF, the parties hereto have caused this agreement to be executed in multiple copies this fourteenth day of September one thousand nine hundred and sixty four.

SIGNED for and on behalf of EXOIL PTY. LTD.

by .....

being a person duly authorised to sign on behalf  
of the Company

in the presence of ..... (Witness)

SIGNED for and on behalf of ADASTRA HUNTING GEOPHYSICS  
PTY. LIMITED by .....

being a person duly authorised to sign on behalf  
of the Company

in the presence of ..... (Witness)

# STAGE 1

(Bands 1-12)

To be commenced by 30 September, 1964.

Mileage -

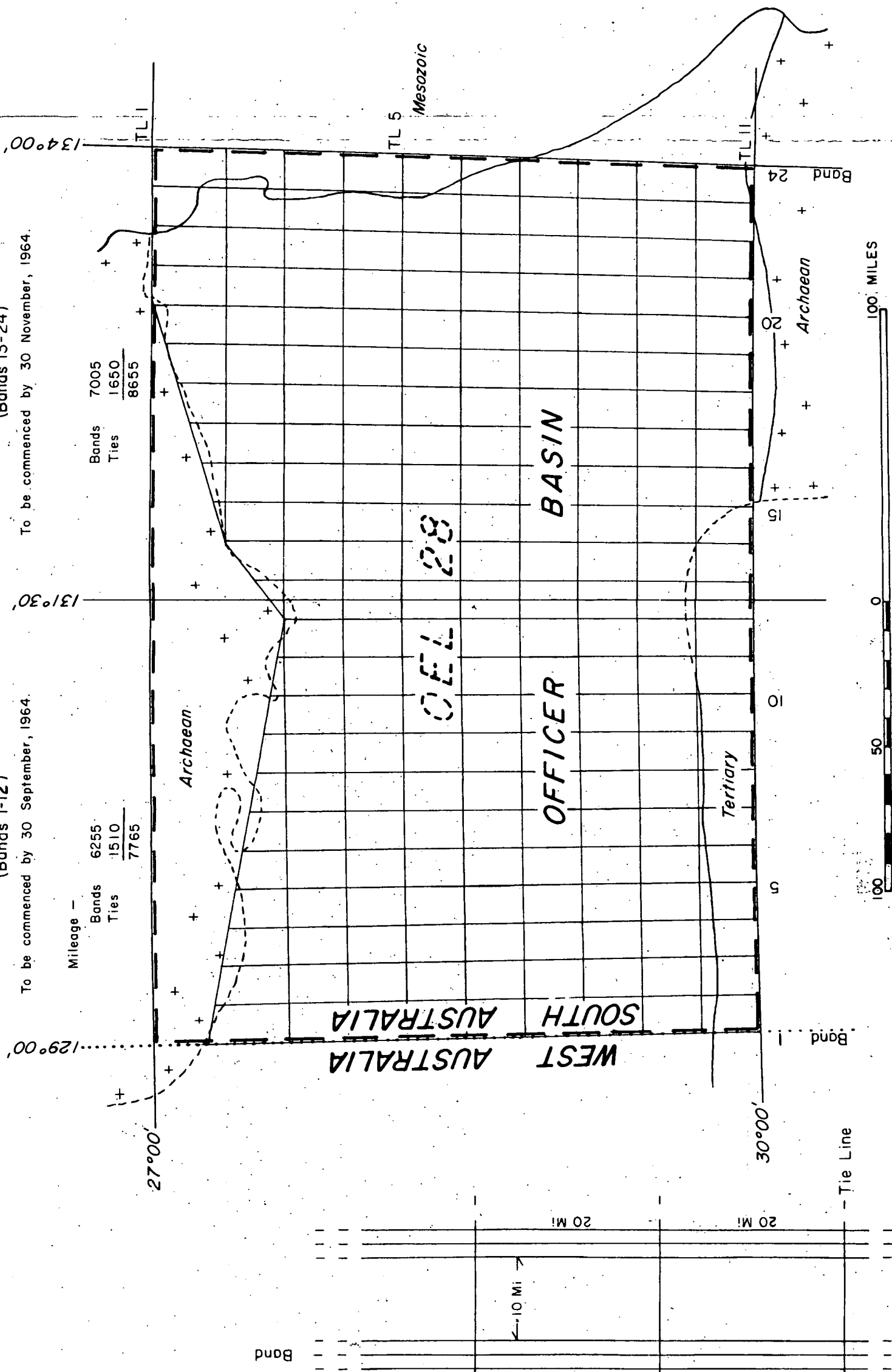
|       |      |
|-------|------|
| Bands | 6255 |
| Ties  | 1510 |
|       | 7765 |

# STAGE 2

(Bands 13-24)

To be commenced by 30 November, 1964.

|       |      |
|-------|------|
| Bands | 7005 |
| Ties  | 1650 |
|       | 8655 |



EXOIL PTY. LTD.

PROPOSED AEROMAGNETIC SURVEY

O.E.L. 28

SOUTH AUSTRALIA

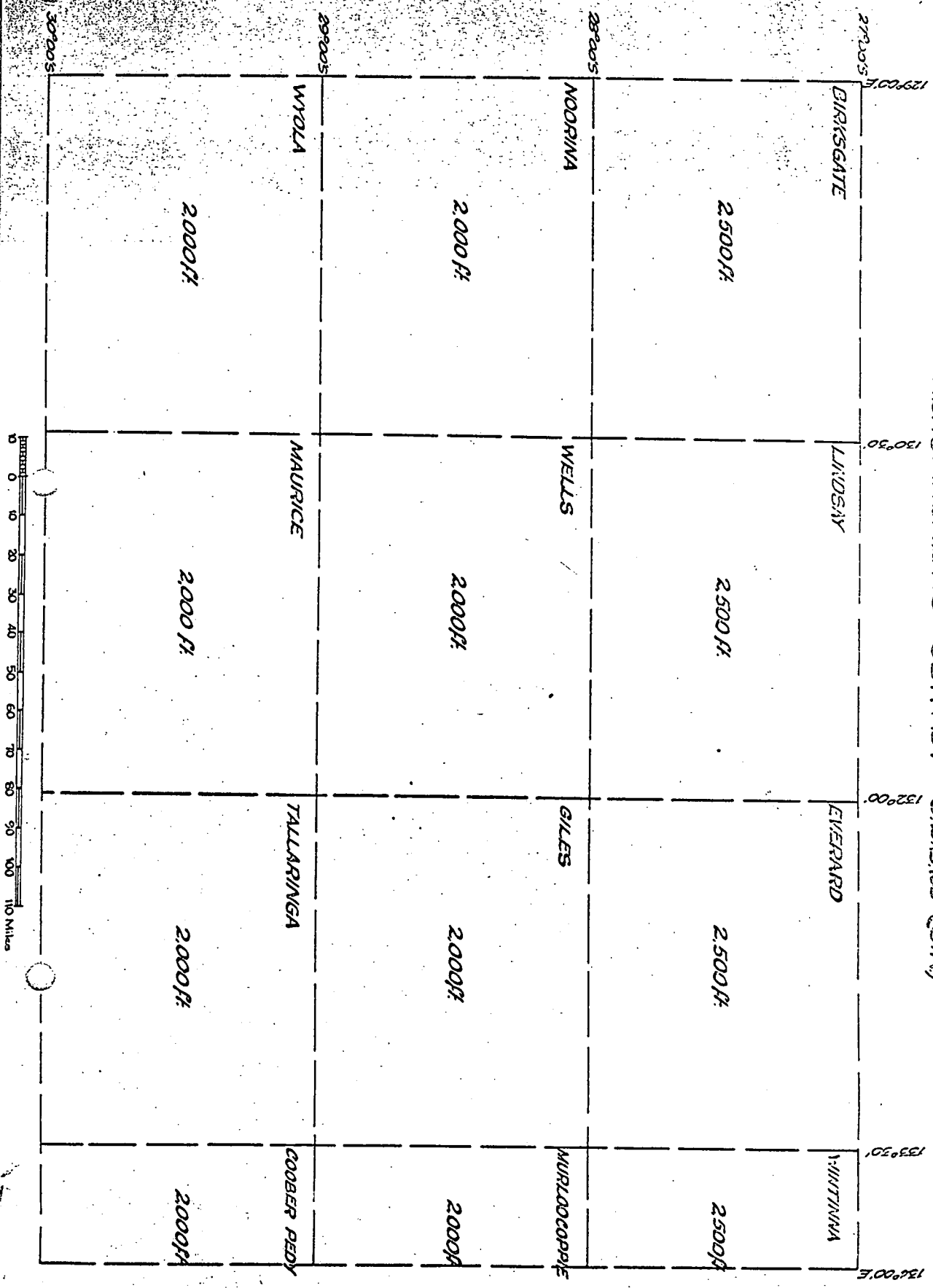
GEOPHYSICAL ASSOCIATES PTY. LTD.

BRISBANE, QUEENSLAND.

SEPTEMBER, 1964

000086

AEROMAGNETIC SURVEY DEL28 (5A) ~



~ AEROMAGNETIC SURVEY OF E. 28 (S.A.) ~

|          |           |           |           |           |
|----------|-----------|-----------|-----------|-----------|
| 27°00'5" | 120°00'5" | 120°00'5" | 120°00'5" | 120°00'5" |
| 28°00'5" | 120°00'5" | 120°00'5" | 120°00'5" | 120°00'5" |
| 29°00'5" | 120°00'5" | 120°00'5" | 120°00'5" | 120°00'5" |
| 30°00'5" | 120°00'5" | 120°00'5" | 120°00'5" | 120°00'5" |



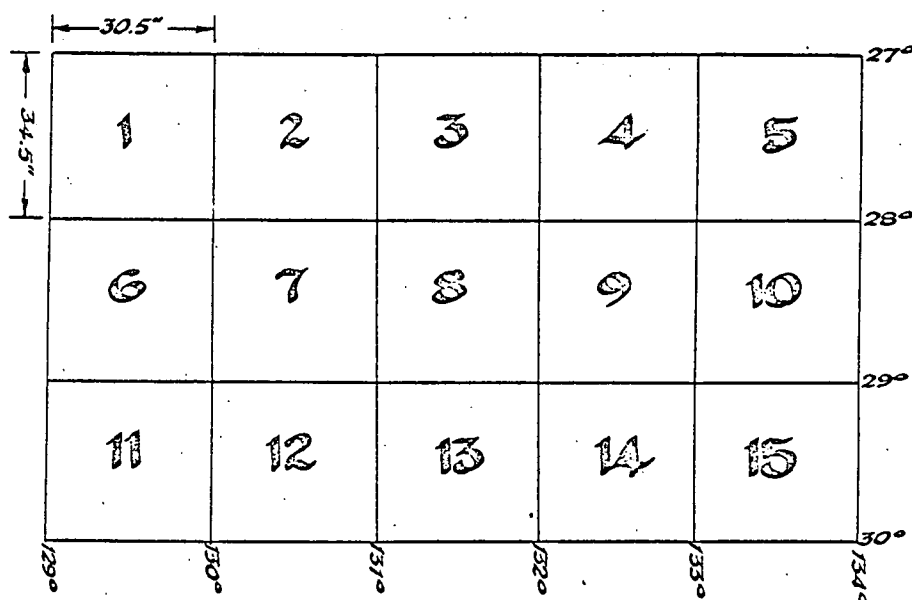
~ AEROMAGNETIC SURVEY O.E.L.28 (S.A.) ~

for

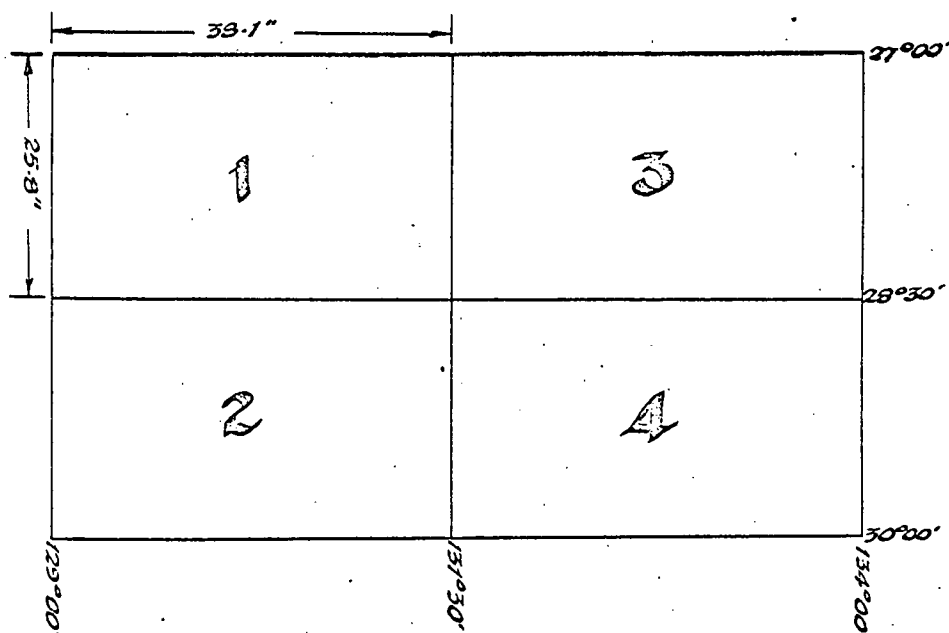
000088

EXOIL PTY. LTD.

REDUCTION SCALE 1:126,720 or 2 Miles to 1 Inch



PUBLICATION SCALE 1:253,440 or 4 Miles to 1 Inch.



~ SHEET LAYOUTS ~

AGREEMENT dated as of  
between EXOIL PTY. LTD., (hereinafter called EXOIL) and  
GEOPHYSICAL ASSOCIATES PTY. LIMITED (hereinafter called GAPL).

Exoil proposes to obtain aeromagnetic data  
from a survey to be made in the Officer Basin in South  
Australia. The survey will comprise bands of flight lines  
which total length will be approximately 16,000 flight-line  
miles.

GAPL is being retained by Exoil to make  
an interpretation of the subject data, provide quality  
control of the field data in Brisbane and quality control  
and preliminary interpretation of the field data in the field  
office as provided herein at the specified rates for these  
services.

NOW, THEREFORE, in consideration of the  
premises and the mutual agreements herein contained, the  
parties hereto agree as follows:

1. GAPL will interpret and analyze the  
data and information of the subject aeromagnetic survey and  
the area covered thereby and from these interpretations and  
analyses will prepare and furnish to Exoil the following:

- (a) One transparency and four  
prints of contoured maps showing  
the depth of the magnetic basement's  
regional surface and the depth  
estimates on which this surface is  
based; these maps also showing  
outlines or fault traces of areas of  
possible local relief of this  
regional surface and outlines of  
areas of shallow magnetic material  
detected within the sedimentary  
section; these maps to be on  
individual sheets at a scale to

conform with the specifications  
of the Australian Bureau of Mineral  
Resources for airborne magnetic surveys.

- <sup>12</sup>  
(b) Four copies of a report describing the  
method or methods of analysis and discussing  
the results fully, incorporating all  
available geologic data.

II. Exoil will furnish GAPL with the following  
data and information from the subject aeromagnetic survey and  
its area to enable GAPL to make the interpretations and analyses  
provided in Article I above:

- (a) Either the originals or legible prints of  
the original aeromagnetic profiles as made  
on the airplane in the course of conducting  
this survey.
- (b) The aeromagnetic observed maps in transparent  
form showing contours of the intensity of the  
magnetic field and with flight-line tracks and  
fiducials.
- (c) If available, base maps, preferably in transparent  
form showing the culture and geographical data  
with no aeromagnetic or flight-line data.
- (d) Any other geological, geophysical, or  
geographical data that would assist the aeromagnetic  
interpretation, particularly the location and  
subsurface "tops" of deep and significant drill  
tests, such accessory data to be provided only at  
the discretion of Exoil.

III. In consideration of the interpretation and  
quality control services to be rendered by GAPL to Exoil, Exoil  
agrees to pay GAPL in accordance with the following schedule of  
rates:

- (a) Interpretation of data, presented in the form of contour maps of the magnetic basement surface and a complete discussion thereof, together with provision of quality control of the data, resulting from the subject survey, by a GAPL geophysicist in GAPL's Brisbane Office inspecting the aeromagnetic tapes:

Rate - Nine shillings (9/-d) per mile of flight-line provided a minimum of 15,000 miles is flown.

- (b) Provision of quality control and preliminary interpretation of the data resulting from the subject survey, in the field by a GAPL geophysicist, at the request of Exoil:

Rate - Fifty pounds (£50.0.0.) per calendar day. Exoil will pay the reasonable travel and living expenses of the geophysicist for the entire time spent in the field.

IV. (a) This agreement may not be assigned or otherwise transferred by GAPL, and the work to be performed by GAPL hereunder may not be subcontracted in whole or in part, without the prior written consent of Exoil. Exoil may assign this agreement to any affiliated company or companies; provided that Exoil shall remain liable to GAPL for the due performance of all of its obligations hereunder. Any of Exoil's obligations hereunder may be discharged by an affiliated company or companies.

(b) All information furnished to GAPL by Exoil prior to the commencement of during or after termination of services rendered hereunder and all reports, maps, records and information prepared or obtained by GAPL in the course or as a result of such services shall be the property of Exoil, shall be for the exclusive use and benefit of Exoil and shall

be held in strict confidence by GAPL, its agents and employees. GAPL, its agents and employees shall not permit any person other than Exoil or its nominees to have access to any such information, reports, records or maps furnished to GAPL by Exoil or obtained or prepared by GAPL in the course or as a result of services rendered hereunder except with written permission from Exoil, shall not itself take any advantage from same, and shall not retain any copies of such information, reports, records, or maps any longer than necessary for completion of final reports to Exoil. The provisions of this paragraph (b) shall survive any termination of this agreement or operations hereunder.

(c) This agreement contains the entire agreement between the parties with relation to the subject matter hereof, and all communications and prior agreements between the parties with relation to such subject matter are superseded hereby. This agreement may not be modified or discharged in whole or in part, except by a written instrument signed by both parties, and there shall be strict compliance by both parties with the provisions of this agreement unless expressly waived by written instrument as provided above.

(d) All questions arising out of this agreement or its interpretation, application, performance or breach shall be governed and determined by the laws of the State of Queensland, Australia.

Upon receipt of all of the data and maps to be provided by Exoil to GAPL, GAPL will proceed to interpret these data and prepare a final report. GAPL estimates a time of completion of the final report of approximately three months. Progress maps will be available to Exoil's Brisbane office as the interpretation proceeds.

IN WITNESS WHEREOF, the parties have caused  
this agreement to be executed by their duly authorized  
officers as of the day and year first above written.

EXOIL PTY. LTD.

By: .....

Attest:.....

GEOPHYSICAL ASSOCIATES PTY. LTD.

By: .....

Attest:.....

000044

COST ESTIMATE

|                                                                                                                                        | £.                      |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| A. Contract cost for 16420 miles of flying and compilation @ £2/15/- per mile                                                          | 45,155                  |
| B. Contract cost for 16420 miles of interpretation @ 9/-d. per mile                                                                    | 7,389                   |
| C. Photo and planimetric base maps as described in attached contract with Adastra Hunting Geophysics at cost plus freight              | 300                     |
| D. Preparation of base photostrips for Murloocopie and Coober Pedy areas                                                               | 150                     |
| E. Positioning of aircraft, crew and equipment to survey area                                                                          | 1,200                   |
| F. Printing as per B.M.R. memo 62/1700 of June, 1963                                                                                   | 640                     |
| G. Xerox copying of records for interpretation and final report                                                                        | 500                     |
| H. Supervision by Geophysical Associates on basis of 3 trips to field by geophysicist at £50 per day plus expenses and 6 days per trip | 1,350                   |
| I. Company Supervision                                                                                                                 | <u>1,200</u>            |
| Total                                                                                                                                  | <u>£57,884</u><br>===== |

SUMMARY AND TIMETABLE FOR PROPOSED SURVEY

- A. Preparation Phase: September 1st to September 30th, 1964.

Purchase photography, prepare photo base maps, lay out flight lines, check and inspect all instruments and navigational aids. Arrange for aviation fuel and accommodation at base of operations.

- B. Flight Phase: September 30th to December 31st, 1964.

It is estimated that the flying phase, including reflights if necessary, can be completed within the above period.

- C. Data Reduction: (Pending)

Within fourteen (14) weeks of completion of Phase "B", the total intensity maps can be delivered.

- D. Interpretation: (Pending)

Within six (6) weeks of completion of Phase (C), the final report will be completed. Copies will be submitted to the Bureau of Mineral Resources within four (4) months of completion of the field work.

TECHNIQUESA. Flight Plan and Positioning:

A total of 16,000  $\pm 10\%$  line-miles of surveying is proposed to be flown at a barometric altitude of 2,000' above sea level, with the possible exception that the Birksgate, Lindsay, Everard and Wintinna four-mile areas (see Schedule "B" Attachment No. 3) may be flown at an altitude of 2,500' if local relief in these areas makes a higher altitude advisable. Profile lines and tie lines will be flown as per Schedule "A" (Attachment No. 3).

The western half of the area will be flown first at which time a visit to the field will be made by geophysicist, R. Hammon, to determine the advisability of continuing the eastern half with the same uniform flight pattern. It may be desirable to adjust the flight density to obtain better coverage over better areas but the total number of line-miles will remain essentially the same.

Navigation will be by a combination of visual and Doppler methods (see Exhibit 1). Where one mile to one inch photomosaics are available visual navigation will be used only. Where four miles to one inch photomosaics and/or one mile to one inch photos are available a combination of Doppler and visual navigation will be used. In the Wintinna area in the north-east corner of the survey area, where no photos are available, the method of navigation will be solely by Doppler. Control and recovery in this latter area will be dependent upon photo base maps of adjacent areas to the south and west and numerous astrofix and geodetic stations within the area.

Flight lines will be plotted on the base maps prior to flying and a maximum 600' deviation will be permitted. Actual flight path by visual navigation will be determined from the 35 mm. continuous recording positioning camera at intervals of one to two miles along each flight path. Where the Doppler method of navigation is used flight path will be recovered within one-half mile accuracy of its actual true position.

Simultaneous fiducial marks are recorded on both the magnetic record and positioning camera film to ensure accurate positioning along the flight paths where visual navigation is employed. The accuracy of data recovery in this case will be commensurate with the quality of the photo coverage. The corners identified on the one mile = 1" photomosaics supplied by the Department of National Mapping are considered to be accurate within 400 yards of true geographical position.

If permission is obtained, the field operational base will be maintained at Maralinga, South Australia, during

flying. If it is not possible to use the Maralinga base it is likely that the western portion of the survey will be flown from Forrest, West Australia, and the eastern portion from Oodnadatta, South Australia.

Aircraft maintenance will be carried out at the base of operation when practical and permissible according to the rules and regulations laid down by the Department of Civil Aviation.

#### B. Instrument Control:

The Gulf Mark III magnetometer with the sensing or detecting head attached to or towed behind a Lockheed Hudson aircraft will be used to record magnetic variations at a sensitivity of 600 or 300 gamma full scale deflection, depending upon magnetic conditions. The noise level of the recorded magnetic field profiles shall at no time exceed a two (2) gamma envelope. The instrument drift shall be less than six gamma per hour. Instrument or photographic lag will be checked over a known magnetic object prior to the commencement of the survey and included in the final report. The sensitivity of the measuring fluxgate will be checked before the survey using a standard Helmholtz coil.

The magnetic storm monitor will be operated at all times during flight operations through the entire survey. No flight will be made during magnetic disturbance periods and survey data recorded during a magnetic storm will be rejected and re-flown during normal magnetic conditions.

#### C. Data Reduction and Presentation:

The data resulting from the survey will be presented as total intensity maps, basement depth estimates and a final report including a summary of operations and interpretation results. The scale of the base maps and overlays are to be 1" = 2 miles and 1" = 4 miles (see contracts with Adastra Hunting Geophysics and Geophysical Associates). Progress reports will be presented to the Bureau of Mineral Resources fortnightly. Data supervision will be carried out by Geophysical Associates in Brisbane, Queensland, who will receive the magnetic records directly from the field for this purpose. This will include determinations of satisfactory, storm-free and error-free magnetometer records. Acceptable records will be forwarded immediately to Adastra Hunting Geophysics in Mascot, New South Wales, where data reduction will be carried out including processing of film strips, determination of actual flight paths, progress reports, compilation and fairline drafting.

Xerox copies of all magnetometer records will be forwarded to Geophysical Associates accompanied by two miles = 1" dye line copies and four miles = 1" cronaflex copies of the pencilled contours of total magnetic intensity immediately when available. Interpretation of all data and preparation of the final report will subsequently be carried out by Geophysical Associates Pty. Ltd. in Brisbane.

REASONS FOR SURVEY

The survey will:-

1. Allow us to determine the regional configuration of magnetic basement plus obtain any other information available from the magnetic records.
2. Provide broad information on the thickness and distribution of sediments over an approximate 50,000 square mile area which is essentially devoid of surface outcrops.

Regional geology (see Attachment No. 9) indicates that prospective Permian and Lower Paleozoic sediments similar to those existing in the adjacent Great Artesian and Amadeus Basins respectively may occur in the Officer Basin. This survey will permit us to be reasonably selective in choosing areas for the more expensive seismic method of prospecting and thus expedite the eventual drilling of a suitable stratigraphic test to evaluate the area's prospectiveness for oil and gas.

REGIONAL GEOLOGY

Oil Exploration Licence No. 28 covers approximately 60,000 square miles of predominantly desert terrain that is completely devoid of surface outcrops. This topographically destitute area constitutes the South Australian portion of the Officer Basin. The Officer Basin extends into Western Australia and has a total area of over 100,000 square miles. The parameters which define its existence have largely been determined through geophysical methods (see Attachment No. 10).

The basin is bounded by the Musgrave Block (Blackstone Ranges, Bell Rock, Tomlinson Range, Mann Range, Musgrave Range and Everard Range) in the north and by the northern limits of the Eucla Basin in the south. In the west the boundary is fixed by outcrops of the Australian Precambrian Shield, while in the east there seems to be a gradual merge into the Great Artesian Basin, but Shields (1961) thinks that the eastern boundary is in the vicinity of the 134th meridian.

The subsurface stratigraphy has not been established. There are indications, however, of some similarities with the Amadeus Basin.

Unmetamorphosed Proterozoic rocks outcrop near the basin to the north, east and south. These rocks have also been identified in water bores at Maralinga, the eastern part of the Eucla Basin and east of Lake Phillipson (Ludbrook, 1958-61).

No Cambrian sediments have yet been identified in or around the margins of the basin but extensive developments occur in the adjacent Great Artesian and Amadeus areas.

Large thicknesses of sandstones believed to be of Ordovician age have been mapped along the basin's northern edge. The only positive identification of Ordovician, however, has been reported by Fitzpatrick (personal communication) to be at Coffin Hill in O.E.L. 28 just west of the Mt. Davies road.

Glacigene, marine and freshwater Permian sediments have been logged in several bores between Lake Phillipson and the Peake and Denison Ranges about 35 miles east of O.E.L. 28. Their areal and vertical distribution suggests a regional dip to the northwest (Rochow 1963). Further north, about 85 miles from O.E.L. 28 and south of Oodnadatta, a small inlier of sediments has been discovered at Mount Toondina (Freytag 1964). These sediments are of lacustrine origin and consist of interbedded shales, siltstones, minor sandstones and coal seams.

The Exoil Emu No. 1 Well was drilled to 1370' in 1963 in central O.E.L. 28. No fossils were noted but Grasso believes the rock resembles some of the ?Permian of the Amadeus Basin.

Some Jurassic sandstone has been noted at Mt. Toondina but there is no indication that a significant thickness of Mesozoic sediments might exist in the Officer Basin. Small amounts of these rocks, along with Tertiary and Pleistocene, could be expected however.

|                                              |                                                          |                                                          |                                                          |          |     |
|----------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------|-----|
| 129°                                         | 130° 30'                                                 | 131°                                                     | 132°                                                     | 133° 30' | 27° |
| <p>BIRKSGATE<br/>VISUAL<br/>1 M. MOSAICS</p> | <p>LINDSAY<br/>VISUAL &amp; DOPPLER<br/>4 M. MOSAICS</p> | <p>EVERARD<br/>VISUAL &amp; DOPPLER<br/>4 M. MOSAICS</p> | <p>WINTINNA<br/>DOPPLER<br/>NO PHOTOS</p>                |          |     |
| 28°                                          | 28°                                                      | 28°                                                      | 28°                                                      | 28°      |     |
| <p>NOORINA<br/>VISUAL<br/>1 M. MOSAICS</p>   | <p>WELLS<br/>VISUAL<br/>1 M. MOSAICS</p>                 | <p>GILES<br/>VISUAL<br/>1 M. MOSAICS</p>                 | <p>MURLOOCCOPPIE<br/>VISUAL &amp; DOPPLER<br/>PHOTOS</p> |          |     |
| 29°                                          | 29°                                                      | 29°                                                      | 29°                                                      | 29°      |     |
| <p>WYOLA<br/>VISUAL<br/>1 M. MOSAICS</p>     | <p>MAURICE<br/>VISUAL<br/>1 M. MOSAICS</p>               | <p>TALLARINGA<br/>VISUAL<br/>1 M. MOSAICS</p>            | <p>COOPER PEDY<br/>VISUAL &amp; DOPPLER<br/>PHOTOS</p>   |          |     |
| 30°                                          | 30°                                                      | 30°                                                      | 30°                                                      | 30°      |     |

LEGEND

MILITARY 4 MILE AREAS  
METHOD OF NAVIGATION  
DESCRIPTION OF BASE MAPS

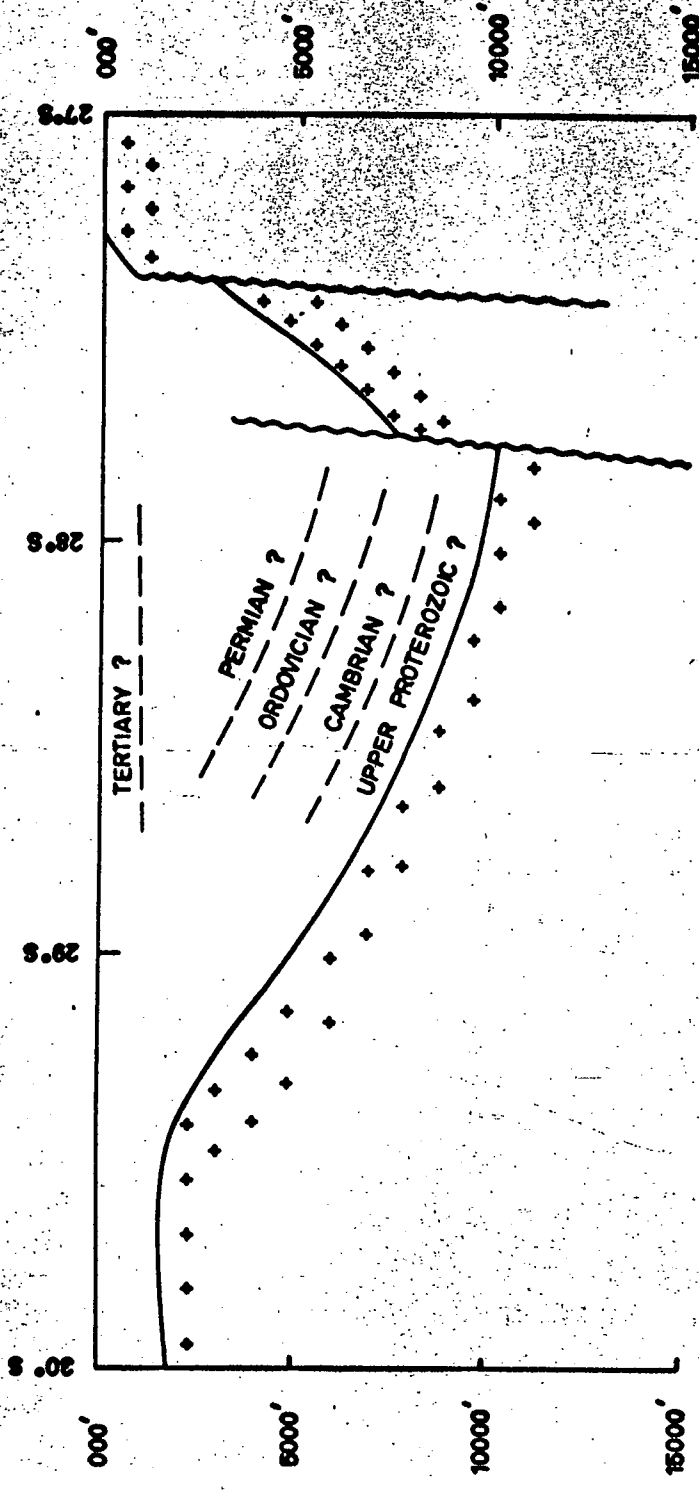
EXXIL PTY. LTD.

PROPOSED AEROMAGNETIC SURVEY  
DIAGRAM SHOWING MAP DATA

52 A

5211/529 Envelope 399

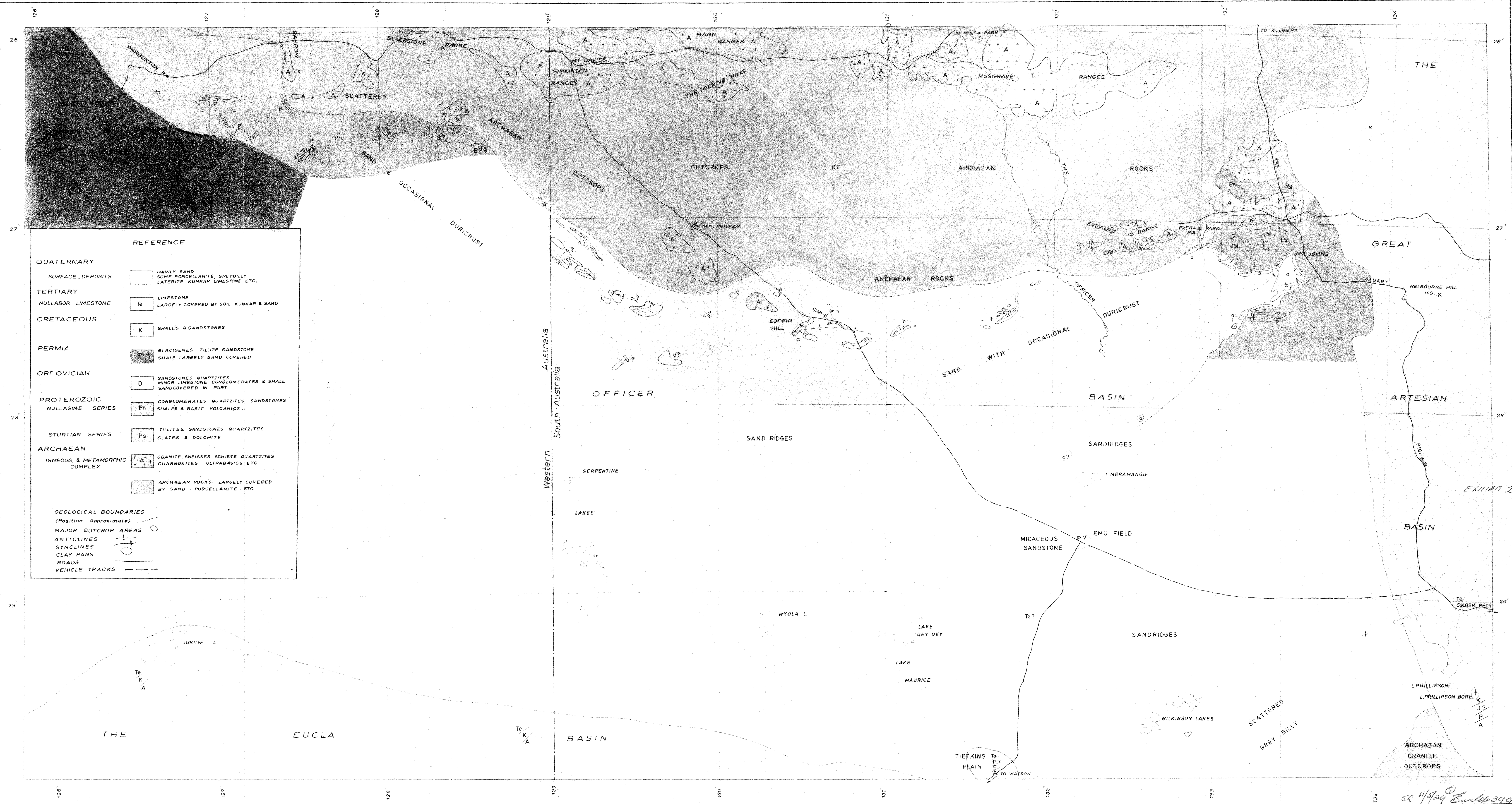
S2 B



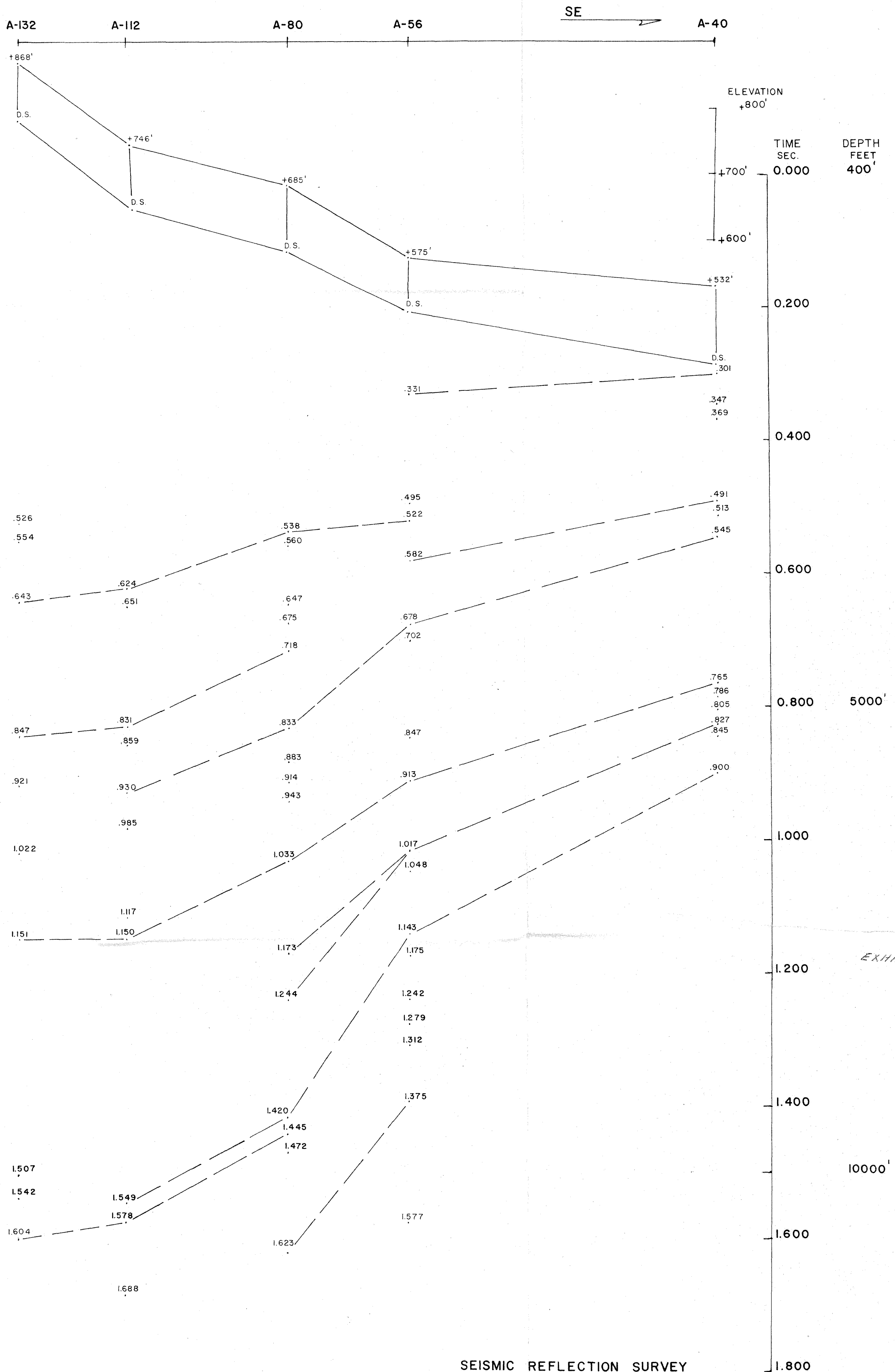
DIAGRAMMATIC CROSS-SECTION OF OFFICER BASIN  
ALONG 131° MERIDIAN



21 SEP 1964  
SR 11/5/29  
Envelope 399



# LINE A



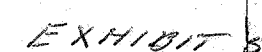
HOR. SCALE  
1" = 10 MILES

SEISMIC REFLECTION SURVEY  
OF THE  
MABEL CREEK AREA  
SOUTH AUSTRALIA  
CONDENSED REFLECTION CORRELATION PROFILE

399-2

Enclosure No. IV

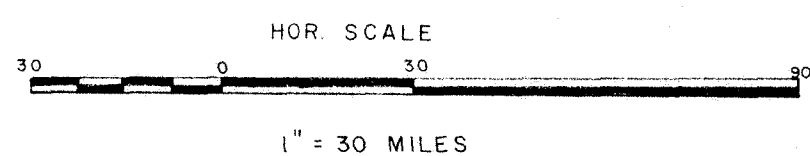
## E



SEISMIC REFLECTION SURVEY

### CONDENSED REFLECTION CORRELATION PROFILE

Enclosure No. V



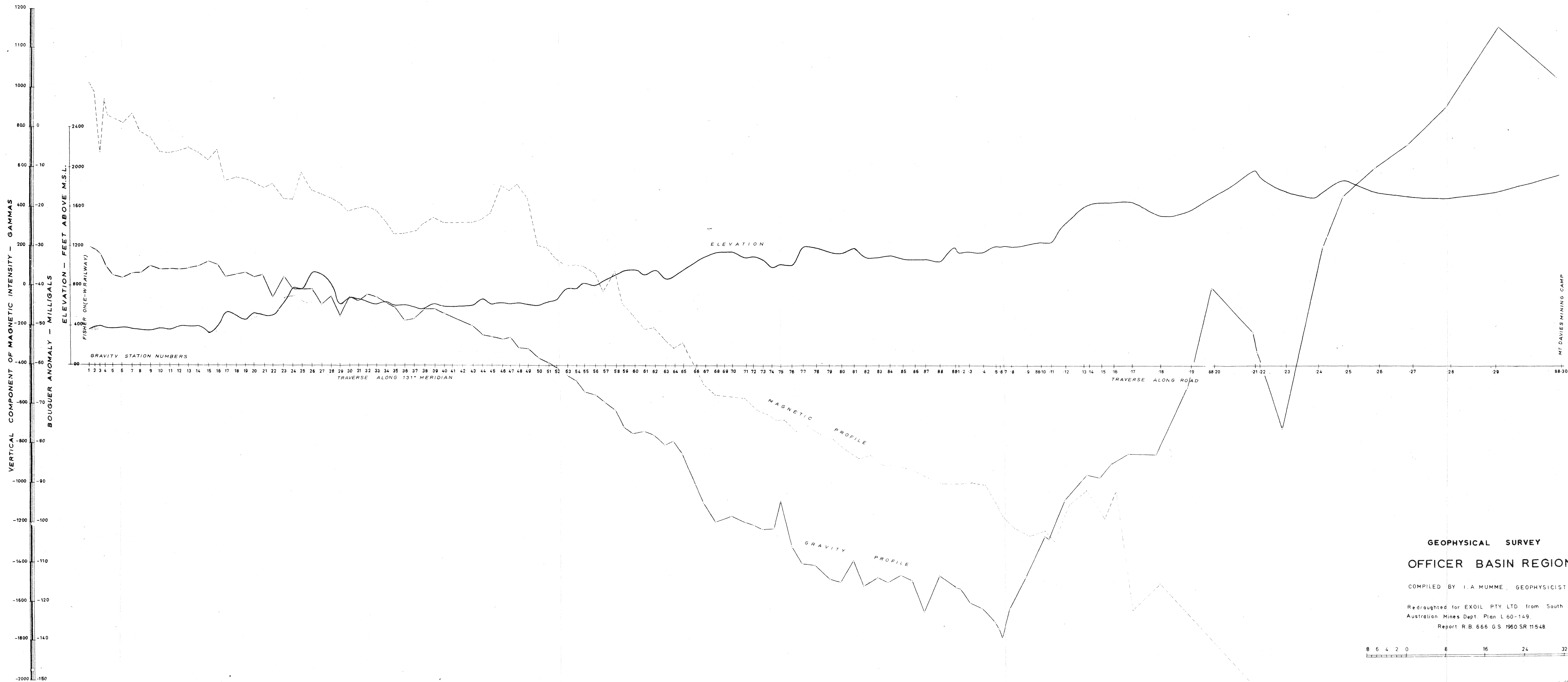


EXHIBIT 6

**GEOPHYSICAL SURVEY  
OFFICER BASIN REGION**

COMPILED BY I. A. MUMME, GEOPHYSICIST

Redrafted for EXOIL PTY LTD. from South  
Australian Mines Dept. Plan L 60-149.

Report R.B. 666 G.S. 1960 SR 11548

8 6 4 2 0 8 16 24 32 40 Miles

399-4 <sup>SR 11/5/59</sup>  
Encl 399

120000053

EXOIL PTY LTD  
EASTERN OFFICER BASIN  
SOUTH AUSTRALIA

PART I  
AIRBORNE MAGNETOMETER SURVEY  
ADASTRA HUNTING GEOPHYSICS PTY LTD

PART II  
ITS INTERPRETATION  
GEOPHYSICAL ASSOCIATES PTY LTD

12 October 1965



12/10/65

12/10/65

## PART I

An  
Airborne Magnetometer Survey  
of  
Eastern Officer Basin  
Oil Exploration Lease O. E. L. 28, S. A.

Carried out by  
ADASTRA HUNTING GEOPHYSICS PTY. LTD.  
39-45 Vickers Avenue  
Mascot, N. S. W.

for  
EXOIL PTY. LTD.  
Brisbane, Q. Id.

Field work carried out between  
26th October - 22nd December, 1964  
and  
14th January - 17th April, 1965

OPERATIONAL REPORT

## LIST OF CONTENTS

I INTRODUCTION

- |    |                       |        |
|----|-----------------------|--------|
| 1. | General Information   | Page 1 |
| 2. | Purpose of the Survey | Page 1 |

II THE FLYING PROGRAMME

- |    |                         |        |
|----|-------------------------|--------|
| 1. | Pre-flight Preparations | Page 2 |
| 2. | Programme Details       | Page 2 |
|    | (1) Height              | Page 2 |
|    | (2) Flight Lines        | Page 2 |

III METHODS AND INSTRUMENTS USED FOR THE SURVEY

- |    |                                     |        |
|----|-------------------------------------|--------|
| 1. | Airborne (Total Force) Magnetometer | Page 3 |
|    | (a) Record                          | Page 3 |
|    | (b) Calibration                     | Page 4 |
|    | (c) Tests                           | Page 4 |
| 2. | 35mm Positioning Camera             | Page 5 |
|    | (a) Tests                           | Page 5 |
| 3. | Radio Altimeter                     | Page 5 |
| 4. | Storm Monitor                       | Page 6 |
|    | (a) Record                          | Page 7 |
|    | (b) Calibration                     | Page 7 |

IV FLYING OPERATIONS

- |    |                      |        |
|----|----------------------|--------|
| 1. | Aircraft             | Page 8 |
| 2. | Bases                | Page 8 |
| 3. | Maps and Mosaics     | Page 8 |
| 4. | Record of Operations | Page 8 |

V AIRBORNE PROCEDURE

- |    |                           |         |
|----|---------------------------|---------|
| 1. | Warming-up of Instruments | Page 10 |
| 2. | Annotation of Records     | Page 10 |
| 3. | Aeromagnetic Record       | Page 10 |
| 4. | Radio Altimeter Record    | Page 11 |
| 5. | Daily Flight Report       | Page 11 |

VI GEOPHYSICAL TECHNIQUES

- |    |                         |         |
|----|-------------------------|---------|
| 1. | Control of Observations | Page 11 |
| 2. | Instrument Drift        | Page 12 |
| 3. | Regional Correction     | Page 12 |
| 4. | Magnetic Information    | Page 12 |

VII REDUCTION OF DATA

- |    |                                                  |         |
|----|--------------------------------------------------|---------|
| 1. | Plotting of Flight Path and Transfer of Overlays | Page 12 |
| 2. | Relating Profiles to the Plotted Flight Path     | Page 13 |
| 3. | Datum Lining and Intercepting                    | Page 13 |

VIII MAPS, CHARTS, RECORDS, ETC. SUPPLIED  
COMPLETION OF THE SURVEY

Page 13

IX PLATES

Page 14

X APPENDIX

Page 15

## I - INTRODUCTION

### 1. GENERAL INFORMATION

The area surveyed covered part of Oil Exploration Licence 28 in South Australia as shown on Plate 1.

Flight lines were flown NORTH-SOUTH in groups of three with a space of 1-1/2 miles between lines and approximately 10 miles between each group.

Tie lines were flown EAST-WEST as single lines spaced approximately 20 miles apart.

For flight/tie line diagram see Plate 7.

The survey was continuous except for a period from the 23rd December 1964 to the 15th January 1965 when operations were suspended owing to close-down of services at Maralinga Aéródrome.

The survey was designed as a reconnaissance programme with the northern boundary delineated by tie line 'A'. The area north of this tie line between 129°00'E and 133°00'E was precluded from the lease coverage as granite outcrops were known to exist.

An additional area east from line 36 (approximately 131°20'E) to the eastern boundary (134°00'E) was later eliminated from the programme based on magnetic information obtained from east-west tie lines.

Lines already flown in this area prior to cancellation remain as part of the final pattern. These lines and the area deleted from the programme are shown on Plate 7.

### 2. PURPOSE OF THE SURVEY

The survey was designed to obtain knowledge of the subsurface rocks from the interpretation of total force field aeromagnetic anomalies.

Such information as depth to magnetic basement, possible edges of sedimentary basins, magnetic intrusives and extrusives and possible composition of the magnetic basement were all features of this survey dealt with in detail under part two of this report - Interpretation of Results.

## II - THE FLYING PROGRAMME

### II 1. PRE-FLIGHT PREPARATIONS

Originally it was intended to use Everard and Lindsay 4 mile mosaics for navigation and plotting and in the Murloocoppie, Coober Pedy, and Wintinna areas, a combination of Doppler and, where available strip photography. During the later stages of the survey, however, the one mile semi-controlled mosaics for these areas became available and so were used for plotting. Flying already carried out by reference to 4 mile photo mosaics for part of the area was re flown on the later 1 inch to 1 mile photo mosaics.

The positions of the lines to be flown were plotted on 1 mile to 1 inch semi-controlled photo mosaics included in the 4 mile to 1 inch areas of Birksgate, Lindsay, Everard, Wintinna, Noorina, Wells, Giles, Murloocoppie, Wyola, Maurice, Tallaringa and Coober Pedy.

(For details of coverage see Plate 8)

### II 2. PROGRAMME DETAILS

#### (1) Height

Because of a large decrease in terrain clearance in the north of the area, it was necessary to fly all lines north of tie line 'D' at 2,500 ft. a.m.s.l. The remainder of the area south of tie line 'D' was flown at 2,000 ft. a.m.s.l.

#### (2) Flight Lines

Seventytwo (72) north-south flight lines were flown in groups of three, the spacing between individual lines being 1-1/2 miles with 10 miles between groups.

Eleven east-west tie lines were flown approximately twenty miles apart.

#### Summary

|                                       |                    |
|---------------------------------------|--------------------|
| 72 north-south flight lines totalling | 11,292 miles       |
| 11 east-west tie lines totalling      | <u>3,146 miles</u> |
| Total                                 | 14,438 miles       |

(see Appendix for list of individual line mileages flown)

### III - METHODS AND INSTRUMENTS USED FOR THE SURVEY

#### III 1. AIRBORNE (TOTAL FORCE) MAGNETOMETER

The instrument used for this survey was a Gulf Mark III Total Force Magnetometer manufactured by the Gulf Research and Development Company, Pittsburgh, Pennsylvania.

The airborne magnetometer is intended primarily for measurements of the earth's total magnetic field intensity, and in particular, local variations in intensity such as may be caused by geological inhomogeneities.

The equipment comprises a measuring or detecting element, an oscillator to excite it, a vacuum tube circuit to amplify and detect the output variations of the same element, orienting devices (which keep the detector element aligned), a potentiometer circuit to compensate ("buck out") large changes of field, and a recorder for the graphic presentation of magnetic variations encountered over the area surveyed.

The airborne magnetometer was designed for use in a moving aircraft, and yet it must provide a continuous and accurate record of the earth's total magnetic intensity. Because the aircraft does not accurately maintain its orientation in space, provision must be made to hold the measuring, or detector element, in a fixed orientation (parallel) with respect to the earth's total field.

The Gulf magnetometer uses the earth's magnetic field itself as a reference, and the detector element is aligned with its axis of sensitivity parallel to this field. This arrangement places the detector element in the most favourable position, and errors due to improper orientation are at a minimum. Two similar sets of detector elements are used to sense and seek the position of zero (null) field.

When the axis of sensitivity of the detector element is aligned parallel to the earth's field, any error of alignment causes a decrease in reading and is a cosine function of the error angle. Errors are therefore small for small angles of misorientation, being in fact of the order of 0.5 gamma for 1/4 degree, and 8.4 gamma for 1 degree misalignment in a total field of 55,000 gamma.

##### (a) RECORD

The speed of the aeromagnetic profile recorder was 3" per minute, and the full scale deflection (sensitivity) was set at 600 gamma. The value of the step (automatic reset procedure when variations of magnetic field exceed f. s. d., i. e., 600 gamma) was 500 gamma.

(b) CALIBRATION

The instrument was calibrated prior to the survey using standard Helmholtz coils registering 10 gamma per 1 milliampere of current.

(c) TESTS

(1) Lag Test

Lag, or delay of signal response considered in relation to the ground position of the aircraft, is due to a combination of the following:

- i) Time delay caused by electrical resistance in the circuitry.
- ii) Time delay caused by mechanical transference of the received signal on to the paper record.
- iii) Positional error due to the difference in location of recording camera with respect to the detector head.

To find the total recorded lag it is necessary that the aircraft fly over an easily identifiable magnetic body on a reciprocal course, e.g., a ship, a large metal pipeline, an iron bridge etc., which will give a well defined sharp magnetic anomaly. Then by identifying the position of the centre of the body on the 35mm tracking film and plotting this point on the magnetometer chart, the difference between this point (average of two directions) and the peak of the magnetic anomaly from the body is the total lag for the installation.

The lag test for this survey was flown over the Sydney Harbour Bridge before the aircraft departed from the area.

The installation used on this survey was checked as above, and no readable lag was detected. The fiducial index pen was aligned with the main recording pen.

(2) Heading Effect

The detector head (measuring fluxgate), aligning fluxgates and servo motors were towed behind the aircraft in a "bomb" shaped bird. With this arrangement there is normally no heading effect, however, a heading test was carried out in the area as a check. No heading effect was observed.

### III 2. 35mm POSITIONING CAMERA

The instrument used for this survey to record the position of the aircraft in relation to the ground was a single frame 35mm camera (using 400 ft. capacity magazines), details of which are as follows:

|                  |                                      |
|------------------|--------------------------------------|
| Type:            | Vinten 35mm Geological Survey Camera |
| Focal Length:    | 28mm (1.10 inches)                   |
| Shutter Speed:   | 1/250 sec. (constant)                |
| Diaphragm Range: | f2-f32                               |
| Format:          | 18mm x 25mm                          |
| Intervals:       | 3/4 sec. to 6 sec.                   |

The camera was mounted in the aircraft with its optical axis set vertical for straight and level flight.

Exposures were made automatically using an electronically controlled intervalometer set at 1.5 or 2.0 second intervals. With the exposure interval so set, each 35mm frame is overlapped by approximately 25% to 30%, thus ensuring complete ground coverage.

The camera exposures were related to the magnetic field record by the use of a fiducial pen on the recorder which operated simultaneously with the camera Veeder counter at every tenth exposure.

Du Pont Type 936 35mm film, rated at 160 A. S. A. was used throughout the survey, except when lighting conditions were poor, such as early morning photography, when Kodak Super XX film was used.

All film processing was carried out by the Automatic Film Laboratories, Moore Park, Sydney.

#### (a) TESTS

The correct functioning of the camera was tested daily, prior to, and at the end of each sortie.

### III 3. RADIO ALTIMETER

Apart from the barometric altimeter, which is standard equipment in all aircraft, a radio altimeter type APN-1 was used to record terrain clearance.

The instrument was set on "high range" (0-4000 ft.) throughout the survey.

An Esterline Angus recording potentiometer was used in conjunction with this instrument to obtain a continuous profile on a five inch wide curvilinear chart recording at a speed of 3 inches per minute.

In order to check that the instrument was functioning correctly, the aircraft was flown over the base aerodrome before and after each sortie.

### III 4. STORM MONITOR

With aeromagnetic surveys it is essential that any time variation of the magnetic field is monitored and recorded throughout the duration of the survey on a 24 hour basis.

The normal diurnal change of field, which occurs daily, is of low gradient and cyclic, and can be compensated for in the standard flight line/tie line control pattern. However, any abnormal variation, when total magnetic field strength varies erratically over short periods, will affect the recorded results of all surveys carried out during these periods.

Where such variations occur, re-flying would be necessary.

The instrument used for this survey was a single fluxgate magnetometer manufactured by the Gulf Research and Development Company, Pittsburgh, Pennsylvania.

The complete equipment consisted of:

- i) Fluxgate Element.
- ii) Detector Head
- iii) "Buck Out" Magnet
- iv) Tripod
- v) Esterline Angus Recorder
- vi) Compensator.

The fluxgate element employs the same principles as the airborne instrument, i.e., it comprises two coils having ferromagnetic cores which are driven cyclically through saturation. A secondary, or compensating coil surrounds both primaries, which are connected in series opposition, so arranged that one core saturates slightly ahead of the other. The resultant output is then in the form of sharp pulses, and when there is no external magnetic field the positive and negative pulses are equal in amplitude.

Should an external field now be applied to these cores their times of saturation will be altered, which will cause a change in output.

To balance or null this introduced external field a current is passed through the secondary coil (surrounding the primaries), equal and opposite to the disturbing field.

It is this current which is measured, amplified, and passed through a recording potentiometer (Esterline Angus Recorder). This record is easily translated into magnetic units.

To ensure maximum sensitivity, a permanent magnet, supported by a ceramic structure, is mounted on the head together with the detecting element, and adjusted to "buck out" the major portion of the earth's normal field at the location used.

#### (a) RECORD

The recorder chart speed was set at 1-1/2 inches per minute whilst the aircraft was on survey, and 1-1/2 inches per hour at all other times.

#### (b) CALIBRATION

Prior to the commencement of the survey the instrument was calibrated using standard Helmholtz coils.

Full scale deflection over the 4-1/2 inches wide recorder chart registered 240 gamma. The chart is divided into 50 divisions, thus each division has a value of 4.8 gamma.

The storm monitor was installed at Forrest aerodrome for the period 27th October to 9th December, 1964 and at Maralinga for the period 10th December to 22nd December, 1964 and again from 14th January to 12th March, 1965.

From 13th March to 17th April, 1965 it was installed at Oodnadatta.

#### IV - FLYING OPERATIONS

##### IV 1. AIRCRAFT

A Lockheed Hudson aircraft registered letters VH-AGE was used to carry out the survey.

The Gulf III Magnetometer measuring head, aligning coils and servomotors were towed in a "bomb" shaped bird below the aircraft.

The average ground speed maintained during the survey was 175 m. p. h.

##### IV 2. BASES

Aircraft VH-AGE was based at Forrest from October 26th to December 9th 1964, and at Maralinga from December 10th to December 22nd 1964, and again from January 14th to March 12th, 1965. From March 13th to April 17th, 1965 it was based at Oodnadatta.

##### IV 3. MAPS AND MÔSAICS

The following maps and mosaics were available at the time of the survey.

###### World Aeronautical Charts (I. C. A. O.)

Scale 1:1,000,000 (15.8 miles to 1 inch) Peterman Ranges, Oodnadatta, Nullabor Plains, Tarcoola.

###### Photomosaics Semi-Controlled

Scale approximately 1 mile to 1 inch, prepared by the Division of National Mapping and South Australian Lands Department.

##### IV 4. RECORD OF OPERATIONS

Lockheed Hudson VH-AGE piloted by Captain K. Rowlands operated from Forrest from October 26th to December 9th, and from Maralinga from December 10th to December 22nd.

Other members of the crew were W. Henderson (Navigator), M. Miller

(Operator Technician). W. Chambers (Ground Engineer).

M. Miller was replaced by R. Nelson from the 7th November.

From January 14th to March 12th the aircraft operated from Maralinga and between March 13th and April 17th from Oodnadatta but with the following crew changes.

Captain E. McKenzie replaced Captain K. Rowlands as pilot and D. Beale replaced W. Chambers as Ground Engineer.

Captain E. McKenzie was replaced by Captain K. Cooper as from 7th March.

Abortive sorties were caused by the following:

|                                           |                                                                         |
|-------------------------------------------|-------------------------------------------------------------------------|
| 27th October                              | - Magnetometer unserviceable                                            |
| 31st October to 5th November inclusive    | - Aircraft unserviceable due to faulty generator                        |
| 6th November                              | - Generator fitted and tested                                           |
| 12th to 23rd November inclusive           | - Engine failure - engine changed                                       |
| 25th November                             | - Excessive turbulence and high winds                                   |
| 28th November to 1st December inclusive   | - Aircraft unserviceable owing to a faulty magnetometer                 |
| 8th and 9th December                      | - Bad weather conditions                                                |
| 10th December                             | - Setting up at Maralinga                                               |
| 18th December to 20th December inclusive  | - Bad weather conditions                                                |
| 22nd December                             | - Bad weather conditions                                                |
| 23rd December, 1964 to 14th January, 1965 | - Maralinga stand-down period                                           |
| 18th January                              | - Bad weather conditions                                                |
| 27th and 28th January                     | - Bad weather conditions                                                |
| 1st February                              | - Bad weather conditions                                                |
| 3rd February                              | - Bad weather conditions                                                |
| 7th February                              | - Magnetic storm                                                        |
| 14th February                             | - Bad weather conditions                                                |
| 16th February                             | - Bad weather conditions                                                |
| 20th February                             | - Severe turbulence                                                     |
| 21st February                             | - Severe turbulence                                                     |
| 28th February                             | - Crew stand-down in accordance with D.C.A. regulation A.N.O. 48.1.1.12 |
| 2nd March                                 | - Severe turbulence and faulty magnetometer                             |

|                                 |                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------|
| 3rd March                       | - Strong winds                                                                    |
| 4th March                       | - Magnetometer unserviceable                                                      |
| 5th and 6th March               | - Magnetic storm                                                                  |
| 10th March                      | - Camera fault                                                                    |
| 12th March                      | - Bad weather conditions                                                          |
| 14th March                      | - Camera unserviceable                                                            |
| 15th March                      | - Magnetometer unserviceable                                                      |
| 16th and 17th March             | - General equipment unserviceability -<br>air tests                               |
| 19th to 22nd March<br>inclusive | - Awaiting magnetometer spare parts                                               |
| 25th March                      | - Magnetometer cable unserviceable                                                |
| 26th March                      | - Equipment servicing                                                             |
| 30th March                      | - Crew stand-down in accordance with<br>D. C. A. regulation A. N. O. 48. 1. 1. 12 |
| 6th April                       | - Crew stand-down in accordance with<br>D. C. A. regulation A. N. O. 48. 1. 1. 12 |
| 12th and 13th April             | - Awaiting reply information                                                      |

## V - AIRBORNE PROCEDURE

### V 1. WARMING-UP OF INSTRUMENTS

All electronic instruments were switched on and kept running for at least half an hour before recording began to ensure their proper and steady function.

### V 2. ANNOTATION OF RECORDS

During the survey, records were annotated for future and plotting purposes, the following annotations being made:

### V 3. AEROMAGNETIC RECORD

- i) Line identification and direction
- ii) Numbering of first fiducial and every fiducial mark equivalent to each 100th frame
- iii) Time (synchronised with storm monitor)
- iv) Step Numbers (automatic reset)
- v) Recorder standardise, marked R. S.

vi) Measuring circuit standardise, marked STD

vii) Instrument drift errors

#### V 4. RADIO ALTIMETER RECORD

i) Start and finish of line showing line numbers and directions

ii) Camera fiducial numbers

#### V 5. DAILY FLIGHT REPORT

These reports give a detailed description of the sorties from an operational point of view and show the following information:

i) Times of start and end of sortie

ii) Instruments used and relevant details

iii) 35mm photography numbers

iv) Times of start and finish of individual lines

v) Direction of lines flown

vi) Changes of film magazines and recording charts

vii) Navigator's diagram showing the flying achieved for the sortie and line direction

#### VI - GEOPHYSICAL TECHNIQUES

##### VI 1. CONTROL OF OBSERVATIONS

Because of difference in magnetic gradient and flight line/tie line layout, two methods of control were used as follows:

(1) In the area south of tie line "G" and east of flight line 45, the method of open loops was used

Intersection readings were taken and the nett closure error was distributed time wise around the circuit.

- (2) Elsewhere control was achieved by the use of all tie lines and selected flight lines so distributed as to form rectangular circuits approximately 20 miles by 13 miles.

At all these intersections readings were taken, and using a system based on least squares, each control line was adjusted to standard datum.

Lines used for control, distribution of errors and remaining errors are shown in Plate 2 of this report.

## VI 2. INSTRUMENT DRIFT

The instrument drift was checked at the end of each surveyed line using the normal standardising procedure. Both recorder and measuring circuit drifts were adjusted in this way.

## VI 3. REGIONAL CORRECTION

A regional correction has been applied to the Total Magnetic Intensity Contour Sheets as follows:

Minus 8.40 gamma per line mile south  
Minus 0.66 gamma per line mile west

These values were taken from the Bureau of Mineral Resources Report No. 62 "Isomagnetic Maps of Australia for the Epoch 1947.5" corrected for secular change.

## VI 4. MAGNETIC INFORMATION (MEAN)

Total Force Field (F) : 56 500 gamma  
Inclination of Field (I) : - 60 degrees  
Deviation of Field (D) : 4 degrees east

## VII - REDUCTION OF DATA

### VII 1. PLOTTING OF FLIGHT PATH AND TRANSFER OF OVERLAYS

The position of the aircraft over the ground recorded on the 35mm film was initially identified and plotted by reference to topographical detail depicted on the one mile to one inch semi-controlled photo mosaics.

Density of plotting was on the average between 1-1/2 to 2 miles.

These stations were then transferred directly on to detail overlays at a scale of two miles to one inch and used as a base for plotting intercepted values from the aeromagnetic profiles.

## VII 2. RELATING PROFILES TO THE PLOTTED FLIGHT PATH

All points identified from the 35mm film and plotted on the final base sheets, were plotted on the aeromagnetic profile charts by interpolation. The points on the charts thus plotted were used to transfer intercepted profile readings.

## VII 3. DATUM LINING AND INTERCEPTING

- i) Aeromagnetic profiles were referred to a common datum based on the adjusted values at the control intersections.

The datum value was selected sufficiently high to avoid any negative anomalies.

- ii) Intercepts from the aeromagnetic profiles were taken at minima, maxima, and at intervals of five gamma. Where the anomaly gradients were steep, other intervals were selected according to the gradients.

- iii) The intercepted values were transferred to the base overlay maps using the plotted 35mm stations.

## VIII - MAPS, CHARTS, RECORDS ETC. SUPPLIED ON COMPLETION OF SURVEY

The following maps, charts, records, etc. were supplied on completion of the survey:

- i) All original magnetometer profile charts with 35mm identified stations plotted and annotated, also positions of flight line/tie line intersections marked with adjusted datum values.
- ii) One Xerox copy of all above magnetometer profile charts for supply to the Bureau of Mineral Resources.

- iii) One Xerox copy similar to (ii) above for interpretation facilitation.
- iv) All original radio altimeter profiles annotated as in (i) above.
- v) All original storm monitor profile charts marked at ten minute intervals.
- vi) All original daily flight reports listing traverses flown, 35mm exposure number, direction of lines and times of start and finish of survey lines.
- vii) Plotted 35mm recovered flight paths showing station numbers at intervals of approximately one to two miles on one inch to one mile mosaics.
- ix) Two copies each of the fifteen total magnetic intensity contour maps at a scale of two miles to one inch on "Cronaflex" or similar stable base material, together with two dyeline copies of each sheet. In addition to the contours these sheets will show skeleton planimetric or topographic and recovered 35mm stations at intervals of approximately two miles along each line or tie line and with every fifth station numbered.
- x) Two copies each of four Total Magnetic Intensity Contour Maps at a scale of one inch to four miles compiled from the fifteen sheets in (ix) above, on "Cronaflex" or similar stable base material, plus three dyeline copies of each sheet.
- xi) An operational report of the flying and reduction of data.

#### IX - PLATES

|         |   |                                                                       |
|---------|---|-----------------------------------------------------------------------|
| PLATE 1 | - | Locality Map                                                          |
| PLATE 2 | - | Least square adjustment of closure errors and distribution of errors. |
| PLATE 3 | - | Specimen aeromagnetic profile with annotations                        |

- PLATE 4 - Specimen radio altimeter profile with annotations
- PLATE 5 - Specimen storm monitor profile
- PLATE 6 - Specimen 35mm film strip
- PLATE 7 - Diagram showing positions of flight lines and tie lines in relation to the area boundaries
- PLATE 8 - Diagram of map and mosaic coverage

# X - APPENDIX

Index to flight lines and tie lines used in reduction listing sortie number, date flown, and 35mm station numbers.

Survey altitude: 2,500 ft. between tie lines A and D and  
2,000 ft. between tie lines D and K.

## Flight Lines

| <u>Sortie No.</u> | <u>Line No.</u> | <u>Exposure No.</u> | <u>Date Flown</u> | <u>Remarks</u> |
|-------------------|-----------------|---------------------|-------------------|----------------|
| 39                | 1 (A-D)         | 2370-2879           | 2. 2. 1965        |                |
| 39                | 1 (D-G)         | 1730-2369           | 2. 2. 1965        |                |
| 18                | 1 (G-K)         | 100- 940            | 2. 12. 1964       |                |
| 39                | 2 (A-D)         | 2880-3439           | 2. 2. 1965        |                |
| 13                | 2 (D-G)         | 1611-2230           | 4. 12. 1964       |                |
| 12                | 2 (G-K)         | 1509-2369           | 3. 12. 1964       |                |
| 39                | 3 (A-D)         | 3440-3929           | 2. 2. 1965        |                |
| 13                | 3 (D-K)         | 101-1610            | 4. 12. 1964       |                |
| 39                | 4 (A-D)         | 3930-4469           | 2. 2. 1965        |                |
| 14                | 4 (D-K)         | 100-1779            | 5. 12. 1964       |                |
| 41                | 5 (A-D)         | 960-1459            | 5. 2. 1965        |                |
| 39                | 5 (D-F)         | 1200-1729           | 2. 2. 1965        |                |
| 14                | 5 (F-K)         | 460-1470            | 5. 12. 1964       |                |
| 41                | 6 (A-D)         | 1460-2030           | 5. 2. 1965        |                |
| 39                | 6 (D-H)         | 320-1199            | 2. 2. 1965        |                |
| 15                | 6 (H-K)         | 290-1100            | 6. 12. 1964       |                |
| 38                | 7 (A-D)         | 1831-2319           | 31. 1. 1965       |                |
| 40                | 7 (D-E)         | 710-1029            | 4. 2. 1965        |                |
| 38                | 7 (E-I)         | 670-1610            | 31. 1. 1965       |                |
| 16                | 7 (I-K)         | 100- 850            | 7. 12. 1964       |                |
| 38                | 8 (A-D)         | 2320-2789           | 31. 1. 1965       |                |

| <u>Sortie No.</u> | <u>Line No.</u> | <u>Exposure No.</u> | <u>Date Flown</u> | <u>Remarks</u> |
|-------------------|-----------------|---------------------|-------------------|----------------|
| 40                | 8 (D-G)         | 101- 709            | 4. 2. 1965        |                |
| 55                | 8 (G-H)         | 71- 390             | 24. 2. 1965       |                |
| 23                | 8 (H-I)         | 280- 760            | 17. 12. 1964      |                |
| 38                | 8 (J-K)         | 390- 669            | 31. 1. 1965       |                |
| 41                | 9 (A-D)         | 391- 959            | 5. 2. 1965        |                |
| 32                | 9 (D-E)         | 3010-3229           | 23. 1. 1965       |                |
| 37                | 9 (E-I)         | 2281-3210           | 30. 1. 1965       |                |
| 41                | 9 (I-J)         | 60- 390             | 5. 2. 1965        |                |
| 38                | 9 (J-K)         | 100- 389            | 31. 1. 1965       |                |
| 41                | 10 (A-C)        | 2230-2440           | 5. 2. 1965        |                |
| 44                | 10 (C-D)        | 1280-1549           | 9. 2. 1965        |                |
| 32                | 10 (D-E)        | 2800-3009           | 23. 1. 1965       |                |
| 20                | 10 (E-K)        | 100-1179            | 14. 12. 1964      |                |
| 48                | 11 (A-D)        | 701-1399            | 13. 2. 1965       |                |
| 32                | 11 (D-K)        | 121-1899            | 23. 1. 1965       |                |
| 37                | 12 (A-D)        | 1821-2280           | 30. 1. 1965       |                |
| 32                | 12 (D-F)        | 1900-2279           | 23. 1. 1965       |                |
| 12                | 12 (F-I)        | 700-1349            | 3. 12. 1964       |                |
| 33                | 12 (I-K)        | 100- 589            | 24. 1. 1965       |                |
| 37                | 13 (A-D)        | 1391-1820           | 30. 1. 1965       |                |
| 32                | 13 (D-F)        | 2280-2799           | 23. 1. 1965       |                |
| 36                | 13 (F-I)        | 560-1289            | 29. 1. 1965       |                |
| 31                | 13 (I-K)        | 2410-2980           | 22. 1. 1965       |                |
| 37                | 14 (A-D)        | 951-1390            | 30. 1. 1965       |                |
| 31                | 14 (D-H)        | 100- 930            | 22. 1. 1965       |                |
| 30                | 14 (H-K)        | 3201-3930           | 21. 1. 1965       |                |
| 37                | 15 (A-D)        | 521- 950            | 30. 1. 1965       |                |
| 31                | 15 (D-E)        | 931-1180            | 22. 1. 1965       |                |
|                   | (G-K)           | 1540-2409           |                   |                |
| 37                | 15 (E-G)        | 111- 520            | 30. 1. 1965       |                |
| 47                | 16 (A-D)        | 3090-3479           | 12. 2. 1965       |                |
| 30                | 16 (D-K)        | 1620-3200           | 21. 1. 1965       |                |
| 47                | 17 (A-D)        | 2600-3089           | 12. 2. 1965       |                |
| 30                | 17 (D-K)        | 110-1619            | 21. 1. 1965       |                |
| 47                | 18 (A-D)        | 2220-2599           | 12. 2. 1965       |                |
| 48                | 18 (D-E)        | 60- 429             | 13. 2. 1965       |                |
| 27                | 18 (E-K)        | 3761-5119           | 17. 1. 1965       |                |
| 47                | 19 (A-D)        | 1740-2219           | 12. 2. 1965       |                |
| 47                | 19 (D-E)        | 1390-1739           | 12. 2. 1965       |                |

| <u>Sortie No.</u> | <u>Line No.</u> | <u>Exposure No.</u> | <u>Date Flown</u> | <u>Remarks</u> |
|-------------------|-----------------|---------------------|-------------------|----------------|
| 27                | 19 (E-K)        | 2570-3760           | 17. 1. 1965       |                |
| 46                | 20 (A-D)        | 2460-2849           | 11. 2. 1965       |                |
| 47                | 20 (D-E)        | 1120-1389           | 12. 2. 1965       |                |
| 27                | 20 (E-H)        | 1240-1900           | 17. 1. 1965       |                |
| 10                | 20 (H-K)        | 269- 900            | 27. 11. 1964      |                |
| 46                | 21 (A-D)        | 2030-2459           | 11. 2. 1965       |                |
| 47                | 21 (D-E)        | 770-1119            | 12. 2. 1965       |                |
| 27                | 21 (E-K)        | 100-1239            | 17. 1. 1965       |                |
| 82                | 22 (A-D)        | 111- 600            | 14. 4. 1965       |                |
| 34                | 22 (D-H)        | 2260-3129           | 25. 1. 1965       |                |
| 26                | 22 (H-K)        | 2470-3430           | 16. 1. 1965       |                |
| 45                | 23 (A-D)        | 1370-1689           | 10. 2. 1965       |                |
| 47                | 23 (D-E)        | 460- 769            | 12. 2. 1965       |                |
| 26                | 23 (E-K)        | 1350-2469           | 16. 1. 1965       |                |
| 82                | 24 (A-D)        | 1121-1630           | 14. 4. 1965       |                |
| 47                | 24 (D-E)        | 100- 459            | 12. 2. 1965       |                |
| 26                | 24 (E-I)        | 100-1349            | 16. 1. 1965       |                |
| 25                | 24 (I-K)        | 3081-3699           | 15. 1. 1965       |                |
| 82                | 25 (A-D)        | 1631-2080           | 14. 4. 1965       |                |
| 34                | 25 (D-G)        | 1560-2259           | 25. 1. 1965       |                |
| 25                | 25 (G-K)        | 2280-3080           | 15. 1. 1965       |                |
| 82                | 26 (A-D)        | 2081-2531           | 14. 4. 1965       |                |
| 43                | 26 (D-E)        | 2170-2469           | 8. 2. 1965        |                |
| 25                | 26 (E-K)        | 100-1750            | 15. 1. 1965       |                |
| 82                | 27 (A-D)        | 2532-3000           | 14. 4. 1965       |                |
| 34                | 27 (D-E)        | 780-1099            | 25. 1. 1965       |                |
| 34                | 27 (E-G)        | 1100-1559           | 25. 1. 1965       |                |
| 29                | 27 (G-H)        | 1390-1640           | 20. 1. 1965       |                |
| 24                | 27 (H-K)        | 2200-2790           | 21. 12. 1964      |                |
| 82                | 28 (A-D)        | 3001-3400           | 14. 4. 1965       |                |
| 43                | 28 (D-E)        | 1881-2169           | 8. 2. 1965        |                |
| 29                | 28 (E-F)        | 570- 770            | 20. 1. 1965       |                |
| 29                | 28 (F-H)        | 100- 569            | 20. 1. 1965       |                |
| 24                | 28 (H-K)        | 1510-2199           | 21. 12. 1964      |                |
| 82                | 29 (A-D)        | 3401-3830           | 14. 4. 1965       |                |
| 35                | 29 (D-E)        | 1810-2089           | 26. 1. 1965       |                |
| 24                | 29 (E-K)        | 151-1209            | 21. 12. 1964      |                |
| 82                | 30 (A-D)        | 3831-4230           | 14. 4. 1965       |                |
| 34                | 30 (D-G)        | 100- 779            | 25. 1. 1965       |                |

| <u>Sortie No.</u> | <u>Line No.</u> | <u>Exposure No.</u> | <u>Date Flown</u> | <u>Remarks</u> |
|-------------------|-----------------|---------------------|-------------------|----------------|
| 22                | 30 (G-K)        | 120- 909            | 16. 12. 1964      |                |
| 82                | 31 (A-D)        | 4231-4610           | 14. 4. 1965       |                |
| 35                | 31 (D-E)        | 1051-1459           | 26. 1. 1965       |                |
| 21                | 31 (E-K)        | 100-1249            | 15. 12. 1964      |                |
| 83                | 32 (A-D)        | 101- 491            | 15. 4. 1965       |                |
| 35                | 32 (D-E)        | 1460-1809           | 26. 1. 1965       |                |
| 28                | 32 (E-H)        | 470-1029            | 19. 1. 1965       |                |
| 19                | 32 (H-K)        | 100- 749            | 13. 12. 1964      |                |
| 83                | 33 (A-D)        | 492- 841            | 15. 4. 1965       |                |
| 57                | 33 (D-E)        | 80- 449             | 26. 2. 1965       |                |
| 18                | 33 (E-K)        | 1770-3209           | 12. 12. 1964      |                |
| 83                | 34 (A-D)        | 842-1230            | 15. 4. 1965       |                |
| 35                | 34 (D-E)        | 700-1050            | 26. 1. 1965       |                |
| 18                | 34 (E-G)        | 970-1400            | 12. 12. 1964      |                |
| 55                | 34 (G-I)        | 391- 920            | 24. 2. 1965       |                |
| 28                | 34 (I-J)        | 100- 300            | 19. 1. 1965       |                |
| 17                | 34 (J-K)        | 2620-2870           | 11. 12. 1964      |                |
| 83                | 35 (A-D)        | 1231-1580           | 15. 4. 1965       |                |
| 35                | 35 (D-E)        | 390- 690            | 26. 1. 1965       |                |
| 18                | 35 (E-I)        | 100- 969            | 12. 12. 1964      |                |
| 17                | 35 (I-K)        | 2180-2619           | 11. 12. 1964      |                |
| 83                | 36 (A-D)        | 1581-1990           | 15. 4. 1965       |                |
| 35                | 36 (D-E)        | 60- 389             | 26. 1. 1965       |                |
| 17                | 36 (E-K)        | 100-1339            | 11. 12. 1964      |                |
| 83                | 37 (A-D)        | 1991-2500           | 15. 4. 1965       |                |
| 54                | 37 (D-H)        | 80- 929             | 23. 2. 1965       |                |
| 50                | 37 (H-J)        | 3070-3689           | 17. 2. 1965       |                |
| 83                | 38 (A-D)        | 2501-3040           | 15. 4. 1965       |                |
| 84                | 38 (D-E)        | 581- 940            | 16. 4. 1965       |                |
| 60                | 38 (E-F)        | 1550-1929           | 7. 3. 1965        |                |
| 59                | 38 (F-H)        | 61- 700             | 1. 3. 1965        |                |
| 50                | 38 (H-J)        | 3690-4369           | 17. 2. 1965       |                |
| 64                | 39 (A-D)        | 1541-1999           | 13. 3. 1965       |                |
| 63                | 39 (D-E)        | 2442-2881           | 11. 3. 1965       |                |
| 60                | 39 (E-H)        | 680-1549            | 7. 3. 1965        |                |
| 50                | 39 (H-J)        | 4370-4989           | 17. 2. 1965       |                |
| 64                | 40 (A-D)        | 2000-2659           | 13. 3. 1965       |                |
| 63                | 40 (D-E)        | 1541-1950           | 11. 3. 1965       |                |
| 54                | 40 (E-G)        | 1520-2050           | 23. 2. 1965       |                |

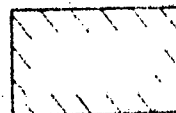
| <u>Sortie No.</u> | <u>Line No.</u> | <u>Exposure No.</u> | <u>Date Flown</u> | <u>Remarks</u> |
|-------------------|-----------------|---------------------|-------------------|----------------|
| 51                | 40 (G-J)        | 1980-2899           | 18. 2. 1965       |                |
| 66                | 41 (A-O)        | 2491-2930           | 23. 3. 1965       |                |
| 64                | 41 (C-D)        | 2660-2979           | 13. 3. 1965       |                |
| 63                | 41 (D-E)        | 1111-1540           | 11. 3. 1965       |                |
| 54                | 41 (E-G)        | 2051-2499           | 23. 2. 1965       |                |
| 60                | 41 (G-I)        | 50- 679             | 7. 3. 1965        |                |
| 49                | 41 (I-K)        | 2720-3389           | 15. 2. 1965       |                |
| 66                | 42 (A-D)        | 2931-3580           | 23. 3. 1965       |                |
| 69                | 42 (D-E)        | 2631-3050           | 28. 3. 1965       |                |
| 63                | 42 (E-F)        | 121- 790            | 11. 3. 1965       |                |
| 51                | 42 (F-K)        | 110-1219            | 18. 2. 1965       |                |
| 66                | 43 (A-D)        | 3581-4341           | 23. 3. 1965       |                |
| 72                | 43 (D-E)        | 1281-1670           | 1. 4. 1965        |                |
| 53                | 43 (E-G)        | 2380-2799           | 22. 2. 1965       |                |
| 52                | 43 (G-K)        | 100- 989            | 19. 2. 1965       |                |
| 66                | 44 (A-D)        | 4360-5060           | 23. 3. 1965       |                |
| 68                | 44 (D-E)        | 3471-3810           | 27. 3. 1965       |                |
| 53                | 44 (E-F)        | 2800-3089           | 22. 2. 1965       |                |
| 52                | 44 (F-K)        | 3340-4629           | 19. 2. 1965       |                |
| 66                | 45 (A-D)        | 5061-5840           | 23. 3. 1965       |                |
| 69                | 45 (D-E)        | 3051-3420           | 28. 3. 1965       |                |
| 53                | 45 (E-K)        | 140-1309            | 22. 2. 1965       |                |
| 67                | 46 (A-D)        | 3121-3900           | 24. 3. 1965       |                |
| 72                | 46 (D-E)        | 1671-2130           | 1. 4. 1965        |                |
| 81                | 46 (E-G)        | 51- 710             | 11. 4. 1965       |                |
| 71                | 46 (G-H)        | 1881-2400           | 31. 3. 1965       |                |
| 61                | 47 (A-D)        | 1000-1769           | 8. 3. 1965        |                |
| 61                | 47 (D-G)        | 50- 999             | 8. 3. 1965        |                |
| 71                | 47 (G-H)        | 1542-1880           | 31. 3. 1965       |                |
| 61                | 48 (A-D)        | 1- 840              | 8. 3. 1965        |                |
| 72                | 48 (D-G)        | 2131-3081           | 1. 4. 1965        |                |
| 71                | 48 (G-H)        | 1091-1541           | 31. 3. 1965       |                |
| 67                | 49 (A-D)        | 3901-4710           | 24. 3. 1965       |                |
| 72                | 49 (D-G)        | 3082-4220           | 1. 4. 1965        |                |
| 58                | 50 (A-D)        | 1730-2449           | 27. 2. 1965       |                |
| 58                | 50 (D-K)        | 100-1309            | 27. 2. 1965       |                |
| 67                | 51 (A-C)        | 5301-5870           | 24. 3. 1965       |                |
| 67                | 51 (C-D)        | 4711-5100           | 24. 3. 1965       |                |

| <u>Sortie No.</u> | <u>Line No.</u> | <u>Exposure No.</u> | <u>Date Flown</u> | <u>Remarks</u> |
|-------------------|-----------------|---------------------|-------------------|----------------|
| 73                | 51 (D-G)        | 131-1220            | 2. 4. 1965        |                |
| 71                | 52 (A-D)        | 3131-4211           | 31. 3. 1965       |                |
| 73                | 52 (D-G)        | 1221-2210           | 2. 4. 1965        |                |
| 72                | 53 (A-D)        | 4221-5230           | 1. 4. 1965        |                |
| 74                | 53 (D-G)        | 101- 951            | 3. 4. 1965        |                |
| 57                | 54 (A-B)        | 2430-2739           | 26. 2. 1965       |                |
| 73                | 54 (B-D)        | 2211-2890           | 2. 4. 1965        |                |
| 74                | 54 (D-G)        | 952-2210            | 3. 4. 1965        |                |
| 77                | 55 (A-B)        | 1251-1580           | 7. 4. 1965        |                |
| 73                | 55 (B-D)        | 2891-3670           | 2. 4. 1965        |                |
| 74                | 55 (D-G)        | 2211-3060           | 3. 4. 1965        |                |
| 73                | 56 (A-D)        | 3671-4690           | 2. 4. 1965        |                |
| 75                | 56 (D-E)        | 101- 579            | 4. 4. 1965        |                |
| 74                | 56 (E-G)        | 3061-4000           | 3. 4. 1965        |                |
| 74                | 57 (A-D)        | 4001-5240           | 3. 4. 1965        |                |
| 75                | 57 (D-G)        | 580-1799            | 4. 4. 1965        |                |
| 77                | 58 (A-D)        | 1581-2520           | 7. 4. 1965        |                |
| 75                | 58 (D-G)        | 1800-2679           | 4. 4. 1965        |                |
| 77                | 59 (A-D)        | 2521-3580           | 7. 4. 1965        |                |
| 75                | 59 (D-G)        | 2680-3919           | 4. 4. 1965        |                |
| 77                | 60 (A-D)        | 3581-4520           | 7. 4. 1965        |                |
| 75                | 60 (D-G)        | 3920-4820           | 4. 4. 1965        |                |
| 78                | 61 (A-B)        | 1202-1570           | 8. 4. 1965        |                |
| 77                | 61 (B-D)        | 4521-5240           | 7. 4. 1965        |                |
| 75                | 61 (D-G)        | 4821-6079           | 4. 4. 1965        |                |
| 78                | 62 (A-D)        | 101-1150            | 8. 4. 1965        |                |
| 76                | 62 (D-E)        | 101- 570            | 5. 4. 1965        |                |
| 75                | 62 (E-G)        | 6219-6950           | 4. 4. 1965        |                |
| 78                | 63 (A-D)        | 1571-2560           | 8. 4. 1965        |                |
| 76                | 63 (D-G)        | 571-1750            | 5. 4. 1965        |                |
| 76                | 64 (A-D)        | 2861-3820           | 5. 4. 1965        |                |
| 76                | 64 (D-G)        | 1861-2860           | 5. 4. 1965        |                |
| 78                | 65 (A-D)        | 2561-3640           | 8. 4. 1965        |                |
| 81                | 65 (D-G)        | 1131-2130           | 11. 4. 1965       |                |
| 78                | 66 (A-D)        | 3641-4620           | 8. 4. 1965        |                |
| 81                | 66 (D-G)        | 2131-3220           | 11. 4. 1965       |                |
| 79                | 67 (A-D)        | 4271-5330           | 9. 4. 1965        |                |
| 80                | 67 (D-G)        | 5851-6910           | 10. 4. 1965       |                |
| 79                | 68 (A-D)        | 3271-4270           | 9. 4. 1965        |                |

| <u>Sortie No.</u> | <u>Line No.</u> | <u>Exposure No.</u> | <u>Date Flown</u> | <u>Remarks</u> |
|-------------------|-----------------|---------------------|-------------------|----------------|
| 80                | 68 (D-G)        | 4751-5800           | 10. 4. 1965       |                |
| 79                | 69 (A-D)        | 2221-3270           | 9. 4. 1965        |                |
| 79                | 69 (D-G)        | 1121-2220           | 9. 4. 1965        |                |
| 79                | 70 (A-D)        | 5331-6370           | 9. 4. 1965        |                |
| 79                | 70 (D-G)        | 101-1120            | 9. 4. 1965        |                |
| 85                | 70 (G-K)        | 1220-2669           | 17. 4. 1965       |                |
| 79                | 71 (A-D)        | 6421-7480           | 9. 4. 1965        |                |
| 80                | 71 (D-K)        | 2471-4750           | 10. 4. 1965       |                |
| 80                | 72 (A-D)        | 6911-7910           | 10. 4. 1965       |                |
| 80                | 72 (D-K)        | 101-2470            | 10. 4. 1965       |                |
| 44                | A (1-23)        | 310-1279            | 9. 2. 1965        |                |
| 45                | A (23-36)       | 321-989             | 10. 2. 1965       |                |
| 57                | A (36-42)       | 750-1359            | 26. 2. 1965       |                |
| 57                | A (42-54)       | 1590-2429           | 26. 2. 1965       |                |
| 77                | A (54-72)       | 101-1250            | 7. 4. 1965        |                |
| 58                | B (40-54)       | 2450-3059           | 27. 2. 1965       |                |
| 64                | B (54-72)       | 100-1189            | 13. 3. 1965       |                |
| 42                | C (1-36)        | 1721-3900           | 6. 2. 1965        |                |
| 66                | C (36-72)       | 151-2490            | 23. 3. 1965       |                |
| 14                | D (1-17)        | 1780-2830           | 5. 12. 1964       | 2000'          |
| 43                | D (17-36)       | 570-1589            | 8. 2. 1965        | 2000'          |
| 54                | D (36-45)       | 940-1519            | 23. 2. 1965       | 2000'          |
| 69                | D (45-72)       | 101-2230            | 28. 3. 1965       | 2000'          |
| 42                | D (1-36)        | 101-1720            | 6. 2. 1965        | 2500'          |
| 72                | D (36-50)       | 101-1280            | 1. 4. 1965        | 2500'          |
| 68                | D (50-72)       | 111-1600            | 27. 3. 1965       | 2500'          |
| 9                 | E (1-36)        | 41-1740             | 26. 11. 1964      |                |
| 67                | E (36-45)       | 1391-1991           | 24. 3. 1965       |                |
| 53                | E (45-54)       | 1310-1779           | 22. 2. 1965       |                |
| 67                | E (54-72)       | 101-1390            | 24. 3. 1965       |                |
| 8                 | F (1-36)        | 101-1771            | 24. 11. 1964      |                |
| 51                | F (36-42)       | 1220-1599           | 18. 2. 1965       |                |
| 52                | F (42-63)       | 2230-3339           | 19. 2. 1965       |                |
| 71                | F (63-72)       | 101-710             | 31. 3. 1965       |                |
| 6                 | G (1-26)        | 101-1230            | 8. 11. 1964       |                |
| 7                 | G (26-36)       | 121-681             | 11. 11. 1964      |                |
| 51                | G (36-42)       | 1600-1979           | 18. 2. 1965       |                |
| 52                | G (42-63)       | 990-2229            | 19. 2. 1965       |                |
| 56                | G (63-72)       | 2130-2649           | 25. 2. 1965       |                |

| <u>Sortie No.</u> | <u>Line No.</u> | <u>Exposure No.</u> | <u>Date Flown</u> | <u>Remarks</u> |
|-------------------|-----------------|---------------------|-------------------|----------------|
| 2                 | H ( 1-26)       | 81-1280             | 28. 10. 1964      |                |
| 7                 | H (26-36)       | 682-1310            | 11. 11. 1964      |                |
| 50                | H (36-63)       | 1660-3069           | 17. 2. 1965       |                |
| 56                | H (63-72)       | 1690-2129           | 25. 2. 1965       |                |
| 5                 | I ( 1-11)       | 1421-1920           | 7. 11. 1964       |                |
| 3                 | I (11-36)       | 450-1550            | 29. 10. 1964      |                |
| 50                | I (36-63)       | 121-1659            | 17. 2. 1965       |                |
| 56                | I (63-72)       | 1100-1689           | 25. 2. 1965       |                |
| 4                 | J ( 1-36)       | 81-1540             | 30. 10. 1964      |                |
| 49                | J (36-50)       | 130- 889            | 15. 2. 1965       |                |
| 49                | J (50-62)       | 890-1649            | 15. 2. 1965       |                |
| 56                | J (62-72)       | 670-1099            | 25. 2. 1965       |                |
| 5                 | K ( 1-36)       | 102-1420            | 7. 11. 1964       |                |
| 49                | K (41-63)       | 1650-2719           | 15. 2. 1965       |                |
| 56                | K (63-72)       | 100- 669            | 25. 2. 1965       |                |

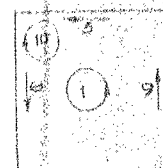
24. 7



### LOCATION DIAGRAM

A H G L Model

PLATE 1

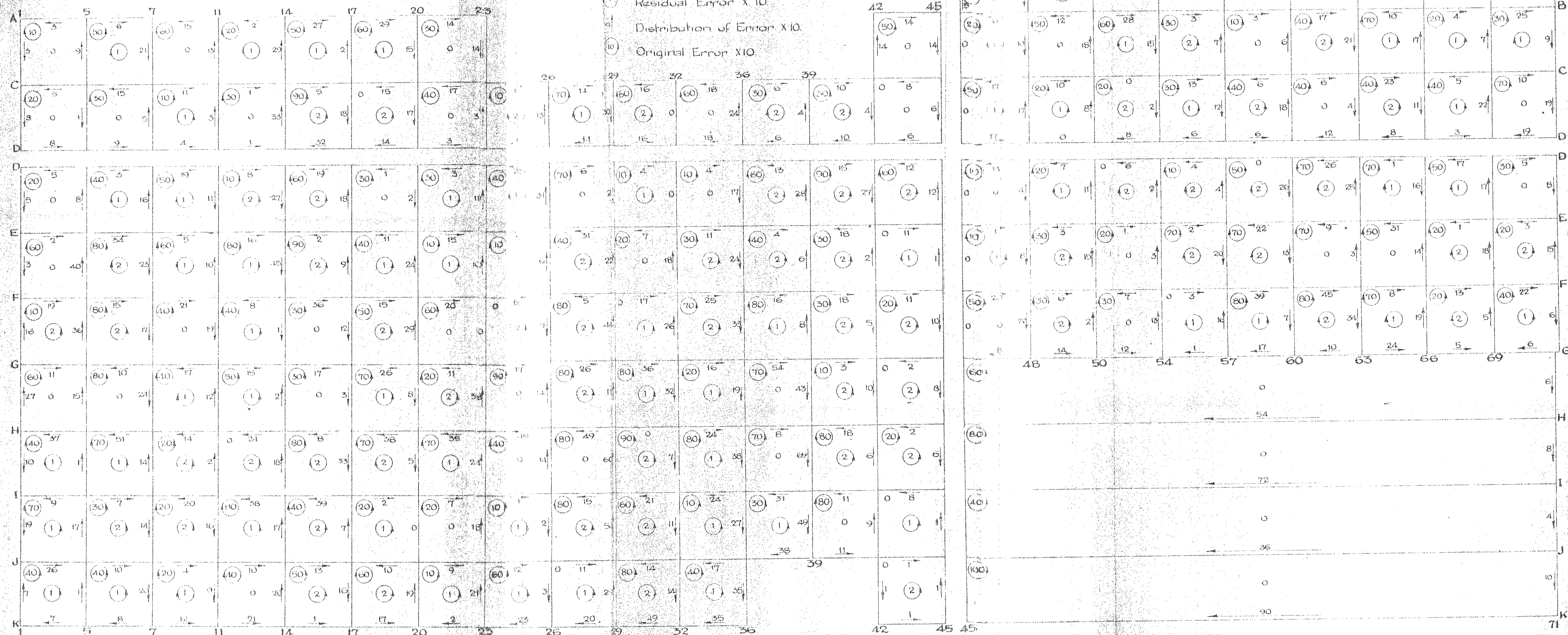


Individual Loop

(1) Residual Error x 10

(2) Distribution of Error x 10

(10) Original Error x 10



DISTRIBUTION OF MAGNETIC CLOSURES ERROR  
& RESIDUAL ERROR

394-5



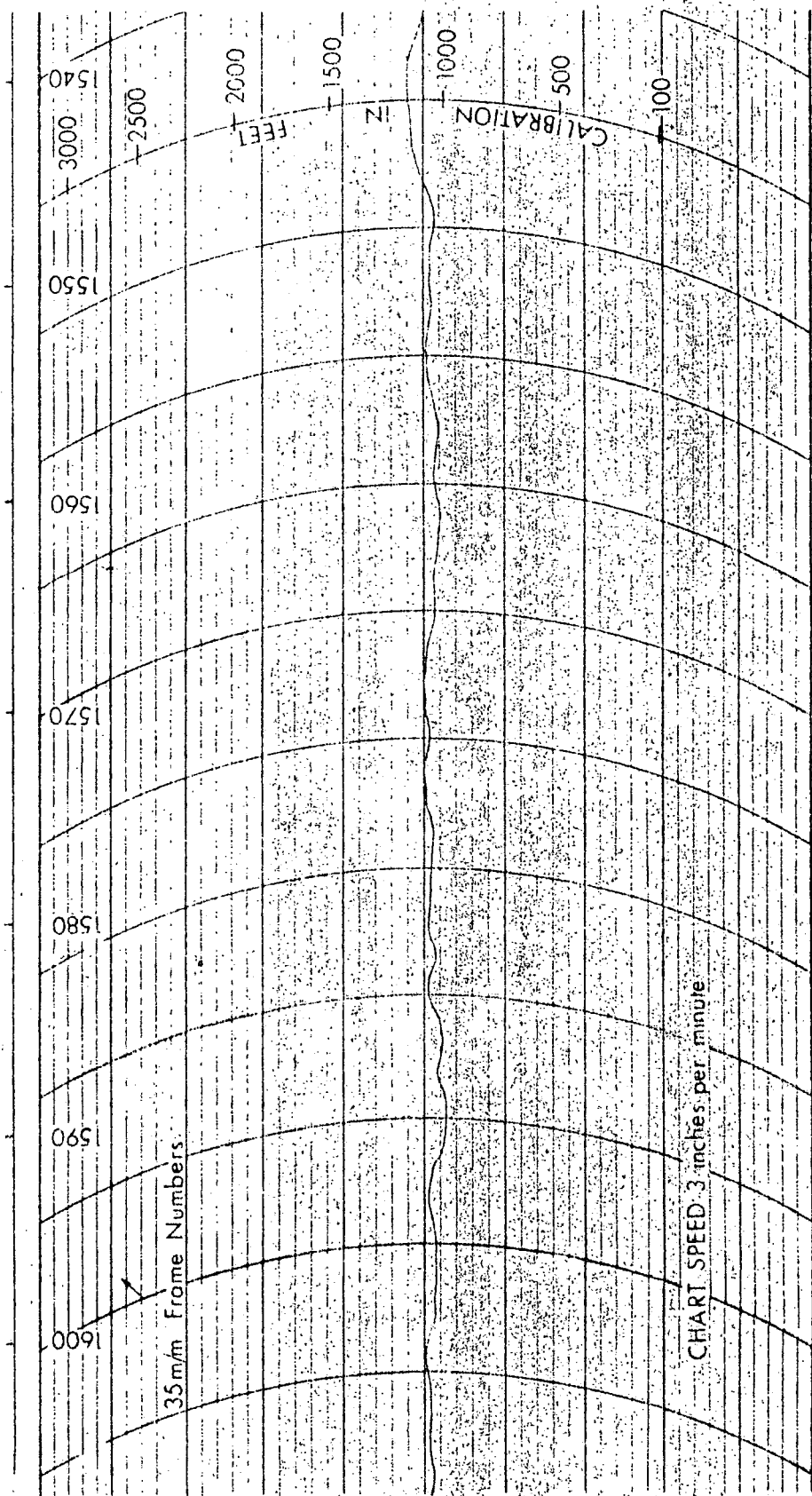


PLATE 4 SPECIMEN RADIO ALTIMETER RECORD (curvilinear)

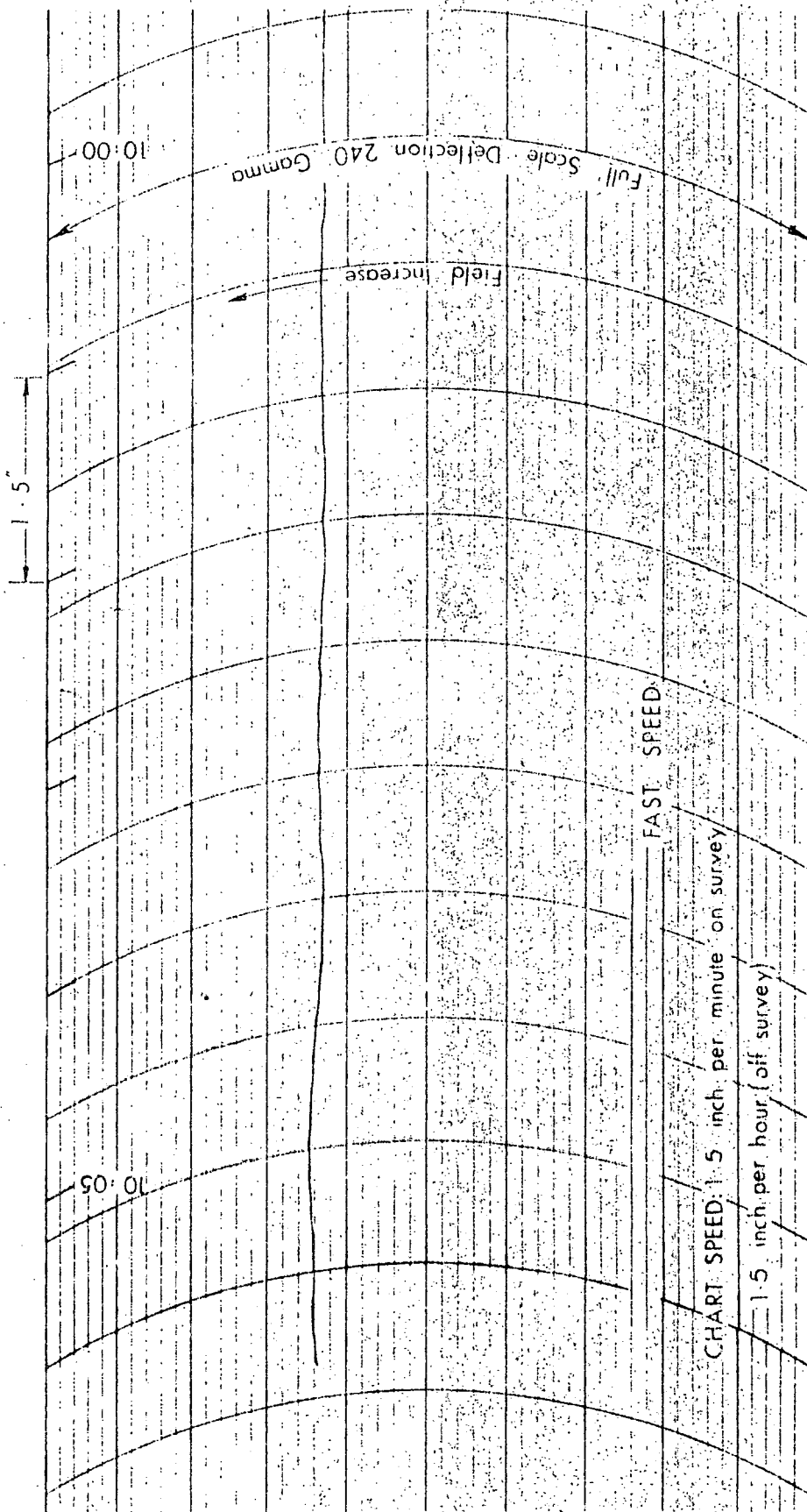


PLATE 5 SPECIMEN STORM MONITOR RECORD

SPECIMEN 35mm STRIP FILM  
(Restricted Photo)

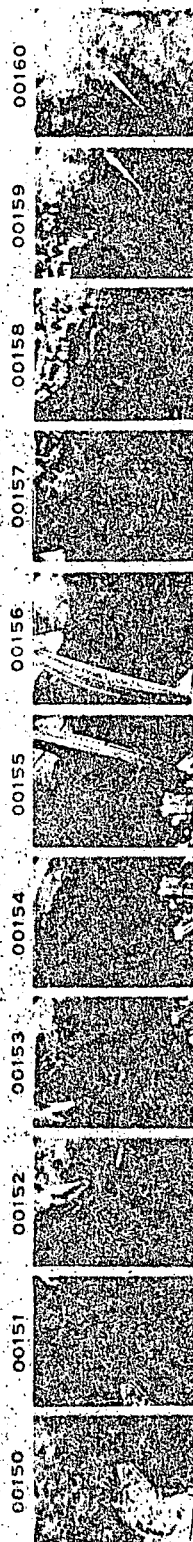


PLATE 6

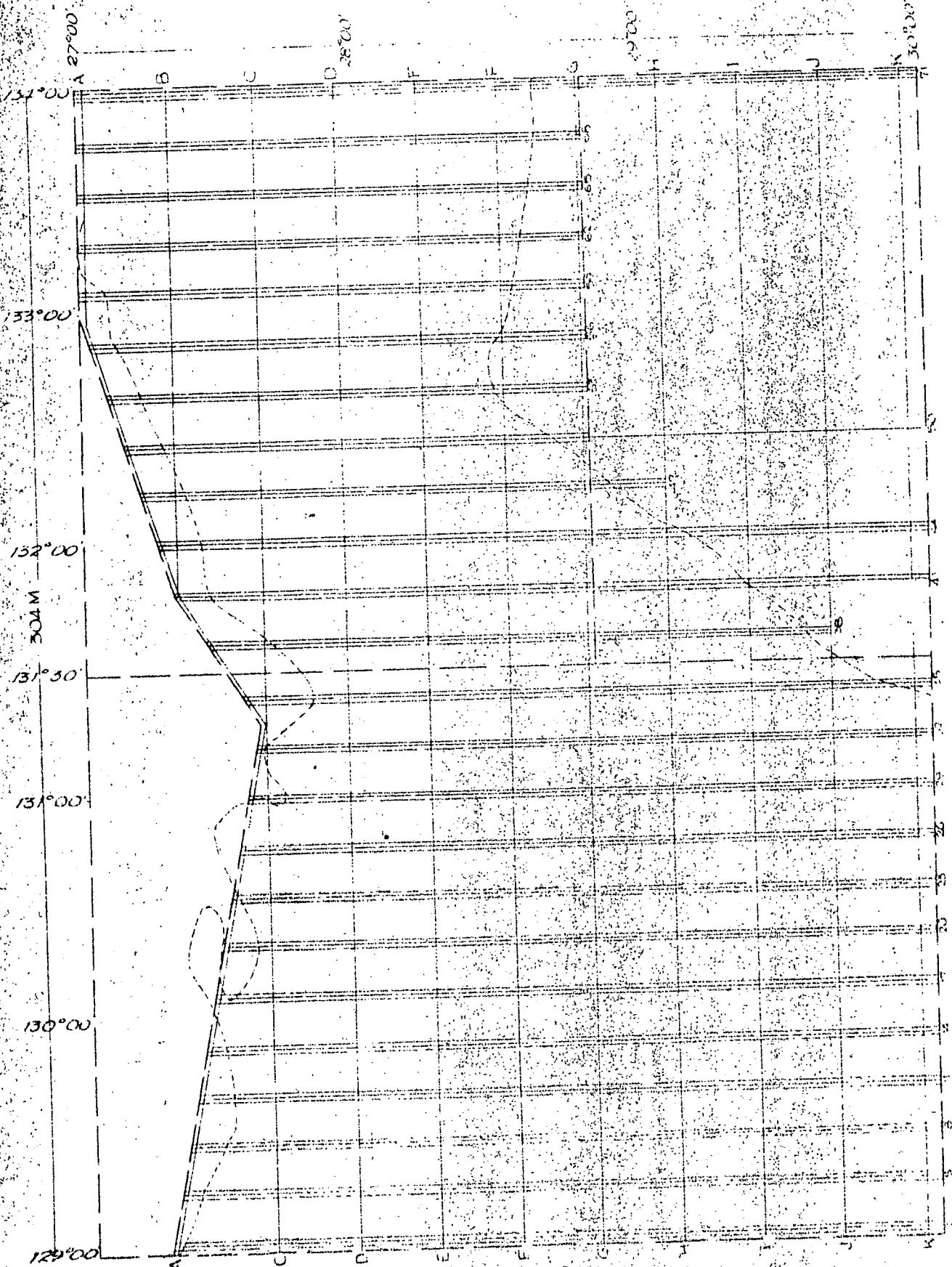
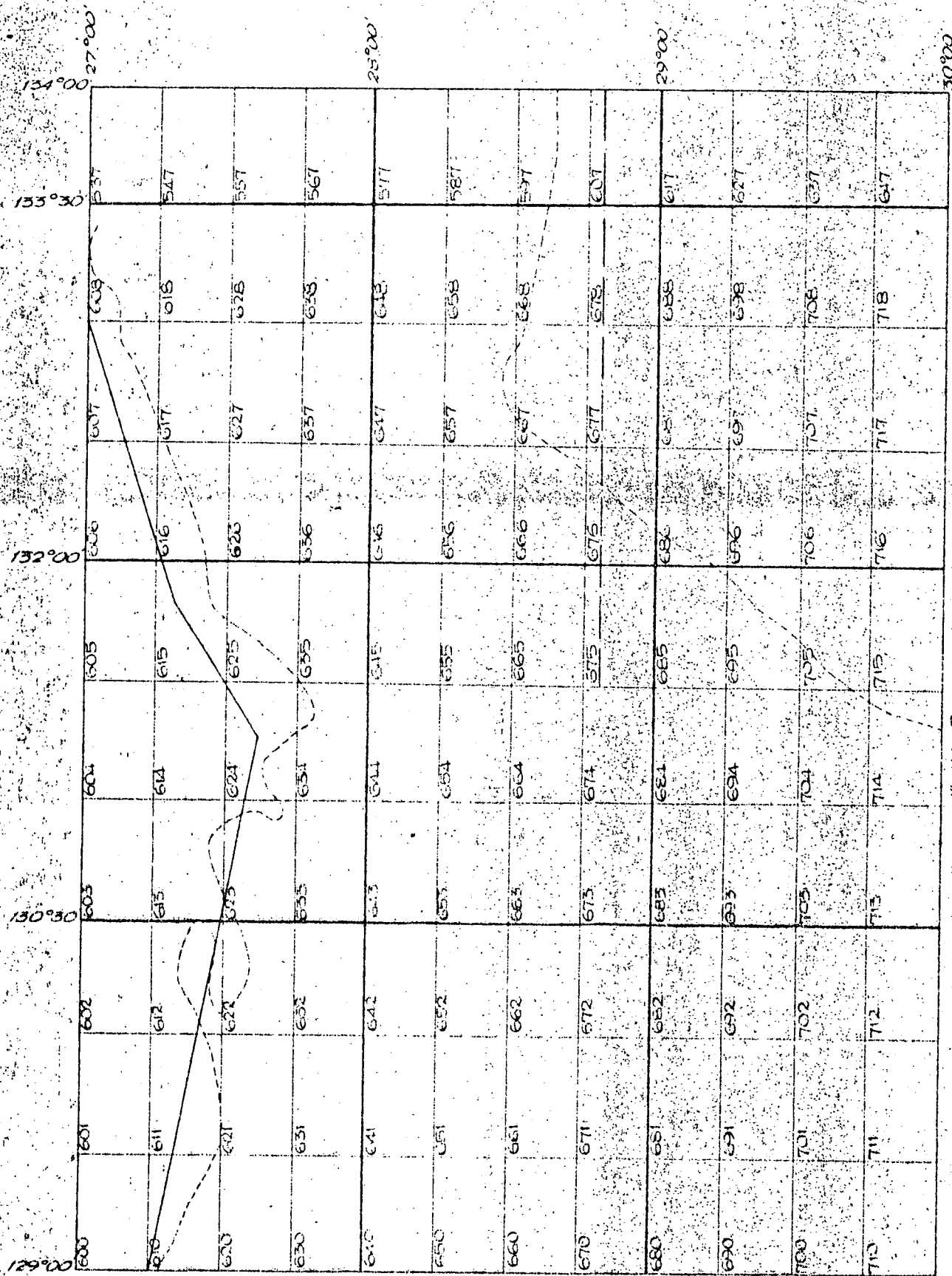


DIAGRAM OF FLIGHT PATTERN



1:1M Photomosaics

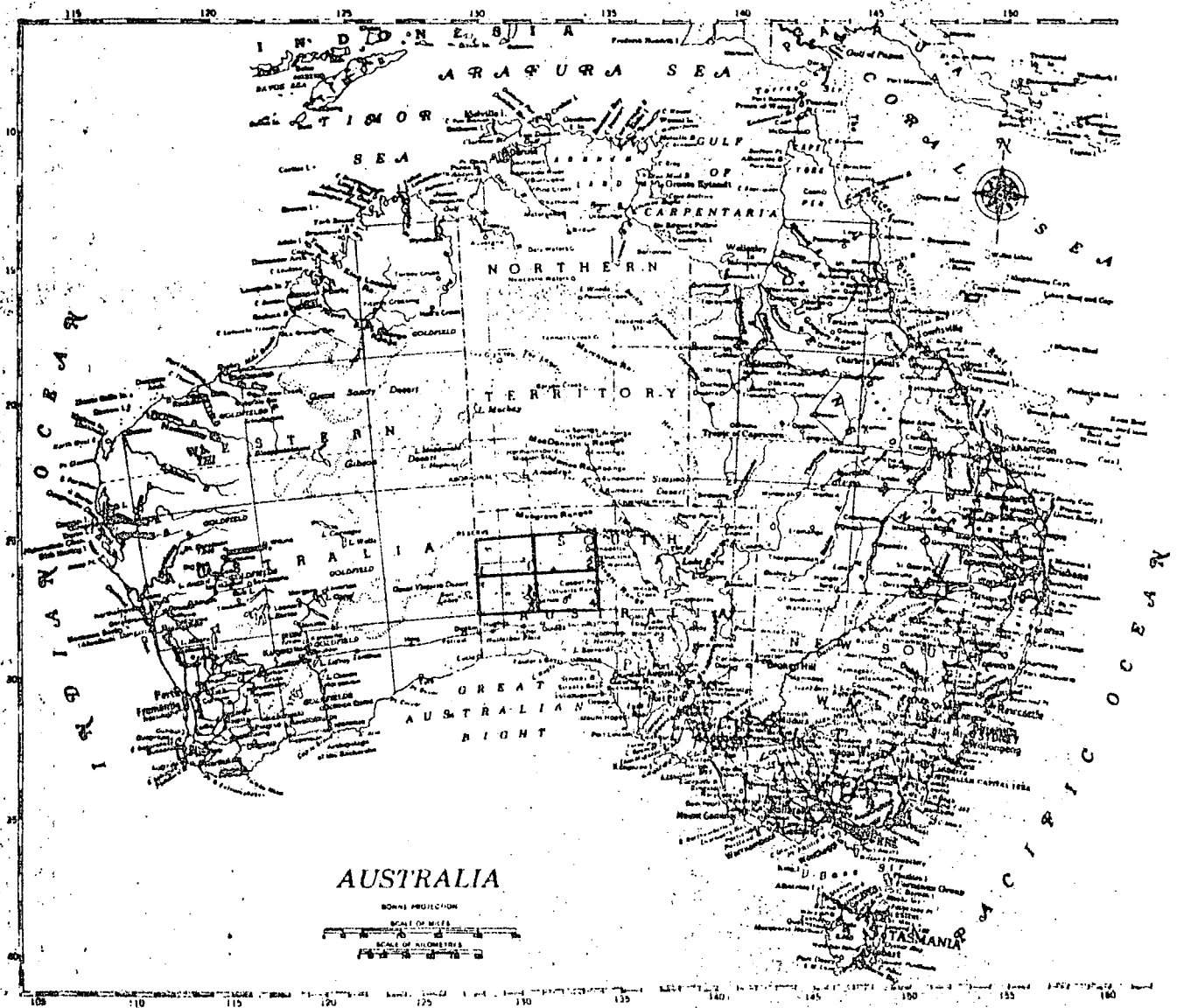
BASE MAPS & MOSAIC COVERAGE

000086

PART II  
EXOIL PTY LTD

INTERPRETATION

12 October 1965



## SUMMARY

The Adastral Hunting Geophysics Pty. Ltd. reconnaissance survey of the Exoil Pty. Ltd. permit O. E. L. 28 in western South Australia is described in Part I of this report, and its interpretation is covered by this Part II. The area, approximately 60,000 mi<sup>2</sup>, is situated between latitudes 27-30°S and longitudes 129-134°E.

The analysis of these data is based upon a method of model comparison developed by GMX which includes both intrabasement and suprabasement models representing thick prisms and thick plates of magnetic rock. Such rocks, igneous or metamorphic, ordinarily underlie a sedimentary section. The interpretation attempts to show the volume of sediments within the area that may be potentially productive of oil and gas by mapping this basement-sedimentary interface.

The results are shown on a Magnetic Basement Map which is contoured at an interval of 1000 ft from the depth estimates computed from the aeromagnetic data. Almost all the eastern half of the area consists of a shelf with broad undulations on which the sedimentary thickness eventually reaches 6000 ft along a hinge line which forms the southern flank of the main sedimentary trough. This trough, with more than 16,000 ft of section, is abruptly terminated on the north by the Musgrave shield of Archean basement. The contact may be faulted, but it is contoured as a steep monocline. Although the strike of the northern flank of the trough is generally east-west, its southern flank, the hinge line between the shelf and the trough, strikes southwestward and loses its identity in the western half of the area.

The western half of the permit apparently has more potential because of the average thicker section of about 8000 ft on the southwestern shelf and because the trough seems to have more foothills type of structures developed within it. The trough has about 20,000 ft of section in the west.

## CONTENTS

|     |                                                |         |
|-----|------------------------------------------------|---------|
| I   | INTRODUCTION                                   | Page 1  |
| II  | QUALITY OF STAFF                               | Page 1  |
| III | DESCRIPTION OF THE SURVEY                      | Page 1  |
| IV  | INSTRUMENTAL CONTROL                           | Page 2  |
| V   | PROGRESS MAPS                                  | Page 2  |
| VI  | <u>STATISTICAL DATA</u>                        | Page 3  |
| 1.  | Objective of the Interpretation                | Page 3  |
| 2.  | General Geology                                | Page 4  |
| 3.  | Geophysical History of the Area                | Page 5  |
| 4.  | Results Obtained                               | Page 6  |
| (a) | Observed Maps                                  | Page 6  |
| (b) | Magnetic Basement Maps                         | Page 11 |
| (c) | Recommended Areas                              | Page 13 |
| (d) | Conclusion                                     | Page 17 |
| VII | <u>ELEMENTS OF AEROMAGNETIC INTERPRETATION</u> | Page 17 |
| 1.  | Method of Interpretation                       | Page 20 |

FRONTISPIECE, Index Map

MAPS  
(four sheets, 1 in/4-mi)

Observed, minimum contour interval 5yMagnetic Basement, contour interval 1000 ft

## I - INTRODUCTION

This is the final report on the interpretation of the aeromagnetic survey of Eastern Officer Basin over O. E. L. 28 in South Australia. This area of approximately 60,000 mi<sup>2</sup> is included between latitudes 27 and 30°S, longitudes 129 and 134°E.

The aeromagnetic survey itself was conducted and compiled by Adastrá Hunting Geophysics Pty. Ltd. whose operational report comprises Part I of this report.

This project is for the account of Exoil Pty. Ltd., holder of permit O. E. L. 28.

## II - QUALITY OF STAFF

The aeromagnetic data were reviewed by GAPL's senior aeromagnetic technician, R. H. Hammons, during the course of the survey for the purpose of ensuring that the quality of the results was satisfactory for the interpretation which was to follow. Mr. Hammons' supervision began in October 1964 and lasted until April 1965 when he was replaced by the senior aeromagnetic technician of GAPL's parent company, Gravity Meter Exploration Company, William D. Gibbons. Mr. Gibbons began interpreting the data at the same time and finished this in September 1965 at which time the entire job was sent to the home office of the parent company in Houston. Here it was reviewed and slightly revised by GMX's partner in charge of aeromagnetic interpretation, Nelson C. Steenland, who is also responsible for Part II of this final report. GMX also made the final inked copies of the Magnetic Basement Maps at 1 in/4000 ft.

Mr. Hammons was employed by GMX in 1954 and has been engaged in seismic interpretation and seismic field supervision for twelve years, aeromagnetic supervision and interpretation for six years.

Mr. William Dean Gibbons was employed by GMX in 1952 and has been GMX's senior magnetic interpreter since that time.

Nelson C. Steenland has been with GMX since 1949 and in charge of its aeromagnetic interpretation since that time.

## III - DESCRIPTION OF THE SURVEY

The objective of the magnetic survey was to determine the depth of the aeromagnetic basement over the entire area and to map magnetic ma-

terials within the sedimentary section above the magnetic basement should any anomalies indicate their presence.

It was recognized that the area might have a thick sequence of metamorphosed sediments of late Precambrian or Proterozoic age. This would create no problem, simply place the age of the magnetic basement within the Precambrian instead of the normal position at the top of the Precambrian.

The survey was reconnaissance in nature with bands of flight lines flown north-south at intervals of approximately ten miles. Each band consisted of three lines spaced at one and one-half miles. Consequently, a band width was three miles. There were twenty-four of these bands. These were crossed by single east-west tie lines every twenty miles. An exception to this pattern occurred in the southeast between latitudes  $28^{\circ}50'$  and  $30^{\circ}S$ , longitudes  $132^{\circ}$  and  $134^{\circ}E$ , where little sedimentary section was anticipated; and the bands were omitted. The flight elevation was 2500 ft asl from the northern edge of the survey over the Musgrave block south to the line D at about  $27^{\circ}55'S$ . South of here the survey was at 2000 ft asl. The total number of line miles was 14,438.

#### IV - INSTRUMENTAL CONTROL

The area was flown with a Gulf Research and Development Company Mark III Total Force Magnetometer. The vertical scale of the magnetic tapes produced in the plane was 600 gamma and their average horizontal scale .91 miles to the inch. However, these scales varied between 1.61 and 1.14. Part I, of course, contains a much more detailed description of the instrumental control.

#### V - PROGRESS MAPS

GAPL inspected the data in its home office in Brisbane. Moreover, preliminary Magnetic Basement Maps were submitted during the course of the survey. The actual survey began in October 1964 and finished in April of 1965. The first preliminary interpretation was submitted 19 May 1965. The western half of the area was completely interpreted and submitted to Exxon 19 July 1965. The preliminary interpretation was finished on 31 August 1965. The interim period between that date and the preparation of this final report was occupied in checking the interpretation, preparing the 1 in/4 mi sheets from the work maps at 1 in/2 mi, and transmitting the necessary material from Brisbane to Houston.

## VI - STATISTICAL DATA

(Many of these statistics are included above but are repeated in tabular form here for conciseness. Moreover, for additional details regarding the equipment and operational procedures, reference should be made to Part I.)

|                                            |                                                                                                                                           |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Client                                     | Exoil Pty. Ltd.                                                                                                                           |
| Survey                                     | Adastra Hunting Geophysics Pty. Ltd.                                                                                                      |
| Survey Interpretation                      | Geophysical Associates Pty. Ltd.                                                                                                          |
| Type of Interpretation                     | Airborne Aeromagnetic Petroleum                                                                                                           |
| Area Surveyed                              | 60,000 mi <sup>2</sup> at Eastern Officer Basin in South Australia                                                                        |
| Bases of Operation                         | Forrest, 26 October to 9 December 1964<br>Maralinga, 10-22 December '64 and 14 January-12 March 1965. Oodnadatta, 13 March-17 April 1965. |
| Initiation of Flying                       | 26 October 1964                                                                                                                           |
| Completion of Flying                       | 17 April 1965                                                                                                                             |
| Total Survey Mileage                       | 14,438 mi                                                                                                                                 |
| Aircraft                                   | Lockheed                                                                                                                                  |
| Magnetometer                               | Gulf Research and Development Mark III (Total Force)                                                                                      |
| Recording Sensitivity                      | 600 gamma full scale deflection                                                                                                           |
| Diurnal Control                            | Ground based Gulf Research and Development Mark III (Total Force) magnetometer with continuous recording                                  |
| Flight Directions                          | North-south with east-west tie lines                                                                                                      |
| Flight Path Monitor                        | 35mm continuous strip camera                                                                                                              |
| Flight Altitude                            | 2500 and 2000 ft asl                                                                                                                      |
| Traverse Interval                          | 10 miles between north-south bands of 3 lines with 1-1/2 miles between lines, 20 miles between single east-west tie lines.                |
| Principal Facts of Earth's Magnetic Field: |                                                                                                                                           |
| Inclination                                | 60°                                                                                                                                       |
| Declination                                | 4°E                                                                                                                                       |
| Total Intensity                            | 56,500 gamma                                                                                                                              |

VI

### 1. OBJECTIVE OF THE INTERPRETATION

The purpose of the interpretation is to map the magnetic basement and

thereby probably to indicate the volume of potentially productive sediments in the area and the structure of their base.

The magnetic basement surface is that horizon at which materials become significantly magnetic to make observable anomalies. Ordinarily this is an interface between relatively nonmagnetic sedimentary rocks and ferromagnetic, igneous-metamorphic rocks usually called "basement." However, "basement" to petroleum geologists identifies a surface below which rocks are no longer potentially productive. Therefore the usefulness of the aeromagnetic method in petroleum exploration depends upon the correlation of the magnetic basement of the geophysicist with the economic basement of the exploration geologist. Sediments usually have susceptibilities of less than  $30 \times 10^{-6}$  whereas the metamorphic-igneous suite has values of the order of  $1000 \times 10^{-6}$ . This difference in magnetic habit is by no means necessarily related to geologic age. The anticipated geology of this area indicates that the magnetic interface would be found within the Precambrian at an interface between the Archean granitic basement and the overlying Proterozoic unmetamorphosed sediments.

## VI 2. GENERAL GEOLOGY

The following excerpt from a geologic report compiled by Exoil describes the regional geology.

"Oil Exploration Licence No. 28 covers approximately 60,000 square miles of predominantly desert terrain that is completely devoid of surface outcrops. This topographically destitute area constitutes the South Australian portion of the Officer Basin. The Officer Basin extends into Western Australia and has a total area of over 100,000 square miles. The parameters which define its existence have largely been determined through geophysical methods.

"The basin is bounded by the Musgrave block (Blackstone Ranges, Bell Rock, Tomlinson Range, Mann Range, Musgrave Range, and Everard Range) in the north and by the northern limits of the Eucla Basin in the south. In the west the boundary is fixed by outcrops of the Australian Precambrian shield, while in the east there seems to be a gradual merge into the Great Artesian Basin.

"The subsurface stratigraphy has not been established. There are indications, however, of some similarities with the Amadeus Basin.

"Unmetamorphosed Proterozoic rocks crop out near the basin to the

north, east, and south. These rocks have also been identified in water bores at Maralinga, the eastern part of the Eucla Basin, and east of Lake Phillipson.

"No Cambrian sediments have been identified in or around the margins of the basin, but extensive developments occur in the adjacent Great Artesian and Amadeus areas.

"Large thicknesses of sandstones believed to be of Ordovician age have been mapped along the basin's northern edge. In the Mt. John area Ordovician age identification has been made by the discovery of *Seglithus* worm tubes and other fossils by Gresso in 1965.

"Glacigene, marine, and freshwater Permian sediments have been logged in several bores between Lake Phillipson and the Peake and Denison Ranges about 35 miles east of O. E. L. 28. Their areal and vertical distribution suggest a regional dip to the northwest. Farther north, about 85 miles from O. E. L. 28 and south of Oodnadatta, a small inlier of sediments has been discovered at Mt. Toondina. These sediments are of lacustrine origin and consist of interbedded shales, siltstones, minor sandstones, and coal seams.

"The Exoil Emu No. 1 Well was drilled to 1370 ft in 1963 in central O. E. L. 28. Microfossils of Mesozoic age have been identified by Bureau of Mineral Resources' palynologists.

"Some Jurassic sandstone has been noted at Mt. Toondina. Small amounts of these rocks, along with Tertiary and Pleistocene, could be expected however."

## VI 3. GEOPHYSICAL HISTORY OF THE AREA

Exoil's partner, Continental Oil Company, also furnished some vital information on previous geophysical history in the area.

"Four (4) aeromagnetic traverses run by the Bureau of Mineral Resources.

"In 1960, Exoil Pty. Ltd. and South Australian Mines Department conducted a gravity traverse along the 131 degree Meridian, primarily to check on magnetic results.

"In 1962, Exoil Pty. Ltd. contracted Namco International Inc. to conduct a seismic survey known as Mable Creek Seismic Survey. This

survey commenced at Emu airstrip (28°38'S Lat. and 132°12'E. Long), continued for four months and included two regional lines of two-mile continuous profiling separated by four-mile gaps. Line "A" ran due northwest along the Mt. Davies road for 104 miles. Line "B" ran due west to the West Australian border, a distance of about 200 miles.

"The survey indicates a sedimentary section increasing from a minimum of 5000 feet in the east to a possible maximum of 10,000 feet in the west and north. Both refraction and reflection profiles were shot. The reflection survey shows a continuation of west and northwest dips into the deeper portion of the basin. There is more evidence of dip reversals in the eastern part of Line "A" than in the deeper parts of the basin shown by Line "B."

"The quality of the above seismic was generally poor. Consequently, a cheaper reconnaissance method was needed. In October, 1964, Ex-oil Pty. Ltd. commenced the Eastern Officer Basin Aeromagnetic Survey, and this group was joined by Continental Oil Company of Australia Ltd. in December, 1964, for a share of the expenditures.

"A photographic study was commenced over a part of the permit O.E.L. 28 in late 1964 and completed in February, 1965. Continental also joined in sharing costs of this project."

VI

4.

#### RESULTS OBTAINED

The results are presented on observed aeromagnetic maps prepared solely by Adastral and the Magnetic Basement Maps made independently by GAPL. Both maps are included with this report at scale 1 in/4 mi in four sheets of one and one-half degrees of latitude, two and one-half degrees of longitude. These are numbered one through four. (See Index Map.) The flight line locations are dashed on the observed maps and are discernible on the Magnetic Basement Maps from the computed depth estimates plotted along the tracks.

##### (a) OBSERVED MAPS

These maps, produced by Adastral, are contoured at an interval of ten gamma wherever band control is present. The datum is arbitrary. The magnetic field along the east-west lines is shown in profile where the flight line track is the datum at 1800 gamma unless otherwise indicated. These profiles have a vertical scale of 200 gamma/inch.

A routine that should be mentioned is that the sensing element of the

magnetometer is reversed from its attitude in the northern hemisphere. The south-seeking pole is the positive one in this area which is south of the magnetic equator. This is done to develop positive anomalies over positive distributions of ferromagnetic materials. Consequently, the anomalies at this inclination of  $60^{\circ}$ \* appear in this southern hemisphere in the same manner in the magnetic body as they do in the northern hemisphere. They have positives over that part of the body which is toward the magnetic equator and negatives on their polar ends. To clarify, the positives on the magnetic map are over the causative bodies and the negatives, whose amplitudes are about 20% of the positives, occur adjacent to and just south of the southern ends of the body. Actually, the body occupies only that portion of the positive which is situated between the axis of the positive anomaly and the beginning of the negative anomaly on the south. Perhaps the anomaly around  $27^{\circ}30'/133^{\circ}45'$  exemplifies the situation where the prominent positive axis culminates in the 2350 gamma contour. One would initiate this anomaly in the north with the 1900 contour leaving a positive amplitude of 450 gamma. The negative axis is about at  $28^{\circ}38'$  and it is quite clear that the negative terminates at about  $27^{\circ}41'$ . It has an amplitude of about 100 gamma which is just in excess of 20% of the positive amplitude. Anyway, similar distribution can be followed rather routinely throughout the entire area which illustrates simply that anomalies arise from induced magnetization by the earth's normal field.

The observed field varies in character throughout the survey. The depths computed to the sources of the anomalies show that the gross variations in the observed field result from changes in depth of the magnetic interface. It may be concluded from this that the interface probably represents one geologic time boundary. Another way of saying this is that there seems to be only one magnetic interface to account for essentially all the observed anomalies which is of primary importance with regard to exploration as indicating the absence of igneous rocks or other magnetic material within the overlying section.

The anomalies may be used to disclose other information than the depth to the magnetic rocks, such as the magnetic susceptibility of the individual causative bodies. Because absolute susceptibilities are of the same order as relative susceptibilities\*\*, computed susceptibility contrasts

\*Reference: Interpretation of Aeromagnetic Maps, Vacquier et al., Geological Society of America Memoir 47, 1951, Figures A50-A60.

\*\*Reference: Geophysical Prospecting for Oil, Nettleton, L. L., 1940, p. 203.

tend to approximate absolute susceptibilities. This is another way of saying that the magnetization of the rocks adjacent to the causative bodies is essentially zero. With this in mind, anomalies of the intra-basement type have been isolated in four geologic provinces and susceptibility contrasts computed by referring to the ideal models in the GSA Memoir 47, previously referred to. The quantities necessary for this computation are the anomaly amplitude, the area of the causative body transposed into depth of burial units, and the depth to the causative body from the flight level. The results are shown in the table on rock susceptibilities.

#### COMPARATIVE ROCK SUSCEPTIBILITIES, $\Delta k$

| <u>Location</u> | <u><math>\Delta k \times 10^6</math></u> |
|-----------------|------------------------------------------|
|-----------------|------------------------------------------|

##### MUSGRAVE BLOCK

|                  |            |
|------------------|------------|
| 27°35' / 130°21' | 1630       |
| 27°40' / 130°35' | 495        |
| 27°16' / 132°30' | 472        |
| 27°08' / 132°42' | 1420       |
| 27°02' / 133°08' | <u>442</u> |

|              |     |
|--------------|-----|
| Avg. . . . . | 890 |
|--------------|-----|

##### FOREDEEP

|                  |             |
|------------------|-------------|
| 28°15' / 129°28' | 1250        |
| 28°21' / 129°55' | 1730        |
| 28°11' / 130°07' | 1020        |
| 28°15' / 131°10' | 236         |
| 28°12' / 131°49' | 2120        |
| 28°11' / 132°15' | 3800        |
| 27°55' / 132°28' | <u>4950</u> |

|              |      |
|--------------|------|
| Avg. . . . . | 2160 |
|--------------|------|

##### SOUTHWEST SHELF

|                  |      |
|------------------|------|
| 29°25' / 129°00' | 362  |
| 29°26' / 129°41' | 2050 |

|                |             |
|----------------|-------------|
| 28°52'/130°05' | 1410        |
| 29°45'/130°05' | 1180        |
| 29°35'/130°45' | 1180        |
| 29°50'/131°25' | <u>2360</u> |

Avg. . . . . 1420

#### SOUTHEAST SHELF

|                |             |
|----------------|-------------|
| 28°22'/131°48' | 2280        |
| 29°02'/131°48' | 955         |
| 29°30'/131°48' | 1160        |
| 28°46'/132°13' | 1980        |
| 28°41'/133°45' | 1140        |
| 28°58'/133°58' | 3460        |
| 29°15'/133°58' | 9500        |
| 29°52'/133°58' | <u>3280</u> |

Avg. . . . . 2965

The first conclusion to be reached from the study of this table is that no exceptionally large susceptibilities are computed. The largest is 9500 on the southeastern shelf which marks the level at which the percent magnetite-susceptibility curve departs from several percent magnetite to increasingly larger percentages as susceptibility increases. The variations among the values is surprising at first glance but is probably more attributable to the difficulties in determining areas of the causative bodies from the reconnaissance data than from large variations in the susceptibilities. One can appreciate that the accurate area of a causative body cannot be determined from coverage which has gaps ten miles wide. The average susceptibilities are highest on the southeastern shelf which is predictable from a general examination of the observed field. That the Musgrave block has the lowest average susceptibility and that the susceptibility of the southwestern shelf is intermediate between Musgrave and the southeastern shelf could also have been anticipated. But the fact that the foredeep area has the high susceptibility of 2160 does not seem reasonable and is more likely attributed to the increased difficulty of accurately determining the areas of the causative bodies in the zone of deepest basement. It probably should only be concluded from all these results that the magnetization of the area is routine or representative of shield type basement without any exceptional ferromagnetic mineralization.

The field along the northern boundary is complex with sharp anomalies of relatively large amplitude. These amplitudes commonly are of the order of 700 gamma, and these represent rather normally magnetized rocks as the Table of Susceptibilities shows. These anomalies undoubtedly mark the presence and abrupt termination, probably by faulting, of the Archean Musgrave block. Immediately south of this anomalous belt the field is as flat as it is anywhere in the survey. The axis of the flat zone may be considered to extend from  $27^{\circ}10'/133^{\circ}20'$  southwestward toward  $28^{\circ}00'/130^{\circ}20'$ . Westward from here the situation is more complex because of a moderately anomalous zone around  $27^{\circ}45'/129^{\circ}00'$ . Even in the "flat" area there is the usual arrangement of positive and negative anomalies which is the evidence for stating that the magnetic basement probably maintains its character throughout the area and that the observed map is changing its character because of the magnetic basement. A weak positive-negative arrangement occurs in the vicinity of  $27^{\circ}35'/132^{\circ}52'$ , for example.

South from the flat belt, the magnetic field again becomes rather abruptly anomalous along a trend which extends from  $27^{\circ}00'/133^{\circ}45'$  to  $29^{\circ}40'/130^{\circ}00'$  where it may be construed to change abruptly to leave the western boundary of the area at around  $28^{\circ}30'$  at the northwestern corner of Sheet 2. South of this boundary the field is generally anomalous, but anomalies cover larger areas than they do over the Musgrave block. This magnetic environment marks the shelf province of the area where the section is only moderately thick.

So the observed magnetic field is thought to represent at once three major geologic provinces within the exploration permit. These are the southern rim of the Musgrave block in the north, the foredeep or trough of thick sediments immediately south of it, and the shelf-like areas which occupy 60% of the overall area. Needless to say, this arrangement of geologic provinces focuses attention on mobile belts as far as gas exploration is concerned. These would be (1) the hinge line between the shelf and the foredeep, and (2) the foothills structures in the foredeep along the Musgrave block.

One should always be concerned with mineral possibilities when a magnetic map is at hand and therefore inspect the field for abnormal anomalies. Anomalies of highest amplitude or large susceptibilities occur on the shelves and not on the Musgrave block. A conspicuous anomaly occurs along tie line H at  $29^{\circ}08'/133^{\circ}45'$  with about 3000 gamma of amplitude along this single tie line. There is every reason to expect that the anomaly might develop with more amplitude north or south. Anomalies of similar amplitude also exist immediately southeast or

about at  $133^{\circ}58'/129^{\circ}15'$ . These appear to come from very narrow, possibly lenticular sources, which are somewhat arcuate but are generally aligned in east-west fashion. The susceptibility computed for this body is .0095 cgs, not an extreme value.

#### (b) MAGNETIC BASEMENT MAPS

These maps, included here in the same series of four sheets as the observed maps, are distinctly geologic maps, not magnetic maps. Consequently, all interpretive results are translated by one means or another into entities corresponding to rocks and not to the magnetic field.

The primary information on the magnetic maps is the intrabasement depth estimates which are shown in hundreds of feet from sea level datum. These have three, two, or one underlines for good, fair, or poor dependability, according to the number of calculations which are averaged to yield the final plotted value. A second category of depth estimates has the suffix "S" denoting that thin plates of material are present at or near the surface of the basement. This is the so-called suprabasement type of depth estimate. These suprabasement sheets are shown with closures and fault traces, but caution must be exercised in interpreting closed outlines as anticlines and fault traces as actually being faults. Both only indicate that thin plates of magnetic material are present, and these can be within the basement as well as on top of the basement. Obviously some symbol such as a fault trace must be used for one-sided anomalies even though faulting is not necessarily present. Whether or not these sheets of material represent relief of the basement's surface can only be shown, as far as the magnetic data are concerned, from the attitude of the basement contours with respect to the sheets. A third suite of depth estimates has the suffix "sh" for "shallow," denoting that magnetic material, also of the thin sheet variety, is derived from anomalies which give depth estimates above the mapped magnetic basement. Therefore, these represent shallow magnetic materials construed to be within the sedimentary section. The outlines for these bodies are shown in dashed (short) form. Within both the dashed and closed outlines, and also with the fault traces, are shown, in feet, the thicknesses of the various plates. These thicknesses are computed from the maximum amplitude of the associated residual suprabasement anomaly with an assumed polarization contrast of 0.001 cgs. The amplitude of the residual is the direct product of the thickness multiplied by the polarization contrast; so as the assumed polarization contrast is lowered, the thickness must be increased and vice versa.

The "sh" suite of depth estimates is not contoured, being isolated pieces or plates of magnetic material within the sediments. The underlined and "S" depth estimates are contoured at an interval of 1000 ft. to represent the surface of the magnetic basement from the correlation between this surface and the Musgrave block in the north. One might speculate at once that this surface represents the top of the Archean. Other data on the Magnetic Basement Maps include the only drill test in the area at Emu, drilled to 1370 ft at  $28^{\circ}38' / 132^{\circ}14'$ . As mentioned earlier, this probably bottomed in Mesozoic sediments. Immediately west of this is the Emu airstrip from where the general tracks of Namco's seismic Lines A and B are indicated in dashed form. Line A extends for 104 miles along the Mt. Davies road and Line B for 200 miles due west to the edge of the permit.

The basement configuration is quite concordant with the observed magnetic field. The zone of steep dip along the northern edge represents the Musgrave front. It is probably faulted, even thrust faulted. But as this is not interpretable from the magnetic data alone, it is contoured as a monocline. The monocline is steep in the west relative to its appearance in the east. By the same token, foothills structures are common in the trough in the west and relatively absent in the east. This is quite logical, assuming that the interpretation is correct, as the foothills subsidiary structures more likely would have developed in response to a sharper Musgrave front as indicated by the increased density of the contours in the west. In general, the Musgrave front has relief of 16,000 ft in the east, 17,000 ft in the center, and probably 21,000 ft in the extreme west.

The foredeep or trough just south of the front is more easily seen in the central part of the survey and in the northeastern sheet where it is less disturbed by internal structures. Just as the magnetic field over the trough becomes more complicated westward, the floor of the trough is broken with many local structures there also. These are contoured in the form of asymmetric structures which are steep, probably thrust faulted, on their southern flanks. This belt of possible local foreland structures in an area of very thick section contours good recommended areas.

The southern flank of the trough or the hinge line between the southern shelf and the trough is very well developed in the east in Sheet 3, but this hinge loses its obviousness southwestward into Sheet 2 primarily because of the southern incursion of the -10,000 ft level to about  $29^{\circ}30'$  in that sheet. In other words, there is a moderate low on the basement

in the north central part of Sheet 2, whereas in Sheet 3 the shelf has a rather steep edge with about 7000 ft of relief developing over ten miles. This certainly might be a zone along which facies changes could be expected as it is quite probable that the hinge area existed during the depositional history of the area in contrast to the Musgrave front which probably formed rather suddenly with respect to the depositional history.

As indicated before, the -10,000 ft contour travels into Sheet 2 to about  $29^{\circ}10'/130^{\circ}20'$  where it gradually works its way northwestward to leave the area at  $28^{\circ}40'$ . This abrupt change in strike may be considered to be caused by a terrace in the southwest which seems complicated by many local structures of north-south and east-west strike.

On the other hand, the southeastern shelf is relatively structureless. The syncline that is developed with northeast strike in the southeastern part of Sheet 4 is, of course, not reliable as it is within the area covered only by single east-west tie lines. Where good control appears on the extreme margin of the survey, no substantial structure is developed; and maximal depths are around 2000 ft.

As for local areas of possible significant structures, none are picked on the southeastern shelf except a few along its down-dip edge. Several are selected on the southwest terrace, and a couple in the moderate basin along the north central part of Sheet 2. However, many are selected in the trough or adjacent to it which are foreland structures or events along the hinge line.

#### (c) RECOMMENDED AREAS

R. A. 1       $27^{\circ}30'/129^{\circ}15'$

A strike-fault at -14,300 ft is contoured with 6000 ft of relief southward and 4000 ft northward. The computed relief on the fault is 2600 ft.

R. A. 2       $27^{\circ}35'/129^{\circ}30'$

Here a horst is developed by a pair of strike-faults with 2400 ft of relief computed for the northern fault. However, the block is contoured as a strike-fold with 4000 ft of relief in the north and 5000 ft on the south.

R. A. 3       $27^{\circ}42'/129^{\circ}50'$

This series of faults is also contoured as a strike-fold or fault block

continuing the 1-2 trend in an echelon fashion. 5000 ft of relief is contoured in the south and 4000 ft in the north.

R. A. 4      27°50' / 129°50'

This eastward plunging nose actually occurs as a projection of a large regional anticline which extends westward beyond the edge of the survey. The -14,000 ft contour marks the top of this overall structure.

R. A. 5      27°58' / 129°30'

Down-to-the-north faulting, presumably on the southern flank of the trough, which is, however, ill-defined here, requires the emplacement of a -12,000 ft closed contour.

R. A. 6      28°12' / 129°45'

A dome culminating in the closure of the -7000 ft contour has about 4000 ft of relief. It is presumably adjacent to the hinge line of the main trough. A similar dome about fifteen miles westward is not recommended only because it is smaller.

R. A. 7      28°05' / 130°08'

The feature is contoured in north-south fashion with respect to a down-to-the-northwest fault. About 3000 ft of relief is shown. The good looking fault just north of it is not recommended because it is based on down-to-the-north faulting in an area where down-to-the-south faulting is presumed to be important.

R. A. 8      28°05' / 130°45'

This calls attention to an arcuate fold with about 2000 ft of relief.

R. A. 9      28°15' / 130°45'

This is an area of large closure on the hinge line along the southern flank of the trough. About 7000 ft of relief is developed into the trough and 2000 ft on the southern flank of the feature.

R. A. 10      28°02' / 131°10'

A small foothills structure is presumably on strike with R. A. 13 which is more circular in form.

R.A. 11    27°55' / 131°10'

Notice that the area of interest is drawn with offset southward from basement structure. This is because these foothills structures are thought to be probably overturned to the south. This is a small anticline with respect to a down-to-the-southwest fault. Seismic Line A presumably went along its southwestern face.

R.A. 12    27°48' / 131°45'

This is probably a good foothills structure drawn with about 1000 ft of relief in the north and 4000 ft in the south. Its top is about at -10,000 ft. Its origin is rather obvious on the observed map where there is a closure of the 1750 gamma contour.

R.A. 13    28°05' / 131°30'

This is contoured in subcircular fashion with a closure of the -12,000 ft contour and with about 2000 ft of relief. It is centrally located within the trough.

R.A. 14    27°45' / 132°05'

A pair of down-to-the-north faults is included within one overall closure in the central portion of the trough. The basis for its selection is not at all obvious on the observed map.

R.A. 15    27°42' / 132°40'

This is on the hinge line and marks a projection into the trough. The -12,000 ft contour is closed. It is probably one of the best of this type of structure with an undesignated one occurring at 28°12' / 131°50', for example.

R.A. 16    27°15' / 133°40'

There is not much section here, but there is a lot of evidence of structure. It interrupts the trough where, however, it is extremely narrow. There is about 7000 ft of relief along strike and on the southern flank.

R.A. 17    28°45' / 129°05'

This circular closure of the -9000 ft contour marks a dome on the southwestern terrace.

R. A. 18    28°45' / 129°30'

The high part of a north-south trending dome is indicated. There is considerable relief on this structure in the southwestern terrace.

R. A. 19    28°45' / 130°25'

A gentle dome in the small basin which interrupts the southwestern terrace results from -8000 ft depth estimates surrounded by depth estimates deeper than -10,000 ft.

R. A. 20    29°10' / 129°15'

This small closure on the southwestern terrace is selected as representing a small structure in an area of moderately thick section.

R. A. 21    29°05' / 129°55'

This is a good example of a strike or east-west structure at -9000 ft. It has a significant amount of cross faulting.

R. A. 22    29°25' / 129°40'

This is good north-south structure with a closure of the -6000 ft contour on the southwestern terrace.

R. A. 23    29°45' / 129°05'

Here is a small east-west trending dome at -5000 ft.

R. A. 24    30°00' / 129°00'

Only the northeastern quarter of this possible dome is on the survey.

R. A. 25    29°35' / 131°05'

This feature at -4000 ft interrupts the north-south striking synclinal area which tends to separate the southwestern terrace from the southeastern shelf by developing a sharp downwarp or graben

R. A. 26    28°35' / 131°50'

This is a good indication of an east-west structure on the northern limit of the southeastern shelf.

(d) CONCLUSION

The aeromagnetic study of 60,000 mi<sup>2</sup> in O. E. L. 28 south of the Musgrave block in the Eastern Officer basin develops a typical shelf-trough-hinterland system of provinces from a magnetic field which presumably represents the top of the Archean. Over 20,000 ft of section is developed in the trough. Geologic studies around the area together with experience in the Amadeus basin suggest that perhaps much of this section is Proterozoic in age. Presumably Lower Paleozoic, Ordovician, and Devonian ages are substantially represented. However, the identity of the rocks within the basement is beyond the capability of the aeromagnetic method which really only establishes that the rocks above the magnetic interface are nonmagnetic. Fortunately, they seem to be clearly nonmagnetic as evidences of shallow magnetic materials which must occur above the mapped surface are insignificant.

The comments on Namco's two seismic lines furnished by Continental are rather interesting. These comments were received after the magnetic analysis was finished. The seismic lines had not been plotted on the results of the magnetic interpretation until the final report was being prepared in Houston. The lines begin at the airstrip where 5000 ft of section was mapped seismically. The -5000 ft basement contour had been drawn practically right through the airstrip. 10,000 ft of section was found toward the ends of the two lines, and it so happens that both lines terminate in areas of about that sedimentary thickness. However, seismic Line A is thought to go through a trough with over 16,000 ft of section before reaching its northwestern termination.

The results of this interpretation are thought to be dependable as far as the map of the magnetic interface is concerned. So the reconnaissance system of bands certainly seems to have been justified. Even the omission of these in the southeast seems to have been advisable. The serious question which is extant is whether or not the mapped interface is significant as far as establishing a basis for a potentially productive sedimentary section. In other words, this is the simple question of whether or not the magnetic basement and the economic basement are one and the same. Presumably only drilling can answer this question.

VII - ELEMENTS OF AEROMAGNETIC INTERPRETATION

Very broadly, the earth may be considered as a uniformly magnetized sphere. If this were the case, the magnetic field would change uniformly and regularly in passing from one point to another on the earth's

surface. Actually, there are local distortions of the field which are caused by magnetic inhomogeneities in the earth's crust.

Any magnetic inhomogeneity will distort the field. An example is shown by Figure 1 in which the shaded area represents a volume of material which is more magnetic than the adjacent material around it. Being more magnetic, the lines of force tend to squeeze together to pass through this volume. This squeezing of the lines is equivalent to an increase in the intensity of the field, and a magnetometer above the area of the magnetic body would show a local increase in magnetic intensity over that body.

Now, let us place the body of Figure 1 in a geological environment as shown in Figure 2. The body may be considered to represent a volume of rock which is more magnetic than the adjacent rock. For the most part, being "more magnetic" means containing a larger volume percentage of magnetite. Magnetite is not the only magnetic mineral but is so much more common and so much more magnetic than any other common rock-forming mineral that, to a very large degree, local variations in magnetic intensity mean local variations in magnetite content of the rocks. The magnetic body may now be thought of as representing a more magnetic basement rock such as gabbro intruded into a less magnetic rock such as granite. The overlying sediments, in general, contain such a low percentage of magnetite that their magnetic effect can be disregarded in an analysis of a magnetic field. This very definite difference in magnetite content between basement rocks and the sediments is of primary importance in the interpretation of magnetic data because it means that, for the most part, the magnetic disturbances begin at a definite geological boundary. So by proper analysis of these disturbances the depth to that boundary can be determined and thereby the thickness of overlying sedimentary rocks.

The preceding remarks apply just as much to the formerly common measurements of vertical magnetic intensity made on the ground as to the airborne magnetometer. There is a technical difference in that the ground magnetometer is leveled for each measurement and determines variations in the vertical component of the field. The airborne magnetometer measures variations in the total intensity as its reference direction is the direction in space of the magnetic vector rather than a level which would be very difficult to maintain in an airplane. This makes for minor technical differences in the analysis of results. A much more important difference is the fact that the airborne survey (in addition to the inherent advantage of being airborne and thereby reducing problems of accessibility) has two important advantages; i. e.:

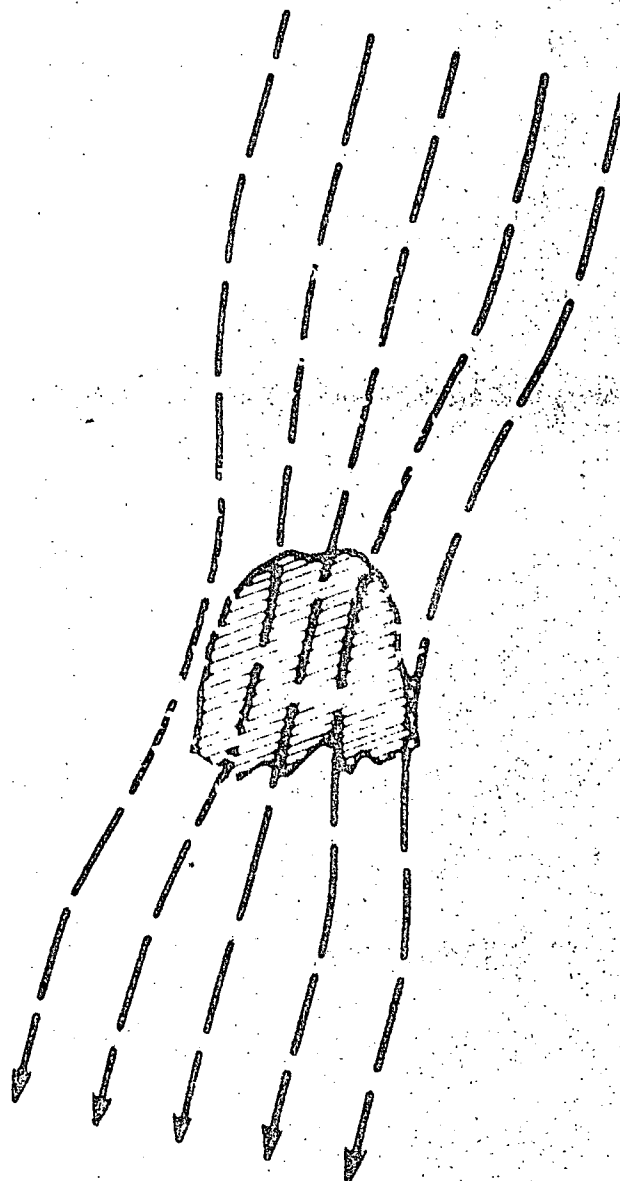
- (1) The airborne instrument makes a continuous recording, rather than a point-by-point measurement, which permits a much higher degree of analysis, and
- (2) In being at some distance above the surface, the distortions due to local accumulations of magnetic material are so much attenuated that usually their effect is completely negligible.

The quantitative use of magnetic surveys to determine basement depth depends on the nature of the magnetic disturbances produced by magnetized bodies of various geometric form. It turns out that a body such as that of Figure 2 can be represented magnetically by a vertical-sided geometric body and that, for practical purposes, the approximations of this simple representation are such that calculated curves based on geometrical bodies can be used effectively to determine the depth to the geological bodies causing the magnetic anomalies found in nature. The effectiveness of such calculations is investigated in detail in Geological Society of America Memoir 47, published in 1951, which includes an extensive atlas of magnetic patterns for various geometric forms.

The use of an ideal geometric body is illustrated by Figure 3. This shows curves of magnetic intensity along an east-west profile across a north-south block of magnetized material which has a width eight times its depth of burial. The four curves, A, B, C, and D, are calculated for different depths to the base of the block, as indicated on the diagram. Curve A, with an amplitude of 500 gamma, is for the case with the bottom at infinite depth. Curve B is for a depth to the bottom of four units, and Curve C, of one unit. The magnitude of these calculated effects is quite different, but it is found that certain essential form parameters are substantially constant. In particular, if a straight line is drawn tangent to the flank of the curve, as shown on the left side of the figure, it is found that the distance,  $d$ , between the points where the curve breaks away from this tangent, i.e., the so-called "slope" measurement, is substantially the same for these three curves and that this distance is linearly related to the depth of burial. Therefore, this essential parameter depends on the depth to the top of the block but practically not at all on the depth to the bottom.

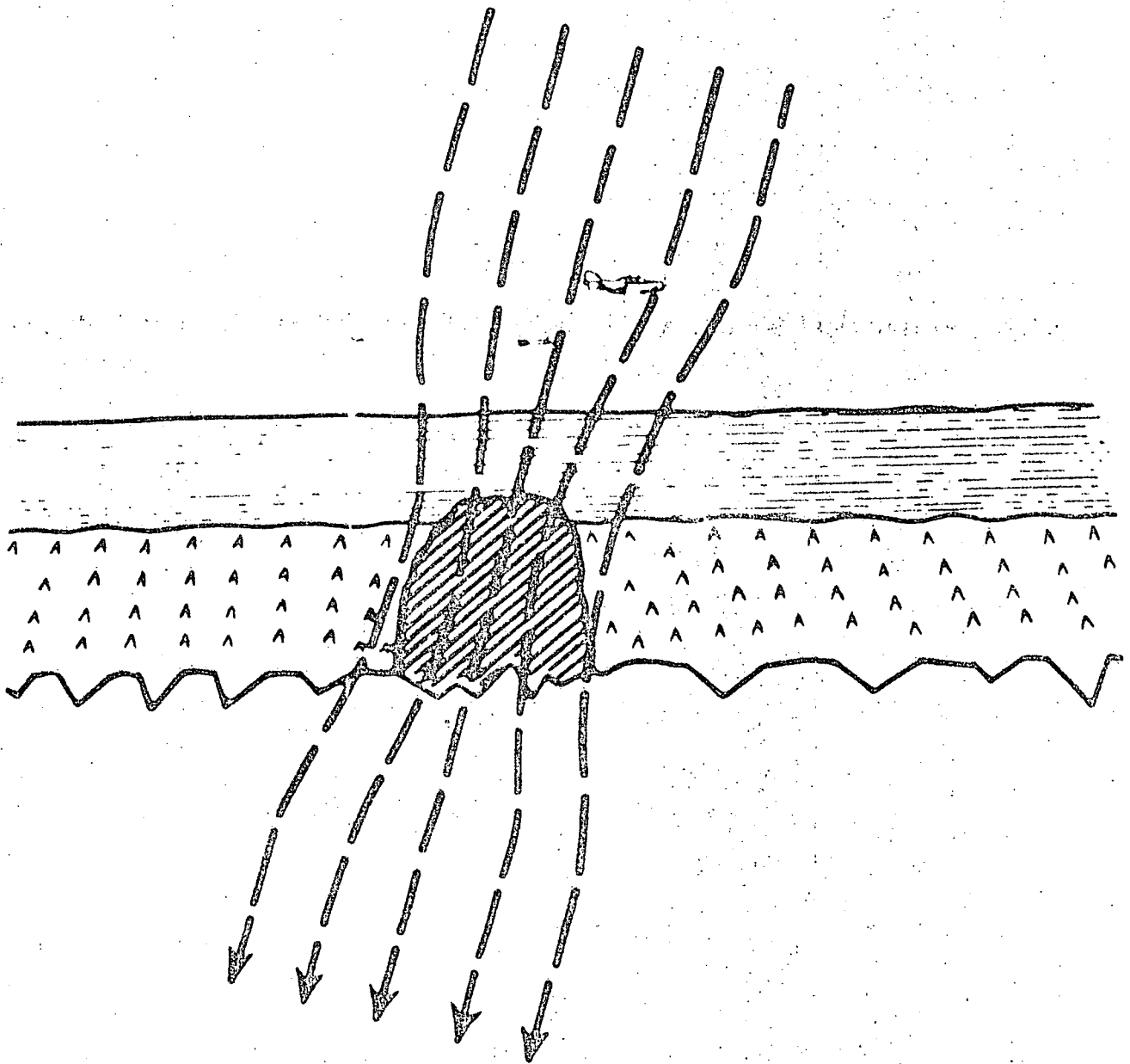
For Curve D, the thickness of the block is reduced to only 0.1 of its depth. In this case, the slope measurement is substantially different (smaller) but is still directly related to the depth of burial.

Of course, the depths define the surface of the "magnetic" basement.



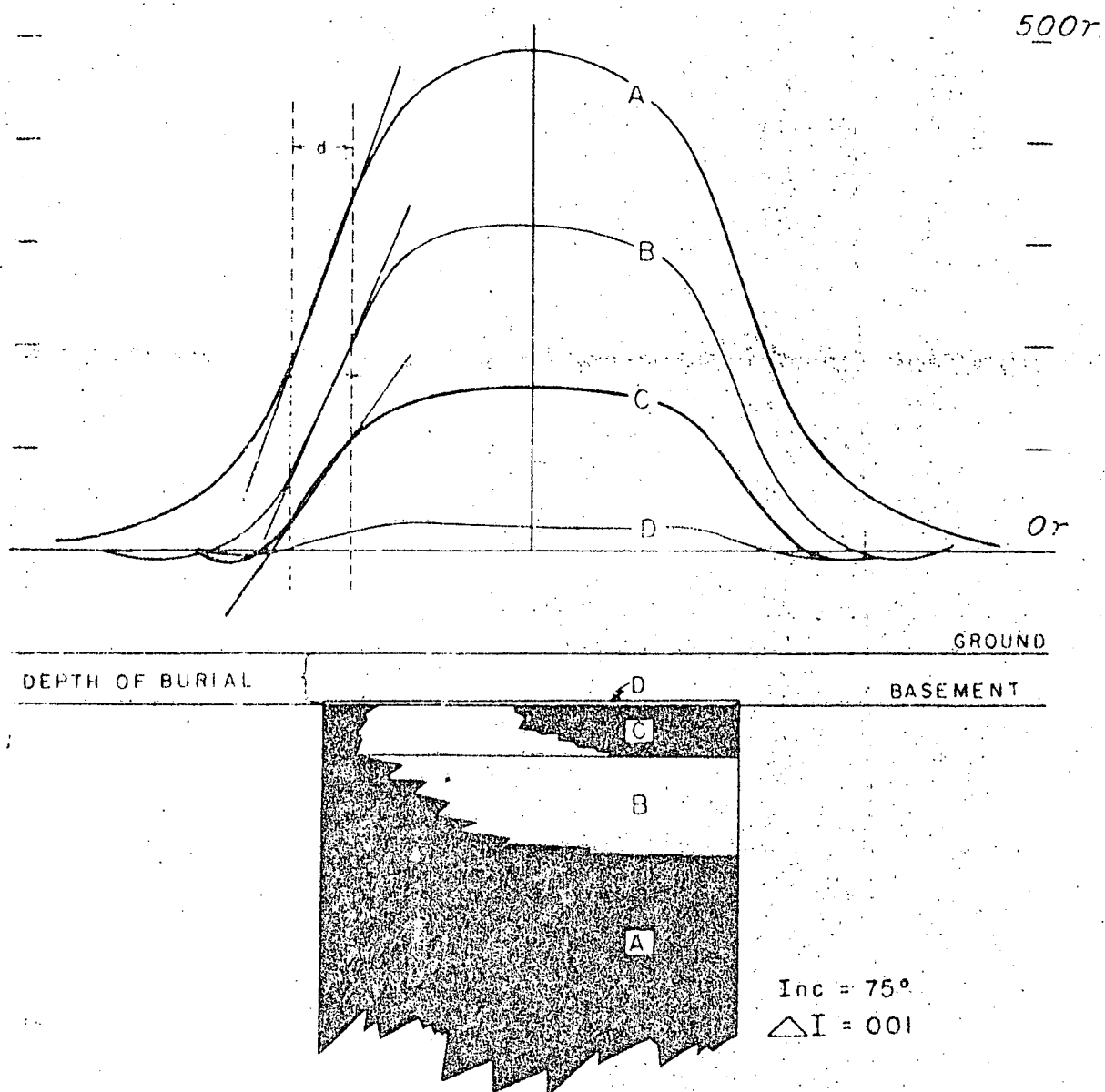
AEROMAGNETIC ANOMALY

FIGURE 1



BASEMENT EFFECT

FIGURE 2



INTRABASEMENT AND SUPRABASEMENT EFFECTS

so that any identification of its age must originate from geologic correlation. Moreover, it is necessary but certainly not predictable, that this basement is the effective limit in depth in exploration. One can experience a basement of nonmagnetic quartzite, for example, acting as the effective basement for exploration but clearly not mappable from magnetic data. Fortunately, experience shows that this is a most infrequent occurrence. Experience over the entire earth shows that most often the "effective basement" and the "magnetic basement" are one and the same. Moreover, the basement is Precambrian in most areas.

## VII 1. METHOD OF INTERPRETATION

It is found that observed magnetic curves can be accounted for almost completely by a combination of thick blocks giving relatively large magnetic effects corresponding to Curves A, B, or C and thin blocks having relatively low relief magnetic effects corresponding to Curve D. The thin sheets or plates could represent local relief on the basement surface which could be erosional or structural in origin or they could represent thin sheets of magnetic material just below the basement surface rather than relief on that surface.

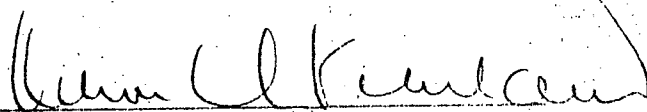
The analysis of aeromagnetic data is based primarily on the original flight line records. These records are examined and resolved into components which can be attributed to (1) "intrabasement" magnetic contrasts which extend into the basement for depths at least as great as the depth of burial (i. e., thick bodies); (2) "suprabasement" components which are attributed to thin bodies at or near the basement surface and which may or may not represent relief of that surface; and (3) shallow disturbances which have their origin within or near the surface of the sedimentary section, usually from intrusive or extrusive rocks. When these components are resolved, certain elements of the curves are measured as distances on the tapes. These distances are corrected for the azimuth of the flight line with respect to the boundary of the magnetized body as inferred from the observed and derivative maps then reduced to distances on the ground. From this distance and the proper depth parameter, a depth below flight level is calculated. This depth is reduced to sea level datum by subtracting the flight elevation, and the resulting number is placed on a map at the location corresponding to the proper point on the intrabasement or suprabasement causative body.

The process of interpretation is very much dependent on recognizing the different components of the aeromagnetic profiles. This recogni-

tion may be easy or difficult, depending on the degree and the manner in which the various effects may overlap or interfere with one another. An important criterion for the recognition and resolution of the anomalies is the consistency of depth calculations, from the thin and thick bodies because the depth parameters from which these calculations are made are quite different. But, properly used, they will lead to the same depth values.

The recognition of the thin plate anomalies and their use for depth estimates greatly extends the amount of depth control which can be obtained from the analysis. These may occur cleanly by themselves, but often occur in association with intrabasement anomalies, as superpositions on intrabasement anomalies, as adjacent to or as noses from intrabasement anomalies, or they may occur along a geologically reasonable trend not otherwise connected with intrabasement anomalies.

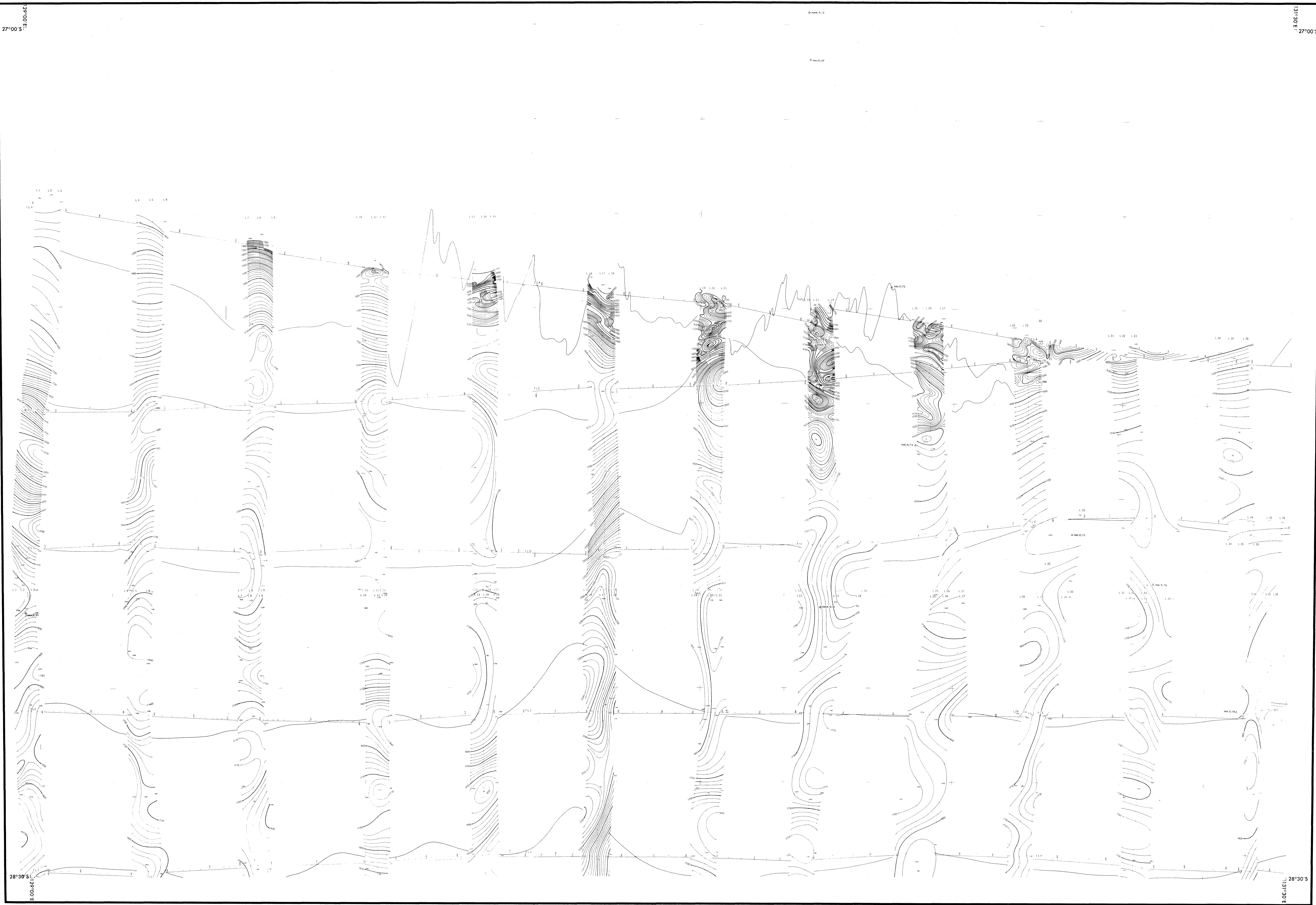
GEOPHYSICAL ASSOCIATES PTY LTD



Nelson C. Steenland

Interpretational Assistants: R. H. Hammons, Jr. and W. D. Gibbons

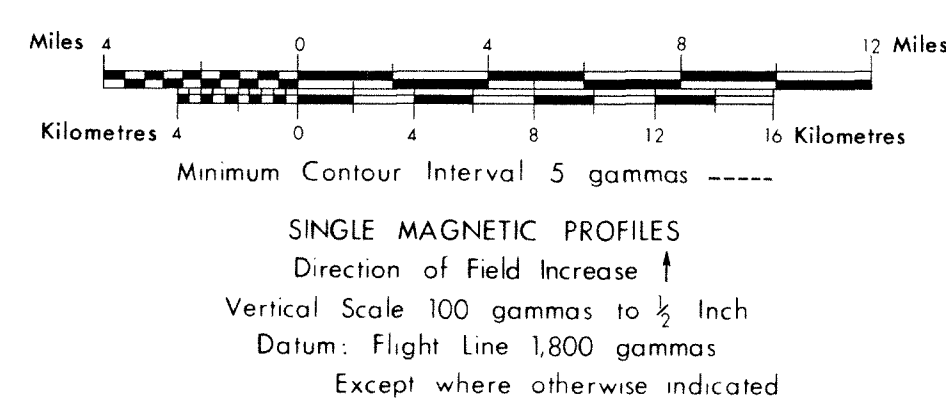
GILES EASTERN OFFICER BASIN AEROMAGNETIC SURVEY 1964-5  
O.E.L. 28, SOUTH AUSTRALIA



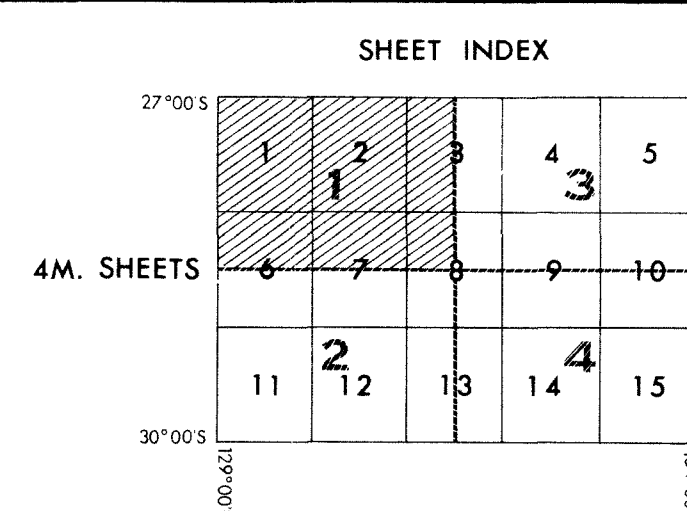
Flown and Compiled by  
ADAstra HUNTING GEOPHYSICS PTY. LTD.,  
39-45 VICKERS AVE.,  
MASCOT. N.S.W.  
Trig. Stn.  $\Delta$  Astro. Stn.  $\diamond$   
Field Work  
October 1964 - April 1965

**EXPLANATORY NOTES**  
All Right and Tie Lines south of T11 'D' were flown at a constant barometric altitude of 2000 feet a.m.s.l. north of T11 'D' the altitude was increased to 2500 feet. Lines were flown in a N45 direction in groups of 3 spaced at 175 miles or intervals of 10 miles. Magnetic control lines (single) were flown E-W at intervals of 20 miles. An APAL radio altimeter recorded to a 35 mm. vertical camera. A GUY RESEARCH TOTAL FIELD MARK 3 MAGNETOMETER towed from a Lockheed Hudson aircraft, was used to record magnetic variations.

**MAGNETIC INFORMATION**  
Regional corrections applied to this sheet minus 0.66 gammas per line mile West minus 8.40 gammas per line mile South  
Total Field (F) 56,500 gammas  
Inclination (I) 60°  
Declination (D) 4° east  
Vertical Field (Z) 49,000 gammas



| 4M. AREAS |         |            |             |
|-----------|---------|------------|-------------|
| BIRKSGATE | LINDSAY | EYEBARD    | WINTINNA    |
| NOORINA   | WELLS   | GILES      | MURLOCCOPPE |
| WYOLA     | MAURICE | TALLARINGA | COOPER PEDY |

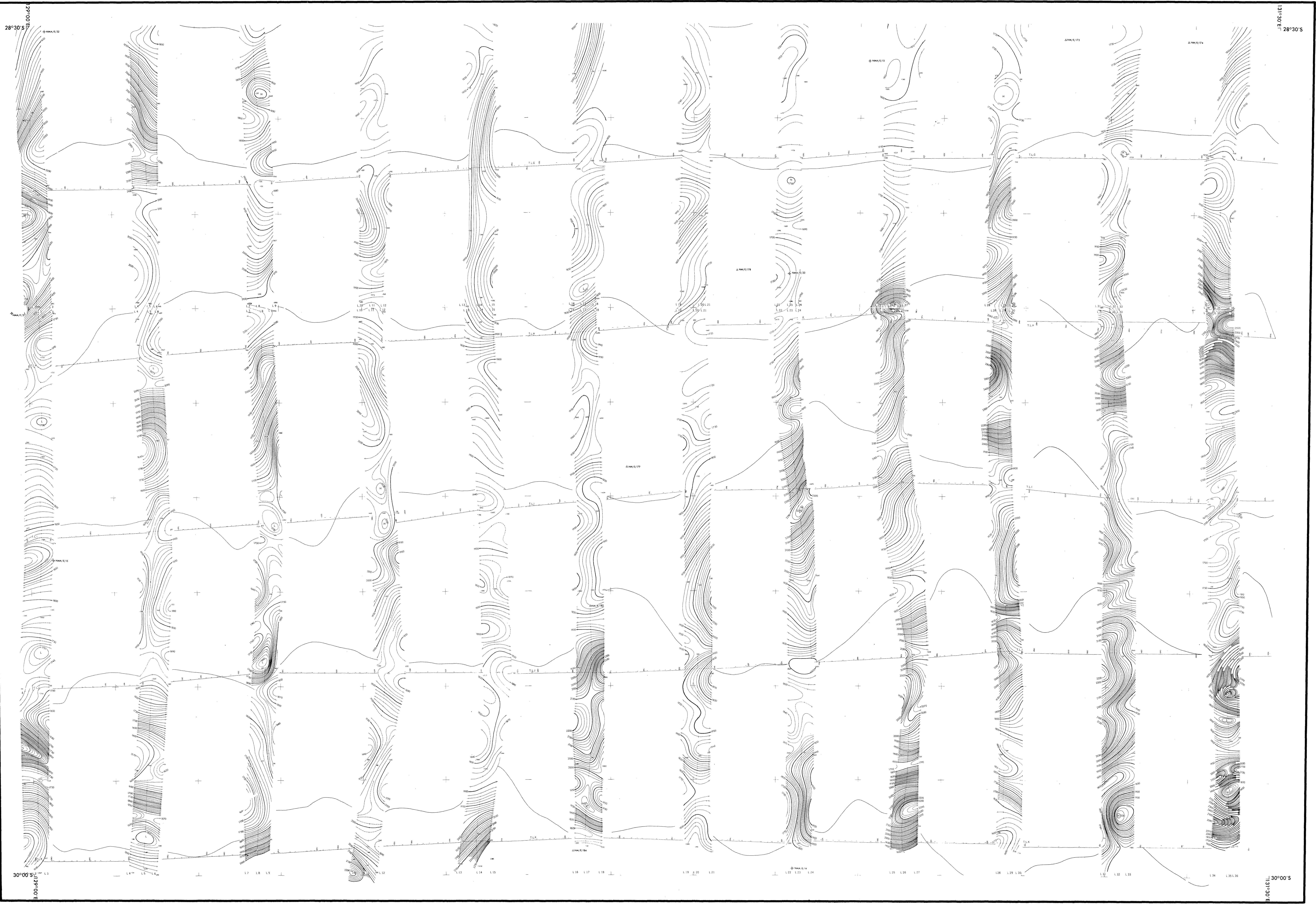


GILES TOTAL MAGNETIC INTENSITY MAP  
AEROMAGNETIC SURVEY, EASTERN OFFICER BASIN,  
O.E.L. 28, SOUTH AUSTRALIA  
EXOIL PTY. LTD.

SHEET NO. 1  
399-6

# GILES EASTERN OFFICER BASIN AEROMAGNETIC SURVEY 1964-5

O.E.L. 28. SOUTH AUSTRALIA



Flown and Compiled by  
ADAstra HUNTING GEOPHYSICS PTY. LTD.,  
39-45 VICKERS AVE.,  
MASCOT. N.S.W.  
Trig. Stn.  $\Delta$  Astro. Stn.  $\odot$   
Field Work  
October 1964 - April 1965

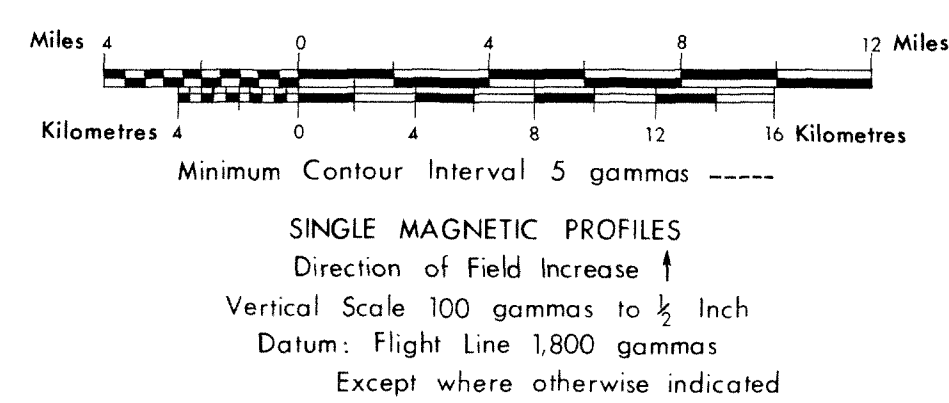
## EXPLANATORY NOTES

All flight and tie lines south of T/L 10 were flown at a constant barometric altitude of 2,000 feet a.m.s.l. north of T/L 10 the altitude was increased to 2,500 feet. Lines were flown in a N-S direction in groups of 3 spaced at 10 miles at intervals of 10 miles. Magnetic contour lines (single) were flown E-W at intervals of 20 miles. An APN-1 radio altimeter recorded terrain clearance. Navigation was entirely visual by reference to photographs, the track of the aircraft being recorded by a 35 mm. vertical camera. A GULF RESEARCH TOTAL FIELD MARK 3 MAGNETOMETER towed from a Lockheed Hudson aircraft, was used to record magnetic variations.

## MAGNETIC INFORMATION

Regional corrections applied to this sheet minus 0.66 gammas per line mile West minus 8.40 gammas per line mile South

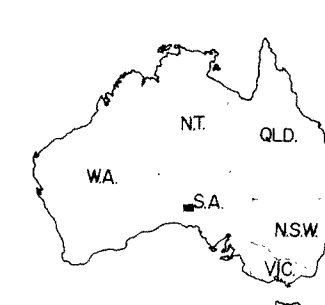
Total Field (F) 56,500 gammas  
Inclination (I)  $60^\circ$   
Declination (D)  $4^\circ$  east  
Vertical Field (Z) 49,000 gammas



## 4M. AREAS

|          |         |            |             |
|----------|---------|------------|-------------|
| BIRKSIDE | LINDSAY | EVERARD    | WINTHINA    |
| NOORINA  | WELLS   | GILES      | MURDOCCOPPE |
| WYOLA    | MAURICE | TALLARINGA | COOPER FELD |

## SURVEY LOCATION



## SHEET INDEX

|    |    |    |    |    |
|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  |
| 6  | 7  | 8  | 9  | 10 |
| 11 | 12 | 13 | 14 | 15 |

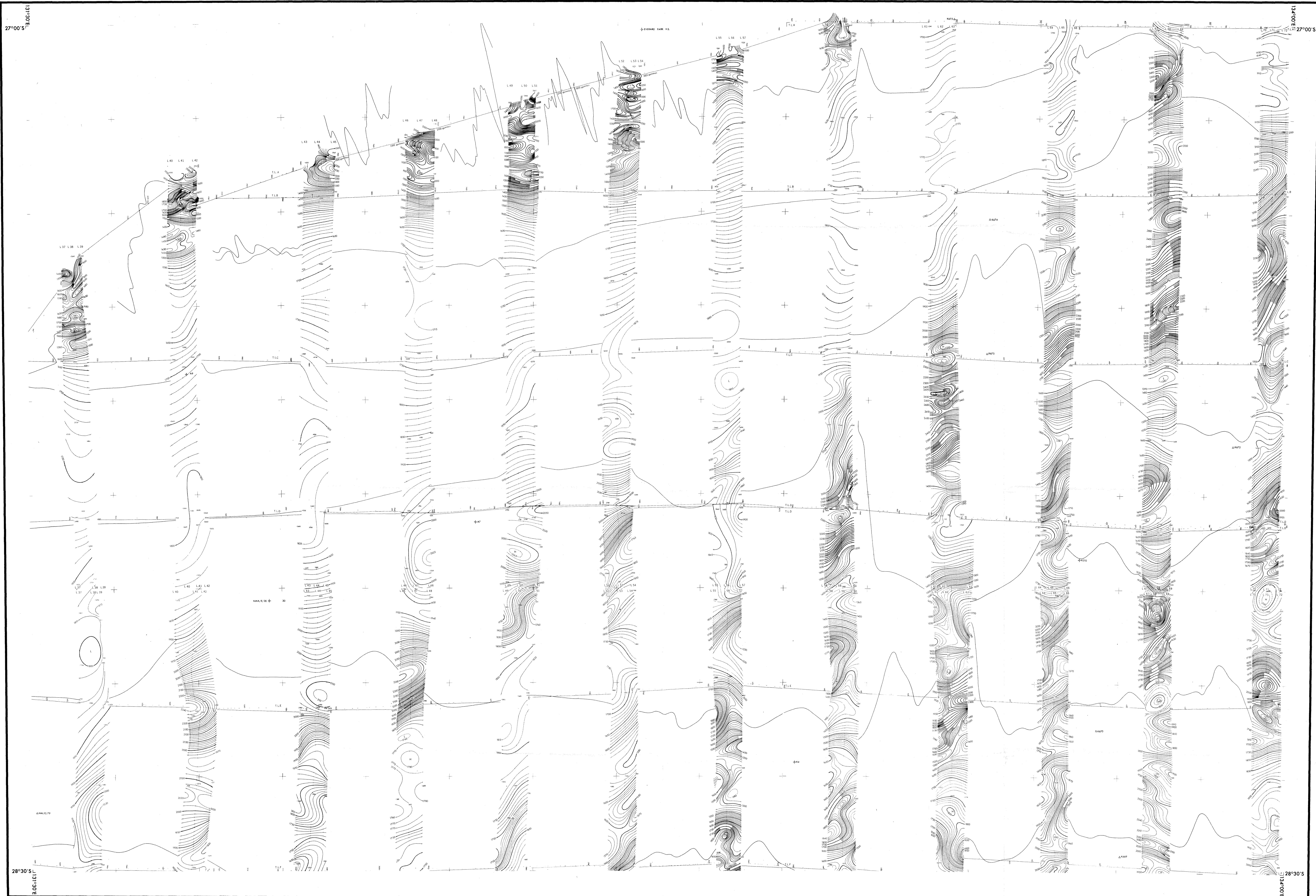
GILES TOTAL MAGNETIC INTENSITY MAP  
AEROMAGNETIC SURVEY, EASTERN OFFICER BASIN,  
O.E.L. 28, SOUTH AUSTRALIA  
EXOIL PTY. LTD.

SHEET NO. 2

399-7

# EASTERN OFFICER BASIN AEROMAGNETIC SURVEY 1964-5

## O.E.L. 28, SOUTH AUSTRALIA



Flown and Compiled by  
**ADAstra**  
 HUNTING GEOPHYSICS PTY. LTD.,  
 39-45 VICKERS AVE.,  
 MASCOT, N.S.W.  
 Trig. Stn.  $\Delta$  Astro. Stn.  $\star$   
 Field Work  
 October 1964 - April 1965

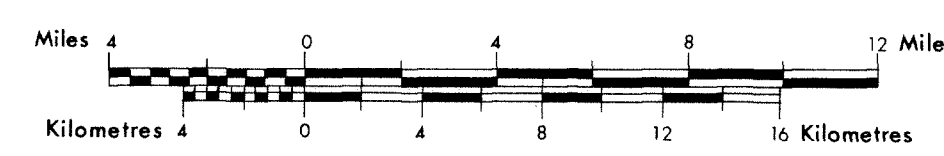
### EXPLANATORY NOTES

All high and low lines south of 131° 0' were flown at a constant barometric altitude of 2000 feet m.s.l. north of 131° 0' the altitude was increased to 2500 feet. Lines were flown in a N-S direction in groups of 3 spaced at 10 miles at intervals of 10 miles. Magnetic control lines (single) were flown E-W at intervals of 20 miles. An APM-1 radio altimeter recorded terrain clearance. Navigation was entirely visual by reference to photostereos. The track of the aircraft being recorded by a 35 mm. vertical camera. A GUY RESEARCH TOTAL FIELD MARK 3 MAGNETOMETER, towed from a Lockheed Hudson aircraft, was used to record magnetic variations.

### MAGNETIC INFORMATION

Regional corrections applied to this sheet  
 minus 0.66 gammas per line mile West  
 minus 8.40 gammas per line mile South

Total Field (F) 56,500 gammas  
 Inclination (I) 60°  
 Declination (D) 4° east  
 Vertical Field (Z) 49,000 gammas

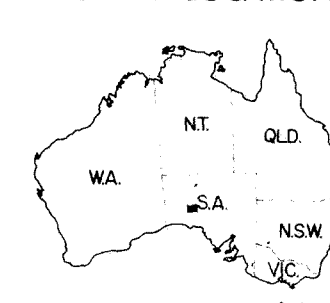


SINGLE MAGNETIC PROFILES  
 Direction of Field Increase  $\uparrow$   
 Vertical Scale 100 gammas to  $\frac{1}{2}$  Inch  
 Datum: Flight Line 1800 gammas  
 Except where otherwise indicated

### 4M. AREAS

|           |         |            |             |
|-----------|---------|------------|-------------|
| BIRKSGATE | LINDSAY | EVERARD    | WINTINNA    |
| NOORINA   | WELLS   | GILES      | MURDOCCOPPE |
| WYOLA     | MAURICE | TALLARINGA | COOPER POND |

### SURVEY LOCATION



### SHEET INDEX

|    |    |    |    |    |
|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  |
| 6  | 7  | 8  | 9  | 10 |
| 11 | 12 | 13 | 14 | 15 |

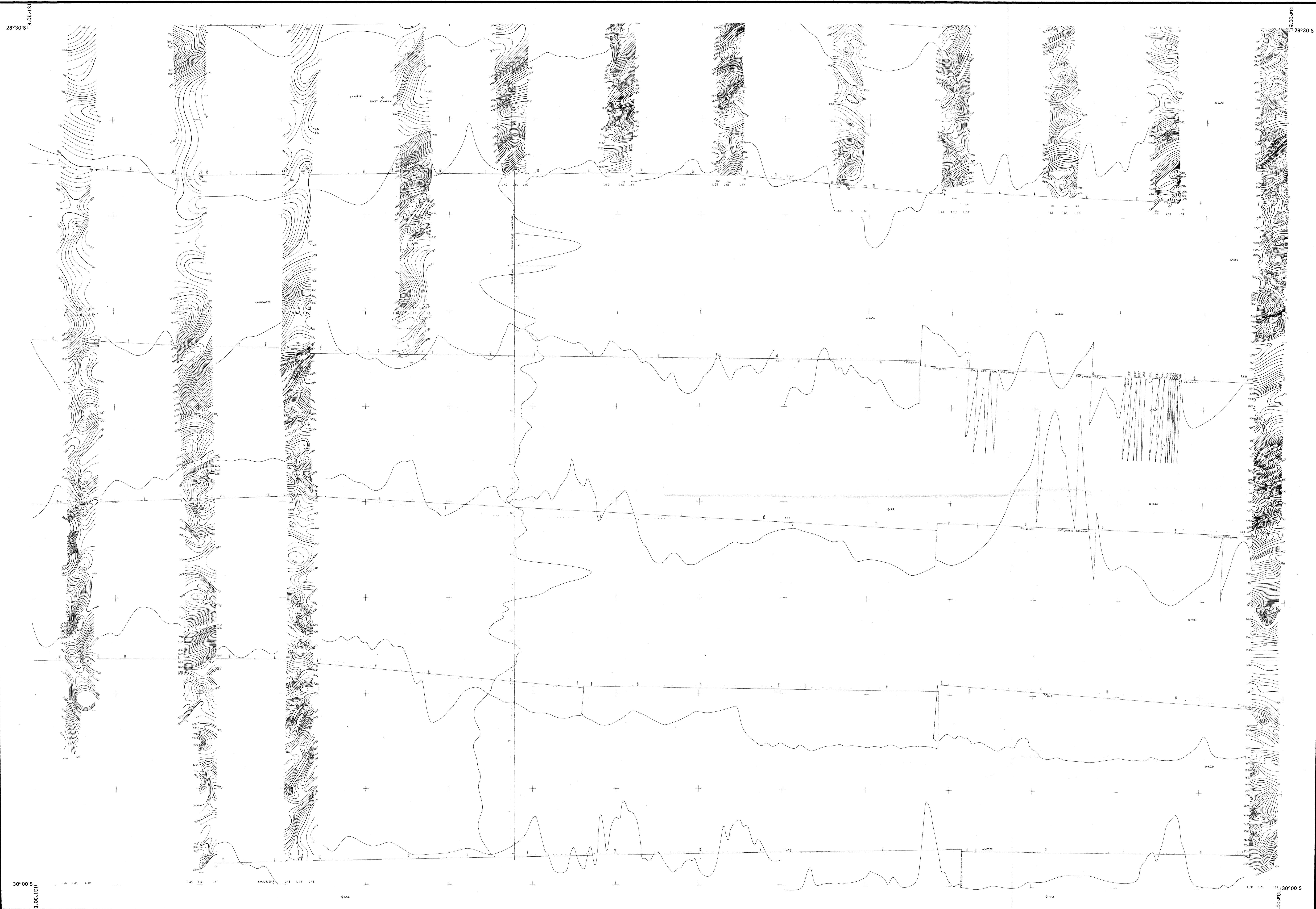
**GILES**  
 TOTAL MAGNETIC INTENSITY MAP  
 AEROMAGNETIC SURVEY, EASTERN OFFICER BASIN,  
 O.E.L. 28, SOUTH AUSTRALIA  
 EXOIL PTY. LTD.

SHEET NO. 3

399-8

# GILES EASTERN OFFICER BASIN AEROMAGNETIC SURVEY 1964-5

O.E.L. 28, SOUTH AUSTRALIA



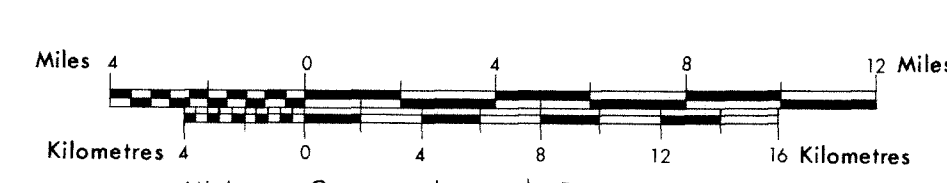
Flown and Compiled by  
**ADASTRA HUNTING GEOPHYSICS PTY. LTD.,**  
 39-45 VICKERS AVE.,  
 MASCOT. N.S.W.  
 Trig. Stn.  $\Delta$  Astro. Stn.  $\odot$   
 Field Work  
 October 1964 - April 1965

## EXPLANATORY NOTES

All flight and the lines south of 1/16" D" were flown at a constant magnetic altitude of 2,000 feet a.s.l. north of 1/16" D" the altitude was increased to 2,500 feet. Lines were flown in a N-S direction in groups of 3 spaced at 1/16 miles at intervals of 10 miles. Magnetic control lines (single) were flown E-W at intervals of 20 miles. An APN1 radio altimeter recorded terrain clearance. Navigation was entirely visual by reference to photostereos, the track of the aircraft being recorded by a 35 mm. vertical camera. A GULF RESEARCH TOTAL FIELD MARK 3 MAGNETOMETER towed from a Lockheed Hudson aircraft was used to record magnetic variations.

## MAGNETIC INFORMATION

Regional corrections applied to this sheet  
 minus 0.66 gammas per line mile West  
 minus 8.40 gammas per line mile South  
 Total Field (F) 56,500 gammas  
 Inclination (I)  $-60^\circ$   
 Declination (D)  $4^\circ$  east  
 Vertical Field (Z) 49,000 gammas

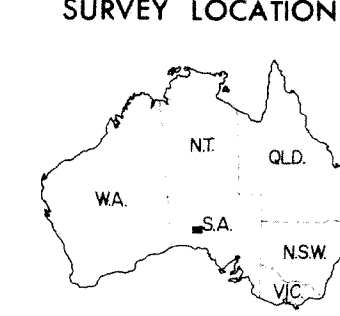


SINGLE MAGNETIC PROFILES  
 Direction of Field Increase  $\uparrow$   
 Vertical Scale 100 gammas to 1/2 inch  
 Datum: Flight Line 1,800 gammas  
 Except where otherwise indicated

## 4M. AREAS

|          |         |            |             |
|----------|---------|------------|-------------|
| BIRKSOTE | LINDSAY | EVERARD    | WINTINNA    |
| MOORINA  | WELLS   | GILES      | MURDOCCOPPE |
| WYOLA    | MAURICE | TALLARINGA | COOPER PEDY |

## SURVEY LOCATION



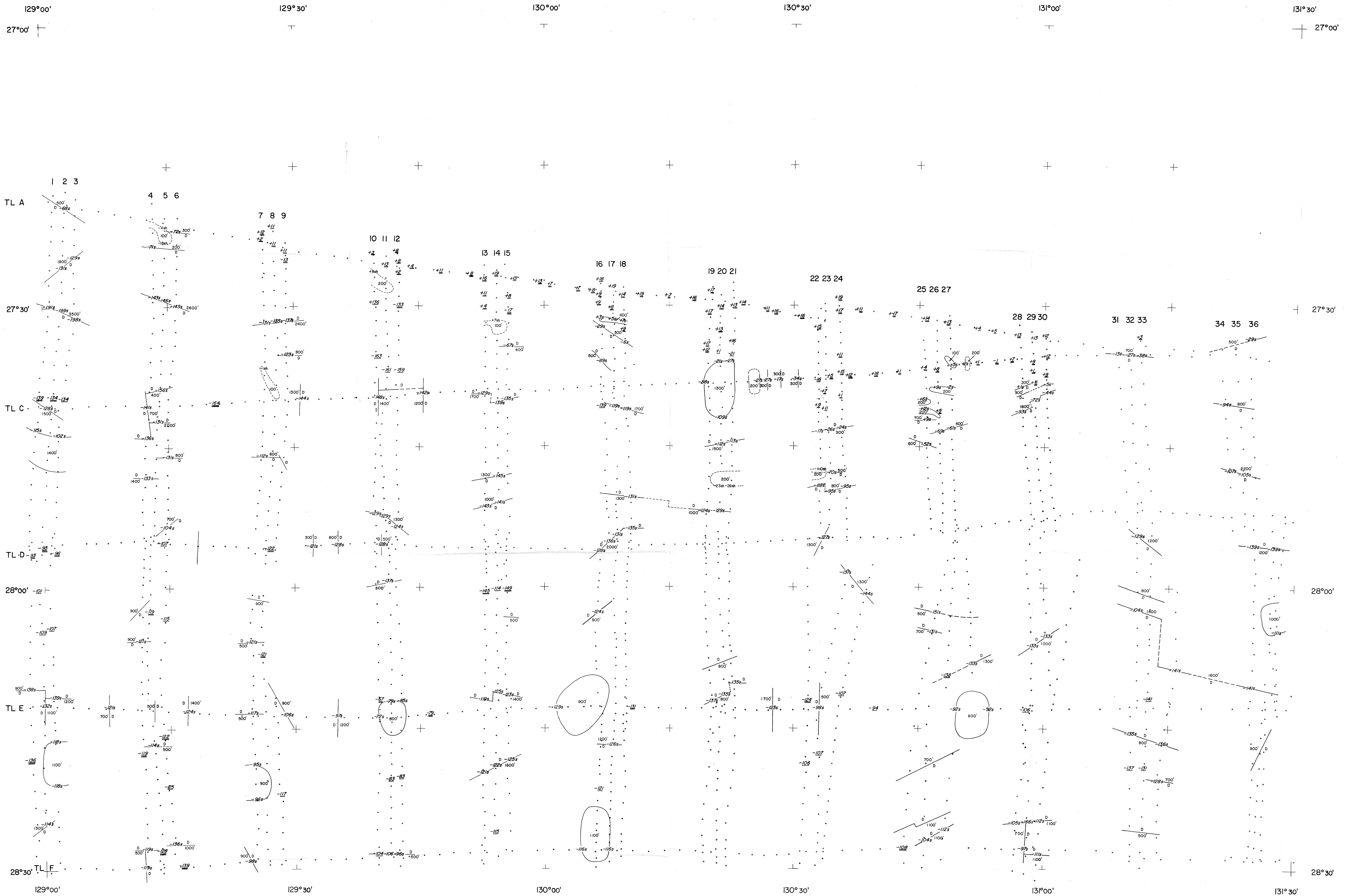
## SHEET INDEX

|    |    |    |    |    |
|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  |
| 6  | 7  | 8  | 9  | 10 |
| 11 | 12 | 13 | 14 | 15 |

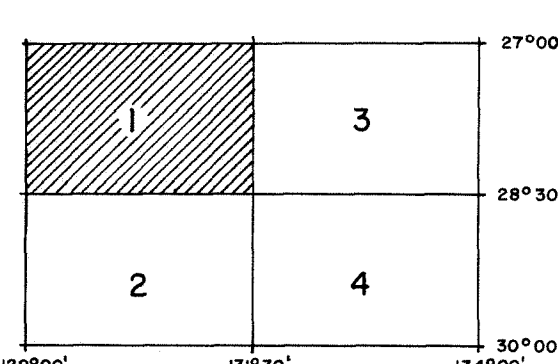
**GILES** TOTAL MAGNETIC INTENSITY MAP  
 AEROMAGNETIC SURVEY, EASTERN OFFICER BASIN,  
 O.E.L. 28, SOUTH AUSTRALIA  
 EXOIL PTY. LTD.

SHEET NO. 4

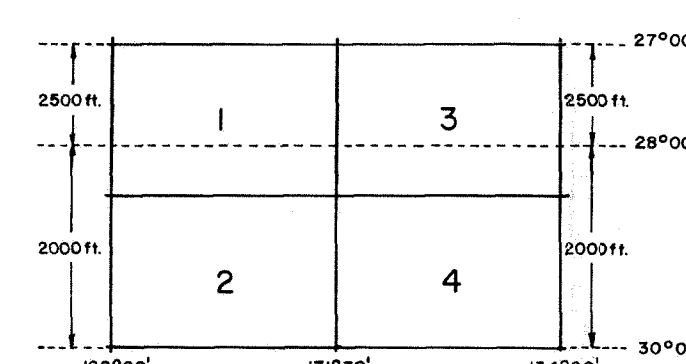
399-9



- SHEET ASSEMBLY -

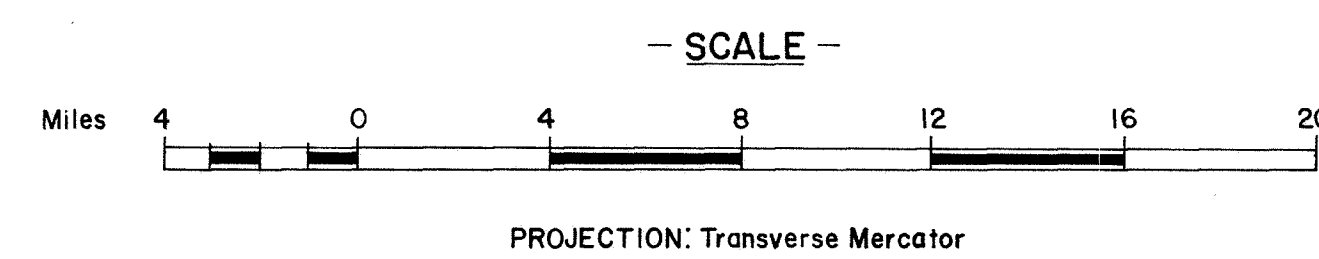
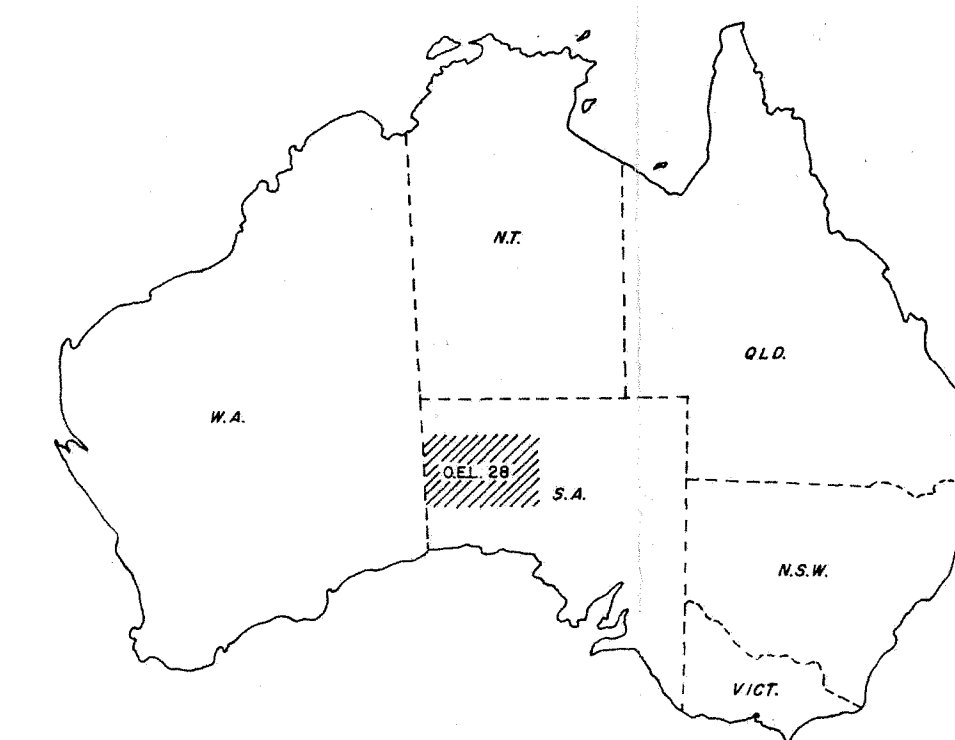


- FLIGHT ALTITUDES -



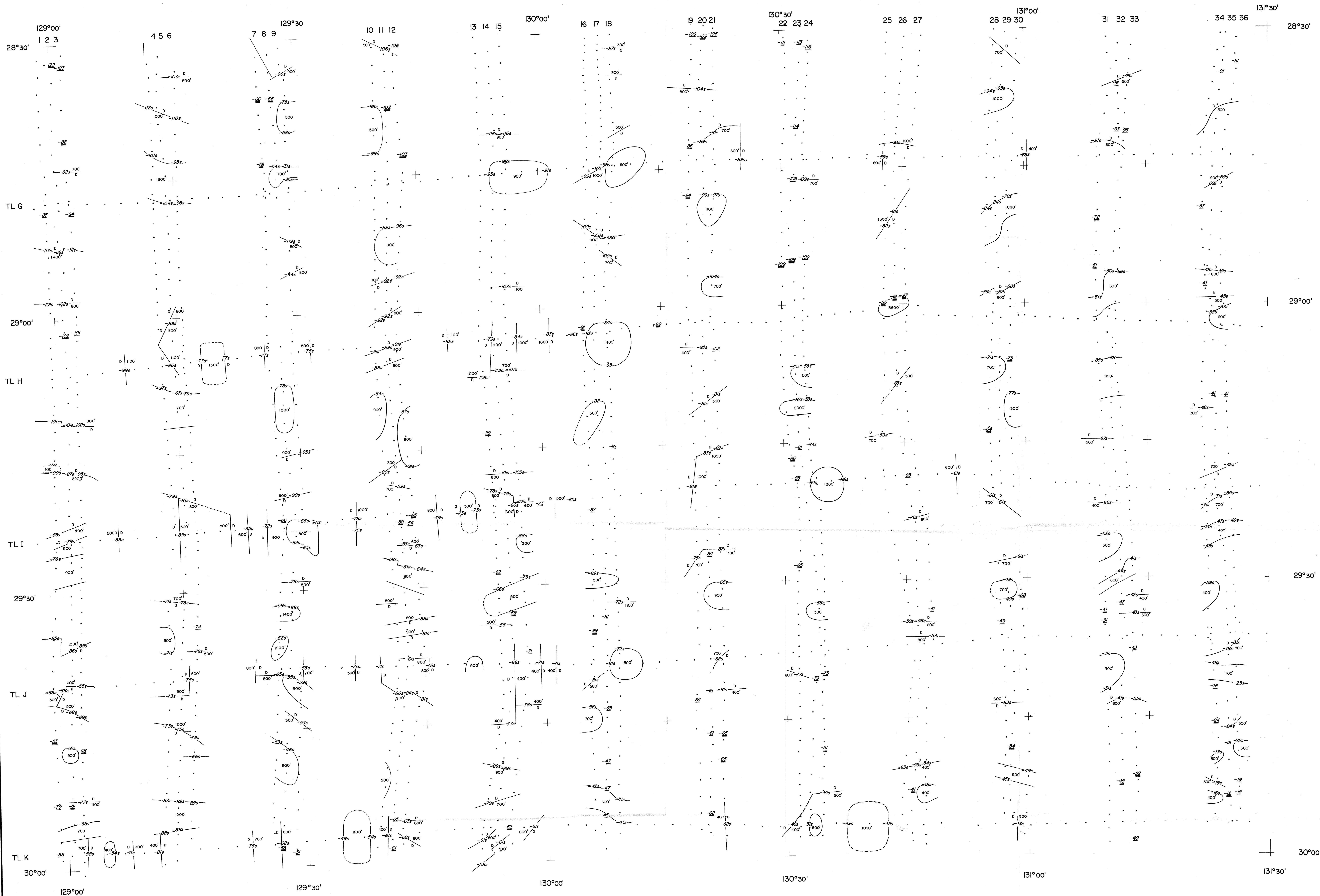
- LEGEND -

- 72
  - 72s
  - 1500
  - 800
  - 150
  - 150
- MAGNETIC BASEMENT DEPTH ESTIMATES FT./100 SEA LEVEL DATUM  
FROM INTRABASMENT ANOMALY  
FROM SUBBASMENT ANOMALY  
OUTLINES OF PLATES FROM SUPRABASMENT ANOMALIES WITH  
MAXIMUM THICKNESS IN FEET ESTIMATED WITH 0.001 Gs  
POLARIZATION CONTRAST  
1500' MAXIMUM THICKNESS IN FEET  
800' VERTICAL DISPLACEMENT IN FEET  
MAGNETIC MATERIAL WITHIN SEDIMENTARY SECTION  
150' MAXIMUM THICKNESS IN FEET  
900' DEPTH ESTIMATES IN FT./100  
\*\*\*\*\* FLIGHT PATH

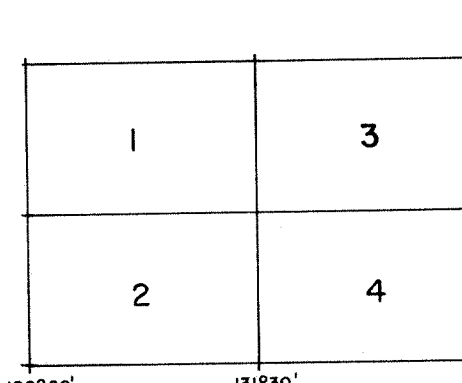


399-10

EXOIL PTY. LTD.  
GILES AEROMAGNETIC INTERPRETATION  
O.E.L. 28 SOUTH AUSTRALIA  
PRELIMINARY  
MAGNETIC BASEMENT  
FLIGHT ALTITUDES 2500, 2000, 1500, 1000 FT.  
GEOPHYSICAL ASSOCIATES INTERNATIONAL  
SHEE 1965



# - SHEET ASSEMBLY -

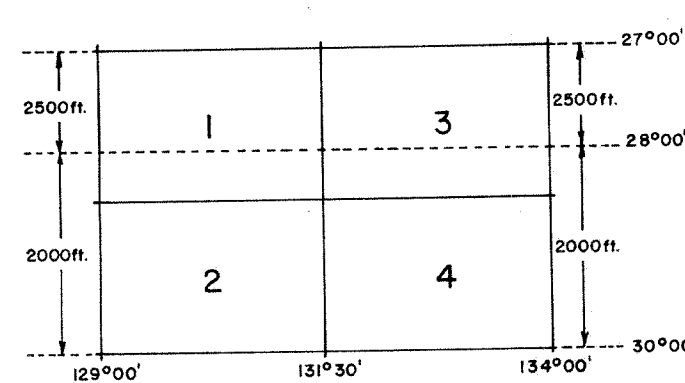


# - SCALE -



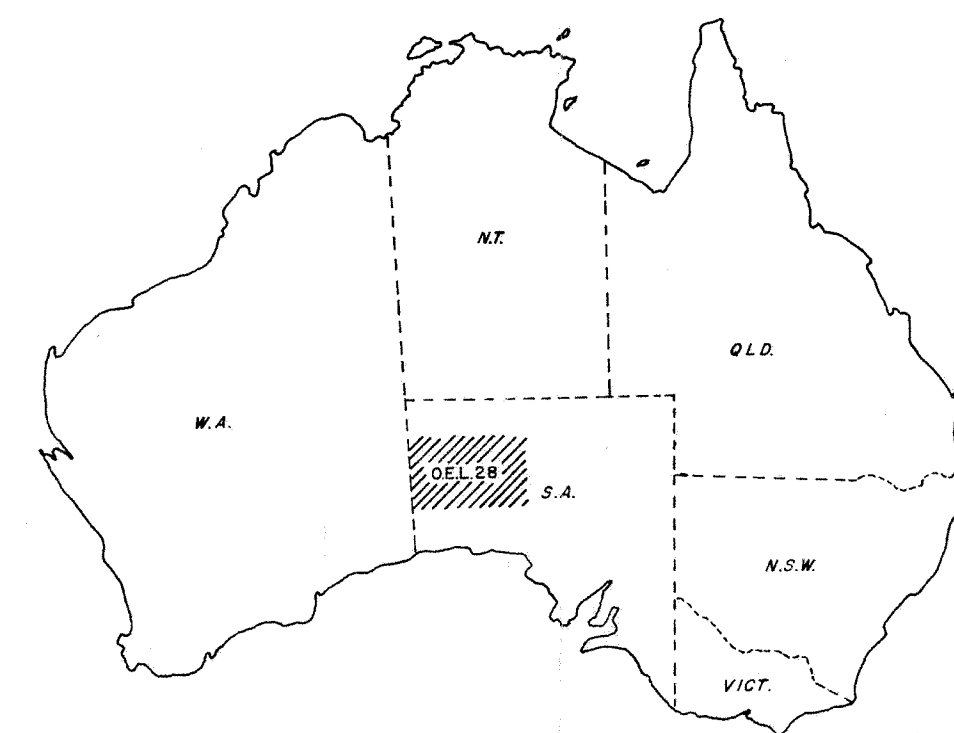
PROJECTION: Transverse Mercator

# - FLIGHT ALTITUDES -



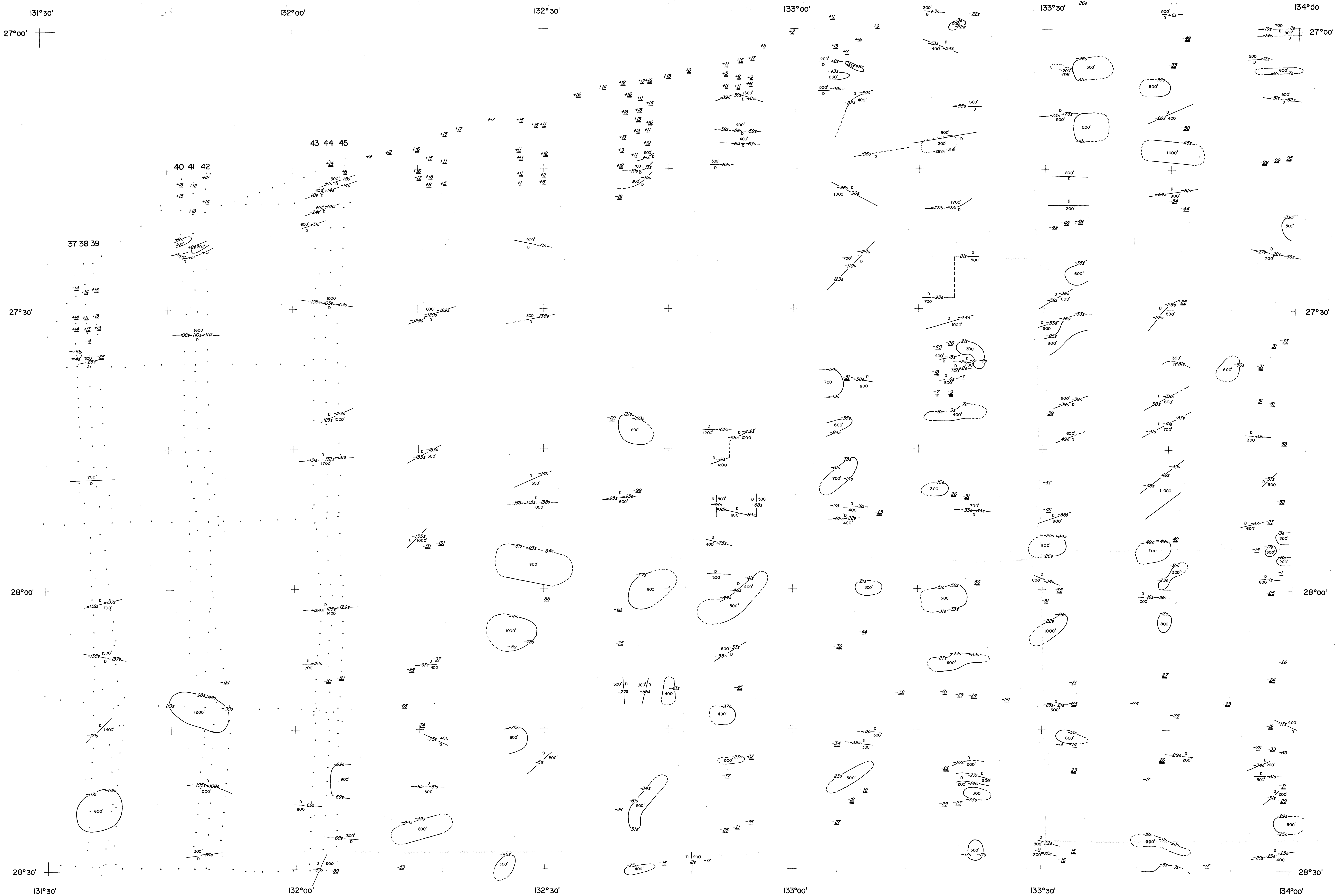
# - LEGEND -

- MAGNETIC BASEMENT DEPTH ESTIMATES #1/100 SEA LEVEL DATUM
- FROM INTRABASMENT ANOMALY
- FROM SUPRABASMENT ANOMALY
- OUTLINES OF PLATES FROM SUPRABASMENT ANOMALIES WITH MAXIMUM THICKNESS IN FEET ESTIMATED WITH 0.001 GRS POLARIZATION CONTRAST
- 1000 MAXIMUM THICKNESS IN FEET
- 800 VERTICAL DISPLACEMENT IN FEET
- MAGNETIC MATERIAL WITHIN SEDIMENTARY SECTION
- 100 MAXIMUM THICKNESS IN FEET
- 500 DEPTH ESTIMATES IN FT/100
- FLIGHT PATH

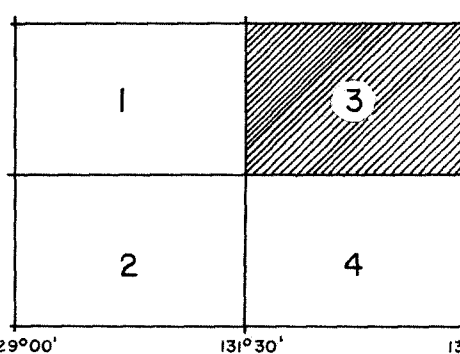


399-11

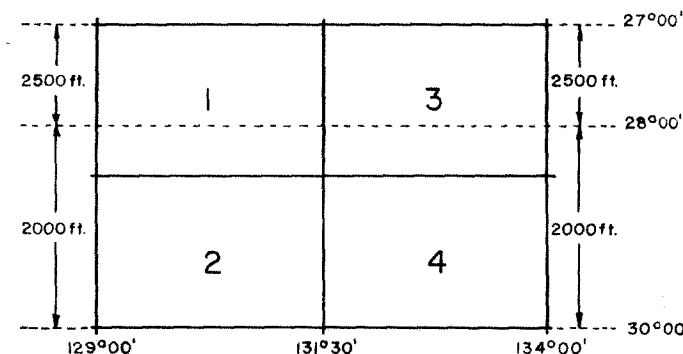
EXOIL PTY. LTD.  
AEROMAGNETIC INTERPRETATION  
O.E.L. 28 SOUTH AUSTRALIA  
PRELIMINARY  
MAGNETIC BASEMENT  
SHEET 2  
FLIGHT ALTITUDE: 2000 FT. CONTOUR INTERVAL: 1000 FT.  
GEOPHYSICAL ASSOCIATES INTERNATIONAL  
BRISBANE, QUEENSLAND 1965



SHEET ASSEMBLY

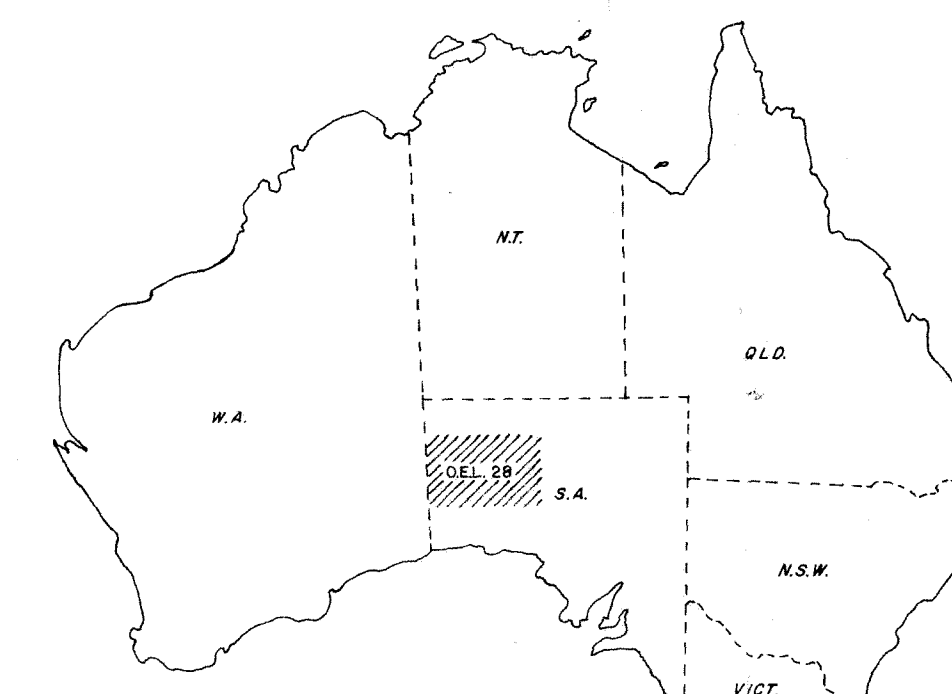


FLIGHT ALTITUDES



LEGEND

- MAGNETIC BASEMENT DEPTH ESTIMATES FT./100 SEA LEVEL DATUM
  - FROM INTRABASMENT ANOMALY
  - FROM SUBBASMENT ANOMALY
  - FROM SUPRABASMENT ANOMALY
- OUTLINE AND EDGES OF PLATES FROM SUPRABASMENT ANOMALIES WITH MAXIMUM THICKNESS IN FEET ESTIMATED WITH 0.001 G/GS POLARIZATION CONTRAST
- 1500' MAXIMUM THICKNESS IN FEET
- 800' VERTICAL THICKNESS IN FEET
- MAGNETIC MATERIAL WITHIN SEDIMENTARY SECTION
- 150' MAXIMUM THICKNESS IN FEET
- 400' DEPTH ESTIMATES IN FT./100



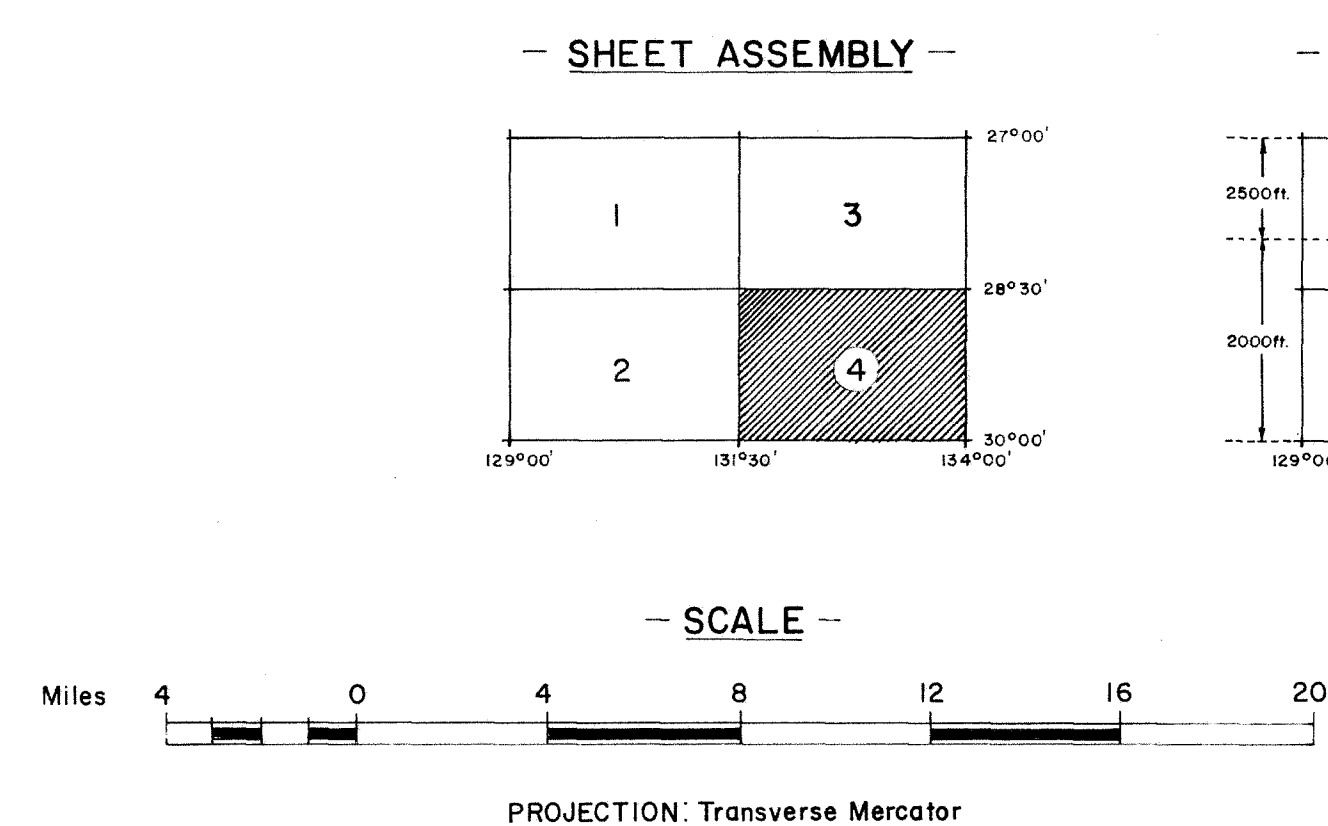
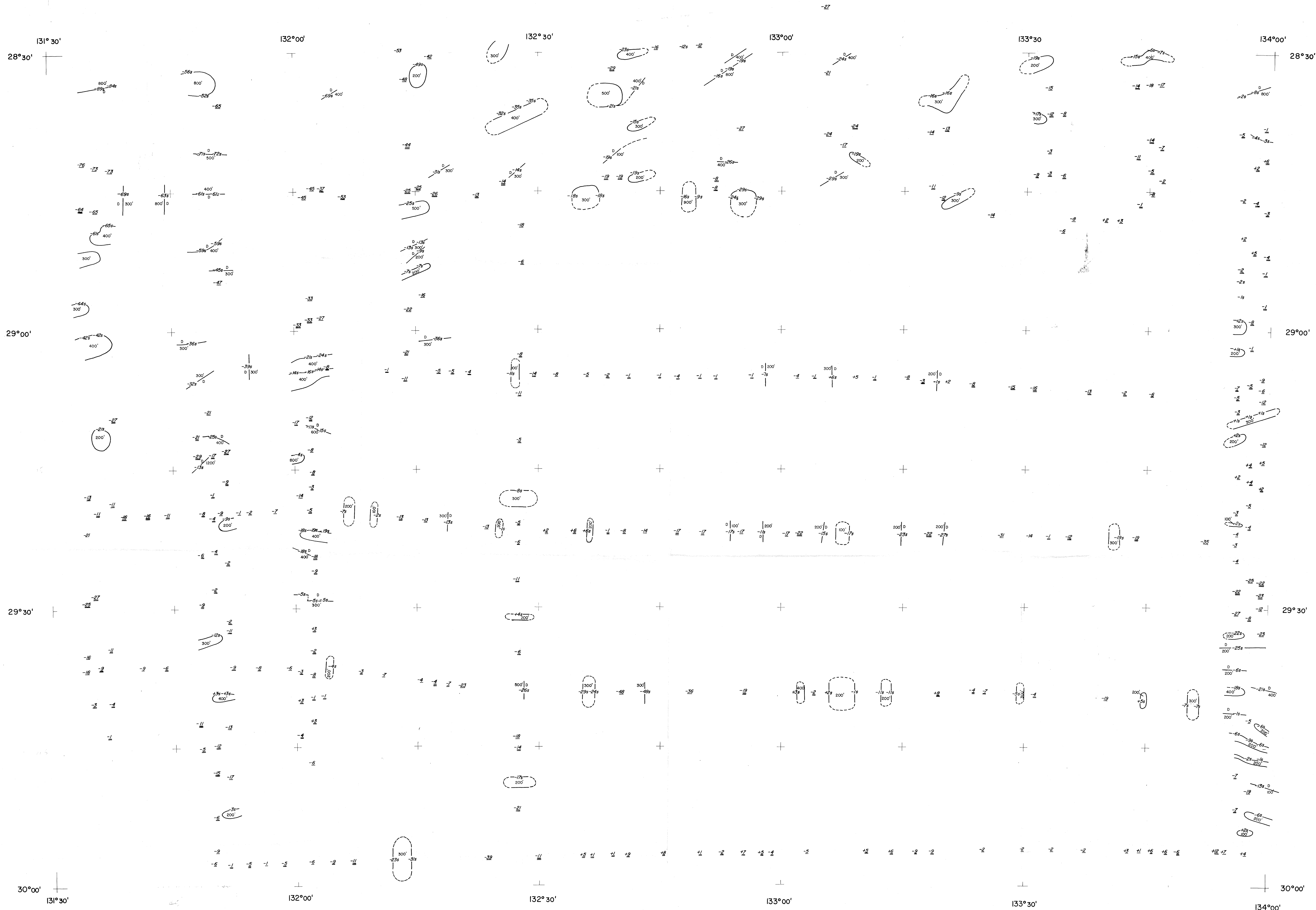
399-12

EXOIL PTY. LTD.

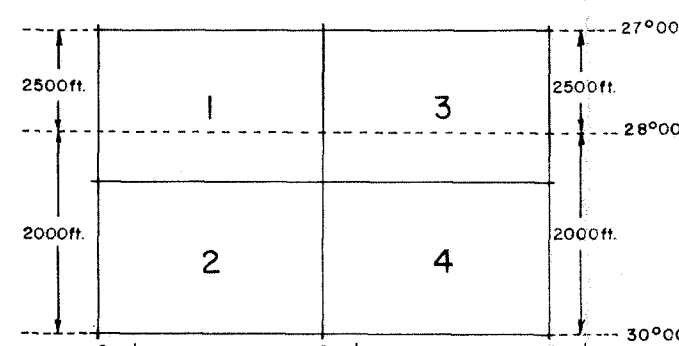
AEROMAGNETIC INTERPRETATION  
O.E.L. 28 SOUTH AUSTRALIA

PRELIMINARY  
MAGNETIC BASEMENT  
SHEET 3

FLIGHT ALTITUDES: 2500, 2000 FT. CONTOUR INTERVAL: 1000 FT.  
GEOPHYSICAL ASSOCIATES INTERNATIONAL  
BRISBANE, QUEENSLAND 6th SEPTEMBER 1965



- FLIGHT ALTITUDES -



$-72$   
 $-72s$   
 $\frac{1500}{800 \div D}$   
 $\frac{150}{+9sh}$

# —LEGEND—

MAGNETIC BASEMENT DEPTH ESTIMATES    FT/100 SEA LEVEL DATUM

FROM INTRABASAMENT ANOMALY

■ GOOD    ▨ FAIR    ▩ POOR

FROM SUPRABASAMENT ANOMALY

OUTLINES AND EDGES OF FLATES FROM SUPRABASAMENT ANOMALY

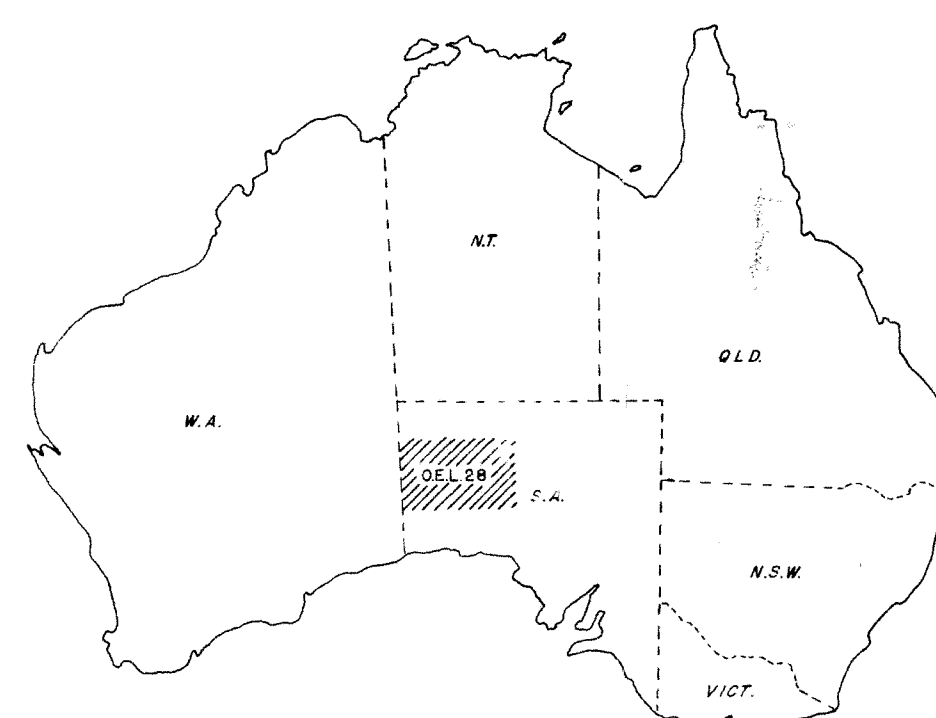
MAXIMUM THICKNESS IN FEET ESTIMATED WITH 0.001 GGS

POLARIZATION CONTRAST

1500 MAXIMUM THICKNESS IN FEET  
500 VERTICAL THICKNESS IN FEET

MAGNETIC MATERIAL WITHIN SEDIMENTARY SECTION

150 MAXIMUM THICKNESS IN FEET  
500 DEPTH ESTIMATES IN FT/100



399-13

EXOIL PTY. LTD.  
 GILES  
 ~ AEROMAGNETIC INTERPRETATION  
 O.E.L. 28 SOUTH AUSTRALIA  
 PRELIMINARY  
 MAGNETIC BASEMENT  
 SHEET 4