SOUTH AUSTRALIA

DEPARTMENT OF MINES AND ENERGY

OPEN FILE ENVELOPE NO. 6428

PEL 33

EUCLA BASIN

TENEMENT DOCUMENTS, MINISTERIAL MEMORANDA TO STATE PETROLEUM REGISTER, AND QUARTERLY PLUS ANNUAL PROGRESS REPORTS FOR THE PERIOD JANUARY 1985 TO APRIL 1989

Submitted by

Lapp Resource Consultants Pty Ltd and SADME

1989

(c) South Australian Department of Mines and Energy: 1/11/93

This report was supplied as part of the requirement to hold a mineral or petroleum exploration tenement in the State of South Australia. The Department accepts no responsibility for statements made, or conclusions drawn, in the report or for the quality of original 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 the S.A. Department of Mines and Energy, P.O. Box 191, Eastwood, S.A. 5063.

ENVELOPE 6428

TENEMENT: PEL 33; Eucla Basin

TENEMENT HOLDER: Median Oil NL (operator), Marvel Petroleum NL, First Australian Resources NL, Geometals Oil Exploration Ltd, Heron Petroleum Pty Ltd, Monitor Exploration Pty Ltd, Gulf Resources NL, Southern Cross Exploration NL and Antarctic Petroleum Pty Ltd

CONTENTS OF VOLUME ONE

		SADME NO.
REPORT:	Participation agreement between Antarctic Petroleum Pty Ltd, Forsayth Oil and Gas NL, Geometals Oil Exploration Ltd, Gulf Resources NL, Heron Petroleum Pty Ltd, Lapp Resource Consultants Pty Ltd, Malita Exploration Pty Ltd, Median Oil NL, Southern Cross Exploration NL and Spectrum Gold NL (4 February 1985).	**6428 R 1** Pgs 3-29
APPENDIX A:	Proposed work programme and expenditure commitments.	Pg. 30
APPENDIX B:	Copy of letter of Application for Petroleum Exploration Licence.	Pgs 31-32
REPORTS:	**Payne, R., 1985.** Minister of Mines and Energy memorandum and Government Gazette notice of grant of, and original licence document for, Petroleum Exploration Licence no. 33 (25 June 1985).	**6428 R 2** Pgs 33-34
	Deed of assignment between Forsayth Oil and Gas NL and First Australian Resources NL (5 July 1985).	**6428 R 3** Pgs 35-59
	Lappi, D.W., 1985. First quarterly report for PEL 33 for the period 25 June - 24 September 1985 (Lapp Resource Consultants Pty Ltd, 1 October 1985).	**6428 R 4** Pgs 60-61
	R. Russell and Associates, 1985. Notes to accompany the space photograph interpretation of the structural geology of PEL 33, Eucla Basin, South Australia - *[Volume 1: Report and enclosures]* (for Lapp Resource Consultants Pty Ltd and PEL 33 Joint Venturers, November 1985).	**6428 R 5** Pgs 62-114

PLANS		**Scale**		
Encl. 1	Interpretation of day NOAA imagery.		6428-1	*A2*
Encl. 2	Interpretation of night thermal NOAA imagery.		6428-2	*A2*
Encl. 3	Landsat (regional) interpretation of the structural geology of the eastern Eucla Basin and surroundings covering PEL 33.	1:1 000 000	6428-3	*B1*
Encl. 4	Landsat (semi-detailed) interpretation of the structural geology of the eastern Eucla Basin covering PEL 33.	1:500 000	6428-4	*A0*
Encl. 5	Fracture density in PEL 33 from Landsat interpretation.		6428-5	*A0*
Encl. 6	Structural features controlling hydrocarbon entrapment.		6428-6	*B1*
Encl. 7	Air photograph tonal anomalies in PEL 33 interpreted from 1:100 000 photomosaics.	1:100 000	6428-7	*A1*

CONTENTS OF VOLUME TWO

	R. Russell and Associates, 1985. Space photograph interpretation of the structural geology of PEL 33, Eucla Basin, South Australia - *[Volume 2: Sheets 1-6]* (for Lapp Resource Consultants Pty Ltd and PEL 33 Joint Venturers, November 1985).	Pg. 115

PLANS	Scale	SADME NO.	
Detailed Landsat interpretation (from colour composite photomosaics) of the structural geology of the eastern Eucla Basin covering PEL 33:			
- Sheet 1.	1:250 000	6428-8	*A0*
- Sheet 2.	1:250 000	6428-9	*A0*
- Sheet 3.	1:250 000	6428-10	*A0*
- Sheet 4.	1:250 000	6428-11	*A0*
- Sheet 5.	1:250 000	6428-12	*A0*
- Sheet 6.	1:250 000	6428-13	*A0*

CONTENTS OF VOLUME THREE

REPORTS:	**Lappi, D.W., 1986.** Second quarterly report for PEL 33 for the period 25 September - 24 December, 1985 (Lapp Resource Consultants Pty Ltd, 21 January 1986).	**6428 R 6** Pg. 116
	Lapp Resource Consultants Pty Ltd, 1986. PEL 33 geological review, April 1986.	**6428 R 7** Pgs 117-206

PLANS		Scale	
Encl. 1	Fence diagram.	1:250 000	6428-14
Encl. 2	Loongana Sandstone isopach map.	1:250 000	6428-15
Encl. 3	Madura Formation isopach map.	1:250 000	6428-16
Encl. 4	Top Cambrian structure contour map.	1:250 000	6428-17
Encl. 5	Top Loongana Sandstone structure contour map.	1:250 000	6428-18
Encl. 6	Play concept map.	1:250 000	6428-19

CONTENTS OF VOLUME FOUR

REPORTS:	**Lappi, D.W., 1986.** Third quarterly report for PEL 33 for the period 25 December 1985 - 24 March 1986 (Lapp Resource Consultants Pty Ltd, 20 May 1986).	**6428 R 8** Pg. 207
	Lappi, D.W., 1986. First annual report for the period 25 June 1985 - 24 June 1986 (Lapp Resource Consultants Pty Ltd, 18 July 1986).	**6423 R 9** Pgs 208-210
	Lappi, D.W., 1986. Fifth quarterly report for PEL 33 for the period 25 June - 25 September 1986 (Lapp Resource Consultants Pty Ltd, 22 October 1986).	**6428 R 10** Pg. 211
	Lappi, D.W., 1987. Sixth quarterly report for PEL 33 for the period 25 September - 24 December 1986 (Lapp Resource Consultants Pty Ltd, 22 January 1987).	**6428 R 11** Pg. 212
	Lapp Resource Consultants Pty Ltd, 1987. Aeromagnetic reprocessing report - BMR open file data - COOK, COOMPANA, OOLDEA and NULLARBOR 1:250 000 mapsheet areas (processed by Tesla 10 Pty Ltd for PEL 33 Joint Venture, March 1987).	**6428 R 12** Pgs 213-220

PLANS	Scale	SADME NO.	
Bandpass filtered, stacked aeromagnetic profiles - interpretation plot.	1:250 000	6428-20	
Magnetic contour maps (10 nT contour interval):			
- Bundulla (4836).	1:100 000	6428-21	*B1*
- Bunburra (4736).	1:100 000	6428-22	*B1*
- Maralinga (5237).	1:100 000	6428-23	*B1*
- Yarle (5137).	1:100 000	6428-24	*B1*
- Fisk (5037).	1:100 000	6428-25	*B1*
- Saleh (4937).	1:100 000	6428-26	*B1*
- Coorara (4837).	1:100 000	6428-27	*B1*
- Korana (4737).	1:100 000	6428-28	*B1*
- Cook (4936).	1:100 000	6428-29	*B1*
- Coompana (4835).	1:100 000	6428-30	*B1*
- Fisher (5036).	1:100 000	6428-31	*B1*
- Reid (5136).	1:100 000	6428-32	*B1*
- Moondrah (5236).	1:100 000	6428-33	*B1*
- Merdayerrah (4735).	1:100 000	6428-34	*B1*
- Knardna (4935).	1:100 000	6428-35	*B1*
- Nullarbor (5035).	1:100 000	6428-36	*B1*
- Illcumba (5135).	1:100 000	6428-37	*B1*
- Yalata (5235).	1:100 000	6428-38	*B1*

CONTENTS OF VOLUME FIVE

PLANS	Scale		
Bandpass filtered, stacked aeromagnetic profiles:			
- COOK.	1:250 000	6428-39	*B1*
- COOMPANA.	1:250 000	6428-40	*B1*
- NULLARBOR.	1:250 000	6428-41	*B1*
- OOLDEA.	1:250 000	6428-42	*B1*
Magnetic contour maps (25 nT contour interval):			
- COOK.	1:250 000	6428-43	B1
- COOMPANA.	1:250 000	6428-44	*B1*
- NULLARBOR.	1:250 000	6428-45	*B1*
- OOLDEA.	1:250 000	6428-46	*B1*
Flight path plots:			
- COOK.	1:250 000	6428-47	*B1*
- COOMPANA.	1:250 000	6428-48	*B1*
- NULLARBOR.	1:250 000	6428-49	*B1*
- OOLDEA.	1:250 000	6428-50	*B1*
Bandpass filtered, stacked aeromagnetic profiles:			
- Merdayerrah (4735).	1:100 000	6428-51	*B1*
- Coompana (4835).	1:100 000	6428-52	*B1*
- Knardna (4935).	1:100 000	6428-53	*B1*
- Nullarbor (5035).	1:100 000	6428-54	*B1*
- Illcumba (5135).	1:100 000	6428-55	*B1*
- Yalata (5235).	1:100 000	6428-56	*B1*
- Bunburra (4736).	1:100 000	6428-57	*B1*

PLANS	Scale	SADME NO.	
Bandpass filtered, stacked aeromagnetic profiles (cont'd):			
- Bundulla (4836).	1:100 000	6428-58	*B1*
- Cook (4936).	1:100 000	6428-59	*B1*
- Fisher (5036).	1:100 000	6428-60	*B1*
- Reid (5136).	1:100 000	6428-61	*B1*
- Moondrah (5236).	1:100 000	6428-62	*B1*
- Maralinga (5237).	1:100 000	6428-63	*B1*

REPORTS:		
Deed of assumption between Forsayth NL, First Australian Resources NL, Median Oil NL, Heron Petroleum Pty Ltd, Geometals Oil Exploration Ltd, Monitor Exploration Pty Ltd, Gulf Resources NL, Southern Cross Exploration NL, Antarctic Petroleum Pty Ltd and Marvel Petroleum NL (dated 30 April 1987).	**6428 R 13** Pgs 221-222
Payne, R., 1987. Minister of Mines and Energy memorandum of Confirmation of PEL 33 deeds and agreements (15 May 1987).	**6428 R 14** Pgs 223-231
Lappi, D.W., 1987. Seventh quarterly report for the period 25 December 1986 - 24 March 1987 (Lapp Resource Consultants Pty Ltd, 20 July 1987).	**6428 R 15** Pg. 232
Lappi, D.W., 1987. Second annual report for the period 25 June 1986 - 24 June 1987 (Lapp Resource Consultants Pty Ltd, 24 July 1987).	**6428 R 16** Pg. 233
Payne, R., 1987. Minister of Mines and Energy memorandum of Variation of Licence Conditions (includes varied work programme) (27 August 1987).	**6428 R 17** Pgs 234-236
Lappi, D.W., 1987. Ninth quarterly report for the period 25 June - 24 September 1987 (Lapp Resource Consultants Pty Ltd, 24 October 1987).	**6428 R 18** Pg. 237
Lappi, D.W., 1988. Tenth quarterly report for the period 25 September - 24 December 1987 (Lapp Resource Consultants Pty Ltd, 16 March 1988).	**6428 R 19** Pgs 238-239
Payne, R., 1988. Minister of Mines and Energy memorandum of Variation of Licence Conditions (includes varied work programme) (24 March 1988).	**6428 R 20** Pgs 240-242
Lappi, D.W., 1988. Eleventh quarterly report for the period 25 December 1987 - 24 March 1988 (Lapp Resource Consultants Pty Ltd, 24 April 1988).	**6428 R 21** Pg. 243
Lappi, D.W., 1988. Request for extension of time to 1/8/88 to complete outstanding PEL 33 Year 3 commitments (Lapp Resource Consultants Pty Ltd letter to SADME, dated 21 June 1988).	**6428 R 22** Pg. 244
Lappi, D.W., 1988. Third annual report [and twelfth quarterly report for the period 25 March - 24 June 1988] (Lapp Resource Consultants Pty Ltd, 23 June 1988).	**6428 R 23** Pgs 245-246
Lappi, D.W., 1988. Discussion of need for further extension of time to allow commencement of drilling of Licence Year 3 commitment wells (Lapp Resource Consultants Pty Ltd letter to SADME, dated 30 August 1988).	**6428 R 24** Pgs 247-249
Lappi, D.W., 1988. Request for extension of time to 1/10/88 to complete outstanding PEL 33 Year 3 commitments (Lapp Resource Consultants Pty Ltd letter to SADME, dated 27 September 1988).	**6428 R 25** Pg. 250
Lappi, D.W., 1988. Notification of intention to surrender licence (Lapp Resource Consultants Pty Ltd letter to SADME, dated 7 December 1988).	**6428 R 26** Pgs 251-253

Klunder, J., 1989. Minister of Mines and Energy memorandum of Cancellation of Petroleum Exploration Licence no. 33 (18 April 1989). 6428 R 27 Pg. 254

END OF CONTENTS

PARTICIPATION AGREEMENT

BETWEEN

ANTARTIC PETROLEUM PTY. LTD.

FORSAYTH OIL & GAS N.L.

GEOMETALS OIL EXPLORATION LTD.

GULF RESOURCES N.L.

HERON PETROLEUM PTY. LTD.

LAPP RESOURCE CONSULTANTS

MALITA EXPLORATION PTY. LTD.

MEDIAN OIL N.L.

SOUTHERN CROSS EXPLORATION N.L.

AND

SPECTRUM GOLD N.L.

JANUARY, 1985

RECEIVED
27 OCT 1986
DEPT. OF MINES AND ENERGY SECURITY
6428

PARTICIPATION AGREEMENT

THIS AGREEMENT is made the 4th day of February, 1985.

BETWEEN: ANTARTIC PETROLEUM PTY. LTD. a company incorporated in the State of Western Australia and having its registered office situate at 15th Floor, 200 St. George's Terrace, Perth, (which together with its successors and assigns is hereinafter called "Antartic") of the first part;

FORSAYTH OIL & GAS N.L. a company incorporated in the State of New South Wales and having its registered office situate at 9th Floor, Challis House, 10 Martin Place, Sydney, (which together with its successors and assigns is hereinafter called "Forsayth") of the second part;

GEOMETALS OIL EXPLORATION LIMITED a company incorporated in the State of Western Australia and having its registered office situate at 4th Floor, Griffin Centre, 28 The Esplanade, Perth, (which together with its successors and assigns is hereinafter called "Geometals") of the third part;

GULF RESOURCES N.L. a company incorporated in the State of Victoria and having its registered office situate at 100 Collins Street, Melbourne (which together with its successors and assigns is hereinafter called "Gulf") of the fourth part;

HERON PETROLEUM PTY. LTD. a company incorporated in the State of Western Australia and having its registered office situate at 189 St. George's Terrace, Perth (which together with its successors and assigns is hereinafter called "Heron") of the fifth part;

David W. Lappi and Lynne A. Lappi trading as LAPP RESOURCE CONSULTANTS a partnership having its registered office situate at 127 Essex Street, Wembley in the State of Western Australia (which together with its successors and assigns is hereinafter known as "LRC") of the sixth part;

MALITA EXPLORATION PTY. LTD. a company incorporated in the State of Western Australia and having its registered office situate at 5th Floor, 189 St. George's Terrace, Perth, (which together with its successors and assigns is hereinafter called "Malita") of the seventh part;

MEDIAN OIL N.L. a company incorporated in the State of New South Wales and having its registered office situate at C/- Stuart Lloyd & Co., 30 Kellett Street, Kings Cross (which together with its successors and assigns is hereinafter called "Median") of the eighth part;

SOUTHERN CROSS EXPLORATION N.L. a company incorporated in the State of New South Wales and having its registered office situate at 9th Floor, 82 Elizabeth Street, Sydney, (which together with its successors and assigns is hereinafter called "Southern Cross") of the ninth part;

SPECTRUM GOLD N.L. a company incorporated in the State of Western Australia and having its registered office situate at 15th Floor, 200 St. George's Terrace, Perth, (which together with its successors and assigns is hereinafter called "Spectrum") of the tenth part.

WHEREAS:

A. Antartic, Forsayth, Geometals, Gulf, Heron, LRC, Median, Malita, Southern Cross and Spectrum (hereinafter collectively called "the Parties") will make application (hereinafter called "the Application") under the Petroleum Act, 1940-1971 of South Australia to the Minister for Mines for a permit to explore for petroleum in respect of the area described in Appendix B hereto (hereinafter called "the Permit") being the area shown on the plan annexed hereto in Appendix B and have proposed in the Application a work programme and expenditure commitment as described in Appendix A hereto.

B. The Parties wish to record the terms and conditions agreed between them as to their respective rights, interests and obligations in relation to the Application and Permit in which work upon the area of the said Permit shall be carried out by them or upon their behalf should one be granted.

NOW THIS AGREEMENT WITNESSETH that in consideration of the premises and of the mutual covenants and agreements hereinafter contained the parties hereby covenant and agree as follows:-

1. Invitation to Accept Permit

1.1 In the event that the Parties hereto are invited to accept a Permit upon conditions no less favourable to the Parties than those referred to in the Application then the Parties shall accept a Permit.

1.2 In the event that the Parties hereto are invited to accept a Permit upon conditions less favourable to them than those referred to in the Application then forthwith the Parties shall consult together with a

view to agreeing or otherwise whether to accept a Permit. If one or more Parties choose to withdraw, then the remaining Parties shall divide the available interests pro-rata or as is otherwise mutually agreed.

1.3 Where the Parties fail or are unable to accept a Permit by the commencement of the seventh day prior to the last statutory date by which the Parties could accept a Permit, then subject to settlement amongst them of all costs and expenses, if any, incurred in respect of the Application up to the date of such decision, the rights and obligations of the Parties as agreed between themselves hereunder shall be at an end and this Agreement shall be deemed terminated.

2. Joint Operating Agreement

Within thirty (30) days or such further period as is mutually agreed following the date of the granting of the Permit the Parties shall enter into a Joint Operating Agreement to regulate their rights, interests and obligations in respect of operations on the Permit. Such agreement shall incorporate but not be limited to the principles that are set out in the Schedule annexed hereto. The "Guidelines for an Exploration Joint Operating Agreement" (1984 Edition) published by the Australian Petroleum Exploration Association Limited shall form the basis for the Joint Operating Agreement.

3. Notices

All notices, consents, or other communications provided for herein shall be in writing and shall be addressed or sent by airmail or telex or telegram to that Party at its address hereinafter specified:

(a) Antartic Petroleum Pty. Ltd.
15th Floor
Mt. Newman House
200 St. George's Terrace
PERTH WA 6000

Attention: Mr. Stephen L. Thomas - Exploration Manager
Telex: AA 94751 Telephone: (09) 322-6788

(b) Forsayth Oil and Gas N.L.
1st Floor
28 The Esplanade
PERTH WA 6000

Attention: Mr. John C. Morris - Chairman
Telex: AA 96127 Telephone: (09) 322-7211

(c) Geometals Oil Exploration Limited
4th Floor
28 The Esplanade
PERTH WA 6000

Attention: Mr. John T. Kopcheff - Exploration Manager
Telex: AA 94043 Telephone: (09) 321-4011

(d) Gulf Resources N.L.
9th Floor
82 Elizabeth Street
SYDNEY NSW 2000

Attention: Mr. Zahir Shah - Director
Telex: AA 22292 Telephone: (02) 233-6022

(e) Heron Petroleum Pty. Ltd.
5th Floor
189 St. George's Terrace
PERTH WA 6000

Attention: Mr. Chris Curnow - Exploration Manager
Telex: AA 93332 Telephone: (09) 322-5945

(f) LAPP Resource Consultants
127 Essex Street
WEMBLEY WA 6014

Attention: Mr. David W. Lappi - General Manager
Telephone: (09) 387-7327

(g) Malita Exploration Pty. Ltd.
5th Floor
189 St. George's Terrace
PERTH WA 6000

Attention: Mr. Chris Curnow - Exploration Manager
Telex: AA 93332 Telephone: (09) 322-5945

(h) Median Oil N.L.
11 Mosman Terrace
MOSMAN PARK WA 6012

Attention: Mr. Alan Flavelle - Managing Director
Telex: AA 94974 Telephone: (09) 384-5581

(i) Southern Cross Exploration N.L.
9th Floor
82 Elizabeth Street
SYDNEY NSW 2000

Attention: Mr. Zahir Shah - Exploration Manager
Telex: AA 22292 Telephone: (02) 233-6022

(j) Spectrum Gold N.L.
15th Floor
Mt. Newman House
200 St. George's Terrace
PERTH WA 6000

Attention: Mr. Stephen L. Thomas - Exploration Manager
Telex: AA 94751 Telephone: (09) 322-6788

4. General

4.1 This Agreement shall be governed by the laws from time to time in force in South Australia.

4.2 This Agreement shall bind the Parties hereto and their assigns and successors in title.

4.3 Each Party shall pay its own costs in having this Agreement prepared, executed and stamped and each Party shall pay its proportionate share of any stamp duty payable hereon which share shall be in accordance with the percentage interests of the Parties as set out in Clause 2.1 of the Schedule.

IN WITNESS WHEREOF the Parties hereto have executed this Agreement effective the day and year first hereinbefore mentioned.

THE COMMON SEAL of ANTARTIC PETROLEUM PTY. LTD. was hereunto affixed in accordance with its Articles of Association in the presence of:

ANTARCTIC PETROLEUM PTY. LTD. COMMON SEAL

Director:

Secretary:

THE COMMON SEAL of FORSAYTH OIL & GAS N.L. was hereunto affixed in accordance with its Articles of Association in the presence of:

FORSAYTH OIL & GAS N.L. COMMON SEAL

Director:

Secretary:

THE COMMON SEAL of GEOMETALS OIL EXPLORATION LIMITED was hereunto affixed in accordance with its Articles of Association in the presence of:

Director:

Secretary:

Geometals Oil Exploration Ltd. COMMON SEAL

THE COMMON SEAL of GULF RESOURCES N.L. was hereunto affixed in accordance with its Articles of Association in the presence of:

Director:

Secretary:

GULF RESOURCES N.L. Common Seal

THE COMMON SEAL of HERON PETROLEUM PTY. LTD. was hereunto affixed in accordance with its Articles of Association in the presence of:

Director:

Secretary:

HERON PETROLEUM PTY. LTD. COMMON SEAL

SIGNED by the said David W. Lappi and Lynne A. Lappi in the presence of:

David William Lappi David W. Lappi Witness:

Lynne Adele Lappi L A Lappi Witness:

THE COMMON SEAL of MALITA EXPLORATION PTY. LTD. was hereunto affixed in accordance with its Articles of Association in the presence of:

Director:

Secretary:

MALITA EXPLORATION PTY. LTD. COMMON SEAL

THE COMMON SEAL of MEDIAN OIL N.L.)
was hereunto affixed in accordance)
with its Articles of Association)
in the presence of:)

Director:

Secretary:

MEDIAN OIL N.L. Common Seal ★

THE COMMON SEAL of SOUTHERN CROSS)
EXPLORATION N.L. was hereunto)
affixed in accordance with its)
Articles of Association in the)
presence of:)

Director:

Secretary:

SOUTHERN CROSS EXPLORATION N.L. Common Seal ★

THE COMMON SEAL of SPECTRUM GOLD)
N.L. was hereunto affixed in)
accordance with its Articles of)
Association in the presence of:)

Director:

Secretary:

SPECTRUM GOLD N.L. ★ COMMON SEAL

SCHEDULE

1. Definitions

Except where otherwise required by the context in which they are used the following terms where used in this Agreement shall bear the meanings hereinafter given them.

1.1 "Act" means The Petroleum Act 1940-1971 of the State of South Australia and any regulations made thereunder and any Act or regulations in modification or amendment thereof or in substitution or replacement therefor.

1.2 "Party" or "Parties" means a Party or Parties to this Agreement and shall include the successors and assigns of such Party or Parties.

1.3 "Operator" shall mean the Party who is from time to time appointed by the Parties as Operator of the Permit pursuant to these presents.

1.4 "Participating Interest" in relation to a Party or Parties shall mean that Party's or those Parties' undivided Interest in the Permit area (or any part thereof), the operations and the joint assets from time to time.

1.5 "Permit" means and includes the Petroleum Exploration Licence which may be granted under the Act as a result of the Application referred to in the Appendicies and shall include all other titles and licences conferring rights to explore for or to produce Petroleum for or on behalf of any Party or Parties hereto during the term hereof arising from, out of or in substitution for or as a result of the Permit or any location or licence granted pursuant to the Permit or arising therefrom.

1.6 "Petroleum" shall bear the meaning it is given in the Act.

1.7 "Related Corporation" shall have the same meaning as is assigned to that expression in The Companies Code (South Australia).

1.8 "Permit Year" means each consecutive twelve (12) month period calculated from the date of granting of the Permit.

1.9 "Production Entitlement" means the entitlement of a Party to a proportion of petroleum produced and saved from the Permit area equal to its participating Working Interest subject to the provisions of Clause 8.

1.10 "Representative" or "Representatives" means the persons appointed by each Party to the Operating Committee and the alternative of such persons when acting as such.

1.11 "Working Interest" means an ownership interest whereby the owner shall bear his proportionate share of all risks and expenses of the operation and shall be entitled to his proportionate share of any gross production derived from such operations pursuant to this agreement.

1.12 "Net Profits Interest" means an ownership interest whereby the owner is entitled to a percentage share of the net pre-tax profits accruing to the Joint Venture Partners resulting from the operations of the joint venture. Net Profit is defined as revenue less all operating expenses, royalties, transportation expenses, undiscounted amortization of past exploration expenses and capital investments over the expected life of the field, and interest on debt financing before deduction of income-based taxes. Expenditure directed at discovering further commercial fields will be charged against those future discoveries and not against previous discoveries. Historical costs will be charged against all commercial fields in proportion to their relative production rates. Expenditure from Sole Risk operations will be reflected in the balance sheets and profit and loss accounts of only those Parties participating in the Sole Risk operations.

2. Interests of the Parties

2.1 Working Interests

Subject to the provisions of this Agreement, the Parties shall bear the risks and expense of the operations, hold, explore, develop and exploit the area and own the joint assets, the permits, and the Petroleum produced therefrom as tenants in common in proportion to their respective Participating Working Interests which are as follows:-

Antartic	5%	Working Interest
Forsayth	10%	Working Interest
Geometals	10%	Working Interest
Gulf	5%	Working Interest
Heron	10%	Working Interest
Malita	10%	Working Interest
Median	30%	Working Interest
Southern Cross	5%	Working Interest
Spectrum	15%	Working Interest

2.2 Net Profits Interests

Subject to the provisions of this Agreement, LAPP Resource Consultants holds a seven (7%) percent Net Profits Interest in any revenue from lands or petroleum production from lands contained in the Permit area. The Net Profits Interest percentage applicable to the Petroleum Exploration Licence will reduce by one (1%) percent at each five (5) year renewal following the initial five (5) year term. The Net Profits Interest

applying during the life of a Production Licence and its renewals will be the Net Profits interest applicable to the exploration acreage at the time the discovery was made.

3. Representatives

3.1 To provide for the orderly supervision of operations, an Operating Committee shall be established within thirty (30) days after finalization of the Joint Operating Agreement. Each Party shall appoint one (1) Representative and give notice thereof to the others. By like notice, a Party may at any time substitute another person as its Representative and may designate alternative Representatives, any one of whom may act in the absence of the person who's alternate he is. A Representative may have present at any meeting of the Operating Committee such advisers as he deems necessary. The Chairman shall be the Representative of the Operator unless otherwise agreed.

3.2 Each Party shall be entitled to have one (1) Representative on the Operating Committee and each Party with a participating Working Interest shall be entitled to cast a vote commensurate with the Percentage Working Interest of that Party.

3.3 The Parties shall control and on their behalf the Operating Committee shall supervise the operations. In addition to the powers and duties enumerated elsewhere and implicit herein, the Operating Committee shall have the following powers:-

(a) to establish policies and operating procedures governing the operation;

(b) to review and approve operating programmes and expenditure budgets submitted pursuant to Clause 5;

(c) to determine well locations, production schedules, production rates and matters pertaining to permits, and

(d) to appoint a Technical Committee and/or other advisory groups having as far as possible, equal members chosen by each Party.

3.4 The Operating Committee shall meet at least once every twelve (12) months to review the operations for the preceding year and those proposed for the next year. Representatives shall receive at least one (1) months written notice of meetings stating the time and place of the meeting and the agenda unless otherwise unanimously agreed. Items not contained in the agenda may not be considered unless all Representatives agree.

3.5 Unless otherwise specifically provided herein, decisions of the Operating Committee shall be valid and

binding on all Parties and shall be made by a vote of at least three (3) Representatives holding in aggregate at least sixty (60%) per cent of the Participating Working Interests in the venture. Notwithstanding the foregoing, a unanimous vote will be required on proposals to surrender a Permit or any parts thereof.

3.6 A resolution in writing signed by the Representatives or agreed by telex shall be valid as if passed at a meeting of the Representatives.

3.7 The Representatives shall appoint a secretary who need not be a Representative. The secretary shall keep minutes of meetings, a copy of which shall be sent to each Party promptly after each meeting. Minutes shall be deemed to be correct as distributed unless notice of errors or omissions is received within fifteen (15) days after they are received by the Parties.

3.8 Meetings of the Representatives shall be held in Perth or such other place as the Representatives may unanimously decide.

4. Operator

4.1 LAPP Resource Consultants is hereby designated as Operator.

4.2 The Operator shall conduct all operations; operations shall be conducted in accordance with policies and programmes approved by the Representatives and good oilfield practice, the Acts and all applicable laws, rules, regulations and directions and the applicable Australian Petroleum Exploration Association's Code of Environmental Practice and Advice on Aboriginal Matters.

4.3 The Operator may conduct operations or operations may be conducted through agents, affiliates or independent contractors. The Operator may not assign the Operatorship to another party.

4.4 The Operator shall have the following powers and duties:-

(a) to pay when due, fees, charges, taxes (excluding income taxes) and other payments required by the Acts in respect of the operations, provided that each Party shall be responsible for and pay royalties due in respect of its Production Entitlement;

(b) to do all things advisable to protect the permits and leases against forfeiture;

(c) to hire, direct, and discharge contractors, consultants, and personnel and to procure services, materials, supplies and equipment;

(d) to furnish each Party for each well a well prognosis (containing information any Party reasonably requires) notices of the date of spudding-in, daily drilling and geological reports, advice of porous zones and showings of Petroleum encountered and of tests run and the result thereof including pressure charts and log surveys as they become available. When practicable to furnish notice of proposed tests to enable the Parties to witness such tests. Upon written request, to make available to any Party at their risk and expense cores or washed samples of cuttings of formations penetrated for inspection;

(e) to provide quarterly reports concerning the operations, provided that the Operator need not disclose proprietary methods or processes or those not generally available to the public so long as an explanation is provided sufficient to enable the Parties to assess such information. The Operator shall not be responsible for the accuracy of interpretations contained in reports;

(f) at all reasonable times, to allow the Parties at their sole risk and expense access to the area and to wells and records pertaining to the drilling, testing and operation of wells;

(g) to purchase and maintain in force such insurance as may be required by law and additional insurance authorized by the Representatives. Insurance policies, except motor vehicle, compulsory third party, workers' compensation and employers' liability shall be written or endorsed to include each Party as insured to the extent of its Participating Interest and to preclude the exercise of any right of subrogation against any Party. The Operator shall require as a condition of contract with contractors and their subcontractors that they carry insurances required by relevant laws, including worker's compensation, employers' liability and public liability;

(h) to purchase from Australian manufacturers or suppliers equipment, materials, supplies and services needed for the operations provided that they are competitive with other sources from the standpoint of delivery time, price, quality and suitability;

(i) to engage legal counsel and where appropriate prosecute, defend, settle or otherwise conclude litigation and arbitrations with third parties with respect to the operations and keep the Parties informed in respect thereof provided that out of court settlements involving payments in excess of TEN THOUSAND DOLLARS ($10,000) must be approved by the Representatives.

4.5 Each Party in proportion to its Participating Interests hereby indemnifies the Operator and agrees to hold it harmless (save to the extent any loss, damage, claim or liability is recovered from insurance or third parties) against loss, damage, claim or liability resulting from the Operator's acts or omissions with respect to the operations unless such loss, damage, claim or liability arises from the recklessness or wilful misconduct of the Operator in directing or supervising the operations. If loss, damage, claim or liability arise as the result the recklessness or wilful misconduct of the Operator in directing or supervising the operations, then the Operator will indemnify and hold harmless the Parties in proportion to their Participating Interests (save to the extent any loss, damage, claim or liability is recovered from insurance or third parties).

4.6 The Operator's employees, agents and contractors shall be under the Operator's direction and control and shall not be considered employees, agents or contractors of the Parties.

4.7 The Operator may resign at any time by written notice to the other Parties and shall resign if requested in writing by at least four (4) Participating Parties holding at least sixty (60%) percent of the Participating Working Interests after operation of the Permit for two (2) years, such resignation is to be effective ninety (90) days after the date thereof or at the time a new operator has taken over the duties of the Operator, whichever is the sooner. The Operatorship may change during the first two (2) years of permit operation if the Operator acted with recklessness, wilful misconduct or gross negligence. Prior to the change of operatorship, all relevant technical information and audited financial records will be transferred to the new operator in good order. The financial audit will be carried out at joint venture expense.

4.8 In carrying out all Operations pursuant to this Agreement, the Operator shall act in the capacity of an independent contractor and shall not (unless expressly authorised so to do) by any representation or conduct represent itself to be the agent of any of the Parties it being expressly agreed that the Operator shall not be authorised by this Agreement to act as the agent of any of the Parties.

4.9 The Operator shall be under the control and direction of the Operating Committee.

5. Programme

5.1 Within thirty (30) days of the granting of a Permit the Operator will submit to the Parties for their approval a Programme and Budget for the First Permit Year.

5.2 At least thirty (30) days prior to the commencement of each Permit Year or other period as mutually agreed the Operator shall submit a recommended operating programme and budget, including forecasts of capital and operating expenditures, for the Permit during the succeeding year, together with a tentative operating programme and preliminary budget for the next succeeding year.

5.3 Within thirty (30) days after receiving recommendations for Permit programmes and budgets, the Operating Committee shall adopt a programme and budget for the Permit for the succeeding Permit Year which will satisfy the respective minimum Permit conditions for that year.

5.4 Whenever the Minister requests an amendment to a programme, the Operating Committee shall consider such a request.

5.5 Whenever Petroleum is discovered in a well drilled as part of a programme, the Operator shall, within sixty (60) days after completion, suspension or abandonment thereof, recommend an amendment to the programme to provide for appropriate evaluation of such discovery.

6. Expenditure and Accounting

6.1 The Parties hereto shall pay all fees in respect of the Application and Permit and contribute all moneys required by way of security by the Minister for Mines in accordance with their Percentage Working Interests.

6.2 Approval of a programme pursuant to the provisions of Clause 5 is authority for the Operator to proceed with such programme and incur costs on behalf of the Parties.

6.3 Prior to calling for tenders for contracts with payments anticipated to exceed FORTY THOUSAND DOLLARS ($40,000) the Operator shall inform the Parties.

6.4 Operating overhead charges for the Work Programme specified in Appendix A will be FIFTY THOUSAND DOLLARS ($50,000) per annum for the first Permit Year rising by ten (10%) per cent per annum for each additional Permit Year, payable quarterly in advance. Interest accruing to money in the Joint Venture account will be the property of the Joint Venture. Operating Overhead expenses for additional work which the Parties may agree to do from time to time will be charged according to the following formula:

Additional Expenditure	Overheads
$0.0 to 0.5 million	6.0%
$0.5 to 2.5 million	3.0%
Greater than $2.5 million	1.5%

"Additional Expenditure" means expenditure on Permit exploration activities including but not limited to geological and geochemical studies, airborne and ground geophysics, remote sensing, drilling, and construction of production and transportation facilities and infrastructure which are in addition to the required minimum work program specified in Appendix A.

6.5 Operating overhead charges will include but not be limited to: costs of administration of the Permit, general office expenses, communications, wages, consultant's fees, drafting and reproduction, travel costs and expenses which are not related to specific exploration projects agreed to by the Operating Committee. The Operator's time will not be charged to the joint venture.

Operating overhead charges will not include office expenses, communications, wages, consultant's fees, drafting and reproduction, travel costs and expenses which are related to specific exploration projects agreed to by the Operating Committee.

6.6 The Operator shall endeavour to obtain fixed-price quotes for Permit exploration work where possible and shall be entitled to recover all direct costs and expenditures excluding operating overheads required for Joint Venture operations including but not limited to all fees, labour and associated salary costs, payroll burden, office materials, equipment and facilities, services and costs of retaining technical employees to work in Australia in relation to the Joint Venture on a fixed price or time-worked basis.

6.7 Within thirty (30) days after the end of each quarter, the Operator shall report to the parties capital expenditure, operating costs, funds committed, estimated final expenditure, and the status of programmes for that quarter.

6.8 Subject to the provisions of Clause 6.9, the Operator may nevertheless make expenditures in excess of the approved budgets by the lesser of ten (10%) per cent of the approved amount for each budget item or FIFTY THOUSAND DOLLARS ($50,000) per annum. Such additional expenditures shall be reported to the Parties in a report submitted pursuant to Clause 6.7, and the reported excess expenditure added to the appropriate budget.

6.9 The Operator shall notify the Representatives in advance of anticipated over-expenditures beyond the limit stated in Clause 6.8. The Operator shall obtain approvals from the Representatives before making such over-expenditures.

6.10 In the event of an emergency, the Operator may incur for the operating account, expenditures it deems necessary for the protection of life and property and

shall promptly report such expenditures to the Parties.

6.11 Calls for funds for expenditure may be made by the Operator and failure by a Party to pay it's share of costs within thirty (30) days when called for shall put it in default, and in that event, the provisions of Clause 7 shall govern the relationship between the Parties.

6.12 Calls for funds for expenditure will be made sufficient to cover the costs of contracts entered into during the next accounting period.

7. Default

7.1 The Operator shall give the defaulting party notice in writing of such default and notice that it will be charged with and liable to pay default interest on that amount equal to one-hundred twenty-five (125%) percent of the then current trading bank interest rate permitted by the Reserve Bank of Australia applying to overdrafts of under ONE HUNDRED THOUSAND DOLLARS ($100,000). If such Party continues to default in such payment or any part of it for a period in excess of ninety (90) days, it shall be deemed to have elected to withdraw from the Joint Venture on the date it failed to make payment as requested by the Operator and its interests and obligations in the Joint Venture at that date shall be transferred to the other Parties of the Joint Venture pro rata to the proportions such Parties' Working Interests in the Joint Venture bear to one another.

7.2 If a Party fails to pay funds due and another Party advances such funds, the defaulting Party shall repay to the Party advancing such funds the amount in default plus default interest. If a default continues for more than ninety (90) days, the defaulting Party shall be deemed to have assigned it share of production to the Operator which shall sell such production and pay the net proceeds to the non-defaulting Party who advanced funds to cover the default until the funds advanced for the defaulting Party plus default interest thereof have been repaid. No Contract for the sale of such production shall be for a period longer than is required by the minimum needs of the Petroleum Industry or one (1) year, whichever is shorter.

7.3 Notwithstanding that a defaulting Party may have elected to withdraw by non-payment under Subclause 1 hereof it shall continue to be liable to pay for its proportionate share of any moneys due to be contributed by it in respect of a programme and budget adopted prior to such withdrawal, with interest as above provided on such moneys.

7.4 If a Party is unable or unwilling to contribute it's respective Participating Interest share of a programme, it shall promptly notify the other Parties and proceed, within ninety (90) days, to find an assignee for it's Working Interest as provided in Clause 10 or to withdraw as provided in Clause 12.

7.5 The percentage interest of the defaulting Party shall not be voted on in the Operating Committee for so long as such Party shall be in default which percentage interest shall accrue notionally and for the purposes of voting only, to the non-defaulting Parties pro-rata as to their percentage interests and the voting percentage set forth in Clause 2.1 shall continue to apply for the purpose of decisions of the Operating Committee.

7.6 If a Party is wound up, liquidated or put into the hands of a receiver or is otherwise insolvent and a liquidator is appointed for it, the other Parties may, by unanimous vote, terminate the Agreement insofar as that Party is concerned by giving it notice of such termination and in the event that such notice is given, it's Working Interest shall forthwith vest in the other Parties in proportion to their then Working Interests without further consideration.

8. Sole Risk Operations

8.1 A sole risk project is one proposed by a Party which is in excess of the minimum work commitment which is not agreed to by all Parties and may involve the following activities:-

(a) Category 1: stratigraphic, wildcat, or appraisal well, including going back into a hole after drilling has ceased, for the purposes of deepening, working over or side-tracking.

(b) Category 2: installation of production, transportation or storage facilities and associated infrastructure, including additions to or expansions of said facilities.

8.2 A sole risk project -

(a) cannot interfere with an existing Joint Venture programme;

(b) will be carried out by the Operator at the proposing Parties' sole risk and expense and direction and they will advance funds to the Operator for the overheads and operations unless the proposing Parties' choose to appoint another Operator for the sole risk project.

8.3 Any project which is proposed by a Party will be considered by the Operating Committee, provided it contains adequate technical detail and cost data. If it is approved unanimously within thirty (30) days, it will become part of a Joint Venture programme and governed by the provisions of Clauses 5, 6 and 7; otherwise, a Party may propose it as a sole risk project as provided in Clause 8.4.

8.4 After expiry of the thirty (30) day period established in Clause 8.3, any Party (hereinafter called "the Participating Party") may propose a sole risk project by giving written notice to the other Parties identifying the project and the area involved. A Party which does not notify the proposing Party within thirty (30) days after it receives such notice that it wishes to be a Participating Party will be a Non-participating Party. If more than one sole risk project is proposed for the same area, the one involving the largest direct exploration expenditure may proceed first.

8.5 A sole risk project will cease to exist -

(a) when ninety (90) days pass without expenditure of TEN THOUSAND DOLLARS ($10,000) on direct exploration expenses by the Participating Parties in the area of the sole risk project;

(b) when the Participating Parties have been reimbursed as provided in Clause 8.6 or 8.7, after which the costs of work will be shared in proportion to the Parties' respective Participating Working Interests.

8.6 A Non-participating Party may become a Participating Party at any time by paying to the then Participating Parties an amount equal to:

(a) the Non-participating Party's proportionate share of the then accrued sole risk project costs multiplied by the percentage factors indicated in Clause 8.7 for the appropriate cost categories if production has not commenced, or

(b) the Non-participating Party's proportionate share of unrecouped sole risk project costs calculated pursuant to Clause 8.7 if production has not commenced.

8.7 If production results from a sole risk project, the Non-participating Parties will receive shares of such production equal to their Participating Interest therein; and they shall pay to the Participating Parties the net proceeds from the sale of such shares (gross proceeds less operating costs, transportation expenses, taxes, royalties and net profit interests) until the Participating parties have received:-

(a) FIVE HUNDRED (500%) per cent of their Category 1 costs, and

(b) ONE THOUSAND (1,000%) per cent of their Category 2 costs,

attributable to the Non-participating Party's proportionate shares of the sole risk project costs. If a Non-participating party fails to make such payments, the Participating parties may take the Non-participating Party's share of production from the sole risk project until the net proceeds of such shares equal the amounts (a) and (b) above. No contract for the sale of such production shall be for a period longer than is required by the minimum needs of the Petroleum Industry or one (1) year, whichever is the shorter.

9. Disposition of Production

9.1 Each Party shall take and separately dispose of it's Production Entitlement at the downstream side of the applicable terminal facility.

9.2 The Parties shall negotiate in good faith to reach equitable adjustment of inbalances occurring between Production Entitlements and liftings and for the adjustment of significant disparities in operating expenses thereby caused.

9.3 Each Party shall be separately responsible for the payment of royalties, excise and other charges on its respective share of production.

10. Assignment

10.1 Subject to compliance with the terms of the Permit, if a Party wishes to assign it's Participating Interest to a third party other than a related Corporation, it shall first give the other parties written notice of such assignment. Subject to compliance with Clause 10.3, the other Parties will not unreasonably withhold their approval of the assignment.

10.2 Subject to the provisions of Clause 10.3, a Party may assign it's Participating Interest to a related Corporation after giving written notice to the other Parties.

10.3 Any assignment of the Party's Participating Interest will be subject to the following conditions:

(a) the assignment will not reduce the Australian equity below FIFTY (50%) per cent;

(b) the assignment will not produce a Participating Working Interest of less than ONE (1%) per cent;

(c) unless the assignee is another Party, the assignee has satisfied the other Parties it can meet it's financial obligations pursuant to this Agreement;

(d) if the assignment is less than all of the Participating Interest of the assigning Party the prior written consent of the other Parties must be obtained;

(e) such necessary clearances and approvals as may be required from time to time have been obtained by the assignor and assignee from all relevant Federal and State Government authorities;

(f) the assignee has signed a deed of covenant undertaking to be bound by the provisions of this Agreement;

(g) the assignor has fulfilled the whole of its obligations pursuant to this Agreement, or has made arrangements satisfactory to the Parties in order to fulfill any outstanding financial obligations pursuant to the Agreement.

11. Charges

11.1 Prior to the first commercial production of Petroleum from the area a Party may create fixed and/or floating charges over it's Participating Interest, including it's share of expenditure pursuant to this Agreement; PROVIDED THAT the instrument creating the charge is in a form which is satisfactory to each of the other Parties, and:-

(a) obliges the chargee and/or any receiver or receiver and manager of the chargee to observe the provisions of this Agreement, and to give each of the other Parties at least thirty (30) days' notice of the chargees intention to exercise any right of sale or forclosure which may be given by the charge, and

(b) obliges the chargee upon default to sell within a reasonable period it's interest acquired under the charge pursuant to the terms of Clauses 10.1, 10.2 and 10.3 hereof.

12. Withdrawal

12.1 In the absence of any objection by any Federal or State Government agency which may have authority in the matter, a Party may withdraw at any time as of the end of any Permit or lease Year giving at least ninety (90) days' written notice to the other Parties of it's intention to transfer it's Participating Interest to the other Parties. The other Parties shall advise the withdrawing Party and each other within ninety (90) days after receiving such notice whether they wish to accept such transfer. Timely notice of non-acceptance

of such transfer by a Party will be deemed to be timely notice of an intention by that Party to withdraw and transfer it's Participating Interest to the other Parties as required by this Clause. If no other Participating Working Interest Party will accept such transfer, the Parties will transfer their interests to the Net Profits Interest holders, provided that all Government surrender obligations of the Participating Working Interest Parties have been met.

12.2 A withdrawing Party will transfer it's Participating Interst to the non-withdrawing Parties in proportion to their then Participating Working Interests by executing an assignment, settling it's share of operating accounts and paying the registration and other costs of the assignment.

13. Force Majeure

13.1 A Party unable by reason of force majeure to carry out it's obligations hereunder other than the obligation to pay money where the inability is not caused by any Government having jurisdiction over the remission of funds to Australia is excused from performance of such obligations while the event of force majeure continues and for a reasonable time thereafter provided that the Party affected gives written notice to the other Parties within a reasonable time after the event of force majeure occurs and does everything reasonably possible to end the force majeure condition and mitigate its effect on the other Parties.

13.2 "Force Majeure" means an act of God, strike, lock-out, ban or limitation of work, or other industrial disturbance, act of the public enemy, war, blockade, riot, lightning, fire, storm, flood, explosion, governmental restraint, shortage or unavailability of equipment or supplies, and any other cause, whether or not of the kind enumerated, not reasonably within the control of the Party concerned. Settlement of strikes, lock-outs, and other labour difficulty is within the discretion of the Party concerned.

14. Relationship of Parties

14.1 This Agreement does not create a partnership and the rights, duties, obligations and responsibilities of the Parties shall be several and not joint nor joint and several.

15. Notices

15.1 Notices required to be given under this Agreement shall be addressed as follows:

Antartic Petroleum Pty. Ltd.
15th Floor
Mt. Newman House
200 St. George's Terrace
PERTH WA 6000

Attention: Mr. Stephen L. Thomas -
Telex: AA 94751 Telephone: (09) 322-6788

Forsayth Oil and Gas N.L.
1st Floor
28 The Esplanade
PERTH WA 6000

Attention: Mr. John C. Morris - Chairman
Telex: AA 96127 Telephone: (09) 322-7211
Telefax:322-4907

Geometals Oil Exploration Limited
4th Floor
28 The Esplanade
PERTH WA 6000

Attention: Mr. John T. Kopcheff - Exploration Manager
Telex: AA 94143 Telephone: (09) 321-4011

Gulf Resources N.L.
9th Floor
82 Elizabeth Street
SYDNEY NSW 2000

Attention: Mr. Zahir Shah - Exploration Manager
Telex: AA 22292 Telephone: (02) 233-6022

Heron Petroleum Pty. Ltd.
5th Floor
189 St. George's Terrace
PERTH WA 6000

Attention: Mr. Chris N. Curnow - Exploration Manager
Telex: AA 93332 Telephone: (09) 322-5945

LAPP Resource Consultants
127 Essex Street
WEMBLEY WA 6014

Attention: Mr. David W. Lappi - General Manager
Telephone: (09) 387-7327

Median Oil N.L.
11 Mosman Terrace
MOSMAN PARK WA 6012

Attention: Mr. Alan Flavelle - Managing Director
Telex: AA 94974 Telephone: (09) 384-5581

Malita Exploration Pty. Ltd.
5th Floor
189 St. George's Terrace
PERTH WA 6000

Attention: Mr. Chris Curnow - Exploration Manager
Telex: AA 93332 Telephone: (09) 322-5945

Southern Cross Exploration N.L.
9th Floor
82 Elizabeth Street
SYDNEY NSW 2000

Attention: Mr. Zahir Shah - Director
Telex: AA 22292 Telephone: (02) 233-6022

Spectrum Gold N.L.
15th Floor
Mt. Newman House
200 St. George's Terrace
PERTH WA 6000

Attention: Mr. Stephen L. Thomas
Telex: AA 94751 Telephone: (09) 322-6788

or to any other address which may be notified by a Party to each of the other Parties in writing. Notices shall be deemed received when delivered at such address or if mailed postage prepaid and registered or certified cover ten (10) days after being deposited in the mail so addressed. Notices may be given by telephone, telex or telegram provided they are promptly confirmed by letter. If so given and confirmed, they shall be deemed to have been received twelve (12) hours after such telephone conversation or the due despatch of the telex or telegram.

16. Conditions Precedent and Subsequent

16.1 Subject to Clause 10.1 no Party may enter into an agreement with a third party covering the subject matter of the Agreement after the date of commencement hereof, but no other rights or obligations shall arise under this Agreement until the following conditions have been fulfilled:

(i) the approval or authority which may be required to be obtained from the Reserve Bank of Australia pursuant to the Commonwealth of Australia Banking (Foreign Exchange) Regulations has been obtained, and

(ii) any approval which is required of the Minister and/or the Registrar obtained under the Act.

16.2 Unless the Parties agree otherwise, the Agreement will terminate one hundred and eighty (180) days after the commencement date if advice has not been received from the Foreign Investment Review Board that the Treasurer has no objection to the Agreement other than to require further approval at the time of development.

17. Release of Information

17.1 To the extent practicable, public announcements of information shall be made jointly in the names of the Parties.

17.2 Except with the prior consent of all Parties, each Party shall keep reports, records, studies, opinions and other information obtained in the course of the operations (other than information already made public) confidential and shall not disclose the same except,

(a) to its affiliates, employees and consultants for the purposes of the operations with precautions to ensure that they keep such information confidential;

(b) as is required by any Stock Exchange on which it's shares or those of any affiliate are then listed for quotation;

(c) as in the opinion of any legal adviser for it or any affiliate is required by law or for their reasonable protection;

(d) as necessary in connection with a proposed assignment of a Party's Participating Interest or in connection with a loan document or effort to obtain funds.

17.3 A Party required or wishing to make material public in accordance with Clause 17.2 shall notify the other Parties of the proposed announcement as far in advance as possible.

18. Miscellaneous Provisions

18.1 No modification of this Agreement shall be effective except by written amendment.

18.2 No waiver by a Party of one or more defaults by another Party shall operate or be construed as a waiver of future default whether or not of a like character.

18.3 This Agreement shall be construed and governed in accordance with the laws of the State of South Australia and the Parties hereby submit to the jurisdiction of the courts of the State of South Australia and all courts competent to hear appeals therefrom.

18.4 If a mineral other than Petroleum is suspected or discovered as a result of the operations, the benefit thereof shall vest in the Parties according to their then respective Participating Interests unless individual Participating Parties elect not to participate in the acquisition and delineation of the suspected or discovered minerals. The transfer of the Non-participating Parties interests will be in accordance with Clause 12 herein.

19. Terms of Agreement: Termination

19.1 This Agreement shall continue in effect until:-

(a) termination by the Parties or by operation of a condition subsequent contained in Clause 16.2;

(b) all interests in the Permits and Licences become vested in one Party, or

(c) no Party has rights to explore for or produce Petroleum within the area and there has been a final settlement as between the parties.

19.2 On surrender of the Permits and Licences, the joint assets shall be distributed to the then Participating Parties in accordance with the balances in the accounts maintained by the Operator as specified in the accounting manual. If all capital accounts maintained by the Operator are zero, each Party shall receiver liquidation proceeds in proportion to it's Participating Interest.

20. Business Practices

20.1 The Operator shall take no action on behalf of the Parties that would subject any Party to liability or penalty to any governmental authority without the unanimous consent of the Operating Committee Representatives.

20.2 Invoices, financial settlements, reports and billings by the Operator shall reflect the facts of the activities and transactions handled for the Operating Account.

20.3 The Operator shall notify the Parties promptly upon discovery of any instance of non-compliance with the requirements of Clauses 19.1 and 19.2.

20.4 The Operator shall take every precaution to prevent it's servants, agents and subcontractors from receiving or procuring or offering substantial gifts, entertainment, payments, loans or other consideration to any person who could be in a position to influence decisions with respect to the operations.

21. Taxation

21.1 The Working Interest Parties own the Joint Assets as tenants in common; nevertheless, additional expenditure that a Party makes under Clause 8 shall be shown in the Operating Account as costs of that Party and reflected in the balance sheets and profit and loss accounts of only that Party.

22. Area of Mutual Interest

22.1 Each Party will not engage alone or in association with others in Permit acquisition activities where the Applications or Permits to be acquired lie either wholly or in part within the original boundary of the Application and Permit covered herein unless the Parties to this Agreement have the option of joining in the new acquisition under equal terms and in proportion to their respective interests herein.

APPENDIX A

Work Programme and Expenditure Commitments

The five-year work programme and expenditure commitments are shown below:

Licence Year	Work Programme	Expenditure
1	* Remote Sensing Interpretation	$ 5,000
	* Integrated Aeromagnetic Radiometric and EM Survey	$170,000
	* Data Review	$ 30,000
	* 50km Self Potential, Radiometric and Geochemical Surveys	$ 70,000
		$275,000
2	* 20km Seismic Survey	$ 40,000
	* One Stratigraphic Core hole	$150,000
	* Data Review and Reinterpretation	$ 40,000
		$230,000
3	* Airborne Multispectral Scanner Survey	$225,000
	* Data Review	$ 30,000
	* 20km Seismic Survey	$ 50,000
	* One Stratigraphic Corehole	$150,000
		$455,000
4	* 100km Seismic Survey	$300,000
	* Two Stratigraphic Core holes	$300,000
	* Data Review and Reinterpretation	$ 40,000
		$640,000
5	* 100km Seismic Survey	$300,000
	* One New-field Wildcat at best location in Area	$1,500,000
		$1,800,000

Total Dry-Hole Expenditure over 5 years:

Year	Expenditure
1	$ 275,000
2	$ 230,000
3	$ 455,000
4	$ 640,000
5	$1,800,000
	$3,400,000

APPENDIX B

The Minister for Mines
Director-General of Mines
South Australian Department of Mines and Energy
191 Greenhill Road
PARKSIDE SA 5063

STATE OF SOUTH AUSTRALIA

Petroleum Act 1940-1984

APPLICATION FOR PETROLEUM EXPLORATION

LICENCE

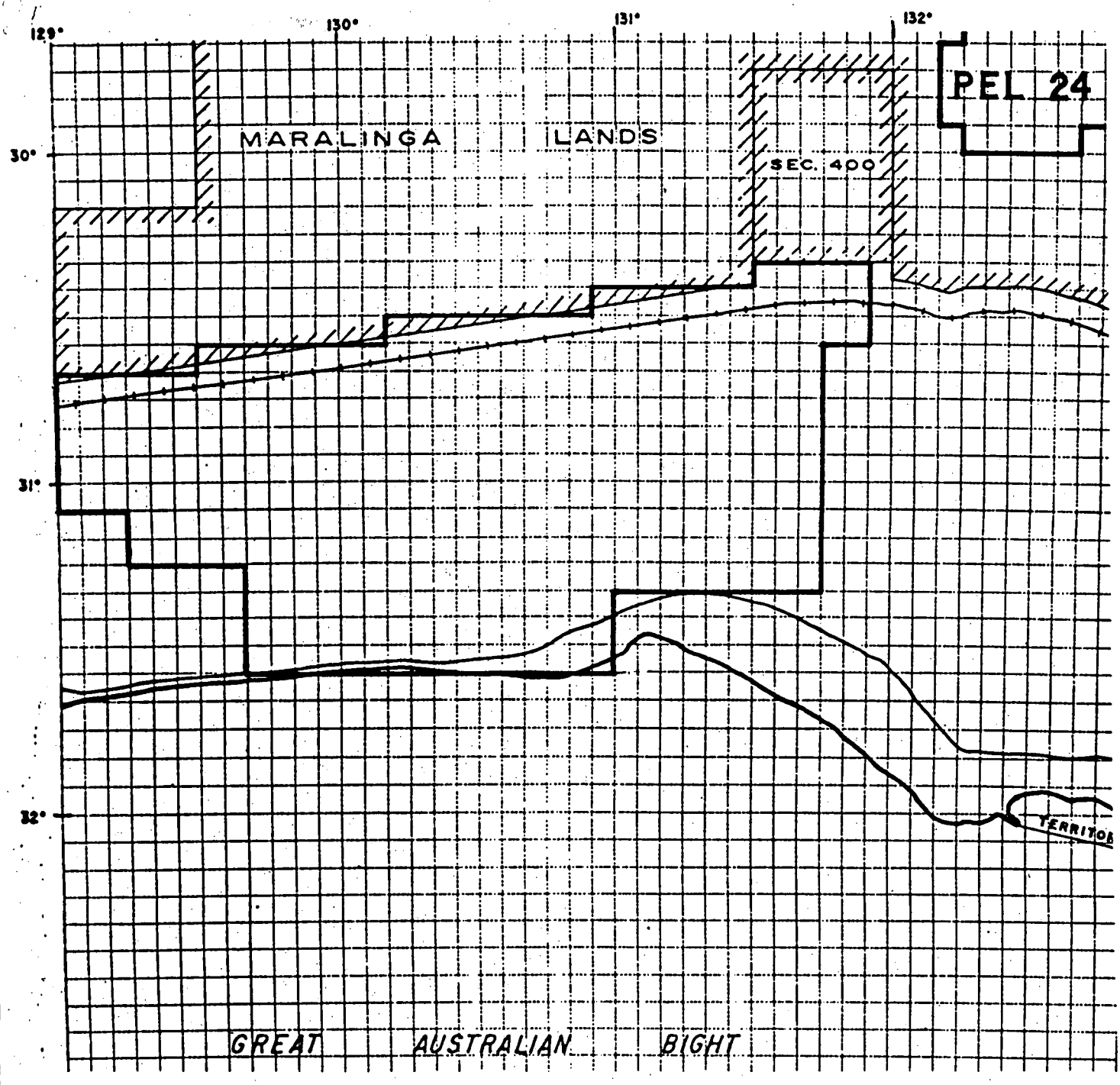
LAPP Resource Consultants of 127 Essex Street, Wembley, Western Australia, Operator of the Joint Venture, hereby make application for the grant of a Petroleum Exploration Licence in respect of the area described hereunder.

1. Description of Area Required:

Commencing from the northeastern corner at 131 degrees 55 minutes E 30 degrees 20 minutes S, thence south to 131 degrees 55 minutes E 30 degrees 35 minutes S, thence west to 131 degrees 45 minutes E 30 degrees 35 minutes S, thence south to 131 degrees 45 minutes E 31 degrees 20 minutes S, thence west to 131 degrees 00 minutes E 31 degrees 20 minutes S, thence south to 131 degrees 00 minutes E 31 degrees 35 minutes S, thence west to 129 degrees 40 minutes E 31 degrees 35 minutes S, thence north to 129 degrees 40 minutes E 31 degrees 15 minutes S, thence west to 129 degrees 15 minutes E 31 degrees 15 minutes S, thence north to 129 degrees 15 minutes E 31 degrees 05 minutes S, thence west to 129 degrees 00 minutes E 31 degrees 05 minutes S, thence north to 129 degrees 00 minutes E 30 degrees 40 minutes S, thence east to 129 degrees 30 minutes E 30 degrees 40 minutes S, thence north to 129 degrees 30 minutes E 30 degrees 35 minutes S, thence east to 130 degrees 10 minutes E 30 degrees 35 minutes S, thence north to 130 degrees 10 minutes E, 30 degrees 30 minutes S, thence east to 130 degrees 55 minutes E, 30 degrees 30 minutes S, thence north to 130 degrees 55 minutes E 30 degrees 25 minutes S, thence east to 131 degrees 30 minutes E 30 degrees 25 minutes S, thence north to 131 degrees 30 minutes E, 30 degrees 20 minutes S, thence east to the initial point of 131 degrees 55 minutes E 30 degrees 20 minutes S.

The above area contains 351 graticular blocks comprising 25,974 square kilometres.

Map of Application Area



SCALE 1:2,000,000

KILOMETRES 20 0 20 40 60 80 100 120 140 160 180 200 KILOMETRES

MEMORANDUM

Petroleum Exploration Licence No. 33.

1. This licence granted on 25/6/85 is hereby entered on the Petroleum Register.

2. A security in the form of a $10,000 bank guarantee has been lodged with respect to this licence.

3. Interests in the licence are as follows:-

- Median Oil N.L. - 30% and operator*
- Geometals Oil Exploration Ltd. - 10%
- Heron Petroleum Pty. Ltd. - 10%
- Malita Exploration Pty. Ltd. - 10%
- Gulf Resources N.L. - 5%
- Southern Cross Exploration N.L. - 5%
- Forsayth Oil and Gas N.L. - 10%
- Antarctic Petroleum Pty. Ltd. - 5%
- Spectrum Gold N.L. - 15%

* By agreement, LAPP Resource Consultants Pty. Ltd. will act as agent of Median Oil N.L. for the purpose of operatorship.

25/6/85
SR 27/2/76

MINISTER OF MINES AND ENERGY

GRANT OF PETROLEUM EXPLORATION LICENCE

Department of Mines and Energy, Parkside, 25 June 1985

NOTICE is hereby given that the undermentioned petroleum exploration licence has been granted under the provisions of the Petroleum Act, 1940-1984.

R. G. PAYNE, Minister of Mines and Energy

No. of Licence	Licensees	Locality	Date of Expiry	Area in Square Km	Reference
33	Median Oil N.L. Geometals Oil Exploration Ltd Heron Petroleum Pty Ltd Malita Exploration Pty Ltd Gulf Resources N.L. Southern Cross Exploration N.L. Forsayth Oil and Gas N.L. Antarctic Petroleum Pty Ltd Spectrum Gold N.L.	Eucla Basin on the Nullarbor Plain area of South Australia	24.6.90	23 793	SR27/2/76

The land comprised in the licence is that portion of the State bounded as follows: Commencing at a point being the intersection of latitude 30°20′S and longitude 131°30′E, thence east to longitude 131°55′E, south to latitude 30°35′S, west to longitude 131°45′E, south to the northern boundary of the Yalata Aboriginal Reserve, thence generally westerly and southerly along the boundaries of the said Reserve, to the north-eastern corner of the Nullarbor National Park, thence generally westerly and southerly along the boundaries of the said park to low water mark, Great Australian Bight, thence generally westerly along the said low water mark to longitude 129°40′E, north to latitude 31°15′S, west to longitude 129°15′E, north to latitude 31°05′S, west to western border of the State of South Australia, thence northerly along the said border to a line 8.047 kilometres north of and parallel to the centre of the Trans Australian Railway, then generally north-easterly along the said line to longitude 131°30′E and north to the point of commencement. All the within latitudes and longitudes are geodetic and expressed in terms of the Australian Geodetic Datum as defined on p. 4984 of *Commonwealth Gazette* number 84 dated 6 October 1966.

Department of Lands, Adelaide, 2 July 1985

THE following list of licences to occupy Crown lands, which have been terminated, is published for general information.

D. J. HOPGOOD, The Minister of Lands

Licence No.	Name	Situation	Date of Termination	Future Tenure
11648	Holness, Brian William and Holness, Gerada Antonia, both c/o Post Office, Andamooka 5722	Allotment No. 180 situate in the town of Andamooka, for residential purposes	19.6.85	Land Grant
13900	Petkovic, Slobodan, c/o Post Office, Andamooka 5722	Allotment No. 363 situate in the town of Andamooka, for residential purposes	19.6.85	Land Grant
15266	Allen, Neva, of 88 Mitchell Road, Alexandria 2015, in the State of New South Wales	Allotment No. 367 situate in the town of Andamooka, for residential purposes	19.6.85	Land Grant
15698	Fesus, Albert Alex, c/o Post Office, Coober Pedy 5723	Allotment No. 340 situate in the town of Coober Pedy, for residential purposes	16.6.85	Land Grant
15782	Norton, Phyllis Coral, of Lipson 5607	Section No. 265 situate in the hundred of Yaranyacka, for grazing and cultivation purposes	16.6.85	Land Grant
15942	Mibus, Mark Howard, c/o Post Office Box 455, Coober Pedy 5723	Allotment No. 565 situate in the town of Coober Pedy, for residential purposes	9.6.85	Land Grant
16760	Nicolitsi, Tony, of 94 Frederick Street, Welland 5007	Allotment No. 161 situate in the town of Coober Pedy, for residential purposes	31.5.85	Crown Land
16976	Noble, Bertram Allan and Noble, Ruth Aileen, both of Darke Peak 5642	Section No. 125 situate in the hundred of Pascoe, and section No. 59 situate in the hundred of Darke, for agricultural purposes	19.6.85	Land Grant
17050	Pidgeon, Gordon Stewart and Pidgeon, Sandra Barbara, both of 4 Tilley Drive, Surrey Downs 5126	Allotment No. 503 situate in the town of Andamooka, for residential purposes	9.6.85	Land Grant
17246	Smith, Graeme Menzies, of Rendelsham 5280	Allotment No. 42 situate in the town of Rendelsham, hundred of Rivoli Bay, for residential purposes	5.5.85	Land Grant

D. J. ALEXANDER, Director of Lands

DELIVERED 9.00am

15 APR 1985 Gulf 25 00035

DESTROY

Petroleum Act 1940-1984

Petroleum Exploration Licence No. 38

I, RONALD GEORGE PAYNE, Minister of Mines and Energy in the State of South Australia pursuant to the provisions of the Petroleum Act, 1940-1984 HEREBY GRANT to:-

- Median Oil N.L. whose registered office is situated at 11 Mosman Terrace, Mosman Park, W.A., 6012;
- Geometals Oil Exploration Ltd. whose registered office is situated at 28 The Esplanade, Perth, W.A., 6000;
- Heron Petroleum Pty. Ltd. whose registered office is situated at 189 St. George's Terrace, Perth, W.A., 6000;
- Malita Exploration Pty. Ltd. whose registered office is situated at 189 St. George's Terrace, Perth, W.A., 6000;
- Gulf Resources N.L. whose registered office is situated at 82 Elizabeth Street, Sydney, N.S.W., 2000;
- Southern Cross Exploration N.L. whose registered office is situated at 82 Elizabeth Street, Sydney, N.S.W., 2000;
- Forsayth Oil & Gas N.L. whose registered office is situated at 28 The Esplanade, Perth, W.A., 6000;
- Antarctic Petroleum Pty. Ltd. whose registered office is situated at 200 St. George's Terrace, Perth, W.A., 6000;
- Spectrum Gold N.L. whose registered office is situated at 200 St. George's Terrace, Perth, W.A., 6000

180685 COMMISSIONER OF STAMPS E.D. R. CLARK IS ORIGINAL INSTRUMENT DULY STAMPED SOUTH AUSTRALIA

(hereinafter referred to as the "Licensees") a Petroleum Exploration Licence in respect of the area described below and subject to the conditions set out below, to have effect for a period of five years and to expire on ...24th...JUNE.... 19.90.... but carrying the rights of renewal conferred by the Petroleum Act 1940-1984.

Description of Area

The land comprised in this licence is that part of the land described in the Schedule hereto and delineated in the plan annexed hereto.

Conditions

1. The Licensees shall at all times comply with:-

   (a) the provisions of the Petroleum Act, 1940-1984 and of any regulations for the time being and from time to time in force under the Act; and

   (b) all directions given to them under the Act or the regulations for the time being and from time to time in force under that Act.

2. During the term of the licence, the Licensees shall carry out or cause to be carried out exploratory operations on the area comprised in the licence in accordance with such work programmes as are approved by the Minister from time to time. These exploratory operations shall include but not necessarily be limited to:-

a) in the first year of the term of the licence, the completion of data review, remote sensing interpretation, 22 000 line kilometres of aeromagnetic, radiometric and electromagnetic surveys and 50 line kilometres of shelf-potential, radiometric and geochemical surveys, such that the estimated minimum expenditure on these exploratory operations shall be $325,000 (three hundred and twenty-five thousand dollars);

b) in the second year of the term of the licence, the completion of 40 line kilometres of seismic acquisition, processing and interpretation, data review and re-interpretation and the drilling of one stratigraphic hole to 900 metres (or prior economic basement), such that the estimated minimum expenditure on these exploratory operations shall be $280,000 (two hundred and eighty thousand dollars);

c) in the third year of the term of the licence, the completion of data review, an airborne multispectral scanner survey, 140 line kilometres of seismic acquisition, processing and interpretation, and the drilling of one stratigraphic hole to 900 metres (or prior economic basement), such that the estimated minimum expenditure on these exploratory operations shall be $755,000 (seven hundred and fifty-five thousand dollars);

d) in the fourth year of the term of the licence, the completion of data review and reinterpretation, 100 line kilometres of seismic acquisition, processing and interpretation, and the drilling of two stratigraphic holes to 1 000 metres each (or prior economic basement), such that the estimated minimum expenditure on these exploratory operations shall be $640,000 (six hundred and forty thousand dollars);

e) in the fifth year of the term of the licence, the drilling of one new-field wildcat well at the best location in the area, to economic basement, such that the estimated minimum expenditure on these exploratory operations shall be $1,500,000 (one million, five hundred thousand dollars).

3. Within sixty days after the end of each year (being the period of twelve calendar months ending on the anniversary of the date upon which this licence comes into force), the Licensees will submit to the Minister a full and complete written statement of expenditures actually made or caused to be made by the Licensees during that year upon approved exploratory operations. This statement of expenditures shall be accompanied by a written opinion on the veracity of the statement from an auditor whose qualifications and independence from the Licensees are acceptable to the Minister.

4. In the event that the Licensees during any year of the term of this licence (a year being the period of twelve calendar months ending on the anniversary of the date upon which this licence comes into force) fail to comply with the exploratory operations requirements of this licence, it is an express term of this licence that the Minister then may at his discretion either cancel this licence or authorise such variation to these requirements as the Minister thinks fit.

5. (a) Not less than thirty days before the commencement of each year (being the period of twelve calendar months ending on the anniversary of the date upon which this licence comes into force), the Licensees must arrange to meet in person with the Director-General or his representative to review the progress of the programme of exploration for the current licence year, and to present a proposal for the programme of exploration for the forthcoming year;

(b) if at any time the work being carried out or intended to be carried out by, or at the cause of, the Licensees is in the opinion of the Director-General not in accordance with the sound principles and practices of petroleum exploration, he may give the Licensees written directions as to the work being carried out or intended to be carried out, and the Licensees shall comply with those directions.

6. (a) The Licensees shall prepare or cause to have prepared a progress report at the conclusion of each period of three calendar months in which the licence remains in force, and shall forthwith submit to the Director-General a copy of each progress report and a copy of each completion report that the Licensees shall prepare or cause to have prepared at the conclusion of each convenient phase of the work programme, or at the conclusion of such parts of the work programme as the Director-General may determine. The reports prepared in accordance with these conditions shall contain full technical details of the work performed and shall include assessments and appraisals;

(b) in addition to the reports specified in the last preceding paragraph of this condition, the Licensees will promptly prepare and submit to the Director-General in a form acceptable to him, detailed reports on all exploratory operations done or caused to be done by or on behalf of the Licensees within and in relation to the licence area.

7. In the event that effective ownership or control of the licence in the opinion of the Minister is held or exercised outside of Australia, and in the event that the Licensees discover petroleum within the area comprised in the licence, it is an express obligation of this licence that the Licensees will make reasonable efforts to offer for a fair and reasonable price to Australian interests at least fifty-one percentum equity in any Petroleum Production Licence that may be applied for by the Licensees pursuant to such discovery of petroleum.

8. An application to drill a well within the area comprised in the licence shall include written proposals of the Licensees in relation to the bringing under control of the well, in the event that effective control of the well is lost, and to the clean-up of oil spills, including financial proposals such as well control insurance or other means to cover the costs involved in such operations.

9. The Licensees shall not recover any petroleum from the licence area except as a result of production testing, drillstem testing or taking samples from a well.

10. At least three calendar months before the proposed date of commencement of any work within the area comprised in the licence that requires:-

(a) access of vehicles, drilling rigs or earthmoving equipment;
(b) the use of explosives;
(c) the use of drilling rigs;
or (d) other activities that may cause damage to the land surface, to the bed of lakes or rivers, to natural vegetation or to sites of scientific or cultural significance,

the Licensees shall submit to the Director-General a Notice of Intent describing:-

(i) the work proposed;
(ii) the expected impact of such work upon the natural and human environment;
and (iii) the environmental protection measures proposed to prevent or reduce such impact and to restore any work sites.

11. The Director-General, after considering a Notice of Intent may:-

    (a) approve the proposed environmental protection measures;
    (b) require variations to the proposed environmental protection measures;

or (c) by written notice require the Licensees to carry out such further studies as the Director-General considers necessary for environmental protection, and to submit a written report setting out the results of such studies.

12. The Licensees shall not carry out or cause to be carried out in the area comprised in the licence any work that is or is to be the subject of a Notice of Intent except:-

    (a) in accordance with environmental protection measures previously approved in writing by the Director-General for the purpose of that work;

and (b) in accordance with the terms of such other approvals or consents as may be required for that work under the Petroleum Act, 1940-1984 and the regulations in force under that Act.

13. The Licensees shall take due care to preserve all Aboriginal and Historic Relics sites and areas of archaeological or anthropological importance discovered in the course of exploration. Such items or sites are stringently protected under the provisions of the Aboriginal and Historic Relics Preservation Act, 1965, which makes it an offence punishable by fine or imprisonment to deface or destroy rock carvings and paintings, tree carvings, stone structures or arranged stones. The Licensees should also be aware that under this legislation they have a duty to report finds of Aboriginal heritage items to the Minister for the Environment, a Police Officer or a Warden authorised under the Act.

00040

SIGNED SEALED AND DELIVERED
by the said MINISTER OF MINES
AND ENERGY at ADELAIDE this
.....25th..... day of .....JUNE.....1985

.....
MINISTER OF MINES AND ENERGY

THE MINISTER OF MINES AND ENERGY
ADELAIDE

SIGNED SEALED AND DELIVERED
by the said LICENSEES at
.....Perth.....
..7th..... day of .....June.....1985

THE COMMON SEAL of MEDIAN OIL N.L. was hereto affixed in the presence of:

.....
(Director)

MEDIAN OIL N.L.
Common Seal

.....
(Secretary)

THE COMMON SEAL of GEOMETALS OIL EXPLORATION LTD. was hereto affixed in the presence of:

.....
(Director)

.....
(Secretary)

Geometals Oil Exploration Ltd.
COMMON SEAL

00041

THE COMMON SEAL of HERON PETROLEUM PTY. LTD. was hereto affixed in the presence of:

.....
(Director)

HERON PETROLEUM PTY. LTD. COMMON SEAL

.....
(Secretary)

THE COMMON SEAL of MALITA EXPLORATION PTY. LTD. was hereto affixed in the presence of:

.....
(Director)

MALITA EXPLORATION PTY. LTD. COMMON SEAL

.....
(Secretary)

THE COMMON SEAL of GULF RESOURCES N.L. was hereto affixed in the presence of:

.....
(Director)

GULF RESOURCES N.L. Common Seal

.....
(Secretary)

THE COMMON SEAL of SOUTHERN CROSS EXPLORATION N.L. was hereto affixed in the presence of:

.....
(Director)

SOUTHERN CROSS EXPLORATION N.L. Common Seal

.....
(Secretary)

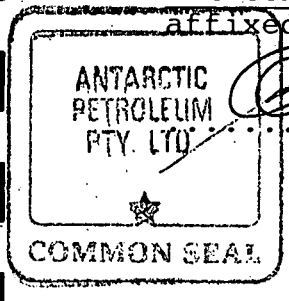
THE COMMON SEAL of FORSAYTH OIL & GAS N.L. was hereto affixed in the presence of:

.....
(Director)

FORSAYTH OIL & GAS N.L. COMMON SEAL

.....
(Secretary)

THE COMMON SEAL of ANTARCTIC PETROLEUM PTY. LTD. was hereto affixed in the presence of:



....

(Director) (Secretary)



THE COMMON SEAL of SPECTRUM GOLD N.L. was hereto affixed in the presence of:

....

(Director) (Secretary)

PEL 33

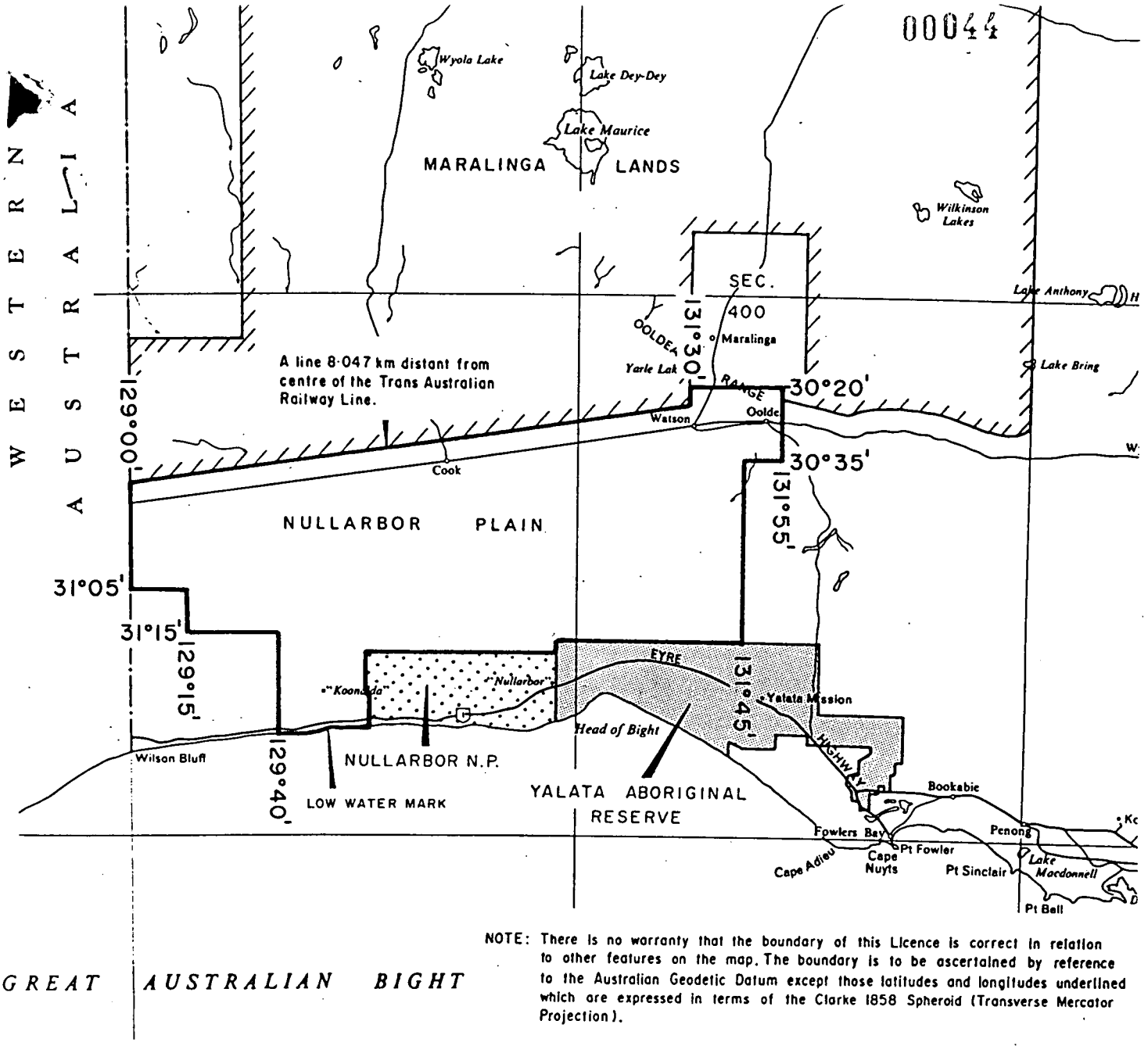
THE SCHEDULE

DESCRIPTION OF AREA

All that part of the State of South Australia bounded as follows:-

Commencing at a point being the intersection of latitude 30°20'S and longitude 131°30'E, thence east to longitude 131°55'E, south to latitude 30°35'S, west to longitude 131°45'E, south to the northern boundary of the Yalata Aboriginal Reserve, thence generally westerly and southerly along the boundaries of the said Reserve, to the northeastern corner of the Nullarbor National Park, thence generally westerly and southerly along the boundaries of the said park to low water mark, Great Australian Bight, thence generally westerly along the said low water mark to longitude 129°40'E, north to latitude 31°15'S, west to longitude 129°15'E, north to latitude 31°05'S, west to the western border of the State of South Australia, thence northerly along the said border to a line 8.047 kilometres north of and parallel to the centre of the Trans Australian Railway, then generally northeasterly along the said line to longitude 131°30'E and north to the point of commencement. All the within latitudes and longitudes are geodetic and expressed in terms of the Australian Geodetic Datum as defined on p.4984 of Commonwealth Gazette number 84 dated October 6, 1966.

AREA: 23 793 square kilometres approximately.



NOTE: There is no warranty that the boundary of this Licence is correct in relation to other features on the map. The boundary is to be ascertained by reference to the Australian Geodetic Datum except those latitudes and longitudes underlined which are expressed in terms of the Clarke 1858 Spheroid (Transverse Mercator Projection).

SCALE 1:2 500 000

km 20 0 20 40 60 80 100 120 140 160 180 km

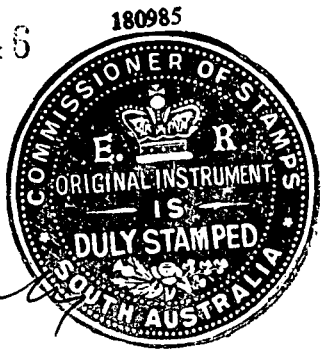
THE PLAN HEREINBEFORE REFERRED TO

MEDIAN OIL N.L. et al

PETROLEUM EXPLORATION LICENCE

Dept. of Mines & E

01084524



DEED OF ASSIGNMENT

THIS DEED is made the 5th day of [illegible] 1985 BETWEEN:

?? F- oil & Gas N.L.?

FORSAYTH N.L., a company incorporated in the State of Western Australia and having its registered office at 1st Floor, Griffin Centre, 28 The Esplanade, Perth, Western Australia ("Forsayth") of the first part AND

FIRST AUSTRALIAN RESOURCES N.L., a company incorporated in the State of Western Australia and having its registered office at 1st Floor, Griffin Centre, 28 The Esplanade, Perth, Western Australia ("FAR") of the other part.

WHEREAS:

NOW THIS DEED WITNESSETH:-

A. Petroleum Exploration Licence No.33 ("the Licence") was granted by the Minister for Mines and Energy of the State of South Australia pursuant to the provisions of the Petroleum Act 1940-1984 (as amended) of the State of South Australia ("the Act") on the 25th June 1985 to the following parties who hold the following Participating Interests:

	%
Median Oil N.L.	30
Heron Petroleum Pty. Ltd.	10
Geometals Oil Exploration Ltd.	10
Malita Exploration Pty. Ltd.	10
Gulf Resources N.L.	5
Southern Cross Exploration N.L.	5
Forsayth	10
Antarctic Petroleum Pty. Ltd.	5
Spectrum Gold N.L.	15
	100%

(which parties, less Forsayth, are hereinafter referred to as ("the Permittees")

B. Pursuant to a Participation Agreement made between the Permittees and Forsayth dated the 4th February 1985 ("the Participation Agreement"), the Permittees and Forsayth recorded the terms and conditions upon which they would work upon the area of the Licence.

C. Pursuant to Clause 2.2 of the Schedule to the Participation Agreement Lapp Resource Consultants is entitled to a 7% Net Profits Interest in any revenue derived from petroleum produced from the Licence.

D. Forsayth is the registered holder of a 10% Participating Interest in the Licence ("the Interest").

E. Forsayth has agreed to assign and transfer to FAR and FAR has agreed to assume the Interest subject to the terms and conditions contained in this Deed.

1. INTERPRETATION

1.1 In this Deed, unless the context otherwise requires:-

"Completion Date" is the date upon which all the conditions specified in clause 2.1 are satisfied;

"Effective Date" is the date upon which the condition specified in Clause 2.1(b) is satisfied;

"the Minister" means the Minister for Mines and Energy of the State of South Australia.

Unless the contrary intention shall appear, words used in this Deed shall bear the same meaning as in the Participation Agreement.

1.2 In this Deed, unless the context otherwise requires:-

(a) reference to a party includes a reference to its personal representatives, successors and assigns;

(b) singular words include the plural and plural words include the singular;

(c) neuter words include the masculine and the feminine;

(d) words importing persons include corporations;

(e) the headings do not affect the interpretation or construction of this Deed;

(f) references to recitals, clauses and paragraphs are references to recitals, clauses and paragraphs in this Deed;

(g) references herein to any agreement, deed or other instrument or document shall be deemed to include references to the agreement, deed, instrument or document as executed and varied or replaced from time to time as permitted by this Deed; and

(h) reference to any statute in this Deed includes a reference to that statute as amended, modified or replaced and includes orders, ordinances, regulations, rules and by-laws made under or pursuant to that statute.

2. CONDITIONS

2.1 This Deed and the obligations of Forsayth and FAR hereunder are conditional upon:-

(a) Any consent or approval required or contemplated by the Act and such necessary consents and approvals as may be required by statute from all other relevant State Government authorities;

(b) FAR being admitted to the Official List of the Member Exchanges of the Australian Associated Stock Exchanges and its shares being listed for official quotation on the stock markets of such Member Exchanges on or before the 31st day of December 1985;

(c) FAR executing a Deed of Covenant undertaking to be bound by the provisions of the Participation Agreement in accordance with clause 10.3(f) of the Schedule to that Agreement. Recital B

2.2 Upon satisfaction of the conditions contained in clause 2.1, this Deed shall have effect from the Effective Date to the fullest extent permitted by law.

2.3 Forsayth shall execute such instruments and do all such acts and things within its power as are necessary or desirable to satisfy the condition contained in clause 2.1(a) as expeditiously as possible.

2.4 FAR shall execute such instruments and do all such acts and things within its power as are necessary or desirable to satisfy the conditions contained in clause 2.1(b) and (c) as expeditiously as possible.

2.5 If any of the conditions contained in clause 2.1 is not satisfied, then, unless otherwise mutually agreed by Forsayth and FAR in writing, this Deed shall be of no further force or effect except that:-

(a) any moneys paid by FAR to Forsayth under clause 4.1(b) shall be repaid by Forsayth to FAR forthwith;

(b) any other consideration paid or given by FAR before that date shall be deemed given in consideration for the covenant of Forsayth in clause 2.3 and shall not be repaid or refunded;

and this clause shall survive termination of this Deed.

2.6 Notwithstanding clause 2.1 it is the intention of the Parties that clauses 2.2, 2.3, 2.4 and 2.5 and this clause shall take effect and bind the Parties on and from the date of execution of this Deed.

3. ASSIGNMENT

3.1 Forsayth hereby agrees to assign and transfer to FAR and FAR hereby agrees to assume from Forsayth the Interest with effect from the Completion Date.

3.2 As consideration for the agreement to assign and for the covenants of Forsayth herein, FAR agrees to assume all of Forsayth's obligations and liabilities under the Participation Agreement and the terms and conditions of the Licence as from the 25th June 1985.

4. COVENANTS BY FAR

4.1 FAR hereby covenants with Forsayth that it will:-

(a) as and from the the Completion Date, observe and perform the Participation Agreement and the terms and conditions of the Licence and be bound by all of the terms thereof to the extent of the Interest;

(b) indemnify Forsayth against all liability, costs and expenses arising or accruing under the Participation Agreement and otherwise in respect of the Licence from the date 25 June 1985, and reimburse Forsayth any moneys which Forsayth has expended in respect of such liability, costs and expenses, payable within 14 days of the Effective Date.

(c) execute the Deed of Covenant substantially in accordance with Annexure "A", or with such amendments as may reasonably be requested by the Permittees.

5. WARRANTIES AND COVENANTS

5.1 Forsayth warrants and represents to FAR that at the date of this Deed and the Completion Date:

(a) Forsayth now is and will be the sole beneficial owner of the Interest and the Interest will be free of any encumbrances whatsoever, save for any royalties or other imposts or obligations imposed by the Act;

(b) all necessary consents, authorities, approvals, licences or waivers for Forsayth to enter into this Deed and to perform its obligations hereunder have been obtained or are being sought by Forsayth;

(c) Forsayth is empowered and authorised by its Memorandum and Articles of Association and the Companies (Western Australia) Code to enter into this Deed;

(d) to the best of Forsayth's knowledge, the Licence is in good standing and in full force and effect;

(e) to the best of Forsayth's knowledge, all obligations in relation to the Licence have been fulfilled in accordance with the terms and conditions thereof and no breach of the Licence has occurred which has not been rectified;

(f) to the best of Forsayth's knowledge, except as may be required pursuant to the Act no part of the area currently covered by the Licence has been surrendered or relinquished; and

(g) Forsayth has not received any notice of the intention of the Minister to cancel the Licence.

5.2 Forsayth covenants with FAR that until the Completion Date:

(a) subject to clause 4.1(b) Forsayth will observe and perform the respective terms and conditions of the Participation Agreement, the conditions of the Licence and the provisions of the Act so far as the same are to be observed and performed by Forsayth thereunder; and

(b) Forsayth will not, without the prior consent of FAR, by any act or omission, make itself liable to have all or any of the Interest purchased or diluted.

6. INDEMNITY

6.1 Forsayth shall indemnify and hold harmless FAR from and against all claims commenced and all damages and losses incurred arising from or in connection with the Interest before the date of grant of the Permit whatsoever and howsoever arising.

6.2 FAR shall indemnify and hold harmless Forsayth from and against all claims commenced and all damages and losses incurred arising from or in connection with the Interest after the date of grant of the Permit whatsoever and howsoever arising.

7. GENERAL PROVISIONS

7.1 FAR shall pay the legal costs incurred in connection with the negotiation and execution of this Deed and all stamp duty and registration fees payable hereon.

7.2 Forsayth and FAR covenant and agree with each other that they will promptly when called upon do, execute and deliver to each other such further acts, instruments or other documents as may be necessary or appropriate to implement any or all of the provisions of this Deed.

7.3 Failure or omission by a party at any time to enforce or require strict or timely compliance with any provision of this Deed shall not affect or impair that provision in any way or the rights of that party to avail itself of the remedies it may have in respect of any breach of any such provision.

7.4 This Deed shall not be changed or modified in any way subsequent to its execution except in writing signed by the parties hereto.

7.5 The covenants and warranties of Forsayth and FAR contained in clause 4 and 5 hereof shall not merge on completion of the assignment contemplated hereunder.

South Aust?

7.6 This Deed shall be governed by and construed in accordance with the laws of Western Australia and the parties agree to submit to the jursidiction of the courts of that State.

7.7 Any notice, direction, election or other communiction which may be or which is required to be given pursuant to this Deed shall be in writing and shall be effective:-

(i) if delivered in person to the party to whom the notice is addressed, then upon delivery; or

(ii) if posted by pre-paid first class mail addressed to the party at its address herein contained, then on the second business day after posting.

IN WITNESS WHEREOF the parties hereto have executed this Deed on the day and year hereinbefore written.

THE COMMON SEAL of FORSAYTH N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

FORSAYTH N.L. COMMON SEAL

THE COMMON SEAL of FIRST AUSTRALIAN RESOURCES N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

FIRST AUSTRALIAN RESOURCES N.L. COMMON SEAL

I CONSENT

MINISTER OF MINES & ENERGY

15/5/87

ANNEXURE "A"

DEED OF ASSUMPTION

THIS DEED is made the day of 1985
BETWEEN:

FORSAYTH N.L., a company incorporated in the State of Western Australia and having its registered office at 1st Floor, Griffin Centre, 28 The Esplanade, Perth ("Forsayth") of the first part;

FIRST AUSTRALIAN RESOURCES N.L., a company incorporated in the State of Western Australia and having its registered office at 1st Floor, Griffin Centre, 28 The Esplanade, Perth ("FAR") of the second part;

MEDIAN OIL N.L. of 11 Mosman Terrace, Mosman Park, Western Australia ("Median") of the third part;

HERON PETROLEUM PTY. LTD. of 189 St. George's Terrace, Perth, Western Australia ("Heron") of the fourth part;

GEOMETALS OIL EXPLORATION LTD. of 28 The Esplanade, Perth, Western Australia ("Geometals") of the fifth part;

MALITA EXPLORATION PTY. LTD. of 189 St. George's Terrace, Perth, Western Australia ("Malita") of the sixth part;

GULF RESOURCES N.L. of 82 Elizabeth Street, Sydney, New South Wales ("Gulf") of the seventh part;

SOUTHERN CROSS EXPLORATION N.L. of 82 Elizabeth Street, Sydney, New South Wales ("Southern") of the eighth part;

ANTARCTIC PETROLEUM PTY. LTD. of 200 St. George's Terrace, Perth, Western Australia ("Antarctic") of the ninth part; and

SPECTRUM GOLD N.L. of 200 St. George's Terrace, Perth, Western Australia ("Spectrum") of the tenth part;

WHEREAS:

A. Petroleum Exploration Licence No.33 ("the Licence") was granted by the Minister for Mines and Energy of the State of South Australia pursuant to the provisions of the Petroleum Act 1940-1984 (as amended) of the State of South Australia ("the Act") on the 25th June 1985 to the following parties who hold the following Participating Interests:

	%
Median Oil N.L.	30
Heron Petroleum Pty. Ltd.	10
Geometals Oil Exploration Ltd.	10
Malita Exploration Pty. Ltd.	10
Gulf Resources N.L.	5
Southern Cross Exploration N.L.	5
Forsayth	10
Antarctic Petroleum Pty. Ltd.	5
Spectrum Gold N.L.	15
	100%

(which parties, less Forsayth, are hereinafter referred to as ("the Permittees")

B. Pursuant to a Participation Agreement made between the Permittees and Forsayth dated the 4th February 1985 ("the Participation Agreement"), the Permittees and Forsayth recorded the terms and conditions upon which they would work upon the area of the Licence.

C. Pursuant to Clause 2.2 of the Schedule to the Participation Agreement, Lapp Resource Consultants is entitled to a 7% Net Profits Interest in any revenue derived from petroleum produced from the Licence.

D. Forsayth is the registered holder of a 10% Participating Interest in the Licence ("the Interest").

E. By an Agreement dated the 5th day of July 1985 made between Forsayth and FAR ("the Deed of Assignment"), Forsayth agreed to assign to FAR the Interest subject to the terms and conditions contained therein.

F. Clause 10.3(F) of the Schedule to the Participation Agreement provides, in summary an assignment of any

Parties' Participating Interest is conditional upon the assignee executing a Deed of Covenant undertaking to be bound by the provisions of the Participation Agreement.

G. Each of the parties hereto consents to the assignment of the Interest by Forsayth to FAR and the assumption by FAR of Forsayth's liabilities and obligations relating to the Interest pursuant to the Participation Agreement and the Permit effective as at the Effective Date, subject to and in accordance with the provisions hereinafter appearing.

NOW THIS DEED WITNESSES as follows:-

1. In this Deed, unless the context otherwise requires:-

"the Parties" shall bear the same meaning as in clause 1.1 of the Participation Agreement, but for the purposes of this Deed, specifically excludes Forsayth.

"Participating Interest" shall bear the same meaning as in the Participation Agreement.

Unless the contrary intention shall appear, words used in this Deed shall bear the same meaning as in the Deed of Assignment and the Participation Agreement.

1.2 In this Deed, unless the context otherwise requires:-

(a) reference to a party includes a reference to its personal representatives, successors and assigns;

(b) singular words include the plural and plural words include the singular;

(c) neuter words include the masculine and the feminine;

(d) words importing persons include corporations;

(e) the headings do not affect the interpretation or construction of this Deed;

(f) references to recitals, clauses and paragraphs are references to recitals, clauses and paragraphs in this Deed;

(g) references herein to any agreement, deed or other instrument or document shall be deemed to include references to the agreement, deed, instrument or document as varied or replaced from time to time as permitted by this Deed; and

(h) reference to any statute in this Deed includes a reference to that statute as amended, modified or replaced and includes orders, ordinances, regulations, rules and by-laws made under or pursuant to that statute.

2. Each of the Parties hereby consents to the assignment of the Interest by Forsayth to FAR on the Completion Date.

3. To the extent of the Interest, FAR covenants and agrees with the Parties that as and from the Completion Date it will observe, perform and be bound by all the terms, conditions, restrictions, covenants and obligations under the Participation Agreement in all respects as if FAR were named in that Agreement in place of Forsayth.

4. Each of the Parties hereby releases and discharges Forsayth from all claims, demands and liabilities whatsoever in respect of any and all of Forsayth's covenants and obligations under the Participating Agreement with effect from the Completion Date (other than any liability accrued before that date).

5. The Deed of Assignment is expressed to be conditional upon such necessary consents and approvals as may be required pursuant to the Act from all relevant State Government Authorities and this Deed is subject to such consent being obtained in respect of the Deed of Assignment. FAR shall notify the Parties upon that condition being satisfied.

6. This Deed may be executed in counterpart and each counterpart shall for all purposes be deemed to be an original and all counterparts shall together constitute one instrument.

7. FAR shall pay the legal costs of and in connection with the preparation and execution of this Deed and all stamp duty and registration fees payable hereon.

8. This Deed shall be governed and construed in accordance with the laws of South Australia and the parties agree to submit to the jurisdiction of the Courts of that State.

9. Any notice, direction, election or other communication which may be or which is required to be given pursuant to this Deed shall be in writing and shall be effected:-

(a) if delivered in person to the party to whom the notice is addressed, then upon delivery; or

(b) if posted by pre-paid first class mail addressed to the party at the address of its registered office, then on the second business day after posting.

IN WITNESS WHEREOF the parties hereof have executed this Deed on the day and year hereinbefore written.

THE COMMON SEAL of FORSAYTH N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

THE COMMON SEAL of FIRST AUSTRALIAN RESOURCES N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

THE COMMON SEAL of MEDIAN OIL N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

THE COMMON SEAL of HERON PETROLEUM PTY. LTD. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

THE COMMON SEAL of GEOMETALS OIL EXPLORATION LTD. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

THE COMMON SEAL of MALITA EXPLORATION PTY. LTD. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

THE COMMON SEAL of GULF RESOURCES N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

THE COMMON SEAL of SOUTHERN CROSS EXPLORATION N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

THE COMMON SEAL of ANTARCTIC PETROLEUM PTY. LTD. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

THE COMMON SEAL of SPECTRUM GOLD N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

LAPP Resource Consultants
127 Essex Street,
Wembley, Western Australia
Australia, 6014.
Telephone: (09) 387 7327

00060

October 1, 1985

The Director-General
South Australian Department of Mines and Energy
191 Greenhill Road
PARKSIDE SA 5063

RE: FIRST QUARTERLY REPORT FOR PEL 33
JUNE 25 TO SEPTEMBER 25, 1985

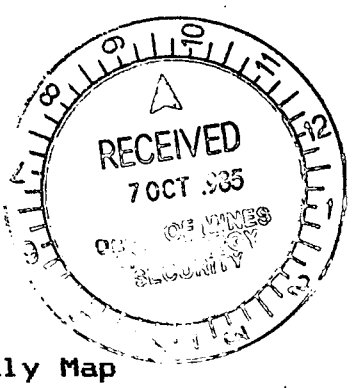
Dear Sirs,

LAPP Resource Consultants is the contract Operator of PEL 33 by agreement with the Joint Venture Partners.

During the Quarter ending September 25, 1985 the Joint Venturers initiated Remote Sensing interpretations and drafted a proposed Joint Venture agreement.

Bids for the Remote Sensing interpretations were requested from four contractors and Dr. Richard Russell was awarded the contract. The work is currently underway. The interpretations will include the following products:

LANDSAT 1:1,000,000 scale	)	Geologic Interpretation
	)	Structural Interpretation
	)	Tectonic Interpretation
1:250,000 scale	)	Geologic Interpretation
	)	Structural Interpretation
	)	Tectonic Interpretation
	)	Tonal/Fuzzy Anomaly Map
NOAA Imagry	)	Geologic Interpretation
	)	Structural Interpretation
	)	Thermal Inertia and Anomaly Map
Air Photo	)	Detailed Analysis of Anomalous
	)	Areas at appropriate scales



Interpretation of these data should yield a reasonably detailed geological and structural picture of the permit and may also indicate areas with possible hydrocarbon-related tonal, "fuzzy" or thermal anomalies. The interpretations should be completed by the end of October, 1985.

The Draft Joint Venture Agreement, based on the APEA Model, has been distributed and the Parties are presently reviewing that document. When the final document has been signed, a copy will be forwarded to SADME for your records.

The following costs apply to the First Quarter's operations in PEL 33:

Data Review:	$ 5,000
Remote Sensing Interp:	$ 5,000
Overheads:	$ 7,500
Total	$17,500

Sincerely,

David W. Lappi

David W. Lappi
General Manager

00062

NOTES TO ACCOMPANY THE SPACE PHOTOGRAPH INTERPRETATION OF THE STRUCTURAL GEOLOGY OF PEL 33, EUCLA BASIN, SOUTH AUSTRALIA

VOLUME I: REPORT AND ENCLOSURES

NOVEMBER 1985

FOR

LAPP RESOURCE CONSULTANTS PTY LTD

AND THE PEL 33 JOINT VENTURE

R. RUSSELL AND ASSOCIATES
11 MERTZ COURT
HILLARYS 6025
WESTERN AUSTRALIA

RECEIVED
23 JAN 1986
DEPT. OF MINES AND ENERGY SECURITY
6425

CONTENTS

00063

		PAGE NO.
ABSTRACT	.....	viii.
CONCLUSIONS	.....	viii.
RECOMMENDATIONS	.....	xi.
CHAPTER I		
INTRODUCTION		
1.1 Objectives and Composition of the Study	.....	1.
1.2 Study Area	.....	1.
1.2.1 Geomorphology	.....	1.
1.2.2 Structure and General Stratigraphy	.....	3.
1.3 Data Sources		
1.3.1 Imagery	.....	8.
a) NOAA	.....	8.
b) Landsat	.....	9.
1.3.2 Publications	.....	9.
1.4 Technique	.....	10.
CHAPTER II		
NOAA INTERPRETATION		
2.1 Day-pass NOAA Interpretation	.....	11.
2.1.1 Tonal Pattern of the Nullarbor Limestone	.....	11.
2.1.2 Diffuse West-Northwest Trending Linears	.....	12.
2.1.3 Major Linear Trends	.....	13.
2.1.4 Circular Anomalies	.....	14.
2.2 Night-pass NOAA Interpretation	.....	14.
2.2.1 Thermal Pattern	.....	15.
2.2.2 Thermal Linears	.....	15.
CHAPTER III		
1:1 Million LANDSAT INTERPRETATION		
3.1 Imagery	.....	17.
3.2 Area	.....	17.

PAGE NO

3.3 Interpretation ..... 17.

3.3.1 Linears ..... 18.

a) Eucla Basin Margins and Linears to the North and West ..... 18.

b) Eucla Basin Linears ..... 19.

3.3.2 Regional Warping ..... 20.

a) Regional Tonal Anomalies ..... 20.

b) Coastline Changes ..... 20.

CHAPTER IV

1:250,000 LANDSAT INTERPRETATION

4.1 Introduction ..... 26.

4.2 Fracture Pattern ..... 26.

4.2.1 Linear Categories ..... 26.

a) Minor Linears ..... 26.

b) Linears and Major Linears ..... 26.

4.2.2 General Pattern ..... 27.

4.2.3 Fracture Density Analysis..... 27.

4.2.4 Fracture Regions in PEL 33 ..... 30.

4.3 Structural Interpretation ..... 32.

4.3.1 High Fracture Density ..... 32.

4.3.2 Fracture Intersection Zones ..... 32.

4.3.3 Surface Anticlines ..... 33.

4.3.4 Light Tonal Anomalies ..... 34.

4.3.5 Exploration Leads ..... 35.

REFERENCES ..... 37.

APPENDIX 1

Air Photography Tonal Anomalies ..... 38.

00065

LIST OF FIGURES

FIGURE		PAGE NO.
A1	Location of 1:250,000 plates and sheets.	vi.
A2	Exploration Leads Map.	ix.
1	Location Map.	2.
2	Major Structural Elements.	5.
3	Formation of north-south faults in the Tertiary Eucla Basin.	21.
4	Stages in divergent rifting between Australia and Antarctica.	22.
	a) Initial arch b) Faulted rift basin with rim basins c) Half arch subsides following thermal decay.	
5	Bouguer Gravity Anomalies in relation to dark tonal area in PEL 33.	23.
6	Tectonic movements in relation to the shape of the coastline.	24.
7	a) Rose diagram of linear vectors (length and direction).	28.
	b) Frequency Histogram.	29.

TABLE

1	Synthesis of Structure and Stratigraphy in PEL 33.	4.

LIST OF ENCLOSURES

(See pocket at rear of report)

ENCLOSURE

1 Interpretation of day NOAA Imagery

2 Interpretation of Night Thermal Imagery in PEL 33.

3 Landsat Interpretation of the Structural Geology of the Eastern Eucla Basin and Surroundings covering PEL 33 (1:1 million).

4 Landsat Interpretation of the Structural Geology of the Eastern Eucla Basin covering PEL 33. (1:500,000 reduction of 1:250,000 interpretation).

5 Fracture Density in PEL 33 from Landsat Interpretation.

6 Structural Features controlling Hydrocarbon Entrapment.

a) High Fracture Density
b) Fracture Intersection Zones
c) Surface Anticlines
d) Light Tonal Anomalies

7 Air photograph tonal anomalies in PEL 33.

00067

LIST OF SHEETS (in separate map folio)

SHEET 1 TO 6 1:250,000 LANDSAT INTERPRETATIONS

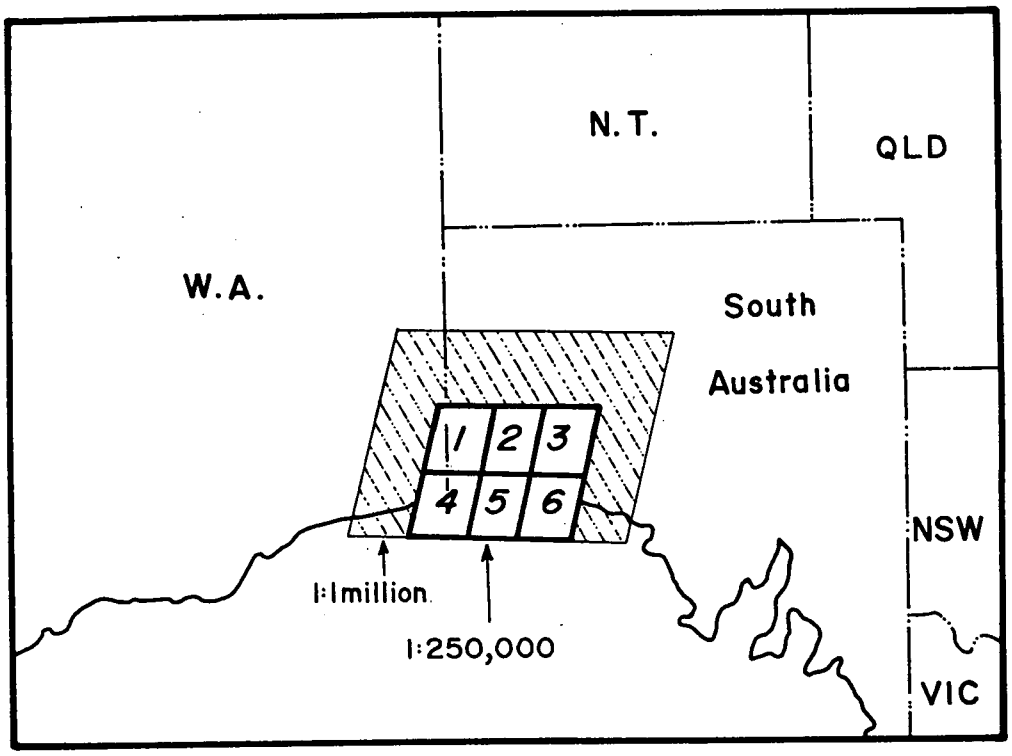


Fig. A1 Location of 1:250,000 plates and sheets

LANDSAT INTERPRETATION OF THE STRUCTURAL GEOLOGY
OF THE EASTERN EUCLA BASIN COVERING PEL 33.

00068

LIST OF PLATES

PLATE	
I	1:3 million day-pass NOAA imagery
II	1:2 million day-pass NOAA imagery
III	1:2 million night thermal NOAA imagery
IV	1:1 million Landsat imagery
V 1	1:250,000 Landsat imagery - northwest frame
2	1:250,000 Landsat imagery - north-central frame
3	1:250,000 Landsat imagery - northeast frame
4	1:250,000 Landsat imagery - south-west frame
5	1:250,000 Landsat imagery - south-central frame
6	1:250,000 Landsat imagery - southeast frame

00069

ABSTRACT

In September 1985, Lapp Resource Consultants commissioned R. Russell and Associates to carry out space photograph interpretation of the structural geology of PEL 33 in western South Australia. NOAA and Landsat imagery was used to construct photo-maps at several interpretation scales with the objective of locating structures which may be prospective for hydrocarbons.

CONCLUSIONS

The photo-interpretations were used to construct an Exploration Leads Map which high-grades the areas where key structural features coincide and represent priority areas for further hydrocarbon exploration (Fig A2). The map is the final product of all the photo-interpretations. Although many priority areas are outlined on the Exploration Leads Map, only the most important are discussed here in descending order of priority.

Lead 1

A zone of relatively intense structuring occurs on the western margin of the Mallabie Depression about 10 Km southwest of O'Malley on the Trans Australia Railway. Fracture density is very high and the fractures frequently intersect each other. Two circular anomalies lie within the area and a light tonal anomaly, possibly associated with chemical changes in the calcrete, occurs immediately to the west. It is not possible to be specific about the structural style in the lead or the likely trap mechanism. However, structural and stratigraphic traps in the area would be favourably placed to receive hydrocarbons migrating westward out of the Mallabie Depression.

Lead 2

A second very similar lead is situated 30 Km to the southeast on the eastern side of the Mallabie Depression. Again, it is not possible to be specific about structural style but the intersection of northeast trending faults (060 degrees) with north-south trends (010 degrees) may have produced the structuring here. A high fracture density and the intersection zone coincide with a circular anomaly and an area of light tone. Structural and stratigraphic traps in the lead may have been filled with hydrocarbons migrating eastward out of the Mallabie Depression.

DENMAN TROUGH

DEPRESSION

MALLABIE

Hughes

Denman

Cook

O'Malley

Watson

Ooldea

Koonalda

Possible Surface Anticline

Fracture Intersection Zone

Light Tonal Anomaly

Background Factor: Fracture Density

② Number of Superimposed Anomalies

(2) Major Leads

→ Possible Hydrocarbon Migration Path

0 10 20 30 40 km

Location

N

Fig. A2 **Exploration Leads Map**

Prepared for Lapp Resource Consultants

by R. Russell and Associates

Lead 3

A broad, low amplitude anticline mapped 12 Km to the southwest of Cook is in a good position to receive hydrocarbons from the Denman Trough. The tonal and textural anomaly which coincides with the anticline is the basis on which the structure was originally identified so it is essentially a single anomaly feature. Nevertheless it is a fairly prominent, favourably placed structure which is easily accessible in terms of road and rail links.

Lead 4

Lead 4 is near the southern margin of the Denman Trough and is located along a strong northwest trending linear. The calcrete surrounding the linear is light-toned and may be bleached by the weathering of hydrocarbon-induced pyrite in the calcium carbonate. The linear may be a fault at depth which controls a fault trap on the margin of the trough and which allows some seepage of the light hydrocarbons to the surface. The centre of the lead is only 7 Km from the Trans Australia Railway.

Lead 5

A series of three north-south trending, low amplitude, double plunging anticlines are interpreted parallel to the coast east of Koonalda. The western-most structure lies within the permit and the structure is designated Lead 5. The folding may have been produced by compression following the rifting to the south when thermal decay caused the crust to sag. The structure would be favourably placed to receive hydrocarbons migrating northward in the Cretaceous section from the depocentre to the south. The structure is easily accessible as the Eyre Highway runs across the southern part of it.

Lead 6

Curved linears and a topographic low in the south-central part of the permit suggest that a large northwest trending (320 degrees) syncline may occur in the subsurface. The flanks of the structure may control stratigraphic traps. The northeastern flank (Lead 6) is associated with major northwest linears and fracture intersections and lies near the western margin of the Mallabie Depression so it would contain better hydrocarbon propects than the southwestern flank.

Lead 7

A northeast trending light tonal anomaly is identified in the central part of the permit. The anomaly may mark the crest of an anticlinal

structure which trends parallel to the Lead 3 structure 30Km to the northwest. The tonal anomaly coincides with a circular anomaly and a fracture intersection zone in the west. This western end of the lead probably contains better prospects than the eastern section. The road (or telegraph line) from the Eyre Highway to Cook passes along the western edge of the lead.

Lead 8

Lead 8 is a large elliptical anomaly in an area of strong northeast linears and intersection zones in the east of the permit. No textural or tonal anomalies are associated with the feature. If the anomaly is an anticline or a structural high at depth, it may trap hydrocarbons migrating eastward onto the Gawler Block from depocentres in the west.

Lead 9

Circular anomalies and fracture intersections create a high-grade area in the western part of the permit. The lead is on-trend with major tonal anomalies to the southeast and northwest but no particular structural style is evident on the mapping.

RECOMMENDATIONS

It is recommended that air photograph interpretation be carried out at two levels:

a) The nine exploration leads should be examined on 1:100,000 black and white air photo mosaics to re-affirm the existence of the leads and map them in more detail. The mosaics are available from the S.A. Department of Lands. In view of the interest in the Denman area based on the results of the Denman 1 well, it would seem appropriate to begin photo-mosaic interpretation at Leads 3 and 4. Two mosaics are required: 4836 and 4936. Leads 1 and 2 should be examined next on mosaics 5136 and 5236. Lead 5 is covered by 4935, Leads 6 and 7 by 5036 and 5035 and Lead 8 by 5235. Lead 9 is on 4736.

b) The exploration leads which are confirmed by the photo-mosaics should then be examined on stereo air photographs. Stereoscopic work would probably best be left until the results of other exploration methods (EM, Radiometrics, Geochemical) are to hand and the areas high-graded on the basis of all the exploration techniques can be examined. The stereoscopic image will provide

the best possible remote sensing view of the structure and enable further detailed structural mapping to be done.

00074

CHAPTER I

INTRODUCTION

1.1 Objectives and Composition of the Study

The purpose of this investigation is to map the structural geology of PEL 33 and its surroundings from space imagery in order to delineate possible oil-bearing structures. Photomapping is carried out on two basic types of imagery; NOAA and LANDSAT. The maps are contained in the pockets at the rear of this report and consist of the following:-

a) Enclosures 1 and 2 are maps derived from day-pass NOAA imagery and night thermal NOAA imagery at an approximate scale of 1:2 million.

b) Enclosure 3 is a photo-interpretation of 1:1 million Landsat imagery designed to give a regional overview of the permit.

c) Enclosure 4 is a 1:500,000 reduction of detailed interpretations of the six 1:250,000 colour composite Landsat images which cover the permit. The six detailed interpretations from which Enclosure 4 was made are contained in a separate map folio (Sheets 1 to 6).

This report contains background information on the permit, the satellite sensors and the interpretation techniques (Chapter I). A discussion on the NOAA interpretation follows in Chapter II and the regional 1:1 million Landsat mapping is dealt with in Chapter III. Chapter IV contains discussion on the 1:250,000 interpretation.

1.2 Study Area

1.2.1 Geomorphology

The permit PEL 33 covers about 23,500 Km^2 in the Eucla Basin of western South Australia (Fig 1). The area is dominated by the Nullarbor Plain which is a flat Tertiary limestone surface. Karstic drainage has produced numerous small sinkholes or dolines which cover the surface of the plain. The thin soils developed

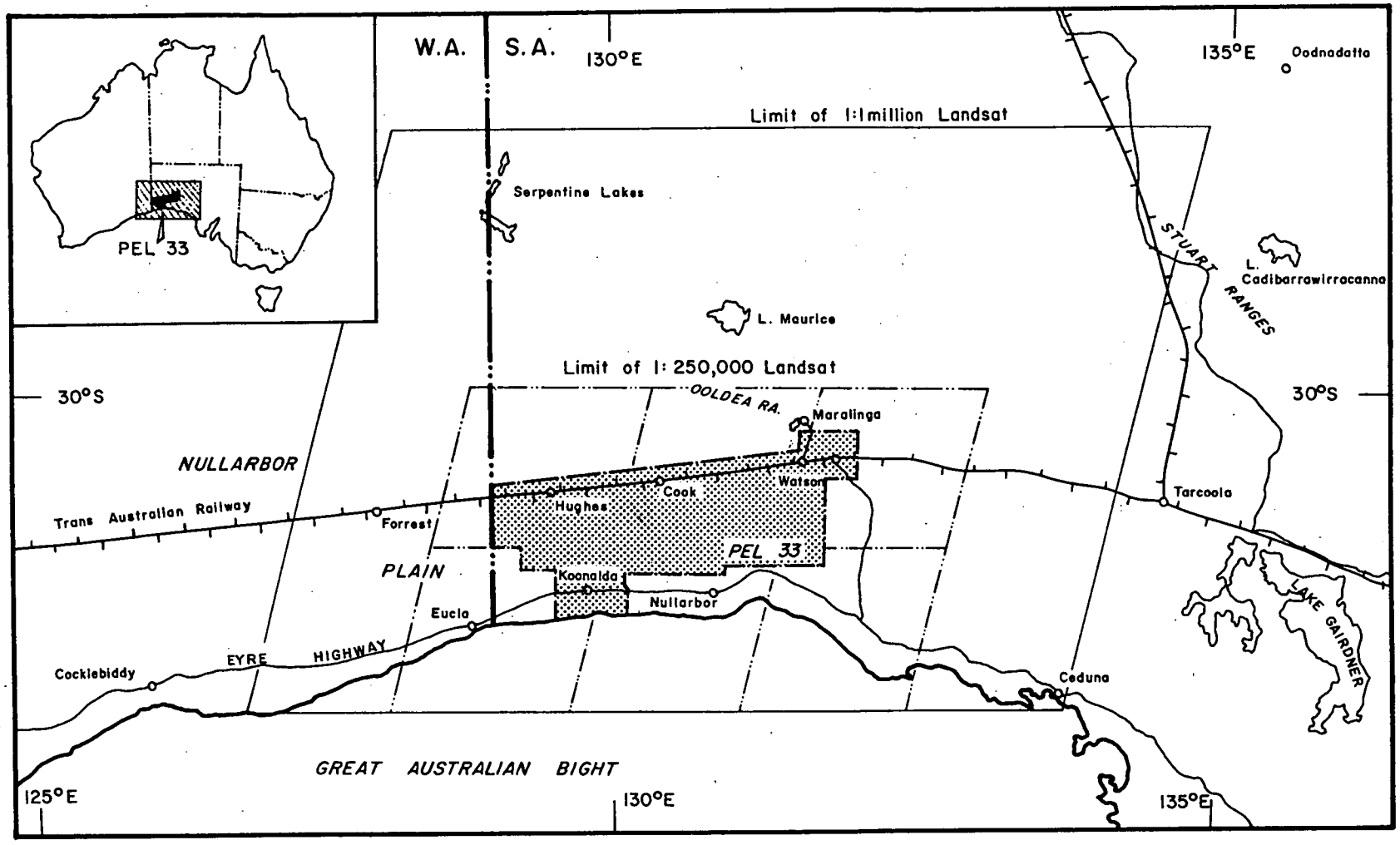


Fig. 1 Location map

000075

on the limestone usually contain strong calcrete horizons. The limestone represents the seabed deposits of a Tertiary marine transgression and many subtle shallow marine and coastal geomorphological features occur on the surface. These include bioherms in the limestone and low sandy islands near the margin of the transgression. Beaches with minor wave-cut platforms were formed along the regressive shoreline and traces of these features run northwest-southwest across the permit. At the edge of the Tertiary transgression to the north and east of PEL 33, dunefields occur which are probably the aeolian remnants of the old coastal deposits. Major palaeodrainage systems are identified beyond the margin of the Tertiary sea which are relics of a wetter period. This drainage consisted of low energy systems draining south and southwest across a flat coastal plain into the Tertiary sea. The palaeochannels are now broad shallow valleys with thick calcrete development and contain numerous salt pans. After the regression of the sea, drainage channels were developed across the limestone surface. However, these palaeochannels are weakly developed because of the porous nature of the Nullarbor Limestone, the extreme flatness of the surface and the climatic dessication which followed the regression.

1.2.2 Structure and General Stratigraphy (from Lappi, 1984; Youngs, 1974).

A general synthesis of the structure and stratigraphy of the area is given in Table 1. Basement probably consists of Archaean rocks of the Western Australian Shield in the west and the Gawler Platform in the east. Deep troughs developed on a north-northwest trend by a tectonic event before and possibly during the early Proterozoic. Later in the Proterozoic, the troughs were filled with considerable thicknesses of Adelaidean sediments and volcanics.

The present structure of the permit area is based on magnetics and gravity and is thought to consists of two troughs approximately at right angles to each other (the "Palaeozoic Troughs") separated by a basement ridge (Fig. 2). The Mallabie Depression trends north-northeast from the coast to west of Watson and contains 2 Km of sediment in the south and 3 Km in the north. The trough is identified from aeromagnetics but much of it is coincident with a gravity low. Gunn (1984) recognises the trough as a failed Proterozoic-Cambrian rift zone. The Denman

Table 1 Synthesis of Structure and Stratigraphy in PEL 33

My	TIMESCALE		STRUCTURE and STRATIGRAPHY
0	*RECENT*		
	QUATERNARY		GENTLE TILTING TOWARD SOUTHEAST AND UPLIFT. IMMATURE KARST DEVELOPS AND SOME DRAINAGE CHANNELS FLOWING SOUTH ACROSS PART OF THE NULLARBOR SURFACE.
1·8	Pliocene		
	Miocene	*TERTIARY*	SECOND TERTIARY TRANSGRESSION. NULLARBOR LIMESTONE DEPOSITED IN OPEN SEA.
	Oligocene		WEATHERING OF WILSON BLUFF LIMESTONE. CONTINENTAL RIM SUBMERGES.
	Eocene		FIRST TERTIARY TRANSGRESSION. HAMPTON SST. PIDINGA FM. AND WILSON BLUFF LIMESTONE DEPOSITED IN LAST STAGES OF RIM BASIN
	Palaeocene		MILD EROSION
65	Cretaceous	*MESOZOIC*	MARINE REGRESSION BREAKUP COMPLETED MARINE TRANSGRESSION ENTERS EUCLA BASIN FROM SOUTH AND WEST. PROBABLY PART OF A RIM BASIN ON THE RIFT HALF-ARCH. MADURA FORMATION DEPOSITED OVER LOONGANA SANDSTONE
135			RIFT DIVERGENCE BEGINS BETWEEN AUSTRALIA AND ANTARCTICA
	Jurassic		EROSION AND NON-DEPOSITION PRODUCES A FLAT LAND SURFACE
205	Triassic		
245	Permian		PROBABLE EXTENSIVE PERMIAN COVER NOW MAINLY SURVIVING IN THE PALAEOZOIC TROUGHS. THE TROUGHS MAY HAVE FORMED A SHALLOW PERMIAN SEAWAY BETWEEN THE CANNING AND ARCKARINGA BASINS. PERMIAN IN DENMAN BASIN WAS DEPOSITED IN A MARGINAL MARINE ENVIRONMENT.
290			PERMO-CARBONIFEROUS GLACIATION
	Carboniferous		
380	Devonian		NO KNOWN ORDOVICIAN TO CARBONIFEROUS SEDIMENTS BUT REMNANTS MAY SURVIVE IN PALAEOZOIC TROUGHS
430	Silurian	*PALAEOZOIC*	FIRST ALTERNATIVE-PALAEOZOIC TROUGHS: DEEP PALAEOZOIC TROUGHS DEVELOP. CAMBRIAN SEDIMENTS DOWN-FAULTED INTO TROUGHS, MUCH OF THE REMAINING CAMBRIAN REMOVED BY EROSION FOLLOWING REGIONAL UPLIFT
460	Ordovician		
530	Cambrian		CAMBRIAN SANDSTONES, SHALES AND DOLOMITE DEPOSITED IN AN ALTERNATING SHALLOW TO DEEP MARINE ENVIRONMENT. STRATA PROBABLY 300M THICK IN NORTH.
610	UPPER	*PROTEROZOIC*	SECOND ALTERNATIVE-PALAEOZOIC TROUGHS: NORTH TRENDING FAILED RIFT ZONE DEVELOPS FROM THE COAST TO NEAR WATSON. NORTHWEST BRANCH MAY HAVE DEVELOPED THROUGH HUGHES/DENMAN TO W.A. BORDER. TRIPLE JUNCTION NEAR PRESENT COAST AT NULLARBOR.
880	MIDDLE		DEPOSITION OF ADELAIDEAN SEDIMENTS AND VOLCANICS INTO BASEMENT TROUGHS TRENDING N-NW.
1640	LOWER		
2300			BASEMENT TECTONICALLY DEFORMED ALONG NORTH-NORTHWEST TRENDS WITH BASEMENT TROUGHS DEVELOPING.

00078

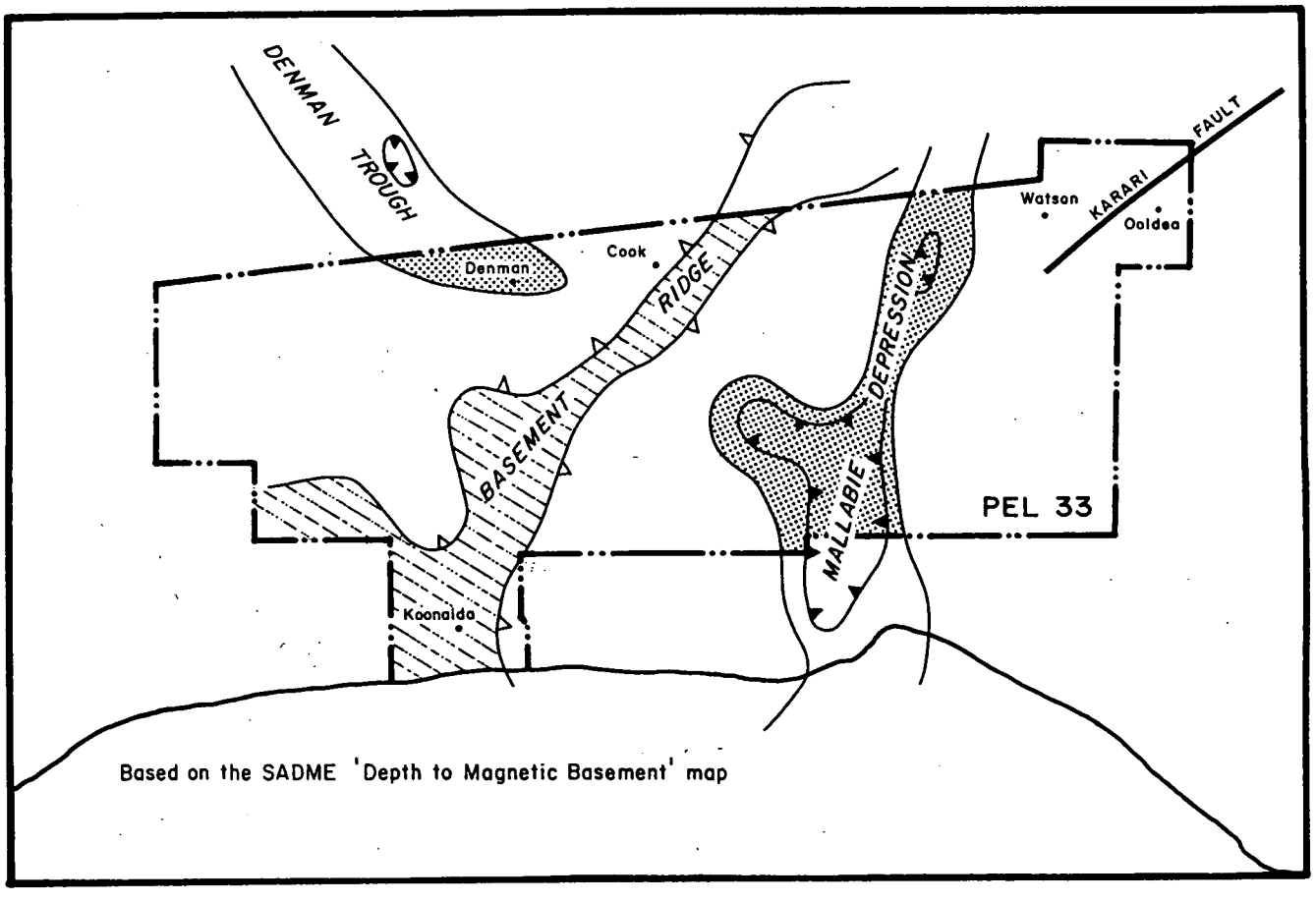


Fig. 2 Major structural elements

Trough extends southeastward from the West Australia border to the vicinity of Denman on the Trans Australian Railway line. A maximum sedimentary thickness of 2.75 Km is interpreted in the trough. Like the Mallabie Depression, the trough is an aeromagnetic feature coincident with a gravity low. Both Palaeozoic troughs have been confirmed by drilling although the basement ridge between the two troughs has not.

It is not certain when this broad structural pattern was estabished beyond the interpretation of Gunn (1984). However, the troughs do contain Cambrian shales, siltstones, interbedded sands and dolomite in the permit area correlating with the Observatory Hill Beds which outcrop in the Officer Basin. Whether the Cambrian sediments were deposited in the troughs which had already formed at this time (less likely) on whether they were down-faulted into the troughs by a later Palaeozoic event (more likely) is probably not important from the perspective of this study. The troughs probably contain the only significant areas of Cambrian sediments in the permit. The sediments are important hydrocarbon source rocks. The Ordovician to Carboniferous history of the area is unknown. It is possible that the sediments of this age in the Officer and Arckaringa Basins to the north and northeast may have spread into the area and the Palaeozoic troughs could contain the remnants of these rocks. Later in the Palaeozoic, Permian sediments were deposited in the Troughs which may have formed a seaway between the Canning Basin to the northwest and the Arckaringa Basin to the northeast. Only small areas of the Permian cover survived the Mesozoic which was an era of non-deposition and probably erosion. It was onto a flat land surface that the early Cretaceous shales and silts of the Madura formation were deposited during a marine transgression initiated by the breakup of Australia and Antarctica in the Late Jurassic - early Cretaceous. The transgression entered the permit area from the south and west and deposition began with non-marine sands and conglomerates which lie below the Madura Formation. From the Cretaceous isopach's it appears that the Palaeozoic troughs had no effect on the thickness of this Mesozoic or subsequent sedimentation. Deposition ceased during the Upper Cretaceous when a marine regression occurred and mild erosion took place. Gentle downwarping began in the Eocene in the permit area and sedimentation began again with the marine Hampton Sandstone in the west and the terrestrial Pidinga

Formation in the southeast. The transgression spread and the Wilson Bluff Limestone was deposited in quiet seas. Regression followed and weathering of the Wilson Bluff Limestone took place in the Oligocene before a second Tertiary transgression occurred in the early Miocene. The Nullarbor Limestone was deposited at this time over large areas of the shelf in open seas with good circulation. Since the Middle Miocene, the Eucla Basin has been slightly tilted toward the southeast and uplifted above sea level. The present land surface reflects post Miocene karst development and calcrete formation. Aeolian landforms have developed along the coast and on the inland margin of the Miocene transgression.

The Tertiary and Cretaceous marine transgressions were probably the result of tectonic events associated with the rift divergence zone along the line of breakup between Australia and Antarctica which lay to the south (Veevers and others, 1982; Fig 4). The first Cretaceous deposits were non-marine (basal sandstones and conglomerates) which may indicate that the position of the permit area was initially within the rifted arch zone above sea level. With the break up at 95 Ma, basins on the rift arch were succeeded by rim basins and the Madura Formation was deposited in a relatively enclosed quiet sea restricted by the continental rim. The Cretaceous in the permit area represents the landward wedge-out of a much thicker section to the south where the Ceduna depocentre of the rim basin may contain 8 Km of sediments. Cretaceous sedimentation in the permit area was ended by a marine regression which may have been related to uplift caused by a late thermal pulse in the (by now) half arch. The Tertiary transgressions were probably the result of thermal decay of the continental margin which led to gentle tilting of the area toward the south. The environment of sedimentation during the first of the transgressions in the Eocene (the Wilson Bluff Limestone) was a quiet, restricted sea which suggests that the continental rim to the south was still above sea level. The second Tertiary transgression in the early Miocene produced open seas with good circulation suggesting that the rim had submerged below sea level in the Oligocene. Subsequent uplift of the Eucla Basin may reflect minor isostatic or thermal rebound and the process of uplift appears to be continuing to the present (Fig. 6).

00081

1.3 Data Sources

1.3.1 Imagery

a) NOAA

The NOAA series of satellites are near-polar orbiting spacecraft with an altitude of 870 to 930 Kms and an orbital period of 102 minutes, resulting in approximately 14 orbits per day. The two satellites operational at present, NOAA-7 and NOAA-9 cross Australia between 0330 hrs to 0340 hrs (night-pass) and 1530 hrs to 1540 hrs (day-pass). The sensor on board the satellites is the Advanced Very High Resolution Radiometer (AVHRR) which is a five channel multispectral scanner with a ground resolution of 1.1 Km at nadir and 5.5 Km near the scan limit. The swath width of the scanner is about 2,900 Km wide. The five spectral channels of the AVHRR are in the visible part of the E.M. spectrum (0.55-0.68 microns), the near infra-red (0.725-1.10), the mid infra-red (3.55-3.93), and the two thermal infra-red windows (10.3-11.3 and 11.5-12.5).

The NOAA imagery used in the present study includes both day-pass and night-pass data. The day-pass imagery was obtained from two different satellite passes. Many different computer treatments were applied to the data to obtain the best enhancement effect. Generally, colour composite imagery was generated by projecting each of the three primary colours through three images created from the spectral channels. Channels giving the best result are often one, two and four. Good visual results are often obtained by creating a new channel from the ratioing of two channels. Two of the computer treatments were selected for photo interpretation and are presented as Plates I and II. The colour balance and tones are similar but the scale is about 1:3 million on Plate I and about 1:2 million on Plate II. The interpretation of the day-pass NOAA is presented on Enclosure 1 and is based on Plate II but includes data from the other day-pass images. The night-pass imagery consists of data from a single band in one of the thermal infra-red channels (Plate III). Shades of green are used to represent the different surface temperatures. Shades of light green to white are used to represent cool temperatures and the darker tones represent warm surface temperatures. The temperature range is relative and the absolute ground

temperatures are not known. The scale of the image is about 1:2 million and the interpretation is found on Enclosure 2. Both the day and the night-pass imagery are distorted by the look-angle of the AVHRR sensor and no attempt has been made to correct the distortion.

b) Landsat

The Landsat imagery used here is of two types : black and white photographs at 1:1 million and colour composites at 1:250,000. The 1:1 million imagery is "quick look" monochromatic prints from the Landsat 2 and 3 spacecraft. Six scenes cover the PEL 33 and these, together with nine surrounding scenes, are mosaiced together to form Plate IV. The interpretation of this regional imagery is found in Enclosure 3. The 1:250,000 imagery is the standard colour composite product supplied by the Australian Landsat Station and is of high quality. The images are a composite of band 4 (visible green) which is in blue, band 5 (visible blue) in green and band 7 (near infra-red) in red. The six scenes covering PEL 33 are designated Plate V 1 to V 6 and the photo interpretations are on Sheets 1 to 6. The sheets 1 to 6 are joined together and reduced to 1:500,000 to produce Enclosure 4. The enclosure is a relatively small and manageable map which is used in this report in preference to the six large sheets.

1.3.2 Publications

The BMR 1:250,000 geological map sheets of Coompana, Cook, Nullarbor and Ooldea were consulted during the interpretation together with the 1:1 million geological and gravity maps of western South Australia. Published papers used in the mapping and in the preparation of this report are listed in the References section.

Considerable use was made during the preparation of this report of the document "Application for Petroleum Exploration Licence, Vacant Area, Western South Australia" by D.W. Lappi. The volume formed the basis of the original application for PEL 33 and was used here for background information.

1.4 Technique

00083

The basic principles of geological photo-interpretation apply to the interpretation of Landsat imagery except that stereovision is absent. Photo-tones and textures and the associations between geomorphological features are the basic elements used in constructing the maps. Land surfaces with different characteristics are mapped from the photo-tones and textures. Photo-linears are mapped on the basis of linear or curved elements in the topography. Emphasis is given to those linears which cannot be satisfactorily explained on the basis of the geomorphology alone and can be interpreted as faults or joints. Associations of features are important. These may include a straight section of river channel, coastline or cliff face, a straight row of small residual hills or spurs which terminate along a straight line. Photo-tones are also a significant factor in mapping linears. A fault may be surrounded by a zone of brecciation or shearing which increases the groundwater holding capacity of the rocks. The clays associated with the shear zone and the relatively prolific vegetation growth will tend to create a slightly darker photo-tone along the trace of the fault. The weight and continuity of the mapped linears represents an assessment of the relative importance of the linears on the photographs as shown on the keys to the sheets and enclosures. It is not usually possible to interpret the nature of the photo linears from the imagery. However, in some instances the topography associated with the linear suggests that it is a fault with a certain direction of throw or lateral displacement and this is indicated on the mapping. In addition to the photo linears it is possible to map anticlines and synclines from tones and textures and the associated topography.

The compass bearing and references to the "trend" of the linears and the axes of structures are given only for the two northern quadrants of the compass. That is, from west (270 degrees) through north (000 degrees) to east (090 degrees). No reciprocal bearing is given in the southern quadrants to de-clutter the text.

00084

CHAPTER II

NOAA INTERPRETATION

2.1 Day-pass Imagery Interpretation

The day-pass NOAA imagery was obtained from two satellite passes and the computer screen projections of the different data treatments were photographed onto 35mm slide transparencies. Colour prints were made from two of the slides which showed the most clarity and detail (Plates I and II). Plate II is used as a basis for interpretation here (Enclosure 1). The Nullabor Limestone of the Eucla Basin has a variety of surface tones from white through to grey. Some of the darker tones appear to related to areas of slightly lower topographic elevation while the lighter tones may correspond to light toned, freshly weathered calcrete in higher areas. The coastal strip has a dark tone and dark red areas occur corresponding to green vegetation communities which probably obtain their moisture from coastal fog. Very light tones correspond to the coastal dune systems and the salt pans in the interior. Inland from the Eucla Basin, the veneer of aeolian sand on the edge of the Tertiary transgressions and across the Officer Basin and Gawler Block has a brown signature on the day-pass imagery. There are several important aspects of the day-pass NOAA which have bearing on the structural geology and which are obscure or not evident on the other forms of imagery. They are the tonal pattern of the Nullarbor Limestone, diffuse west-northwest trending linears in the central Eucla Basin, major linear trends and circular anomalies.

2.1.1 Tonal pattern of the Nullarbor Limestone

The dark grey and red colour of the coastal strip is the signature of relatively dense vegetaion watered by the coastal fog banks and is a common feature of desert coastlines. The grey tones represent old dry vegetation and the red tone corresponds to new green growth. Further inland, the tone of the limestone surface is probably more structurally significant. A broad area of relatively dark-toned limestone lies in the centre of the image. It is thought likely that this dark surface is topographically lower than the surrounding light coloured

limestone for two reasons:-

a) Spot heights taken by the BMR during a geophysical survey indicate that the darker area may be up to 15m lower than its surroundings.

b) A palaeochannel associated with darker tones runs east-southeast from the edge of the Eucla Basin towards the dark toned area near Denman. The palaeochannel is referred to here as the "Denman Palaeochannel".

The dark tone may therefore reflect thin terrestrial superficial deposits resting on top of the limestone in a very broad topographic low. The limestone at slightly higher elevations is being weathered and actively eroded to give the lighter signature on the imagery. The tonal contrasts are also evident on the other imagery but are not as starkly represented as on the day-pass NOAA. The writer feels that the general principle of light tones being high ground (and therefore areas of possible relative uplift) and the dark limestone tones being low ground (and therefore areas of possible relative downwarping) can be sustained in the interpretation of the other imagery. From the present imagery, the broad area of dark tone may be a structural low as well as a topographic low and may be the Tertiary depocentre of the Eucla Basin.

2.1.2 Diffuse West-northwest Trending Linears

Diffuse west-northwest trending linears enter the permit area from the west. The linears are paired into sets of two and three main pairs are identified (sets 1 to 3, Enclosure 1). The linears are enigmatic in terms of structural geology but the following characteristics may be significant:-

a) The sets are extremely linear, they run parallel to each other and can be mapped for up to 200 Kms. The set pairs are about 8 Km apart.

b) The linears are light-toned features and may terminate in the dark-toned limestone at the centre of the image.

c) The linears appear to influence the western edge of the dark area with "embayments" of dark tone on the northern side of the linear sets.

d) The linears run approximately parallel to the Denman Palaeochannel to the north.

e) Even by NOAA standards, the traces of the linears are diffuse.

f) Sections of the sets 2 and 3 are mapped from Landsat but the linears are more striking on this day-pass NOAA imagery.

The linears are tentatively interpreted as geomorphological features. They may be beach ridges or other marine depositional features left by minor still-stands in sea level during the Late Miocene regression. The dark tone area may have been an enbayment at this time and the regression took on a different character to the east thus the beaches terminate here in the embayment. This interpretation does not account for all the features of the linears as listed above.

2.1.3 Major Linear Trends

Several major northeast trending linears occur on the day-pass NOAA imagery which are not evident on the other imagery. The linears are marked 1a to c on Enclosure 1 and cross the western part of PEL 33. Linear 1c is particularly strong on the NOAA imagery. It is felt that the linears are important for two reasons:-

a) They are on-trend with the eastern edge of the Officer Basin to the northeast and may reflect the southwestern extension of this Palaeozoic margin subcropping below the Tertiary sediments.

b) The Denman Trough terminates to the southeast against a postulated northeast trending basement ridge (Fig 2). The linears 1a and c are almost directly on-trend with the northwestern edge of this feature.

Other linear trends on the day-pass NOAA are mapped on the Landsat but the significance of the linears is reinforced by the present imagery. In particular, these linears are the strong north-south elements just west of the W.A. border (2) and the strong east-west trend to the north of the Head of the Bight (3).

2.1.4 Circular Anomalies

Circular anomalies mapped from day-NOAA are much larger in scale than those interpreted from other imagery. A particularly prominent circular anomaly is mapped in the eastern part of the permit (C1). The curved linear traces by which the feature is identified are light-tone features and the total diameter of the anomaly is about 100 Km. The light and dark tonal anomaly pattern of the Nullabor Limestone appears to be unrelated to the anomaly and there is no trace of the feature on the Landsat imagery. The anomaly may reflect a large structure in the Gawler Block which forms basement here but beyond this, the origins of the anomaly are obscure. Further east, a similar but smaller semi-circular anomaly occurs on the edge of the Eucla Basin (C2). More complex curved linears are mapped here on the 1:250,000 Landsat, (Enclosure 4) and these, together with the C2 anomaly are thought to be produced by drape and compaction of the Mesozoic and Tertiary sediments over the basement topography.

2.2 Night-pass Imagery Interpretation

The night-pass NOAA imagery was obtained from the 0330 hrs pass of the satellite which obtained the data in the far (thermal) infra-red part of the E.M. spectrum. The imagery is of a high quality (Plate III) although some east-west compression of the data remains on the photography. Resolution ranges from about 2 Km on the western edge of the permit to about 4 Km towards the eastern side. The imagery shows the effects of wind streaking which has created a north-south grain. Winds blowing at the time of photography have the effect of creating "warm" streaks behind topographic obstacles which shelter downwind area from the wind and "cool" streaks in exposed areas. The photo-tones relate closely to the temperature of the surface materials and changes of 0.2 degrees C are detected. The light shades represent cool temperatures and the darker tones are the warm areas. Water surfaces appear very warm on the imagery due to the high thermal inertia of water. The imagery depicts a warm fog bank along the coast which extends a considerable distance inland near the centre of the image and obscures some of the surface.

00083

2.2.1 Thermal Pattern

Much of the surface of the Nullarbor Limestone has a cool thermal signature. The calcrete which forms the surface in these areas probably has a high albedo, reflecting much of the solar radiation during the day and remaining relatively cool at night. Within the cool surfaces are several very cool areas which are thought to be the floodout areas of palaeodrainage systems (1 to 4, Enclosure 2). Warm signatures characterize the central part of the permit in an area corresponding to the dark tone limestone of the day-pass imagery. The warm signature here could be the result of greater absorbtion of solar energy by the dark surface materials. Warm signatures also characterize the marginal Eucla Basin sediments and the marine deposits at the limit of the Tertiary transgression. The marginal Eucla sediments have a greater proportion of clastic material than the basinal deposits and the presence of clay and sand in the carbonates would change the thermal properties of the surface near the basin margin. A strong warm linear anomaly is located along the Tertiary Eucla coast in the Maralinga area (5) and a thermal edge continues westward which follows the same palaeoshoreline (6). The Eucla coastline at 5 is represented by a wave-cut platform and it is this rock-cut feature which appears so warm on the imagery. Westward to Lake Ell, the old coast forms a very distinct thermal edge with warm surfaces to the south and cooler surfaces to the north. It is thought that a deep-weathered early Tertiary land surface was established in this area prior to the later Tertiary transgressions. The transgressions eroded the surface particularly near the Tertiary coastline and resulted in clastic deposition along the margin of the sea as mentioned above. The undisturbed old land surface to the north now appears cooler than the more recent Eucla surface to the south.

2.2.2 Thermal Linears

Much of the north-south linear grain is probably related to wind streaking and so the mapping of linears in this direction is done with caution. The major linears on the thermal imagery are also mapped on the Landsat. However, like the day-pass NOAA, the present imagery tends to provide reinforcement for the Landsat linears. A major north-south linear (7) appears to control a palaeo-floodout to the west of the permit. Strong north-south

linears are mapped here on the 1:250,000 Landsat. North-northeast trending linears cross the eastern part of the permit (8a to d, Enclosure 2). These linears correspond to trends mapped from the Landsat at 020 degrees but generally, the major Landsat linears here lie at 060 degrees. It is not clear why the 060 degree linears are not imaged by the thermal data. The linear margins of the Eucla Basin in the north (linear 5 and 6) are a strong feature of the thermal imagery. Linear 5 corresponds to the Ooldea Ranges and runs parallel to other major northwest linears on the Landsat interpretation (Enclosure 4). Although consisting of erosional (wave cut) and depositional (beach and sand-bar) features of the Tertiary coast, the ultimate control on the position of the coast is possibly a major basement fault. Linear 6 is more diffuse and forms a thermal edge as discussed above. However, it is also extremely straight and may represent a hinge-line along which the uplift associated with the rift-arch to the south terminated. The hinge would tend to control the position of the northern coast of the rim basin.

CHAPTER III

1:1 Million LANDSAT INTERPRETATION

3.1 Imagery

The 1:1 million Landsat imagery (Plate IV) is a mosaic of fifteen black and white "quick look" prints. The prints are not computer enhanced or tone corrected. No overlap is provided in a north-south direction so the photographs are butt-joined in this direction. The quality of the photography is good to excellent with a considerable amount of detail evident.

3.2 Area

The intention of the 1:1 million interpretation is to provide a regional overview of the PEL 33. The southern Officer Basin and the western Gawler Block are included in Plate IV in order to obtain the structural context of the eastern Eucla Basin. The area covered by 1:1 million imagery is shown in Fig 1. Beyond the Eucla Basin to the north and east is an old Tertiary land surface much of which has been virtually erosionally and tectonically undisturbed since its formation. The surface is being destroyed by erosion in the northeast where uplift has created the Stewart Ranges in central South Australia. The Nullabor Limestone forms a smooth, light toned surface in the southwestern part of the Plate. The limestone merges with darker, rough textured marginal facies of the Eucla Basin to the north and east and the old Eucla coastline is recognisable in many places.

3.3 Interpretation

The 1:1 million interpretation is presented on Enclosure 3. The discussion concentrates on two aspects of the mapping; linears and regional warping.

00091

3.3.1 Linears

a) Eucla Basin Margins and Linears to the North and West

Major linear trends characterize the northern margin of the Eucla Basin (1 and 2). These linears are evident on the night-pass NOAA imagery (5 and 6) but on the present imagery they are represented by sets of wave-cut platforms and beach ridges. This edge of the Tertiary transgression is straight over very long distances (linear 1 is 200 Km long and linear 2 at least 240 Kms). As discussed in the section on the night-pass NOAA, the straight coastline probably reflects deeper basement control but it is not possible to be more specific. The eastern part of the Eucla coastline appears to be controlled by a linear (No. 3) parallel to linear 1 (310 degrees) but displaced right laterally from it in the Lake Ifould area. Further south, other linears lie parallel to linear 3 (e.g. no. 4) and the present coastline east of the Head of the Bight is oriented in the same direction (5, 310 degrees). Beyond the study area to the northwest in W.A. major structural features such as the Anketell Gravity Ridge and the edge of the Proterozoic Bangemall Basin share the same trend as these northwest linears suggesting that they are part of a significant, although obscure, trans-Australia trend.

Beyond the Eucla Basin, in spite of the very subdued relief of the Tertiary land surface, several major linear trends are identified. These trends are important in that they underlie the permit area and may control the pre-Mesozoic structure as discussed in the next section. To the east and northeast, across the western Gawler Block and the southwestern Arckaringa Basin (Tallaringa Trough), linears trend northwest (310 degrees to 320 degrees; linears 6 a to c), parallel to the edge of the Eucla Basin, and northeast (060 degrees). The northeast linears include the Karari Fault between the Gawler Block and the Tallaringa Trough (7a) and other faults in the Gawler Block (7b and c). The northeast trend swings to the north-northeast (030 degrees; linears 8 a to c) on the margin of the Officer Basin and the Tallaringa Trough. To the north of the Eucla Basin in the southern Officer Basin, the 030 degree trend continues (8d) but the 060 degree trend again becomes strong to the west (9a and b). In this area, north-northwest linears (330 degrees to 340 degrees; 10a and b) become prominent.

b) Eucla Basin Linears

Northwest trending linears (310 degrees) form a structural grain across this part of the Eucla Basin (11a to e). Many of these linears are beaches left behind by the final Tertiary regression so they effectively run along the topographic contours of the Tertiary sea bed. Linear 11d appears to be a fault or hinge controlling the margins of tonal anomalies and the behaviour of subsurface drainage. In the northwest, strong northwest trends run parallel to the trends in the southern Officer Basin (330 degrees; linears 12a and b). Diffuse west-northwest trending linears (285 degrees) identified on the day-pass NOAA (section 2.1.2) are evident on this Landsat. As on the day-pass NOAA, they form "rails" of light toned linears but the present imagery sheds no further light on these obscure trends.

Northeast trending linears are mapped in the eastern part of the Eucla Basin. The trends reflect the northeast faulting beyond the margin of the basin with 060 degrees linears in the south-east (13a to c) parallel to the Karari Fault and linears at 030 degrees in the north and northeast (14) parallel to the trends on the eastern edge of the Officer Basin.

These linears all reflect Basement and Palaeozoic trends ghosting through the Tertiary cover. Possibly the only linears which represent faults active during the Tertiary to Recent are the north-south trends. There are two reasons for this suggestion:

a) Very few north-south linears are identified in the older rocks to the north and east.

b) North-south faults in the W.A. part of the Eucla Basin form minor fault scarps in the Nullarbor Limestone indicating very late movement in this direction.

A strong north-south linear, probably forming a scarp, occurs to the west of the permit (15). Strong north-south trends occur to the north of the permit (16a to c) and in at least one place, appear to control the palaeodrainage (16b). The trends continue southward into the permit but they are not a dominant feature on the 1:1 million imagery. The north-south faulting is probably

00093

produced by the Mesozoic rift arching which may have resulted in north-south extension (Fig 3). The down warping in the Tertiary may have produced compression which reversed the movements on the faults and possibly created folds along the coastal strip (see next chapter).

3.3.2 Regional Warping

The formation of the Eucla Basin was coincident with and immediately subsequent to, the break-up of Australia and Antarctica which began about 95 Ma. The tectonic events during the breakup can be used to explain major elements in the formation of the basin (Fig 4a to c). The features related to regional warping interpreted from the present imagery are associated with the tectonic events from the Tertiary to Recent.

a) Regional Tonal Anomalies

The NOAA data showed a broad dark tonal area in the centre of the permit which was thought to correspond to a topographic low. The same dark tone occurs on the 1:1 million Landsat and the area may correspond to a zone of "least uplift" in this part of the Eucla Basin. The dark tonal anomaly corresponds approximately to a broad gravity low (Fig 5). The relative sag in this part of the continental margin could reflect a deeper sedimentary section here which is lower because it has been slightly more compacted.

b) Coastline Changes

The present coastline contains evidence of tectonic movements (Fig 6). West of the W.A. border is a fossil wave-cut cliff line which lies progressively further from the present coast toward the west. The feature probably reflects an up-warp which has a maximum amplitude to the west and minimum near Eucla on the W.A. border. Here, the hinge of the uplift may be the major fault 11d which reaches the coast at precisely this point.

00094

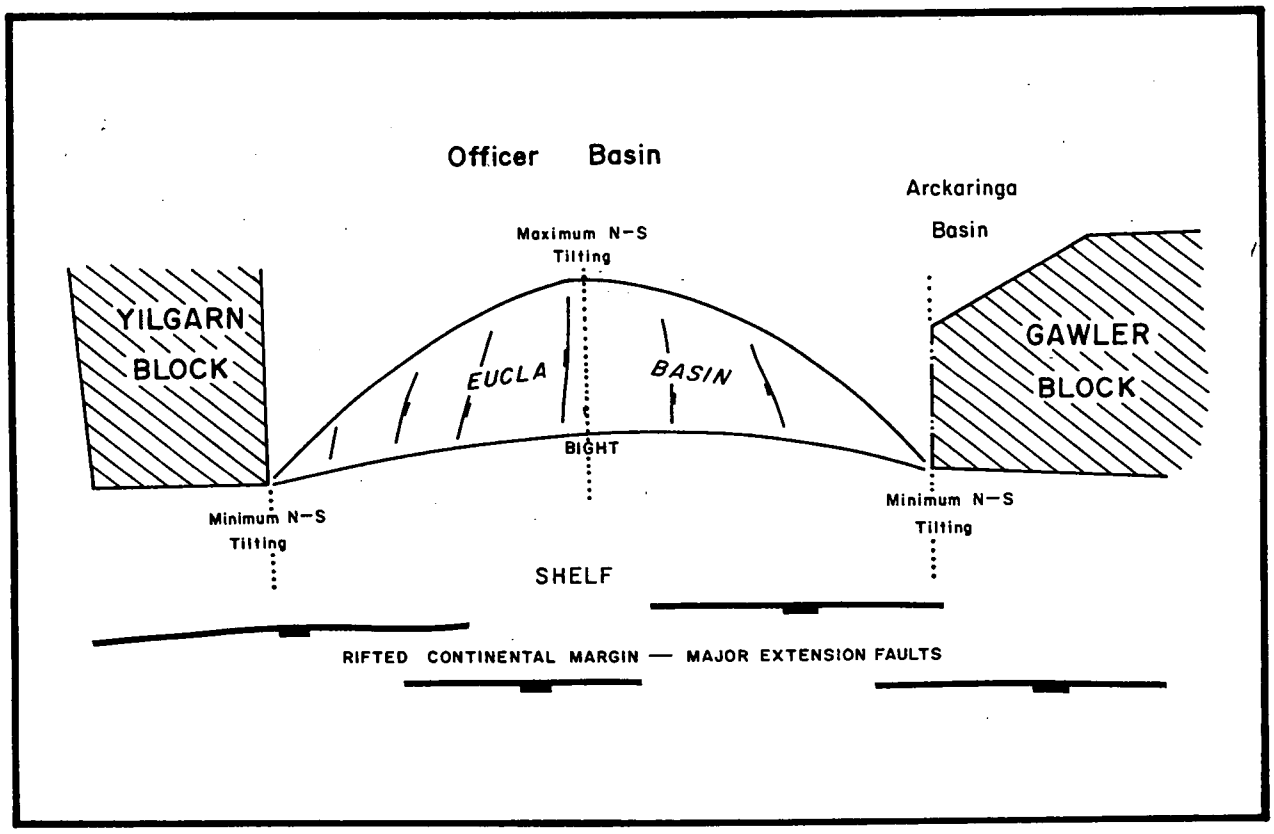


Fig. 3 Formation of north–south faults in the Tertiary Eucla Basin

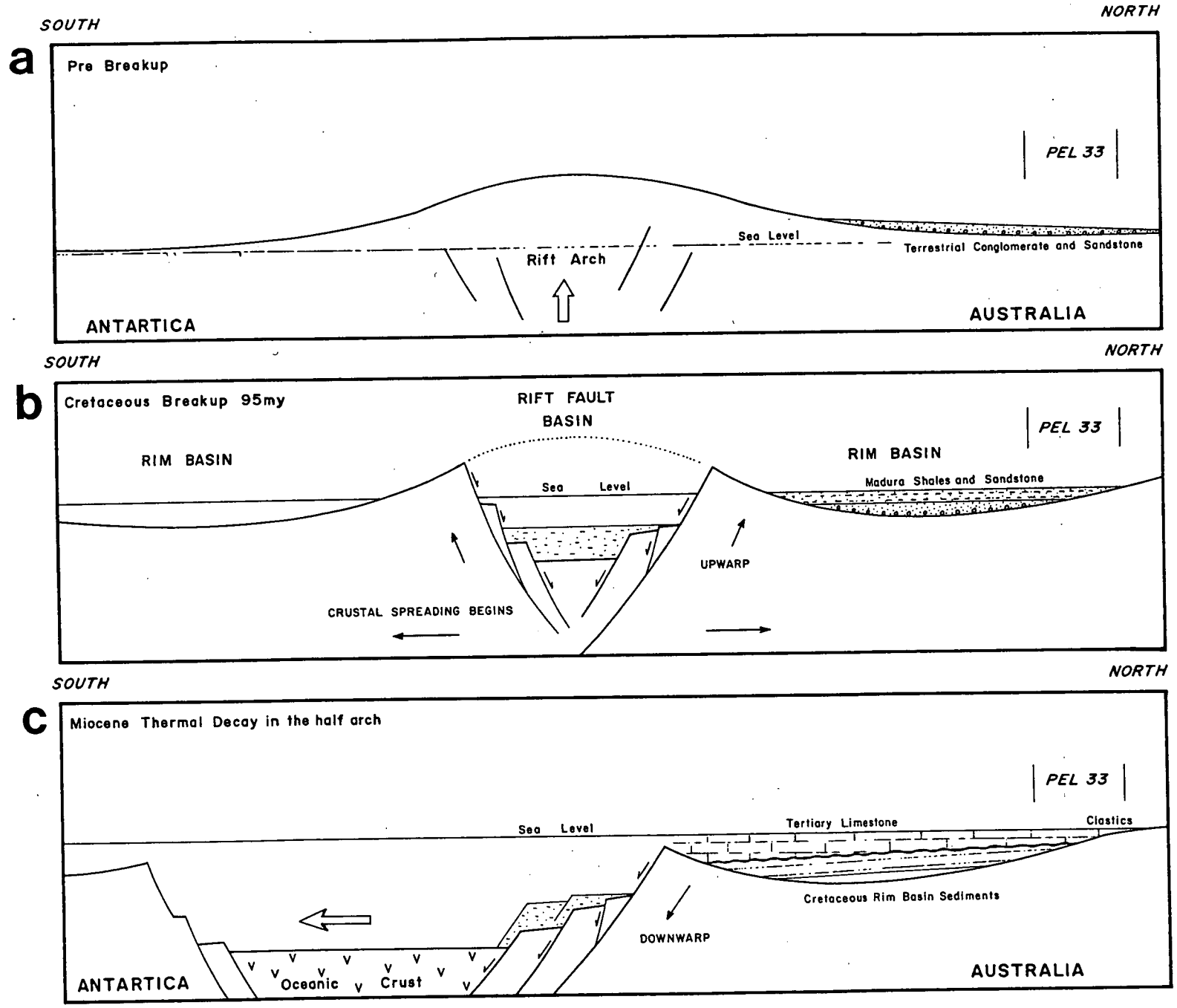


Fig. 4 **Stages in divergent rifting between Australia and Antarctica**

a. Initial arch
b. Faulted rift basin with rim basins
c. Half arch subsides following thermal decay

00096

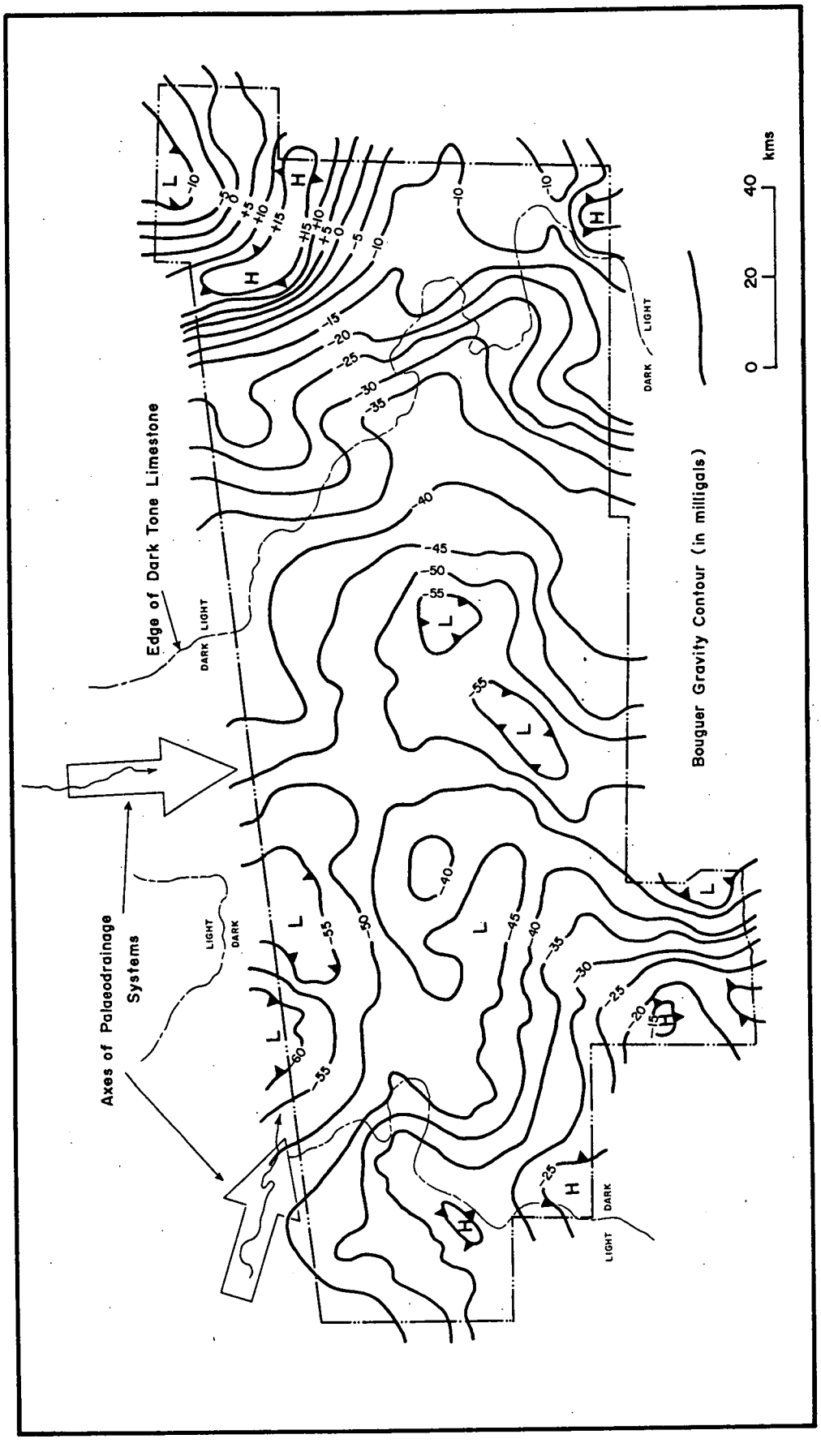


Fig. 5 Bouguer anomalies in relation to dark tonal area in PEL 33

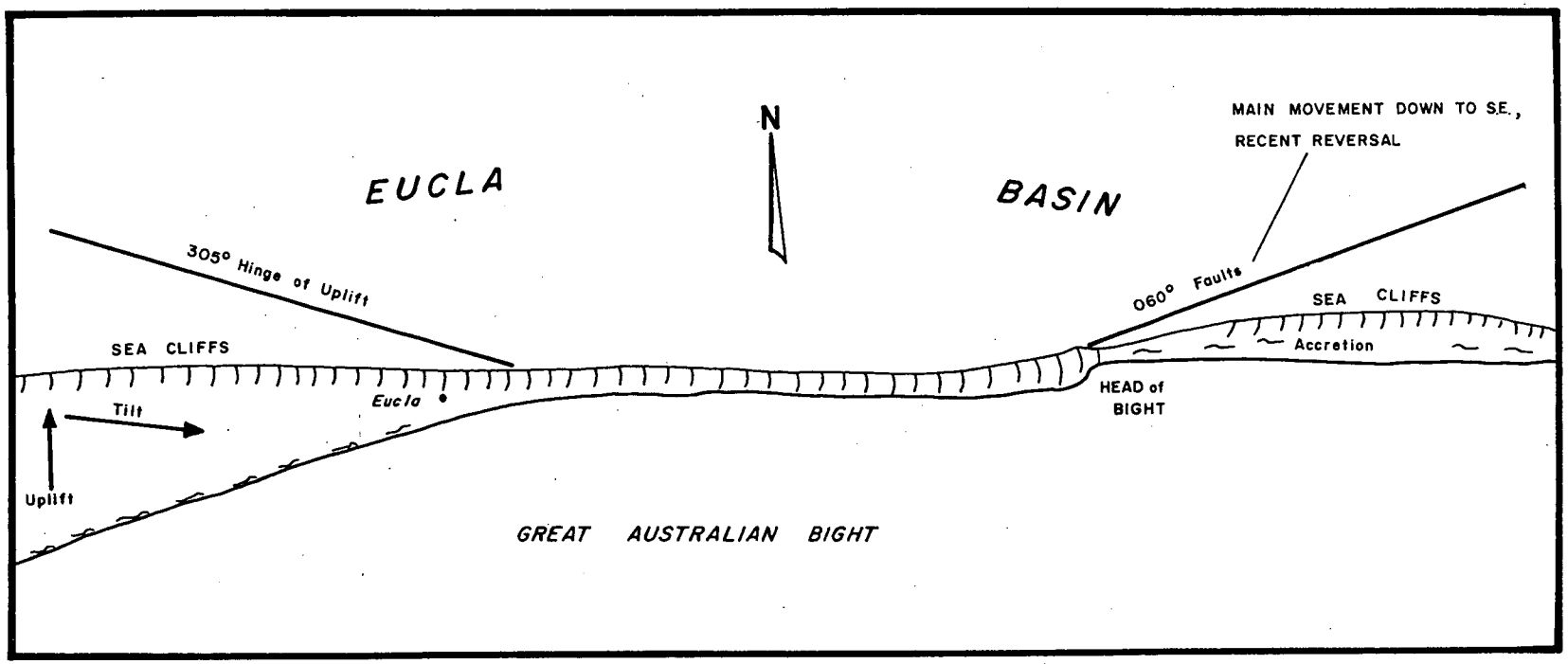


Fig. 6 Tectonic movements in relation to the shape of the coastline

The coast to the east of the Head of the Bight is accretionary. A line of old sea cliffs lies about 15 km inland. Uplift has also occurred along this section of the coast but the movement appears to be related to faulting rather than tilting. A minor recent reversal of movement along northeast trending faults which reach the coast at the Head of the Bight is probably responsible (Fig 6).

CHAPTER IV

00099

1:250,000 LANDSAT INTERPRETATION

4.1 Introduction

Six Landsat frames cover the PEL 33 (Fig 1). Photo interpretation was carried out on the six frames and are included in the separate map folio accompanying this report (Sheets 1 to 6). To make the 1:250,000 mapping more easy to manage in this report, the sheets are reduced to 1:500,000 and mosaiced together to form Enclosure 4. The information on the enclosure is identical to that on the original 1:250,000 mapping.

4.2 Fracture Pattern

The basic elements in the mapping are the photo linears of which several orders of magnitude are interpreted on the basis of their clarity on the photographs (see key to sheets).

4.2.1 Linear Categories

a) Minor Linears

Many short, discontinuous linears are mapped. Many of these are thought to be geomorphological and relatively insignificant in terms of deeper structuring. Others are likely to be joints or small extension faults in the Nullarbor Limestone which formed during lithification. Although such linears may be preferrentially orientated parallel to deeper fracturing, they are essentially meaningless in terms of interpreting deeper structure.

b) Linears and Major Linears

Linears which may represent faults or other structures at depth are mapped as heavy continuous or near-continuous lines. Generally it is not possible to interpret the precise nature of the linear but in some cases, this is attempted.

4.2.2 General Pattern

Linears and major linear lengths were measured in the permit area, their orientation noted and a rose diagram was constructed (Fig 7a) representing the vectors of length and orientation in the northern quadrants of the compass. No reciprocal vectors are drawn for the southern quadrants. The same data were used to construct a histogram representing the percentage frequency of linear occurrences in nine 20 degree classes from west (270 degrees) through north (000 degrees) to east (090 degrees) (Fig 7b). The contribution of major linears to the total percentage frequency is shown by the shaded area in each column.

Preferred linear orientations are broadly spread between 310 degrees (north west) and 070 degrees (east-northeast). Major linears peak in the 330 degrees to 350 degrees class (parallel to the northeastern edge of the Eucla Basin) while less prominent linears peak in the 010 degrees to 050 degrees classes. The wide spread of the linear orientations together with the large size of the permit suggests that several different structural regions are represented in the data. Visually, structural regions are not immediately apparent on the photo-map and this problem will be addressed in the next sub-sections.

4.2.3 Fracture Density Analysis

A fracture density map was constructed with two objectives:-

a) To form the basis of a regional fracture pattern analysis
b) To delineate areas of high fracture density where hydrocarbon fracture reservoirs may occur.

The map (Enclosure 5) was constructed by overlaying a 6.5 Km grid over the 1:250,000 interpretations and counting the linears (excluding the geomorphological trends) in each 42.25 Km^2 square.

The resultant values were then contoured. Attention was given to the underlying linear pattern during contouring and with this subjective element, a more realistic pattern was obtained. The map is presented as Enclosure 5.

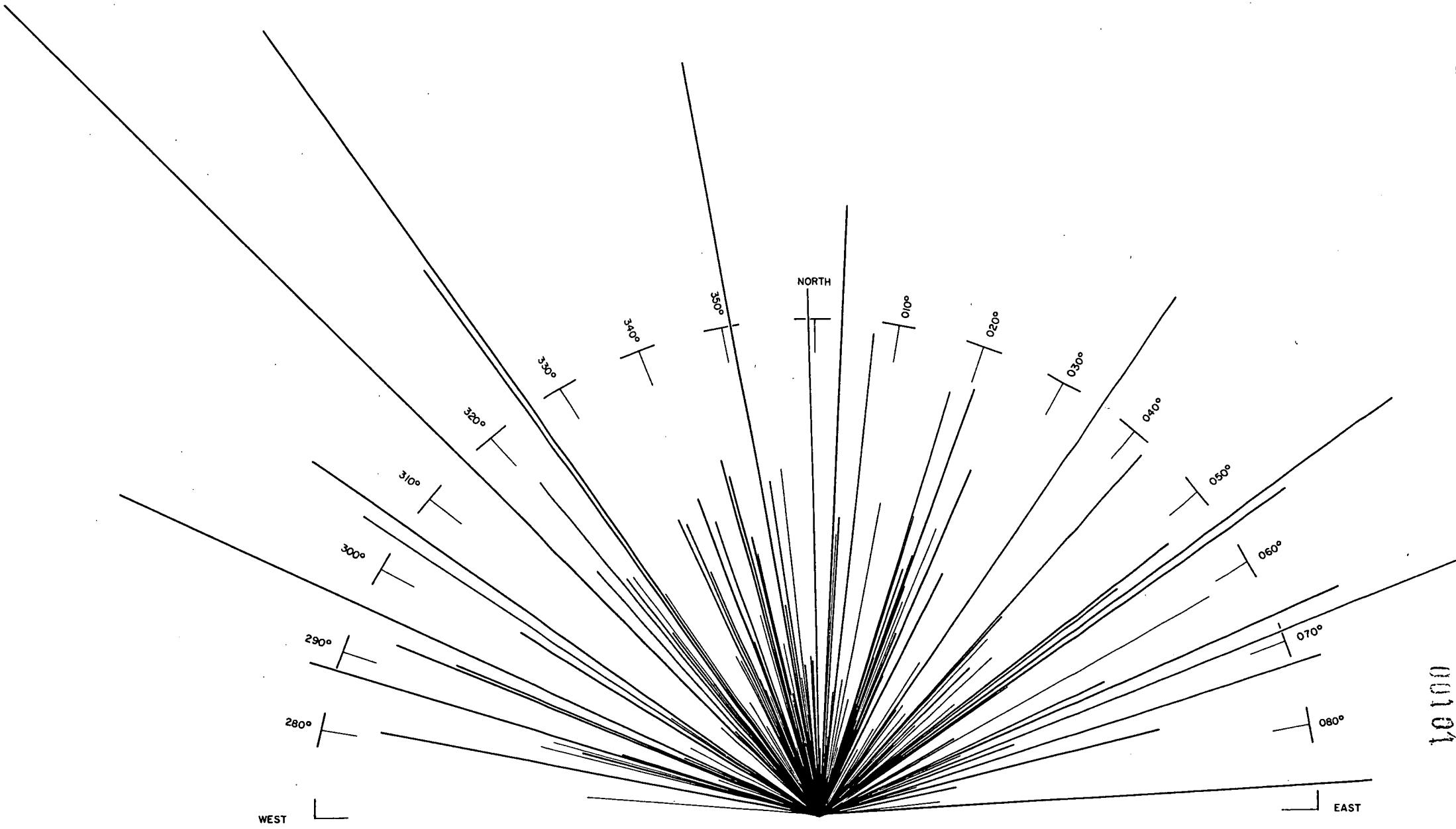


Fig. 7a Rose diagram of linear vectors (length and direction)



Fig. 7b Frequency histogram

The fracture density map shows that fracture density varies considerably across the permit. The density is probably related to a number of factors such as a) the closeness of crystalline basement to the surface (high density), b) areas that have been deformed by tectonic events (high density), c) underformed areas (low density) and d) areas of thick superficial cover (low density). Six areas of high fracture density are identified on Enclosure 5.

a) Northeastern basement high.
The curved gravity high in the Watson area (Fig 5) is closely correlatable with a high fracture density area. Basement may be close to the surface here.

b) Southeastern high.
In the southeast of the permit a high density area occurs which is apparently detached from a).

c) and d) East and West-Central Highs
Broad diffuse highs trend north-northwest through the centre of the permit.

e) Southern Folds
High fracture densities occur in the southwest of the permit where curved and circular anomalies are mapped which may reflect folds in the subsurface.

f) Western Highs
Seven centres of high density are scattered across the western permit which is generally a low density area.

4.2.4 Fracture Regions in PEL 33

The six areas of high fracture density probably provide a valid basis for the division of the permit into fracture regions. Rose diagrams and percentage frequency histograms were constructed for each of the six areas. The fracture diagrams are included in Enclosure 5 and show the following characteristics.

a) Northeastern Basement High

A broad northerly spread of linears occurs here with a peak in the 010 degree to 030 degree class. This model group is on-trend with the linears on the eastern edge of the Officer Basin to the north.

b) Southeastern High

The distribution of linears in this area is strongly skewed to the northeast with linear lengths and frequencies peaking at around 060 degrees. This is a strong trend in the Gawler Block to the east (Karari, Colona and Coorabbie Faults) which suggests that Gawler rocks are close to the surface here.

c) East-central Highs

The northeast dominance is maintained in this area with a broad modal group lying between 010 degrees and 070 degrees. However, a significant subgroup occurs at 310 to 330 degrees which represents a departure from the groups a and b to the east.

d) West-central highs

North-northeast trends become dominant in this region with a modal group at 330 degrees to 350 degrees. Northeast linears have a very low frequency possibly signifying that the area is west of the buried edge of the Gawler Block and the Arckaringa Basin.

e) Southern folds

North trending linears are the dominant characteristic of this region with a very strong cluster at 330 degrees to 010 degrees. The northerly linears are associated with approximately north-south trending circular anomalies which may be folds. The northerly trends may be part of the Tertiary structuring of the central Eucla Basin (Fig 3).

f) Western Highs

An almost identical linear pattern to e) occurs in this region with strong north-northwest trending linears.

4.3 Structural Interpretation

Four surface features on the Landsat are important in the high-grading of certain areas for hydrocarbon exploration. They are a high fracture density, fracture intersection zones, surface anticlines and light tonal anomalies. These features are transferred from the interpretations (Enclosures 1 to 5) and summarized on Enclosure 6 a to e.

4.3.1 High Fracture Density

Fracture reservoirs could be located in areas of high-density folding and faulting which are identified on Enclosure 5. In addition, porosity in the Cambrian dolomites will probably be related to the degree of faulting. Good locations for fracture reservoirs are likely to be in high fracture density areas associated with the margins of the Denman Trough and the Mallabie Depression. The main high-density fracture areas are transferred from Enclosure 5 to Enclosure 6a. Two high density areas lie in the Denman Trough (F1 and F2) and several occur on the margin of the Mallabie Depression (F3 to F6). Other high-fracture areas exist in the permit but the best potential for fracture reservoirs is thought to exist within the eight areas identified on Enclosure 6a.

4.3.2 Fracture Intersection Zones

The intersections of major fractures may provide several structural or stratigraphic hydrocarbon plays. For example "box corners" may have been forced upward at the intersection zones during compressional events and provide structural highs for hydrocarbon traps. Fault blocks, tilting away from the intersection zones may also have been developed by compression. Reefs and palaeoshorelines may have developed on the highs giving a stratigraphic component to the trap. During extensional or wrench phases, the intersection zones may have been the focus of down-faulting with small triangular or trap-door basins developing and providing depocentres within the larger basins. Closure could be provided by the faults themselves in two directions and possibly by stratigraphy or unconformity in other directions.

Numerous fracture intersection zones are identified from the photo-mapping and are located on Enclosure 6b. Care was taken to exclude purely geomorphological linears and to include and emphasise linears mapped from NOAA and 1:1 million Landsat. Again, intersection zones on the margins and within the Palaeozoic Troughs are thought to be relatively more important than elsewhere (DI1 to DI5 (Denman Trough) and MI1 to MI12 (Mallabie Depression). At this stage of the exploration programme, it is not possible to identify which of the major intersecting trends may be most significant. The size of the area high-graded around the intersection point (the intersection zone) is a subjective assessment of the area likely to be influenced by the structuring at the fracture intersection.

4.3.3 Surface Anticlines

Surface fold structuring is extremely subtle in PEL 33. The interpretation of structure is based on curved lineations in the surface calcrete and textural anomalies. Several anticlinal features are mapped from the 1:250,000 Landsat with a fair degree of confidence (Enclosure 6c).

An east-west trending row of low amplitude, double plunging anticlines runs parallel to the coast to the south of the permit and the western member of the group lies within the boundary (A1). The zone of circular anomalies continues westward into W.A. where a considerable amount of structuring occurs in association with north-south faulting. The sag of the continental margin following rifting probably produced compression in this area which created the folds. The structures are in a good position to receive hydrocarbons migrating up-dip from the Ceduna depocentre to the south in the Cretaceous section.

An east-northeast trending anticline is identified to the southwest of Cook (A2). The dark-toned rough-textured surface calcrete, which is thought to designate low-lying topography, is breached in a roughly elliptical shape and gives way to smooth light-toned calcrete in the central area. Several small circular anomalies run along the crest of the feature which may represent culminations on the crest of the anticline. The structure is approximately on the western margin of a postulated basement

ridge at the point where it terminates the Denman Trough. It may therefore be situated in a good position to trap hydrocarbons migrating eastward out of the low.

Major curved linears in the south-central part of the permit provide evidence of a northwest-trending (320 degrees) syncline in the subsurface. The structure is associated with faulting in the same direction and the structural trends here are on-trend with the Denman Trough 60 Km to the northwest. None of the geophysical data provide evidence for the structure. However, if the syncline exists at depth, stratigraphic traps may be situated on its flanks and these are designated A5 and A6. Numerous other more obscure circular and elliptical anomalies are mapped in the permit (Enclosure 6c) but it is not possible to assess their significance.

4.3.4 Light Tonal Anomalies

Regionally, the Nullarbor Limestone surface consists of light-toned areas where weathering and erosion are thought to be active and dark-toned, rough-textured areas in low-lying areas where minor superficial deposits occur and the desert varnished surface is undisturbed. There is clearly a danger of extending this interpretation to the micro-scale but it is thought that careful interpretation of the tonal pattern at the macro and meso-scale is acceptable. There are two aspects to the theory:-

a) As already mentioned, light-toned areas are probably topographically higher than dark-toned areas. Where associated with linears or circular anomalies, the light-toned areas may correspond to structural highs.

b) The light-toned areas represent light-toned surface carbonates (calcrete). The light tone may represent weathered suphides (pyrite) introduced into the carbonates by seeping hydrocarbons which have been bleached by weathering. Again, such anomalies are only high-graded where they are associated with linears, circular anomalies or other structural features.

Tonal anomalies which are thought to be significant are mapped on Enclosure 6d.

Subtle and diffuse northwest trending tonal anomalies occur in the western part of the permit (T1a to T1c). The anomalies are possibly part of the diffuse west-northwest trends identified on the NOAA and the 1:1 million Landsat which were thought to be geomorphological features. However, the three anomalies on the 1:250,000 Landsat appear to be associated with northwest trending linears and the diffuse tonal pattern suggests that the calcrete may be altered by seeping hydrocarbons.

Anomaly T2 lies along a strong northwest trending linear on the edge, and parallel to, the Denman Trough. The tone suggests that the calcrete may be altered by seepage along a possible fault.

Anomalies T3a to T3c are textural and tonal anomalies associated with interpreted anticlines. T4 is a strongly linear zone of light tone on trend with T3a. The anomaly could represent the early stages of erosion and weathering at the crest of an anticline similar to T3a. The western end of the anomaly is circular and represents a fracture intersection zone.

A light tonal anomaly (T5) is situated in close proximity to a zone of relatively intense structuring south of O'Malley. The anomaly may reflect seepage although a palaeochannel drained into the area suggesting that it may be an old evaporite-rich lake bed.

The tonal anomalies in the southeast of the permit (T6a to T6f) are thought to represent evaporites in topographic lows, thus contradicting part of the basic tonal anomaly theory. T6d to f are thought to be produced by ponding of surface drainage behind northeast faults which were reactivated by recent minor uplift on the continental margin.

4.3.5 Exploration Leads

The four key factors in determining prospectivity for hydrocarbons at this photo-interpretation stage of the exploration programme are high fracture density, fracture intersection zones, surface anticlines and light tonal anomalies. The selection of leads is carried out by overlaying the maps of the four key factors (Enclosure 6a to d) and creating a fifth map delineating areas where the key factors coincide. This

00109

Exploration Leads Map (Fig A2) summarizes the photo interpretation work and is located in the Conclusions section at the front of the report.

00110

REFERENCES

General reference is made to the preliminary drafts of the 1:250,000 BMR geological sheets of Coompana, Cook, Nullarbor and Ooldea. The 1:1 million geological and gravity maps of the state of South Australia were also used.

LAPPI, D.W., 1984 : Application for petroleum exploration licence, vacant area, western South Australia. Vol 2, Nov., unpub. appl. document., 46pp.

VEEVERS, J.J.; JONES, J.G. & POWELL, C.McA., 1982 : Tectonic framework of Australia's sedimentary basins APEA Joul., 22(1), 283-300.

00111

APPENDIX I

Air Photograph Tonal Anomalies

A1.1 INTRODUCTION

Tonal anomalies have been mapped from Landsat and NOAA imagery (section 4.3.4, p34). From 1:100,000 black and white photomosaics, tonal anomalies can be mapped in more detail and the anomalies can be subjectively graded according to degrees of importance.

In the permit area, the anomalies are light-toned surface carbonates (mainly calcrete). Some of the light tonal areas may be related to seeping hydrocarbons. The main objective of this interpretation is to locate these anomalies.

Other light tonal areas occur around boreholes or waterholes where animals have removed the vegetation and scuffed the desert varnished surface. The largest number of light-toned anomalies are associated with the surface and subsurface drainage of water. Enclosed karstic hollows contain light-toned soil and the evaporites in salt pans appear very light on the photography. Boreholes and drainage-related anomalies can easily be differentiated from anomalies produced by seepage. However, at this level of interpretation it is not possible to be certain whether the seepage is of hydrocarbons or of water. It seems likely that many of the seepage anomalies will be related to groundwater rather than hydrocarbons.

A1.2 IMAGERY

The imagery consists of 15 black and white air photo mosaics at an approximate scale of 1:100,000. The photographs from which the mosaics are derived were taken in 1978 and the quality appears to be very good. However, several very large and subtle east-west trending tonal anomalies are identified in the analysis. The anomalies are parallel to the photographic flight-lines and appear to be located near the centres of the individual flight strips. This suggests that the anomalies may be artefacts

produced by the photography. The imagery covers the entire permit except for a small strip along the coast south of Koonalda.

A1.3 INTERPRETATION

Seepage-related light tonal anomalies were identified on the photo mosaics and transferred to a 1:500,000 base map (Enclosure 7). The anomalies are graded from 1 to 5 according to their possible significance. The number 1 anomalies are of relatively low significance and 5 of high significance. The grading is carried out on the following grounds:-

a) The intensity of the photo-tone.
b) The structural context of the anomaly in relation to the structural interpretation from Landsat and the structures on the air photographs.
c) The general shape and character of the anomaly. It is thought that an anomaly related to hydrocarbon seepage will be a diffuse "fuzzy" anomaly providing a background light tone.

1.3.1 East-west trending anomalies

A possible explanation for the major east-west trending anomalies across the northern half of the permit is that they are artefacts related to the air photo flight lines as mentioned in section 1.2. The anomalies also appear to change character across mosaic boundaries suggesting that there may be an influence from photographic development processes. Furthermore, within the diffuse light tonal bands are smaller very light areas which appear to co-incide with the west-central sections of individual photographs. However, some of the anomalies do not appear to be associated with the configuration of photographs on the mosaics and these are graded 3 and above on Enclosure 7. Such anomalies are mapped south of Cook on mosaic 4936 and 5236 in the east of the permit.

1.3.2 Anomalies in the northeast

A few significant anomalies occur in the northeast of the permit. South of O'Malley, a large area of slightly lighter tone (A) lies to the east of a zone of relatively intense structuring interpreted from Landsat (Mosaic 5136). Three small fairly strong anomalies occur on the eastern edge of the diffuse anomaly. This area of anomalies does not appear to be associated with the structuring to the west.

Several anomalies related to seepage occur near the eastern margin of the permit on mosaic 5236. The area is characterized by small fault scarps which may reflect major faulting at depth. Two strong anomalies occur in association with the faulting. Anomaly B1 is associated with an offset in a fault scarp. The scarp in the vicinity of the offset is much lower than elsewhere. Anomaly B2 occurs in an intersection zone of the fault scarps. The two anomalies are probably related to seepage of ground fluids.

1.3.3 Anomalies in the south and southeast

Many of the anomalies in the south-southeast of the permit are related to the patterns of karstic drainage which may be related to structure but which do not necessarily reflect seepage from below. However, on mosaic 5035 two anomalies occur which may be associated with a large curved structure identified on Landsat. Both C1 and C2 follow the curve of the feature suggesting that the curved linears may represent subcropping bedding beneath the Tertiary cover and that seepage is being produced along two porous beds.

1.3.4 Northwest tending anomalies

A dominant feature of the air photo tonal anomalies are northwest trending light tone zones corresponding to major linears mapped

from the Landsat. Indeed, the basis of the interpretation of the Landsat linears were the tonal traces. Two major trends of northwest anomalies occur; a west-northwest linear (D1) and a northwest linear (D2). The tonal linears converge in a complex intersection zone on mosaic 4935 where an intense light tone anomaly occurs. The northwest linear (D2) consists of a series of displaced segments with a very strong anomaly (D2a) just south of the railway line. This anomaly was also mapped on the Landsat. The northwest trend continues in the Hughes area where three fairly intense light anomalies occur (D2b). The west-northwest tonal trend also consists of a series of segments and is most marked on the mosaic 4835. It is likely that the tonal linears D1 and D2 are major fault trends along which fluids are seeping to the surface.

Other minor tonal anomalies occur in the western and southwestern part of the permit which are considered to be less significant.

W.A. S.A.

DENMAN PALAEOCHANNEL

EDGE OF EUCLA BASIN

Light tone limestone

Railway

Diffuse linear trends

Set 1

Set 2

Set 3

Dark tone limestone

Dark Tone

Light tone limestone

(1a) (1b) (1c) (2) (3) (C1) (C2)

PEL 33

Location

N

Interpretation of Day NOAA Imagery

PEL 33

by R. Russell for Lapp Resource Consultants

6428-1

ENCLOSURE 1

Hinge on N margin of Eucla Basin

⑥

L. Maurice

Eucla Basin

Palaeocoastlines

⑤

L.EII

WARM

WARM

WARM

Cool
Dunes

WARM

PEL 33

8d

8c

8b

8a

①

Fossil
Floodouts

②

③

④

WARM

Warm moist air

⑦

Location

N

Interpretation of Night Thermal

NOAA Imagery in PEL 33

by R. Russell for Lapp Resource Consultants

6428-2

ENCLOSURE 2

KEY

Superficial Deposits

- Marine deposits
- Colluvium, hillslope deposits
- Evaporites
- Aeolian
- Palaeochannel

Rock Outcrops

- Quaternary to Recent
- Ce — Cainozoic Eucla Basin limestone
- Mcrj — Mesozoic Eromanga Basin
- Є — Cambrian Officer Basin
- Pg — Proterozoic Gawler Block

Photo Linears

- Geomorphological
- Minor linear, may be minor fault or joint
- Linear, possible fault
- Major linear, possible major fault
- Diffuse linear trend

Structural Forms

- Possible Anticline
- Possible Syncline

Other

- Scarp
- Railway
- Lake

Basin Margin may be Tertiary Hinge

This section of fault obscure

Coastline Affected by Faulting

Relatively Static Coastline

Coastline Affected by Tilting

Hinge of tilt

E. Tertiary Extension Fault

PEL 33

Lake Ifould Offset

Wonnie L.

Serpentine L.

Wynbo

Dey-Dey

Maurice

Wilkinson Lakes

Forrest L.

L. Ell

Duncs

Yorla L.

Oolabeena L.

Coldea 1

Watson

Reid 1

O'Malley

Cook

Cook 1

Hughes 2

Hughes 1

Denman 1

Flanman

Nullarbor 7

Nullarbor 6

Nullarbor 8

Nullarbor 3

Malinbine 1

Emu

Mc

Mj

Eg

Pg

Ce

Є

Eo

Et

128°E 129°E 130°E 131°E 132°E 133°E 134°E

29°S 30°S 31°S 32°S

N

10 0 20 40 60 80 100 Km

SCALE 1:1,000,000

LOCATION

NT QLD WA SA NSW V T

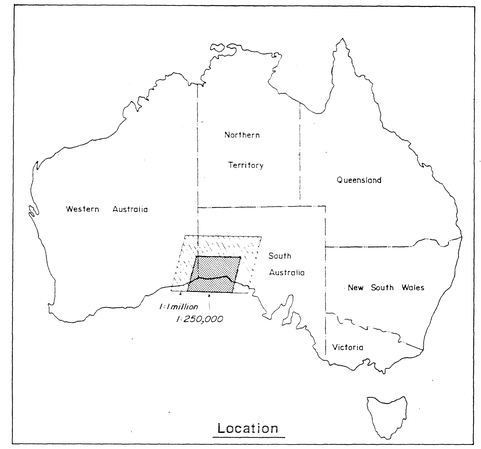
Landsat Interpretation of the Structural Geology of the Eastern Eucla Basin and Surroundings covering PEL 33

Prepared for Lapp Resource Consultants

by R. Russell October 1985

6428-3

ENCLOSURE 3



Location

KEY

SUPERFICIAL DEPOSITS

- Marine deposits
- Colluvium, hillslope deposits
- Evaporites
- Aeolian

ROCK OUTCROPS

- Quaternary to Recent deposits
- Te^d Tertiary Eucla Basin limestone – dark tone
- Te^l – light tone
- M Mesozoic
- Є Cambrian
- Ꝑ Proterozoic

PHOTO-LINEARS

- Geomorphological ; no structural significance
- Structural lineation ; may be bedding, foliation plane or joint
- Minor linear ; may be minor fault or master joint
- Linear ; possible fault
- Major linear ; possible major fault
- Probable major fault trend or axis of a structure
- Apparent vertical displacement
- Apparent horizontal displacement

STRUCTURAL FORMS

- Possible Anticline
- Possible Syncline

OTHERS

- Railway
- Palaeochannel
- Road
- Scarp
- Lake

N

10 0 10 20 30 40 50 Km

1: 500,000 Scale

LANDSAT INTERPRETATION of the STRUCTURAL GEOLOGY of the EASTERN EUCLA BASIN

covering

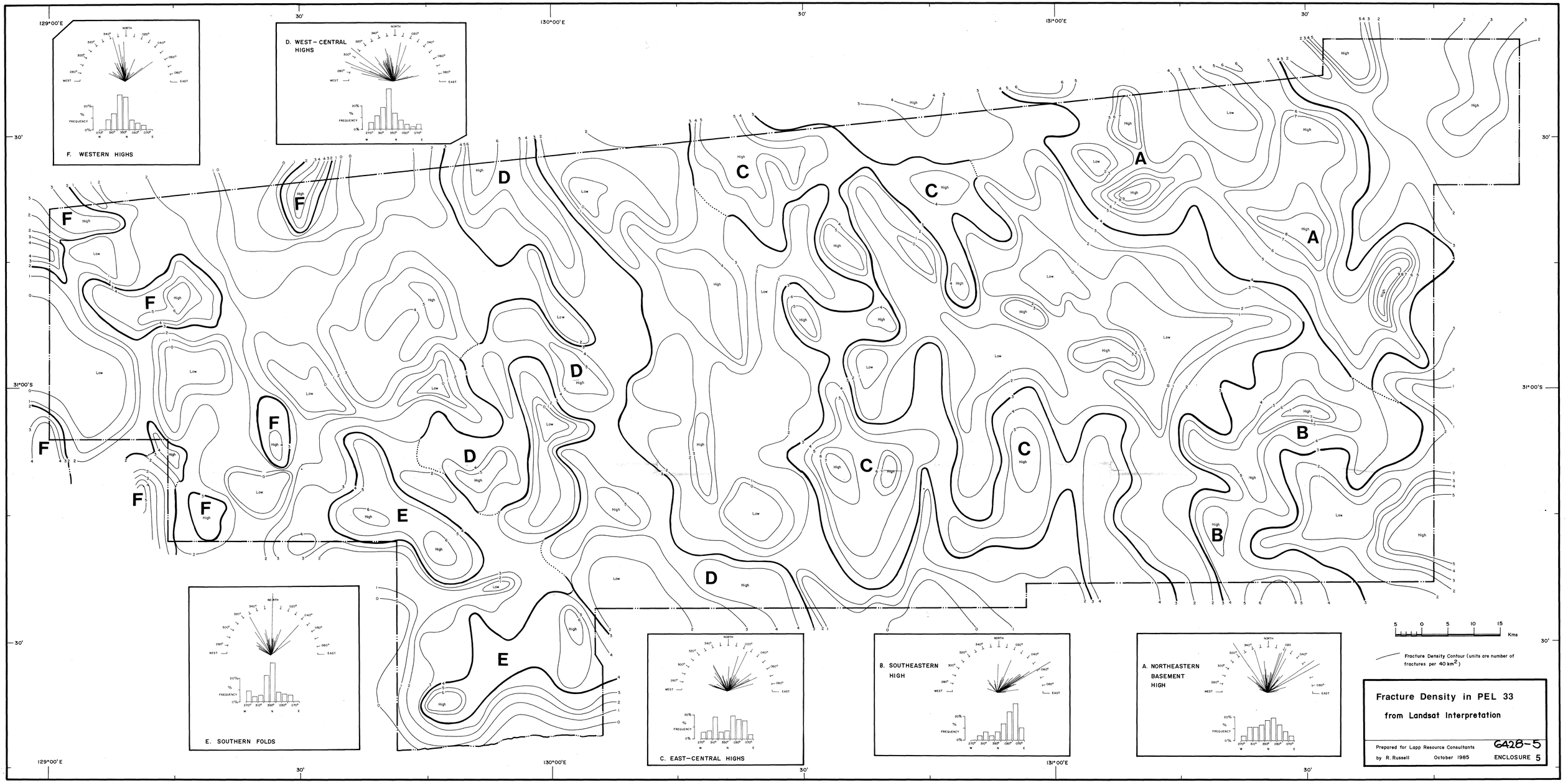
PEL 33

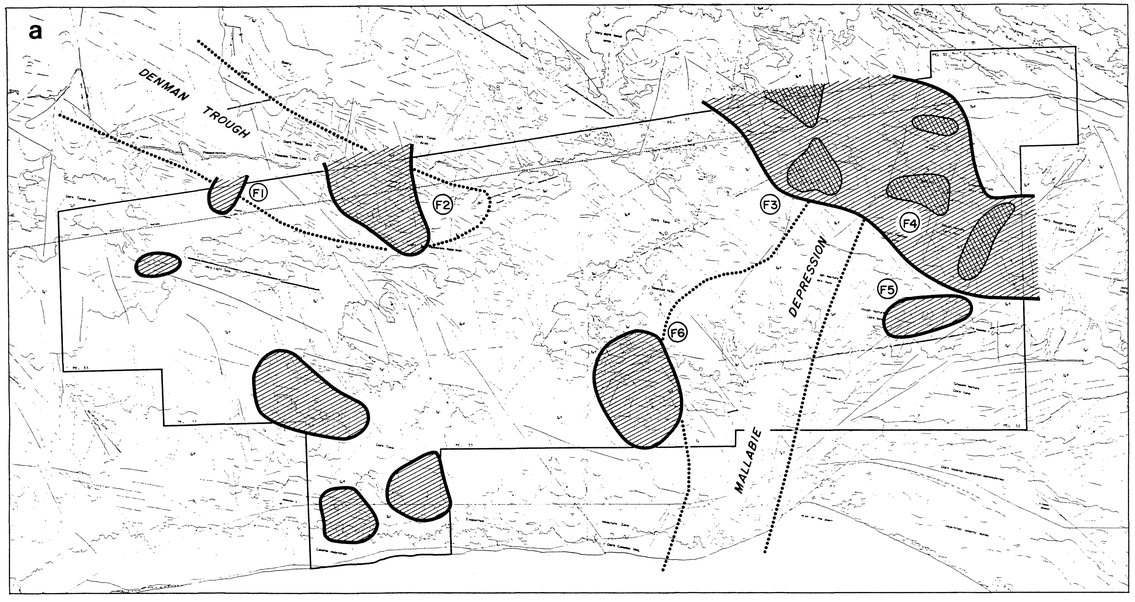
Prepared for Lapp Resource Consultants by R. Russell October 1985

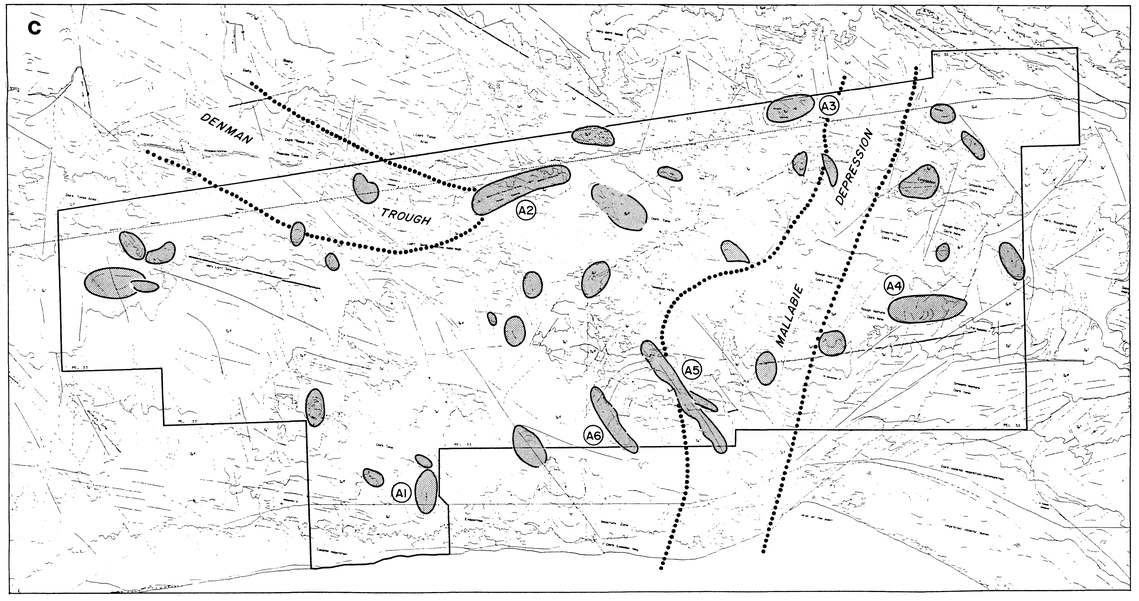
6428-4

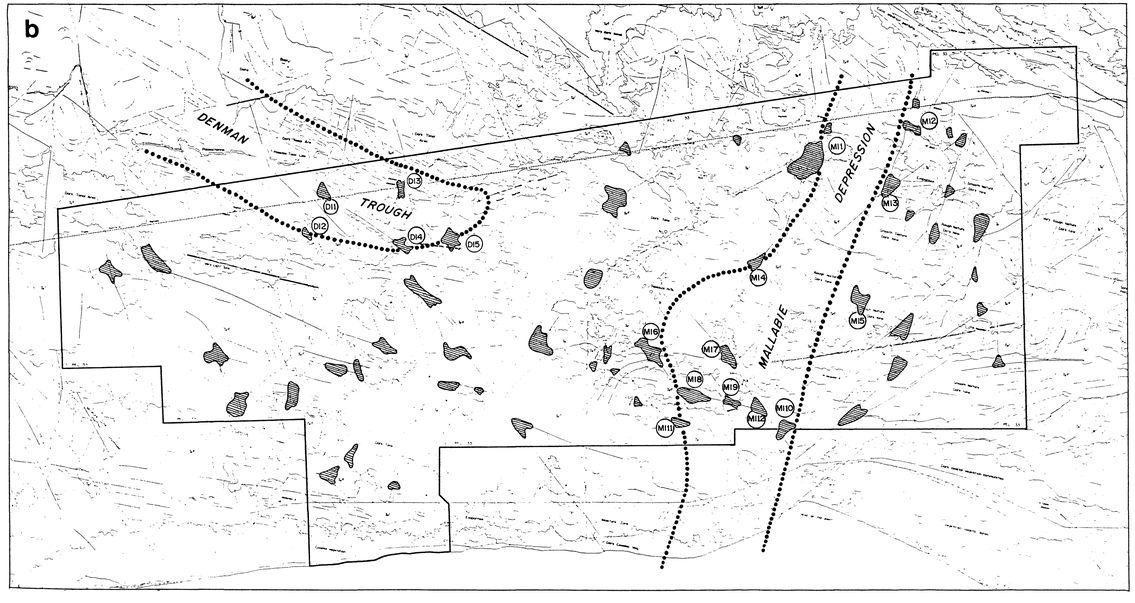
ENCLOSURE

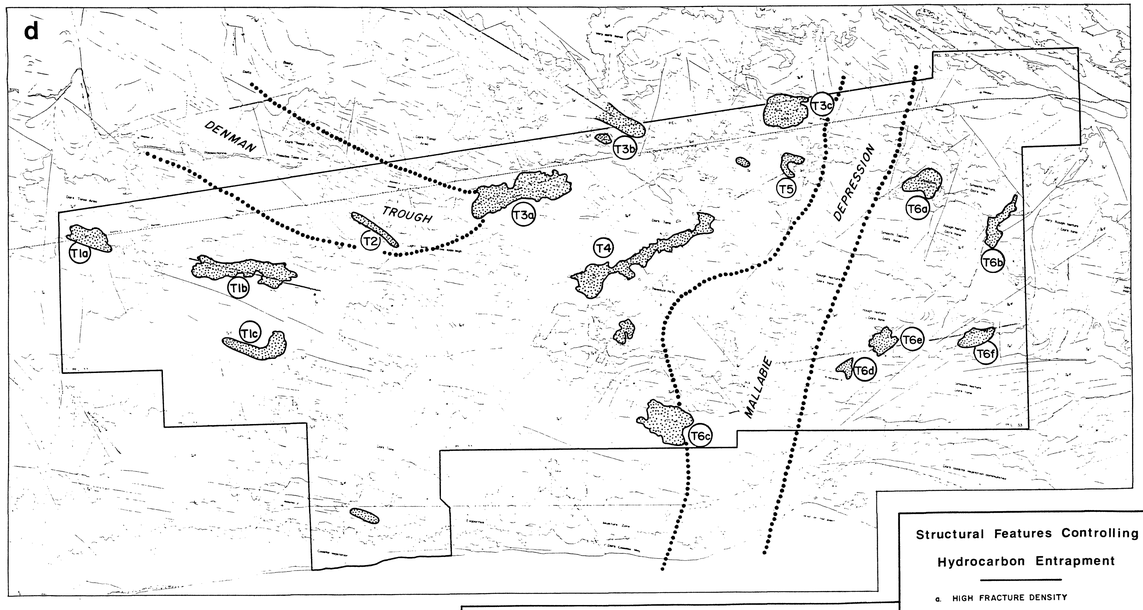
4


129°00'E
130°00'E
131°00'E
30'
31°00'S
F. WESTERN HIGHS
D. WEST – CENTRAL HIGHS
E. SOUTHERN FOLDS
C. EAST–CENTRAL HIGHS
B. SOUTHEASTERN HIGH
A. NORTHEASTERN BASEMENT HIGH
NORTH
EAST
WEST
FREQUENCY
High
Low
5 0 5 10 15 Kms
Fracture Density Contour (units are number of fractures per 40 km²)
Fracture Density in PEL 33
from Landsat Interpretation
Prepared for Lapp Resource Consultants
by R. Russell October 1985
6428-5
ENCLOSURE 5









N

10 0 10 20 30 40 50 kms

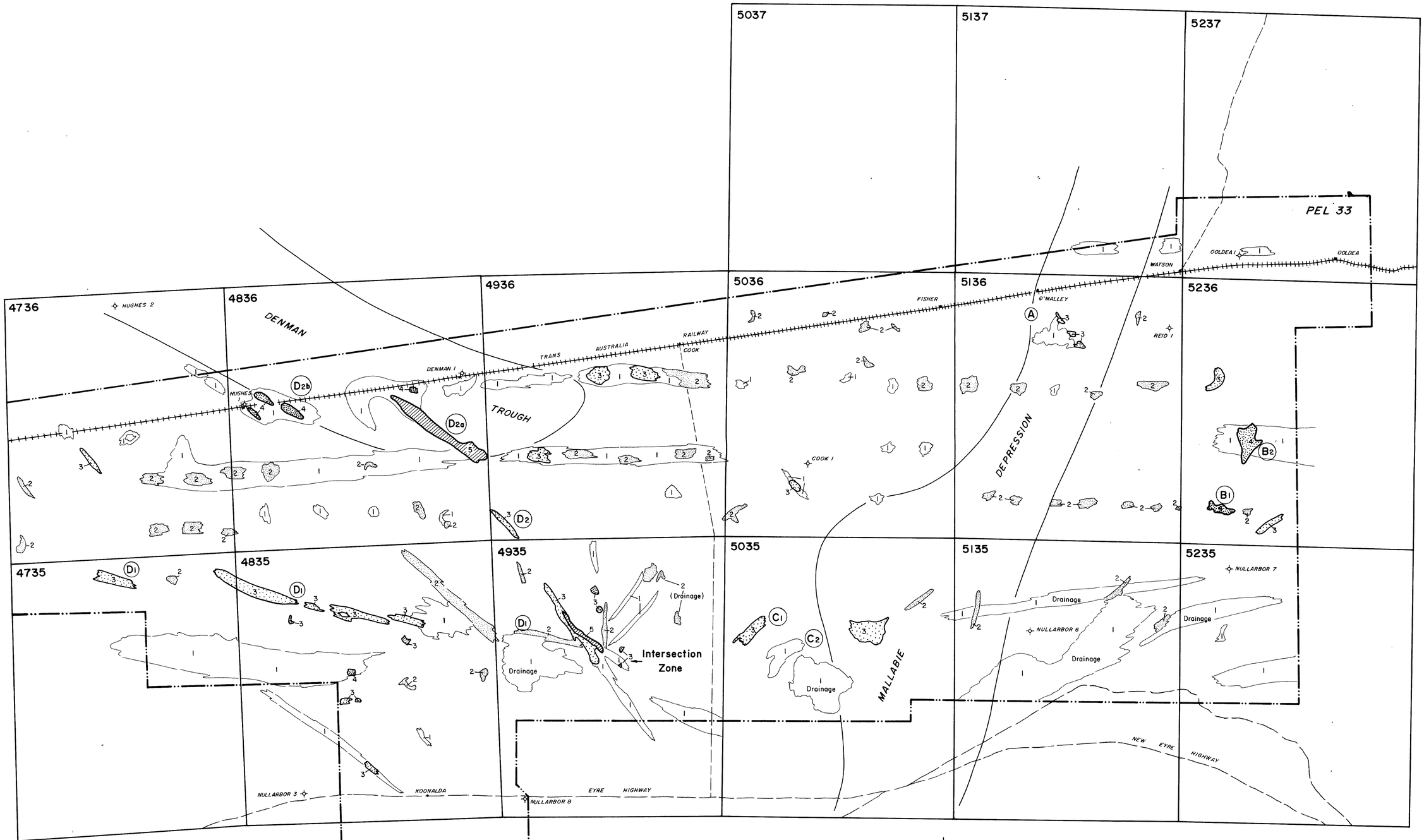
Structural Features Controlling Hydrocarbon Entrapment

a. HIGH FRACTURE DENSITY
b. FRACTURE INTERSECTION ZONES
c. SURFACE ANTICLINES
d. LIGHT TONAL ANOMALIES

6428-6

Prepared for
Lapp Resource Consultants
by
R. Russell and Associates

ENCLOSURE 6



Railway

Roads

Permit Boundary

4835 Photomosaic Boundary

1 — Anomalies related to photo-processing or topography

2
3
4
5 — Tonal anomalies of increasing importance

Anomalies may be produced by hydrocarbon seepage

10 0 10 20 30 40 km

Scale 1:500,000

AIR PHOTOGRAPH TONAL ANOMALIES in PEL 33

FROM 1:100,000 PHOTOMOSAICS

6428-7

Prepared for Lapp Resource Consultants
by R. Russell December 1985

ENCLOSURE 7

SPACE PHOTOGRAPH INTERPRETATION OF THE STRUCTURAL GEOLOGY OF PEL 33, EUCLA BASIN, SOUTH AUSTRALIA

VOLUME II: SHEETS 1 TO 6

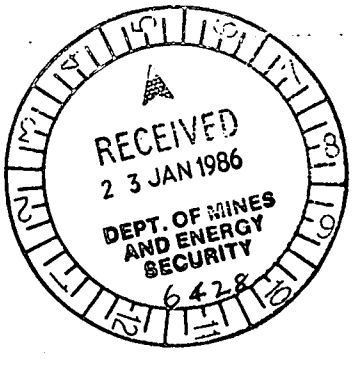
NOVEMBER 1985

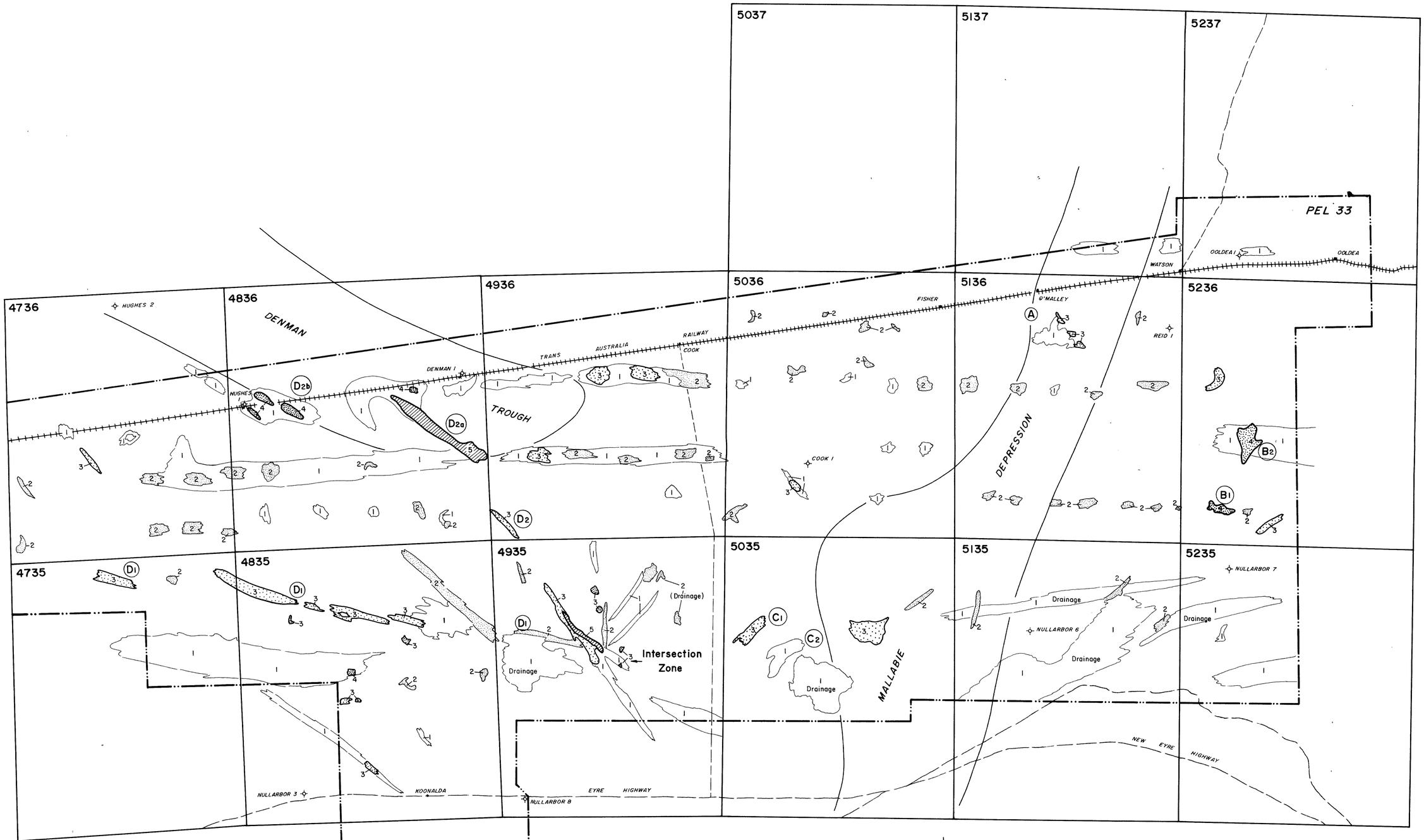
FOR

LAPP RESOURCE CONSULTANTS PTY LTD

AND THE PEL 33 JOINT VENTURE

R. RUSSELL AND ASSOCIATES
11 MERTZ COURT
HILLARYS 6025
WESTERN AUSTRALIA





Railway

Roads

Permit Boundary

4835 Photomosaic Boundary

1 — Anomalies related to photo-processing or topography

2
3
4
5 — Tonal anomalies of increasing importance

Anomalies may be produced by hydrocarbon seepage

10 0 10 20 30 40 km

Scale 1:500,000

AIR PHOTOGRAPH TONAL ANOMALIES in PEL 33

FROM 1:100,000 PHOTOMOSAICS

6428-7

Prepared for Lapp Resource Consultants
by R. Russell December 1985

ENCLOSURE 7

129°00'E 129°30'E 130°00'E

29°30'S 30°00'S 30°30'S 31°00'S

128°30'E 129°00'E 129°30'E 130°00'E

Dark Tone – superficial fluvial wash

Superficial fluvial wash

Eucla Coastline

Basin

Delta

Dark Tonal Area

Possible Topo Low

Palaeochannel

Hughes 2

Dennan 1

Dark Tonal Area

Hughes 1

Hughes

Trans Australia Railway

Very Light Tone

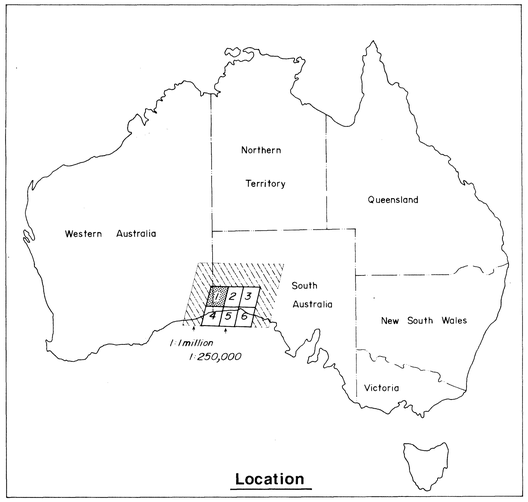
Dark Tonal Area – Regional Topographic Low

Moisture Zone

Moisture Zone

PEL 33

$\mathcal{E}/Te^l$ Te^l Te^d



Location

KEY

SUPERFICIAL DEPOSITS

- Marine deposits
- Colluvium, hillslope deposits
- Evaporites
- Aeolian

ROCK OUTCROPS

- Quaternary to Recent deposits
- Te^d Tertiary Eucla Basin limestone – dark tone
- Te^l – light tone
- M Mesozoic
- $\mathcal{E}$ Cambrian
- P Proterozoic

PHOTO-LINEARS

- Geomorphological ; no structural significance
- Structural lineation ; may be bedding, foliation plane or joint
- Minor linear ; may be minor fault or master joint
- Linear ; possible fault
- Major linear ; possible major fault
- Probable major fault trend or axis of a structure
- Apparent vertical displacement
- Apparent horizontal displacement

STRUCTURAL FORMS

- Possible Anticline
- Possible Syncline

OTHERS

- Railway
- Palaeochannel
- Road
- Scarp
- Lake

N

5 0 5 10 15 20 25 Km

Scale 1:250,000

LANDSAT INTERPRETATION of the STRUCTURAL GEOLOGY of the EASTERN EUCLA BASIN

covering

PEL 33

Prepared for Lapp Resource Consultants by R. Russell October 1985

6428-8

1 2 3
4 5 6

SHEET 1

130°30'E 131°00'E 131°30'E

29°30'S 30°00'S 30°30'S 31°00'S

L. Maurice

Major Eucla Coastline

Dunefield

Moraliago

Eucla wave cut platform

York Lakes

Poss. wave-cut bench

Coastal sands and silts

Very dark tonal area

Dark Tone

Oldsea 1

Watson

Railway

Australind

Sweave

Trans

O'Malley

Fisher

PEL 33

Dark tone along railway

Light Tone

Rough texture Dark tone

Smooth texture, dark tone

Dark Tonal Area

Light Tone possible topo high

Residual Hills

Belt of Sinkholes (500m dia)

Nullarbor 6

Denman 1

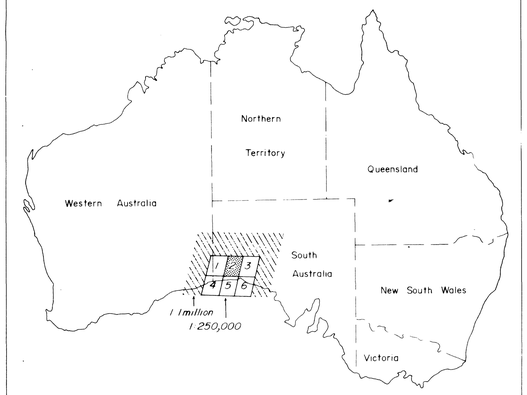
Eoas

Tent

Te^d

Te^l

Location



KEY

SUPERFICIAL DEPOSITS

- Marine deposits
- Colluvium, hillslope deposits
- Evaporites
- Aeolian

ROCK OUTCROPS

- Quaternary to Recent deposits
- Te^d Tertiary Eucla Basin limestone – dark tone
- Te^l – light tone
- M Mesozoic
- € Cambrian
- Ɛ Proterozoic

PHOTO-LINEARS

- Geomorphological ; no structural significance
- Structural lineation ; may be bedding, foliation plane or joint
- Minor linear ; may be minor fault or master joint
- Linear ; possible fault
- Major linear , possible major fault
- Probable major fault trend or axis of a structure
- Apparent vertical displacement
- Apparent horizontal displacement

STRUCTURAL FORMS

- Possible Anticline
- Possible Syncline

OTHERS

- Railway
- Palaeochannel
- Road
- Scarp
- Lake

N

5 0 5 10 15 20 25 Km

Scale 1:250,000

LANDSAT INTERPRETATION of the STRUCTURAL GEOLOGY of the EASTERN EUCLA BASIN

covering

PEL 33

Prepared for Lapp Resource Consultants by R. Russell October 1985

6428-9

1 2 3
4 5 6

SHEET 2

131°30'E 132°00'E 132°30'E 133°00'E

29°30'S

30°00'S

30°30'S

31°00'S

Thin Mesozoics feathering-out to SW

Wilkinson Lakes

L. Anthony

Limit of Eucla transgression

Eucla wave-cut platform

Moralinga

Yarle Lakes

PEL 33

Trans Australia Railway

Bates

Childea

Childea 1

Watson

O'Malley

Reid 1

Tfould Lakes

Nullarbor 2

Evaporites

Smooth texture, Dark tone

Very Rough texture Dark tone

Rough texture Dark tone

Smooth Texture Dark tone

Sandy Eucla basin margin facies

Rough texture Dark tone

Distinct Eucla limestone facies Smooth texture, Dark tone

Possible Regional Low

M

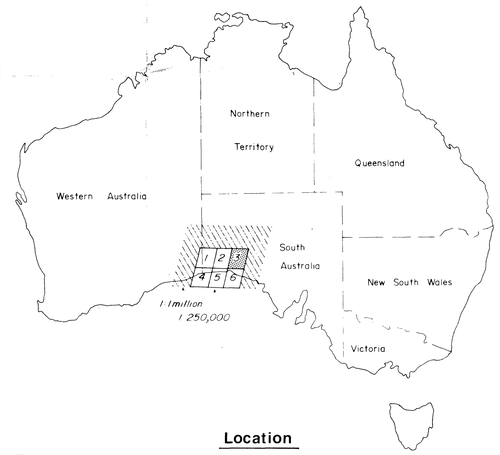
E?

E

Te^d

Te^l

Location



KEY

SUPERFICIAL DEPOSITS

- Marine deposits
- Colluvium, hillslope deposits
- Evaporites
- Aeolian

ROCK OUTCROPS

- Quaternary to Recent deposits
- Te^d Tertiary Eucla Basin limestone – dark tone
- Te^l – light tone
- M Mesozoic
- E Cambrian
- E Proterozoic

PHOTO-LINEARS

- Geomorphological ; no structural significance
- Structural lineation ; may be bedding, foliation plane or joint
- Minor linear ; may be minor fault or master joint
- Linear , possible fault
- Major linear ; possible major fault
- Probable major fault trend or axis of a structure
- Apparent vertical displacement
- Apparent horizontal displacement

STRUCTURAL FORMS

- Possible Anticline
- Possible Syncline

OTHERS

- Railway
- Palaeochannel
- Road
- Scarp
- Lake

N

0 5 10 15 25 Km

Scale 1 250,000

LANDSAT INTERPRETATION of the STRUCTURAL GEOLOGY of the EASTERN EUCLA BASIN

covering

PEL 33

Prepared for Lapp Resource Consultants by R. Russell October 1985

6428-10

1 2 3
4 5 6

SHEET 3

128°30'E 129°00'E 129°30'E 130°00'E

31°00'S

32°00'S

31°30'S

32°30'S

Moisture Zone

Moisture Zone

PEL 33

Major subsurface seepage line

Subsurface 'Delta'

Dark Tone – coastal vegetation communities

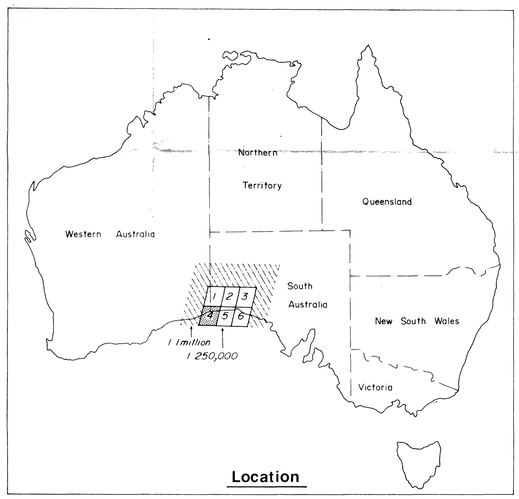
Wave-cut cliffs

Eucla

Nullarbor 3

Koonalda

Te^l Te^d



Location

KEY

SUPERFICIAL DEPOSITS

- Marine deposits
- Colluvium, hillslope deposits
- Evaporites
- Aeolian

ROCK OUTCROPS

- Quaternary to Recent deposits
- Te^d Tertiary Eucla Basin limestone – dark tone
- Te^l – light tone
- M Mesozoic
- € Cambrian
- Ɛ Proterozoic

PHOTO-LINEARS

- Geomorphological ; no structural significance
- Structural lineation ; may be bedding, foliation plane or joint
- Minor linear ; may be minor fault or master joint
- Linear ; possible fault
- Major linear ; possible major fault
- Probable major fault trend or axis of a structure
- Apparent vertical displacement
- Apparent horizontal displacement

STRUCTURAL FORMS

- Possible Anticline
- Possible Syncline

OTHERS

- Palaeochannel
- Scarp
- Railway
- Road
- Lake

N

5 0 5 10 15 20 25 Km

Scale 1:250,000

LANDSAT INTERPRETATION of the STRUCTURAL GEOLOGY of the EASTERN EUCLA BASIN

covering

PEL 33

Prepared for Lapp Resource Consultants by R. Russell October 1985

6428-11

1 2 3
4 5 6

SHEET 4

130°00'E 130°30'E 131°00'E

31°00'S

31°30'S

32°00'S

129°30'E 130°00'E 130°30'E 131°00'E

Te^d Te^l

Dark Tone

Dark Tone

PEL 33

Moisture Zone

Evaporites

Dark Coastal Veg.

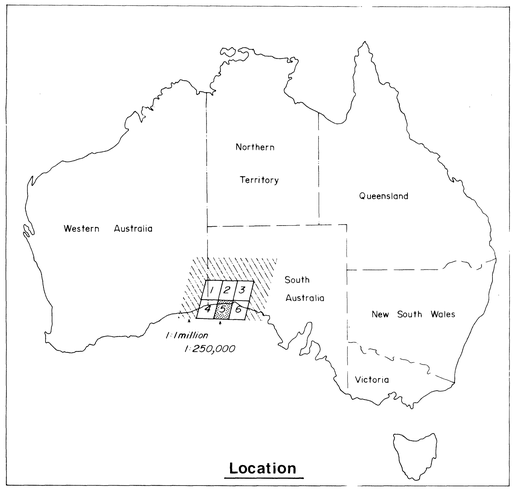
Coastal vegetation

Koonalda

Nullarbor 3

Nullarbor 6

HEAD OF THE BIGHT



Location

KEY

SUPERFICIAL DEPOSITS

- Marine deposits
- Colluvium, hillslope deposits
- Evaporites
- Aeolian

ROCK OUTCROPS

- Quaternary to Recent deposits
- Te^d Tertiary Eucla Basin limestone – dark tone
- Te^l – light tone
- M Mesozoic
- Є Cambrian
- P Proterozoic

PHOTO-LINEARS

- Geomorphological ; no structural significance
- Structural lineation ; may be bedding, foliation plane or joint
- Minor linear ; may be minor fault or master joint
- Linear ; possible fault
- Major linear ; possible major fault
- Probable major fault trend or axis of a structure
- Apparent vertical displacement
- Apparent horizontal displacement

STRUCTURAL FORMS

- Possible Anticline
- Possible Syncline

OTHERS

- Palaeochannel
- Scarp
- Railway
- Road
- Lake

N

5 0 5 10 15 20 25 Km

Scale 1:250,000

LANDSAT INTERPRETATION of the STRUCTURAL GEOLOGY of the EASTERN EUCLA BASIN

covering

PEL 33

Prepared for Lapp Resource Consultants by R. Russell October 1985

G428-12

1 2 3
4 5 6

SHEET 5

131°30'E 132°00'E 132°30'E

31°00'S

31°30'S

32°00'S

Rough texture
Dark tone

Smooth texture
Dark tone

Te^d Te^l

Nullarbor 7 Nullarbor 6

PEL 33

Dark coastal vegetation communities

Kolata Mission

Vegetated coastal dunes

HEAD OF THE BIGHT

Moisture Zone

Farmland

FOWLERS BAY

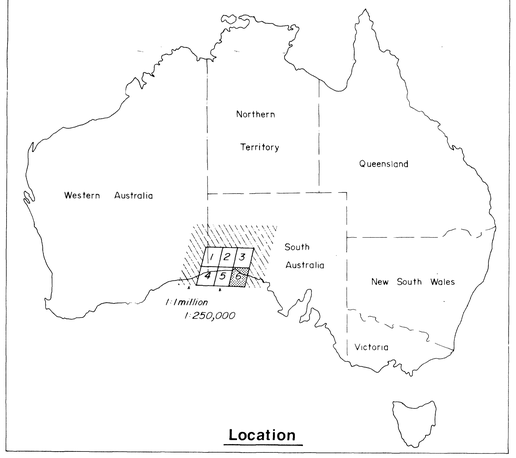
M

€

P

131°00'E 131°30'E 132°00'E

Location



KEY

SUPERFICIAL DEPOSITS

- Marine deposits
- Colluvium, hillslope deposits
- Evaporites
- Aeolian

ROCK OUTCROPS

- Quaternary to Recent deposits
- Te^d Tertiary Eucla Basin limestone – dark tone
- Te^l – light tone
- M Mesozoic
- € Cambrian
- P Proterozoic

PHOTO-LINEARS

- Geomorphological ; no structural significance
- Structural lineation ; may be bedding, foliation plane or joint
- Minor linear ; may be minor fault or master joint
- Linear ; possible fault
- Major linear ; possible major fault
- Probable major fault trend or axis of a structure
- Apparent vertical displacement
- Apparent horizontal displacement

STRUCTURAL FORMS

- Possible Anticline
- Possible Syncline

OTHERS

- Railway
- Palaeochannel
- Road
- Scarp
- Lake

N

5 0 5 10 15 20 25 Km

Scale 1:250,000

LANDSAT INTERPRETATION of the STRUCTURAL GEOLOGY of the EASTERN EUCLA BASIN

covering

PEL 33

Prepared for Lapp Resource Consultants by R. Russell October 1985

6428-13

1 2 3
4 5 6

SHEET 6

27/2/86

00116

LAPP Resource Consultants Pty. Ltd.

127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

January 21, 1986

The Director-General
South Australian Department of Mines & Energy
191 Greenhill Road
PARKSIDE SA 5063

RE: SECOND QUARTERLY REPORT FOR PEL 33
SEPTEMBER 25 TO DECEMBER 25, 1985

Dear Sirs,

LAPP Resource Consultants Pty. Ltd. is the contract Operator of PEL 33 by agreement with the Joint Venture Partners.

During the quarter ending December 25, 1985 the Joint Venturers finalized a Satellite Sensing and Air Photo Mosaic interpretation and negotiations continued on a draft Joint Venture Operating Agreement.

Enclosed is your copy of Dr. R. Russell's Landsat and NOAA imagry interpretation for PEL 33. Tonal anomalies on the permit were also interpreted on black and white air photo mosaics at a scale of 1:100,000. The results of the photo interpretation have been appended to the report as Enclosure 7.

The enclosed interpretation has been successful in defining several coincident areas which are anomalous on the basis of structure, fracture intersections, fracture density and colour tone. These areas are possible hydrocarbon traps which will be upgraded or downgraded by our upcoming airborne geophysical surveys. Ground-based geophysics and geochemistry will then follow up solid leads which have been confirmed by these low-cost techniques. Limited seismic and slim-hole drilling will be done on the most attractive anomaly in Permit Year 2.

The Draft Joint Venture Agreement, based on the APEA Model, was distributed during the first quarter and the Parties are presently negotiating that document. When the final document has been signed, a copy will be forwarded to SADME for your records.

The following costs apply to the Second Quarter's operations in PEL 33:

Data Review	$ 5,000.00
Overheads	$ 7,500.00
Total	$12,500.00

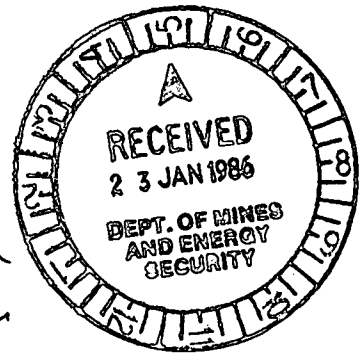
ENV.6428

Sincerely,

David W. Lappi

David W. Lappi
Managing Director

DLG
JM
JE



Encl: Landsat & NOAA imagry interp.

PEL 33 GEOLOGICAL

REVIEW

April, 1986



LAPP Resource Consultants Pty. Ltd.
127 Essex Street
WEMBLEY WA 6014

(09) 387-7327

PEL 33 Distribution List
(one copy each)

	Interest
Antarctic Petroleum Pty. Ltd.	5.000% WI
First Australian Resources N.L.	10.000% "
D. R. Gascoine	5.000% "
Geometals Oil Exploration Ltd.	10.000% "
Gulf Resources N.L.	5.000% "
Heron Petroleum Pty. Ltd.	5.000% "
Marvel Petroleum N.L.	15.000% "
Median Oil N.L.	30.000% "
Monitor Exploration Pty. Ltd.	5.000% "
Oil Venturers Pty. Ltd.	5.000% "
Southern Cross Exploration N.L.	5.000% "
	100.000%

LAPP Resource Consultants Pty. Ltd.

South Australian Department of Mines and Energy

SUMMARY

Previous drilling within and surrounding PEL 33 has shown good potential for commercial hydrocarbon accumulations at relatively shallow depths.

The Cambrian Observatory Hills Beds are locally excellent oil source rocks which are now oil-mature in the vicinity of PEL 33. The Cretaceous Madura Formation is also an excellent oil source rock but is unlikely to be regionally mature. This formation contains oil shale and if geothermal gradients have been high in local areas, then recoverable oil could be sourced from within this shale.

Reservoirs are abundant in PEL 33. In the Cambrian section, fracture and vuggy porosity is present within carbonate units and the Munaroo Sandstone, present in the northern part of the Permit, has excellent porosity and permeability (measured in core just north of PEL 33 at 18.3% porosity and 1.2 Darcy permeability). Other Cambrian reservoirs are present at 400-500 metres depth within the Permit where several drill holes have encountered strong inflows of highly saline water. In the Cretaceous section, excellent reservoirs exist in the Loongana Sandstone which is the deepest aquifer tapped by the region's water well drillers. The shallowest reservoir which may be locally prospective is the Hampton Sandstone which is also an excellent aquifer tapped by a number of water wells.

Seals are provided by Cambrian shales, the Permian clay-rich sediments, and the Cretaceous Madura and Pidinga Formations.

Untested Cambrian hydrocarbon occurrences have been noted in Mallabie 1, Denman 1 and Hughes 2. Muddauganan Bore and several CRA Exploration drillholes intersected oil shales in the Cretaceous Madura Formation. Drillhole SMD 5002 just north of PEL 33 intersected the Cambrian Munaroo Sandstone which contained small amounts of bitumen.

The Fence Diagram (Enclosure 1) summarizes all the available lithostratigraphic information for the area derived from mineral, water well and stratigraphic drilling.

The isopach mapping completed during this review (Enclosures 2 and 3) shows that the Loongana Sandstone thickness is not uniform and contains thick lobes of sand developed from the west. It was either not deposited or was eroded in the east. The sandstones are thickest in the northwest-trending Denman Trough and at the western edge of the Permit. The sandstone thins over a possible palaeohigh along the coast. The Madura Formation is also thickest along the general trend of the Denman Trough but in contrast to the Loongana, it thickens gradually to the south. The Madura thins over the thickest developments of Loongana Sandstone suggesting that the lower Madura shales were deposited contemporaneously or soon after Loongana deposition ceased. Continued shale deposition sealed the Loongana reservoirs. Stratigraphic (pinchout) traps should exist along the updip edges of the Loongana Sandstone.

Structural mapping of the top of the Loongana Sandstone (Enclosure 5) shows that it dips gently to the south. Pinchout traps with probable lateral dip closure exist near Cook 1 and Hughes 1. The Madura Formation is shown to seal the Loongana reservoir as the Madura is present in wells beyond the pinchout edge of the Loongana. The structure contour map of the Top Cambrian Unconformity (Enclosure 4) shows that a pre-Cretaceous high has persisted in the northeast corner of the Permit during Cretaceous and Tertiary deposition. This palaeohigh coincides with a gravity high and an area of relatively shallow crystalline basement. Cambrian lithologies suggest that this high was present during Cambrian deposition, with generally more carbonates deposited to the north (Wilkinson 1) and more clastics deposited in the south (Mallabie 1). It is also probable that some erosion occurred from this high during the post-Cambrian pre-Cretaceous erosional period.

The Play Concept Map (Enclosure 6) shows a number of leads within the permit. The Loongana Sandstone pinches out within the permit, creating about 150 km of strike length favourable for trap formation. In particular, the Key Lead near Cook 1 looks promising as it may be related to the underlying Loongana Sandstone pinchout. Cook 1 is located near a regional post-Cambrian high, meaning that any hydrocarbons generated in the Cambrian will migrate updip toward that location. Other leads identified from the 1985 Landsat interpretation are supported by the Loongana pinchout, especially near Hughes in the north western corner of the Permit.

		Page
1.0	INTRODUCTION	1
2.0	GEOGRAPHY	1
3.0	EXPLORATION HISTORY	2
4.0	DATA REVIEW MAPPING	5
	4.1 Data Sources	5
	4.2 1986 Mapping	6
5.0	GEOLOGY	7
	5.1 Depositional History	7
	5.2 Stratigraphy	9
	5.3 Structure	16
6.0	HYDROCARBON PROSPECTIVITY	21
	6.1 Source	23
	6.2 Reservoir	24
	6.3 Seal	24
	6.4 Timing of Migration	24
7.0	PLAY CONCEPTS	26
	7.1 Structural Plays	26
	7.11 Anticlines	26
	7.12 Fault Blocks	26
	7.2 Stratigraphic Plays	27
8.0	EXPLORATION PHILOSOPHY	28
9.0	CONCLUSION	29
10.0	PEL 33 REFERENCES	29

1.0 INTRODUCTION

PEL 33 was granted to this Joint Venture on June 25, 1985 for a period of 5 years. The Joint Venture has proposed an exploration programme covering the entire permit with a variety of low-cost exploration techniques to effectively screen large areas of the Permit for hydrocarbon prospectivity prior to conducting expensive seismic and drilling. This geological review report is part of this integrated exploration programme.

This report is a revision of the November, 1984 Technical Data Package which was submitted with the Application for Petroleum Exploration Licence. This revision includes a comprehensive review of all the available subsurface geological information resulting in the maps contained as Enclosures 1 through 6 at the back of this report. The results of this mapping has been incorporated in the text of this review.

2.0 GEOGRAPHY

The Permit area is large, covering an area of 23,793 square kilometres. The Area is contained in the Ooldea, Nullabor, Cook and Coompana 1:250,000 map sheets.

2.1 Location and Access

The Permit is approximately rectangular in shape and covers 140 km in a north-south direction and a maximum of 280 km in an east-west direction. The centre of the Area is 1,350 km east of Perth, 950 km northwest of Adelaide and 800 km west northwest of Stony Point (Location Map, Figure 1).

Access to the Area is good via the sealed Eyre Highway in the southern portion and via the Transcontinental Railway in the north. A network of secondary roads link stations and railway sidings with the highway. Local stations maintain airstrips for their private use. By prior arrangement, most private strips would be available for Joint Venture use. Airstrips are also located adjacent to some railway sidings.

2.2 Geomorphology

Drainage systems within the Area are relics of wetter climates in the past. Ephemeral water flow is present in most systems during heavy rains, drying up during dry periods.

The major landform is the Nullarbor Plain which is an exceptionally flat limestone surface punctuated by numerous vegetated shallow depressions produced by the infilling of karstic sinkholes. The plain is covered

vegetation. Occasional relict river courses can be seen on air photographs. One such example has been mapped from the West Australian border to near Cook, a distance of 130 km.

2.3 Climate and Field Season

The climate of the Eucla Basin is cool and arid to semi-arid during winter months and hot and arid during the summer. Along the coast most of the rain falls during the winter months but further inland, summer thunderstorms mean that rain is distributed irregularly throughout the year. Summer temperatures may be high with the average maximum temperature close to 40 degrees C.

3.0 EXPLORATION HISTORY

Early explorers Flinders and Eyre explored parts of the Eucla Basin in the late 1800s. Tate, in 1879, made important observations about the stratigraphy of the Tertiary limestones. Very little was known about the geology until bores were sunk for water along the Transcontinental Railway route around 1900. Several of these bores intersected the entire sedimentary section and provided the first formal information on the geology of the region. Few geological investigations were made until interest in petroleum was aroused in 1960. Two stratigraphic wells, Eyre No. 1 and Gambanga No. 1 were sunk by Exoil in the West Australian Eucla Basin. In 1964, Alliance drilled Eucla No. 1, also in Western Australia.

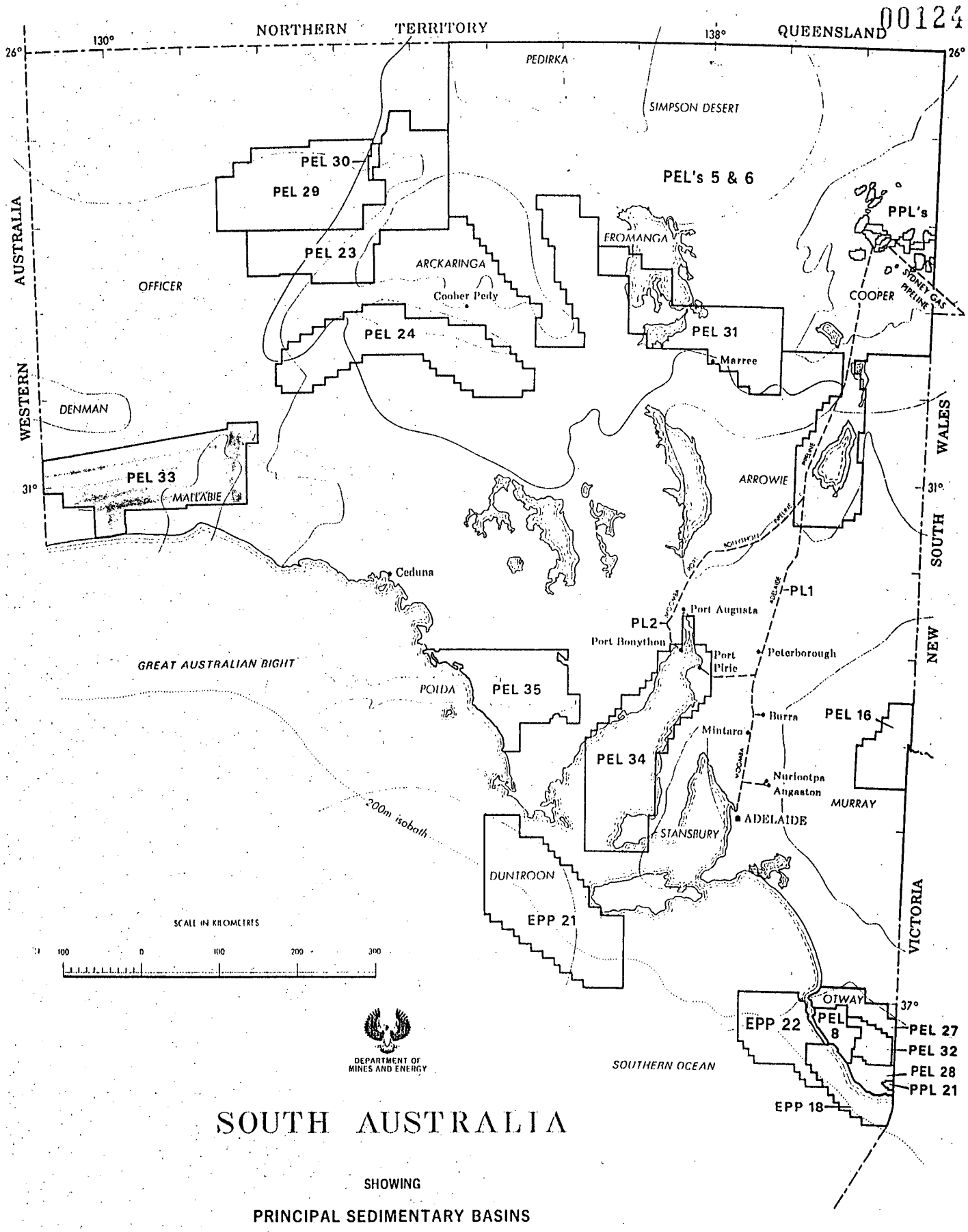
The South Australian Department of Mines and Energy (SADME) conducted seismic refraction surveys in the Eucla Basin in the mid-1960s. These surveys confirmed gravity and magnetic evidence of sedimentary sub-basins under the Tertiary cover.

In 1965, Outback Oil N.L. drilled Cook 1, a stratigraphic test in their permit, OEL 33. In 1966, Outback drilled Hughes 1, 2 and 3, and Denman 1. Hughes 1, and Denman 1 are in the Permit Area. These stratigraphic wells established the presence of Cambrian age shallow marine sediments beneath the Eucla Basin cover. In 1969 Outback drilled a new-field wildcat, Mallabie 1, near the coast.

Aeromagnetic coverage has been obtained by the BMR, Outback Oil and Exoil and these data have been merged to produce the present published maps.

Gravity surveys were conducted in 1966 by Geosurveys for Outback Oil supplementing earlier gravity work by the BMR in 1956 and 1958.

Little petroleum exploration has been done in the area since the Mallabie 1 was drilled in 1969 and the area has been vacant for approximately 10 years. Two of the five Outback stratigraphic wells (which were sited without the benefit of seismic) had untested oil and bitumen occurrences. Mallabie 1 encountered methane (untested) near its total depth.



SOUTH AUSTRALIA

SHOWING

PRINCIPAL SEDIMENTARY BASINS

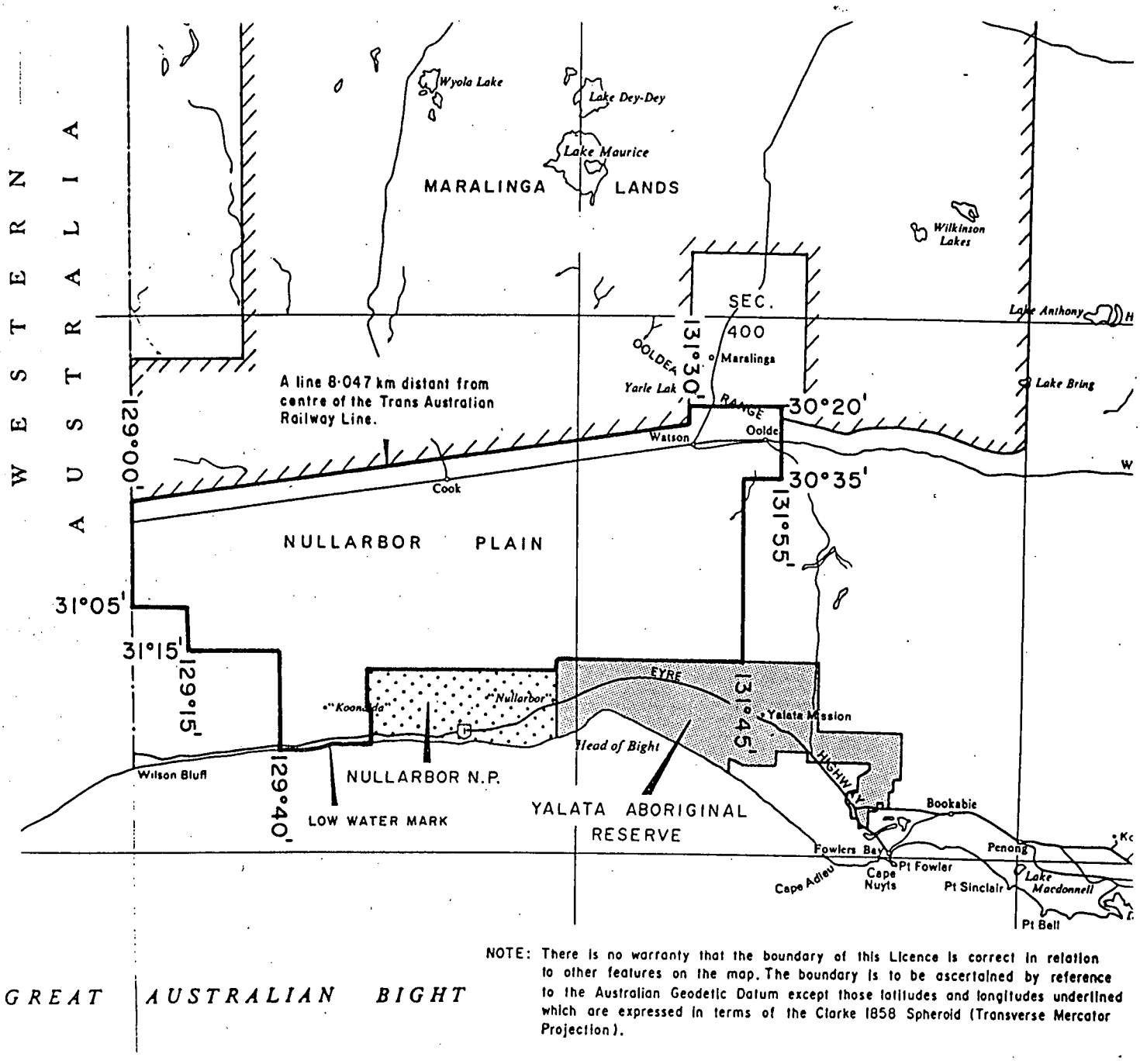
AND

CURRENT PETROLEUM TENEMENTS

MARCH 1986

DEPARTMENT OF MINES AND ENERGY — SOUTH AUSTRALIA

Figure 1 - Location Map



NOTE: There is no warranty that the boundary of this Licence is correct in relation to other features on the map. The boundary is to be ascertained by reference to the Australian Geodetic Datum except those latitudes and longitudes underlined which are expressed in terms of the Clarke 1858 Spheroid (Transverse Mercator Projection).

SCALE 1:2 500 000



THE PLAN HEREINBEFORE REFERRED TO

MEDIAN OIL N.L. et al

PETROLEUM EXPLORATION LICENCE

Figure 2 - Map of Permit Area

In 1981 and 1982 Swan Resources and CRA Exploration conducted a drilling programme aimed at defining an economic resource of oil shale in the Madura Formation. Their exploration has been suspended as, under current conditions, oil shale appears uneconomic. More recently, mineral exploration companies such as BHP, CRA, WMC, AMOCO, Getty, ASARCO, BP, Seltrust, Aquitaine, and Carpenteria Exploration have been active in the region is search of diamonds, copper-lead-zinc, gold and uranium. Previous drilling is summarized on the Fence Diagram (Enclosure 1).

The South Australian Government has drilled several wells and deepened several others in the region in recent years to delineate the stratigraphy of Officer Basin sediments.

In mid-1984 the current Joint Venture selected this area for a Petroleum Permit application. The Area was granted as PEL 33 on June 25, 1985 for 5 years.

During late 1985, SADME geophysically logged three existing drillholes in the region (YLs 1, 2 and 3) and drilled 2 additional holes (Ooldea 2 and 3) near PEL 33 for stratigraphic purposes.

The PEL 33 Joint Venture conducted 1:2,000,000 scale NOAA, 1:250,000 Landsat and 1:100,000 airphoto interpretations of the area in November, 1985.

4.0 DATA REVIEW MAPPING

During January to April, 1986 LAPP Resource Consultants Pty. Ltd. conducted a review of the existing geological and drilling information in the vicinity of PEL 33. This report presents the results of that review.

4.1 Data Sources

Geological information was primarily obtained from three sources: mineral exploration investigations, water well drilling reports, and stratigraphic drilling done by petroleum explorers and the South Australian Department of Mines and Energy.

Topographic information used to reduce drillhole formation depths to Mean Sea Level was obtained from well completion reports, and where none existed, by hand-contouring the barometric elevations of gravity stations. Surface drillhole elevations were estimated from their locations on the topographic contour maps.

Mineral exploration information was obtained from open-file reports submitted by companies to SADME. These reports were purchased on microfiche. While this approach proved effective, paper "hard copies" of the information would have been preferable. Some reports submitted by companies were also incomplete, sometimes lacking accurate drillhole location diagrams or coordinates. In these cases, locations were plotted as accurately as possible from the available information.

Water well records were also obtained from SADME on microfiche. The quality of the lithologic information from this source was generally very good considering some of the wells were drilled in the 1890s. Locations for individual water wells were plotted from 1:250,000 scale Water Bore Location maps published by SADME.

Information from stratigraphic wells drilled by Outback Oil N.L. from 1965 to 1969 came from the appropriate well completion reports. Well completion reports for Ooldeas 2 and 3 recently drilled by SADME are not yet available although copies of geophysical logs and lithologic columns were obtained. SADME also provided geophysical logs for three mineral exploration drillholes, YLs 1, 2 and 3 which were valuable in making lithostratigraphic correlations.

4.2 1986 Mapping

The following diagrams and maps were produced at 1:250,000 scale:

Base Map - Not included in this report
Enclosure 1 - Fence Diagram
" 2 - Loongana Isopachs
" 3 - Madura Isopachs
" 4 - Top Cambrian Structure
" 5 - Top Loongana Structure
" 6 - Play Concept Map

The Base Map was computer-plotted at 1:250,000 scale using a Transverse Mercator projection. The map was plotted at this scale and projection to allow published data to be overlayed easily. Although the maps are large, they are able to show all the information relevant to PEL 33 on one map sheet.

The Fence Diagram was constructed first using all the available drilling information. Where two or more wells are adjacent, only the well with the most information is shown. Many of the wells required interpretation or reinterpretation of the stratigraphy to yield the stratigraphic correlations. Cretaceous or younger sediments are correlated primarily on a chronostratigraphic basis. Detailed information on age relations in Cambrian rocks is lacking so correlation there is based on a lithostratigraphic basis.

From the information on the Fence Diagram and topographic maps, the Isopach and Structure Contour Maps were constructed. The Play Concept Map incorporates data from all the above maps and includes some of the 1985 Landsat Leads thought to be significant at this time.

5.0 GEOLOGY

5.1 Depositional History (after Youngs, 1974)

The sediments of the area are underlain by Archaean rocks of the Western Australian Shield and the Gawler Platform. Crystalline basement was encountered at total depth in drillholes BN 1 and 2, KN 1, Nullarbor 3, 4, and 7, Mallabie 1, Maralinga 7, ORP 1 and 2, and Ooldea 2 and 3.

Before, and possibly during the Proterozoic, the basement was tectonically deformed along north-northwesterly and northeasterly trends thus enabling the large thickness of Adelaidean sediments and volcanics, like those encountered in Mallabie 1, to be deposited in the deep basement troughs. These old sediments have only been encountered in wells along the coast. Further north, crystalline basement was encountered in Maralinga 7 directly under Cambrian age sediments. Scott and Speer (1969) postulate a shallow marine origin for the sandstone overlying basement in Mallabie 1.

Cambrian strata were deposited throughout the central trough area. In the north at SMD 5002 over 675m of sandstones, shales, siltstones and dolomites were deposited in what may have been an alternately shallow to moderately deep marine environment. The Cambrian clastic sediments in the south also suggest deposition in a shallow marine environment. Clastics in the south give way to carbonate sedimentation in the Hughes and Denman areas as well as further north. The Top Cambrian Structure Map (Enclosure 2) shows the current limits of the Cambrian section.

The Ordovician to Carboniferous history of the Area is unknown at present. No sediments of this age have been found. If sedimentation did occur, extensive uplift and erosion will have taken place and remnants may have been left only in the deep fault-bounded Palaeozoic troughs.

Permian sediments may have been more extensive than they are at present and it is possible that a connection from the Canning Basin in the northwest to the Arckaringa Basin in the northeast may have existed by way of the Palaeozoic troughs underlying the Eucla Basin. The Permian strata in the Denman Basin were deposited in a marginal marine environment after the Late Carboniferous-Permian glaciation (Harris and Ludbrook, 1966).

During most of the Mesozoic era the region was possibly subject to erosion and non-deposition resulting in a relatively flat land surface onto which the Cretaceous sediments were laid. The Cretaceous transgression is believed to have been initiated by the parting of Antarctica and Australia during the late Jurassic or

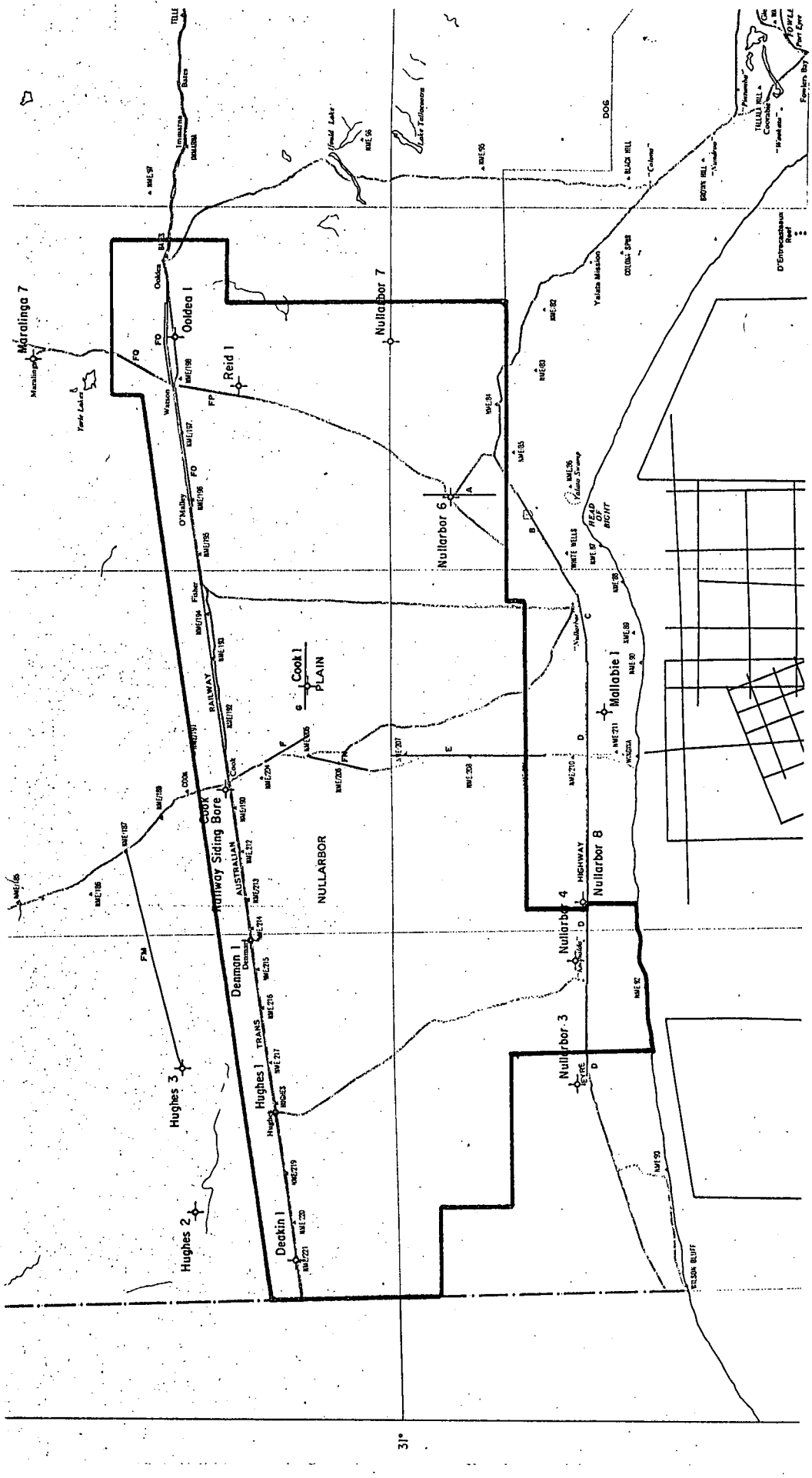


Figure 3 - Availability of Seismic Data in the Permit Area (from SADME Drawing No. 84304)

early Cretaceous. This transgression deposited the basal Loongana Sandstone in irregular lobes which may have been deltas built eastward from sediment sources in the Yilgarn Block. (Enclosure 2).

The transgression entered the Eucla Basin from the south and west during the early Cretaceous and the glauconitic shales and silts of the Madura Formation were deposited alongside and over the non-marine basal Loongana sands and conglomerates. Deposition ceased during the Upper Cretaceous and subsequent erosion was probably not significant. The Madura Isopach Map (Enclosure 3) shows the depositional pattern of the formation.

Gentle downwarping of the Eucla Basin commenced in the Eocene and sedimentation started with the marine Hampton Sandstone in the west and the restricted terrestrial Pidinga Formation in the east. The Pidinga was deposited in channels (which locally contain lignite deposits, clay and sandstone) eroded into basement and sediments. As the seas spread, the Wilson Bluff Limestone was deposited in quiet seas.

The Oligocene was a period of slow erosion and weathering of the Wilson Bluff Limestone. Another marine transgression occurred during the early Miocene and the Nullarbor Limestone was deposited over large areas of the shelf in open seas with good circulation and currents.

Since the Middle Miocene, the Eucla Basin has been gently tilted towards the southeast, uplifted above sea-level and has developed an immature karst topography. The uplift was accompanied by a small amount of compression, which reactivated old faults and created gentle anticlines in the surface limestones. Aeolian sand occur deposits near the present coastline and in the vicinity of the Ooldea Sand Range in the northeastern end of the Permit.

5.2 Stratigraphy

The Cambrian and Proterozoic(?) sediments are concealed within the Permit by Cretaceous and Tertiary sediments. The Cambrian Officer Basin sediments crop out immediately north of the area where the Observatory Hill beds have been mapped at the surface. The pre-Hampton Sandstone Cretaceous formations are also known only from bores.

The following table gives the stratigraphy in the vicinity of the Permit Area:

Age	Formation	Thickness
Lower Miocene	Nullarbor Limestone	5 - 50m
---------- Unconformity ----------		
Upper Eocene	Wilson Bluff Limestone	30 - 150m
Middle Eocene	Hampton Sandstone	3 - 40m
---------- Unconformity ----------		
Lower? Upper Cretaceous	Madura Fm.	0 - 135m
Lower Cretaceous	Unnamed Siltstones	0 - 65m
Lower Cretaceous	Loongana Sandstone	0 - 65m
Lower Cretaceous	Unnamed Pyritic Sandstone	0 - 17m
---------- Unconformity ----------		
Lower Permian	Unnamed Sandstones	0 - 88m
---------- Unconformity ----------		
Cambrian	Part Observatory Hill Beds Equivalent	0 - 480m
---------- ?Possible Unconformity? ----------		
Cambrian(?) or Proterozoic(?)	Altered Amygdaloidal Basalt	0 - 291m
Cambrian(?) or Proterozoic(?)	Unnamed Sandstone	0 - 134m
---------- Unconformity ----------		
Archaean(?)	Crystalline Basement	-

Youngs (1974) gives the following descriptions of the lithologies:

> Possible Archaean rocks were intersected in the bottom of Mallabie 1 (Scott and Spear, 1969); they were dated at 1150 m.y. (Thomson, 1970) but this probably represents the effects of the Willouran Tectonism on some rocks of the older Western Australian Shield. The gneiss in Nullarbor 7 also may be Archaean.

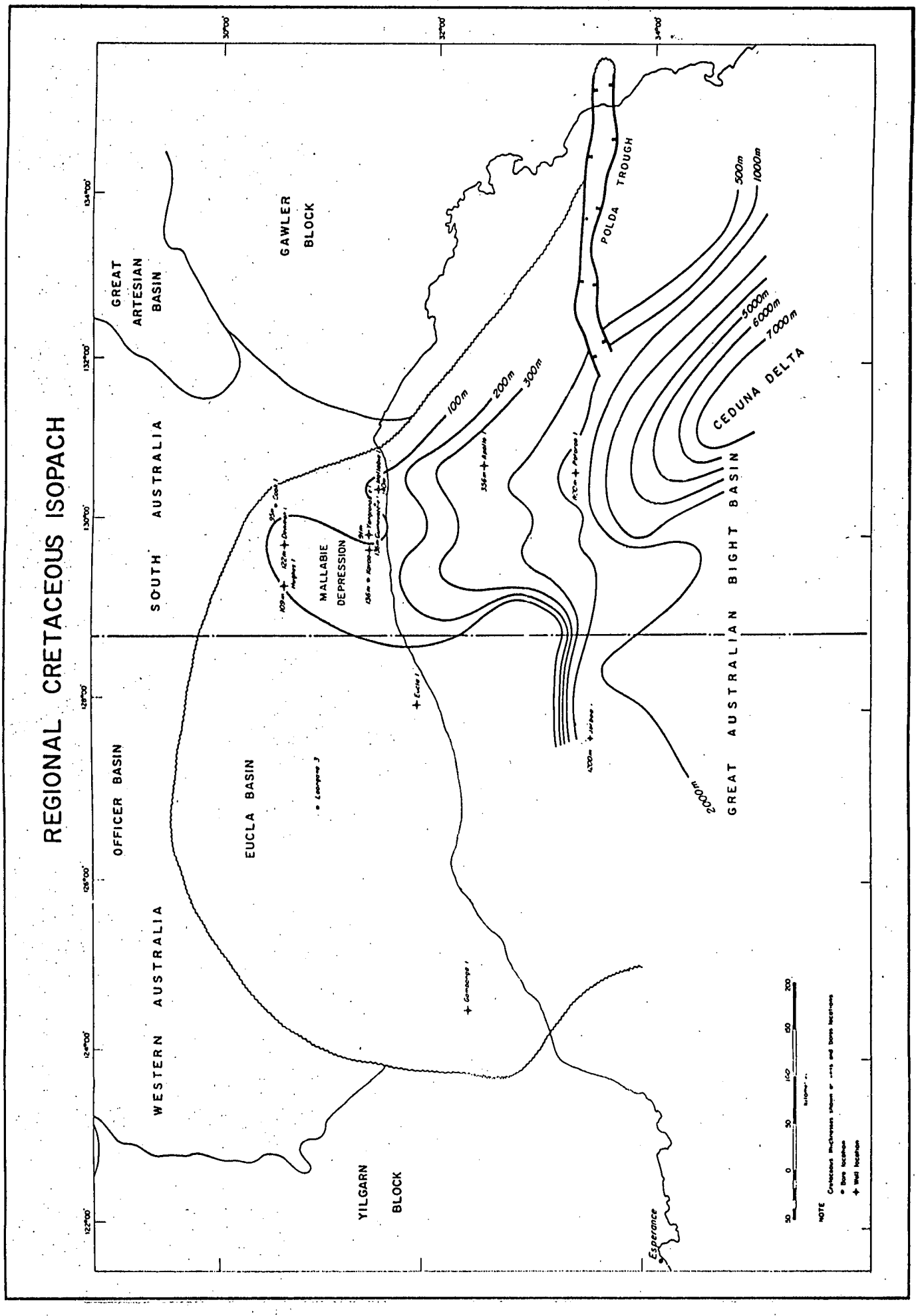


Figure 4 - Regional Cretaceous Isopach Map

Mallabie 1 intersected 425 m of metamorphosed feldspar porphyry and underlying arkosic sandstone [now identified as amygdaloidal basalt]. The porphyry encountered in Nullarbor 3, 4 and 8 is similar and these have all been tentatively correlated with the Carpentarian Gawler Range Porphyry to the east of the basin [or possibly the Cambrian Table Hill Volcanics of Western Australia].

Probable Cambrian sediments underlie much of the Eucla Basin in South Australia and within PEL 33, appear to be restricted to Palaeozoic troughs bounded by fault controlled basement blocks. The strata in the northern wells are chocolate shales, red and green siltstones with thin interbedded sands and dolomites (Ludbrook, 1965 and 1966; Outback Oil Co., 1966). The latter are cherty and oolitic; they may correlate with the Observatory Hill Beds which crop out in the Officer Basin (Wopfner, 1969). Mallabie 1 encountered 480 m of an orange-red, moderately sorted, friable sandstone containing traces of gypsum and chert in parts (Scott and Speer, 1969). Nullarbor 6 contained red and green shales underlain by a ferruginous sandstone.

Lower Permian strata have been identified in Mallabie 1 and Nullarbor 8. Harris and Ludbrook (1966) proved an Artinskian (Stage 3) age for grey, non-glacial claystones in Nullarbor 8 and the sands and silts in Mallabie 1 were dated at Sakmarian (Stage 2) (Scott and Speer, 1969). The sandstones are unconsolidated, sub-rounded to subangular. Ludbrook (1965 and 1966) reported up to 36 m of presumed Permian strata in the northern wells. The assumption was made entirely on lithological and stratigraphic grounds and more recent palynological work has proved a Lower Cretaceous age for the strata.

The oldest Eucla Basin sediments are the Lower Cretaceous sands and grits which have been intersected in nearly all of the wells and bores in the basin (Enclosure 1). The sediments have their greatest thickness along the trend of the Denman Trough. The margins of the Cretaceous deposition appear to be partly fault controlled, especially in the southeast corner of PEL 33. The prominent lithology in the Loongana is a medium-grained, permeable sandstone containing accessory minerals such as feldspar, pyrite and glauconite. In the Hughes, Denman and Mallabie wells, a medium granule conglomerate containing moderately well-sorted quartz and minor other lithics overlies the sandstone unit. Two similar lithologies are combined in Western Australia and have been named the Loongana Sandstone (Lowry, 1970) - it is

tentatively suggested that the unnamed Lower Cretaceous units in the South Australian area are lateral extensions of the Loongana Sandstone.

The Loongana Sandstone is overlain by up to 120 m of soft grey clays and fissile claystones. The sequence is glauconitic, carbonaceous and pyritic throughout. Maximum thicknesses occur in the western parts of the South Australian portion of the basin (Figure 6), i.e., near to the central basin areas in Western Australia (see Lowry, 1970, for isopach plan). This clay sequence is the eastern extension of the Madura Formation in Western Australia, which is Cretaceous in age (Lowry, 1970). Isopach plans of the Loongana and Madura Formation show that the Madura is thickest where little Loongana exists and thinnest where the Loongana is thickest. This implies that they were deposited contemporaneously (or nearly so).

The Tertiary Eucla Group comprises a basal sandstone and overlying limestones. The Middle Eocene Hampton Sandstone is a medium to coarse grained, quartz sandstone with limonite staining of the grains. The maximum thickness attained is 36 m and the unit occurs in all but the southeastern bores of the basin.

Enclosure 1, the Fence Diagram, shows the Pidinga Formation, consisting of carbonaceous and pyritic clays, silts and minor sands, has been encountered in many drill holes in the Permit. The maximum thickness of the formation is 44m at YL 2. Ludbrook (in Parkin, 1969) assigns it a Middle Eocene age and suggests it is either the same age in part or older than the Hampton Sandstone [based on the 1986 mapping the Pidinga seems to be a clay-rich facies of the Hampton Sandstone, possibly derived from weathering of Madura shales or shaley facies of the Observatory Hills Beds].

The Upper Eocene Wilson Bluff Limestone conformably overlies the Hampton Sandstone and is present throughout the basin, although it is thin in the east along the basin margins. The formation is a white, compact chalk composed of bryozoal fragments in a micrite groundmass. Porosity is very high and permeability may also be high owing to the cavities within individual bryozoa.

Chert nodules, and occasionally larger pods, occur in all but the uppermost 12 m of the formation. The maximum thickness is over 100 m which occurs in the southern part of the onshore area. The Wilson Bluff Limestone crops out in the cliffs at the Head of the Great Australian Bight.

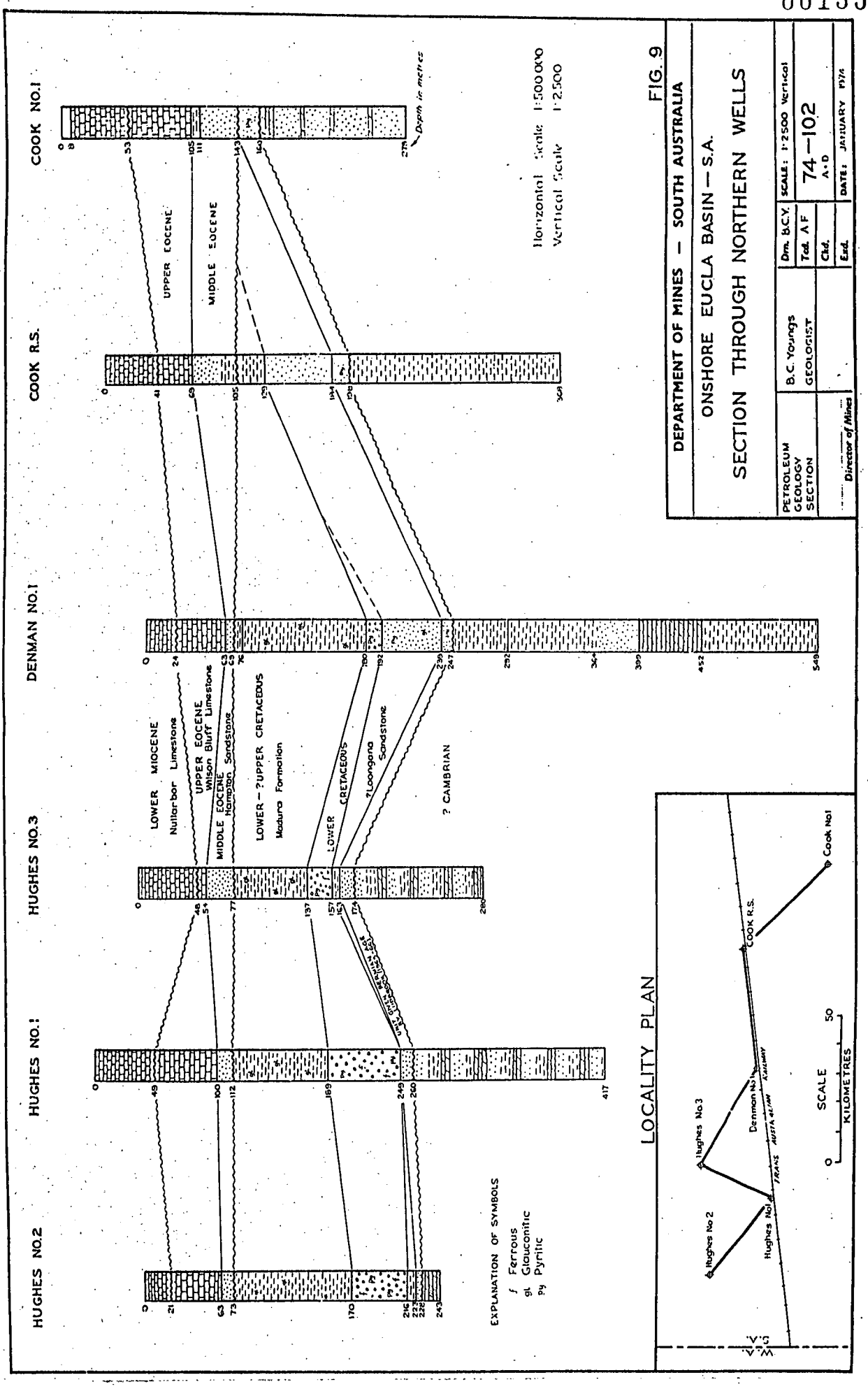


Figure 5 – Hughes-Denman-Cook Cross Section

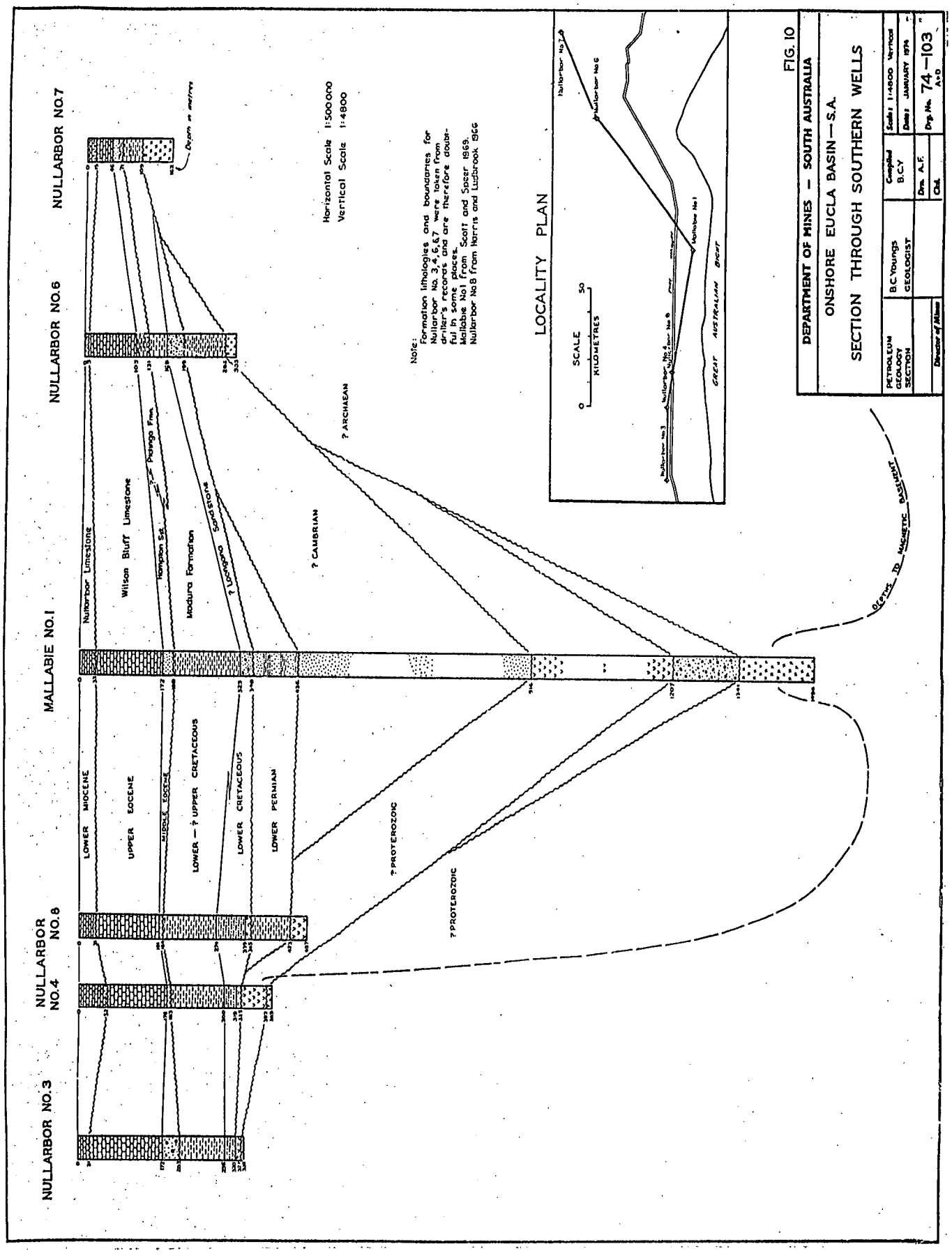


Figure 6 - Nullarbor-Mallabie Cross Section

The youngest formation in the Eucla Group is the Lower Miocene Nullarbor Limestone which crops out over all of the present basin area. This carbonate is a hard and dense, white biosparite composed mainly of algae and foraminiferal tests. Thicknesses are generally around 50 m but are less at the basin margins.

Quaternary aeolianites cover the Nullarbor Limestone in the area of the head of the Bight and in the northeastern corner of the permit, near the Ooldea Sand Range. Elsewhere superficial deposits are rare.

5.3 Structure

The present day basement structure of the Permit is best demonstrated by the Depth to Magnetic Basement map compiled by the South Australian Department of Mines (Figure 7) and by the Fence Diagram (Enclosure 1). These show a southeast-trending sedimentary trough crossing the West Australian border into South Australia and continuing to the vicinity of the Hughes and Denman wells. The maximum interpreted thickness of sediments in this trough is 2.75 km. This trough is coincident with a major gravity low (see Figure 7, Gravity Map). Other aeromagnetic basement lows are found south of the railway at Hughes and immediately west of Watson however these are not confirmed by trends in the gravity map. A shallow basement ridge delineated by drilling trends northwest across the northeast corner of the Permit. This ridge is roughly coincident with a gravity high.

An aeromagnetic high trends northeast through the Area dividing the Mallabie Depression from the Denman Trough. The Mallabie Depression, trending north northeast from the coast contains approximately 2.0 km of sediment near the coast increasing to 3.0 km west of Watson. The major portion of the aeromagnetic Mallabie Depression is coincident with a gravity low. Both the Denman trough and the Mallabie Depression have been confirmed by Outback Oil drilling although the basement ridge(?) between the two has not been drilled.

Only limited seismic refraction surveys have been run in the Area by SADME in the mid-1960s and they generally confirm the picture generated by other methods.

The 1986 Top Cambrian Structure Map (Enclosure 4) shows the current structure of the post-Cambrian, pre-Cretaceous unconformity. The map shows a "V" shaped outline of Cambrian sediments extending south through the Permit beyond the coastline. The unconformity surface dips toward the south with nearly 500 metres of relief from the northeastern corner of the Area (at +120m MSL) to the southern edge (at - 360m MSL). Several northwest-trending normal faults are suspected

along the southwest margin of the Cambrian section implying that an extensional tectonic regime was present during and/or after deposition.

A major northwest-trending basement horst is present in the northeastern corner of the Permit. The Cambrian section is either absent or very thin on this horst block. It is unclear from the current information if this horst was present during deposition. If so, good reservoir sands may be developed adjacent to the uplifted block. Alternatively, the faults may have developed after Cambrian deposition ceased, and the Cambrian subsequently eroded from the uplifted block.

Fault block traps are probably present in the Cambrian section, especially southwest of Denman 1 in the north; along the margins of the Mallabie Depression in the south; and along the basement high in the northeast corner of the permit. The structure maps, Enclosures 4 and 5, cannot be expected to show individual drillable structures as they are based on very sparse well control only, without the benefit of seismic.

The 1986 Top Loongana Structure Map (Enclosure 5) shows the structure and pinchout edge of the Cretaceous reservoir, the Loongana Sandstone. Hydrocarbons escaping from the Cambrian section (for example at Denman 1) may be trapped in stratigraphic and structural traps in this sand. The sand is overlain by the excellent regional seal, the Madura Formation. The subcrop pattern of this formation suggests that the area of Loongana non-deposition or erosion near Cook 1 is the result of northeast-trending horst block. The southern margin of the high, could contain fault-block traps in the Loongana. If the Loongana was deposited around an existing high at Cook 1 then stratigraphic pinchout traps will be present along the updip edges of subcrop (i.e., south of Cook 1, 80EP7, and Hughes 1). The subcrop margin just north of Hughes 1 and 2 is also suggestive of a fault-controlled boundary, possibly normal faulting along the southwest margin of the Denman Trough.

Air photo interpretation in 1966 delineated a number of possible anticlinal trends but ground checking at that time failed to confirm those. No seismic reflection surveys have been run to define structure in the Area. Seismic methods may be difficult to apply because of the cavernous nature of the surface limestones.

Landsat image analysis done by the PEL 33 Joint Venture in November, 1985 indicates that several possible anticlines are present in the surface of the Nullarbor Limestone especially near Cook 1 and along the south coast. Several of these anomalies are also fracture intersection zones and tonal anomalies. Tonal anomalies may be related to hydrocarbon microseeps.



Figure 7 - Depth to Magnetic Basement - SADME

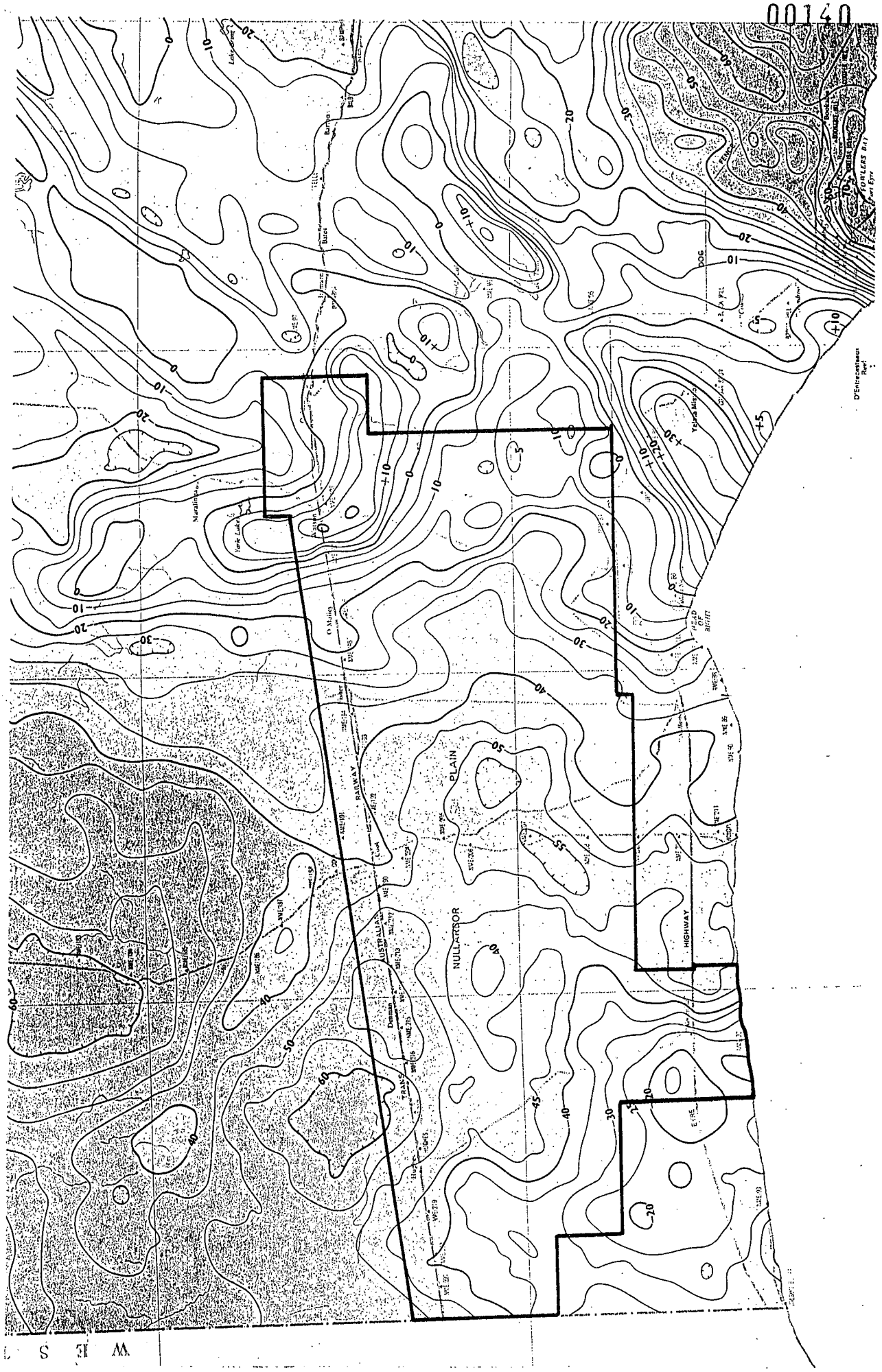


Figure 8 - Bouger Gravity Anomalies - SADME

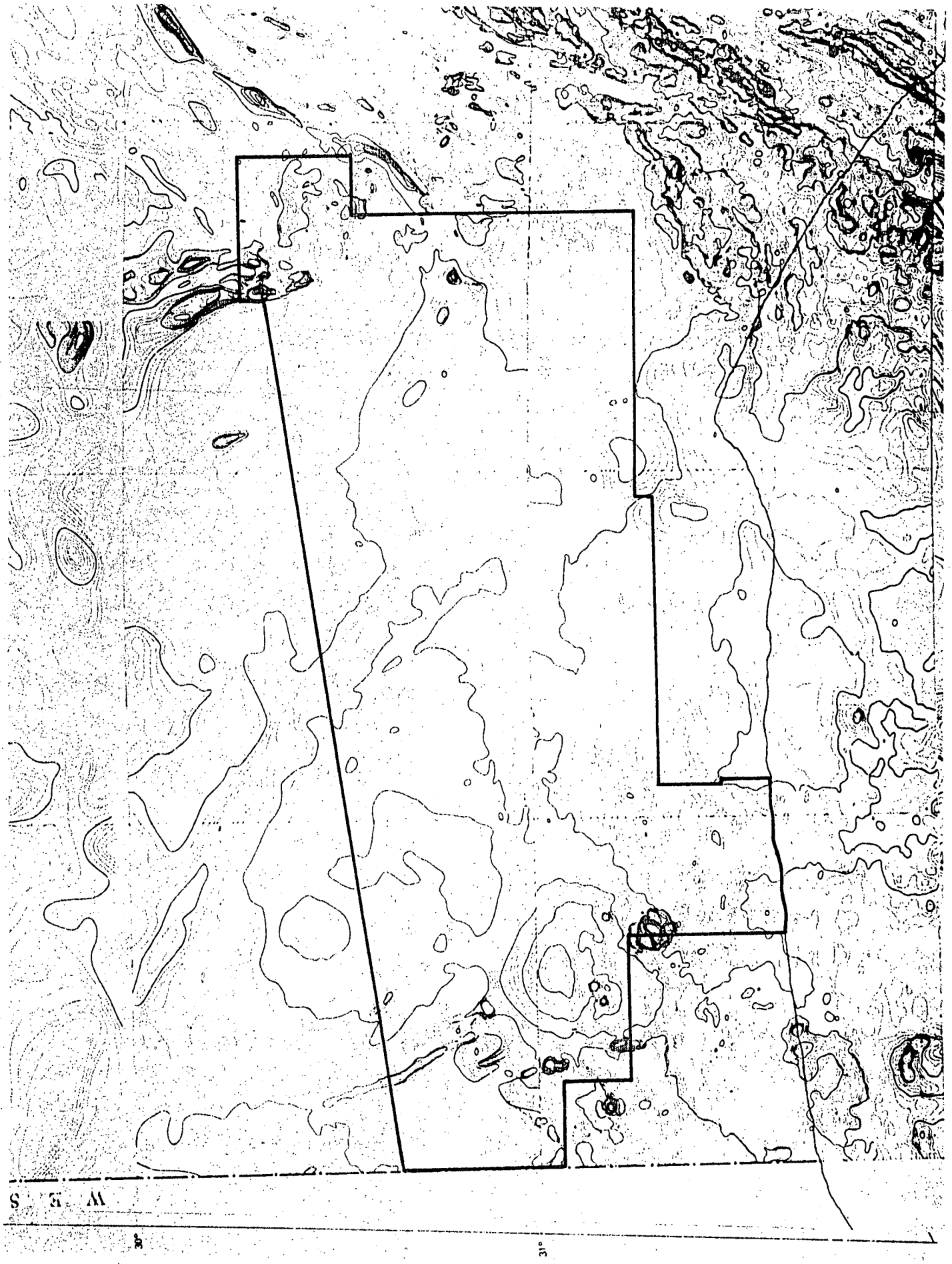


Figure 9 - Aeromagnetic Contours - SADME

6.0 HYDROCARBON PROSPECTIVITY

The prospectivity of the area has been demonstrated by the oil occurrences encountered while drilling stratigraphic wells Hughes 2 and Denman 1, bitumen noted in thin section in Cambrian sandstones in SMD 5002, gas shows in basement rocks in Mallabie 1, and by oil and gas shows in Muddauganan Water Bore.

Hughes 2 encountered black soft bituminous material from 192 m to 195 m and from 210 m to 213 m. The bitumen gave a bright yellow cut in 1.1.1 trichloroethane under ultraviolet light. The lower occurrence is contained in fine to medium grained Cretaceous conglomerate. The upper occurrence is found in gray silty clays and claystones.

In Denman 1 sporadic oil indications were found from 243 m to 548.6 m in Cambrian sandstone, shale, evaporite and dolomite.

The following table from the Denman 1 Well Completion Report describes the nature of the shows:

Interval (metres)	Nature of Material	Nature of cut in 1.1.1. trichloroethane
243.2-243.5	Black soft bituminous material of uncertain origin noted in the pits. This is a zone of lost circulation.	strong
378-381	Oil stained quartz grains	medium
381-384	Oil stained quartz grains	medium
384-387	Oil stained quartz grains	medium
390-393	Oil stained quartz grains	medium
396.2-399.3	Small fragments of black, soft bituminous material	strong
399.3-402.3	Small fragments of black, soft bituminous material	strong
426.7-429.8	Small fragments of black, soft bituminous material	strong
432.8-435.9	Small fragments of black, soft bituminous material	strong
435.9-438.9	Small fragments of black, soft bituminous material	strong
451.1-454.2	A few oil stained cuttings of shale and gypsum.	weak

460.3-463.3	A few oil stained cuttings of shale and gypsum	weak
463.3-466.3	A few oil stained cuttings of shale and gypsum	weak
466.3-469.4	A few oil stained cuttings of shale and gypsum	weak
469.4-472.4	A few oil stained cuttings of shale and gypsum	weak
472.4-475.5	A few oil stained cuttings of shale and gypsum	weak
475.5-478.5	Trace of black bituminous material	strong
496.8-499.9	Trace of black bituminous material	strong
509.0-512.1	Trace of black bituminous material	strong
512.1-515.1	Trace of black bituminous material	strong
515.1-518.2	Fragments of bituminous material up to 1"x3/4"x1/10"	strong
518.2-521.2	Fragments of bituminous material up to 1"x3/4"x1/10"	strong
521.2-524.3	Trace of black bituminous material	strong
524.3-527.3	Trace of black bituminous material	strong
536.5-539.5	A few oil stained cuttings of shale	weak
542.5-545.6	A few oil stained cuttings of shale and sandstone	weak
545.6-548.6	A few oil stained cuttings of shale and sandstone	weak

TD = 548.6 METRES

The well completion report for Denman 1 states "Unfortunately there was no provision for testing these intervals catered for in the drilling contract."

The mineral exploration corehole, SMD5002 encountered over 675m of Cambrian shale, sandstone and calcareous siltstone. In the Cambrian Munaroo Sandstone, thin sections cut by the South Australian Department of Mines and Energy revealed small amounts of bitumen, suggesting that oil had at some time migrated through the sand.

Mallabie 1, drilled in 1969 encountered crystalline basement at 1,341m but drilling continued to 1,496m. At one point, while drilling basement, a sharp methane gas kick was registered on the mud gas monitoring equipment. It is probable that the well intersected a fracture or fault, filled with gas sourced from the sediments above, or from sediments in a downfaulted block below the occurrence. The kick was not drill stem tested as no market existed for the gas.

Muddauganan Water Bore, completed in 1923 encountered gas shows at 67m in Tertiary Limestones and traces of oil were found in shales in the Cretaceous Madura Formation.

6.1 Source

Excellent oil source rocks are present in the Cambrian sediments underlying the Area.

The South Australian Department of Mines has drilled several stratigraphic wells into Officer Basin sediments and were successful in recovering oily cores from the Observatory Hill beds (probably equivalent to the Babbagoola Beds in W.A.) in Byilkaoora No. 1 in 1979. Other wells encountering the Observatory Hill Beds (notably Wilkinson 1) found organic-rich marine sabkha micritic carbonates. Analysis of these rocks showed that they are oil-prone, marginally mature to mature, and good to excellent source rocks (Figure 17). A stratigraphic well drilled by COMALCO in PEL 23 to the north has reportedly encountered significant oil shows over a 300m interval in Cambrian sediments.

In addition to Cambrian source, the Cretaceous Madura Formation is an excellent source for both oil and gas. Swan Resources and CRA conducted a shallow drilling programme to look for Cretaceous oil shale. They successfully located shale of the Madura Formation which yielded 150 litres of oil per tonne by Fischer Assay.

Shell analysed cuttings from the Hughes and Denman wells and found intervals in the Madura Formation were excellent sources, mainly for gas. The Madura at these locations was immature, but offshore the Cretaceous thickens to over 5,000 metres and should be mature and oil prone. Hydrocarbons generated offshore would migrate up-dip toward PEL 33. Maturity would be enhanced by the high geothermal heat flows during the breakup with Antarctica. Some relatively shallow water bores in the WA Eucla Basin yield water at 50 degrees C showing that a high geothermal gradient still exists.

6.2 Reservoir

Porosity and permeability is present in the Cambrian sandstones of Denman 1 where circulation was lost completely at 228 m during drilling. This is presumed to be caused by fracturing. Cambrian carbonates commonly display good vuggy porosity with vugs from 0.5 mm to 6 cm in diameter with unhealed fractures providing communication. Drilling of three mineral exploration wells (YLs 1, 2, and 3) had to be abandoned when salt water inflow became so great that core recovery became difficult. This highly saline water came from interstitial and possibly fracture porosity in the Cambrian section.

Cretaceous clastics beneath the Madura Formation shales provide optimum reservoir characteristics. Core Laboratories measured two specimens of Core 1 from Mallabie 1 and found porosities of 35.2% to 39.8% and permeabilities of 1610 to 3500 millidarcies. The Loongana Conglomerate below Core 1 displayed even better reservoir qualities but was not measured (Mallabie 1 Well Completion Report, Scott, 1969).

In September 1985 SADME sampled core of the Cambrian Munaroo Sandstone from drillhole SMD 5002 (Lake Maurice East) and found primary porosities up to 18.3% and permeabilities up to 1,210 millidarcies.

6.3 Seal

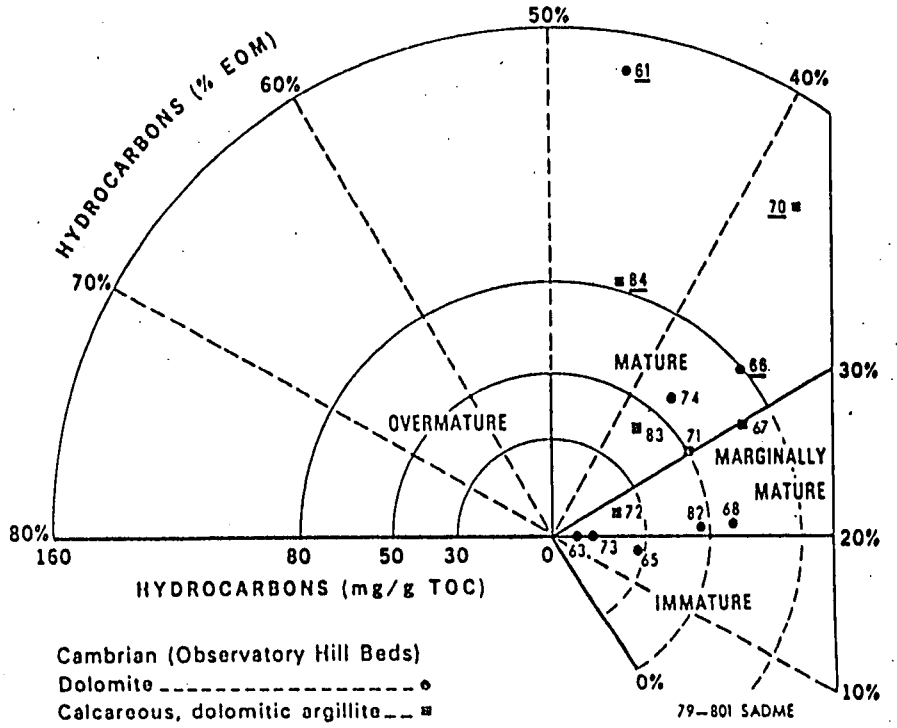
Seal is provided by tight carbonates and evaporites in the Cambrian section and by the Cretaceous Madura Formation. The Madura Formation is likely to be the most regionally extensive and effective seal. As mentioned earlier, this seal could provide a means by which hydrocarbons generated offshore could migrate updip into the Permit Area. The Madura Formation onlaps basement along the southern margins of the Permit providing an effective barrier to migration (Enclosures 1 and 3).

Further evidence of seal is provided by formation waters. Formation water resistivities calculated from electric logs give values of up to 20,000 ppm NaCl, indicating that flushing of this reservoir by meteoric water has not occurred. Direct analyses of water from water bores also shows that the aquifers generally contain very saline waters.

6.4 Timing of Migration

The presence of hydrocarbons in Cretaceous gravels in Hughes 2 proves that migration occurred or continued after the Cretaceous. Maturity measurements show that the Cambrian sediments are oil-mature now, meaning that little (if any) oil was lost during the pre-Cretaceous erosional periods.

BYILKAOORA–1



WILKINSON–1 AND WALLIRA WEST–1

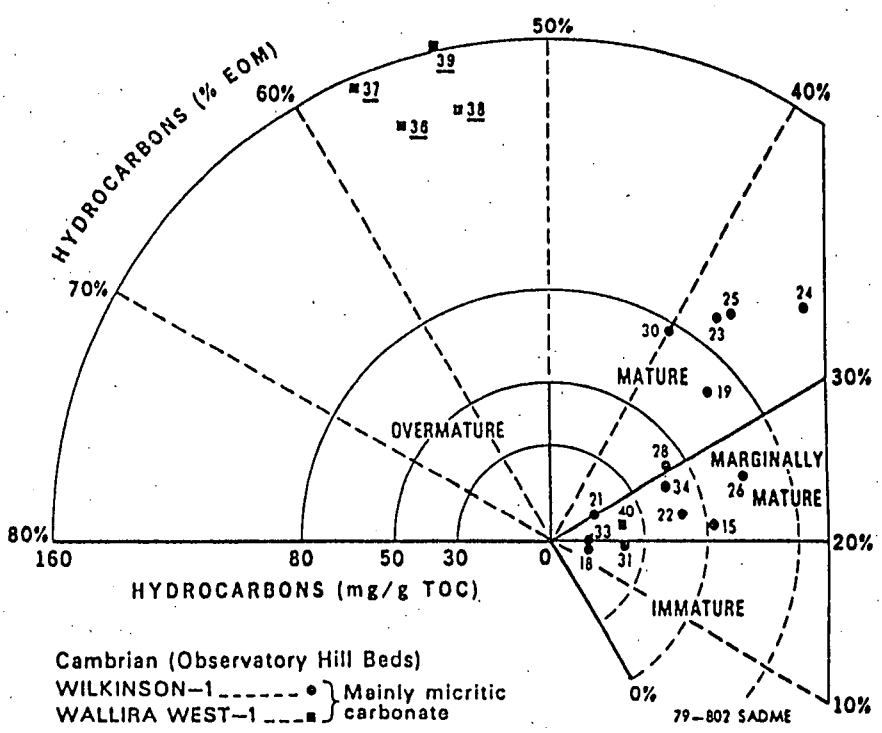


Figure 10 – Source Rock Richness and Maturity (in McKirdy, AAPG Memoir in preparation)

7.0 PLAY CONCEPTS

7.1 Structural Plays

Numerous structural plays have been identified in the Permit. Specific play concepts and leads are shown on the Play Concept Map (Enclosure 6). Figure 11 shows the 1985 Landsat Exploration Leads Map. The surface anticlines and the fracture intersection zones are possible structural traps which may contain hydrocarbons.

7.11 Anticlines

Simple doubly plunging anticlines and fault-closed anticlines are mapped on surface geology in the Area in Eucla Basin sediments. Anticlinal trends mapped in 1966 from air photos remain untested. Landsat interpretation in 1986 (Figure 11) showed 21 anticlinal trends within PEL 33. The 1986 Play Concept Map (Enclosure 6) shows the leads thought to be the most promising at this time.

In particular, the anticlines along the margins of the current Cambrian sediment limits may be related to wrench faulting at depth. Examples of this type of lead occur between Koonalda Station and Hughes, near the northwestern corner of the Permit.

Another set of anticlines occurs in the south-central portion of the Permit trending northwest. These anticlines are associated with several strong Landsat linears which are of unknown geological significance.

In the northeastern end of the permit, adjacent to the basement horst, there are two leads which may be related to drape over individual fault blocks along the downthrown side of the horst.

Several anticlinal leads trend northeast across the central part of the permit, subparallel to the Karrari Fault. Strong tonal anomalies are also associated with these leads.

Two small anticlines are located between Denman and Hughes. These trends may be associated with drape over normal fault blocks in the Denman Trough.

7.12 Fault Blocks

Tilted fault blocks could provide numerous exploration targets throughout the Area but especially in the vicinity of the margins of the deeper Palaeozoic troughs or in the northeast corner of the Permit where the basement ridge is probably bounded by several discrete fault blocks. Faulting could juxtapose Cambrian source beds against Cambrian or Cretaceous reservoirs, depending on the age and displacement of the fault.

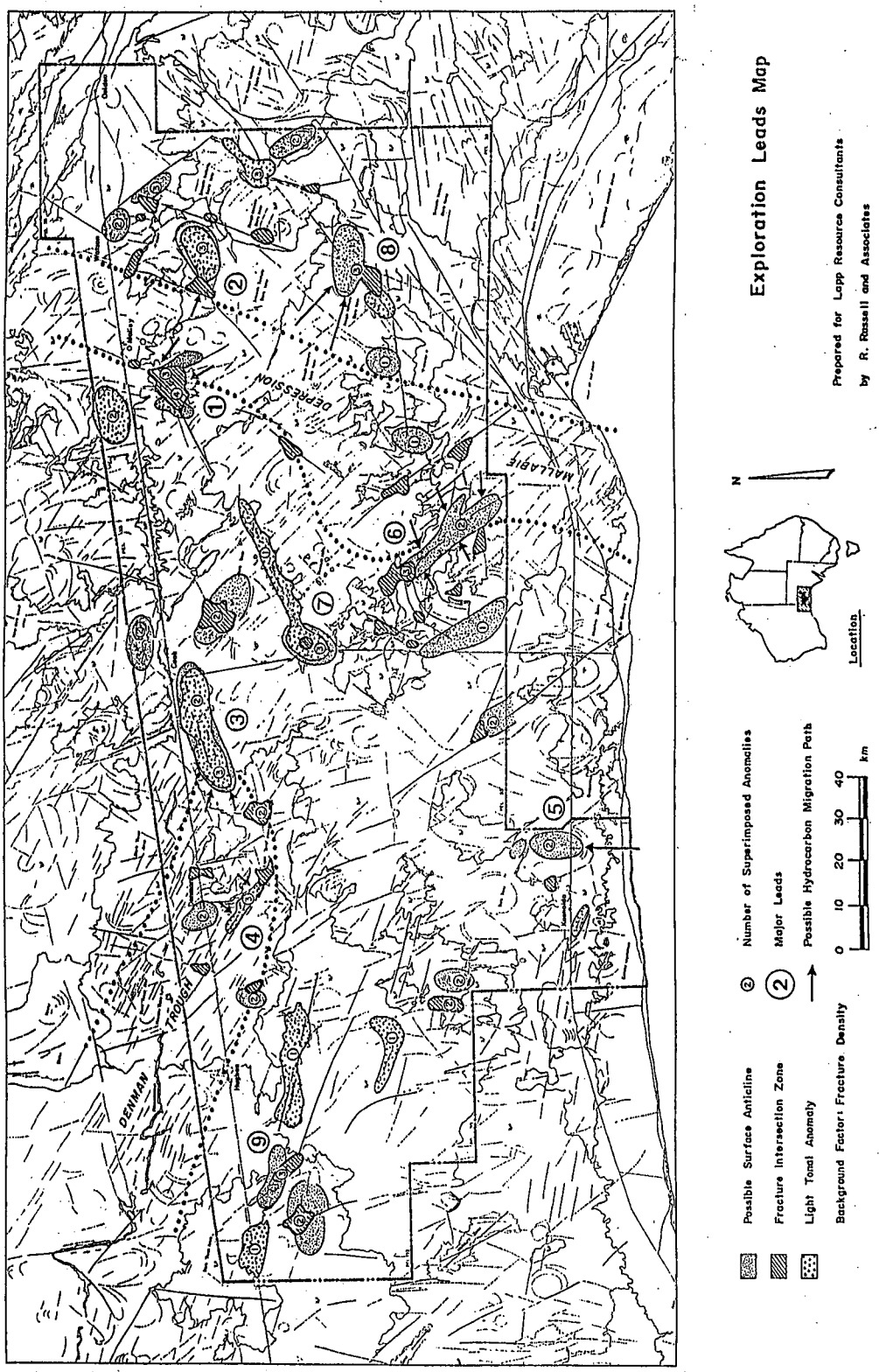


Figure 11 - 1985 Landsat Exploration Leads Map
(R. Russell and Associates)

In the southeast corner of the Permit faulting has apparently truncated the Cretaceous Loongana Sandstone reservoir and juxtaposed it against basement. The Loongana on the upthrown block may have been eroded or never deposited. The truncation is sealed by the Madura Formation.

7.2 Stratigraphic Plays

A variety of stratigraphic traps are likely to be present in the Cambrian and Cretaceous sediments.

7.21 Stratigraphic traps may occur at the truncation of beds at the Top Cambrian unconformity where it is sealed by Permian or Cretaceous pelitic sediments. Updip permeability barriers can also be formed by diagenetic infilling of pore space or by depositional facies changes. Rapid lateral facies changes are especially likely in the Cambrian shallow-water marine sediments. These traps could be found anywhere in the Permit Area and are difficult targets to locate by conventional exploration methods.

7.22 Preserved primary porosity in carbonate and clastic reservoirs can be expected throughout the Permit Area. Given sufficient data, palaeogeography maps could be constructed to identify areas of probable algal reef and shoreline development. A detailed structure contour and facies map of the unconformity surface may provide clues to the location of karstic topography sealed by draping Eucla Basin sediments. The Top Cambrian Structure Map (Enclosure 4) shows that the Cambrian unconformity surface dips to the south while the Fence Diagram (Enclosure 1) shows that the the Cambrian sediments may dip to the north. This implies that Cambrian carbonates subcrop and a pre-Cretaceous karstic topography is present within PEL 33. Drilling control and well correlations are too unreliable at this time to nominate specific target areas for this play type.

7.23 Secondary dolomitic porosity will probably be related to faults as they provide conduits for the movement of magnesium-rich dolomitizing fluids. Exploration for diagenetic dolomitic porosity should initially be concentrated along the faulted margins of the Cambrian sedimentary troughs.

7.24 Fracture reservoirs will probably be associated with faulting and folding in the Denman Graben and Mallabie Depression. Fractured lithologies housing hydrocarbons could include igneous basement rocks in upthrown fault blocks such as the basement ridge in the northeast corner of the permit.

7.25 One of the more attractive plays in PEL 33 is the updip pinchout edge of the Loongana Sandstone. The Play Concept Map (Enclosure 6) shows the sinuous course of

the pinchout through PEL 33. It is highly probable that the pinchout is sealed everywhere by the Madura Formation. In many wells where the Loongana is absent, the Madura is still found in significant thickness. This is especially true in the northwestern end of the permit where the Loongana pinchout is present but the Madura does not pinch out. Several tonal anomalies are also coincident with this western Loongana pinchout. In the center of the permit, the pinchout is apparently controlled by the palaeohigh around the Cook 1 location. "The Key" lead is possibly associated with the pinchout as the exact location of the pinchout cannot be assured with the present data. The Loongana pinchout is found at a very shallow depth (100 to 300m) in PEL 33 meaning that the exploration and development drilling could be extremely low cost.

8.0 EXPLORATION PHILOSOPHY

This Joint Venture is committed to use a variety of low-cost exploration methods aimed at locating hydrocarbons instead of structure. By limiting exploration costs smaller fields can be developed and larger fields will be more profitable. With todays lower oil prices, this is a key element in successful exploration ventures.

Although there are many inexpensive methods which have been used to find petroleum around the world, most of these methods have not been seriously tested in Australia. These alternatives to reconnaissance seismic methods find oil by detecting the physical, chemical and electrical changes in the rocks surrounding and overlying the hydrocarbon pool or by detecting hydrocarbon seeps directly. Alteration phenomena have been proved to exist in many fields and have been discussed in detail in the exploration literature since the 1930s. Our approach will be to use a variety of independent tools and where coincident anomalies occur, further exploration will proceed. To effectively explore such a large area quickly, conventional reconnaissance seismic methods cannot be used. Seismic is reserved for detailing areas of interest prior to drilling. The exploration philosophy we are using should be more effective than other approaches because it uses all the available information and concentrates on finding oil not structures. Structures prove to be dry 9 times out of 10 on a worldwide average. The search for structures also ignores the real possibility of finding oil in stratigraphic traps, which (when found) are usually found by accident.

If successful, the techniques used here to identify areas for further investigation by seismic and drilling could be used in other underexplored areas of South Australia and Australia, significantly accelerating the evaluation of virgin acreage.

We are using inexpensive exploration methods which will provide a wealth of "hard" geological, geophysical, and geochemical information in this relatively unexplored area. In addition, we are effectively screening this large area

for hydrocarbon prospectivity, leading to detailed surface geophysics, geochemistry and drilling in anomalous areas. This interdisciplinary approach is the only viable way to explore the entire Area for the wide variety of structural and stratigraphic traps which are present within the first term of the Licence.

9.0 CONCLUSIONS

This data package has demonstrated that PEL 33 contains source, reservoir, seal and a wide variety of structural and stratigraphic leads.

When the results of this 1986 subsurface geology review and the 1985 Landsat Interpretation are combined with further independent regional exploration tools, a comprehensive picture of the Permit's prospectivity and prospects will be formed. Based on current knowledge, the Loongana Sandstone pinchout and Cambrian fault block and anticlinal traps seem the most promising play types. Late-formed Tertiary anticlines could also be prospective if oil generation and migration are continuing.

10.0 PEL 33 REFERENCES

The following reference list, sorted in chronological order, was obtained from the SADME computer database and includes references to works on or about the geology of rocks contained in the Cook, Nullarbor, Ooldea and Coompana 1:250,000 map sheets.

This list, used in connection with the reference list in the November, 1984 edition of this report should give the user a comprehensive file of sources for information on the Officer and Eucla Basins.

LRC Pty Ltd - start of listing .....

1.

#CNO 006420 TYPE: SERIAL
TITLE
THE NATURAL HISTORY OF THE COUNTRY AROUND THE HEAD OF THE GREAT AUSTRALIAN BIGHT
AUTHOR
TATE,R
SOURCE
ROYAL PHILOSOPHICAL SOCIETY OF SOUTH AUSTRALIA. TRANSACTIONS & PROCS. , VOL. 2 P94-128; MAPS, #DOP 1879
KEYWORDS

#SC 1500	REGIONAL GEOLOGY	TERTIARY
LIMESTONE	GEOLOGICAL CROSS SECTION	PALAEONTOLOGY
CAINOZOIC		

LOCALITIES

GREAT AUSTRALIAN BIGHT	BUNDA PLATEAU	EUCLA
WILSON BLUFF	NULLARBOR	

MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5313 FOWLER
#250: SI5301 NUYTS

2.

#CNO 007658 TYPE: GOVERNMENT REPORT
TITLE
UNDERGROUND WATER IN WESTERN PORTION OF S.A.
AUTHOR
WARD,L K
SOURCE
SADME UNPUBLISHED REPORT, #RB 8 /065 4 PAGES; #DOP 1921
KEYWORDS

#SC 1240	HYDROGEOLOGY	WATER PROSPECTING
GROUND WATER	WATER SUPPLY	

LOCALITIES

NULLARBOR	COOK	HUGHES BORES

MAP #250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5215 COOMPANA
#250: SH5216 NULLARBOR

3.

#CNO 007671 TYPE: GOVERNMENT REPORT
TITLE
THE CAVES ON THE MARGIN OF THE NULLARBOR PLAIN AND THEIR RELAITION TO UDERGROUND WATER
AUTHOR
WARD,L K
SOURCE
SADME UNPUBLISHED REPORT, #RB 10/231 10 PAGES; #DOP 1927
KEYWORDS

#SC 1240	HYDROGEOLOGY	CAVES
WATER QUALITY	NULLARBOR LIMESTONE	

LOCALITIES

NULLARBOR	KOONALDA	

MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR

4.
#CNO 014490 TYPE: SERIAL
TITLE
AUSTRALITES PART I CLASSIFICATION OF THE W.H.C. SHAW COLLECTION
AUTHOR
FENNER,C
SOURCE
ROYAL SOCIETY OF SOUTH AUSTRALIA. TRANSACTIONS, VOL. 58 P62-79;
MAPS,ILLUST, #DOP 1934
KEYWORDS
#SC 1170 EXTRATERRESTRIAL GEOLOGY AUSTRALITES
LOCALITIES
NULLARBOR EUCLA PENONG
MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5211 COOK
#250: SH5212 OOLDEA #250: SH5313 FOWLER

5.
#CNO 003635 TYPE: GOVERNMENT REPORT
TITLE
WATER BORING AT X300 PRELIMINARY REPORT POINTS TO GUIDE DRILLERS(S.R.2
4/1/2 2-12-53
AUTHOR
BARNES,T A
SOURCE
SADME UNPUBLISHED REPORT, #RB 50 3 PAGES; MAPS,
#DOP 1953
KEYWORDS
#SC 1240 HYDROGEOLOGY DRILLING
WATER SUPPLY
LOCALITIES
MARALINGA TIETKINS PLAINS EUCLA BASIN
MAP #250: SH5212 OOLDEA
#100: 5237

6.
#CNO 003632 TYPE: GOVERNMENT REPORT
TITLE
AN INTERPRETATION OF THE TERTIARY SEQUENCE BETWEEN WATSON AND MARALINGA
IN THE NORTH WESTERN PORTION OF THE EUCLA BASIN
AUTHOR
LUDBROOK,N H
SOURCE
SADME UNPUBLISHED REPORT, #RB 258 31PAGES; MAPS,
#DOP 1954
KEYWORDS
#SC 1590 STRATIGRAPHY TERTIARY
BIOSTRATIGRAPHY MICROPALAEONTOLOGY DRILLING
GEOLOGICAL CROSS SECTION SAMPLING
LOCALITIES
EUCLA BASIN MARALINGA TIETKINS PLAINS
WATSON
MAP #250: SH5212 OOLDEA
#100: 5237

7.
#CNO 003634 TYPE: GOVERNMENT REPORT
TITLE
UNDERGROUND WATER SURVEY OF MARALINGA AREA FINAL REPORT
AUTHOR
BARNES,T A

SOURCE
SADME UNPUBLISHED REPORT, #RB 104 4 PAGES; MAPS,
#DOP 1954
KEYWORDS
#SC 1240 HYDROGEOLOGY WATER SUPPLY
DRILLING SALINITY GEOLOGICAL LOGS
LOCALITIES
MARALINGA TIETKINS PLAINS EUCLA BASIN
MAP #250: SH5212 OOLDEA
#100: 5237

8.
#CNO 003636 TYPE: GOVERNMENT REPORT
TITLE
UNDERGROUND WATER SURVEY OF THE MARALINGA AREA PROGRESS REPORT NO.2
AUTHOR
BARNES,T A
SOURCE
SADME UNPUBLISHED REPORT, #RB 51 3 PAGES;
#DOP 1954
KEYWORDS
#SC 1240 HYDROGEOLOGY WATER SUPPLY
DRILLING AGGREGATES
LOCALITIES
MARALINGA TIETKINS PLAINS EUCLA BASIN
MAP #250: SH5212 OOLDEA
#100: 5237

9.
#CNO 004496 TYPE: GOVERNMENT REPORT
TITLE
GRAVITY SURVEY IN THE NORTH-EASTERN PORTION OF THE NULLARBOR PLAIN AND ADJACENT AREAS(GEOPHYS.REP.5/54) 3 PLANS
AUTHOR
GRANT,C K ; PEGUM,D M
SOURCE
SADME UNPUBLISHED REPORT, #RB 374 7 PAGES; MAPS,
#DOP 1954
KEYWORDS
#SC 1230 GEOPHYSICS BED ROCK
GRAVITY SURVEYS BOUGUER GRAVITY MAPS GRAVITY PROFILE
LOCALITIES
NULLARBOR EUCLA BASIN MARALINGA
TIETKINS PLAINS
MAP #250: SH5212 OOLDEA #250: SH5309 BARTON #250: SH5208 MAURICE
#100: 5236 5336 5237 5238

10.
#CNO 006934 TYPE: GOVERNMENT REPORT
TITLE
GROUNDWATERS OF THE EUCLA BASIN (SR 24/1/2)
AUTHOR
BARNES,T A
SOURCE
SADME UNPUBLISHED REPORT, #RB 313 4 PAGES; MAPS,
#DOP 1954
KEYWORDS
#SC 1240 HYDROGEOLOGY GROUND WATER SURVEYS
WATER POLLUTION CONTAMINATION RADIOACTIVITY

SURVEYS
GROUND WATER MOVEMENT
LOCALITIES
EUCLA BASIN MARALINGA
MAP #250: SH5212 OOLDEA

11.
#CNO 011982 TYPE: GOVERNMENT REPORT
TITLE
GEOLOGICAL RECONNAISSANCE OF THE EUCLA BASIN
AUTHOR
REED,L C ; EVANS,H J
SOURCE
SADME UNPUBLISHED REPORT, #RB 39/085 13 PAGES;
#DOP 1954
KEYWORDS
#SC 1500 REGIONAL GEOLOGY SEDIMENTARY BASINS
GEOLOGICAL SURVEYS PETROLEUM EXPLORATION STRUCTURAL GEOLOGY
LOCALITIES
EUCLA BASIN WESTERN AUSTRALIA
MAP #250: SH5214 #250: SH5215 COOMPANA #250: SH5216
NULLARBOR
#250: SI5301 NUYTS
#100: 5333

12.
#CNO 014389 TYPE: GOVERNMENT REPORT
TITLE
RECONNAISSANCE SURVEY OF THE EUCLA BASIN. STRATIGRAPHY AND
PALAEONTOLOGY.
AUTHOR
LUDBROOK,N H
SOURCE
SADME UNPUBLISHED REPORT, #RB 38/036 36 PAGES; MAPS,ILLUST,
#DOP 1954
KEYWORDS
#SC 1430 BIOSTRATIGRAPHY STRATIGRAPHY
NULLARBOR LIMESTONE HAMPTON SANDSTONE BUNDA CHALK
CAINOZOIC STRATIGRAPHIC CORRELATION
BIOSTRATIGRAPHY STRATIGRAPHY NULLARBOR LIMESTONE
HAMPTON SANDSTONE BUNDA CHALK CAINOZOIC
STRATIGRAPHIC CORRELATION
LOCALITIES
EUCLA BASIN PIDINGA LAKES
MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5313
FOWLER
#250: SI5301 NUYTS

13.
#CNO 014655 TYPE: GOVERNMENT REPORT
TITLE
REPORT ON THE GEOLOGICAL RECONNAISSANCE SURVEY OF THE SOUTHERN PORTION
OF THE EUCLA BASIN AND OF PART OF THE WARBURTON RANGES
AUTHOR
CAMPBELL,I R
SOURCE
SADME UNPUBLISHED REPORT, #RB 37/143 21 PAGES; MAPS,
#DOP 1954
KEYWORDS
#SC 1500 REGIONAL GEOLOGY SEDIMENTARY BASINS

EUCLA LIMESTONE LIMESTONE MIOCENE
GEOLOGICAL MAPS
LOCALITIES
EUCLA BASIN WESTERN AUSTRALIA
MAP #250: SH5215 COOMPANA #250: SI5401 ORROROO #250: SG5413 GASON
#100: 4734 6533 4245

14.
#CNO 003633 TYPE: GOVERNMENT REPORT
TITLE
WATER BORING - MARALINGA GEOLOGICAL AND HYDROLOGICAL COMMENTS
AUTHOR
BARNES,T A
SOURCE
SADME UNPUBLISHED REPORT, #RB 493 22 PAGES;
#DOP 1956
KEYWORDS
#SC 1240 HYDROGEOLOGY REGIONAL GEOLOGY
STRATIGRAPHY DRILLING WATER SUPPLY
WELL LOCATION SURVEYS WELL DISCHARGE TESTS SAFE YIELD
AQUIFER WATER LEVEL SALINITY
LOCALITIES
MARALINGA EUCLA BASIN TIETKINS PLAINS
MAP #250: SH5212 OOLDEA
#100: 5237

15.
#CNO 008657 TYPE: OTHER GOVERNMENT REPORT
TITLE
PRELIMINARY REPORT ON SEISMIC REFRACTION SURVEY AT
MARALINGA,S.A.(REC.1956/11)
CORPORATE
BMR
AUTHOR
VALE,K R ; WIEBENGA,W A
SOURCE
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS. RECORD, VOL. 56/11
1 PAGES; MAPS, #DOP 1956
KEYWORDS
#SC 1230 GEOPHYSICS SEISMIC SURVEYS
SEISMIC REFRACTION SURVEYS
LOCALITIES
MARALINGA
MAP #250: SH5212 OOLDEA
#100: 5237

16.
#CNO 008658 TYPE: OTHER GOVERNMENT REPORT
TITLE
SEISMIC SURVEY AT MARALINGA, SOUTH AUSTRALIA (1955-56) (REC.1956/4)
CORPORATE
BMR
AUTHOR
WIEBENGA,W A ; HAWKINS,L V
SOURCE
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS. RECORD, VOL. 56/48
6 PAGES; MAPS, #DOP 1956
KEYWORDS
#SC 1230 GEOPHYSICS SEISMIC SURVEYS
SHOTHOLE SEISMIC REFRACTION SURVEYS

GEOLOGICAL CROSS SECTION
LOCALITIES
MARALINGA
MAP #250: SH5212 OOLDEA
#100: 5237

17.
#CNO 008660 TYPE: OTHER GOVERNMENT REPORT
TITLE
REGIONAL GRAVITY TRAVERSES ACROSS THE EUCLA BASIN, 1954-55 (REC.1956/145)
CORPORATE
BMR
AUTHOR
GUNSON,S . ; LINDEN,J VAN-DER
SOURCE
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS. RECORD, VOL. 56/145
7 PAGES; MAPS, #DOP 1956
KEYWORDS
#SC 1230 GEOPHYSICS GRAVITY SURVEYS
GRAVITY PROFILE
LOCALITIES
EUCLA BASIN WESTERN AUSTRALIA
MAP #250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5215 COOMPANA
#250: SH5216 NULLARBOR #250: SH5313 FOWLER #250: SI5302 STREAKY BAY

18.
#CNO 010813 TYPE: GOVERNMENT REPORT
TITLE
PRELIMINARY REPORT ON GROUNDWATER INVESTIGATIONS YALATA MISSION STATIONCO. HOPETOWN
AUTHOR
JOHNSON,W
SOURCE
SADME UNPUBLISHED REPORT, #RB 42/113 8 PAGES; MAPS, #DOP 1956
KEYWORDS
#SC 1240 HYDROGEOLOGY GROUND WATER SURVEYS
WATER PROSPECTING
LOCALITIES
YALATA MISSION
MAP #250: SH5216 NULLARBOR #250: SI5301 NUYTS #250: SH5313 FOWLER
#100: 5134 5135 5235 5234 5333 5334

19.
#CNO 010361 TYPE: GOVERNMENT REPORT
TITLE
PALAEONTOLOGICAL EXAMINATION OF BORES IN THE WESTERN PORTION OF THE EUCLA BASIN
AUTHOR
LUDBROOK,N H
SOURCE
SADME UNPUBLISHED REPORT, #RB 45/053 16 PAGES; MAPS, #DOP 1957
KEYWORDS
#SC 1430 BIOSTRATIGRAPHY CRETACEOUS
QUATERNARY WILSON BLUFF LIMESTONE NULLARBOR LIMESTONE

LOCALITIES
EUCLA BASIN MADURA WESTERN AUSTRALIA
MAP #250: SH5213 #250: SH5212 OOLDEA

20.
#CNO 008659 TYPE: OTHER GOVERNMENT REPORT
TITLE
SEISMIC DATA OBTAINED FROM THE ATOMIC WEAPONS TEST AT MARALINGA, SOUTH AUSTRALIA, 1956 (REC.1958/89)
CORPORATE
BMR
AUTHOR
EVERINGHAM,I B
SOURCE
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS. RECORD, VOL. 58/89
11 PAGES; MAPS, #DOP 1958
KEYWORDS
#SC 1230 GEOPHYSICS SEISMOLOGY
SOLID EARTH GEOPHYSICS EARTH CRUST SEISMIC WAVES
MOHO EXPLOSIONS
LOCALITIES
MARALINGA
MAP #250: SH5212 OOLDEA
#100: 5237

21.
#CNO 003670 TYPE: GOVERNMENT REPORT
TITLE
MATERIAL FROM THE WESTERN PORTION OF THE EUCLA BASIN (ENV61)
CORPORATE
EXOIL
AUTHOR
LUDBROOK,N H
SOURCE
SADME UNPUBLISHED REPORT, #RB 48/119 4 PAGES;
#DOP 1959
KEYWORDS
#SC 1430 BIOSTRATIGRAPHY PETROLEUM
MOLLUSCA PLEISTOCENE NULLARBOR LIMESTONE
WILSON BLUFF LIMESTONE CAINOZOIC
LOCALITIES
EUCLA BASIN HAMPTON WILSON BLUFF
WESTERN AUSTRALIA MADURA
MAP #250: SH5215 COOMPANA #250: SH5214

22.
#CNO 006935 TYPE: GOVERNMENT REPORT
TITLE
CLAY DEPOSITS AT MARALINGA (MARALINGA PROJECT) (RB 620)
AUTHOR
JOHNS,R K
SOURCE
SADME UNPUBLISHED REPORT, #RB 620 7 PAGES; MAPS,
#DOP 1959
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS MINERAL DEPOSITS
CLAYS MINERAL EXPLORATION DRILLING
AUGER DRILLING LACUSTRINE SEDIMENTS MINERALOGY
LABORATORY TESTS
LOCALITIES

MARALINGA YARLE LAKES
MAP #250: SH5212 OOLDEA
#100: 5137 5237

23.
#CNO 006835 TYPE: GOVERNMENT REPORT
TITLE
SUBSURFACE STRATIGRAPHY OF THE MARALINGA AREA, SOUTH AUSTRALIA
AUTHOR
LUDBROOK,N H
SOURCE
ROYAL SOCIETY OF SOUTH AUSTRALIA. TRANSACTIONS, VOL. 84 #RB 47/020
P51-60; MAPS, #DOP 1961
KEYWORDS

#SC 1590	STRATIGRAPHY	DRILLING
PERCUSSION DRILLING	WELLS	SUBSURFACE
CORRELATION		
GEOLOGICAL CROSS SECTION	GEOLOGICAL LOGS	PRE-ADELAIDEAN
DIORITE	ADELAIDEAN	MARINOAN
PERMIAN	EOCENE	WILSON BLUFF
LIMESTONE		
CAINOZOIC	BIOSTRATIGRAPHY	LIGNITE

LOCALITIES

MARALINGA	EUCLA BASIN	TIETKINS PLAINS
MARCOO	WATSON	

MAP #250: SH5212 OOLDEA #250: SH5208 MAURICE
#100: 5237 5238

24.
#CNO 007832 TYPE: GOVERNMENT REPORT
TITLE
AGGREGATE SOURCES - MARALINGA
AUTHOR
JOHNS,R K
SOURCE
SADME UNPUBLISHED REPORT, #RB 53/054 2 PAGES; MAPS,
#DOP 1961
KEYWORDS

#SC 1345	NON-METALLIFEROUS MINS	EXTRACTIVE MINERALS
AGGREGATES	ROAD METAL	LIMESTONE

LOCALITIES
MARALINGA
MAP #250: SH5212 OOLDEA
#100: 5237

25.
#CNO 007476 TYPE: GOVERNMENT REPORT
TITLE
REPORT ON GROUNDWATER PROSPECTS EYRE HIGHWAY-HWYS & LOCAL GOVT- PART VI - CEDUNA-EUCLA SECTION
AUTHOR
SHEPHERD,R G
SOURCE
SADME UNPUBLISHED REPORT, #RB 54/143 5 PAGES; MAPS,
#DOP 1962
KEYWORDS

#SC 1240	HYDROGEOLOGY	WATER SUPPLY
HIGHWAY ENGINEERING	GROUND WATER SURVEYS	

LOCALITIES

CEDUNA	EUCLA	EUCLA BASIN

MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5313 FOWLER
#250: SI5301 NUYTS #250: SI5302 STREAKY BAY #250: SH5314 CHILDARA
#100: 5633 5634

26.
#CNO 003631 TYPE: GOVERNMENT REPORT
TITLE
GEOPHYSICAL SURVEY OF THE OFFICER BASIN S.A.
AUTHOR
MUMME,I A
SOURCE
ROYAL SOCIETY OF SOUTH AUSTRALIA. TRANSACTIONS, VOL. 87 #RB 666 P119-122; MAPS, #DOP 1963
KEYWORDS
#SC 1230 GEOPHYSICS PETROLEUM
SEDIMENTARY BASINS GRAVITY SURVEYS GROUND MAGNETIC SURVEYS
REGIONAL SURVEYS GRAVITY PROFILE MAGNETIC PROFILE
BOUGUER GRAVITY MAPS
LOCALITIES
OFFICER BASIN
MAP #250: SH5204 WELLS #250: SH5208 MAURICE #250: SH5212 OOLDEA
#250: SG5211 MANN #250: SG5212 WOODROFFE #250: SG5216 LINDSAY
#250: SG5309 ALBERGA #250: SG5314 WINTINNA

27.
#CNO 006721 TYPE: SERIAL
TITLE
SOME GEOMORPHOLOGICAL PROBLEMS OF THE NULLARBOR PLAIN
AUTHOR
JENNNINGS,J N
SOURCE
ROYAL SOCIETY OF SOUTH AUSTRALIA. TRANSACTIONS, VOL. 87 P41-62; MAPS,ILLUST, #DOP 1963
KEYWORDS
#SC 1610 SURFICIAL GEOLOGY GEOMORPHOLOGY
KARST TOPOGRAPHY CAVES COASTS
LIMESTONE CAINOZOIC SEA LEVEL
LOCALITIES
NULLARBOR WESTERN AUSTRALIA EUCLA BASIN
MAP #250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5215 COOMPANA
#250: SH5216 NULLARBOR #250: SH5313 FOWLER #250: SI5301 NUYTS
#250: SH5213 #250: SH5214

28.
#CNO 006919 TYPE: GOVERNMENT REPORT
TITLE
AN EVALUATION OF THE CRUSTAL THICKNESS IN THE MARALINGA AREA, SOUTH AUSTRALIA
AUTHOR
MUMME,I A
SOURCE
ROYAL SOCIETY OF SOUTH AUSTRALIA. TRANSACTIONS, VOL. 87 #RB 52/107 P197-198; #DOP 1963

KEYWORDS
#SC 1230 GEOPHYSICS SOLID EARTH
GEOPHYSICS
EARTH CRUST GRAVITY ANOMALIES GRAVITY SURVEYS
CRUSTAL THICKNESS
LOCALITIES
MARALINGA
MAP #250: SH5204 WELLS #250: SH5208 MAURICE #250: SH5212
OOLDEA

29.
#CNO 002408 TYPE: COMPANY REPORT
TITLE
HUGHES STRATIGRAPHIC WELLS (2 MAPS SHOWING LOCALITIES-NO TEXT)
CORPORATE
OUTBACK OIL
AUTHOR
GEOSURVEYS-LTD
SOURCE
SADME UNPUBLISHED REPORT, #ENV 586 MAPS, #DOP
1964
KEYWORDS
#SC 1400 MISCELLANEOUS STRATIGRAPHIC WELLS
MAPS TOPOGRAPHIC MAPS PETROLEUM
LOCALITIES
HUGHES 1 HUGHES 2 HUGHES 3
MAP #250: SH5211 COOK
#100: 4736 4836 4737 4837

30.
#CNO 002523 TYPE: COMPANY REPORT
TITLE
PROGRESS REPORTS AND SUMMARY REPORT-EUCLA BASIN INVESTIGATION(5 REPORTS
#TN O EL33
CORPORATE
OUTBACK OIL
AUTHOR
WEBB,B P ; SPRIGG,R C ; GEOSURVEYS-AUST-PL
SOURCE
SADME UNPUBLISHED REPORT, #ENV 377 MAPS, #DOP
1964
KEYWORDS
#SC 1440 PETROLEUM PETROLEUM
EXPLORATION
GEOLOGICAL SURVEYS PHOTOINTERPRETATION CAINOZOIC
NULLARBOR LIMESTONE WILSON BLUFF LIMESTONE LIMESTONE
JOINTING GRAVITY SURVEYS PROPOSAL SAMPLING
LOCALITIES
EUCLA BASIN
MAP #250: SH5211 COOK #250: SH5215 COOMPANA #250: SH5212
OOLDEA
#250: SH5216 NULLARBOR

31.
#CNO 007029 TYPE: GOVERNMENT REPORT
TITLE
TERRIAN SURVEY PORT AUGUSTA TO EUCLA (3 VOLS OF PLANS & LOGS)
AUTHOR
FIRMAN,J B
SOURCE

SADME UNPUBLISHED REPORT, #RB 59/075 1 PAGES; MAPS,ILLUST,
#DOP 1964

KEYWORDS

#SC 1140	ENGINEERING GEOLOGY	SURFICIAL GEOLOGY
LANDFORMS	RIPPABILITY	TRENCHING
HYDROGEOLOGY	WELL LOCATION SURVEYS	GEOLOGICAL LOGS
SALINITY		

LOCALITIES

EYRE HIGHWAY	PORT AUGUSTA	EUCLA

MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5313 FOWLER
#250: SI5302 STREAKY BAY #250: SI5303 YARDEA #250: SI5304 PORT AUGUSTA
#250: SI5307 KIMBA #250: SI5308 WHYALLA

32.

#CNO 007264 TYPE: GOVERNMENT REPORT
TITLE
DIAMOND DRILLING OPERATIONS - ROADSIDE(MARALINGA) DOLOMITE
AUTHOR
JOHNS,R K
SOURCE
MINING REVIEW, ADELAIDE (SADME), VOL. 116 #RB 54/054 P128-132;
MAPS, #DOP 1964

KEYWORDS

#SC 1345	NON-METALLIFEROUS MINS	EXTRACTIVE MINERALS
DOLOMITE (ROCK)	AGGREGATES	ROAD METAL
CONCRETE	DIAMOND DRILLING	GEOLOGICAL LOGS
LOS ANGELES TEST	SULPHATE SOUNDNESS	BITUMEN STRIPPING
TEST		
DENSITY	RESERVES	TERTIARY

LOCALITIES
MARALINGA
MAP #250: SH5212 OOLDEA
#100: 5237

33.

#CNO 001316 TYPE: COMPANY REPORT
TITLE
FINAL REPORT ON S.M.L.149 PIDINGA LAKES, SOUTH AUSTRALIA
#TN SML149
CORPORATE
MINES ADMIN
AUTHOR
KING,D
SOURCE
SADME UNPUBLISHED REPORT, #ENV 869 2 PAGES; MAPS,
#DOP 1965

KEYWORDS

#SC 1345	NON-METALLIFEROUS MINS	INDUSTRIAL MINERALS
BRINES	ALUNITE	CHEMICAL ANALYSIS
DRILLING	GEOLOGICAL LOGS	LACUSTRINE SEDIMENTS

LOCALITIES

EROMANGA BASIN	LAKE TALIA COOTRA	

MAP #250: SH5212 OOLDEA #250: SH5309 BARTON #250: SH5216 NULLARBOR
#250: SH5313 FOWLER
#100: 5236 5336 5235 5335

34.

#CNO 002336 TYPE: COMPANY REPORT
TITLE
EUCLA BASIN GRAVITY SURVEY O.E.L.33 S.A. PROGRESS REPORTS (3)
CORPORATE
OUTBACK OIL
AUTHOR
GEOSURVEYS-AUST
SOURCE
SADME UNPUBLISHED REPORT, #ENV 537 MAPS, #DOP 1965
KEYWORDS
#SC 1230 GEOPHYSICS PETROLEUM
GRAVITY SURVEYS BOUGUER GRAVITY MAPS
LOCALITIES
EUCLA BASIN
MAP #250: SH5211 COOK #250: SH5215 COOMPANA #250: SH5212 OOLDEA
#250: SH5216 NULLARBOR

35.
#CNO 002553 TYPE: GOVERNMENT REPORT
TITLE
OUTBACK OIL CO.N.L. COOK NO.1 WELL SUBSURFACE STRATIGRAPHY (R.B.714)
CORPORATE
OUTBACK OIL
AUTHOR
LUDBROOK,N H
SOURCE
SADME UNPUBLISHED REPORT, #ENV 460 6 PAGES;
#DOP 1965
KEYWORDS
#SC 1430 BIOSTRATIGRAPHY PALAEONTOLOGY
STRATIGRAPHY PETROLEUM BIOSTRATIGRAPHIC
LOGS
STRATIGRAPHIC CORRELATION CAMBRIAN
PALAEOZOIC CAINOZOIC WILSON BLUFF
LIMESTONE
NULLARBOR LIMESTONE DRILL CUTTINGS
LOCALITIES
COOK 1 EUCLA BASIN NULLARBOR
MAP #250: SH5212 OOLDEA
#100: 5036

36.
#CNO 002686 TYPE: COMPANY REPORT
TITLE
APPLICATION FOR SUBSIDY HELICOPTER GRAVITY SURVEY EUCLA BASIN PORTION OF O.E.L.33 S.A.
#TN O EL33
CORPORATE
OUTBACK OIL
AUTHOR
SOURCE
SADME UNPUBLISHED REPORT, #ENV 524 MAPS, #DOP 1965
KEYWORDS
#SC 1230 GEOPHYSICS PETROLEUM
PETROLEUM SUBSIDY APPLICATION GRAVITY SURVEYS
PROPOSAL
LOCALITIES

EUCLA BASIN COOK
MAP #250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5216 NULLARBOR
#250: SH5215 COOMPANA
#100: 5036 5035 5034

37.
#CNO 003269 TYPE: GOVERNMENT REPORT
TITLE
TESTING OF BORES FROM THE EUCLA AND OFFICER BASINS FOR SEDIMENTARY PHOSPHATE
AUTHOR
RUSS,P J
SOURCE
SADME UNPUBLISHED REPORT, #RB 60/099 5 PAGES; MAPS, #DOP 1965
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS SEDIMENTARY BASINS
PHOSPHATES MINERAL EXPLORATION GEOLOGICAL LOGS
PALAEOZOIC MESOZOIC
LOCALITIES
EUCLA BASIN OFFICER BASIN
MAP #250: SH5203 NOORINA #250: SH5204 WELLS #250: SH5208 MAURICE
#250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5215 COOMPANA
#250: SH5216 NULLARBOR

38.
#CNO 002312 TYPE: COMPANY REPORT
TITLE
COMPOSITE WELL LOGS HUGHES AND DENMAN WELLS (NO TEXT)
#TN OEL33
CORPORATE
OUTBACK OIL
AUTHOR
SOURCE
SADME UNPUBLISHED REPORT, #ENV 668 MAPS, #DOP 1966
KEYWORDS
#SC 1440 PETROLEUM PETROLEUM EXPLORATION
COMPOSITE LOGS GEOPHYSICAL LOGS SP LOGS
ELECTRICAL WELL LOGS RADIOACTIVITY LOGS CAMBRIAN
PALAEOZOIC CRETACEOUS MESOZOIC
CAINOZOIC EOCENE WILSON BLUFF
LIMESTONE
NULLARBOR LIMESTONE
LOCALITIES
HUGHES 2 DENMAN 1 HUGHES 1
HUGHES 3 EUCLA BASIN
MAP #250: SH5211 COOK
#100: 4836 4736 4837

39.
#CNO 002325 TYPE: COMPANY REPORT
TITLE
EUCLA BASIN GRAVITY SURVEY O.E.L.33 S.A.
#TN OEL33
CORPORATE

OUTBACK OIL
AUTHOR
GEOSURVEYS-AUST ; HOOGENRAAD,R M ; STACKLER,W F ; WILSON,R B
SOURCE
SADME UNPUBLISHED REPORT, #ENV 549 MAPS, #DOP 1966
KEYWORDS
#SC 1230 GEOPHYSICS GRAVITY SURVEYS
PETROLEUM GEOPHYSICAL INTERPRETATION
REGIONAL GEOPHYSICS BOUGUER GRAVITY MAPS PHOTOGEOLOGICAL MAPS
GRAVITY INTERPRETATION
LOCALITIES
EUCLA BASIN
MAP #250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5215 COOMPANA
#250: SH5216 NULLARBOR
#100: 5036 5034 5035

40.
#CNO 003555 TYPE: GOVERNMENT REPORT
TITLE
OUTBACK OIL HUGHES AND DENMAN WELLS PALYNOLOGICAL REPORT 5/66
AUTHOR
HARRIS,W K
SOURCE
SADME UNPUBLISHED REPORT, #RB 731 2 PAGES;
#DOP 1966
KEYWORDS
#SC 1430 BIOSTRATIGRAPHY PALYNOLOGY
PETROLEUM EARLY CRETACEOUS STRATIGRAPHIC WELLS
LOCALITIES
HUGHES 2 DENMAN 1 EUCLA BASIN
HUGHES 3
MAP #250: SH5211 COOK
#100: 4836 4736 4837

41.
#CNO 003556 TYPE: GOVERNMENT REPORT
TITLE
HUGHES-DENMAN STRATIGRAPHIC DRILLING PROJECT OF OUTBACK OIL COMPANY N.L.
SUBSURFACE STRATIGRAPHY AND MICROPALAEONTOLOGICAL STUDY(PAL REP.10/66
AUTHOR
LUDBROOK,N H
SOURCE
SADME UNPUBLISHED REPORT, #RB 731 14PAGES;
#DOP 1966
KEYWORDS
#SC 1430 BIOSTRATIGRAPHY STRATIGRAPHIC WELLS
STRATIGRAPHY MICROPALAEONTOLOGY PETROLEUM
PROTEROZIC CAMBRIAN PALAEOZOIC
EARLY CRETACEOUS TERTIARY HAMPTON SANDSTONE
WILSON BLUFF LIMESTONE NULLARBOR LIMESTONE DRILL CUTTINGS
LOCALITIES
HUGHES 1 DENMAN 1 EUCLA BASIN
HUGHES 2 HUGHES 3
MAP #250: SH5211 COOK
#100: 4836 4736 4837

42.
#CNO 004869 TYPE: GOVERNMENT REPORT

TITLE
RECONNAISSANCE SEISMIC REFRACTION SURVEY -1964 SOUTH AUSTRALIAN PORTION OF THE EUCLA BASIN (18-2-65)
AUTHOR
KENDALL,G W
SOURCE
MINING REVIEW, ADELAIDE (SADME), VOL. 122 #RB 60/030 P113-120; MAPS, #DOP 1967
KEYWORDS
#SC 1230 GEOPHYSICS PETROLEUM
SEISMIC SURVEYS SEISMIC REFRACTION SURVEYS
SHOTHOLE TIME DEPTH CURVE SEISMIC PROFILE
GEOPHYSICAL SURVEYS SEISMIC INTERPRETATION GEOLOGICAL LOGS
LOCALITIES
EUCLA BASIN
MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5211 COOK
#250: SH5212 OOLDEA
#100: 4936 5036

43.
#CNO 003215 TYPE: COMPANY REPORT
TITLE
FINAL REPORT MARINE SEISMIC SURVEY OFFSHORE EUCLA BASIN SOUTH AND WESTERN AUST.FIELD OPERATIONS & RECORDERS FIELD DATA WESTERN GEOPHYS. CO. #TN O EL33
CORPORATE
TENNECO AUST
AUTHOR
WESTERN-GEOPHYS-CO ; PARTY-86
SOURCE
SADME UNPUBLISHED REPORT, #ENV 861 63 PAGES; MAPS, #DOP 1968
KEYWORDS
#SC 1230 GEOPHYSICS PETROLEUM
MARINE GEOPHYSICS MARINE SURVEYS MARINE PETROLEUM EXPLORATI
SEISMIC SURVEYS SEISMIC REFLECTION SURVEYS
SEISMIC STACKING EXPLOSIVES DIGITAL PROCESSING
DIGITAL PROCESSING OCEANOGRAPHIC CHARTS GEOPHYSICAL DATA
CRETACEOUS CRETACEOUS-BASEMENT ISOPACH
BASEMENT
LOCALITIES
EUCLA BASIN GREAT AUSTRALIAN BIGHT WESTERN AUSTRALIA
MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5413 PARACHILNA
#250: SI5301 NUYTS #250: SI5203 #250: SI5204

44.
#CNO 005677 TYPE: GOVERNMENT REPORT
TITLE
LIMESTONE FOR RAILWAY BALLAST NULLARBOR PLAIN -COMMONWEALTH RAILWAYS.
AUTHOR
HIERN,M N
SOURCE
SADME UNPUBLISHED REPORT, #RB 66/100 9 PAGES; MAPS,ILLUST, #DOP 1968
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS EXTRACTIVE MINERALS
RAIL BALLAST AGGREGATES LIMESTONE
QUARRIES GEOLOGICAL SURVEYS NULLARBOR LIMESTONE

LOCALITIES
NULLARBOR COOK LOONGANA
WATSON REID EUCLA BASIN
MAP #250: SH5209 #250: SH5210 #250: SH5211 COOK
#250: SH5212 OOLDEA

45.
#CNO 007976 TYPE: GOVERNMENT REPORT
TITLE
FRAGMENTAL LIMESTONES ON THE NULLARBOR PLAIN
AUTHOR
HIERN,M N
SOURCE
SOUTH AUSTRALIA. GEOLOGICAL SURVEY. QUARTERLY GEOLOGICAL NOTES (SADME)
, VOL. 28 P1-4 ; ILLUST, #DOP 1968
KEYWORDS
SEDIMENTARY GEOLOGY NULLARBOR LIMESTONE
LIMESTONE
LOCALITIES
NULLARBOR EUCLA BASIN COOK
REID LOONGANA WATSON
MAP #250: SH5211 COOK #250: SH5212 OOLDEA

46.
#CNO 003472 TYPE: GOVERNMENT REPORT
TITLE
OUTBACK OIL-PICKRELL MALLABIE NO.1 WELL PALAEONTOLOGICAL REPORT
CORPORATE
OUTBACK OIL
AUTHOR
HARRIS ; W K ; LINDSAY,J M ; MCGOWRAN,B
SOURCE
SADME UNPUBLISHED REPORT, #RB 756 7 PAGES;
#DOP 1969
KEYWORDS
#SC 1430 BIOSTRATIGRAPHY PETROLEUM
TERTIARY NULLARBOR LIMESTONE WILSON BLUFF
LIMESTONE
CRETACEOUS PERMIAN BRIDGEWATER
FORMATION
CAINOZOIC MESOZOIC PALAEOZOIC
PALYNOLOGY MICROPALAEONTOLOGY
LOCALITIES
EUCLA BASIN MALLABIE 1
MAP #250: SH5216 NULLARBOR
#100: 5034

47.
#CNO 004056 TYPE: COMPANY REPORT
TITLE
URANIUM INVESTIGATION PROJECT PIDINGA LAKES AREA SOUTH AUSTRALIA REP NO
1 (12 PLANS)
#TN SML316
CORPORATE
AUST MINING CORP
AUTHOR
CAMPBELL,J L H
SOURCE
SADME UNPUBLISHED REPORT, #ENV 1200 64 PAGES; MAPS,ILLUST,
#DOP 1969

KEYWORDS
#SC 1345 | METALLIFEROUS MINERALS | MINERAL EXPLORATION
URANIUM EXPLORATION | GEOLOGICAL SURVEYS | TERTIARY
RADIOACTIVITY SURVEYS | NUCLEAR RADIATION | AUGER DRILLING
GEOPHYSICS | GEOPHYSICAL LOGS | RADIOACTIVITY LOGS
TRENCHING | RADIUM | GEOLOGICAL LOGS
DRILLING | SALT LAKES
LOCALITIES
PIDINGA LAKES | TALLACOOTRA | SEVEN MILE SWAMP
RED LAKE | EUCLA BASIN
MAP #250: SH5313 FOWLER | #250: SH5309 BARTON | #250: SH5216 NULLARBOR
#100: 5336 5436 5536 5235 5234

48.
#CNO 004602 TYPE: COMPANY REPORT
TITLE
MALLABIE NO.1 WELL COMPLETION REPORT
#TN P EL4
CORPORATE
OUTBACK OIL
AUTHOR
SCOTT,A F ; SPEER,G W
SOURCE
SADME UNPUBLISHED REPORT, #ENV 1172 37 PAGES; MAPS,
#DOP 1969
KEYWORDS
#SC 1440 | PETROLEUM | WELL COMPLETION
REPORTS
STRATIGRAPHIC WELLS | DRILLING | ROTARY DRILLING
COMPOSITE LOGS | GEOPHYSICAL LOGS | ELECTRICAL WELL LOGS
RADIOACTIVITY LOGS | NEUTRON LOGS | GAMMA GAMMA LOGS
CALIPER LOGS | STRATIGRAPHY | PRECAMBRIAN
PALAEOZOIC | EARLY CRETACEOUS | TERTIARY
PALYNOLOGY | PALAEONTOLOGY | PETROLOGY
GEOPHYSICS | CORE LOGS | DRILL CORE ANALYSIS
LOCALITIES
MALLABIE 1 | EUCLA BASIN
MAP #250: SH5216 NULLARBOR
#100: 5034

49.
#CNO 007978 TYPE: GOVERNMENT REPORT
TITLE
A MIDDLE EOCENE PLANKTONIC FORAMINIFERAL ASSEMBLAGE FROM THE EUCLA BASIN
AUTHOR
MCGOWRAN,B ; LINDSAY,J M
SOURCE
SOUTH AUSTRALIA. GEOLOGICAL SURVEY. QUARTERLY GEOLOGICAL NOTES (SADME)
, VOL. 30 P2-10; ILLUST, #DOP 1969
KEYWORDS
#SC 1430 | BIOSTRATIGRAPHY | MICROPALAEONTOLOGY
PLANKTONIC FORAMINIFERA | MIDDLE EOCENE | WILSON BLUFF
LIMESTONE
BIOSTRATIGRAPHIC CORRELATION
LOCALITIES
EUCLA BASIN | NULLARBOR 8 | ALBALA KAROO BORE
MAP #250: SH5215 COOMPANA
#100: 4935 4835

50.
#CNO 011584 TYPE: COMPANY REPORT
TITLE
OUTBACK OIL PICKRELL MALLABIE NO 1 WELL TEST REPORTS
#TN P EL4
AUTHOR
OUTBACK-OIL
SOURCE
SADME UNPUBLISHED REPORT, #ENV 1133 #DOP
1969
KEYWORDS
#SC 1440 PETROLEUM DRILLING
FORMATION TESTS GEOLOGICAL LOGS
LOCALITIES
MALLABIE 1 EUCLA BASIN
MAP #250: SH5216 NULLARBOR
#100: 5034

51.
#CNO 011585 TYPE: COMPANY REPORT
TITLE
FINAL REPORT ON THE VELOCITY DETERMINATION SURVEY ON OUTBACK OIL-PICKRELL MALLABIE NO 1 WELL FOR OUTBACK OIL-PICKRELL DRILLING (1969/18)
AUTHOR
GEOSEISMIC-AUST ; YAKUNIN,A
SOURCE
SADME UNPUBLISHED REPORT, #ENV 1122 5 PAGES; ILLUST,
#DOP 1969
KEYWORDS
#SC 1230 GEOPHYSICS WELL SHOOTING
PETROLEUM
LOCALITIES
MALLABIE 1 EUCLA BASIN
MAP #250: SH5216 NULLARBOR
#100: 5034

52.
#CNO 001692 TYPE: GOVERNMENT REPORT
TITLE
GEOLOGY OF THE COOK,OOLDEA AND BARTON 1 250 000 AREAS
AUTHOR
FORBES,B G
SOURCE
SADME UNPUBLISHED REPORT, #RB 70/042 MAPS, #DOP
1970
KEYWORDS
#SC 1500 REGIONAL GEOLOGY BASEMENT
SEDIMENTARY BASINS LINEAMENTS ADELAIDEAN
PRE-ADELAIDEAN MESOZOIC TERTIARY
BASEMENT DEPTH PHOTOINTERPRETATION AERIAL PHOTOGRAPHY
PHOTOGEOLOGY STRUCTURAL GEOLOGY STRATIGRAPHY
BIBLIOGRAPHIES CAINOZOIC
LOCALITIES
OFFICER BASIN EUCLA BASIN GREAT ARTESIAN BASIN
WALLIRA TROUGH GAWLER CRATON
MAP #250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5309
BARTON

53.

#CNO 002129 TYPE: GOVERNMENT REPORT
TITLE
PENONG AREA GROUNDWATER ASSESSMENT PROGRESS REPORT, AUGUST 1968
AUTHOR
BLEYS,C ; CAMPBELL,J D S
SOURCE
MINERAL RESOURCES REVIEW, SOUTH AUSTRALIA (SADME), VOL. 129 #RB 67/035 P178-186; MAPS, #DOP 1970
KEYWORDS

#SC 1240	HYDROGEOLOGY	GROUND WATER SURVEYS
GROUND WATER BASINS	WATER RESOURCES	RAINFALL
AQUIFER	UNCONFINED AQUIFERS	BRIDGEWATER FORMATION
CAINOZOIC	SALINITY	SAFE YIELD
GEOLOGICAL LOGS	PHOTOGEOLOGICAL MAPS	SUBSURFACE CORRELATION
WELL LOCATION SURVEYS		

LOCALITIES
PENONG ROBINSON BASIN
MAP #250: SI5301 NUYTS #250: SI5302 STREAKY BAY #250: SH5313 FOWLER
#250: SH5314 CHILDARA #250: SH5216 NULLARBOR

54.
#CNO 002880 TYPE: COMPANY REPORT
TITLE
REPORT ON S.M.L.367 PIDINGA LAKES
#TN SML367
CORPORATE
AUST MINING CORP
AUTHOR
WESTHOFF,J ; MINOIL-SERVICES
SOURCE
SADME UNPUBLISHED REPORT, #ENV 1317 MAPS, #DOP 1970
KEYWORDS

#SC 1345	METALLIFEROUS MINERALS	MINERAL EXPLORATION
URANIUM	URANIUM EXPLORATION	DRILLING
TERTIARY	PRECAMBRIAN	BASEMENT
BASEMENT DEPTH	RADIOACTIVITY LOGS	BACTERIOLOGICAL ANALYSIS
POTASSIUM	RADIOACTIVITY LOGS	RADIOMETRIC ANOMALIES
LIGNITE	PETROLEUM	RADIOMETRIC MAPS
GEOPHYSICAL LOGS	GEOLOGICAL LOGS	CAINOZOIC

LOCALITIES
PIDINGA LAKES NULLARBOR
MAP #250: SH5212 OOLDEA #250: SH5309 BARTON
#100: 5237 5236 5337 5336

55.
#CNO 004630 TYPE: GOVERNMENT REPORT
TITLE
GROUNDWATER SURVEY-IVY TANKS MOTEL-R.J.MARTIN
AUTHOR
PAINTER,J A C
SOURCE
SADME UNPUBLISHED REPORT, #RB 70/116 MAPS, #DOP 1970
KEYWORDS

#SC 1240 HYDROGEOLOGY GROUND WATER SURVEYS
WATER PROSPECTING NULLARBOR LIMESTONE PIDINGA FORMATION
SALINITY DRILLING PROPOSALS
LOCALITIES
NULLARBOR
MAP #250: SH5216 NULLARBOR
#100: 5135

56.
#CNO 004631 TYPE: GOVERNMENT REPORT
TITLE
GROUNDWATER SURVEY-YALATA LUTHERAN MISSION,CO.HOPETOUN
AUTHOR
PAINTER,J A C
SOURCE
SADME UNPUBLISHED REPORT, #RB 70/115 MAPS, #DOP 1970
KEYWORDS
#SC 1240 HYDROGEOLOGY GROUND WATER SURVEYS
WATER PROSPECTING NULLARBOR LIMESTONE PIDINGA FORMATION
SALINITY
LOCALITIES
YALATA MISSION
MAP #250: SH5216 NULLARBOR
#100: 5234 5235

57.
#CNO 004632 TYPE: GOVERNMENT REPORT
TITLE
GROUNDWATER SURVEY-NULLARBOR STATION-M.G.&D.THOMAS
AUTHOR
PAINTER,J A C
SOURCE
SADME UNPUBLISHED REPORT, #RB 70/114 MAPS, #DOP 1970
KEYWORDS
#SC 1240 HYDROGEOLOGY GROUND WATER SURVEYS
WATER PROSPECTING NULLARBOR LIMESTONE PIDINGA FORMATION
SALINITY DRILLING PROPOSALS
LOCALITIES
NULLARBOR
MAP #250: SH5216 NULLARBOR
#100: 5034 5035

58.
#CNO 005372 TYPE: GOVERNMENT REPORT
TITLE
LIMESTONE FOR RAILWAY BALLAST ON THE NULLARBOR PLAIN WITH APPENDIX ON PALAEONTOLOGY
AUTHOR
HIERN,M N ; LUDBROOK,N H
SOURCE
MINERAL RESOURCES REVIEW, SOUTH AUSTRALIA (SADME), VOL. 128 #RB 66/118 P166-174; MAPS,ILLUST, #DOP 1970
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS EXTRACTIVE MINERALS
AGGREGATES RAIL BALLAST LIMESTONE
QUARRIES NULLARBOR LIMESTONE MIOCENE
GEOLOGICAL SURVEYS BIOSTRATIGRAPHY PALAEONTOLOGY
LOCALITIES

NULLARBOR EUCLA BASIN WATSON
COOK REID LOONGANA
MAP #250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5209
#250: SH5210

59.
#CNO 013856 TYPE: GOVERNMENT REPORT
TITLE
THE GEOCHRONOLOGY OF THE YOUNGER GRANITES OF THE GAWLER BLOCK AND ITS NORTH WEST MARGIN. (PROG. REPS.1-4), 1969-1970
CORPORATE
AMDEL
AUTHOR
TURNER,A R ; WEBB,A W
SOURCE
SADME UNPUBLISHED REPORT, #ENV 1582 58 PAGES;
#DOP 1970
KEYWORDS
#SC 1200 GEOCHRONOLOGY IGNEOUS PETROLOGY
HILTABA GRANITE GRANITE KOKATHA GRANITE
CARNDING GRANITE COOLADDIN ROCKHOLE GRANITE
BASIC IGNEOUS ROCKS GAWLER RANGE VOLCANICS POTASSIUM ARGON DATING
LOCALITIES
GAWLER CRATON MALLABIE 1 KOKATHA
HILTABA MOUNT FURNER 1 WALLIRA 1
MAP #250: SH5302 MURLOOCOPPIE #250: SH5216 NULLARBOR #250: SH5307 BILLAKALINA
#250: SH5310 TARCOOLA #250: SH5315 GAIRDNER #250: SI5303 YARDEA
#100: 5741 5034 5939 5935

60.
#CNO 000710 TYPE: COMPANY REPORT
TITLE
DENMAN BASIN SEISMIC SURVEY EPP4 PROGRESS AND FINAL REPORTS 3 VOLS(4REPS)
#TN EPP 4
CORPORATE
OUTBACK OIL
AUTHOR
G J LONG ; & ; ASSOC
SOURCE
SADME UNPUBLISHED REPORT, #ENV 1952 MAPS, #DOP 1972
KEYWORDS
#SC 1230 GEOPHYSICS SEISMIC SURVEYS
SEISMIC REFLECTION SURVEYS SEISMIC INTERPRETATION
PETROLEUM EXPLORATION MARINE SURVEYS PETROLEUM
ISOPACH MAPS MARINE PETROLEUM EXPLORATION
SATELLITE NAVIGATION SEISMIC ENERGY SOURCE DIGITAL PROCESSING
MARINE GEOPHYSICS DIGITAL PROCESSING MESOZOIC
JURASSIC CRETACEOUS SEISMIC STACKING
PROCESSED SECTIONS
LOCALITIES
DENMAN BASIN GREAT AUSTRALIAN BIGHT
MAP #250: SI5203 #250: SI5204 #250: SH5215 COOMPANA
#250: SH5216 NULLARBOR

61.
#CNO 000722 TYPE: COMPANY REPORT
TITLE
PROGRESS NOTES S.M.L. 700 NULLARBOR,KOONALDA,SOUTH AUSTRALIA
CORPORATE
DAMPIER
AUTHOR
BROKEN-HILL-PTY-LTD
SOURCE
SADME UNPUBLISHED REPORT, #ENV 2086 MAPS, #DOP 1972
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS INDUSTRIAL MINERALS
MINERAL EXPLORATION CARBONATE ROCKS ROTARY DRILLING
GEOLOGICAL LOGS CHEMICAL ANALYSIS DRILL CORE
SULPHUR PHOSPHORUS WILSON BLUFF
LIMESTONE
NULLARBOR LIMESTONE ABRAKURRIE LIMESTONE GEOLOGICAL CROSS SECTION
DRILLING CAINOZOIC
LOCALITIES
NULLARBOR EUCLA BASIN KOONALDA
MAP #250: SH5215 COOMPANA
#100: 4834

62.
#CNO 000723 TYPE: COMPANY REPORT
TITLE
PROGRESS NOTES ON S.M.L. 701 NULLARBOR -BUNABIE, SOUTH AUSTRALIA
#TN SML701
CORPORATE
DAMPIER
AUTHOR
BROKEN-HILL-PTY-LTD
SOURCE
SADME UNPUBLISHED REPORT, #ENV 2087 MAPS, #DOP 1972
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS INDUSTRIAL MINERALS
MINERAL EXPLORATION CARBONATE ROCKS ROTARY DRILLING
GEOLOGICAL LOGS CHEMICAL ANALYSIS DRILL CORE
SULPHUR PHOSPHORUS WILSON BLUFF
LIMESTONE
NULLARBOR LIMESTONE ABRAKURRIE LIMESTONE GEOLOGICAL CROSS SECTION
DRILLING CAINOZOIC
LOCALITIES
NULLARBOR EUCLA BASIN BUNABIE
MAP #250: SH5215 COOMPANA
#100: 4734

63.
#CNO 000724 TYPE: COMPANY REPORT
TITLE
PROGRESS NOTES ON S.M.L. 699 NULLARBOR SOUTH AUSTRALIA
#TN SML699
CORPORATE
DAMPIER
AUTHOR

BROKEN-HILL-PTY-CO-LTD
SOURCE
SADME UNPUBLISHED REPORT, #ENV 2090 MAPS, #DOP 1972
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS INDUSTRIAL MINERALS
MINERAL EXPLORATION CARBONATE ROCKS ROTARY DRILLING
GEOLOGICAL LOGS CHEMICAL ANALYSIS DRILL CORE
SULPHUR PHOSPHORUS WILSON BLUFF
LIMESTONE
NULLARBOR LIMESTONE MULLAMULLANG MEMBER ABRAKURRIE LIMESTONE
GEOLOGICAL CROSS SECTION DRILLING CAINOZOIC
LOCALITIES
NULLARBOR EUCLA BASIN
MAP #250: SH5216 NULLARBOR
#100: 5034

64.
#CNO 001046 TYPE: GOVERNMENT REPORT
TITLE
NEW FORM SPECIES OF POLLEN FROM SOUTHERN AUSTRALIAN EARLY TERTIARY SEDIMENTS
AUTHOR
HARRIS,W K
SOURCE
ROYAL SOCIETY OF SOUTH AUSTRALIA. TRANSACTIONS, VOL. 96 #RB 72/009 P53-65; ILLUST, #DOP 1972
KEYWORDS
#SC 1430 PALAEONTOLOGY PALYNOLOGY
SYSTEMATIC PALAEONTOLOGY POLLEN TERTIARY
CLINTON COAL MEASURE PEBBLE POINT FORMATION POELPENA FORMATION
WILKATANA FORMATION WANILLA FORMATION MURNPEOWIE FORMATION
RENMARK BEDS PIDINGA FORMATION
LOCALITIES
OTWAY BASIN POLDA BASIN PIRIE-TORRENS BASIN
GREAT ARTESIAN BASIN CUMMINS BASIN MURRAY BASIN
MAP #250: SH5216 NULLARBOR #250: SI5307 KIMBA #250: SI5311 LINCOLN
#250: SH5413 PARACHILNA #250: SH5409 COPLEY #250: SI5405 BURRA
#250: SH5410 FROME #250: SH5414 CURNAMONA #250: SI5414 PINNAROO
#100: 5135 5930 6031 6029 6535 6536

65.
#CNO 001385 TYPE: GOVERNMENT REPORT
TITLE
MINERAL RESOURCES OF THE EYRE PLANNING AREA
AUTHOR
HIERN,M N
SOURCE
MINING REVIEW, ADELAIDE (SADME), VOL. 133 #RB 70/133 P11-31; MAPS, #DOP 1972
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS METALLIFEROUS MINERALS
MINERAL RESOURCES EXTRACTIVE MINERALS INDUSTRIAL MINERALS
ENVIRONMENTAL PROTECTION PLANNING LAND USE PLANNING
RESERVES MINERAL DEPOSITS REGIONAL GEOLOGY
WATER RESOURCES GYPSUM CALCAREOUS SANDS
IRON DEPOSITS CLAYS URANIUM

TALC AGGREGATES
LOCALITIES
EYRE PENINSULA BLACK SPRINGS EUCLA BASIN
GAWLER CRATON COFFIN BAY TUMBY BAY
MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5314 CHILDARA

66.
#CNO 001621 TYPE: GOVERNMENT REPORT
TITLE
GEOLOGY OF THE COOMPANA,NULLARBOR AND FOWLER 1/250 000 AREAS
AUTHOR
FORBES,B G
SOURCE
SADME UNPUBLISHED REPORT, #RB 72/066 MAPS, #DOP 1972
KEYWORDS
#SC 1500 REGIONAL GEOLOGY PHOTOGEOLOGY
PHOTOINTERPRETATION MESOZOIC TERTIARY
STRATIGRAPHY STRUCTURAL GEOLOGY ECONOMIC GEOLOGY
PRECAMBRIAN BASEMENT EXPLANATORY NOTES
BASEMENT DEPTH SEDIMENTARY BASINS BIBLIOGRAPHIES
LOCALITIES
EUCLA BASIN GAWLER BLOCK MALLABIE DEPRESSION
MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5313 FOWLER

67.
#CNO 002324 TYPE: COMPANY REPORT
TITLE
REVIEW OF ISOPACH GRAVITY INTERPRETATION EUCLA BASIN S.A.
#TN O EL33
CORPORATE
OUTBACK OIL
AUTHOR
BIBLE,J L
SOURCE
SADME UNPUBLISHED REPORT, #ENV 549 MAPS, #DOP 1972
KEYWORDS
#SC 1230 GEOPHYSICS PETROLEUM
MAGNETIC INTERPRETATION GRAVITY INTERPRETATION GEOPHYSICAL INTERPRETATION
ISOPACH MAPS
LOCALITIES
EUCLA BASIN
MAP #250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5216 NULLARBOR
#250: SH5215 COOMPANA
#100: 5036 5035 5034 4835 4935 4934

68.
#CNO 002326 TYPE: COMPANY REPORT
TITLE
AEROMAGNETIC INTERPRETATION EUCLA BASIN S.A./ DEPTH DETERMINATIONS OF MAGNETIC BASEMENT EUCLA BASIN S.A.(2 REPS VOL 2)
#TN O EL33
CORPORATE
OUTBACK OIL
AUTHOR

WEBB,J E ; TRETHEWIE,J
SOURCE
SADME UNPUBLISHED REPORT, #ENV 549 MAPS, #DOP 1972
KEYWORDS
#SC 1230 GEOPHYSICS PETROLEUM
GEOPHYSICAL INTERPRETATION MAGNETIC INTERPRETATION
MAGNETIC BASEMENT DEPTH MAPS AERIAL MAGNETIC MAPS
BASEMENT DEPTH MAGNETIC BASEMENT
LOCALITIES
EUCLA BASIN
MAP #250: SH5211 COOK

69.
#CNO 002786 TYPE: COMPANY REPORT
TITLE
BORE-SAMPLE ANALYSES SOUTHERN EUCLA BASIN (VOL3) NORTHERN EUCLA BASIN & MARALINGA WTH SPECIAL REF TO OBSERVATION HILL BEDS(VOL4 TABLES ONLY)
CORPORATE
ASARCO(AUS)
AUTHOR
WARNE,S B ; OVERLAND-ENTERPRISES-PL
SOURCE
SADME UNPUBLISHED REPORT, #ENV 1880 66 PAGES; #DOP 1972
KEYWORDS
#SC 1190 GEOCHEMISTRY METALLIFEROUS MINERALS
MINERAL EXPLORATION DRILL HOLE DATA GEOCHEMICAL LOGS
GEOLOGICAL LOGS CHEMICAL ANALYSIS COPPER
LEAD ZINC SILVER
URANIUM BARIUM GOLD
VANADIUM WOLFRAMITE MOLYBDENUM
BERYLLIUM OBSERVATORY HILL BEDS
LOCALITIES
EUCLA BASIN MARALINGA BORES COOK 1
DENMAN 1 EMU 1 HUGHES BORES
MAP #250: SH5208 MAURICE #250: SH5211 COOK #250: SH5212 OOLDEA
#250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5301 GILES

70.
#CNO 004012 TYPE: GOVERNMENT REPORT
TITLE
FIRST PROGRESS REPORT-EYRE HIGHWAY GROUNDWATER SURVEY PENONG TO THE WESTERN AUSTRALIAN BORDER
AUTHOR
WILLIAMS,A F
SOURCE
SADME UNPUBLISHED REPORT, #RB 72/216 MAPS, #DOP 1972
KEYWORDS
#SC 1240 HYDROGEOLOGY GROUND WATER SURVEYS
WATER PROSPECTING WATER SUPPLY SALINITY
AQUIFER DRILLING PROPOSALS TRENCHING
WELL DISCHARGE TESTS REGIONAL GEOLOGY
LOCALITIES
EYRE HIGHWAY YALATA MISSION NULLARBOR

KOONALDA EUCLA PENONG
MAP #250: SH5313 FOWLER #250: SH5216 NULLARBOR #250: SH5215 COOMPANA

71.
#CNO 005762 TYPE: OTHER GOVERNMENT REPORT
TITLE
EUCLA BASIN AIRBORNE MAGNETIC AND RADIOMETRIC SURVEY,S.A. 1970 (1972/60)
AUTHOR
WALLER,D R ; QUILTY,J H ; LAMBOURN,S S
SOURCE
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS. RECORD, VOL. 72/ 60
11 PAGES; MAPS, #DOP 1972
KEYWORDS
#SC 1230 GEOPHYSICS AERIAL MAGNETIC SURVEYS
AERIAL RADIOACTIVITY SURVEYS REGIONAL SURVEYS
GEOPHYSICAL INTERPRETATION TOTAL MAGNETIC INTENSITY
MAGNETIC PROFILE BOUGUER GRAVITY MAPS MAGNETIC BASEMENT DEPTH MA
BASEMENT DEPTH
LOCALITIES
EUCLA BASIN GAWLER CRATON
MAP #250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5309 BARTON

72.
#CNO 000849 TYPE: GOVERNMENT REPORT
TITLE
SECOND PROGRESS REPORT EYRE HIGHWAY GROUNDWATER SURVEY, PENONG TO THE WESTERN AUSTRALIAN BORDER
AUTHOR
WILLIAMS,A F
SOURCE
SADME UNPUBLISHED REPORT, #RB 73/144 MAPS,ILLUST, #DOP 1973
KEYWORDS
#SC 1240 HYDROGEOLOGY WATER SUPPLY
TRENCHING LOVEDAY SOIL NULLARBOR LIMESTONE
PIDINGA FORMATION WILSON BLUFF LIMESTONE WATER ANALYSIS
SALINITY SULPHATE (NOT MINERAL) WELL DISCHARGE TESTS
GROUND WATER SURVEYS CAINOZOIC GEOLOGICAL LOGS
ROTARY DRILLING
LOCALITIES
EYRE HIGHWAY EUCLA BASIN
MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5313 FOWLER

73.
#CNO 000898 TYPE: GOVERNMENT REPORT
TITLE
FINAL REPORT EYRE HIGHWAY GROUNDWATER SURVEY PENONG TO THE WESTERN AUSTRALIAN BORDER
AUTHOR
WILLIAMS,A F
SOURCE
SADME UNPUBLISHED REPORT, #RB 73/243 #DOP 1973
KEYWORDS

#SC 1240 HYDROGEOLOGY GROUND WATER SURVEYS
WATER SUPPLY WATER ANALYSIS ROTARY DRILLING
GEOLOGICAL LOGS NULLARBOR LIMESTONE WILSON BLUFF
LIMESTONE
SALINITY WELL DISCHARGE TESTS DRILLING
CAINOZOIC
LOCALITIES
EYRE HIGHWAY EUCLA BASIN PENONG
MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR

74.
#CNO 000938 TYPE: GOVERNMENT REPORT
TITLE
EYRE HIGHWAY - NULLARBOR PLAIN CAVE DETECTION STUDY CLIENT- HIGHWAYS DEPARTMENT
AUTHOR
WIGHTMAN,W E
SOURCE
SADME UNPUBLISHED REPORT, #RB 73/291 MAPS, #DOP 1973
KEYWORDS
#SC 1230 GEOPHYSICS ENGINEERING
GEOPHYSICS
GRAVITY SURVEYS CAVES HIGHWAY ENGINEERING
GEOPHYSICAL INTERPRETATION METHODS
THEORETICAL STUDIES RESEARCH AND DEVELOPMENT KARST TOPOGRAPHY
LOCALITIES
NULLARBOR EYRE HIGHWAY WHITE WELL
MAP #250: SH5216 NULLARBOR
#100: 5035

75.
#CNO 000574 TYPE: GOVERNMENT REPORT
TITLE
PRELIMINARY NOTES ON THE GEOLOGY OF THE EASTERN MARGIN OF THE EUCLA BASIN
-FOWLER 1-250 000 SHEET AREA
AUTHOR
FIRMAN,J B
SOURCE
SADME UNPUBLISHED REPORT #RB 73/085
MAPS,ILLUST, #DOP 1973
KEYWORDS
#SC 1500 REGIONAL GEOLOGY STRATIGRAPHY
ECONOMIC GEOLOGY EXPLANATORY NOTES GEOLOGICAL MAPS
CLIMATOLOGY GEOLOGICAL SURVEYS LATE PROTEROZOIC
MIOCENE QUATERNARY NULLARBOR LIMESTONE
BRIDGEWATER FORMATION BAKARA SOIL RIPON CALCRETE
GLANVILLE FORMATION WOORINEN FORMATION YAMBA FORMATION
ST KILDA FORMATION MOLINEAUX SAND GRANITE
GRAVITY MAPS MINERAL EXPLORATION NUCLEAR RADIATION
RADIOACTIVE MINERALS LIGNITE URANIUM
THORIUM GEOLOGICAL LOGS BASEMENT
BIBLIOGRAPHIES COAL ANALYSIS PETROLOGY
CAINOZOIC GEOPHYSICS PRE-ADELAIDEAN
MIDDLE PROTEROZOIC ASSAY VALUE PIDINGA FORMATION
LOCALITIES
EUCLA BASIN GAWLER BLOCK
MAP #250: SH5413 PARACHILNA #250: SH5309 BARTON #250: SH5216 NULLARBOR

#250: SH5212 OOLDEA #250: SH5314 CHILDARA
#100: 5234 5235 5236 5635

76.
#CNO 000671 TYPE: SERIAL
TITLE
SEISMIC EXPERIMENTS IN THE NORTHERN EUCLA BASIN, SOUTH AUSTRALIA
AUTHOR
MILTON,B E
SOURCE
SOUTH AUSTRALIA. GEOLOGICAL SURVEY. QUARTERLY GEOLOGICAL NOTES (SADME) , VOL. 51 #RB 74/124 P5-9 ; MAPS, #DOP 1974
KEYWORDS
#SC 1230 GEOPHYSICS EXPERIMENTAL STUDIES
SEISMIC REFLECTION SURVEYS GEOPHYSICAL INTERPRETATION
NULLARBOR LIMESTONE TROUGH MAGNETIC BASEMENT
DENSITY SEISMIC INTERPRETATION SEISMIC VELOCITY
CAMBRIAN CRETACEOUS GRAVITY ANOMALIES
MAGNETIC ANOMALIES DIRECTED LINE SOURCE SEISMIC REFRACTION SURVEYS
PETROLEUM SEDIMENTARY BASINS
LOCALITIES
EUCLA BASIN DENMAN 1 HUGHES 1
HUGHES 2 HUGHES 3
MAP #250: SH5211 COOK

77.
#CNO 000730 TYPE: GOVERNMENT REPORT
TITLE
EXPERIMENTAL SEISMIC EXPLORATION, EASTERN EUCLA BASIN, SOUTH AUSTRALIA
AUTHOR
MILTON,B E
SOURCE
SOUTH AUSTRALIA. GEOLOGICAL SURVEY. QUARTERLY GEOLOGICAL NOTES (SADME) , VOL. 52 #RB 74/187 P4-9 ; MAPS, #DOP 1974
KEYWORDS
#SC 1230 GEOPHYSICS EXPERIMENTAL STUDIES
SEISMIC VELOCITY SEISMIC INTERPRETATION PERMIAN
PIDINGA FORMATION SEDIMENTARY BASINS SEISMIC REFRACTION SURVEYS
GEOPHYSICAL INTERPRETATION PETROLEUM
SEISMIC INTERPRETATION MAGNETIC BASEMENT DEPTH MAPS
TROUGH BOUGUER GRAVITY MAPS
LOCALITIES
EUCLA BASIN ARCKARINGA BASIN DENMAN TROUGH
WATSON
MAP #250: SH5212 OOLDEA

78.
#CNO 000731 TYPE: GOVERNMENT REPORT
TITLE
DRILLING FOR CAVES ON THE EYRE HIGHWAY NEAR WHITE WELL
AUTHOR
JOHNSON,P D
SOURCE
SADME UNPUBLISHED REPORT, #RB 74/188 MAPS,ILLUST, #DOP 1974
KEYWORDS
#SC 1140 ENGINEERING GEOLOGY CAVES

ROTARY DRILLING | HIGHWAY ENGINEERING | GEOPHYSICS
GRAVITY ANOMALIES | RIPON CALCRETE | NULLARBOR LIMESTONE
WILSON BLUFF LIMESTONE | GEOLOGICAL LOGS | FOUNDATIONS
CAINOZOIC | KARST TOPOGRAPHY | DRILLING

LOCALITIES
WHITE WELL

MAP #250: SH5216 NULLARBOR
#100: 5035 5135

79.

#CNO 000738 TYPE: COMPANY REPORT
TITLE
FINAL REPORT RELINQUISHED AREA FROM EXPLORATION LICENCE 9 (IFOULD LAKE - PIDINGA AREA SOUTH AUSTRALIA)
#TN EL9

CORPORATE
PECHINEY

AUTHOR
CHAIGNE,M

SOURCE
SADME UNPUBLISHED REPORT, #ENV 2434 MAPS, #DOP 1974

KEYWORDS
#SC 1345 | METALLIFEROUS MINERALS | MINERAL EXPLORATION
URANIUM EXPLORATION | GEOPHYSICS | AERIAL RADIOACTIVITY SURVEY
ROTARY DRILLING | GEOPHYSICAL LOGS | RADIOACTIVITY LOGS
SP LOGS | RESISTIVITY LOGS | GEOLOGICAL LOGS
DRILL CUTTINGS | CHEMICAL ANALYSIS | URANIUM
TERTIARY | NULLARBOR LIMESTONE | PIDINGA FORMATION
LIGNITE | GEOLOGICAL CROSS SECTION | DRILLING
AERIAL SURVEYS | RADIOACTIVITY SURVEYS | CAINOZOIC
ASSAY VALUE | AERIAL SURVEYS | RADIOACTIVITY SURVEYS
CAINOZOIC | DRILLING | DRILL CUTTINGS

LOCALITIES
EUCLA BASIN | IFOULD LAKE | PIDINGA LAKES

MAP #250: SH5212 OOLDEA #250: SH5309 BARTON
#100: 5236 5336

80.

#CNO 000458 TYPE: COMPANY REPORT
TITLE
FINAL AND PROGRESS REPORTS OOLDEA AREA, SOUTH AUSTRALIA, E.L.23

#TN EL23

CORPORATE
CHEVRON EXPLORATION

AUTHOR
TELUK,J A

SOURCE
SADME UNPUBLISHED REPORT #ENV 2183
MAPS, #DOP 1974

KEYWORDS
#SC 1345 | METALLIFEROUS MINERALS | MINERAL EXPLORATION
URANIUM EXPLORATION | LITERATURE REVIEWS | GEOLOGICAL SURVEYS
HYDROLOGY | STRUCTURAL GEOLOGY | ROTARY DRILLING
GEOPHYSICAL LOGS | RESISTIVITY LOGS | SP LOGS
RADIOACTIVITY LOGS | COMPOSITE LOGS | STRATIGRAPHY
NULLARBOR LIMESTONE | TENT HILL FORMATION | HAMPTON SANDSTONE

PIDINGA FORMATION | WILSON BLUFF LIMESTONE | BASEMENT
X RAY DIFFRACTION | ALUNITE | JAROSITE
PALAEOGEOGRAPHY | RADIOACTIVITY SURVEYS | GEOPHYSICAL
INTERPRETATION
WEATHERING | CHEMICAL ANALYSIS | URANIUM
THORIUM | CROSS SECTION | RADIUM
STRATIGRAPHIC CORRELATION | | ADELAIDEAN
CAINOZOIC | DRILLING

LOCALITIES
OOLDEA | EUCLA BASIN | PIDINGA LAKES
MAP #250: SH5212 OOLDEA | #250: SH5413 PARACHILNA | #250: SH5409
COPLEY
#250: SH5216 NULLARBOR
#100: 5236 5235

81.
#CNO 001378 TYPE: COMPANY REPORT
TITLE
FINAL REPORT RELINQUISHED AREA FROM E.L.10 LAKE TALLACOOTRA-PIDINGA AREA SOUTH AUSTRALIA
#TN EL10
CORPORATE
PECHINEY
AUTHOR
CHAIGNE,M
SOURCE
SADME UNPUBLISHED REPORT, #ENV 2435 MAPS, #DOP 1974
KEYWORDS
#SC 1345 | METALLIFEROUS MINERALS | MINERAL EXPLORATION
URANIUM | URANIUM EXPLORATION | GEOPHYSICS
AERIAL RADIOACTIVITY SURVEYS | | ROTARY DRILLING
COMPOSITE LOGS | PIDINGA FORMATION | LIGNITE
GEOPHYSICAL LOGS | RADIOACTIVITY LOGS | RESISTIVITY LOGS
SP LOGS | GEOLOGICAL CROSS SECTION | GEOCHEMICAL LOGS
ASSAY VALUE
LOCALITIES
EUCLA BASIN
MAP #250: SH5309 BARTON | #250: SH5212 OOLDEA
#100: 5336 5236

82.
#CNO 006373 TYPE: SERIAL
TITLE
FOSSIL BIRDS (AVES) FROM WEEKES CAVE , NULLARBOR PLAIN, S.A.
AUTHOR
VAN-TETS,G F
SOURCE
ROYAL SOCIETY OF SOUTH AUSTRALIA. TRANSACTIONS, VOL. 98 P229-230; #DOP 1974
KEYWORDS
#SC 1430 | PALAEONTOLOGY | VERTEBRATE
PALAEONTOLOGY
AVES | CAVES
LOCALITIES
NULLARBOR
MAP #250: SH5215 COOMPANA
#100: 4835

83.

#CNO 006855 TYPE: SERIAL
TITLE
UPPER MANTLE STRUCTURE FROM THE TRANS-AUSTRALIA SEISMIC SURVEY (TASS) AND OTHER SEISMIC REFRACTION DATA
AUTHOR
FINLAYSON,D M ; CULL,P J ; DRUMMOND,B J
SOURCE
GEOLOGICAL SOCIETY OF AUSTRALIA. JOURNAL, VOL. 21 P447-458; MAPS, #DOP 1974
KEYWORDS

#SC 1230	GEOPHYSICS	SOLID EARTH
GEOPHYSICS		
EARTH MANTLE	SEISMIC SURVEYS	SEISMIC REFRACTION
SURVEYS		
SHOTHOLE	SEISMOLOGY	MOHO

LOCALITIES

MOUNT FITTON SOUTH MINE	WESTERN AUSTRALIA	BASS STRAIT
MARALINGA	AUSTRALIA	

MAP #250: SH5410 FROME #250: SH5212 OOLDEA
#100: 6837 5237

84.
#CNO 015000 TYPE: COMPANY REPORT
TITLE
EL 9 IFOULD LAKE SA PROGRESS REPORTS FROM JAN 1973 TO 12-11-74(3 VOLS 11 MAPS,17 SECTS,38 HOLS)
#TN EL9
CORPORATE
PECHINEY
AUTHOR
BELL,M
SOURCE
SADME UNPUBLISHED REPORT, #ENV 2169 16 PAGES; #DOP 1974
KEYWORDS

#SC 1345	METALLIFEROUS MINERALS	MINERAL EXPLORATION
URANIUM EXPLORATION	ROTARY DRILLING	COMPOSITE LOGS
GEOPHYSICAL LOGS	GEOLOGICAL LOGS	RADIOACTIVITY LOGS
SP LOGS	RESISTIVITY LOGS	ASSAY VALUE
URANIUM	THORIUM	GEOPHYSICS
RADIOACTIVITY SURVEYS	RADIOMETRIC ANOMALIES	BASEMENT DEPTH
LIGNITE	PIDINGA FORMATION	TERTIARY
PROTEROZIC	URANIUM EXPLORATION	

LOCALITIES

NULLARBOR	IFOULD LAKE	GAWLER CRATON
EROMANGA BASIN		

MAP #250: SH5312 ANDAMOOKA #250: SH5309 BARTON #250: SH5212 OOLDEA
#100: 6336 5336 5236

85.
#CNO 001857 TYPE: GOVERNMENT REPORT
TITLE
MAGNETIC AND GRAVITY INTERPRETATION OF NULLARBOR-FOWLER 1/250 000 SHEET AREAS
AUTHOR
ROBERTS,D
SOURCE
SADME UNPUBLISHED REPORT, #RB 75/138 MAPS, #DOP 1975

KEYWORDS
#SC 1230 | GEOPHYSICS | GEOPHYSICAL DATA
REGIONAL GEOPHYSICS | GRAVITY INTERPRETATION | MAGNETIC INTERPRETATION
MAGNETIC LINEAMENTS | BASEMENT STUDIES | BASEMENT DEPTH
CLEVE METAMORPHICS | AERIAL MAGNETIC MAPS | TOTAL MAGNETIC INTENSITY
MAGNETIC BASEMENT DEPTH MAPS | BOUGUER GRAVITY MAPS
QUALITATIVE INTERP | GRANITE | FAULTS
GEOPHYSICAL INTERPRETATION
LOCALITIES
GAWLER CRATON | MALLABIE 1 | EUCLA BASIN
DENMAN TROUGH | PINTUMBA FAULT
MAP #250: SH5216 NULLARBOR #250: SH5313 FOWLER

86.
#CNO 006283 TYPE: GOVERNMENT REPORT
TITLE
FOSSILIFEROUS MARINE AND NON-MARINE CAINOZOIC ROCKS FROM THE EASTERN EVCLA BASIN
AUTHOR
LINDSAY,J M ; HARRIS,W K
SOURCE
SADME UNPUBLISHED REPORT, VOL. 138 #RB 73/070 P29-42;
MAPS,ILLUST, #DOP 1975
KEYWORDS
#SC 1430 | BIOSTRATIGRAPHY | STRATIGRAPHY
PALYNOLOGY | MICROPALAEONTOLOGY | BENTHONIC FORAMINIFERA
PLANKTONIC FORAMINIFERA | CAINOZOIC | STRATIGRAPHIC DEFINITION
PIDINGA FORMATION | WILSON BLUFF LIMESTONE | TOOLINNA LIMESTONE
ABRAKURRIE LIMESTONE | NULLARBOR LIMESTONE | MULLAMULLANG MEMBER
COLVILLE SANDSTONE FORMATION | TYPE SECTION | BRIDGEWATER
GLANVILLE FORMATION | ST KILDA FORMATION | YAMBA FORMATION
BIBLIOGRAPHIES | SEDIMENTARY ENVIRONMENT
LOCALITIES
EUCLA BASIN | PIDINGA LAKES
MAP #250: SH5212 OOLDEA #250: SH5216 NULLARBOR #250: SH5309 BARTON
#250: SH5313 FOWLER #250: SI5301 NUYTS
#100: 5036 5135 5235 5336 5433

87.
#CNO 010414 TYPE: MAPS
TITLE
COOK AEROMAGNETIC MAP OF TOTAL INTENSITY. GEOPHYSICAL ATLAS OF AUSTRALIA. 1/250 000 SERIES. GEOL.SURV.S.AUST. (PLAN NO.75-1037)
AUTHOR
GEOL SURV S AUST
SOURCE
SADME UNPUBLISHED REPORT, MAPS, #DOP 1975
KEYWORDS
#SC 1230 | GEOPHYSICS | GEOPHYSICAL MAPS
AERIAL MAGNETIC MAPS | TOTAL MAGNETIC INTENSITY
LOCALITIES
MAP #250: SH5211 COOK

88.

#CNO 010415 TYPE: MAPS
TITLE
COOMPANA AEROMAGNETIC MAP OF TOTAL INTENSITY. GEOPHYSICAL ATLAS OF AUSTRALIA. 1/250 000 SERIES. GEOL.SURV.S.AUST. (PLAN NO.75-603)
AUTHOR
GEOL SURV S AUST
SOURCE
SADME UNPUBLISHED REPORT, MAPS, #DOP 1975
KEYWORDS
#SC 1230 GEOPHYSICS GEOPHYSICAL MAPS
AERIAL MAGNETIC MAPS TOTAL MAGNETIC INTENSITY
LOCALITIES
MAP #250: SH5215 COOMPANA

89.
#CNO 010472 TYPE: MAPS
TITLE
OOLDEA AEROMAGNETIC MAP OF TOTAL INTENSITY. GEOPHYSICAL ATLAS OF AUSTRALIA, 1/250 000 SERIES. GEOL.SURV.S.AUST. (PLAN NO.75-1011)
AUTHOR
GEOL SURV S AUST
SOURCE
SADME UNPUBLISHED REPORT, MAPS, #DOP 1975
KEYWORDS
#SC 1230 GEOPHYSICS GEOPHYSICAL MAPS
AERIAL MAGNETIC MAPS TOTAL MAGNETIC INTENSITY
LOCALITIES
MAP #250: SH5212 OOLDEA

90.
#CNO 010476 TYPE: MAPS
TITLE
NULLARBOR AEROMAGNETIC MAP OF TOTAL INTENSITY. GEOPHYSICAL ATLAS OF AUSTRALIA, 1/250 000 SERIES. GEOL.SURV.S.AUST. (PLAN NO.75-604)
AUTHOR
GEOL SURV S AUST
SOURCE
SADME UNPUBLISHED REPORT, MAPS, #DOP 1975
KEYWORDS
#SC 1230 GEOPHYSICS GEOPHYSICAL MAPS
AERIAL MAGNETIC MAPS TOTAL MAGNETIC INTENSITY
LOCALITIES
MAP #250: SH5216 NULLARBOR

91.
#CNO 001566 TYPE: COMPANY REPORT
TITLE
EXPLORATION LICENCE 216 OOLDEA,S.A. FINAL REPORT (+3 PROCESS REPS)
CORPORATE
DAMPIER
AUTHOR
BROKEN-HILL-PTY-LTD
SOURCE
SADME UNPUBLISHED REPORT, #ENV 2691 MAPS, #DOP 1976
KEYWORDS
#SC 1050 COAL METALLIFEROUS MINERALS
MINERAL EXPLORATION COAL EXPLORATION COAL
IRON HELICOPTER SURVEYS GEOLOGICAL SURVEYS

GEOPHYSICS | RADIOACTIVITY SURVEYS | DRILLING
ROTARY DRILLING | GEOPHYSICAL LOGS | RADIOACTIVITY LOGS
GEOLOGICAL LOGS | ADELAIDEAN | PALAEOZOIC
CAINOZOIC | NULLARBOR LIMESTONE | MAGNETIC ANOMALIES
DUNES

LOCALITIES
GOLDEA | EUCLA BASIN | OFFICER BASIN
TALLARINGA TROUGH | GAWLER BLOCK
MAP #250: SH5212 OOLDEA | #250: SH5309 BARTON
#100: 5237 5236 5336 5337 5436 5437

92.
#CNO 001890 TYPE: COMPANY REPORT
TITLE
PROGRESS AND FINAL REPORTS E.L.164 IFOULD LAKE SOUTH AUSTRALIA (2 REPS CY) (3 VOLS) FORMERLY EL 10
#TN EL164

CORPORATE
PECHINEY

AUTHOR
COCQUIO,D

SOURCE
SADME UNPUBLISHED REPORT, #ENV 2504 MAPS, #DOP 1976

KEYWORDS
#SC 1345 | METALLIFEROUS MINERALS | MINERAL EXPLORATION
URANIUM EXPLORATION | GEOLOGICAL SURVEYS | RADIOMETRIC ANOMALIES
GEOPHYSICS | RADIOACTIVITY SURVEYS | RADON DETECTION
TRACK ETCH SURVEY METHOD | DRILLING | PERCUSSION DRILLING
COMPOSITE LOGS | GEOPHYSICAL LOGS | SP LOGS
RESISTIVITY LOGS | RADIOACTIVITY LOGS | BASEMENT
PRECAMBRIAN | CAINOZOIC | EOCENE
PIDINGA FORMATION | LIGNITE | GEOCHEMISTRY
SOIL SAMPLING | ROCK (CHIP) SAMPLING | WATER SAMPLING
DRILL CUTTINGS | CHEMICAL ANALYSIS | URANIUM
THORIUM | ISOPACH MAPS | LIMESTONE
SALT LAKES | NULLARBOR LIMESTONE

LOCALITIES
IFOULD LAKE | NULLARBOR | EUCLA BASIN
MAP #250: SH5309 BARTON | #250: SH5212 OOLDEA
#100: 5336 5236

93.
#CNO 009442 TYPE: MAPS
TITLE
NULLARBOR BOUGUER ANOMALY MAP,DENSITY 2.67 GM/CM3.GEOPHYSICAL ATLAS OF AUSTRALIA, 1:250 000 SERIES. GEOL.SURV.S.AUST (PLAN NO.76-972)

AUTHOR
GERDES,R A

SOURCE
SADME UNPUBLISHED REPORT, MAPS, #DOP 1976

KEYWORDS
#SC 1230 | GEOPHYSICS | GEOPHYSICAL MAPS
BOUGUER GRAVITY MAPS | GRAVITY MAPS

LOCALITIES
MAP #250: SH5216 NULLARBOR

94.
#CNO 005556 TYPE: GOVERNMENT REPORT

TITLE
LITHOLOGS AND COAL ANALYSES OF LIGNITES AND LIGNITIC CLAYS OF FIFTEEN HOLES DRILLED IN EUCLA BASIN (NO TEXT)
#TN EL281
AUTHOR
TOWNSEND,I J ; GATEHOUSE,C G
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3105 90 PAGES;
#DOP 1977
KEYWORDS
#SC 1440 FOSSIL FUELS COAL
COAL EXPLORATION DRILLING GEOLOGICAL LOGS
COAL ANALYSIS CHEMICAL ANALYSIS LIGNITE
COAL FIELDS
LOCALITIES
EUCLA BASIN PIDINGA BORES CHUNDIE SWAMP BORES
TALLACOOTRA BORES
MAP #250: SH5313 FOWLER #250: SH5309 BARTON #250: SH5212 OOLDEA
#100: 5335 5336 5236 5435

95.
#CNO 007149 TYPE: OTHER GOVERNMENT REPORT
TITLE
AN INTERPRETATION OF THE AIRBORNE MAGNETIC & RADIOMETRIC SURVEY OF COMPANA,NULLARBOR,FOWLER AND NUYTS(ONSHORE) 1/250 000 SHEET AREAS SA 1972/3
AUTHOR
LAMBOURN,S S
SOURCE
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS. RECORD, VOL. 77/52
24 PAGES; MAPS, #DOP 1977
KEYWORDS
#SC 1230 GEOPHYSICS AERIAL MAGNETIC SURVEYS
AERIAL RADIOACTIVITY SPECTROMETER SURVEY MAGNETIC INTERPRETATION
REGIONAL GEOPHYSICS RADIOMETRIC INTERPRETATION
TOTAL MAGNETIC INTENSITY MAGNETIC BASEMENT DEPTH MAPS
RADIOMETRIC PROFILE TECTONIC MAPS BASEMENT DEPTH
LOCALITIES
EUCLA BASIN GAWLER CRATON MALLABIE DEPRESSION
MAP #250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5313 FOWLER
#250: SI5301 NUYTS

96.
#CNO 009423 TYPE: MAPS
TITLE
COOK BOUGUER ANOMALY MAP DENSITY 2.20 GM/CM3. GEOPHYSICAL ATLAS OF AUSTRALIA, 1:250 000 SERIES. GEOL SURVEY.S.AUST. (PLAN NO.77-312)
AUTHOR
GERDES,R A
SOURCE
SADME UNPUBLISHED REPORT, MAPS, #DOP 1977
KEYWORDS
#SC 1230 GEOPHYSICS GEOPHYSICAL MAPS
BOUGUER GRAVITY MAPS GRAVITY MAPS
LOCALITIES
MAP #250: SH5211 COOK

97.
#CNO 009424 TYPE: MAPS
TITLE
COOMPANA BOUGUER ANOMALY MAP DENSITY 2.20 GM/CM3.GEOPHYSICAL ATLAS OF AUSTRALIA, 1:250 000 SERIES. GEOL. SURVEY. S.AUST.(PLAN NO.77-395)
AUTHOR
GERDES,R A
SOURCE
SADME UNPUBLISHED REPORT, MAPS, #DOP 1977
KEYWORDS
#SC 1230 GEOPHYSICS GEOPHYSICAL MAPS
BOUGUER GRAVITY MAPS GRAVITY MAPS
LOCALITIES
MAP #250: SH5215 COOMPANA

98.
#CNO 009438 TYPE: MAPS
TITLE
OOLDEA BOUGUER ANOMALY MAP, DENSITY 2.20 GM/CM3. GEOPHYSICAL ATLAS OF AUSTRALIA, 1:250 000 SERIES GEOL.SURVEY.S.AUST. (PLAN NO.77-215)
AUTHOR
GERDES,R A
SOURCE
SADME UNPUBLISHED REPORT, MAPS, #DOP 1977
KEYWORDS
#SC 1230 GEOPHYSICS GEOPHYSICAL MAPS
BOUGUER GRAVITY MAPS GRAVITY MAPS
LOCALITIES
MAP #250: SH5212 OOLDEA

99.
#CNO 010060 TYPE: SERIES
TITLE
ENVIRONMENTS OF SOUTH AUSTRALIA PROVINCE 7 WESTERN PASTORAL. DIVISION OF LAND USE RESEARCH, C.S.I.R.O. CANBERRA
CORPORATE
C.S.I.R.O.
AUTHOR
LAUT,P ; HEYLIGERS,P C ; KEIG,G ; LOFFLER,E ; MARGULES,C
SOURCE
CSIRO. DIVISION OF SOILS. SOILS AND LAND USE SERIES, 184PAGES; MAPS,ILLUST, #DOP 1977
KEYWORDS
#SC 1150 ENVIRONMENTAL PROTECTION NATURAL RESOURCES
LANDFORMS CLIMATOLOGY LAND USE PLANNING
CONSERVATION SOILS ECOLOGY
BIBLIOGRAPHIES LANDSAT
LOCALITIES
GAWLER RANGES NULLARBOR LAKE GAIRDNER
LAKE TORRENS
MAP #250: SH5207 WYOLA #250: SH5211 COOK #250: SH5212 OOLDEA
#250: SH5309 BARTON #250: SH5310 TARCOOLA #250: SH5311 KINGOONYA
#250: SH5312 ANDAMOOKA #250: SH5315 GAIRDNER #250: SH5316 TORRENS

100.
#CNO 011434 TYPE: OTHER GOVERNMENT REPORT

TITLE
SOURCE ROCK ANALYSES ON SAMPLES FROM THE 13 AUSTRALIAN SEDIMENTARY BASINS (ETRACT FROM CSIRO RESTRICTED REPORT 868R) ALSO IN ENV 916
CORPORATE
C.S.I.R.O.
AUTHOR
SAXBY,J D
SOURCE
SADME UNPUBLISHED REPORT, #ENV 1365 3 PAGES;
#DOP 1977
KEYWORDS
#SC 1440 PETROLEUM SOURCE BEDS
ORGANIC ANALYSIS DRILL CORE ANALYSIS
LOCALITIES
WEEDINA 1 ARCKARINGA BASIN STANSBURY TOWN 1
NADDA 1 MALLABIE 1 BERRI SOUTH 1
MAP #250: SH5303 WARRINA #250: SI5410 RENMARK #250: SH5216
NULLARBOR
#250: SI5312 MAITLAND
#100: 6041 7028 5034 6428 7029

101.
#CNO 005842 TYPE: GOVERNMENT REPORT
TITLE
COOK WATER SUPPLY WELL NUMBER 3 COMPLETION REPORT (5 FIGS)
AUTHOR
WATERHOUSE,J D
SOURCE
SADME UNPUBLISHED REPORT, #RB 78/052 12 PAGES; MAPS,
#DOP 1978
KEYWORDS
#SC 1240 HYDROGEOLOGY DRILLING
AQUIFER TESTS AQUIFER AQUIFERS
SALINITY CABLE TOOL DRILLING WATER ANALYSIS
WATER SUPPLY WELL COMPLETION REPORTS GEOLOGICAL LOGS
LOCALITIES
COOK NULLARBOR EUCLA BASIN
MAP #250: SH5211 COOK
#100: 4936

102.
#CNO 006295 TYPE: GOVERNMENT REPORT
TITLE
GEOCHRONOLOGY OF THE ANCIENT BASEMENT ROCKS OF THE GAWLER CRATON,PROG. REPS. 1-16,1976-1978 (12FIGS)
CORPORATE
AMDEL
AUTHOR
STEVESON,B G ; WEBB,A W ; WHITEHRAD,S
SOURCE
SADME UNPUBLISHED REPORT, #ENV 2797 179PAGES; ILLUST,
#DOP 1978
KEYWORDS
#SC 1200 GEOCHRONOLOGY RUBIDIUM-STRONTIUM
DATING
POTASSIUM ARGON DATING IGNEOUS PETROLOGY METAMORPHIC
PETROLOGY
PETROLOGY ARCHAEAN EARLY PROTEROZOIC
CLEVE METAMORPHICS GRANITE GNEISS
DRILL CORE

LOCALITIES
GAWLER CRATON | EYRE PENINSULA | YORKE PENINSULA
SPENCER GULF | MOUNT WOODS INLIER
MAP #250: SH5306 COOBER PEDY | #250: SH5309 BARTON | #250: SH5310
TARCOOLA
#250: SH5314 CHILDARA | #250: SI5311 LINCOLN | #250: SI5312
MAITLAND
#250: SH5212 OOLDEA | #250: SI5301 NUYTS | #250: SH5305
TALLARINGA
#250: SH5315 GAIRDNER
#100: 5237 5533 5538 5935

103.
#CNO 006487 TYPE: GOVERNMENT REPORT
TITLE
STRATIGRAPHIC DRILLING PROGRESS REPORT NO.2
CORPORATE
AMDEL
AUTHOR
STEVESON,B
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3357 23 PAGES;
#DOP 1978
KEYWORDS
#SC 1450 | PETROLOGY | DRILLING
STRATIGRAPHIC WELLS | SEDIMENTARY PETROLOGY | POROSITY
PERMEABILITY | PETROLEUM
LOCALITIES
OOLDEA
MAP #250: SH5212 OOLDEA
#100: 5237

104.
#CNO 007620 TYPE: GOVERNMENT REPORT
TITLE
OOLDEA NO1 AND REID NO1 AND 1A WELL COMPLETION REPORTS
AUTHOR
MEYER,G M
SOURCE
SADME UNPUBLISHED REPORT, #RB 79/083 18 PAGES; MAPS,
#DOP 1979
KEYWORDS
#SC 1050 | COAL | DRILLING
GEOPHYSICS | WELL COMPLETION REPORTS | SEDIMENTARY BASINS
DIAMOND DRILLING | STRATIGRAPHY | DRILL HOLE DATA
DRILL CORE | SEISMIC INTERPRETATION | GEOLOGICAL LOGS
PETROLOGY | BIOSTRATIGRAPHY | DRILL CUTTINGS
COMPOSITE LOGS | CORE SAMPLING | NULLARBOR LIMESTONE
WILSON BLUFF LIMESTONE | PIDINGA FORMATION | MIOCENE
EOCENE
LOCALITIES
EUCLA BASIN | OOLDEA | REID
WATSON | OFFICER BASIN | ARCKARINGA BASIN
MAP #250: SH5212 OOLDEA
#100: 5136 5137

105.
#CNO 010373 TYPE: COMPANY REPORT
TITLE
ASSESSMENT OF GROUND MAGNETIC DATA,OOLDEA AREA S.A./ASSESSMENT OF

AEROMAGNETIC DATA OOLDEA AREA S.A. (2 REPS)
AUTHOR
ASHLEY,J
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3794 4 PAGES; MAPS,
#DOP 1979
KEYWORDS
#SC 1230 GEOPHYSICS MAGNETIC
INTERPRETATION
MAGNETIC ANOMALIES MAGNETIC PROFILE
LOCALITIES
NULLARBOR OOLDEA
MAP #250: SH5212 OOLDEA #250: SH5216 NULLARBOR
#100: 5036 5035

106.
#CNO 010696 TYPE: MAPS
TITLE
COOK,COOMPANA,OOLDEA,NULLARBOR METALLIC EXPLNINDEX SER.1:500
000.GEOCHEM-GEOPHYS,GEOL-DRILLING,URANIUM-MIN.OCCURRENCES(PLANS
79-173,AB,CD,EF)
AUTHOR
GEOL,SURV S AUST
SOURCE
SADME UNPUBLISHED REPORT, MAPS, #DOP 1979
KEYWORDS
#SC 1345 METALLIFEROUS MINERALS MINERAL EXPLORATION
INDEX MAPS GEOPHYSICS REGIONAL GEOLOGY
DRILLING URANIUM
LOCALITIES
MAP #250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5215
COOMPANA
#250: SH5216 NULLARBOR

107.
#CNO 010918 TYPE: GOVERNMENT REPORT
TITLE
STRATIGRAPHIC DRILLING FOR COAL IN THE EASTERN EUCLA BASIN SOUTH
AUSTRLIA
#TN EL281
AUTHOR
TOWNSEND,I J
SOURCE
SADME UNPUBLISHED REPORT, #RB 79/145 9 PAGES; MAPS,
#DOP 1979
KEYWORDS
#SC 1050 COAL COAL FIELDS
LIGNITE TERTIARY COAL ANALYSIS
COAL EXPLORATION DRILLING PIDINGA FORMATION
COMPOSITE LOGS GEOPHYSICAL LOGS RADIOACTIVITY LOGS
GAMMA GAMMA LOGS NEUTRON LOGS RESERVES
STRATIGRAPHIC WELLS
LOCALITIES
LILYDALE
MAP #250: SH5212 OOLDEA #250: SH5309 BARTON #250: SH5313
FOWLER
#100: 5236 5336 5335 5435

108.
#CNO 011325 TYPE: PHD THESIS

TITLE
PALYNOSTRATIGRAPHY OF THE AUSTRALIAN EARLY AND MIDDLE CRETACEOUS
AUTHOR
MORGAN,R
SOURCE
GEOLOGICAL SURVEY OF NEW SOUTH WALES. MEMOIRS, VOL. 18 153PAGES;
MAPS,ILLUST, #DOP 1979
KEYWORDS
#SC 1430 PALAEONTOLOGY PALYNOLOGY
BIOSTRATIGRAPHY MICROPLANKTON EARLY CRETACEOUS
CRETACEOUS TAXONOMY SPORES
POLLEN BIOSTRATIGRAPHIC ZONE
LOCALITIES
AUSTRALIA EROMANGA BASIN EUCLA BASIN
OODNADATTA WELL KALLADEINA NULLARBOR 8
MAP #250: SG5315 OODNADATTA #250: SG5413 GASON #250: SH5410 FROME
#250: SH5215 COOMPANA
#100: 5943 6742 7036 4935

109.
#CNO 008893 TYPE: COMPANY REPORT
TITLE
QUARTERLY REPORT E.L.561 6TH DECEMBER 1979 TO 5TH MARCH 1980
365A.O.(AUST)P.L.
#TN EL561
AUTHOR
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3749 21 PAGES; MAPS,
#DOP 1980
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS MINERAL EXPLORATION
KIMBERLITES GEOPHYSICS MAGNETIC
INTERPRETATION
MAGNETIC PROFILE GEOPHYSICAL MODELS MAGNETIC ANOMALIES
GROUND MAGNETIC SURVEYS SOIL SAMPLING
LOCALITIES
EUCLA BASIN HUGHES PROSPECT
MAP #250: SH5211 COOK
#100: 4736 4836

110.
#CNO 008894 TYPE: COMPANY REPORT
TITLE
QUARTERLY REPORT EL 560 6TH DEC 1979 TO 5TH MARCH 1980(20 FIGS)
#TN EL560
CORPORATE
A.O.(AUST)
AUTHOR
A O (AUST)P L
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3748 23 PAGES; MAPS,
#DOP 1980
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS MINERAL EXPLORATION
KIMBERLITES GEOPHYSICS MAGNETIC
INTERPRETATION
GEOPHYSICAL MODELS MAGNETIC ANOMALIES GROUND MAGNETIC
SURVEYS
MAGNETIC PROFILE MAGNETIC DATA SOIL SAMPLING
MAGNETIC SUSCEPTIBILITY

LOCALITIES
NULLARBOR EUCLA BASIN
MAP #250: SH5215 COOMPANA #250: SH5211 COOK
#100: 4735 4835 4736 4836

111.
#CNO 008911 TYPE: COMPANY REPORT
TITLE
QUARTERLY REPORT EL 562 6TH DECEMBER 1979 TO 5TH MARCH 1980
#TN EL562
CORPORATE
A.O.(AUST)
AUTHOR
A Ó AUST ; PL
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3750 21 PAGES; MAPS,
#DOP 1980
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS MINERAL EXPLORATION
KIMBERLITES GEOPHYSICS MAGNETIC
INTERPRETATION
MAGNETIC PROFILE GEOPHYSICAL MODELS MAGNETIC ANOMALIES
GROUND MAGNETIC SURVEYS SOIL SAMPLING
LOCALITIES
EUCLA BASIN BUNABIE
MAP #250: SH5215 COOMPANA
#100: 4734 4735 4834 4835

112.
#CNO 009262 TYPE: GOVERNMENT REPORT
TITLE
TERTIARY COALS OF THE EASTERN EUCLA BASIN,S.A.
AUTHOR
KWITKO,G
SOURCE
MINERAL RESOURCES REVIEW, SOUTH AUSTRALIA (SADME), #RB 80/052 35
PAGES; MAPS, #DOP 1980
KEYWORDS
#SC 1050 COAL TERTIARY
LIGNITE COAL FIELDS PIDINGA FORMATION
COAL EXPLORATION COAL ANALYSIS GEOLOGICAL LOGS
COAL RESOURCES PALAEOCHANNEL
LOCALITIES
EUCLA BASIN NULLARBOR CHUNDIE SWAMPS
TALLACOOTRA PIDINGA LAKES BURDUNGA
MAP #250: SH5305 TALLARINGA #250: SH5309 BARTON #250: SH5313
FOWLER
#250: SH5212 OOLDEA #250: SH5216 NULLARBOR

113.
#CNO 010374 TYPE: COMPANY REPORT
TITLE
PROGRESS & FINAL REPORTS ON EL 545 OOLDEA AREA S.A.(5 REPS)
#TN EL545
CORPORATE
MERIDIAN OIL
AUTHOR
FEHLBERG,B
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3794 18 PAGES; MAPS,

#DOP 1980
KEYWORDS
#SC 1345 NON-METALLIFEROUS MINS MINERAL EXPLORATION
IGNEOUS INTRUSIONS GEOPHYSICS AERIAL MAGNETIC SURVEYS
AERIAL RADIOACTIVITY SPECTROMETER SURVEY GROUND MAGNETIC SURVEYS
GRAVITY SURVEYS MAGNETIC ANOMALIES DIAMONDS
LOCALITIES
NULLARBOR OOLDEA
MAP #250: SH5212 OOLDEA #250: SH5216 NULLARBOR
#100: 5036 5035

114.
#CNO 010375 TYPE: COMPANY REPORT
TITLE
REPORT ON GRAVITY SURVEY COOK AREA,SOUTH AUSTRALIA ON BEHALF OF MINPLEX
AUTHOR
STREET,G J
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3794 7 PAGES; MAPS,
#DOP 1980
KEYWORDS
#SC 1230 GEOPHYSICS GRAVITY SURVEYS
GRAVITY PROFILE LIMESTONE CAVES
BOUGUER GRAVITY MAPS MAGNETIC ANOMALIES
LOCALITIES
NULLARBOR
MAP #250: SH5212 OOLDEA
#100: 5036

115.
#CNO 010529 TYPE: SERIAL
TITLE
MUCKERA AND MILLBILLIE - AUSTRALIAN ACHONDRITIC METEORITES
AUTHOR
FITZGERALD,M J
SOURCE
ROYAL SOCIETY OF SOUTH AUSTRALIA. TRANSACTIONS, VOL. 104 P201-209;
ILLUST, #DOP 1980
KEYWORDS
#SC 1170 EXTRATERRESTRIAL GEOLOGY METEORITES
LOCALITIES
MUCKERA WESTERN AUSTRALIA
MAP #250: SH5211 COOK
#100: 4937

116.
#CNO 010673 TYPE: COMPANY REPORT
TITLE
PROGRESS REPORTS E.L.5958 WATSON SOUTH, SOUTH AUSTRALIA (2 REPS)
CORPORATE
DAMPIER
AUTHOR
BHP
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3796 2 PAGES;
#DOP 1980
KEYWORDS
#SC 1230 GEOPHYSICS MINERAL EXPLORATION

MAGNETIC ANOMALIES GROUND MAGNETIC SURVEYS GRAVITY SURVEYS
LOCALITIES
WATSON NULLARBOR
MAP #250: SH5212 OOLDEA
#100: 5136 5236

117.
#CNO 011718 TYPE: COMPANY REPORT
TITLE
COMPILATION OF GEOPHYSICAL DATA EUCLA AND OFFICER BASINS
AUTHOR
ASHLEY,J
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3972 10 PAGES; MAPS,
#DOP 1980
KEYWORDS
#SC 1230 GEOPHYSICS GEOPHYSICAL
INTERPRETATION
SEISMIC INTERPRETATION GRAVITY INTERPRETATION MAGNETIC BASEMENT
DEPTH MA
MAGNETIC INTERPRETATION ISOPACH MAPS; CAMBRIAN DENSITY
SEISMIC INTERPRETATION MAGNETIC SUSCEPTIBILITY DRILLING
AERIAL MAGNETIC MAPS
LOCALITIES
OFFICER BASIN EUCLA BASIN MALLABIE DEPRESSION
DENMAN TROUGH WILKINSON 1 MUNYARIE 1 WELL
MAP #250: SH5203 NOORINA #250: SH5204 WELLS #250: SH5207 WYOLA
#250: SH5208 MAURICE #250: SH5211 COOK #250: SH5212
OOLDEA
#250: SH5215 COOMPANA #250: SH5216 NULLARBOR #250: SH5305
TALLARINGA

118.
#CNO 014798 TYPE: COMPANY REPORT
TITLE
INTERPRETATION OF REGIONAL AIRBORNE MAGNETIC SURVEYS OVER OOLDEA AREA.
PRELIM REP (1 MAP)
CORPORATE
AMOCO
AUTHOR
DODDS,A ; GEOEX
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3855 5 PAGES; MAPS,
#DOP 1980
KEYWORDS
#SC 1230 GEOPHYSICS REGIONAL GEOPHYSICS
MAGNETIC INTERPRETATION AERIAL MAGNETIC MAPS BASEMENT DEPTH
MAGNETIC BASEMENT DEPTH MAPS MAGNETIC ANOMALIES
LOCALITIES
GAWLER CRATON OOLDEA KARARI FAULT
TALLARINGA TROUGH
MAP #250: SH5212 OOLDEA
#100: 5137 5237 5136 5236

119.
#CNO 014800 TYPE: COMPANY REPORT
TITLE
A COMBINED GRAVITY AND MAGNETICS SURVEY INCORPORATING GRIDDING OPTICAL
LEVELLING AND SOIL SAMPLING
#TN EL616

CORPORATE
AMOCO
AUTHOR
RAU,G L ; SOLO-GEOPHYSICS
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3855 2 PAGES; MAPS,
#DOP 1980
KEYWORDS

#SC 1230	GEOPHYSICS	MINERAL EXPLORATION
GRAVITY SURVEYS	GROUND MAGNETIC SURVEYS	GEOCHEMISTRY
SOIL SAMPLING	GRAVITY STATIONS	GRAVITY DATA
GRAVITY PROFILE	MAGNETIC PROFILE	MAGNETIC DATA
ASSAY VALUE	COPPER	LEAD
ZINC	NICKEL	COBALT
MERCURY	COPPER	LEAD
ZINC	NICKEL	COBALT
MERCURY	ASSAY VALUE	COPPER
LEAD	ZINC	NICKEL
COBALT	MERCURY	

LOCALITIES

OOLDEA	GAWLER CRATON	

MAP #250: SH5212 OOLDEA
#100: 5237 5236

120.
#CNO 015045 TYPE: COMPANY REPORT
TITLE
MAGNETIC INTERPRETATION - COOMPANA AREA, SOUTH AUSTRALIA(EL 747,748,749)(4 MAPS) (AEROMAGNETIC MAPS REPROCESSED)
#TN EL747
CORPORATE
SHELL
AUTHOR
LAYTON-GEOPHYS
SOURCE
SADME UNPUBLISHED REPORT, #ENV 4046 3 PAGES; MAPS,
#DOP 1980
KEYWORDS

#SC 1230	GEOPHYSICS	AERIAL MAGNETIC MAPS
MAGNETIC INTERPRETATION	MAGNETIC PROFILE	MAGNETIC BASEMENT
DEPTH MA		
TECTONIC MAPS		

LOCALITIES

COOMPANA	EUCLA BASIN	GAWLER CRATON
MERDEYERRAH		

MAP #250: SH5215 COOMPANA
#100: 4735 4835

121.
#CNO 011384 TYPE: COMPANY REPORT
TITLE
FINAL REPORT ON WYOLA 3 EL 732 WYOLA 4 EL 733 WYOLA 7 EL 735,WYOLA 8 EL 736, WYOLA 11 EL 738, WYOLA 13 EL 739 S.A. TO 27 FEB 1981
#TN EL732
CORPORATE
C.R.A. EXPLOR
AUTHOR
MANNING,R A
SOURCE
SADME UNPUBLISHED REPORT, #ENV 4112 8 PAGES; MAPS,

#DOP 1981

KEYWORDS

#SC 1440	PETROLEUM	COAL
METALLIFEROUS MINERALS	OIL SHALE	LIGNITE
MINERAL EXPLORATION	HELICOPTER SURVEYS	ROCK (CHIP) SAMPLING
OBSERVATORY HILL BEDS	CAMBRIAN	GEOCHEMISTRY
CHEMICAL ANALYSIS	COPPER	LEAD
ZINC	BARIUM	ARSENIC
URANIUM	FLUORINE	MANGANESE
PERCUSSION DRILLING	HYDROLOGIC CYCLE	EARLY CRETACEOUS
MADURA SHALE	TERTIARY	PIDINGA FORMATION
CARBONACEOUS SHALE		

LOCALITIES

WYOLA	EUCLA BASIN	OFFICER BASIN
MAP #250: SH5203 NOORINA	#250: SH5204 WELLS	#250: SH5207 WYOLA
#250: SH5208 MAURICE	#250: SH5211 COOK	#250: SH5212
OOLDEA		

122.

#CNO 011719 TYPE: COMPANY REPORT

TITLE

PROGRESS & FINAL REPORTS ON EL 671 - MURRAWIJINIE EL 672 DENMAN, EL 673 - KOONALDA, EL677- COOK

#TN EL671

CORPORATE

C.R.A. EXPLOR

AUTHOR

MANNING,R A ; ANDREWS,D A

SOURCE

SADME UNPUBLISHED REPORT, #ENV 3972 27 PAGES; MAPS,

#DOP 1981

KEYWORDS

#SC 1440	PETROLEUM	OIL SHALE
PETROLEUM EXPLORATION	ROTARY DRILLING	GEOLOGICAL LOGS
GEOPHYSICS	GRAVITY SURVEYS	MADURA SHALE
EARLY CRETACEOUS	OIL ANALYSIS	GEOCHEMICAL LOGS
CHEMICAL ANALYSIS	COPPER	LEAD
ZINC	SILVER	URANIUM
GRAVITY DATA	GEOLOGICAL LOGS	

LOCALITIES

MURRAWIJINIE	DENMAN TROUGH	KOONALDA
COOK	EUCLA BASIN	OFFICER BASIN
MAP #250: SH5211 COOK	#250: SH5215 COOMPANA	#250: SH5216
NULLARBOR		

123.

#CNO 011858 TYPE: COMPANY REPORT

TITLE

FINAL REPORT ON WYOLA 5, E.L.734 SOUTH AUSTRALIA.(REF.NO.10362)

#TN EL734

CORPORATE

C.R.A. EXPLOR

AUTHOR

ANDREWS,D L

SOURCE

SADME UNPUBLISHED REPORT, #ENV 4255 6 PAGES; MAPS,

#DOP 1981

KEYWORDS

#SC 1440	PETROLEUM	PETROLEUM
EXPLORATION		

OIL SHALE | MADURA SHALE | PERCUSSION DRILLING
COMPOSITE LOGS | GEOPHYSICAL LOGS | NEUTRON LOGS
RADIOACTIVITY LOGS | GAMMA GAMMA LOGS | OBSERVATORY HILL BEDS
CARBONACEOUS SHALE | OIL ANALYSIS

LOCALITIES
EUCLA BASIN | WYOLA | OFFICER BASIN
MAP #250: SH5207 WYOLA #250: SH5211 COOK
#100: 4938 4837

124.
#CNO 012005 TYPE: COMPANY REPORT
TITLE
PALYNOLOGICAL REPORT ON CORE FROM 81EPR5(APP.3 OF FINAL REPORT ON 9TH JULY 1981, VOL 3)
#TN EL730

CORPORATE
C.R.A. EXPLOR

AUTHOR
HARRIS,W K

SOURCE
SADME UNPUBLISHED REPORT, #ENV 4032 3 PAGES;
#DOP 1981

KEYWORDS
#SC 1430 | BIOSTRATIGRAPHY | DRILL CORE
PALYNOLOGY | EOCENE | EARLY CRETACEOUS
SEDIMENTARY ENVIRONMENT

LOCALITIES
EUCLA BASIN | WYOLA
MAP #250: SH5211 COOK
#100: 4737

125.
#CNO 012006 TYPE: COMPANY REPORT
TITLE
E.L. 730,731,732 733 734 735 736 737 738 739 PROGRESS & FINAL REPORTS (JOINT VENTURE 4 REPS 3 VOLS)
#TN EL730

CORPORATE
C.R.A. EXPLOR

AUTHOR
MANNING,R A ; ANDREWS,D L

SOURCE
SADME UNPUBLISHED REPORT, VOL. 1-3 #ENV 4032 61 PAGES;
MAPS, #DOP 1981

KEYWORDS
#SC 1440 | PETROLEUM | MINERAL EXPLORATION
OIL SHALE | COAL EXPLORATION | METALLIFEROUS MINERALS
MADURA SHALE | OBSERVATORY HILL BEDS | PIDINGA FORMATION
SUBBITUMINOUS COAL | OIL ANALYSIS | ROTARY DRILLING
COMPOSITE LOGS | GEOPHYSICS | GROUND MAGNETIC SURVEYS
GEOCHEMISTRY | ROCK (CHIP) SAMPLING | STREAM SEDIMENT SAMPLING
CHEMICAL ANALYSIS | COPPER | LEAD
ZINC | BARIUM | ARSENIC
VANADIUM | AUGER DRILLING | GEOPHYSICAL LOGS
MAGNETIC SUSCEPTIBILITY

LOCALITIES

WYOLA EUCLA BASIN OFFICER BASIN
HUGHES BORES DENMAN TROUGH
MAP #250: SH5202 #250: SH5203 NOORINA #250: SH5205
#250: SH5206 #250: SH5207 WYOLA #250: SH5208
MAURICE
#250: SH5211 COOK #250: SH5212 OOLDEA #250: SH5214

126.
#CNO 013623 TYPE: COMPANY REPORT
TITLE
OIL CONTENT OF CORE FROM HUGHES NO:1,2.
CORPORATE
SHELL
AUTHOR
HALL,D B
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3859 P386-387;
#DOP 1981
KEYWORDS
#SC 1440 PETROLEUM DRILL CORE ANALYSIS
OIL ANALYSIS
LOCALITIES
HUGHES 1 HUGHES 2 EUCLA BASIN
MAP #250: SH5211 COOK
#100: 4736 4836

127.
#CNO 013898 TYPE: COMPANY REPORT
TITLE
E.L.716 O"MALLEY SIDING, S.A. PROGRESS REPORTS FROM 5-12-80 TO 4-6-81.
(3 REPS, SEE ENV.3874 FOR EXPLORATION RESULTS. GODC-SANTOS.VENTURE)
#TN EL716
CORPORATE
GETTY MINING
AUTHOR
ALLEN,J H ; EDGECOMBE,D
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3963 9 PAGES; MAPS,
#DOP 1981
KEYWORDS
#SC 1345 METALLIFEROUS MINERALS MINERAL EXPLORATION
LOCALITIES
O'MALLEY SIDING EUCLA BASIN OFFICER BASIN
OOLDEA
MAP #250: SH5212 OOLDEA
#100: 5136 5036

128.
#CNO 013899 TYPE: COMPANY REPORT
TITLE
E.L.643.YARLE LAKES,E.L.716 O"MALLEY SIDING S.A. PROGRESS REPORTS FROM
20-6/80 TO 19-12-81 (6 REPS-GODS-SANTOS VENTURE SEE ALSO ENV.3963)
#TN EL64
CORPORATE
GETTY MINING
AUTHOR
ALLEN,J H ; EDGECOMBE,D R ; LEMAIRE,H ; WHITE,R M S
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3874 63 PAGES; MAPS,
#DOP 1981

KEYWORDS
#SC 1345 | METALLIFEROUS MINERALS | MINERAL EXPLORATION
GEOPHYSICS | GRAVITY SURVEYS | GROUND MAGNETIC SURVEYS
MAGNETIC ANOMALIES | GRAVITY ANOMALIES | PERCUSSION DRILLING
LIGNITE | SULPHIDE MINERALS | OBSERVATORY HILL BEDS
GEOLOGICAL LOGS | GEOPHYSICAL LOGS | RADIOACTIVITY LOGS
SP LOGS | RESISTIVITY LOGS | CARBONACEOUS ROCKS
CHEMICAL ANALYSIS | COPPER | LEAD
ZINC | GEOCHEMICAL LOGS
LOCALITIES
YARLE LAKES | EUCLA BASIN | OFFICER BASIN
MARALINGA | O'MALLEY SIDING | OOLDEA
HUNDRED
MAP #250: SH5212 OOLDEA
#100: 5137 5037 5136 5036

129.
#CNO 013906 TYPE: COMPANY REPORT
TITLE
E.L.601 IFOULD LAKE AREA S A. EUCLA BASIN LIGNITE EXPLOR. PROGRESS REPORTS(6 REPS, 2 VOL LOONGANA PL KUMUNGA PL TANNADICE PL JOINT VENTURE)
#TN EL601
CORPORATE
KUMUMGA
AUTHOR
GRASSO,R ; DUNCAN,N
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3829 44 PAGES; MAPS,
#DOP 1981
KEYWORDS
#SC 1050 | COAL | COAL EXPLORATION
LIGNITE | DIAMOND DRILLING | COMPOSITE LOGS
COAL ANALYSIS | GROUND WATER | SALINITY
COAL ASH | PIDINGA FORMATION
LOCALITIES
IFOULD LAKE | PIDINGA LAKES | EUCLA BASIN
MAP #250: SH5212 OOLDEA | #250: SH5309 BARTON
#100: 5236 5336

130.
#CNO 013908 TYPE: COMPANY REPORT
TITLE
E.L.625 LAKE TALLACOOTRA AREA, SOUTH AUST.EUCLA BASIN LIGNITE EXPLORATIE.L.625 SOUTH AUST. EUCLA BASIN LIGNITE EXPLORATION PROGRESS REPORTS. (4 #TN EL625
CORPORATE
TANNADICE PL
AUTHOR
GRASSO,R ; DUNCAN,N
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3884 25 PAGES; MAPS,
#DOP 1981
KEYWORDS
#SC 1050 | COAL | COAL EXPLORATION
LIGNITE | DIAMOND DRILLING | COMPOSITE LOGS
COAL ANALYSIS | PIDINGA FORMATION
LOCALITIES
IFOULD LAKE | EUCLA BASIN | LAKE TALIA COOTRA

MAP #250: SH5212 OOLDEA #250: SH5313 FOWLER #250: SH5309 BARTON
#100: 5236 5335 5336

131.
#CNO 015143 TYPE: COMPANY REPORT
TITLE
EL 464-466 RECONNAISSANCE GEOMORPHOLOGIC STUDY OF THE LAKE MAURICE AREA,SOUTH AUSTRALIA(4 FIGS,2 MAPS,7 PLATES) 5 REFS
#TN EL464
CORPORATE
AQUITAINE AUSTRALIA
AUTHOR
HUNTING-GEOL-GEOPHYS
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3816 15 PAGES; MAPS,
#DOP 1981
KEYWORDS
#SC 1610 SURFICIAL GEOLOGY GEOMORPHOLOGY
MINERAL EXPLORATION REMOTE SENSING LANDSAT
PHOTOINTERPRETATION CAINOZOIC PALAEODRAINAGE
URANIUM EXPLORATION
LOCALITIES
LAKE MAURICE EUCLA BASIN OFFICER BASIN
MAP #250: SH5203 NOORINA #250: SH5204 WELLS #250: SH5207 WYOLA
#250: SH5208 MAURICE #250: SH5305 TALLARINGA #250: SH5211 COOK
#250: SH5212 OOLDEA #250: SH5309 BARTON #250: SH5301 GILES

132.
#CNO 011993 TYPE: COMPANY REPORT
TITLE
E.L. 730,731,732,733,734,735,736,737,738,739 PROGRESS & FINAL REPORTS (JOINT VENTURE 4 REPS 3 VOLS)
AUTHOR
SOURCE
SADME UNPUBLISHED REPORT, #ENV 4032 #DOP 1981
KEYWORDS
#SC 1140
LOCALITIES
MAP #250: SH5204 WELLS #250: SH5215 COOMPANA #250: SH5216 NULLARBOR

133.
#CNO 014408 TYPE: COMPANY REPORT
TITLE
E.L.490, 897"TRIAL WELL",S.A. PROGRESS REPORTS FROM 14-9-79 TO 4-1-82(9REPS,3 VOLS)
#TN EL490
CORPORATE
CARPENTARIA
AUTHOR
BOYER,D D ; SIMPSON,P G
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3530 62 PAGES; MAPS,
#DOP 1982
KEYWORDS
#SC 1345 METALLIFEROUS MINERALS BEACH SANDS
COAL EXPLORATION MINERAL EXPLORATION LIGNITE
GEOPHYSICS AERIAL MAGNETIC SURVEYS GRAVITY SURVEYS

MAGNETISM | MAGNETIC ANOMALIES | ROTARY DRILLING
TERTIARY | PIDINGA FORMATION | MULGATHING COMPLEX
BASEMENT | SULPHIDE MINERALS | MARCASITE
IP SURVEYS | DIPOLE DIPOLE ARRAY | GEOLOGICAL LOGS
GEOCHEMICAL LOGS | MAGNETIC SUSCEPTIBILITY | DENSITY
COAL ANALYSIS | SALINITY | AERIAL MAGNETIC MAPS
CHEMICAL ANALYSIS | URANIUM | BOUGUER GRAVITY MAPS
MAGNETIC PROFILE | GRAVITY STATIONS | FREE AIR ANOMALY

LOCALITIES
TRIAL WELL | NULLARBOR

MAP #250: SH5216 NULLARBOR
#100: 5235

134.
#CNO 014797 TYPE: COMPANY REPORT
TITLE
EL 616 OOLDEA SOUTH AUSTRALIA. PROGRESS & FINAL REPORTS FROM 4-9-80 TO 16-4-82 (8 REPS, 2 VOLS, 23 FIGS, 5 MAPS)
#TN EL616

CORPORATE
AMOCO

AUTHOR
MILLER,G

SOURCE
SADME UNPUBLISHED REPORT, #ENV 3855 44 PAGES; MAPS,
#DOP 1982

KEYWORDS
#SC 1345 | METALLIFEROUS MINERALS | MINERAL EXPLORATION
GEOPHYSICS | MAGNETIC INTERPRETATION | GRAVITY SURVEYS
GROUND MAGNETIC SURVEYS | DIAMOND DRILLING | PERCUSSION DRILLING
GEOLOGICAL LOGS | ASSAY VALUE | PETROLOGY
BANDED IRON FORMATION | SAPPHIRINE | BASEMENT
GEOCHEMISTRY | SOIL SAMPLING | MAGNETIC
SUSCEPTIBILITY
DENSITY | GRAVITY ANOMALIES | MAGNETIC ANOMALIES
GRANULITE FACIES | GNEISS | GEOCHEMICAL LOGS
GEOPHYSICAL LOGS | RADIOACTIVITY LOGS | SP LOGS
RESISTIVITY LOGS | GOLD | ZINC
MAGNETITE | GOLD EXPLORATION | BASE METAL
EXPLORATION

LOCALITIES
OOLDEA | KARARI FAULT | GAWLER CRATON

MAP #250: SH5212 OOLDEA
#100: 5137 5237 5136 5236

135.
#CNO 014986 TYPE: COMPANY REPORT
TITLE
EL 905 EL 503 "KOONALDA",SA. BASE METALS EXPLORATION.PROGRESS REPORTS FROM 6-11-79 TO 18-7-82 (2 MPS, 3 SECTS, 28 P.DATA)
#TN EL905

CORPORATE
CARPENTARIA

AUTHOR
SIMPSON,P ; STEPHENSON,P N ; BOYER,D D

SOURCE
SADME UNPUBLISHED REPORT, #ENV 3604 22 PAGES; MAPS,
#DOP 1982

KEYWORDS
#SC 1345 | METALLIFEROUS MINERALS | MINERAL EXPLORATION

GEOPHYSICS | GROUND MAGNETIC SURVEYS | ROTARY DRILLING
BASE METAL EXPLORATION | MAGNETIC PROFILE | GABBRO
CARBONACEOUS SHALE | OIL ANALYSIS | GEOCHEMICAL LOGS
ASSAY VALUE | MULTIELEMENT ANALYSIS | TERTIARY
PIDINGA FORMATION | MADURA SHALE | PRECAMBRIAN
BASEMENT | GEOLOGICAL LOGS | GEOPHYSICAL LOGS
RADIOACTIVITY LOGS | MAGNETIC SUSCEPTIBILITY | REMANENT MAGNETISM
PETROLOGY | MAGNETIC ANOMALIES

LOCALITIES
KOONALDA | EUCLA BASIN | GAWLER CRATON

MAP #250: SH5215 COOMPANA
#100: 4835

136.
#CNO 015037 TYPE: COMPANY REPORT
TITLE
EL 747 BUNABIE ROCKHOLE,748 HUGHES, 749 NULLARBOR PLAIN,SA. PROGRESS REPS.FROM 20-10-80 TO AUG.82.(57 MAPS,27 SECTS) (7 HOLES,T.D.1303 M)
#TN EL747

CORPORATE
SHELL

AUTHOR
BRASH,A H ; WEEDEN,R J

SOURCE
SADME UNPUBLISHED REPORT, #ENV 4046 101PAGES; MAPS,
#DOP 1982

KEYWORDS
#SC 1345 | METALLIFEROUS MINERALS | MINERAL EXPLORATION
BASE METAL EXPLORATION | URANIUM EXPLORATION | OIL SHALE
GEOPHYSICS | MAGNETIC INTERPRETATION | GROUND MAGNETIC SURVEYS
GRAVITY SURVEYS | MAGNETIC ANOMALIES | OIL ANALYSIS
PERCUSSION DRILLING | DIAMOND DRILLING | GEOLOGICAL LOGS
GRAVITY DATA | MAGNETIC SUSCEPTIBILITY | GEOPHYSICAL LOGS
RADIOACTIVITY LOGS | NEUTRON LOGS | SP LOGS
RESISTIVITY LOGS | PETROLOGY | MADURA SHALE
PRECAMBRIAN | BASALT | GRAPHIC LOGS
GEOCHEMICAL LOGS | ASSAY VALUE | COPPER
LEAD | ZINC | BISMUTH
COBALT | DENSITY | GRAVITY
INTERPRETATION
REMANENT MAGNETISM

LOCALITIES
BUNABIE | HUGHES PROSPECT | NULLARBOR
EUCLA BASIN | GAWLER CRATON

MAP #250: SH5211 COOK #250: SH5215 COOMPANA
#100: 4736 4836 4735 4835 4734 4834

137.
#CNO 015038 TYPE: COMPANY REPORT
TITLE
EL 946 WATSON SIDING,S.A. PROGRESS & FINAL REP FROM 22-4-82 TO 16-12-82(17P.DATA.8 MAPS, 11 SECTS,(1 HOLE T.D. 597 M. NO MINERALIZATION
#TN EL946

CORPORATE
ENDEAVOUR OIL

AUTHOR
TAHAN,G

SOURCE
SADME UNPUBLISHED REPORT, #ENV 4589 36 PAGES; MAPS,

#DOP 1982
KEYWORDS
#SC 1345 METALLIFEROUS MINERALS MINERAL EXPLORATION
GEOPHYSICS GRAVITY SURVEYS GROUND MAGNETIC
SURVEYS
DIAMOND DRILLING GEOLOGICAL LOGS PETROLOGY
LIGNITE COAL ANALYSIS PIDINGA FORMATION
STRATIGRAPHY MADURA SHALE LOONGANA SANDSTONE
OBSERVATORY HILL BEDS WILPENA GROUP CALLANNA BEDS
GRAPHIC LOGS PROTEROZIC PYRITE
BASE METAL EXPLORATION
LOCALITIES
WATSON GAWLER CRATON EUCLA BASIN
MAP #250: SH5212 OOLDEA
#100: 5136 5236

138.
#CNO 015052 TYPE: COMPANY REPORT
TITLE
AN INTERPRETATION REPORT ON GEOPHYSICAL DATA AT WATSON SIDING SOUTH AUSTRALIA. (15 P.DATA, 3 MAPS, 1 SECT.)
#TN EL946
CORPORATE
ENDEAVOUR OIL
AUTHOR
JONES,R K -&-ASSOC
SOURCE
SADME UNPUBLISHED REPORT, #ENV 4589 3 PAGES; MAPS,
#DOP 1982
KEYWORDS
#SC 1230 GEOPHYSICS MINERAL EXPLORATION
GRAVITY INTERPRETATION MAGNETIC INTERPRETATION GRAVITY SURVEYS
BOUGUER GRAVITY MAPS GRAVITY PROFILE GRAVITY DATA
LOCALITIES
WATSON
MAP #250: SH5212 OOLDEA
#100: 5136 5236

139.
#CNO 015090 TYPE: COMPANY REPORT
TITLE
EL 472,849 BUNDULLA SA. PROGRESS REPORTS FROM 24-7-79 TO 19-10-82 (53 P.DATA,5 MAPS,5 SECS,2 HOLES T.D. 855M. NO MINERALIZATION)
#TN EL849
CORPORATE
CARPENTARIA
AUTHOR
BOYER,D D ; STEPHENSON,P N ; SIMPSON,P G ; BINKS,P J
SOURCE
SADME UNPUBLISHED REPORT, #ENV 3515 33 PAGES; MAPS,
#DOP 1982
KEYWORDS
#SC 1345 METALLIFEROUS MINERALS MINERAL EXPLORATION
GEOPHYSICS AERIAL MAGNETIC SURVEYS AERIAL MAGNETIC MAP
MAGNETIC PROFILE GROUND MAGNETIC SURVEYS BASE METAL DEPOSITS
MAGNETIC SUSCEPTIBILITY REMANENT MAGNETISM ROTARY DRILLING
GEOLOGICAL LOGS GEOPHYSICAL LOGS RADIOACTIVITY LOGS
GEOCHEMICAL LOGS PETROLOGY ASSAY VALUE
OIL ANALYSIS CARBONACEOUS SHALE MULTIELEMENT
ANALYSIS

DENSITY DOLERITE OIL SHALE
URANIUM EXPLORATION
LOCALITIES
BUNDULLA EUCLA BASIN GAWLER CRATON
NULLARBOR
MAP #250: SH5215 COOMPANA
#100: 4735

140.
#CNO 015161 TYPE: COMPANY REPORT
TITLE
BULK MINERALOGY CLAY MINERALOGY AND TOTAL ORGANIC CARBON OF CORES FROM SADME LIBRARY (NO TEXT - TABLES ONLY)
CORPORATE
C.R.A. EXPLOR
AUTHOR
SURDAM,R C ; WARME,J E ; BOESE,S W ; STANLEY,K J
SOURCE
SADME UNPUBLISHED REPORT, VOL. 2 #ENV 3859
#DOP 1982
KEYWORDS
MINERALOGY MINERAL EXPLORATION
COAL CLAY MINERALS ORGANIC ANALYSIS
DRILL CORE ANALYSIS
LOCALITIES
COOPER BASIN FORTVILLE 3 EROMANGA BASIN
KALLADEINA MALLABIE 1
MAP #250: SH5216 NULLARBOR #250: SG5413 GASON #250: SH5406
CALLABONNA
#100: 5034 6742 7039

141.
#CNO 015162 TYPE: COMPANY REPORT
TITLE
BULK MINERALOGY CLAY MINERALOGY AND THE TOTAL ORGANIC CARBON OF CORES FROM SADME LIBRARY(NO TEXT - TABLES ONLY)
AUTHOR
SURDAM,R C ; WARME,J E ; BOESE,C W ; STANLEY,K D
SOURCE
SADME UNPUBLISHED REPORT, VOL. 2 #ENV 3859
#DOP 1982
KEYWORDS
MINERALOGY MINERAL EXPLORATION
COAL CLAY MINERALS ORGANIC ANALYSIS
DRILL CORE ANALYSIS
LOCALITIES
HUGHES 1 EUCLA BASIN
MAP #250: SH5211 COOK
#100: 4836

142.
#CNO 015164 TYPE: COMPANY REPORT
TITLE
BULK MINERALOGY CLAY MINERALOGY AND TOTAL ORGANIC CARBON OF CORES FROM SADME LIBRARY(NO TEXT- TABLES ONLY)
CORPORATE
C.R.A. EXPLOR
AUTHOR
SURDAM,R C ; WARME,J E ; BOESE,S W ; STANLEY,K O
SOURCE

SADME UNPUBLISHED REPORT, VOL. 2 #ENV 3859
#DOP 1982
KEYWORDS
MINERALOGY MINERAL EXPLORATION
COAL CLAY MINERALS ORGANIC ANALYSIS
DRILL CORE ANALYSIS
LOCALITIES
REID OFFICER BASIN OOLDEA
WALLIRA 1 WALLIRA 2
MAP #250: SH5212 OOLDEA #250: SH5306 COOBER PEDY
#100: 5136 5237 5739 5639

143.
#CNO 015178 TYPE: COMPANY REPORT
TITLE
EL 946 EL 996 NULLARBOR,SA. PROGRESS REPORTS FROM 11-7-82 TO 11-10-82 (HOLE ABANDONED AT 597 M.WITHOUT INTERSECTION MINERALIZATION
#TN EL996
AUTHOR
ENDENAVOUR-RESOURCES-LTD
SOURCE
SADME UNPUBLISHED REPORT, #ENV 4785 2 PAGES;
#DOP 1982
KEYWORDS
#SC 1345 METALLIFEROUS MINERALS MINERAL EXPLORATION
BASE METAL EXPLORATION DRILLING MAGNETIC ANOMALIES
GRAVITY ANOMALIES
LOCALITIES
NULLARBOR
MAP #250: SH5212 OOLDEA
#100: 5136 5236

144.
#CNO 015382 TYPE: COMPANY REPORT
TITLE
GEOPHYSICAL REPORT ON THE KARARI PROJECT S.A. FOR DUVAL MINING AUST LTD
#TN EL997
CORPORATE
DUVAL MINING
AUTHOR
RICHARDSON,R L ; RICHARDSON-MCSHARRY
SOURCE
SADME UNPUBLISHED REPORT, #ENV 4161 19 PAGES; MAPS,
#DOP 1982
KEYWORDS
#SC 1230 GEOPHYSICS GRAVITY
INTERPRETATION
MAGNETIC INTERPRETATION MINERAL EXPLORATION BASE METAL
EXPLORATION
LOCALITIES
KARARI FAULT TALLARINGA TROUGH OFFICER BASIN
MAP #250: SH5212 OOLDEA #250: SH5309 BARTON #250: SH5305
TALLARINGA
#100: 5236 5237 5336 5337 5437 5338

145.
#CNO 015383 TYPE: COMPANY REPORT
TITLE
EL 772 773 977 1050 & APPLN DME 368/82 KARARI PROJECT.PROGRESS& FINAL REPORTS FROM 11-4-81 TO JAN 1983 (19 MAPS 7 FIGS)

#TN EL772
CORPORATE
DUVAL MINING
AUTHOR
GILLAN,M ; MILLER,G ; AMOCO-MINERALS ; EDGECOMBE,D R
SOURCE
SADME UNPUBLISHED REPORT, #ENV 4161 127PAGES; MAPS,
#DOP 1983
KEYWORDS

#SC 1345	METALLIFEROUS MINERALS	MINERAL EXPLORATION
BASE METAL EXPLORATION	CAMBRIAN	CARBONATE ROCKS
DENSITY	DIAMOND DRILLING	GEOLOGICAL LOGS
GEOPHYSICS	GROUND MAGNETIC SURVEYS	PETROLOGY
GRAVITY SURVEYS	GEOCHEMICAL LOGS	ASSAY VALUE
EVAPORITE MINERALS	GYPSUM	ANHYDRITE
CARBONACEOUS SEDIMENTS	GRAVITY INTERPRETATION	MAGNETIC
INTERPRETATION		
BARIUM	MANGANESE	AERIAL MAGNETIC
SURVEYS		
OBSERVATORY HILL BEDS	BOUGUER GRAVITY MAPS	MAGNETIC PROFILE
GRAVITY PROFILE		

LOCALITIES

IMMARNA	KARARI FAULT	OFFICER BASIN
TALLARINGA TROUGH		

MAP #250: SH5212 OOLDEA #250: SH5309 BARTON #250: SH5305
TALLARINGA
#100: 5236 5237 5336 5337 5437 5338

146.
#CNO 85/08/467 DOC-TYPE: Gov rep
TITLE
British nuclear weapons tests in Australia - a summary.
AUTHOR
Major, R B
SOURCE
SADME Unpublished Report #RB 84/037 , 79 pages; 7 appx, 7 fig, 31p text, 26 plates, 23 ref, 4 tables, #DOP 1985 April
ABSTRACT
Nuclear weapons tests and related minor trials conducted by the British Government between 1952 and 1963, are summarized. The possible effects on test personnel and civilians by radiation and fallout, the situation as at 1977 and 1978 regarding radiation levels at the test areas, and the marking of test and waste disposal sites are discussed. Reports by the Australian Ionising Radiation Advisory Council showed residual radiation at former test and minor trials sites present little hazard.
KEYWORDS
#SC 1490 ; #SC 1540 ; #SC 1500 ; Radiation; Safety; Environmental protection; Rehabilitation; Nuclear weapons tests; Public health; Aboriginals; History
LOCALITIES
Monte Bello Islands, (WA); Emu; Maralinga
MAP #250: SH5301 GILES; #250: SH5212 OOLDEA
#100: 5340 5237

6 708 879mN
475 828mE

6 703 010mN
862 715mE

6 487 235mN
476 322mE

6 481 139mN
855 260mE

128°45' 129° 15' 30' 45' 130° 15' 30' 45' 131° 15' 30' 45' 132° 15' 30' 45' 132°45'

29°45' 30° 15' 30' 45' 31° 15' 30' 45' 31°45'

6700 6650 6600 6550 6500

500 550 600 650 700 750 800 850

WESTERN AUSTRALIA

SOUTH AUSTRALIA

PEL 33

Great Australian Bight

Deakin

SHALLOW

BASEMENT

9824

HORIZONTAL SCALE 1:250,000
VERTICAL SCALE 1:5,000

Kilometres 0 5 10 15 20 25

KEY

LITHOLOGY

- Limestone
- Dolomite
- Sandstone
- Siltstone, or sand with shale
- Loongana Sandstone
- Lignite or Coal
- Shale, Claystone or Mudstone
- Volcanics
- Basement (undiff)

FORMATIONS

LMs	Tertiary Limestone
HSs	Hampton Sandstone
PFm	Pidinga Formation
MFm	Madura Formation
LSs	Loongana Sandstone
P	Permian
OHB	Observatory Hill Beds
MSs	Munaroo Sandstone
Vol	Volcanics
Ss	Sandstone (in Mallabie 1, Unnamed)
B	Basement

Note: Pidinga Formation is a clay-rich facies of the Hampton Sandstone

PEL 33 JOINT VENTURE

FENCE DIAGRAM

Compiled by DWL	Date 15/4/86
Drawn by RR	Date 20/4/86
Revised by	Date
Drawing No.	Scale 1:250,000
Report No.	Enclosure No. 1

LAPP RESOURCE CONSULTANTS Pty Ltd

G428-14

6 708 879mN
475 828mE

6 703 010mN
862 715mE

6 487 235mN
476 322mE

6 481 139mN
855 280mE

128°45' 129° 15' 30' 45' 130° 15' 30' 45' 131° 15' 30' 45' 132° 15' 30' 132°45'

500 550 600 650 700 750 800 850

29°45' 30° 15' 30' 45' 31° 15' 30' 31°45'

6700 6650 6600 6550 6500

WESTERN AUSTRALIA

SOUTH AUSTRALIA

PEL 33

PEL 33

GREAT AUSTRALIAN BIGHT

SHALLOW

BASEMENT

TEN METRE CONTOUR INTERVAL

SCALE 1 : 250,000

Kilometres

SMD 5002

SADME WILKINSON 1

WL 2 WL 1

CRA 5 CRA 6 CRA 7

CRA 3

KD 2

Maralinga Water Wells 1,2

15 16 18 Maralinga Water Wells

YL 2

BHP 1

ORP 2

OOLDEA 1

PDH 2a

PDH 1

YL 3

SADME KEIO 1

ORP 1

PDH 3

9RR24

625/4

T4L 23

625/1

COOK 1

YL

COOK 15a

Nullarbor 7

Nullarbor 6 30

Nullarbor W Well 5 >23

TW 13 TW 12

TW 11

Yalata W Well 2

Yalata W Wells

12 9

Yalata W Wells 8 10

Nullarbor W Well 4 >26

Ilcumba WW2

Ilcumba W Wells 2 4 >19 >3

Murrowijinee Bore >15

Muddougana Bore 7

Roberts Well >8

Nullarbor 5 or Albala Karoo Bore 25

Nullarbor 4 or Guineacorra 9

Nullarbor 6 6

MALLABIE 1 25

BI EPR 10 >50

BI EPR 6 ?

BI EPR 7 >12

BO EP5 >8

BI EPR 8 >8

BI EPR 9 >9

BO EP6a

BO EP7

BO EP4 30

BO EP3 >32

BO EP2 >22

BI EPR 4 ?

HUGHES 3 26

HUGHES 2

HUGHES 1

Bundutta W Well 1

Bundutta WW2 >18

BI EPR 3 21

JENMAIN 1 47

COOK R 5 35

Bunburra Water Well 1 ?

DEAKIN 1

BI EPR 2 >12

BN 2 65

BN 1 50

KN 2 43

KN 1 33

Nullarbor W Well 3 ?

BI EPR 1 ?

BO EP 1 18

Wilson W Well 4

Wilson W Well 5

0 10 20 30 40 50 60

PEL 33 JOINT VENTURE

Loongana Isopachs

Compiled by DWL	Date 20/4/86
Drawn by RR	Date 22/4/86
Revised by	Date
Drawing No.	Scale 1:250,000
Report No.	Enclosure No. 2

LAPP RESOURCE CONSULTANTS Pty Ltd

6428-15

6 708 879mN
475 828mE

6 703 610mN
862 713mE

6 487 235mN
476 322mE

6 481 139mN
855 280mE

WESTERN AUSTRALIA

SOUTH AUSTRALIA

PEL 33

PEL 33

GREAT AUSTRALIAN BIGHT

SHALLOW

BASEMENT

TEN METRE CONTOUR INTERVAL

SCALE 1:250,000

PEL 33 JOINT VENTURE

Madura Isopachs

Compiled by DWL	Date 22/4/86
Drawn by RP	Date 23/4/86
Revised by	Date
Drawing No.	Scale 1:250,000
Report No.	Enclosure No. 3

LAPP RESOURCE CONSULTANTS Pty Ltd

G428-16

PEL 33

WESTERN AUSTRALIA / SOUTH AUSTRALIA

CAMBRIAN ABSENT

CAMBRIAN

SHALLOW

BASEMENT

Karari Fault System

L

H

L

GREAT AUSTRALIAN BIGHT

CONTOURS IN METRES RELATIVE TO SEA LEVEL

PEL 33 JOINT VENTURE

Top Cambrian Structure

Compiled by DWL	Date 28/4/86
Drawn by RR	Date 29/4/86
Revised by	Date
Drawing No.	Scale 1:250,000
Report No.	Enclosure No. 4

LAPP RESOURCE CONSULTANTS Pty Ltd

6428-17

6 708 879mN
475 828mE

6 703 010mN
862 715mE

6 487 235mN
476 322mE

6 481 139mN
855 280mE

Top Loongana Structure

PEL 33 JOINT VENTURE

Compiled by DWL	Date 23/4/86
Drawn by RR	Date 24/4/86
Revised by	Date
Drawing No.	Scale 1:250,000
Report No.	Enclosure No 5

LAPP RESOURCE CONSULTANTS Pty Ltd

CONTOURS IN METRES RELATIVE TO SEA LEVEL

SCALE 1:250,000

G428-18

6 708 879mN
475 828mE

6 703 010mN
862 715mE

6 487 235mN
476 322mE

6 481 139mN
855 280mE

SMD 5002

EDGE OF MADURA SEAL

LOONGANA PINCHOUT ZONE

WESTERN AUSTRALIA

SOUTH AUSTRALIA

LOONGANA PINCHOUT ZONE

LOONGANA ABSENT

LANDSAT ANOMALIES IN LOONGANA PINCHOUT ZONE

DENMAN FAULT LEAD

Coincides with Cambrian structure map and surface lead

THE KEY LEAD

EDGE OF MADURA FORMATION SEAL

LOONGANA PINCHOUT ZONE

Possible Traps in surface monoclines

Circular Features on Landsat lie along buried edge of Cambrian

Possible Fault Traps in Loongana Sandstone

Fracture Intersection

BASEMENT HORST

Pinchouts and Fault Block traps in Cambrian against Basement Horst

Coincident Landsat anomalies

SHALLOW

BASEMENT

PEL 33

Great Australian Bight

KEY

- LOONGANA SANDSTONE PINCHOUT ZONE
- SURFACE ANTICLINE
- CIRCULAR LANDSAT ANOMALY
- LIGHT TONE ANOMALY

SCALE 1:250,000

PEL 33 JOINT VENTURE

Play Concept Map

Compiled by D W L	Date 30/4/86
Drawn by R R	Date 30/4/86
Revised by	Date
Drawing No.	Scale 1:250,000
Report No.	Enclosure No. 6

LAPP RESOURCE CONSULTANTS Pty Ltd

6428-19

LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

May 20, 1986

The Director-General
South Australian Department of Mines and Energy
191 Greenhill Road
PARKSIDE SA 5063

Re: THIRD QUARTERLY REPORT FOR PEL 33
DECEMBER 25, 1985 TO MARCH 25, 1986

Dear Sirs,

LAPP Resource Consultants Pty. Ltd. is the contract Operator of PEL 33 by agreement with the Joint Venture Partners.

During the Quarter ending March 25, the integrated aeromagnetic, radiometric and EM survey parameters were selected and bids were obtained from the four Australian contractors providing these surveys.

A Geological Review Report of PEL 33 was also completed during the quarter which identified a number of previously unknown features of the geology. This report is the first comprehensive synthesis of the subsurface geology known from previous drilling. This report was forwarded to you by courier on May 13, 1986.

In particular, the Review revealed that the updip pinchout edge of the Loongana Sandstone is an excellent target for exploration in the permit. The pinchout occurs at a depth of between 200 to 300 metres and is sealed by the thick, clay-rich Madura Formation.

The Review also delineated a large basement horst in the northeastern end of the permit which may have generated Cambrian fault-block traps, or stratigraphic traps if the horst was present during Cambrian deposition. The extreme northeastern end of the permit contains the southernmost extension of the Tallaringa Trough. This area may host hydrocarbons generated in this trough.

Plans are now being put in place to reprocess the existing BMR aeromagnetics at 1:000,000 scale to further delineate prospective areas of the permit.

The following costs apply to the 3rd Quarter's operations in PEL 33:

Data Review and Overheads	$6,000.00

Sincerely,

David W. Lappi

David W. Lappi
Managing Director

LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

July 18, 1986

The Director General
South Australian Department of Mines and Energy
191 Greenhill Road
PARKSIDE SA 5063

Re: FIRST ANNUAL REPORT - PEL 33 JUNE 25, 1985 TO JUNE 25, 1986

Dear Sirs,

During the first year of the Permit Operation the Joint Venturers have identified a large number of play concepts and leads using an integrated programme of literature review, and Landsat, NOAA, and air photo interpretation. New structure contour and isopach maps were generated for reservoir and seal horizons and for the Top Cambrian Unconformity. These subsurface geological studies demonstrated that attractive leads exist at very shallow depths (150 to 300m) within PEL 33. Other deeper prospective areas exist in the Cambrian sediments within the permit.

The following Reports have been forwarded during Year 1:

First Quarterly Report - June 25 to September 25 1985
Landsat and NOAA Interpretation (R. Russell, November 1985)
Air Photo Interpretation Supplement (R. Russell)
Second Quarterly Report - September 25 to December 25 1985
Geological Review Report (LRC P/L, May 1986)
Third Quarterly Report - December 25 1985 to March 25 1986

The above studies were conducted independently and some leads identified from each method employed are found to be coincident, lending credibility to these targets. A summary map of targets, leads and play concepts is attached. The next phase of the exploration programme will be to use aeromagnetics to confirm leads identified by review, remote sensing and geological methods.

The following table shows expenditures to date on the project:

Quarters	1st	2nd	3rd	4th
Projects & Data Review	12,500	5,000	6,000	0
Overheads	7,500	7,500	3,000	3,000
Total	17,500	12,500	9,000	3,000

Total Expenditure for Year 1: $42,000.00.

Further expenditure of approximately $50,000.00 is still pending which will also be credited to Year 1 when completed.

During the Year, the price of crude oil in Australia fell from A$40.00-$45.00 in January 1986 to approximately A$20.00 today. This dramatic fall in crude oil prices has given some of the participants in PEL 33 difficulties in raising the funds required to continue with their exploration efforts. I believe that these difficulties will be overcome in the near future.

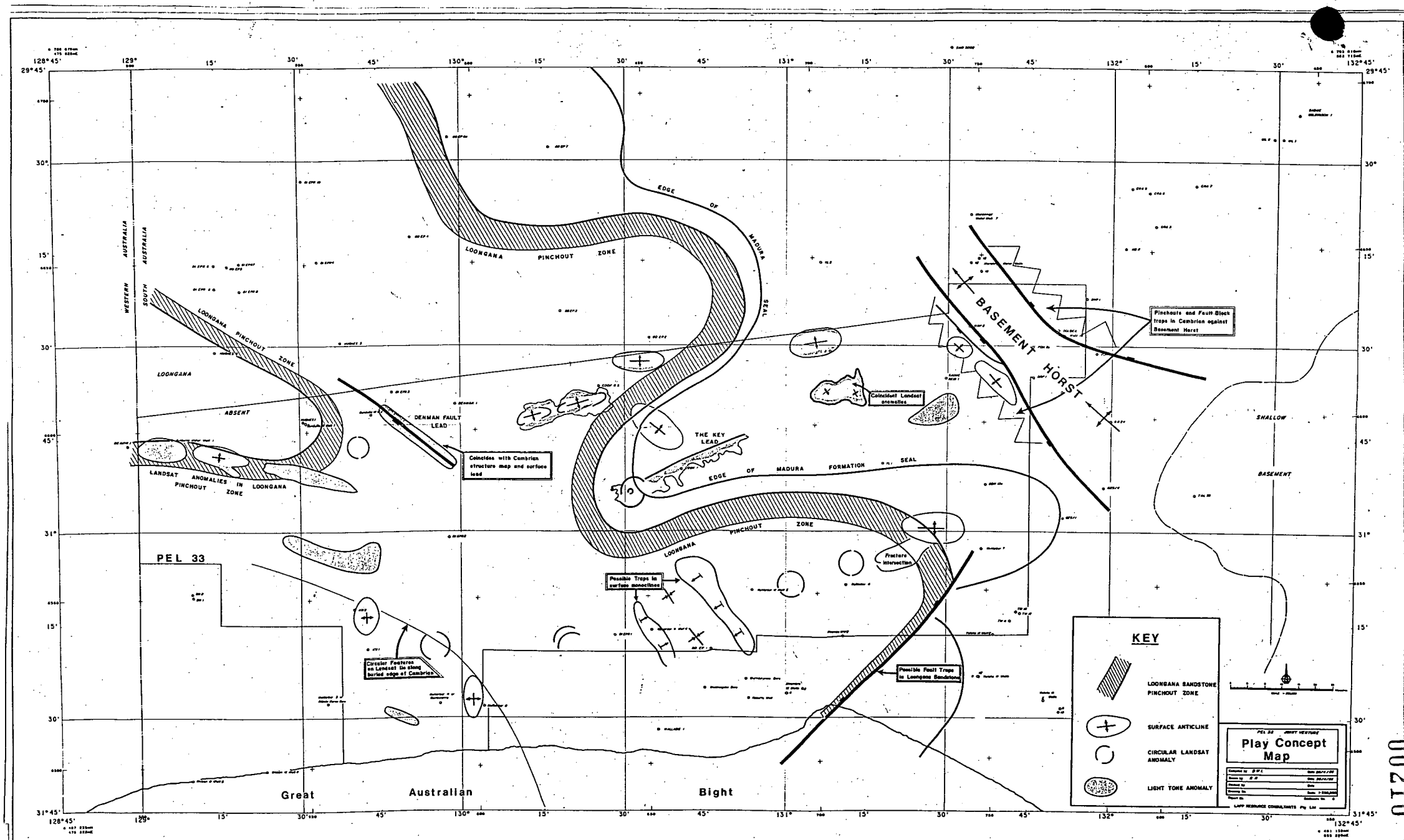
The low-cost exploration philosophy being pursued by this Joint Venture is our method of dealing with falling oil prices. If exploration and development expenses can be minimized, while identifying valid exploration targets and producing discovered hydrocarbons, then exploration in distant areas like PEL 33 is justified.

We look forward to testing some of the Leads identified in Year 1 in the coming Year.

Sincerely,

David W. Lappi

David W. Lappi
Managing Director


EDGE OF MADURA SEAL
LOONGANA PINCHOUT ZONE
WESTERN AUSTRALIA
SOUTH AUSTRALIA
LOONGANA PINCHOUT ZONE
LOONGANA
ABSENT
DENMAN FAULT LEAD
Coincides with Cambrian structure map and surface lead
LANDSAT ANOMALIES IN LOONGANA PINCHOUT ZONE
THE KEY LEAD
EDGE OF MADURA FORMATION SEAL
LOONGANA PINCHOUT ZONE
Coincident Landsat anomalies
BASEMENT HORST
Pinchouts and Fault-Block traps in Cambrian against Basement Horst
SHALLOW BASEMENT
Fractures intersection
Possible Traps in surface monoclines
Possible Fault Traps in Loongana Sandstone
Circular Features on Landsat lie along buried edge of Cambrian
PEL 33
Great Australian Bight
KEY
LOONGANA SANDSTONE PINCHOUT ZONE
SURFACE ANTICLINE
CIRCULAR LANDSAT ANOMALY
LIGHT TONE ANOMALY
PEL 33 JOINT VENTURE
Play Concept Map
LAPP RESOURCE CONSULTANTS Pty Ltd

27/2/76/1

00211 I

LAPP Resource Consultants Pty. Ltd.

127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: [09] 387 7327

October 22, 1986

The Director General
Department of Mines and Energy South Australia
191 Greenhill Road
PARKSIDE SA 5063

Re: FIFTH QUARTERLY REPORT - PEL 33, JUNE 25 TO SEPTEMBER 25, 1986

Dear Sirs,

During the fifth quarter, a new Joint Venture Partner (Mr. A. R. Burns) was added to the Permit to replace Median Oil N.L. who withdrew because of their difficulties in raising further exploration capital in the financial markets.

The uncertainty associated with the search for another Joint Venture Partner prevented any direct exploration expenditure on the Permit during this Quarter.

Quotes were obtained from geophysical contractors for reprocessing the existing BMR aeromagnetics to produce detailed contour maps and filtered stacked profiles at 1:100,000 scale.

Discussions with seismic and drilling contractors also proceeded to identify the most cost-effective exploration technology which would be applicable to PEL 33.

The following costs are applicable to the 5th Quarter:

Direct Exploration	$ 0
Data Review & Overheads	3,000.00
TOTAL	$ 3,000.00

I look forward to completing the aeromagnetic reprocessing during the coming quarter.

Sincerely,

David W. Lappi

David W. Lappi
Managing Director



LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

January 22, 1987

The Director General
South Australian Department of Mines and Energy
191 Greenhill Road
PARKSIDE SA 5063

Re: SIXTH QUARTERLY REPORT - PEL 33,
SEPTEMBER 25, 1986 to DECEMBER 25, 1987

Dear Sirs,

During the sixth quarter, the Joint Venture carried out reprocessing of the BMR aeromagnetic data for PEL 33. Contour maps at 1:250,000 and 1:100,000 were compiled and an intensive study of filtering techniques was carried out to identify the most appropriate filter to enhance the high-frequency "noise" which may be associated with diagenetic changes in the sediments overlying petroleum accumulations. We tentatively selected a fourth-difference filter as the most suitable for the purpose. The work was continuing at the end of the Quarter.

Quotes were obtained from geophysical contractors for the upcoming 40 km seismic survey in PEL 33. The survey is currently scheduled for April.

Discussions with drilling contractors also proceeded to help identify the most cost-effective exploration technology which would be applied to PEL 33. A well is scheduled for mid-year after the seismic has been processed and interpreted.

The following costs incurred during the current quarter are attributed to Year 1:

Aeromag Reprocessing Project	$ 25,000.00

The following costs are applicable to the 6th Quarter:

Direct Exploration	$ 0
Data Review & Overheads	3,000.00
TOTAL	$ 3,000.00

I look forward to forwarding the completed aeromagnetic maps in the near future.

Sincerely,

David W. Lappi

David W. Lappi
Managing Director



00213

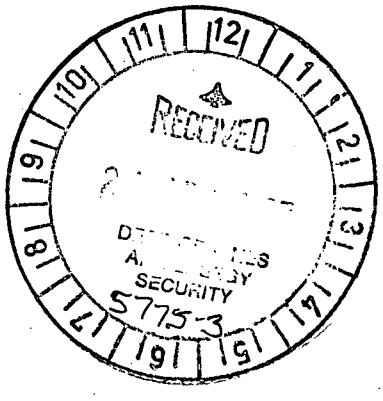
PEL 33 JOINT VENTURE

AEROMAGNETIC REPROCESSING REPORT

BMR OPEN FILE DATA

COOK, COOMPANA, OOLDEA AND NULLARBOR SHEETS

MARCH 1987



LAPP RESOURCE CONSULTANTS PTY. LTD.
127 Essex Street
Wembley, WA 6014

SUMMARY

Open file aeromagnetic data from the Bureau of Mineral Resources were reprocessed by the PEL 33 Joint Venture to assist the petroleum exploration effort in the Permit. Contour maps and filtered stacked profiles were plotted at 1:250,000 and 1:100,000 scale. Nine, seven, five and three point running average filters, second and fourth difference filters, and bandpass filters were tested prior to selecting the bandpass filtering for the final display.

The contour maps confirm and refine the general basin structure outlined by previous reports. The filtered stacked profiles however, show several new near-surface linear trends near the Cook 1 well and several areas of anomalous high-frequency "noise" similar to the type which has been linked to hydrocarbon occurrences overseas. Most "direct" indicators were not coincident with prospects generated by remote sensing in the northern end of the Permit. Along the southern edge of the permit, and in the Nullarbor National Park and Yalata Aboriginal Reserve however, several targets defined by remote sensing are in a region characterized by anomalous high-frequency magnetics.

Contours in the Denman area show northeast-trending features which is probably related to basement composition or deep faulting. This basement feature on trend with the Cretaceous-age structural high defined by drilling in the north-western end of the Permit. Cretaceous and Tertiary sediments may be draped across this structural arch forming hydrocarbon traps in the Loongana Sandstone reservoir. Landsat and air photo analysis show a strong northwest-trending lineation crossing the arch, possibly a fault at depth, forming a faulted anticlinal trap. Given the extensive oil shows in the Denman 1 well which was drilled approximately 15 km to the northeast (and probably downdip), this is the area recommended for seismic detailing.

The 1:100,000 scale profiles also show three areas of extremely high gradient in an area of shallow basement on the eastern side of the permit. These areas will be covered by EL applications if mineral exploration play concepts and targets can be identified.

PROJECT AREA

PEL 33 is situated in South Australia at the head of the Great Australian Bight in the onshore Tertiary to Cretaceous-age Eucla Basin. The Permit is traversed by the Eyre Highway in the south and by the Trans-Australian Railway in the north. North-south roads connect the highway with the railway at Cook and at Hughes near the center of the Permit. Numerous other unmaintained tracks are found in the area.

There is little topographic relief in the permit as it was the floor of a warm shallow sea relatively recently in the geologic past. Gentle regional uplift raised the area above sea level where the relatively dry climate has preserved the old seabed surface.

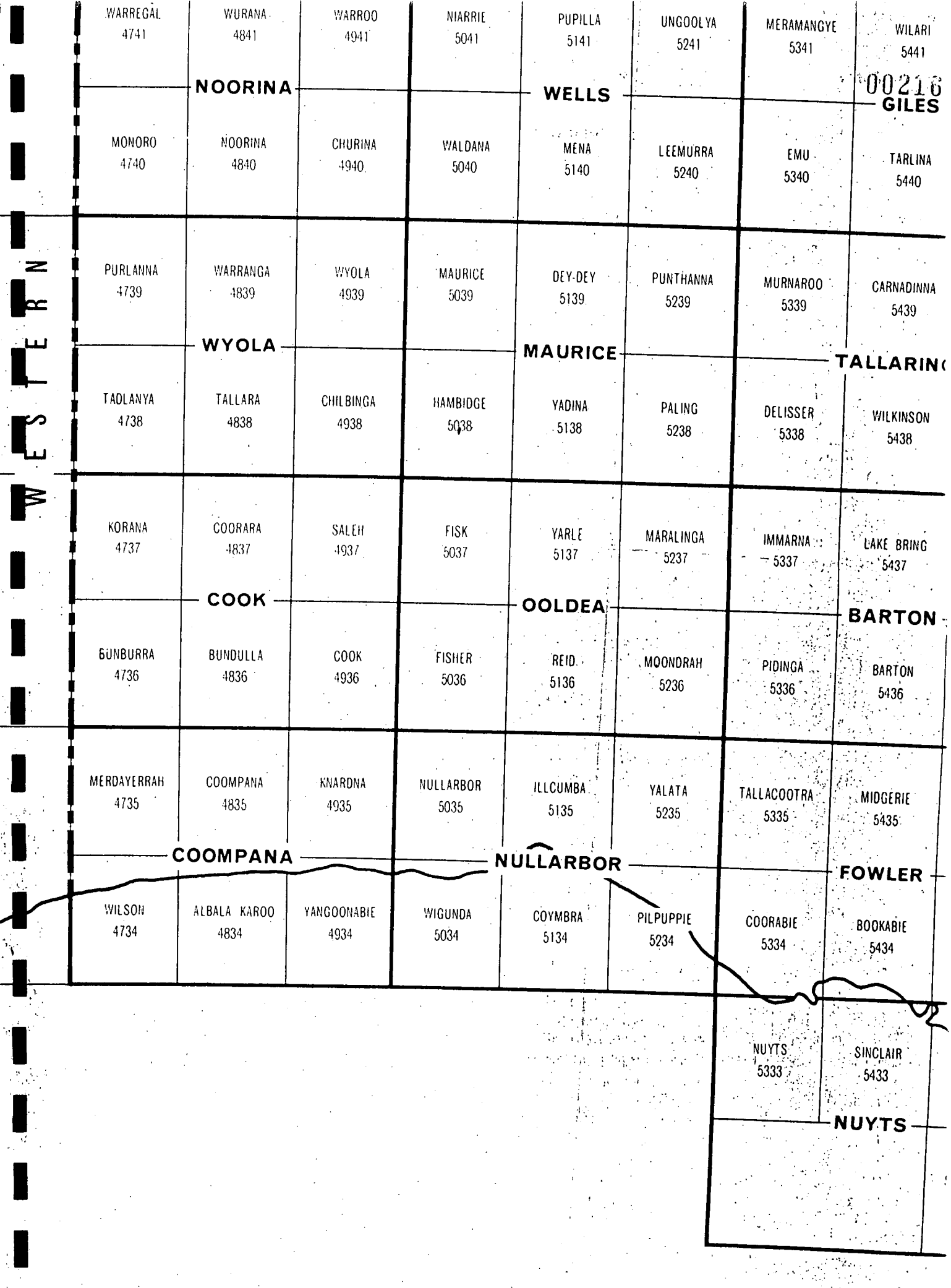
GEOLOGY

PEL 33 is covered by Tertiary limestone, the Nullarbor Limestone and the Wilson Bluff Limestone; and a clayey sandstone, the Pidinga Formation. Underlying the Tertiary a thick blanket of black to gray carbonaceous shale forming an oil shale up to 140 liters per tonne in part, seals the excellent Loongana Sandstone reservoir. The Loongana is not present everywhere in the Permit and the pinchout zones form possible stratigraphic traps.

Most of PEL 33 is also underlain by Cambrian age Officer Basin shallow water marine sediments. Prior drilling in the permit has identified Cambrian dolomite, limestone, shale, siltstone, sandstone, and gypsum. In Mallabie 1 wildcat well, a possible Proterozoic section was identified with a thick basaltic flow overlying a clastic section and basement. It is these oil-mature Cambrian age sediments which are the probable source for the hydrocarbon shows in stratigraphic, wildcat, mineral and water wells in and around the PEL 33. Basement in the permit has only been intersected along the shallow margins of the basin. It consists of metasediments in the east, and granitic rocks along the south coast. Basement has not been intersected in the northwestern part of the permit.

PURPOSE OF THE REPROCESSING PROJECT

The reprocessing served two purposes. First it gave us a detailed look at the aeromagnetics at 1:100,000 scale to allow an assessment of basement structure and character. Second, the filtered, stacked profiles highlighted the near-surface structure (from ground level down to 300 m) and also gave some evidence of "direct hydrocarbon indicators". The aeromagnetic information, when interpreted together with the the previous airborne radiometrics, Landsat, NOAA, air photo studies and the subsurface geologic mapping from drillholes will allow us to select locations most likely to contain hydrocarbons for further ground-based geophysics and drilling.


WARREGAL 4741
WURANA 4841
WARROO 4941
NIARRIE 5041
PUPILLA 5141
UNGOOLYA 5241
MERAMANGYE 5341
WILARI 5441
NOORINA
WELLS
GILES
MONORO 4740
NOORINA 4840
CHURINA 4940
WALDANA 5040
MENA 5140
LEEMURRA 5240
EMU 5340
TARLINA 5440
PURLANNA 4739
WARRANGA 4839
WYOLA 4939
MAURICE 5039
DEY-DEY 5139
PUNTHANNA 5239
MURNAROO 5339
CARNADINNA 5439
WYOLA
MAURICE
TALLARIN
TADLANYA 4738
TALLARA 4838
CHILBINGA 4938
HAMBIDGE 5038
YADINA 5138
PALING 5238
DELISSER 5338
WILKINSON 5438
KORANA 4737
COORARA 4837
SALEH 4937
FISK 5037
YARLE 5137
MARALINGA 5237
IMMARNA 5337
LAKE BRING 5437
COOK
OOLDEA
BARTON
GUNBURRA 4736
BUNDULLA 4836
COOK 4936
FISHER 5036
REID 5136
MOONDRAH 5236
PIDINGA 5336
BARTON 5436
MERDAYERRAH 4735
COOMPANA 4835
KNARDNA 4935
NULLARBOR 5035
ILLCUMBA 5135
YALATA 5235
TALLACOOTRA 5335
MIDGERIE 5435
COOMPANA
NULLARBOR
FOWLER
WILSON 4734
ALBALA KAROO 4834
YANGOONABIE 4934
WIGUNDA 5034
COYMBRA 5134
PILPUPPIE 5234
COORABIE 5334
BOOKABIE 5434
NUYTS 5333
SINCLAIR 5433
NUYTS
WESTERN

00216

CONTOURING PROJECT

The located data tapes were obtained from the BMR in Canberra and converted to ASCII format from the BMR's binary format by the BMR using the CSIRONET computer network. The tapes were then couriered to Tesla-10 in Perth where the processing took place.

Upon receiving the data, stacked profiles and a flight line map were plotted. The flight line plot showed that several of the east-west flight lines crossed other east-west lines at odd angles. Preliminary contouring of the data showed the location of some of these lines to be in error. Discussions with the BMR in Canberra confirmed that some lines were inaccurately located. The original navigation data for the survey were not available so our only option was to use the BMR's own published flight line maps as a guide to which lines or parts of lines were to be discarded. This worked well and the contouring proceeded. IGRF and parallax were removed and the data gridded on a 500m X 500m mesh. Final contours were drawn using a 10nT contour interval at 1:100,000 scale and 25nT contour interval at 1:250,000 scale. A 1:750,000 scale colour contour map with a contour interval of 20 nT was also plotted for display as a summary illustration in this report. The located data tapes, and a gridded data tape of the final contoured data are included in the final products of the project.

FILTERED STACKED PROFILES

The purpose of the filtered stacked profiles is to give us some understanding of the near-surface magnetic features which are related to structure and possibly to hydrocarbons.

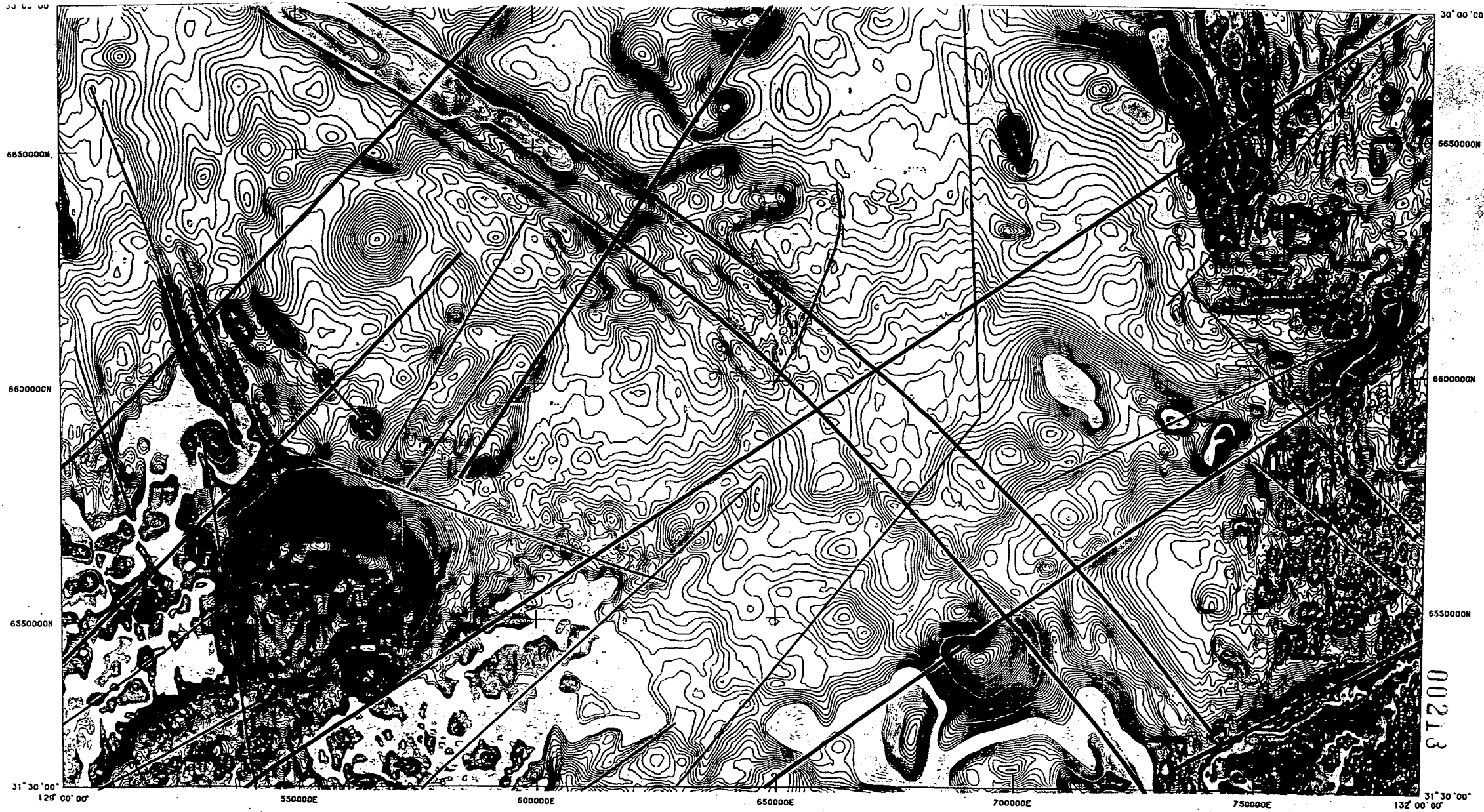
Several filters were tested on the data including 9, 7, 5, and 3-point running average filters, second and fourth difference filters and bandpass filters. The bandpass filter was selected for final display as it had the advantage that we could select the wavelengths we allowed through the filter and those anomalies retained their proper amplitudes relative to each other. The second and fourth difference filters amplified the shortest wavelength anomalies more than we thought was permissible.

The final bandpass filter design removes long-wavelength magnetic features and allows the retention of near-surface anomalies caused by the geology. The higher frequency anomalies caused by instrument noise are removed by a high-cut feature of the filter.

STACKED PROFILE INTERPRETATION

A 1:250,000 scale interpretation map of the stacked profile data is included at the back of this report.

Regions of thinner sediments are outlined by large numbers of major and minor linear trends and by a general "roughness" in the profile data. Shallow basement is generally found along the southeast and southwest margins of the permit. In the northeast



00213

LEGEND

CONTOUR INTERVAL 20 NANOTESLA

- 5600 & ABOVE
- 5400 - 5580
- 5200 - 5380
- 5000 - 5180
- 4800 - 4980
- 4600 - 4780
- 4400 - 4580
- 4380 & BELOW

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

00 10 20 30 40 50kms

Scale 1:750000

N

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE MAGNETIC CONTOURS

GEOPH. D. Lapp	Reviewed	Report No.

corner of the permit, the basement "horst" which was mapped from water and mineral exploration drilling is well defined by the data. In the shallow basement areas of the southwest, three intrusive plugs are readily apparent as circular anomalous areas. Also apparent here are many intrusive dikes which show as linear sets of anomalies trending both north-northwest and north-northeast. In the southern part of PEL 33 near the highway, a radial pattern of linear anomalies suggests that another intrusion has at some point intruded a dike set into the overlying country rock. The apex of the radial dike pattern is mapped as an anticline or dome on the Landsat interpretation of the area. Most of these features which we see on the stacked profiles are not obvious on contour maps.

In areas of thicker sediments, the bandpass filtered data displays a noise envelope of about 1 nanoTesla. In several areas, for example near the head of the Bight, we can recognize anomalous features as small as 2 to 3 nanoTeslas which cross from line to line. In the north central part of the permit there is another set of anomalous linears. They are also interpreted to be intrusive dikes at shallow depth along a northwest-trending basement high which is obvious on the contour maps. Near the center of the permit, the basement high appears to be eroded or faulted to a much deeper level. The resulting trough is possibly full of Cambrian marine sediments.

Several areas of anomalous high-frequency magnetic activity occur near the head of the Bight in the Nullarbor National Park, the Yalata Aboriginal Reserve and in PEL 33. The type of anomaly which is present is similar to those associated with hydrocarbons in some basins overseas. The anomalous areas are characterized by the thickest Cretaceous and Tertiary section of any part of the South Australian Eucla Basin. It may be possible that long-range migration has occurred from offshore areas and hydrocarbons are now present in these areas. Gas and oil have been found in the area in water and oil exploration wells.

Although the second and fourth difference anomaly maps are not presented in this report as final films were not made, I have included areas of anomalies from those maps on the bandpass filter interpretation map. In two cases, one in PEL 33 and one in the National Park, the bandpass, 2nd difference and the 4th difference anomalies overlap. The three filters "see" to different depths; the bandpass to 300m, the 2nd difference to 200m, and the 4th difference to (at most) 100m.

CONCLUSIONS

The bandpass filter method of processing magnetic data has provided a much more detailed look at near surface structure and possible hydrocarbon-related anomalies than could be obtained using contour maps. Used in conjunction with the magnetic contours, remote sensing, drilling and other information within PEL 33, the method has provided leads in the south-central part of the Permit for further geophysical followup.

LIST OF ENCLOSURES

1:250,000 SCALE STACKED PROFILE INTERPRETATION MAP, COOK, COOMPANA, NULLARBOR AND OOLDEA SHEETS.

1:250,000 SCALE MAPS:	FLIGHT LINES	CONTOUR MAPS	STACKED PROFILES
COOK	X	X	X
COOMAPANA	X	X	X
OOLDEA	X	X	X
NULLARBOR	X	X	X
1:100,000 SCALE MAPS:			
KORANA		X	
COORARA		X	
SALEH		X	
FISK		X	
YARLE		X	
MARALINGA		X	X
BUNBURRA		X	X
BUNDULLA		X	X
COOK		X	X
FISHER		X	X
REID		X	X
MOONDRAH		X	X
MERDAYERRAH		X	X
COOMPANA		X	X
KNARDNA		X	X
NULLARBOR		X	X
ILLCUMBA		X	X
YALATA		X	X

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION	: BUREAU OF MINERAL RESOURCES COOK, GOLDEA, BARTON 1970 COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT	: 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION	: EAST/WEST
LINE SPACING	: 1500 METRES
SAMPLE INTERVAL	: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0 nT
VERTICAL SCALE : 25 nT/cm
CLIPPED AT /25/ nT

N

LOCATION DIAGRAM

COOK | GOLDEA | COOMPANA | NULLARBOR | SURVEY AREA

0 10 20km
Scale 1:250000

HIGH FREQUENCY ANOMALIES

- Bandpass
- 2nd Difference
- 4th Difference

LEGEND

BASE VALUE : 0 nT
VERTICAL SCALE : 25 nT/cm
CLIPPED AT /25/ nT

- Major Linears
- Minor Linears

0 10 20km
Scale 1:250000

N

LOCATION DIAGRAM

COOK | GOLDEA | BARTON | COOMPANA | NULLARBOR | FOWLER | NUYTS | SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-20

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE BANDPASS FILTERED STACKED PROFILES INTERPRETATION

GEOPH : D. Lapp	Revised : MAR 87	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 30' 00"

560000E

580000E

130° 00' 00"

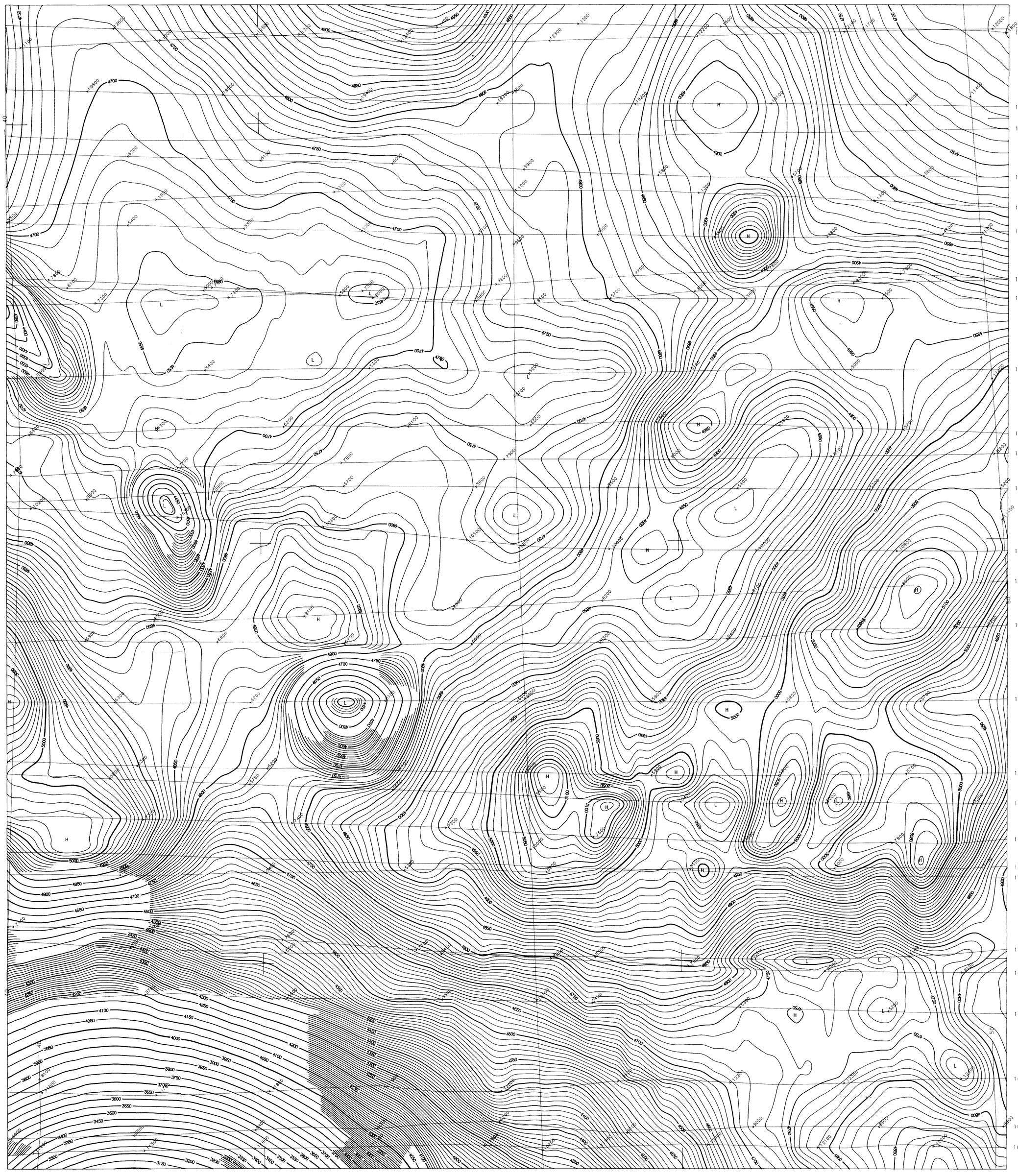
30° 30' 00"

6620000N

6600000N

6580000N

31° 00' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

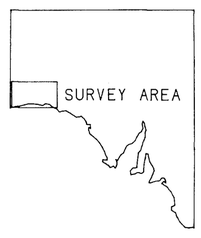
N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

KORANA 4737	COORARA 4837	SALEH 4937
BUNBURRA 4736	BUNDULLA 4836	COOK 4936
MERDAYERRAH 4735	COOMPANA 4835	KNARDNA 4935



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-21

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
4836 BUNDULLA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 00' 00"

520000E

540000E

129° 30' 00"

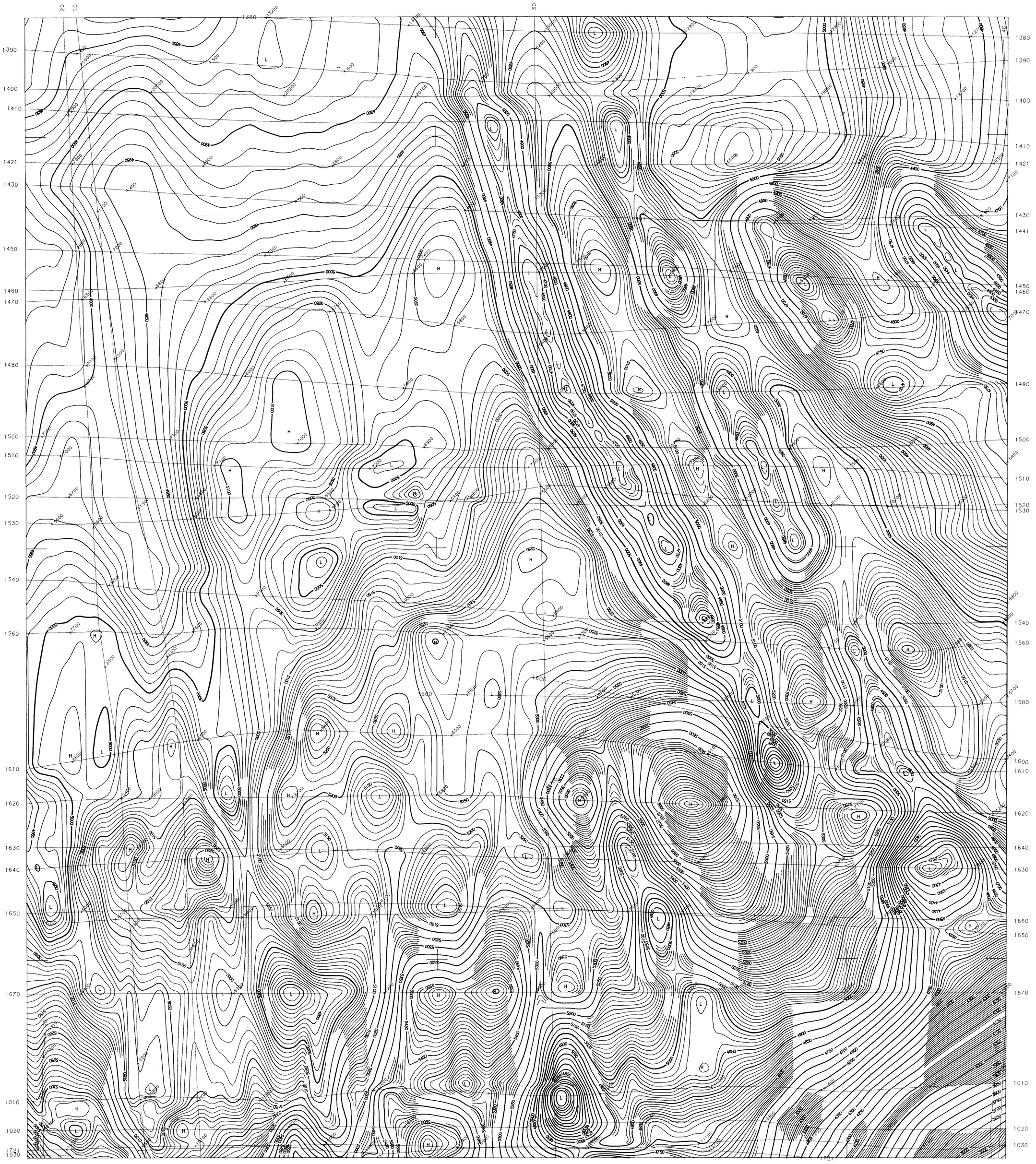
30° 30' 00"

6620000N

6600000N

6580000N

31° 00' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

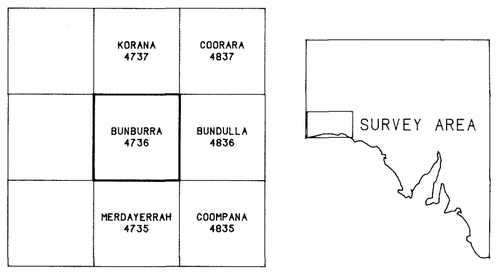
1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

N

0 2 4 6 8 10

Scale 1:100000

LOCATION DIAGRAM



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

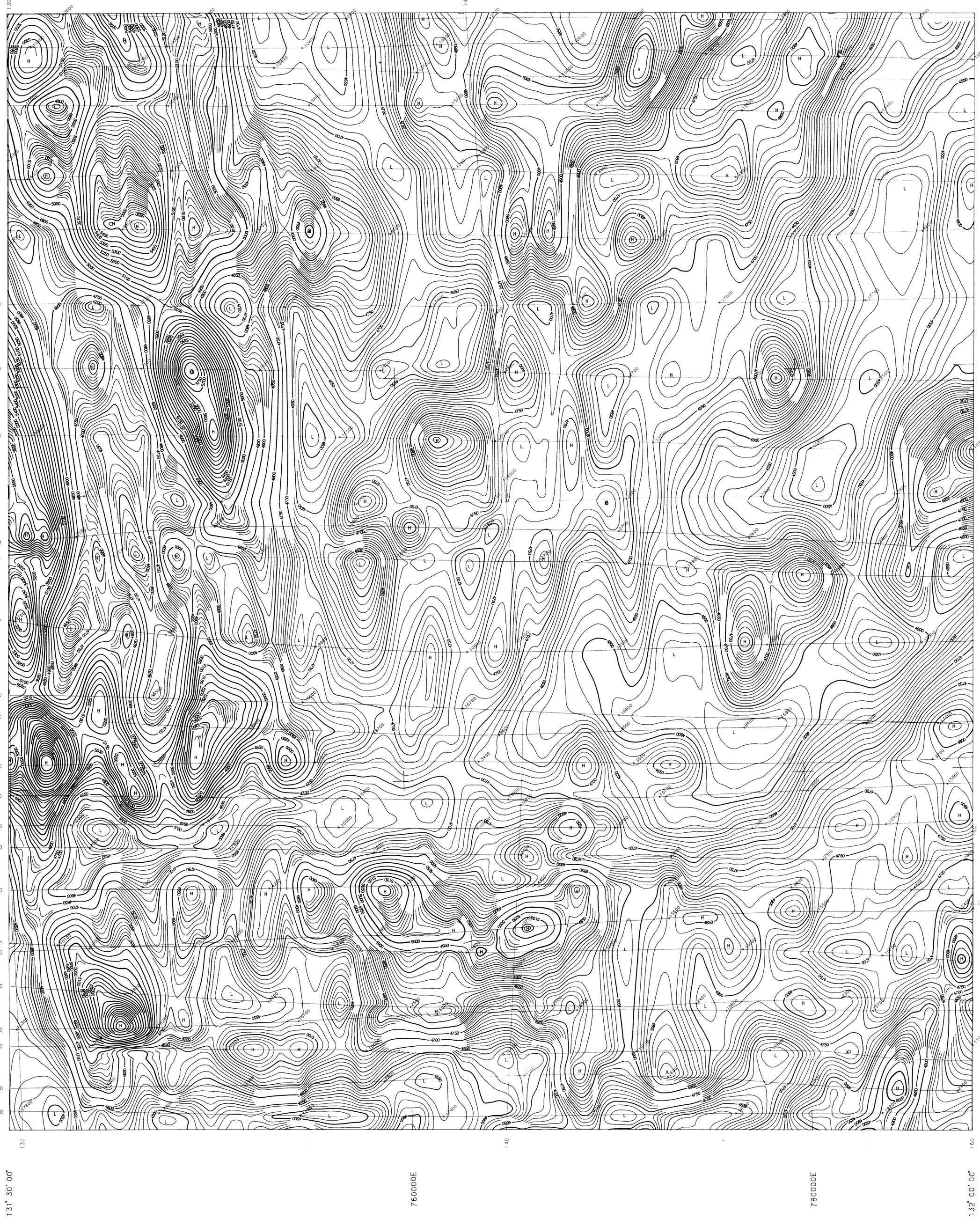
6428-22

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
4736 BUNBURRA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

131° 30' 00"
760000E
780000E
132° 00' 00"
30° 00' 00"
30° 30' 00"
6660000N
6640000N



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

YADINA 5138	PALING 5238	DELISSER 5338
YARLE 5137	MARALINA 5237	IMMARNA 5337
REID 5136	MOONDRAH 5236	PIDINGA 5336

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

G428-23

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
5237 MARALINA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

131° 00' 00"

700000E

720000E

131° 30' 00"

30° 00' 00"

6660000N

6640000N

30° 30' 00"

110

120

121

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

HAMBIDGE 5038	YADINA 5138	PALING 5238
FISK 5037	YARLE 5137	MARALINA 5237
FISHER 5036	REID 5136	MOONDRAH 5236

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

G428-24

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE MAGNETIC CONTOURS
5137 YARLE

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 30' 00"

660000E

680000E

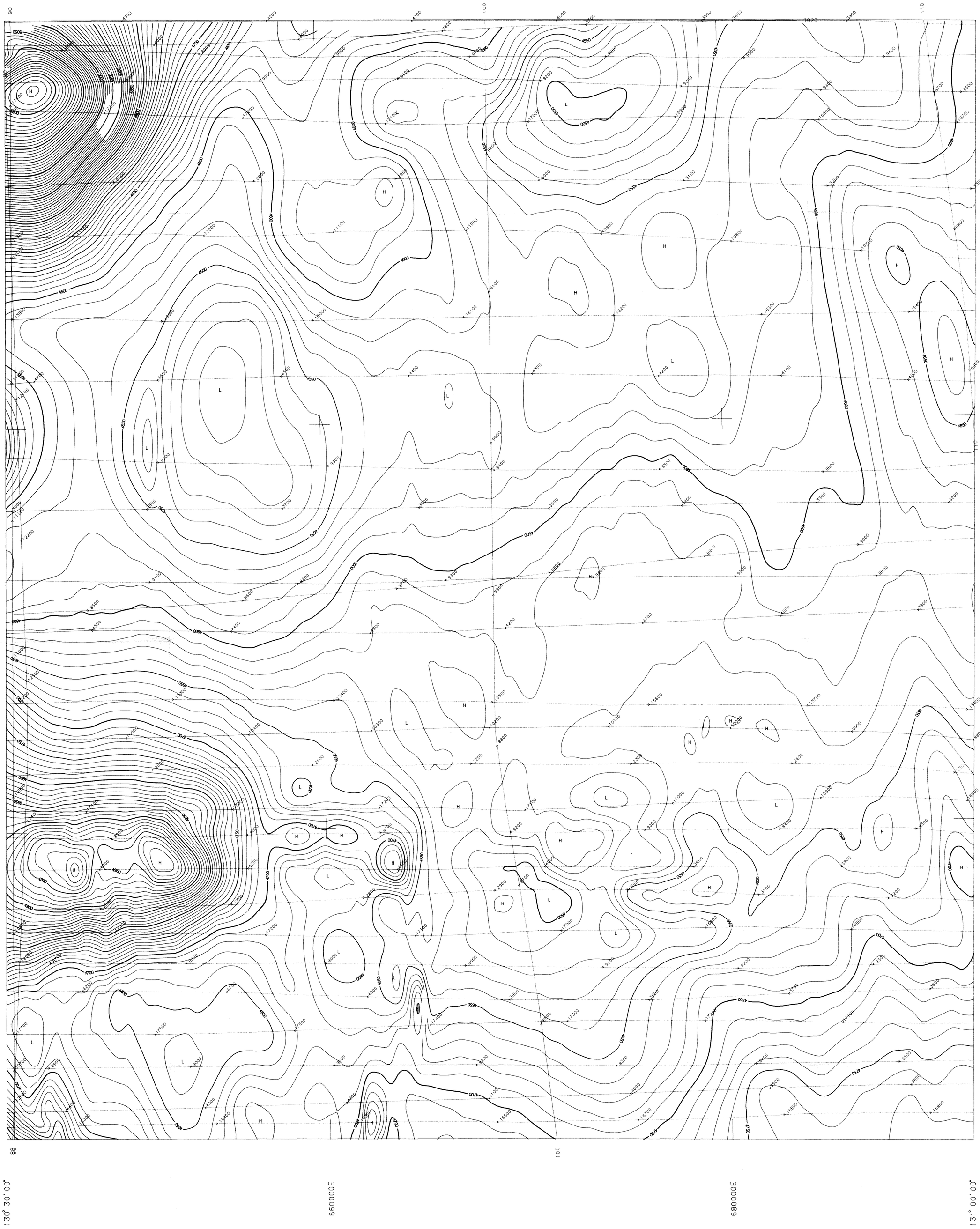
131° 00' 00"

30° 00' 00"

6660000N

6640000N

30° 30' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

CHILBINGA 4938	HAMBIDGE 5038	YADINA 5138
SALEH 4937	FISK 5037	YARLE 5137
COOK 4936	FISHER 5036	REID 5136

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-25

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE MAGNETIC CONTOURS
5037 FISK

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 00' 00"

600000E

620000E

640000E

130° 30' 00"

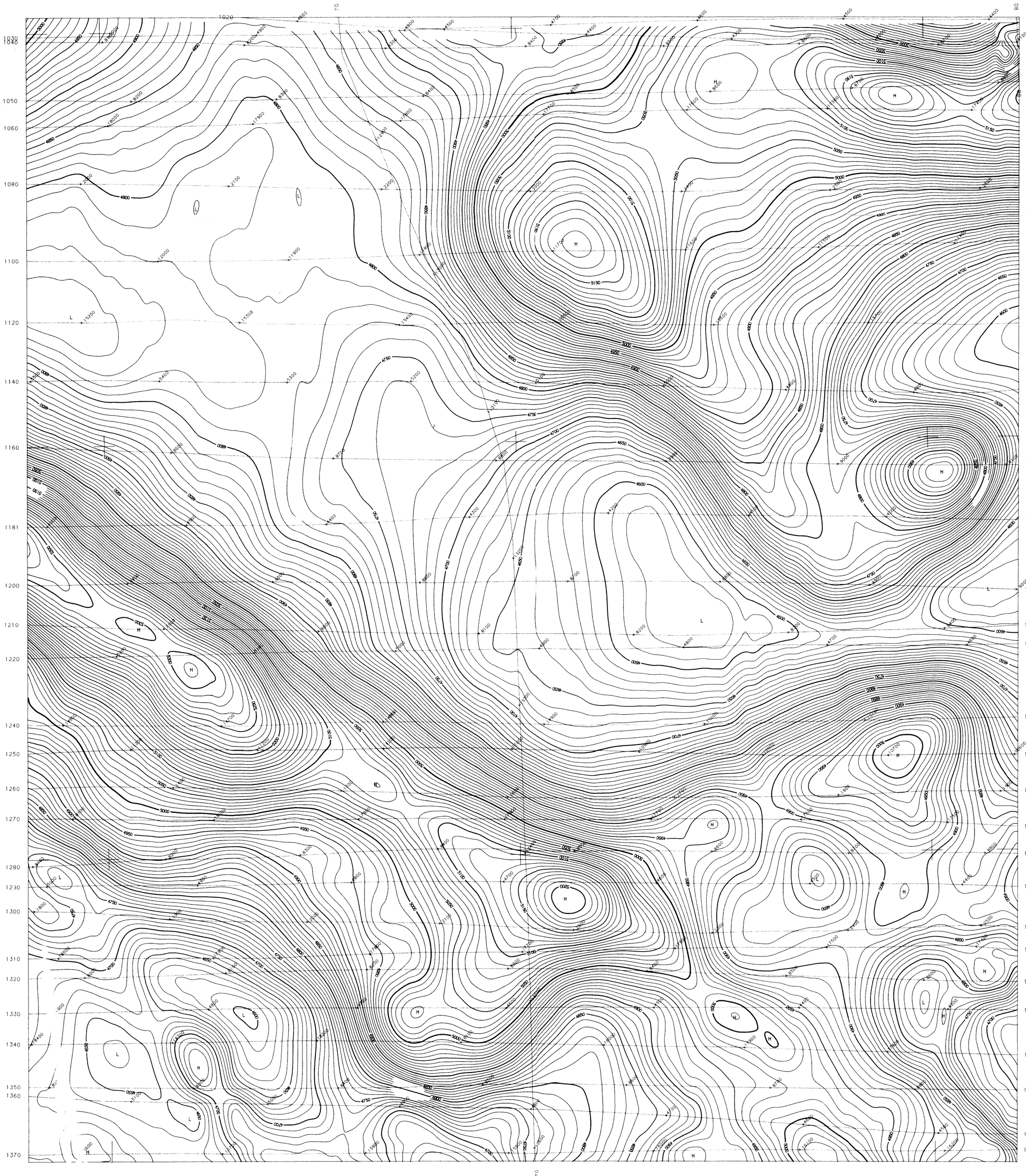
30° 00' 00"

6680000N

6660000N

6640000N

30° 30' 00"



130° 00' 00"

600000E

620000E

640000E

130° 30' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

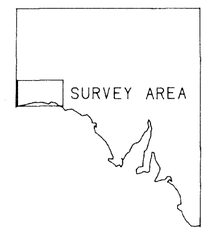
N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

TALLARA 4838	CHILBINGA 4938	HAMBIDGE 5038
COORARA 4837	SALEH 4937	FISK 5037
BUNDULLA 4836	COOK 4936	FISHER 5036



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-26

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
4937 SALEH

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 30' 00"

560000E

580000E

130° 00' 00"

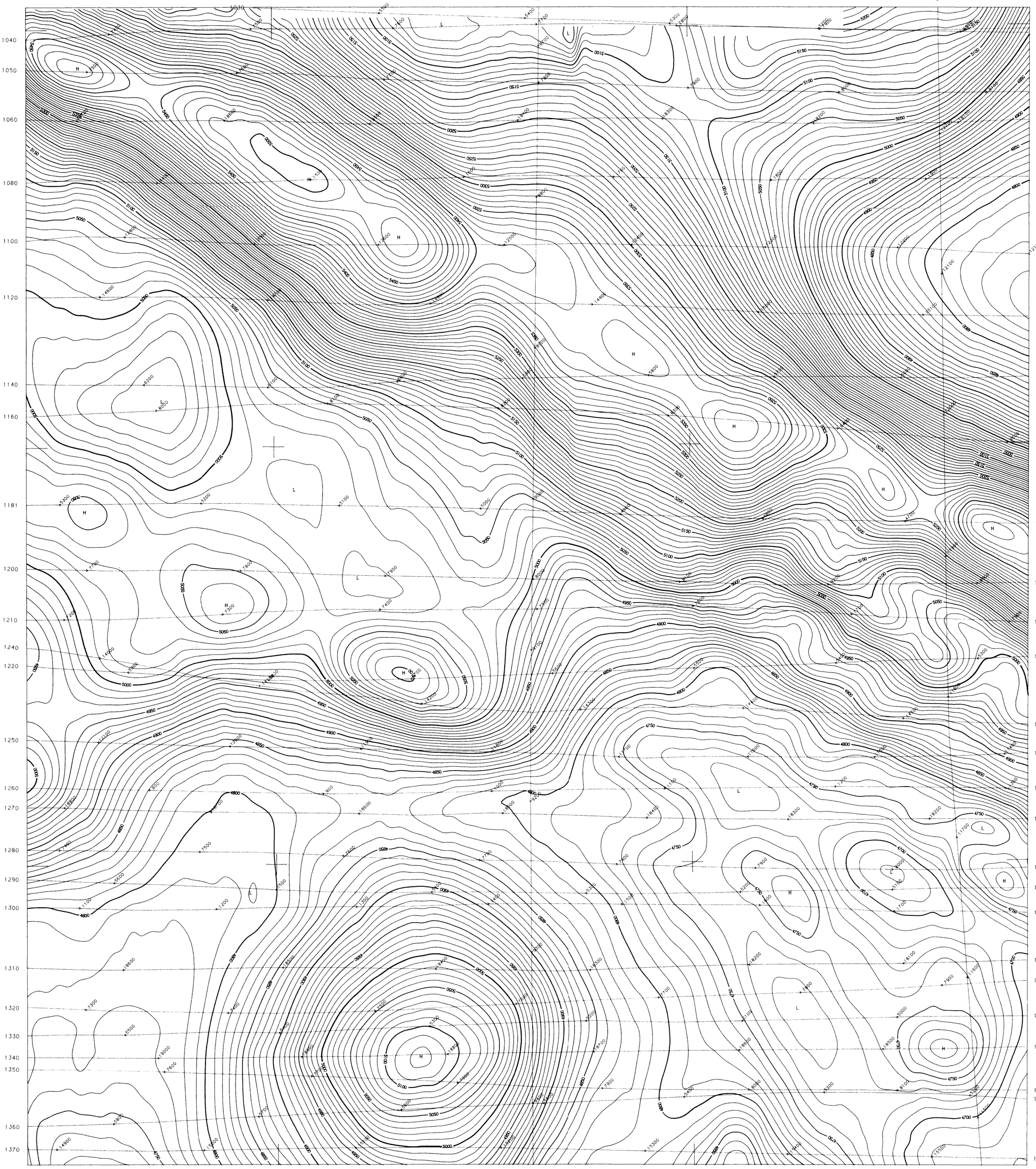
30° 00' 00"

6680000N

6660000N

6640000N

30° 30' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

- 1000 NANOTESLA CONTOUR
- 100 NANOTESLA CONTOUR
- 50 NANOTESLA CONTOUR
- 10 NANOTESLA CONTOUR

N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

TADLANYA 4738	TALLARA 4838	CHILBINGA 4938
KORANA 4737	COORARA 4837	SALEH 4937
BUNBURRA 4736	BUNDULLA 4836	COOK 4936

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-27

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
4837 COORARA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 00' 00"

520000E

540000E

129° 30' 00"

30° 00' 00"

6680000N

6660000N

6640000N

30° 30' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

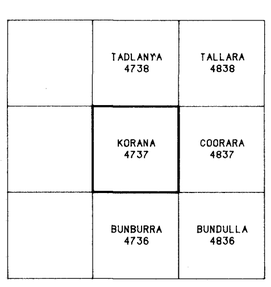
1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

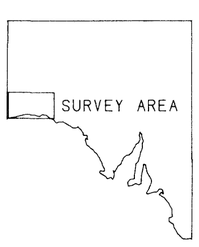
N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM





PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

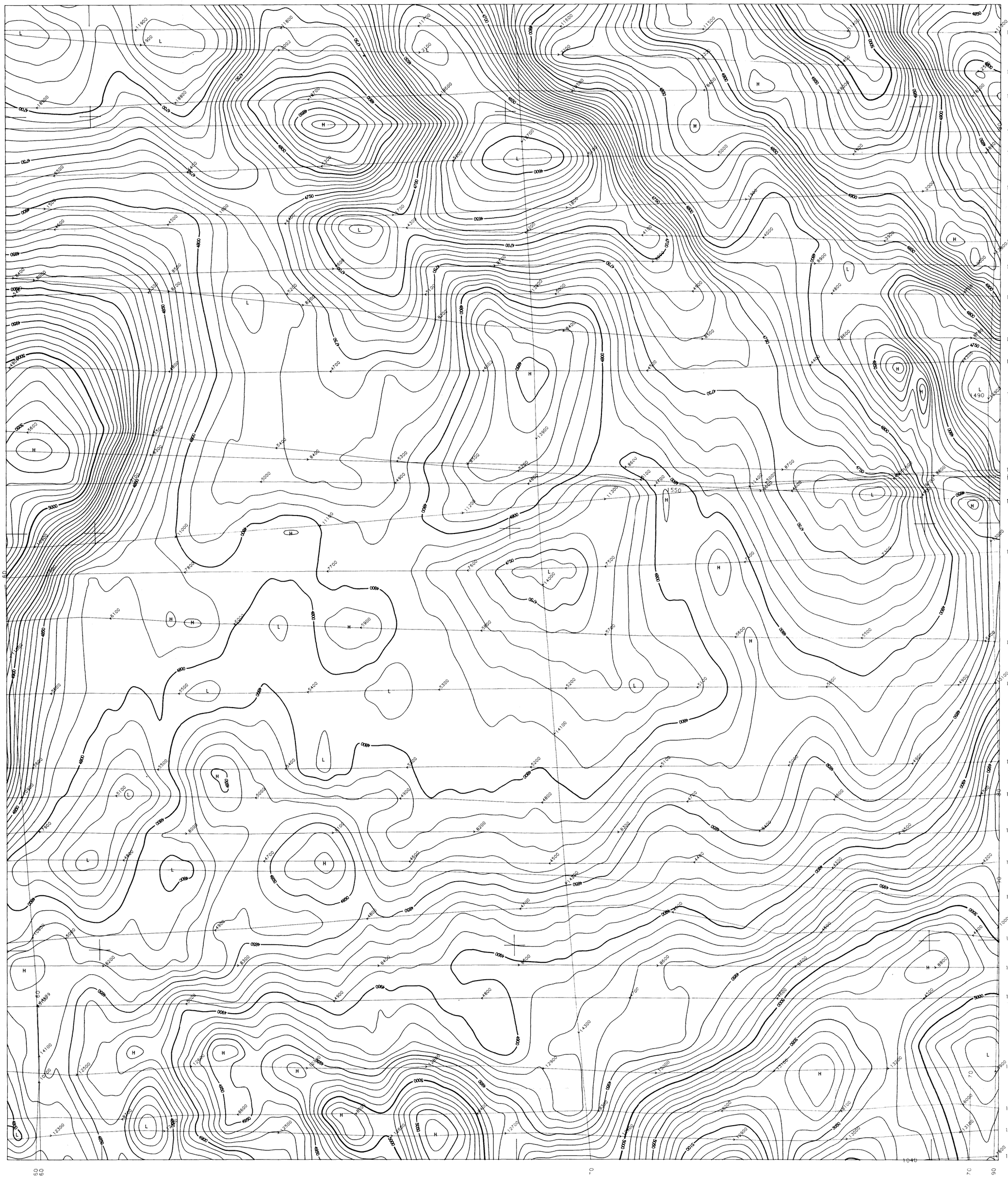
G428-28

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
4737 KORANA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 00' 00"
600000E
620000E
640000E
130° 30' 00"
30° 30' 00"
6620000N
6600000N
6580000N
31° 00' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

CODRARA 4837	SALEH 4937	FISK 5037
BUNDULLA 4836	COOK 4936	FISHER 5036
COOMPANA 4835	KNARDNA 4935	NULLARBOR 5035



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

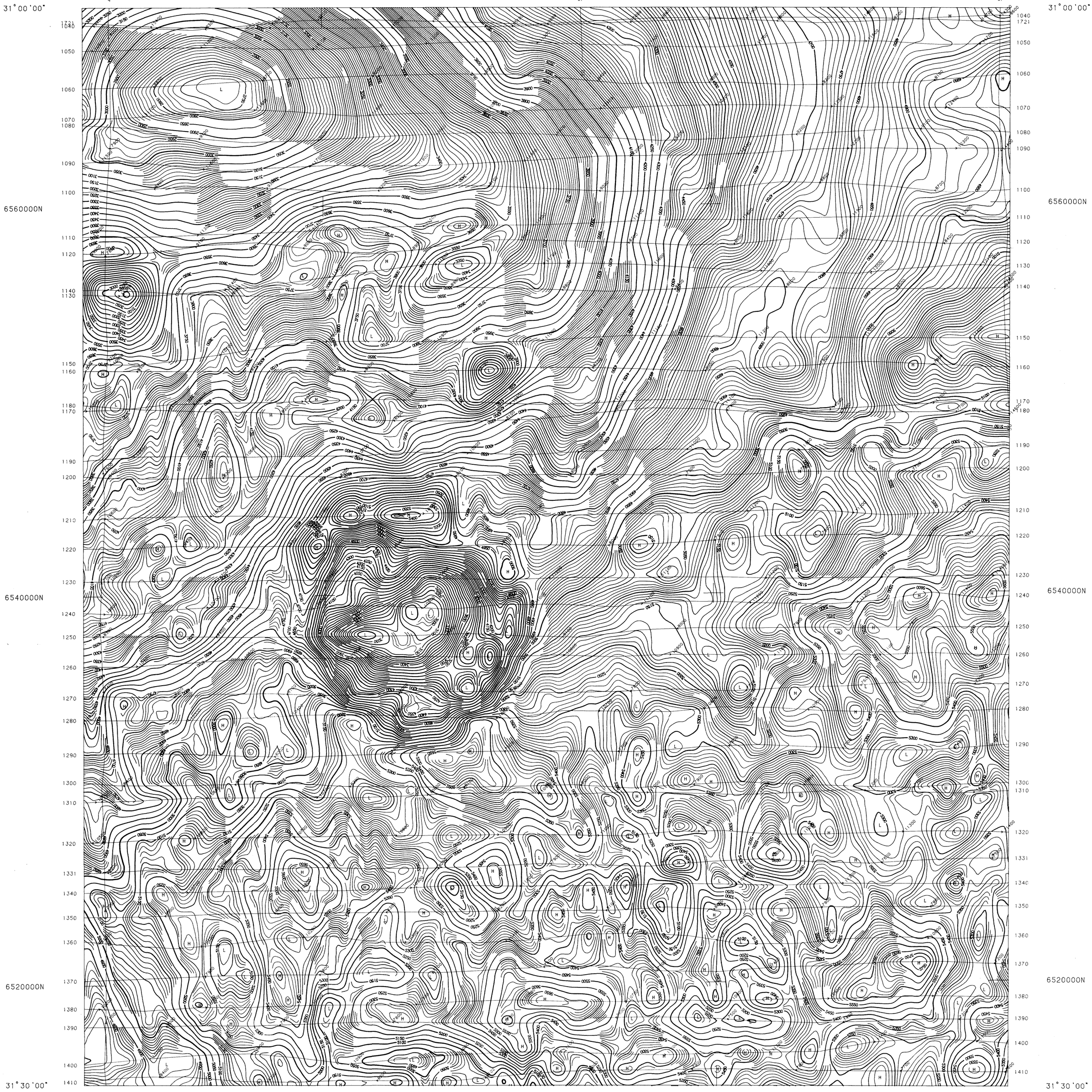
6428-29

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
4936 COOK

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 30' 00"
560000E
580000E
130° 00' 00"
31° 00' 00"
6560000N
6540000N
6520000N
31° 30' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

BUNBURRA 4736	BUNDULLA 4836	COOK 4936
MERDAYERRAH 4735	COOMPANA 4835	KNARDNA 4935
WILSON 4734	ALBALAKAROO 4834	YANGOONABIE 4934

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-30

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
4835 COOMPANA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 30 '00"

660000E

680000E

131° 00 '00"

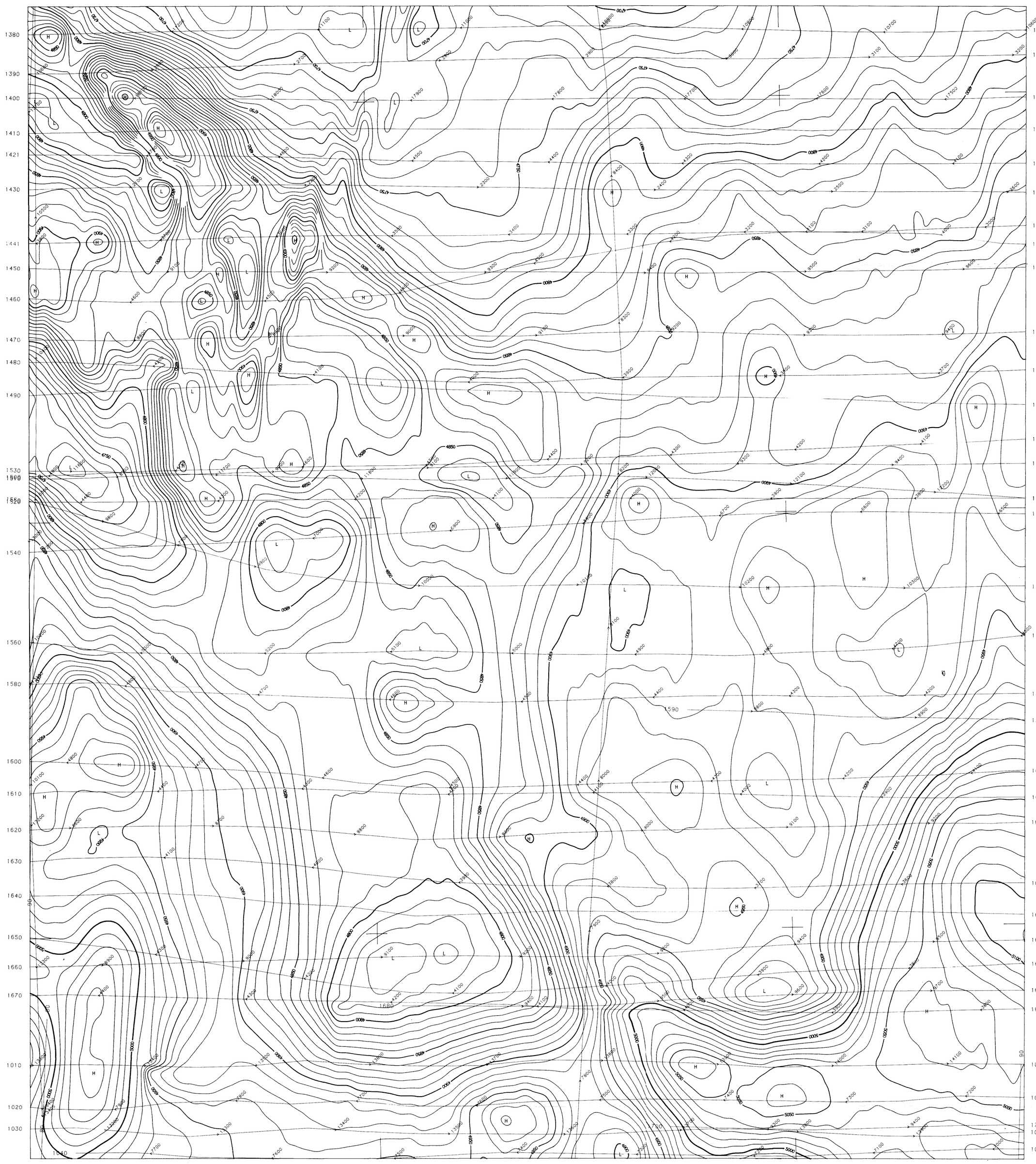
30° 30 '00"

6620000N

6600000N

6580000N

31° 00 '00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

SALEH 4937	FISK 5037	YARLE 5137
COOK 4936	FISHER 5036	REID 5136
KNARDNA 4935	NULLARBOR 5035	ILLCUMBA 5135



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-31

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
5036 FISHER

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

131° 00' 00"

700000E

720000E

131° 30' 00"

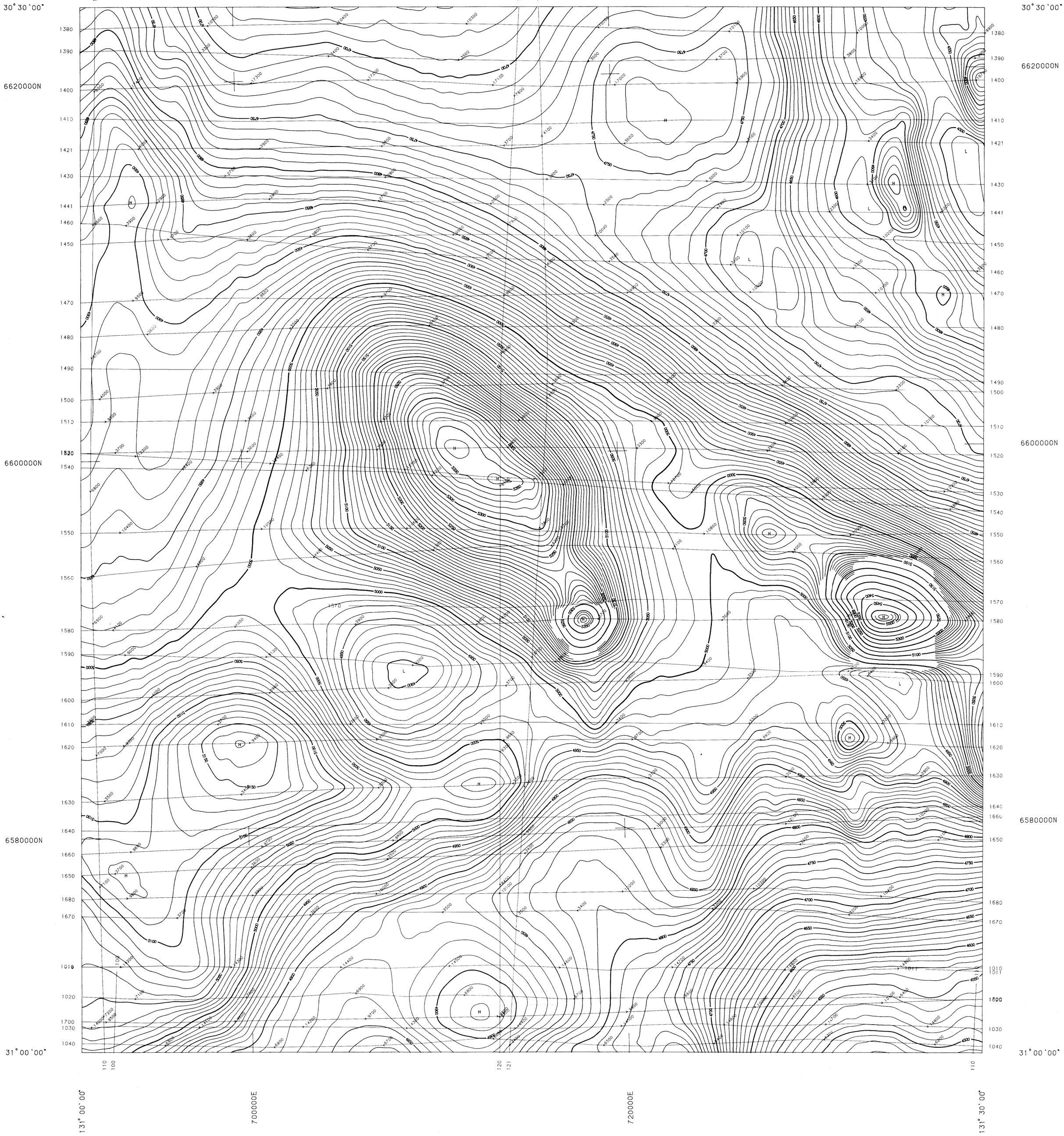
30° 30' 00"

6620000N

6600000N

6580000N

31° 00' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

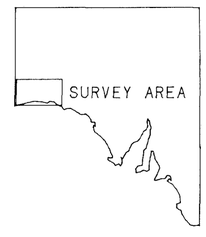
N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

FISK 5037	YARLE 5137	MARALINA 5237
FISHER 5036	REID 5136	MOONDRAH 5236
NULLARBOR 5035	ILLCUMBA 5135	YALATA 5235



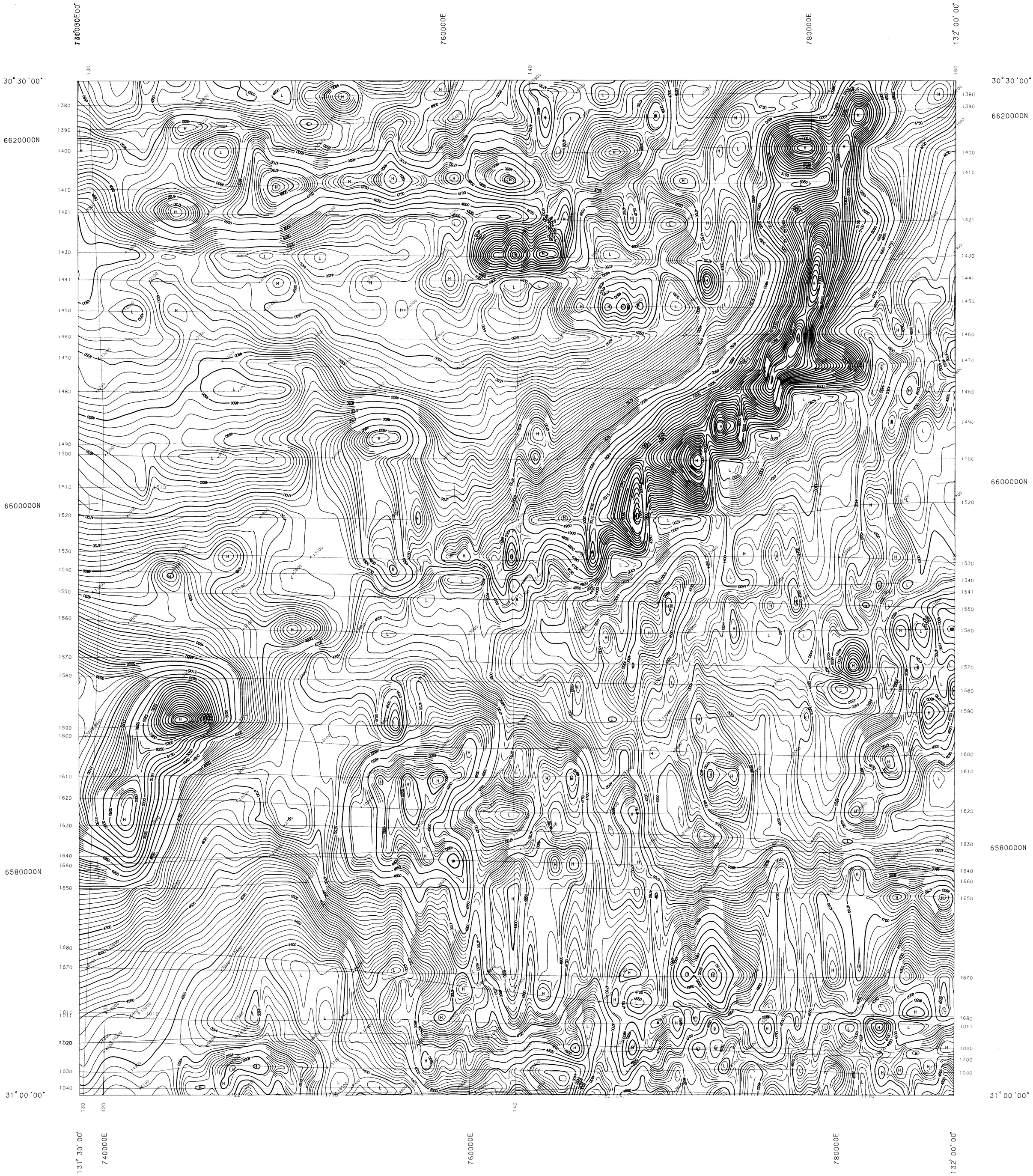
PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-32

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
5136 REID

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

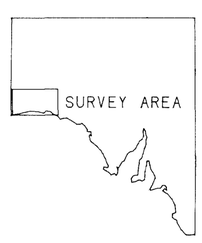
1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

0 2 4 6 8 10km
Scale 1:100000

N

LOCATION DIAGRAM

YARLE 5137	MARALINA 5237	IMMARNA 5337
REID 5136	MOONDRAH 5236	PIDINGA 5336
ILLCUMBA 5135	YALATA 5235	TALLACOOTRA 5335



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-33

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
5236 MOONDRAH

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 00' 00"

520000E

540000E

129° 30' 00"

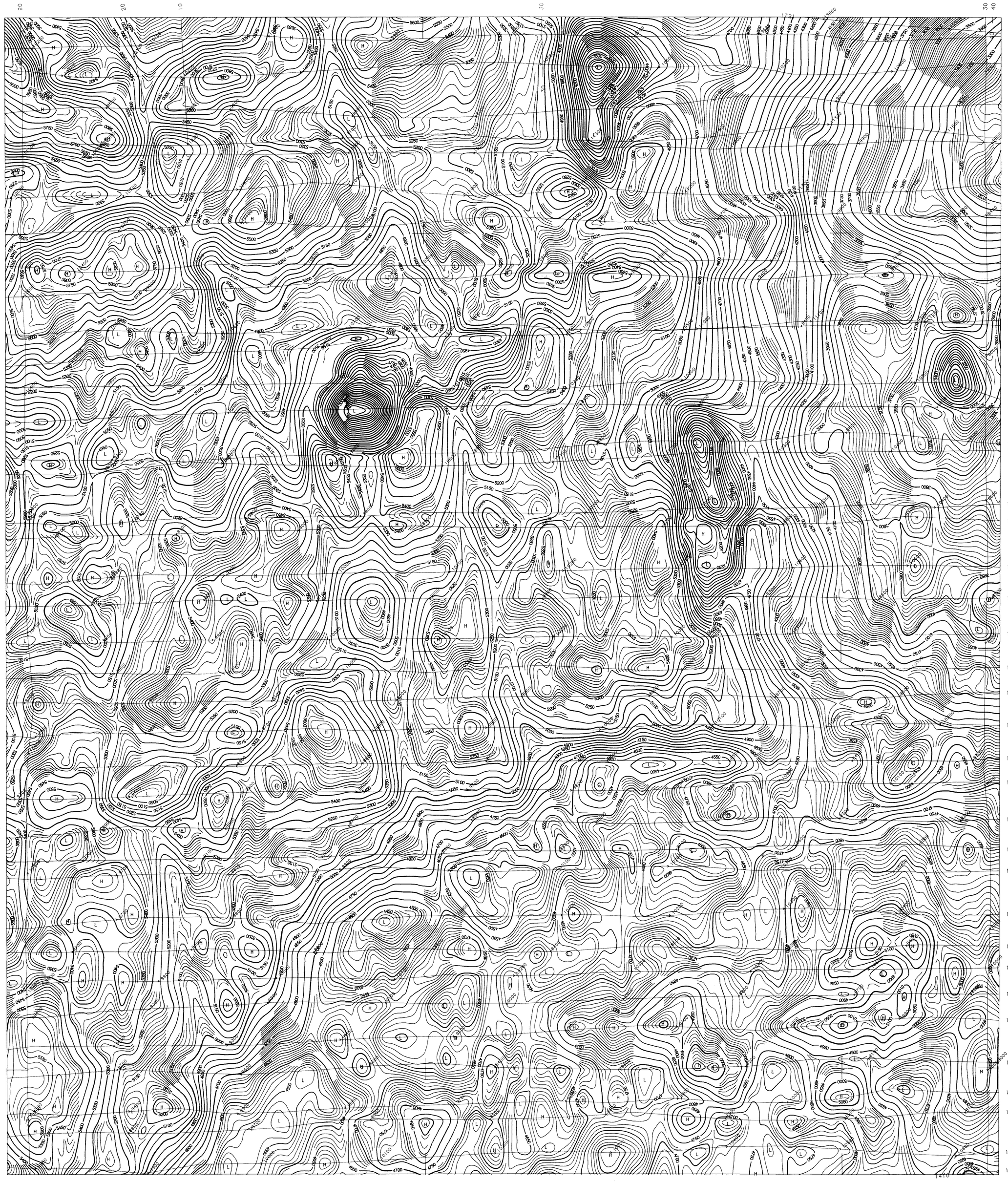
31° 00' 00"

6560000N

6540000N

6520000N

31° 30' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

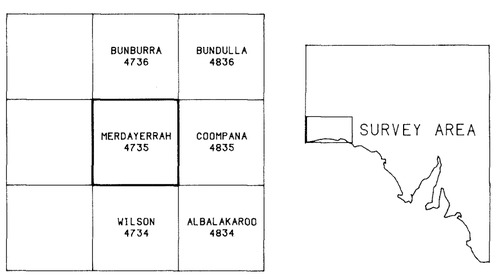
1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

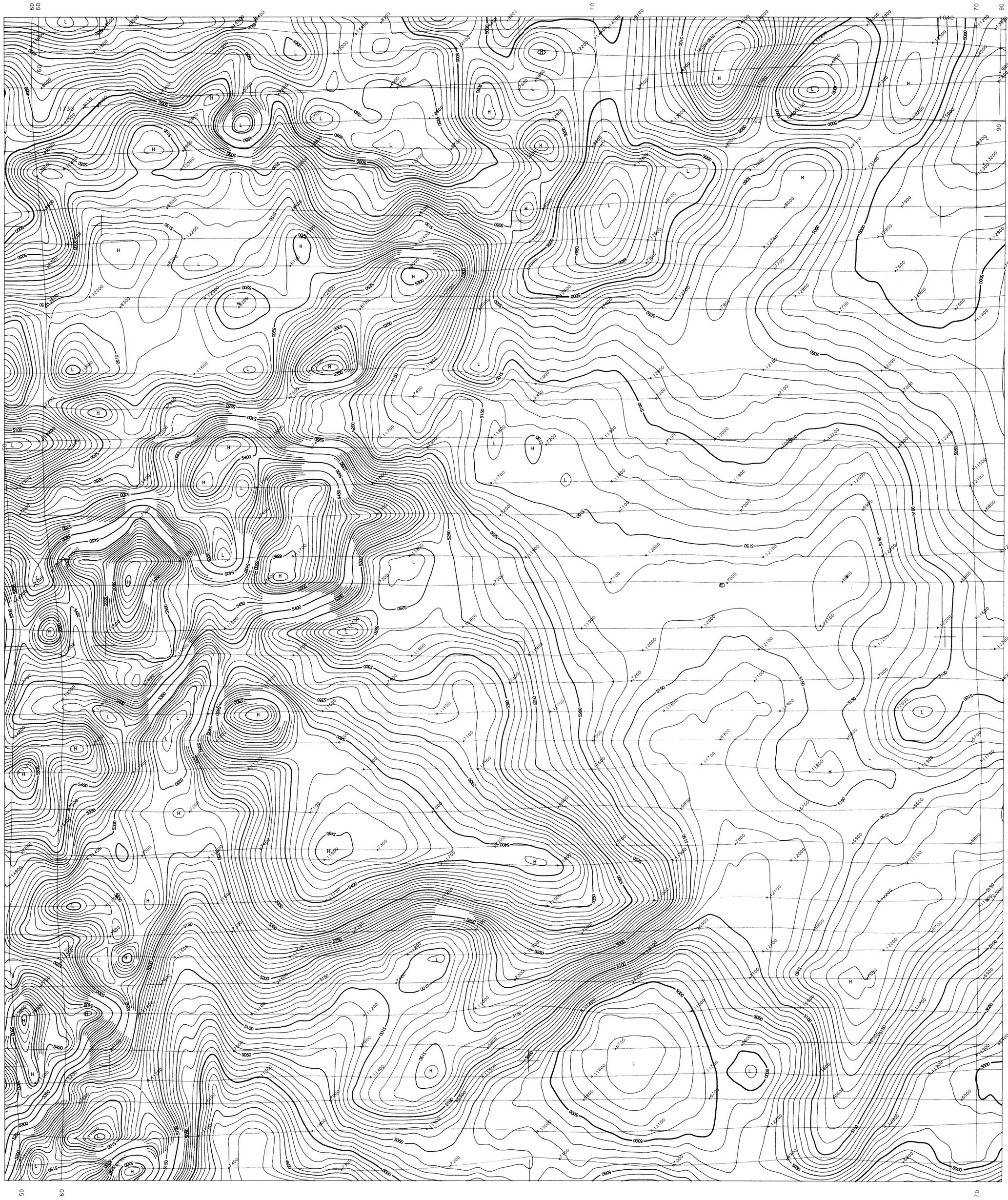
6428-34

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
4735 MERDAYERRAH

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 00' 00"
600000E
620000E
640000E
130° 30' 00"
31° 00' 00"
6560000N
6540000N
6520000N
31° 30' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

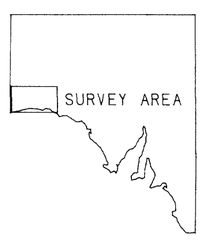
1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

BUNDULLA 4836	COOK 4936	FISHER 5036
COOMPANA 4835	KNARDNA 4935	NULLARBOR 5035
ALBALAKAROO 4834	YANGOONABIE 4934	WIGUNDA 5034



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-35

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
4935 KNARDNA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 30' 00"

660000E

680000E

131° 00' 00"

31° 00' 00"

6560000N

6540000N

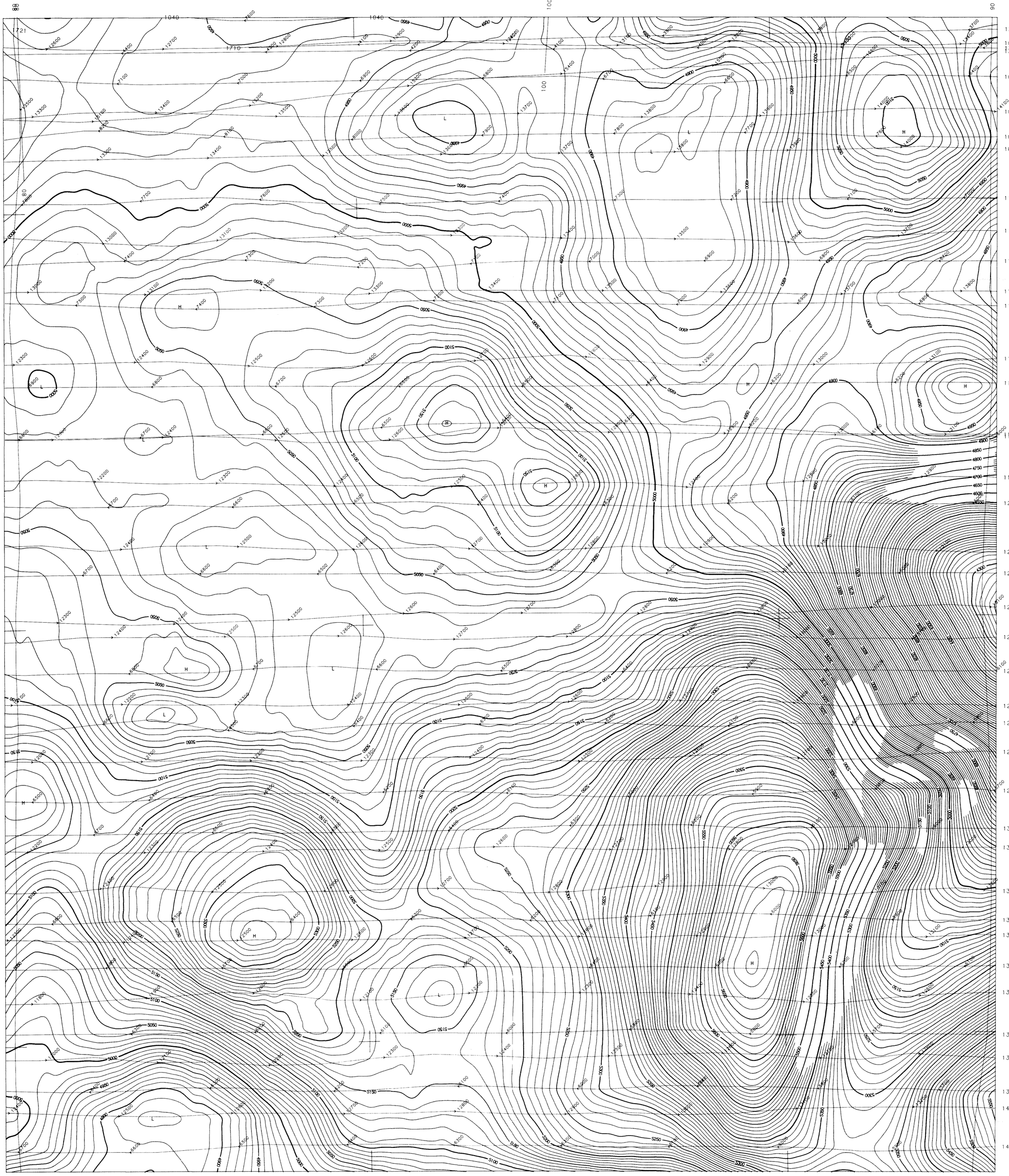
6520000N

31° 30' 00"

80

90

100



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

COOK 4936	FISHER 5036	REID 5136
KNARDNA 4935	NULLARBOR 5035	ILLCUMBA 5135
YANGOONABIE 4934	WIGUNDA 5034	COYMBRA 5134

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-36

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
5035 NULLARBOR

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

131° 00' 00"

700000E

720000E

131° 30' 00"

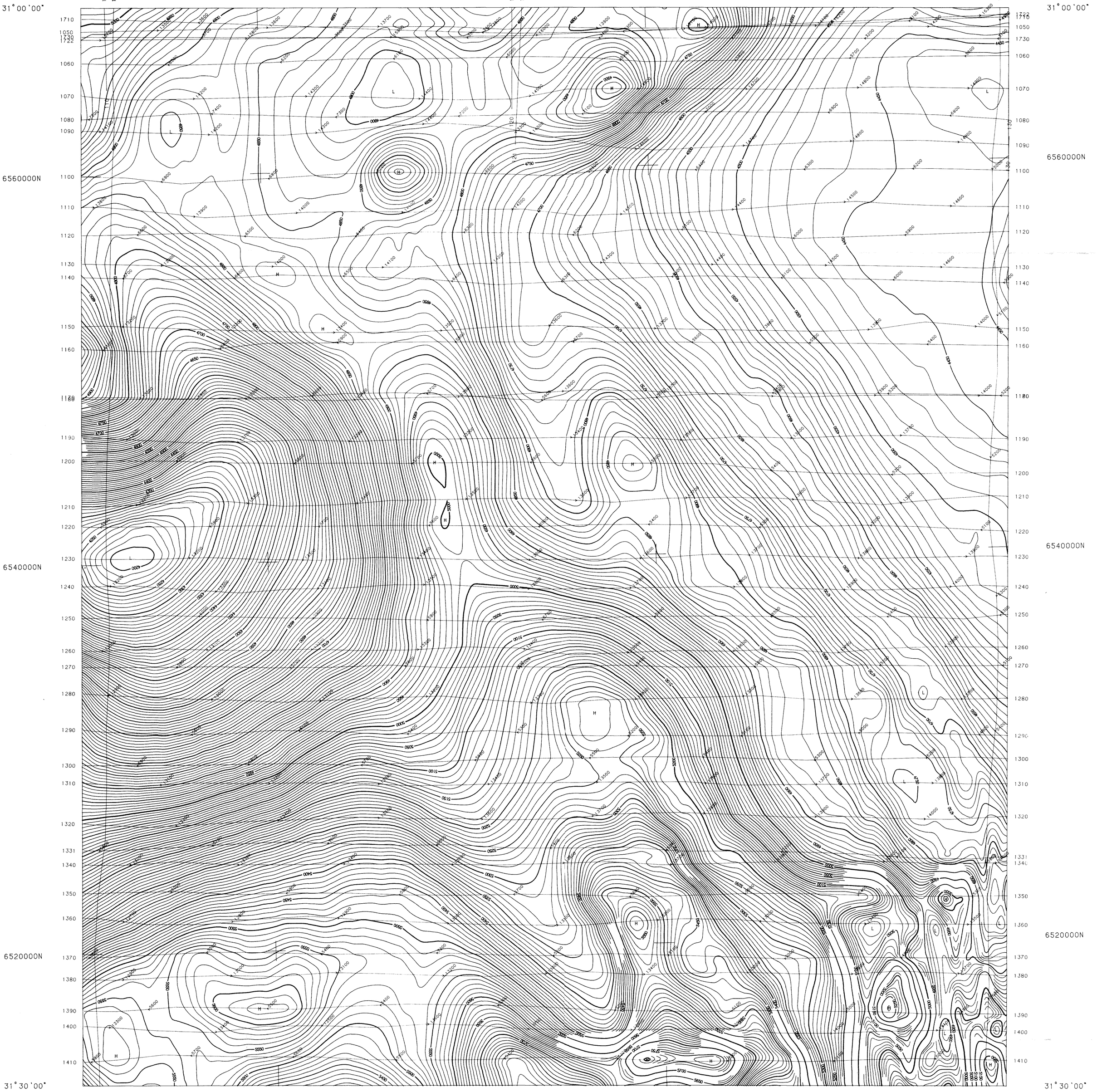
31° 00' 00"

6560000N

6540000N

6520000N

31° 30' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

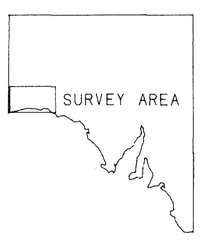
N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

FISHER 5036	REID 5136	MOONDRAH 5236
NULLARBOR 5035	ILLCUMBA 5135	YALATA 5235
WIGUNDA 5034	COYMBRA 5134	PILPUPPIE 5234



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

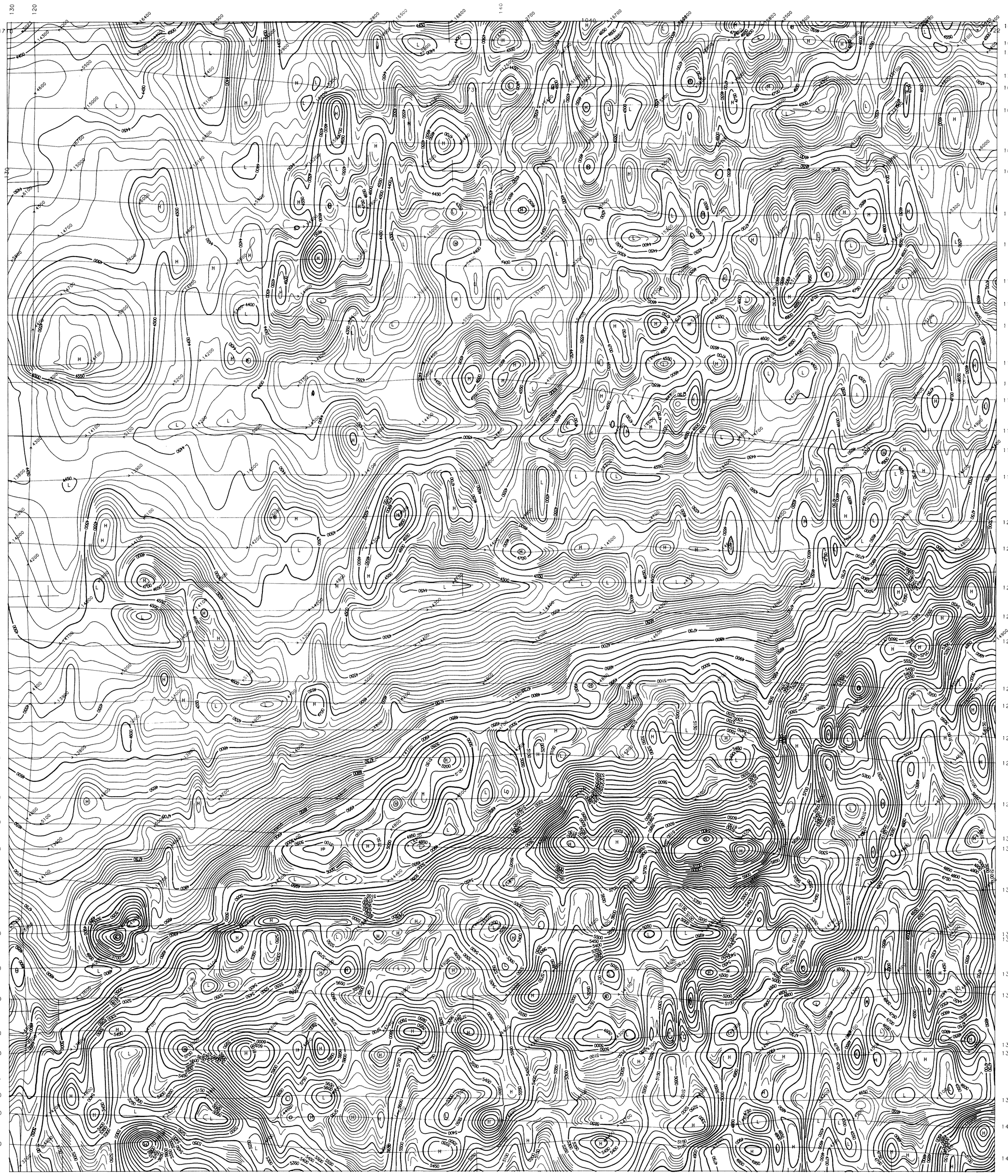
6428-37

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
5135 ILLCUMBA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

131° 30' 00"
740000E
760000E
780000E
132° 00' 00"
31° 00' 00"
6560000N
6540000N
6520000N
31° 30' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

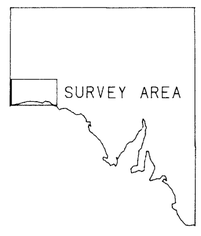
CONTOUR INTERVAL 10 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
50 NANOTESLA CONTOUR
10 NANOTESLA CONTOUR

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

REID 5136	MOONDRAH 5236	PIDINGA 5336
ILLCUMBA 5135	YALATA 5235	TALLACOOTRA 5335
COYMBRA 5134	PILPUPPIE 5234	COORABIE 5334



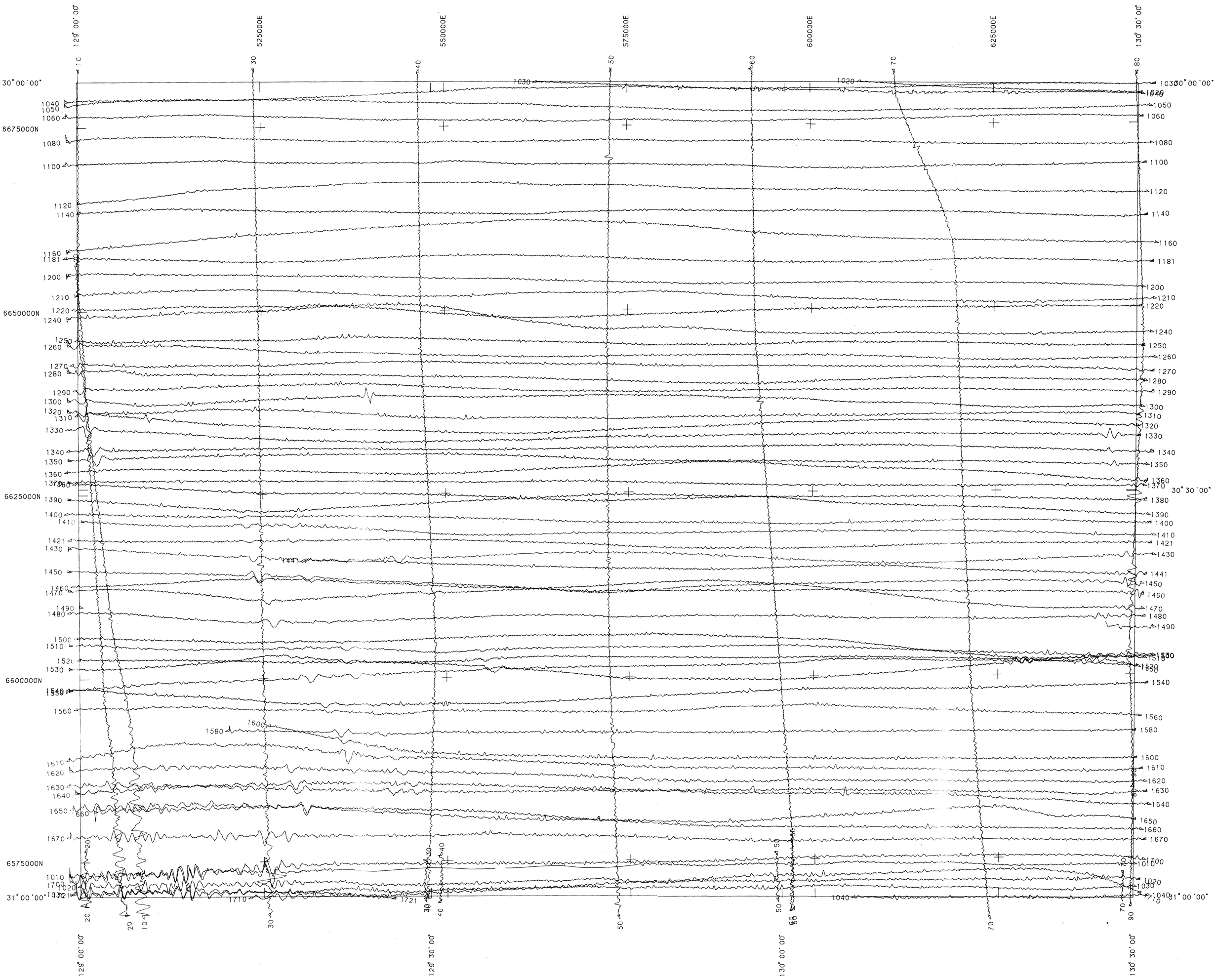
PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-38

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE MAGNETIC CONTOURS
5235 YALATA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :



AIRBORNE SURVEY SPECIFICATIONS

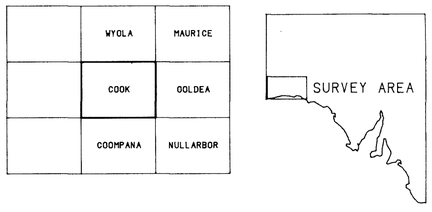
ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0 nT
VERTICAL SCALE : 25 nT/cm
CLIPPED AT /25/ nT

N

LOCATION DIAGRAM



0 10 20km
Scale 1:250000

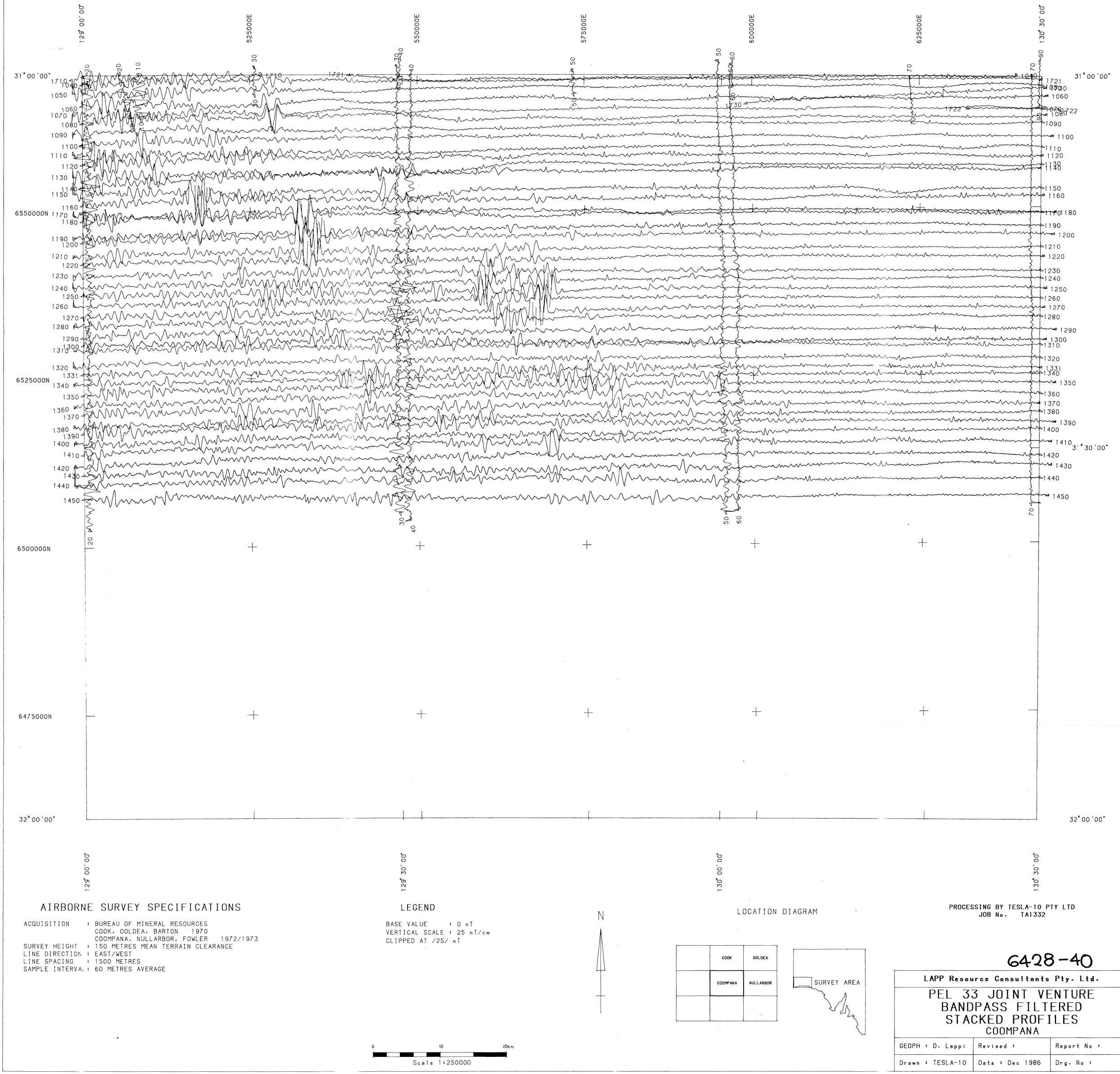
PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-39

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE BANDPASS FILTERED STACKED PROFILES
COOK

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL : 60 METRES AVERAGE

LEGEND

BASE VALUE : 0 nT
VERTICAL SCALE : 25 nT/cm
CLIPPED AT /25/ nT

N

0 10 20km
Scale 1:250000

LOCATION DIAGRAM

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

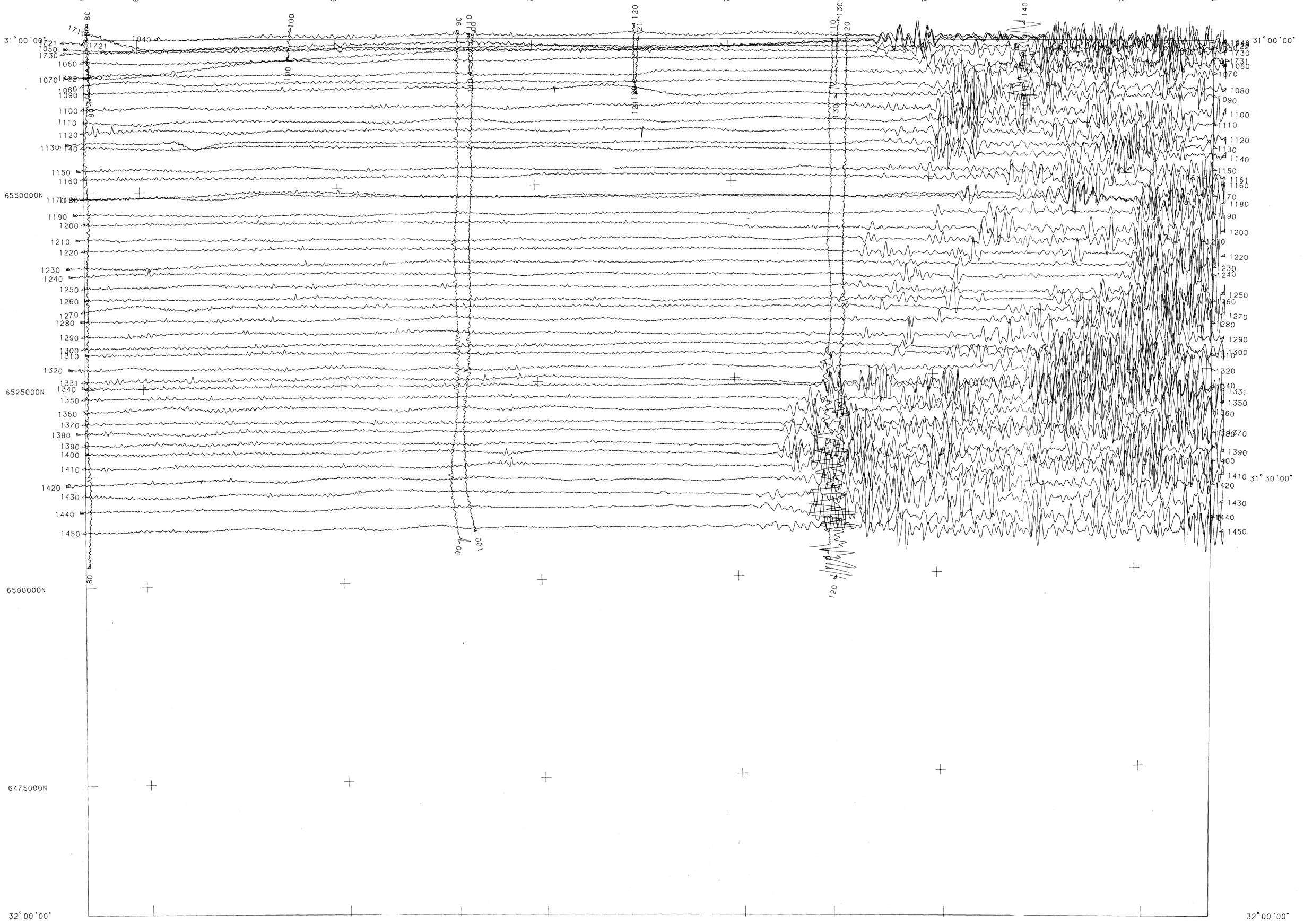
6428-40

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED
STACKED PROFILES
COOMPANA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 30' 00"
650000E
675000E
700000E
725000E
750000E
775000E
132° 00' 00"
31° 00' 00"
6550000N
6525000N
6500000N
6475000N
32° 00' 00"



130° 30' 00"
131° 00' 00"
131° 30' 00"
132° 00' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0 nT
VERTICAL SCALE : 25 nT/cm
CLIPPED AT /25/ nT

N

0 10 20km
Scale 1:250000

LOCATION DIAGRAM

COOK	OOLDEA	BARTON
COOMPANA	NULLARBOR	FOWLER
		NUYTS



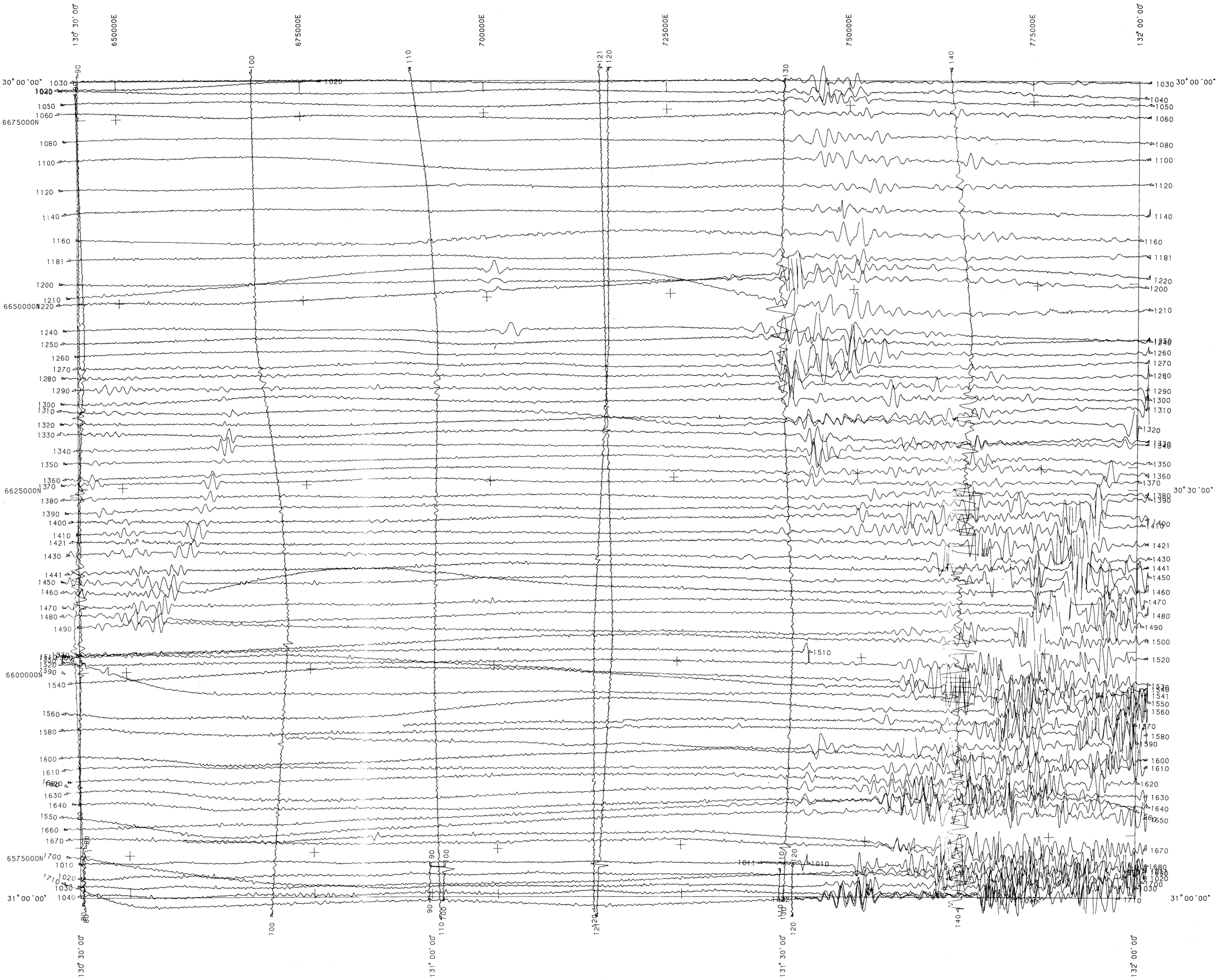
PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-41

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED
STACKED PROFILES
NULLARBOR

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0 nT
VERTICAL SCALE : 25 nT/cm
CLIPPED AT /25/ nT

N

0 10 20km
Scale 1:250000

LOCATION DIAGRAM

WYOLA	MAURICE	TALLARINGA
COOK	OOLDEA	BARTON
COOMPANA	NULLARBOR	FOWLER



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

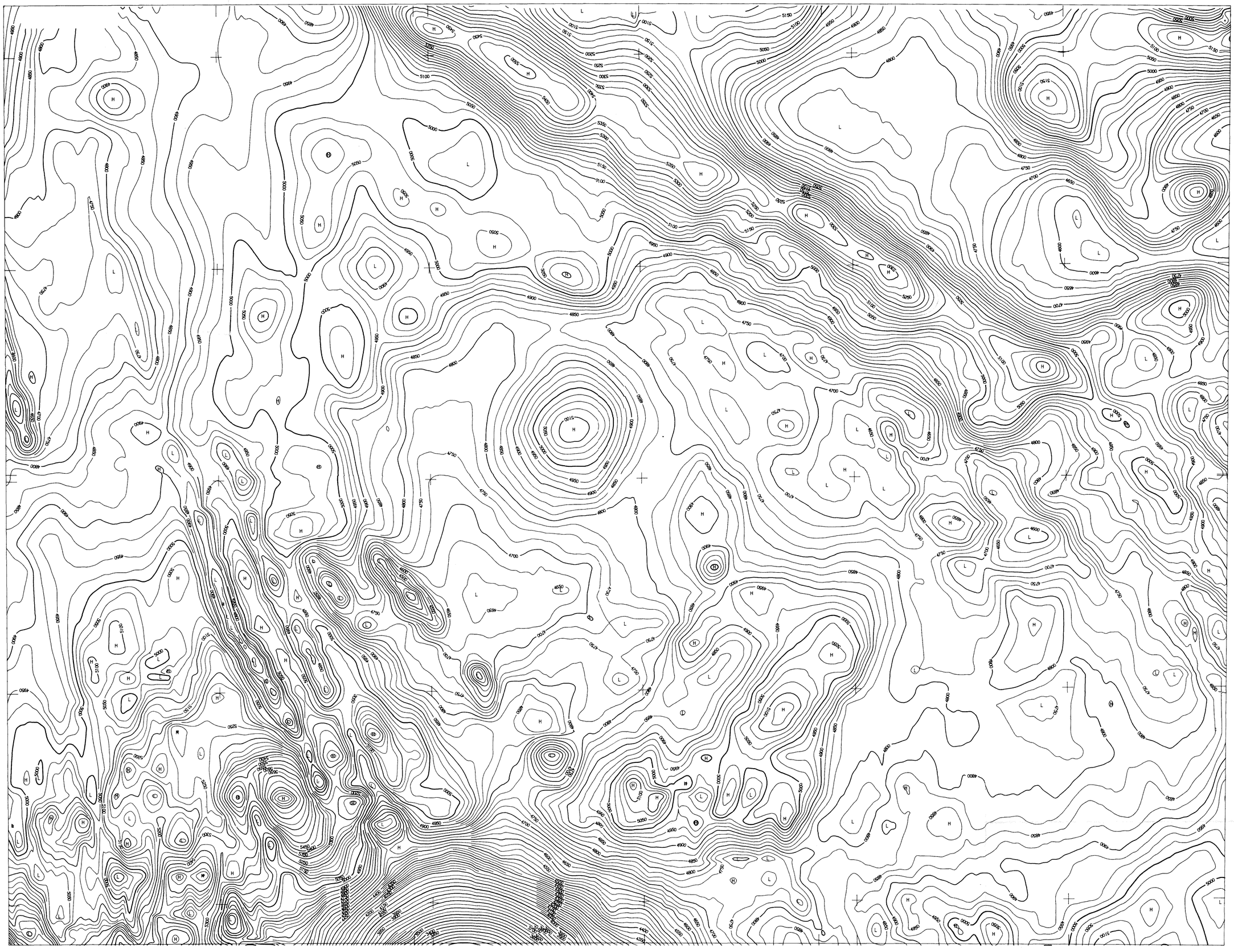
6428-42

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED
STACKED PROFILES
OOLDEA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 00' 00"
525000E
550000E
575000E
600000E
625000E
130° 30' 00"
30° 00' 00"
6675000N
6650000N
6625000N
6600000N
6575000N
31° 00' 00"



129° 00' 00"
129° 30' 00"
130° 00' 00"
130° 30' 00"
30° 30' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 25 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
25 NANOTESLA CONTOUR

N

0 10 20km
Scale 1:250000

LOCATION DIAGRAM

MASON	WYOLA	MAURICE
FORREST	COOK	OOLDEA
EUCLA	COOMPANA	NULLARBOR

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

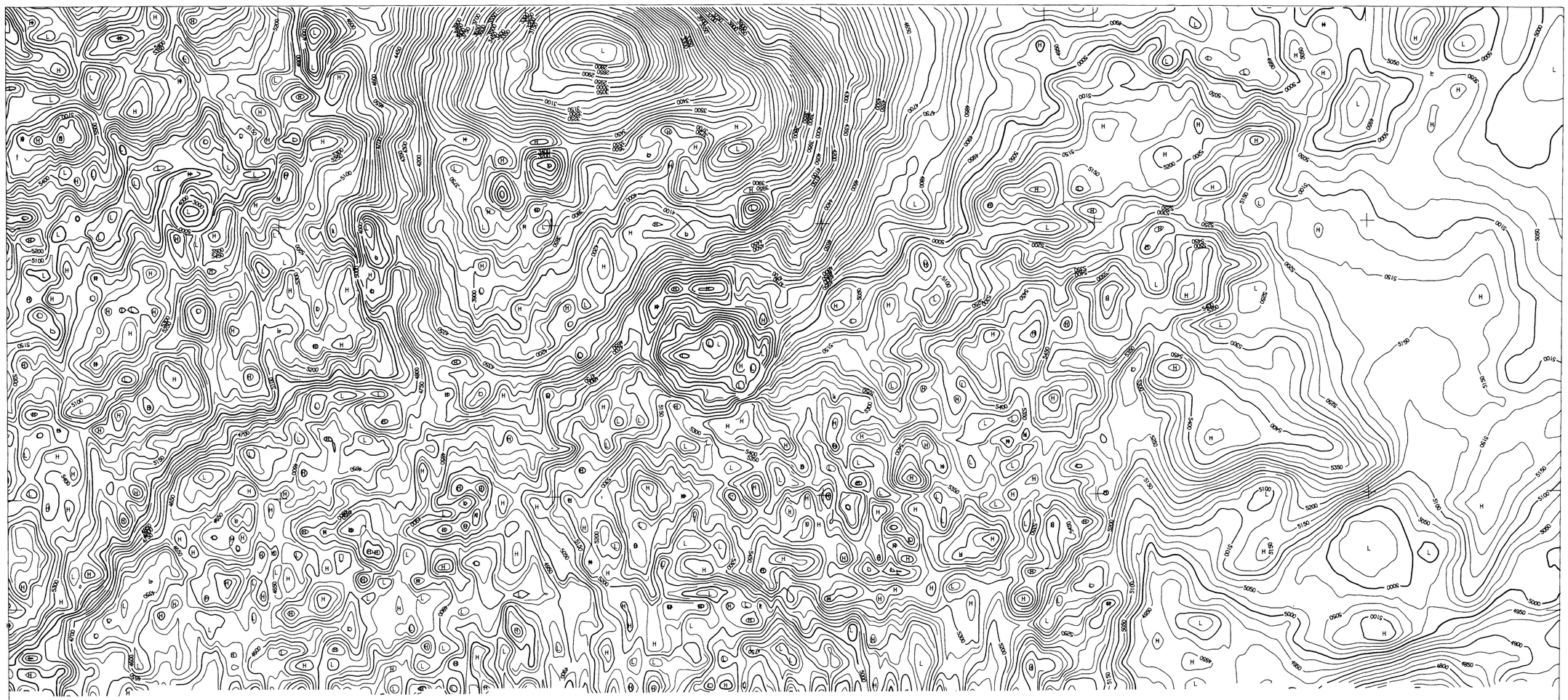
6428-43

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE MAGNETIC CONTOURS
COOK

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 00' 00"
525000E
550000E
575000E
600000E
625000E
130° 30' 00"
31° 00' 00"
6550000N
6525000N
6500000N
6475000N
32° 00' 00"
129° 30' 00"
130° 00' 00"



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 25 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
25 NANOTESLA CONTOUR

N

0 10 20km
Scale 1:250000

LOCATION DIAGRAM

FORREST	COOK	OOLDEA
EUCLA	COOMPANA	NULLARBOR
NOONAERA		



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

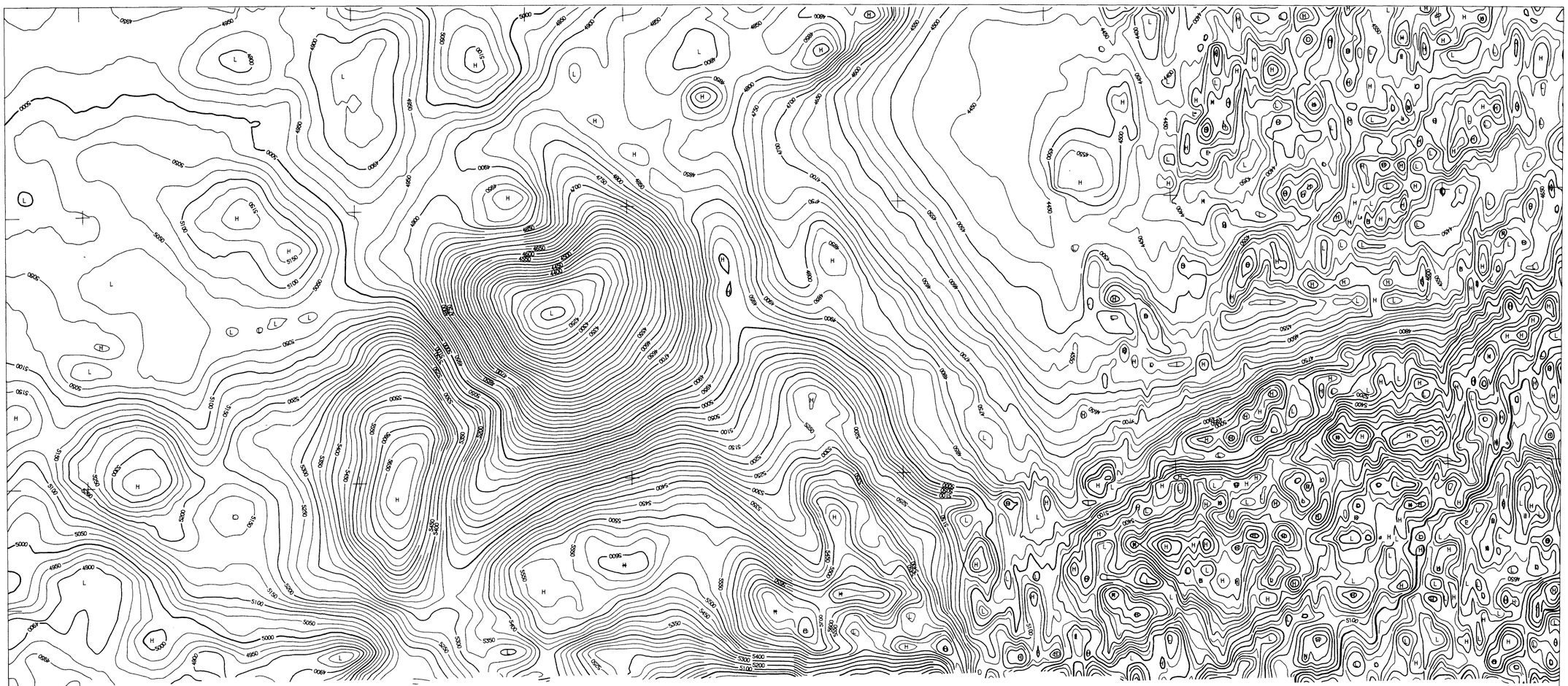
6428-44

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
COOMPANA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 30' 00"
650000E
675000E
700000E
725000E
750000E
775000E
132° 00' 00"
31° 00' 00"
6550000N
6525000N
31° 30' 00"
6500000N
6475000N
32° 00' 00"



130° 30' 00"
131° 00' 00"
131° 30' 00"
132° 00' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 25 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
25 NANOTESLA CONTOUR

N

0 10 20km
Scale 1:250000

LOCATION DIAGRAM

COOK	OOLDEA	BARTON
COOMPANA	NULLARBOR	FOWLER
		NUYTS

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-45

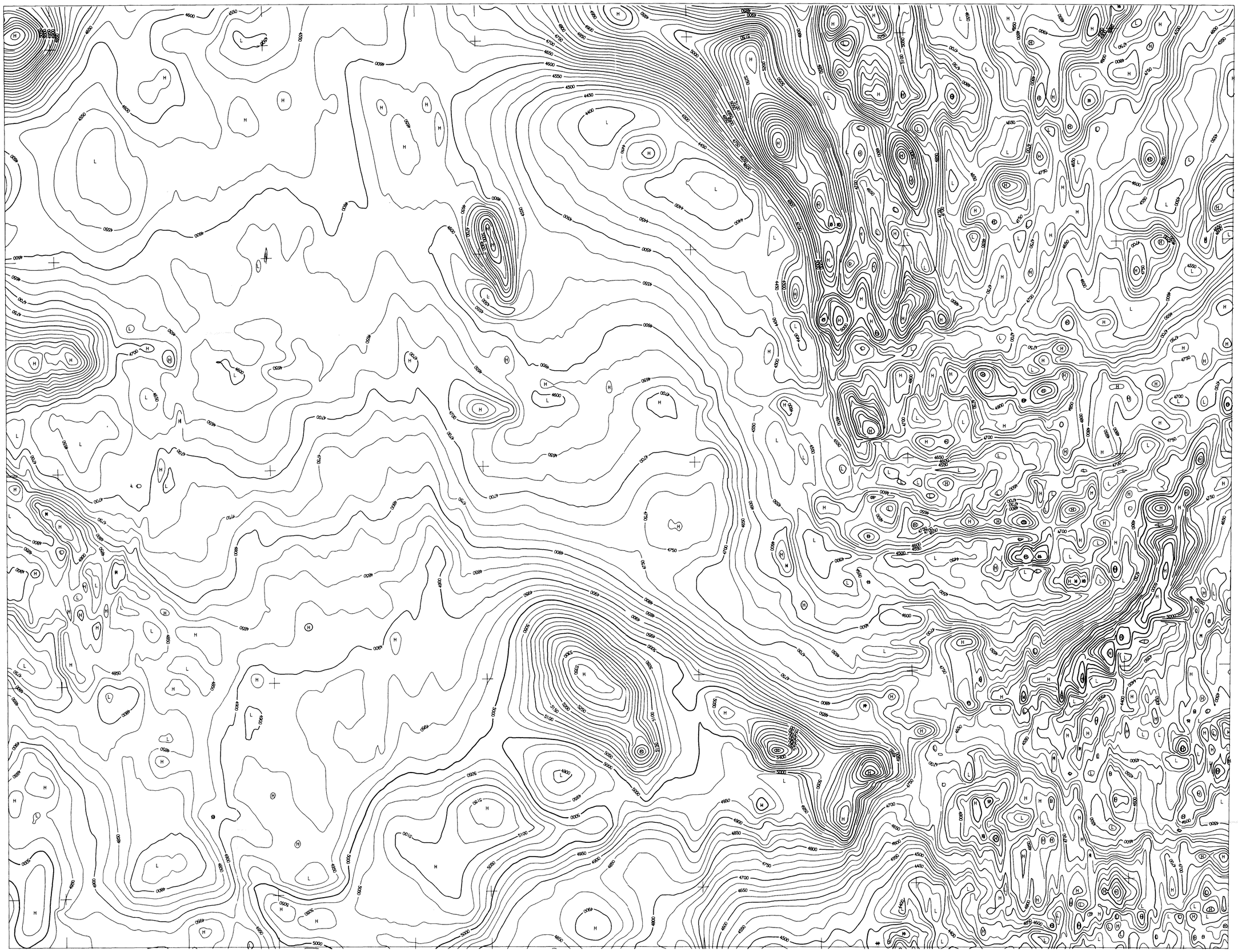
LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
NULLARBOR

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 30' 00"
650000E
675000E
700000E
725000E
750000E
775000E
132° 00' 00"

30° 00' 00"
6675000N
6650000N
6625000N
6600000N
6575000N
31° 00' 00"



130° 30' 00"
131° 00' 00"
131° 30' 00"
132° 00' 00"

30° 30' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

CONTOUR INTERVAL 25 NANOTESLA

1000 NANOTESLA CONTOUR
100 NANOTESLA CONTOUR
25 NANOTESLA CONTOUR

N

0 10 20km
Scale 1:250000

LOCATION DIAGRAM

WYOLA	MAURICE	TALLARINGA
COOK	OOLDEA	BARTON
COOMPANA	NULLARBOR	FOWLER



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

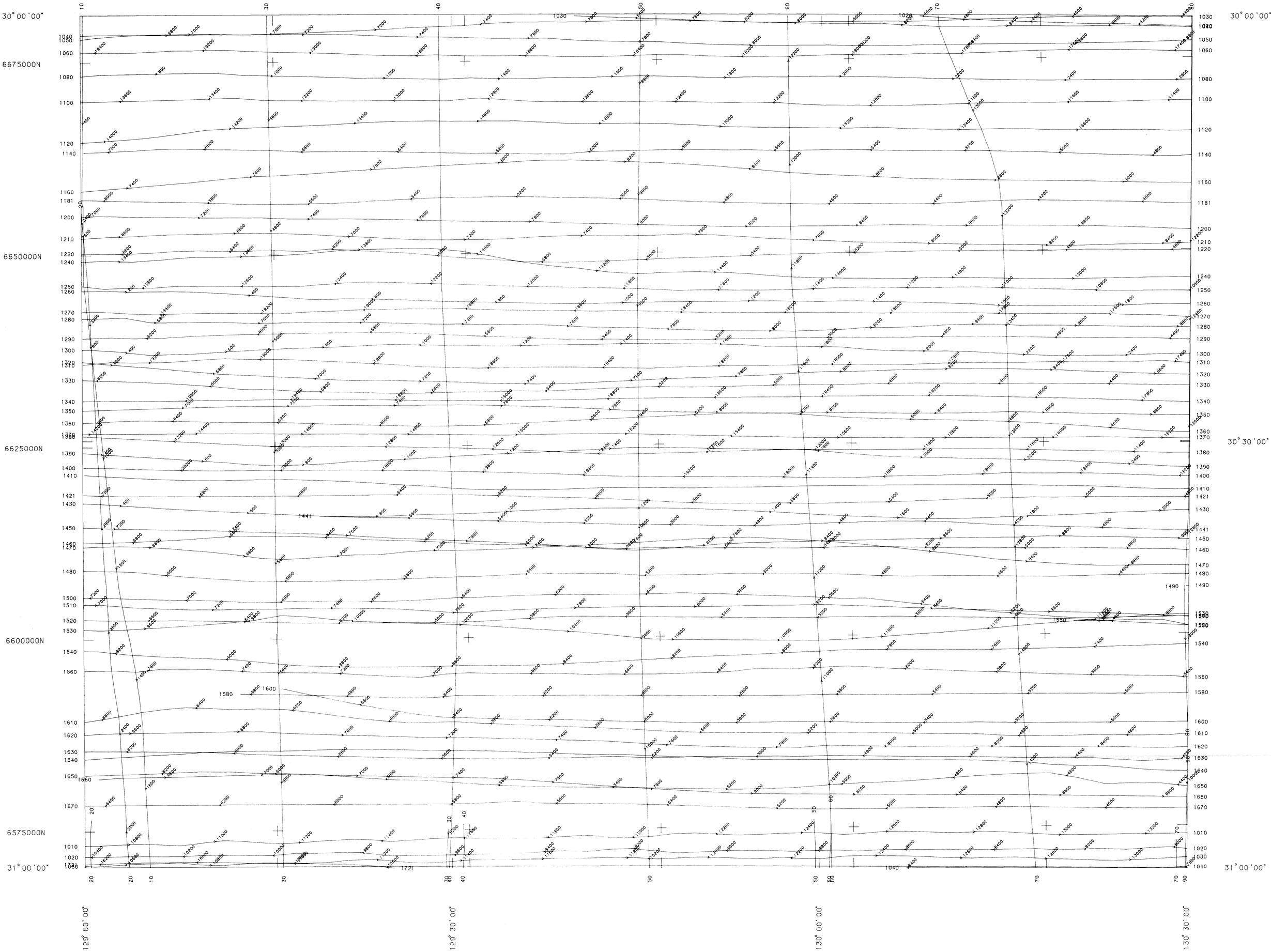
6428-46

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
MAGNETIC CONTOURS
OOLDEA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 00' 00"
525000E
550000E
575000E
600000E
625000E
130° 30' 00"
30° 00' 00"
6675000N
6650000N
6625000N
6600000N
6575000N
31° 00' 00"



129° 00' 00"
129° 30' 00"
130° 00' 00"
130° 30' 00"

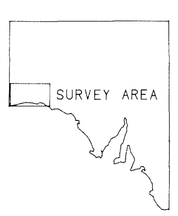
AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

N

LOCATION DIAGRAM

MASON	WYOLA	MAURICE
FORREST	COOK	OOLDEA
EUCLA	COOMPANA	NULLARBOR



0 10 20km
Scale 1:250000

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-47

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
FLIGHT PATHS
COOK

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 00' 00"
525000E
550000E
575000E
600000E
625000E
130° 30' 00"
31° 00' 00"
6550000N
6525000N
6500000N
6475000N
31° 30' 00"
32° 00' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

N

0 10 20km
Scale 1:250000

LOCATION DIAGRAM

FORREST	COOK	OOLDEA
EUCLA	COOMPANA	NULLARBOR
NOONAERA		

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-48

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
FLIGHT PATHS
COOMPANA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 30' 00"
650000E
675000E
700000E
725000E
750000E
775000E
132° 00' 00"
31° 00' 00"
6550000N
6525000N
31° 30' 00"
6500000N
6475000N
32° 00' 00"
130° 30' 00"
131° 00' 00"
131° 30' 00"
132° 00' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OODLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

N

0 10 20km
Scale 1:250000

LOCATION DIAGRAM

COOK	OODLDEA	BARTON
COOMPANA	NULLARBOR	FOWLER
		NUYTS

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

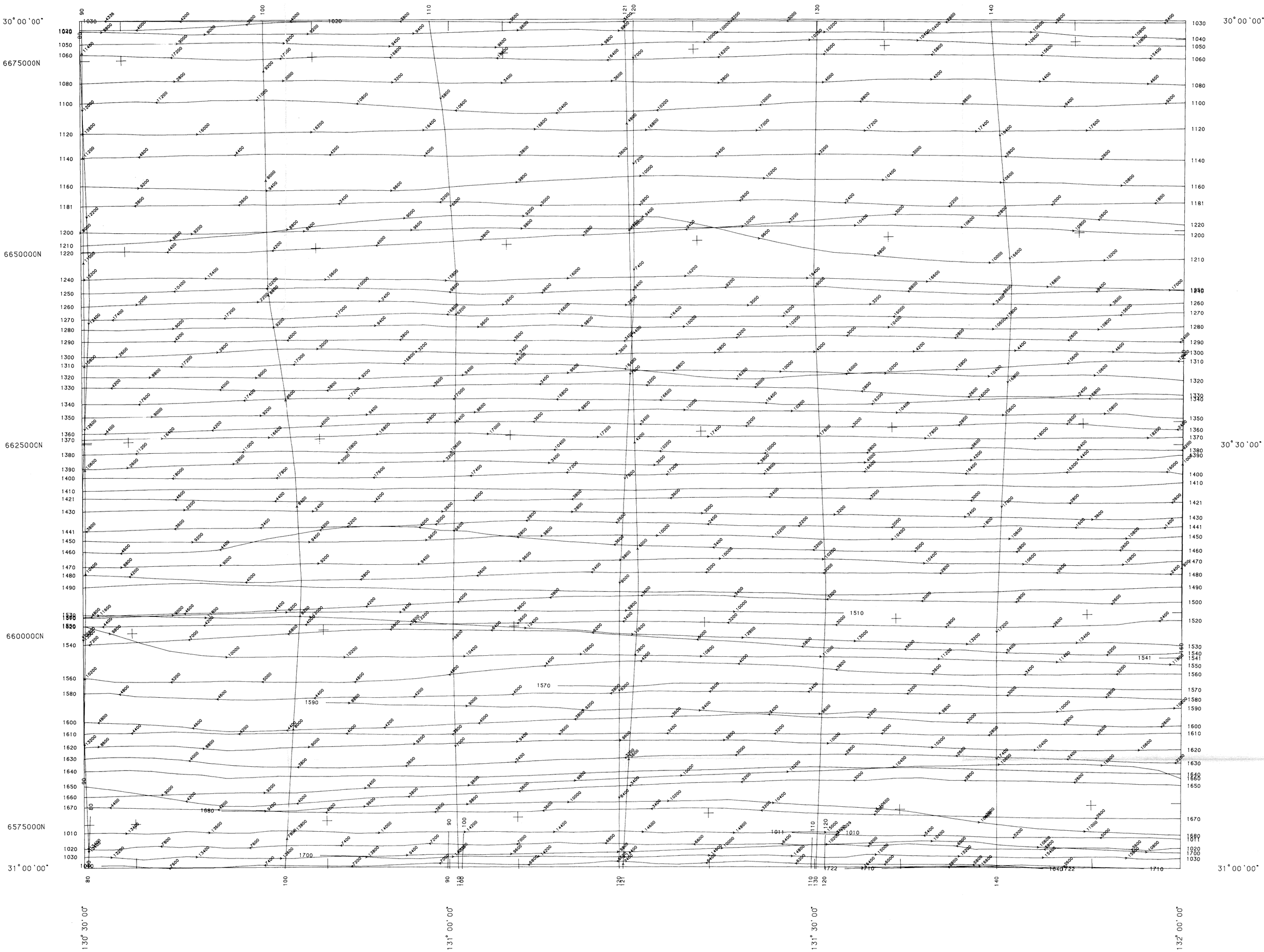
6428-49

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
FLIGHT PATHS
NULLARBOR

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 30' 00"
650000E
675000E
700000E
725000E
750000E
775000E
132° 00' 00"
30° 00' 00"
6675000N
6650000N
6625000N
6600000N
6575000N
31° 00' 00"
30° 30' 00"
131° 00' 00"
131° 30' 00"



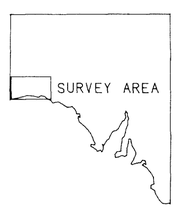
AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

N

LOCATION DIAGRAM

WYOLA	MAURICE	TALLARINGA
COOK	OOLDEA	BARTON
COOMPANA	NULLARBOR	FOWLER



0 10 20km
Scale 1:250000

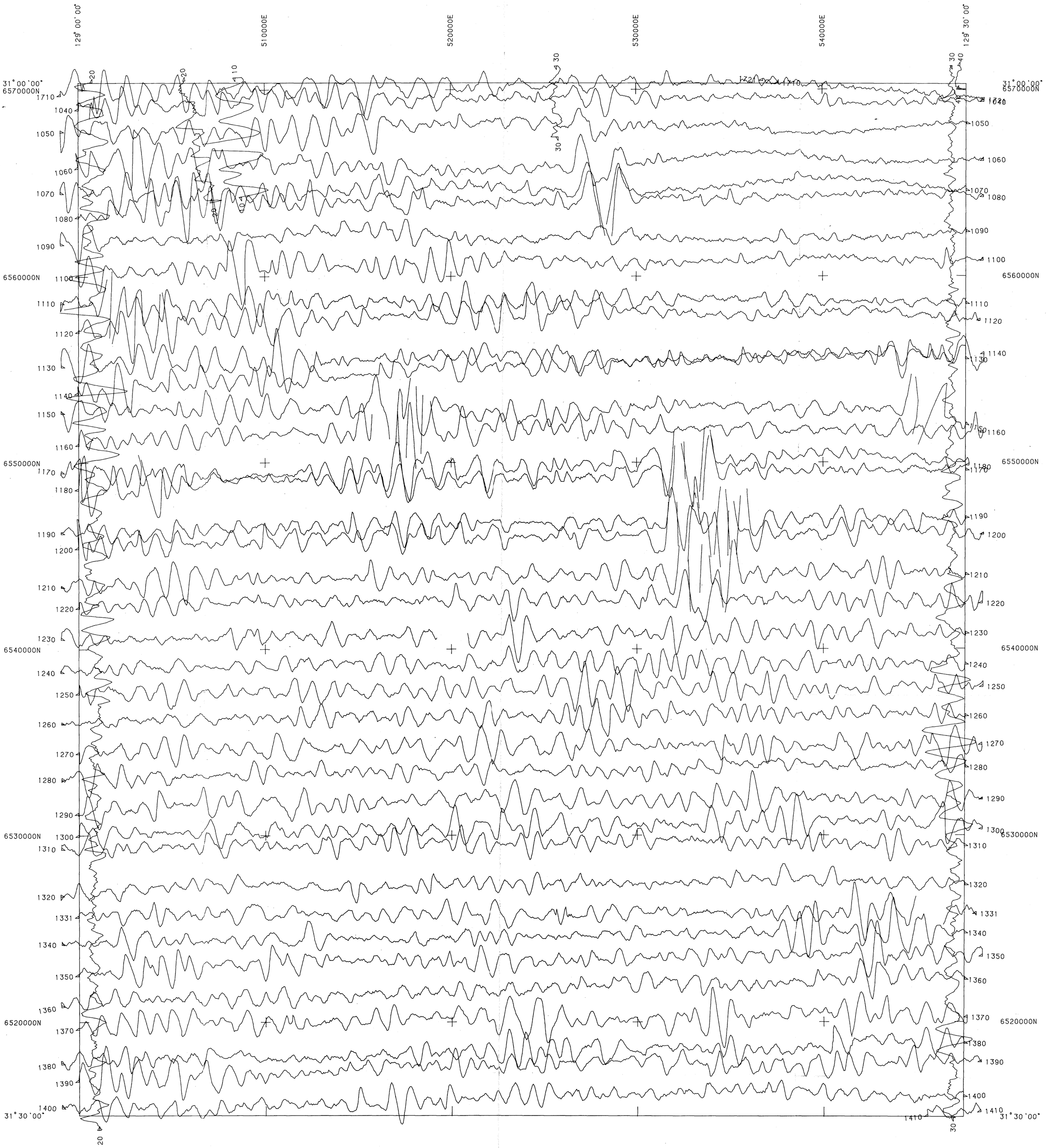
PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-50

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
FLIGHT PATHS
OOLDEA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

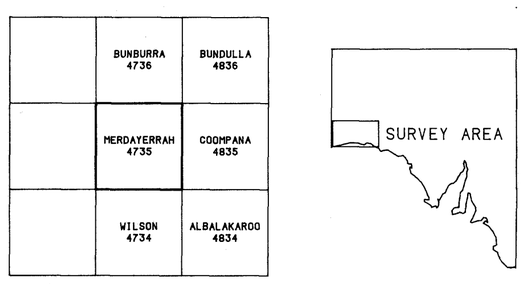
LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

0 2 4 6 8 10km
Scale 1:100000

N

LOCATION DIAGRAM



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-51

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED STACKED PROFILES
4735 MERDAYERRAH

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 30' 00"
550000E
560000E
570000E
580000E
590000E
130° 00' 00"
31° 00' 00"
31° 30' 00"
6560000N
6550000N
6540000N
6530000N
6520000N
40
50

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

BUNBURRA 4736	BUNDULLA 4836	COOK 4936
MERDAYERRAH 4735	COOMPANA 4835	KNARDNA 4935
WILSON 4734	ALBALAKAROO 4834	YANGOONABIE 4934

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-52

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE BANDPASS FILTERED STACKED PROFILES
4835 COOMPANA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 00' 00"
600000E
610000E
620000E
630000E
640000E
130° 30' 00"
31° 00' 00"
6560000N
6550000N
6540000N
6530000N
6520000N
31° 30' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

BUNDULLA 4836	COOK 4936	FISHER 5036
COOMPANA 4835	KNARDNA 4935	NULLARBOR 5035
ALBALAKAROO 4834	YANGOONABIE 4934	WIGUNDA 5034

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-53

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED
STACKED PROFILES
4935 KNARDNA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 30' 00"
650000E
660000E
670000E
680000E
131° 00' 00"
31° 00' 00"
6560000N
6550000N
6540000N
6530000N
6520000N
31° 30' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

COOK 4936	FISHER 5036	REID 5136
KNARDNA 4935	NULLARBOR 5035	ILLCUMBA 5135
YANGOONABIE 4934	WIGUNDA 5034	COYMBRA 5134



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-54

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE BANDPASS FILTERED STACKED PROFILES
5035 NULLARBOR

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

131° 00' 00" 700000E 710000E 720000E 730000E 131° 30' 00"

31° 00' 00"

6560000N

6550000N

6540000N

6530000N

6520000N

31° 30' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

FISHER 5036	REID 5136	MOONDRAH 5236
NULLARBOR 5035	ILLCUMBA 5135	YALATA 5235
WIGUNDA 5034	COYMBRA 5134	PILPUPPIE 5234



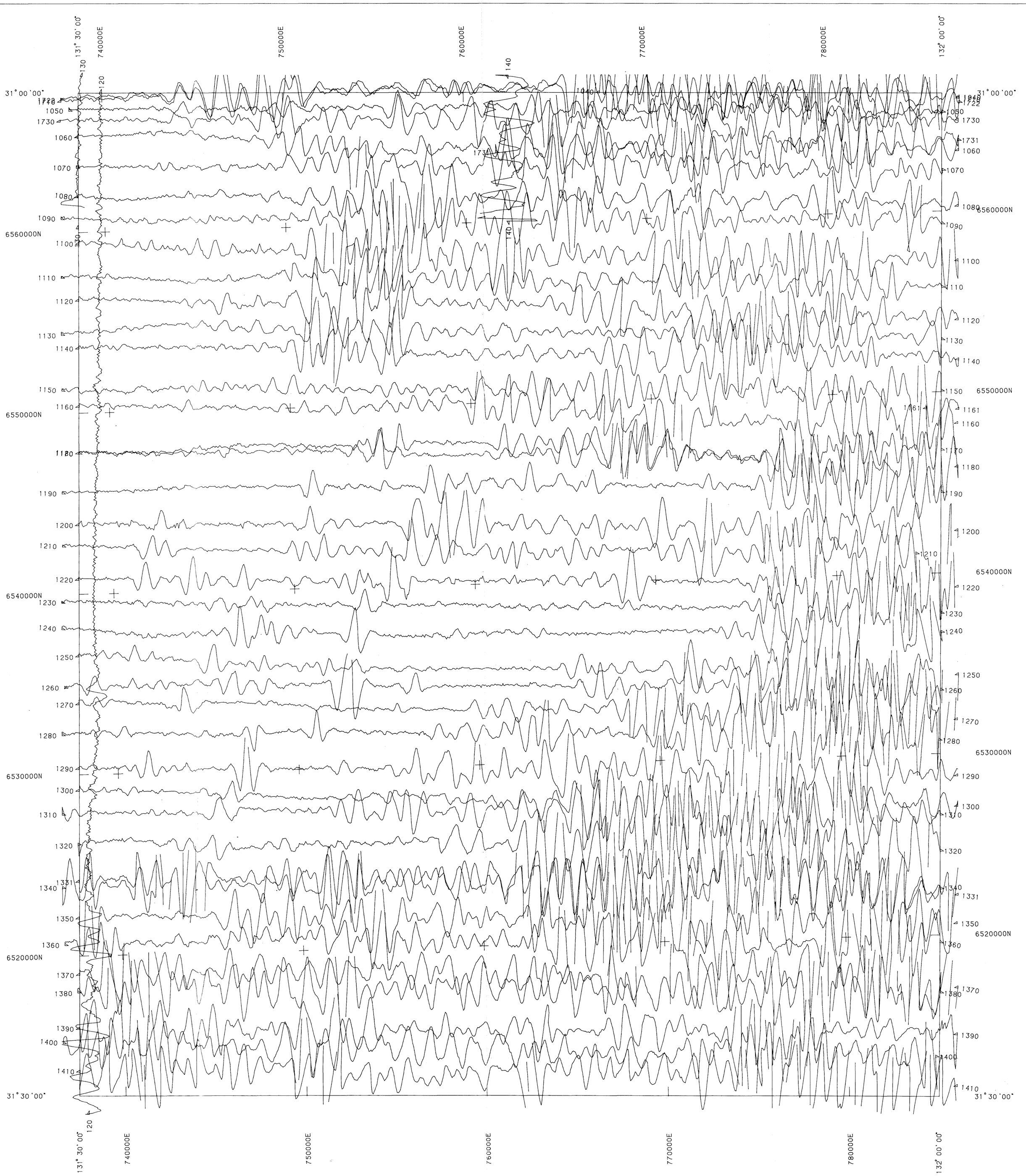
PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-55

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED
STACKED PROFILES
5135 ILLCUMBA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

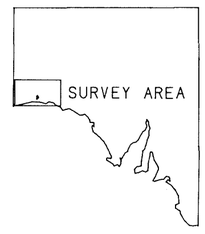
BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

REID 5136	MOONDRAH 5236	PIDINGA 5336
ILLCUMBA 5135	YALATA 5235	TALLACOOTRA 5335
COYMBRA 5134	PILPUPPIE 5234	COORABIE 5334



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-56

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED
STACKED PROFILES
5235 YALATA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 00' 00"
510000E
520000E
530000E
540000E
129° 30' 00"
30° 30' 00"
31° 00' 00"
6620000N
6610000N
6600000N
6590000N
6580000N

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

KORANA 4737 | COORARA 4837
BUNBURRA 4736 | BUNDULLA 4836
MERDAYERRAH 4735 | COOMPANA 4835

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-57

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED
STACKED PROFILES
4736 BUNBURRA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

129° 30' 00"
550000E
560000E
570000E
580000E
590000E
130° 00' 00"
30° 30' 00"
6620000N
6610000N
6600000N
6590000N
6580000N
31° 00' 00"
50
60
40
1380
1390
1400
1410
1421
1430
1441
1450
1460
1470
1480
1500
1510
1520
1530
1550
1540
1560
1580
1600
1610
1620
1640
1630
1660
1650
1670
1700
1010
1020
1030
1710

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

KORANA 4737	COORARA 4837	SALEH 4937
BUNBURRA 4736	BUNDULLA 4836	COOK 4936
MERDAYERRAH 4735	COOMPANA 4835	KNARDNA 4935

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-58

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED STACKED PROFILES
4836 BUNDULLA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 00 '00"
600000E
610000E
620000E
630000E
640000E
130° 30 '00"
30° 30 '00"
6620000N
6610000N
6600000N
6590000N
6580000N
6570000N
31° 00 '00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

COORARA 4837	SALEH 4937	FISK 5037
BUNDULLA 4836	COOK 4936	FISHER 5036
COOMPANA 4835	KNARDNA 4935	NULLARBOR 5035



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-59

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE BANDPASS FILTERED STACKED PROFILES
4936 COOK

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

130° 30' 00"
650000E
660000E
670000E
680000E
690000E
131° 00' 00"
30° 30' 00"
6620000N
6610000N
6600000N
6590000N
6580000N
6570000N
31° 00' 00"

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

SALEH 4937	FISK 5037	YARLE 5137
COOK 4936	FISHER 5036	REID 5136
KNARDNA 4935	NULLARBOR 5035	ILLCUMBA 5135

SURVEY AREA

PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-60

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED
STACKED PROFILES
5036 FISHER

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

131° 00' 00"
700000E
710000E
720000E
730000E
131° 30' 00"
30° 30' 00"
31° 00' 00"
6620000N
6610000N
6600000N
6590000N
6580000N
6570000N
110
120
121
100
1380
1390
1400
1410
1421
1430
1441
1460
1450
1470
1480
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
1610
1620
1630
1640
1660
1650
1680
1670
1011
1020
1700
1030
1040

AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

FISK 5037	YARLE 5137	MARALINA 5237
FISHER 5036	REID 5136	MOONDRAH 5236
NULLARBOR 5035	ILLCUMBA 5135	YALATA 5235

SURVEY AREA

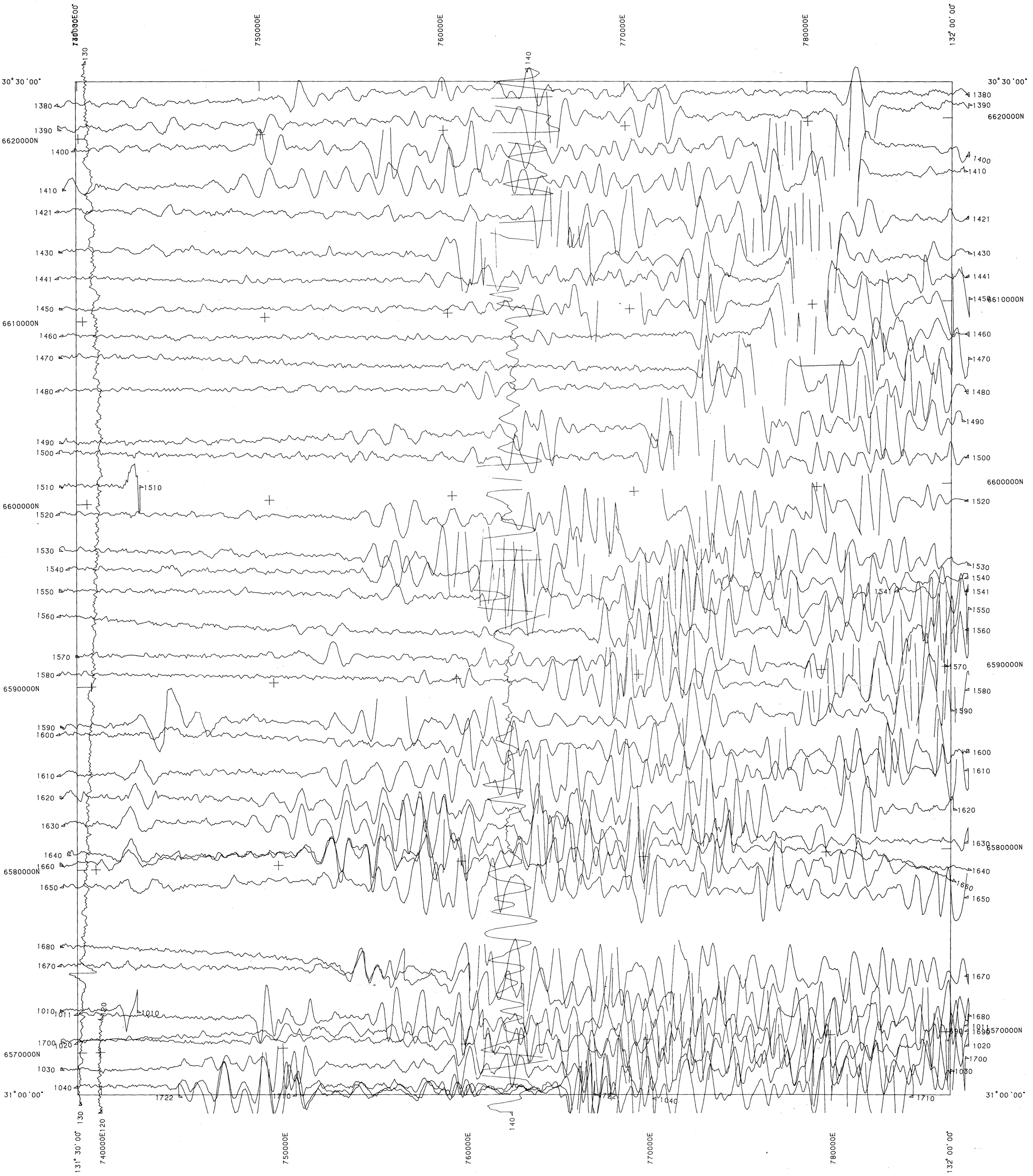
PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-61

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED STACKED PROFILES
5136 REID

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km
Scale 1:100000

LOCATION DIAGRAM

YARLE 5137	MARALINA 5237	IMMARNA 5337
REID 5136	MOONDRAH 5236	PIDINGA 5336
ILLCUMBA 5135	YALATA 5235	TALLACOOTRA 5335



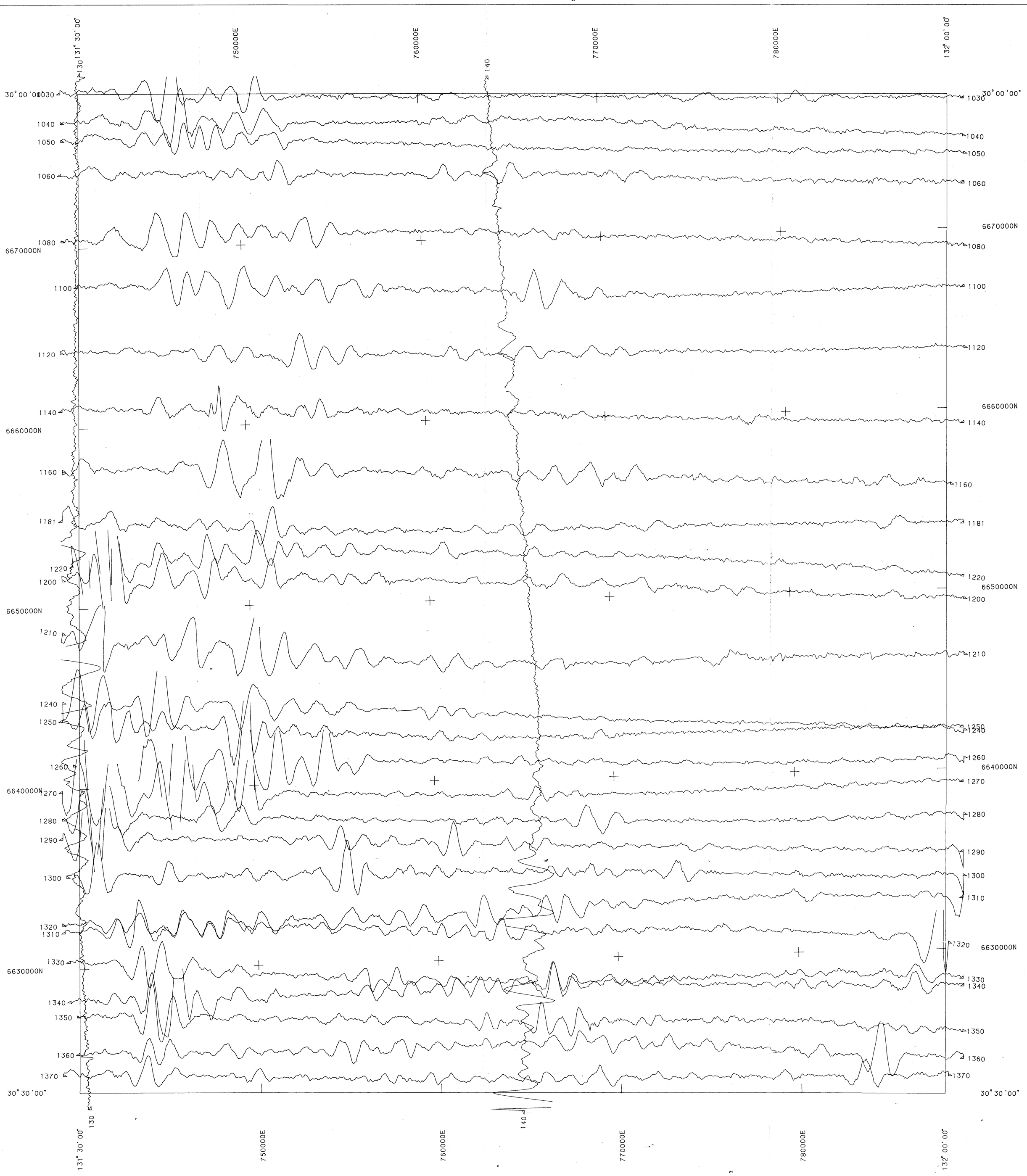
PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-62

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED
STACKED PROFILES
5236 MOONDRAH

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :



AIRBORNE SURVEY SPECIFICATIONS

ACQUISITION : BUREAU OF MINERAL RESOURCES
COOK, OOLDEA, BARTON 1970
COOMPANA, NULLARBOR, FOWLER 1972/1973
SURVEY HEIGHT : 150 METRES MEAN TERRAIN CLEARANCE
LINE DIRECTION : EAST/WEST
LINE SPACING : 1500 METRES
SAMPLE INTERVAL: 60 METRES AVERAGE

LEGEND

BASE VALUE : 0
VERTICAL SCALE : 10 nT/cm
CLIPPED AT /20/ nT

N

0 2 4 6 8 10km

Scale 1:100000

LOCATION DIAGRAM

YADINA 5138	PALING 5238	DELISSER 5338
YARLE 5137	MARALINA 5237	IMMARNA 5337
REID 5136	MOONDRAH 5236	PIDINGA 5336



PROCESSING BY TESLA-10 PTY LTD
JOB No. TA1332

6428-G3

LAPP Resource Consultants Pty. Ltd.

PEL 33 JOINT VENTURE
BANDPASS FILTERED
STACKED PROFILES
5237 MARALINA

GEOPH : D. Lappi	Revised :	Report No :
Drawn : TESLA-10	Date : Dec 1986	Drg. No :

This DEED is made the 30th day of April 1987 between:-

FORSAYTH N.L., a company incorporated in Western Australia having its principal office at 1st Floor, 28 The Esplande, Perth ("Forsayth"); and

FIRST AUSTRALIAN RESOURCES N.L. a company incorporated in Western Australia having its principal office at 1st Floor, 28 The Esplanade, Perth("FAR").

WHEREAS:

A. By a Deed of Assignment dated 5 July 1985 between Forsayth and FAR ("the Deed of Assignment"). Forsayth agreed to assign to FAR a 10% interest in exploration permit PEL33 issued under the provisions of the Petroleum Act 1940 of South Australia ("the Permit").

B. The parties wish to amend and confirm the Deed of Assignment in various respects.

NOW THIS DEED WITNESSES as follows:-

1. Clause 7.6 of the Deed of Assignment is amended by deleting "Western Australia" therefrom and substituting in lieu thereof "South Australia".

2. The parties acknowledge and confirm that Clause 2.1(b) of the Deed of Assignment has been varied by deleting therefrom "31st day of December 1985"

and substituting in lieu thereof "31st day of January 1986".

3. The parties otherwise confirm the Deed of Assignment in all respect.

EXECUTED as a DEED.

THE COMMON SEAL of FORSAYTH N.L. was hereunto affixed by Authority of the Directors in the presence of:

Director:

Secretary:

FORSAYTH N.L. COMMON SEAL

THE COMMON SEAL of FIRST AUSTRALIAN RESOURCES N.L. was hereunto affixed by Authority of the Directors in the presence of:

Director:

Secretary:

FIRST AUSTRALIAN RESOURCES N.L. COMMON SEAL

I CONSENT

MINISTER OF MINES & ENERGY

15/5/87

1986

FORSAYTH N.L.

FIRST AUSTRALIAN RESOURCES N.L.

MEDIAN OIL N.L.

HERON PETROLEUM PTY. LTD.

GEOMETALS OIL EXPLORATION LTD.

MONITOR EXPLORATION PTY. LTD.

GULF RESOURCES N.L.

SOUTHERN CROSS EXPLORATION N.L.

ANTARTIC PETROLEUM PTY. LTD.

MARVEL PETROLEUM N.L.

PEL 33 - DEED OF ASSUMPTION

FREEHILL, HOLLINGDALE & PAGE
SOLICITORS
AUSTRALIA PLACE
15-17 WILLIAM STREET
PERTH
WESTERN AUSTRALIA
TELEPHONE 327 5777
REF: JCR:PJ:FIRS7700-016

00224

ANNEXURE "A"

DEED OF ASSUMPTION

THIS DEED is made the 20th day of January 1985
BETWEEN:

FORSAYTH N.L., a company incorporated in the State of Western Australia and having its registered office at 1st Floor, Griffin Centre, 28 The Esplanade, Perth ("Forsayth") of the first part;

FIRST AUSTRALIAN RESOURCES N.L., a company incorporated in the State of Western Australia and having its registered office at 1st Floor, Griffin Centre, 28 The Esplanade, Perth ("FAR") of the second part;

MEDIAN OIL N.L. of 11 Mosman Terrace, Mosman Park, Western Australia ("Median") of the third part;

HERON PETROLEUM PTY. LTD. of ~~189~~ 220 St. George's Terrace, Perth, Western Australia ("Heron") of the fourth part;

GEOMETALS OIL EXPLORATION LTD. of 28 The Esplanade, Perth, Western Australia ("Geometals") of the fifth part;

~~MALITA~~ MONITOR EXPLORATION PTY. LTD. of ~~189~~ 220 St. George's Terrace, Perth, Western Australia ("Malita") of the sixth part;

GULF RESOURCES N.L. of 82 Elizabeth Street, Sydney, New South Wales ("Gulf") of the seventh part;

SOUTHERN CROSS EXPLORATION N.L. of 82 Elizabeth Street, Sydney, New South Wales ("Southern") of the eighth part;

ANTARCTIC PETROLEUM PTY. LTD. of ~~200~~ 55 St. George's Terrace, Perth, Western Australia ("Antarctic") of the ninth part; and

~~SPECTRUM GOLD~~ MARVEL PETROLEUM N.L. of ~~200~~ 55 St. George's Terrace, Perth, Western Australia ("Spectrum") of the tenth part;

4824d

WHEREAS:

A. Petroleum Exploration Licence No.33 ("the Licence") was granted by the Minister for Mines and Energy of the State of South Australia pursuant to the provisions of the Petroleum Act 1940-1984 (as amended) of the State of South Australia ("the Act") on the 25th June 1985 to the following parties who hold the following Participating Interests:

	%
Median Oil N.L.	30
Heron Petroleum Pty. Ltd.	10
Geometals Oil Exploration Ltd.	10
Monitor ~~Malita~~ Exploration Pty. Ltd.	10
Gulf Resources N.L.	5
Southern Cross Exploration N.L.	5
Forsayth	10
Antarctic Petroleum Pty. Ltd.	5
~~Spectrum Gold N.L~~. MARVEL PETROLEUM N.L.	15
	100%

(which parties, less Forsayth, are hereinafter referred to as ("the Permittees")

B. Pursuant to a Participation Agreement made between the Permittees and Forsayth dated the 4th February 1985 ("the Participation Agreement"), the Permittees and Forsayth recorded the terms and conditions upon which they would work upon the area of the Licence.

C. Pursuant to Clause 2.2 of the Schedule to the Participation Agreement, Lapp Resource Consultants is entitled to a 7% Net Profits Interest in any revenue derived from petroleum produced from the Licence.

D. Forsayth is the registered holder of a 10% Participating Interest in the Licence ("the Interest").

E. By an Agreement dated the 5th day of July 1985 made between Forsayth and FAR ("the Deed of Assignment"), Forsayth agreed to assign to FAR the Interest subject to the terms and conditions contained therein.

F. Clause 10.3(F) of the Schedule to the Participation Agreement provides, in summary an assignment of any

Parties' Participating Interest is conditional upon the assignee executing a Deed of Covenant undertaking to be bound by the provisions of the Participation Agreement.

G. Each of the parties hereto consents to the assignment of the Interest by Forsayth to FAR and the assumption by FAR of Forsayth's liabilities and obligations relating to the Interest pursuant to the Participation Agreement and the Permit effective as at the Effective Date, subject to and in accordance with the provisions hereinafter appearing.

NOW THIS DEED WITNESSES as follows:-

1. In this Deed, unless the context otherwise requires:-

"the Parties" shall bear the same meaning as in clause 1.1 of the Participation Agreement, but for the purposes of this Deed, specifically excludes Forsayth.

"Participating Interest" shall bear the same meaning as in the Participation Agreement.

Unless the contrary intention shall appear, words used in this Deed shall bear the same meaning as in the Deed of Assignment and the Participation Agreement.

1.2 In this Deed, unless the context otherwise requires:-

(a) reference to a party includes a reference to its personal representatives, successors and assigns;

(b) singular words include the plural and plural words include the singular;

(c) neuter words include the masculine and the feminine;

(d) words importing persons include corporations;

(e) the headings do not affect the interpretation or construction of this Deed;

(f) references to recitals, clauses and paragraphs are references to recitals, clauses and paragraphs in this Deed;

(g) references herein to any agreement, deed or other instrument or document shall be deemed to include references to the agreement, deed, instrument or document as varied or replaced from time to time as permitted by this Deed; and

(h) reference to any statute in this Deed includes a reference to that statute as amended, modified or replaced and includes orders, ordinances, regulations, rules and by-laws made under or pursuant to that statute.

2. Each of the Parties hereby consents to the assignment of the Interest by Forsayth to FAR on the Completion Date.

3. To the extent of the Interest, FAR covenants and agrees with the Parties that as and from the Completion Date it will observe, perform and be bound by all the terms, conditions, restrictions, covenants and obligations under the Participation Agreement in all respects as if FAR were named in that Agreement in place of Forsayth.

4. Each of the Parties hereby releases and discharges Forsayth from all claims, demands and liabilities whatsoever in respect of any and all of Forsayth's covenants and obligations under the Participating Agreement with effect from the Completion Date (other than any liability accrued before that date).

5. The Deed of Assignment is expressed to be conditional upon such necessary consents and approvals as may be required pursuant to the Act from all relevant State Government Authorities and this Deed is subject to such consent being obtained in respect of the Deed of Assignment. FAR shall notify the Parties upon that condition being satisfied.

6. This Deed may be executed in counterpart and each counterpart shall for all purposes be deemed to be an original and all counterparts shall together constitute one instrument.

7. FAR shall pay the legal costs of and in connection with the preparation and execution of this Deed and all stamp duty and registration fees payable hereon.

8. This Deed shall be governed and construed in accordance with the laws of South Australia and the parties agree to submit to the jurisdiction of the Courts of that State.

9. Any notice, direction, election or other communication which may be or which is required to be given pursuant to this Deed shall be in writing and shall be effected:-

(a) if delivered in person to the party to whom the notice is addressed, then upon delivery; or

(b) if posted by pre-paid first class mail addressed to the party at the address of its registered office, then on the second business day after posting.

IN WITNESS WHEREOF the parties hereof have executed this Deed on the day and year hereinbefore written.

THE COMMON SEAL of FORSAYTH N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

FORSAYTH N.L. COMMON SEAL

THE COMMON SEAL of FIRST AUSTRALIAN RESOURCES N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

~~Secretary~~ Director:

FIRST AUSTRALIAN RESOURCES N.L. COMMON SEAL

THE COMMON SEAL of MEDIAN OIL N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

MEDIAN OIL N.L. Common Seal

THE COMMON SEAL of HERON PETROLEUM PTY. LTD. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

HERON PETROLEUM PTY. LTD. COMMON SEAL

THE COMMON SEAL of GEOMETALS OIL EXPLORATION LTD. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

Geometals Oil Exploration COMMON SEAL

THE COMMON SEAL of ~~MALITA~~ MONITOR EXPLORATION PTY. LTD. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

MONITOR EXPLORATION PTY. LTD. COMMON SEAL

THE COMMON SEAL of GULF RESOURCES N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

GULF RESOURCES N.L. Common Seal

THE COMMON SEAL of SOUTHERN CROSS EXPLORATION N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

SOUTHERN CROSS EXPLORATION N.L. Common Seal

THE COMMON SEAL of ANTARCTIC PETROLEUM PTY. LTD. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

ANTARCTIC PETROLEUM PTY. LTD. COMMON SEAL

MARVEL PETROLEUM

THE COMMON SEAL of ~~SPECTRUM GOLD~~ N.L. was hereunto affixed by authority of the Directors in the presence of:

Director:

Secretary:

MARVEL PETROLEUM NL COMMON SEAL

I CONSENT

Ron Payne

MINISTER OF MINES & ENERGY

15/5/87

MEMORANDUM

Petroleum Exploration Licence No. 33

This memorandum will confirm that on ...15..May..1987..... I approved:

- Deed of Assignment dated 5/7/85 between Forsayth N.L. formerly Forsayth Oil & Gas N.L.) and First Australian Resources N.L.

- A Deed of Assumption dated 20/1/86 between Forsayth N.L., First Australian Resources N.L., Median Oil N.L., Heron Petroleum Pty. Ltd., Gulf Resources N.L., Southern Cross Exploration N.L., Antarctic Petroleum Pty. Ltd., and Marvel Petroleum N.L.

- A Deed dated 30/4/87 between Forsayth N.L. and First Australian Resources N.L.

The purpose of these documents is for Forsayth N.L. to assign its 10% interest in the licence to First Australian Resources N.L. so that interests in the licence will change as follows:

Company	Existing Interests(%)	Revised Interests(%)
Median Oil N.L.	30	30
Marvel Petroleum N.L. (formerly Spectrum Gold N.L.)	15	15
Forsayth N.L. (formerly Forsayth Oil & Gas N.L.	10	-
First Australian Resources N.L.	-	10
Geometals Oil Exploration Ltd.	10	10
Heron Petroleum Pty. Ltd.	10	10
Monitor Exploration Pty. Ltd. (formerly Malita Exploration Pty.Ltd.)	10	10
Antarctic Petroleum Pty. Ltd.	5	5
Gulf Resources N.L.	5	5
Southern Cross Exploration N.L.	5	5

N.B. Further changes in the interests in this licence are still pending.

This memorandum and one copy of all three documents are hereby entered on the Petroleum Register.

15/5/87

Ron Payne

MINISTER OF MINES & ENERGY

2/12/1761

LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

20th July, 1987

Department of Mines & Energy,
191 Greenhill Road,
PARKSIDE SA 5063.

ATTN: Mr. R. Laws - Director, Oil Gas & Coal Division PEL 33

RE: 7th Quarterly Report Dec 25 1986 to March 24 1987

Dear Sirs,

During the 7th Quarter the Joint Venture completed reprocessing of the BMR Aeromagnetic data for PEL 33. This work was done as part of the Year 2 work programme and the results have been forwarded to the Department.

The Joint Venture also conducted the 40km Denman Seismic Reflection Survey at the end of February. The results of this survey were being processed at the end of the quarter.

Preparations were made for drilling Denman 2 including discussions with potential drilling contractors, mud and mudlogging companies, and electrical logging companies.

Cost estimates for the drilling and logging were prepared based on three 300 metre wells, two 450 metre wells or one 900 metre well. Pending approval of the Minister, the Joint Venture would like to make the final decision on the number of wells and their depths based on the results of the seismic investigations.

A Well Plan for Denman 2 and a "Declaration of Environmental Factors" were prepared and submitted for comment from the Department.

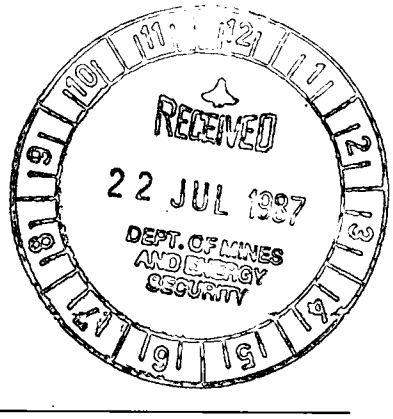
The following costs incurred during current quarter:

Denman Seismic Survey Acquisition	$ 87,340
Operating Costs	$ 13,750
Total	$101,090

Sincerely,

David W. Lappi

David W. Lappi,
Managing Director
For and on behalf of the PEL 33 Joint Venture



LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

24 July 1987

The Director - General
South Australian Department of Mines and Energy
P.O. Box 151
EASTWOOD SA 5063

Attn: Mr R. Laws - Director, Oil, Gas and Coal
Re: PEL 33 - SECOND ANNUAL REPORT
25 JUNE 1986 TO 24 JUNE 1987

Dear Sirs,

During the eighth quarter, the Joint Venture continued processing the Denman Seismic Survey data using the Curtin University Processing Center. Prior processing of the data by Geosystems has thus far proved unsuccessful with coherent interpretable reflectors notably absent. Processing tests are continuing and we are contemplating processing the first breaks in the field records for their refraction information.

A portion of the central part of line D87-02 was processed by Digicon in Singapore as a test to see if reliable reflectors could be obtained. Again very poor data quality was found on the processed section.

The Joint Venture decided to apply to the Department of Mines and Energy for permission to substitute further seismic reflection surveys for the Year 2 drilling programme. The object of the new survey will be to comprehensively test three sources: Vibroseis, Weight Drop and Dynamite.

If adequate reflectors are obtained from the trial field records, production shooting will be done over the Denman 1 wellsite.

Total Expenditure for the eighth Quarter is:

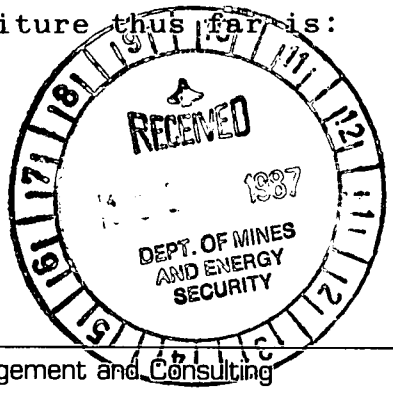
Denman "B" Seismic Survey (if approved)	$200,000.00
Data Review and Overheads	13,750.00
	$213,750.00

Total Exploration for Year 2 is:

5th Quarter	$ 3,000.00
6th Quarter	3,000.00
7th Quarter	107,000.00
8th Quarter (if approved)	213,750.00
	$326,750.00

Cumulative Exploration Expenditure thus far is:

Year 1	$ 73,500.00
Year 2 (if approved)	326,750.00
	$400,250.00



Sincerely,

David W. Lappi

David W. Lappi

MEMORANDUM

Petroleum Exploration Licence No. 33

A variation of Licence Conditions to take effect from ....27th AUGUST 1987... is hereby entered upon the Petroleum Register.

SR 27/2/76
27/8/87

MINISTER OF MINES & ENERGY

PETROLEUM ACT, 1940

I, RONALD GEORGE PAYNE, Minister of Mines and Energy in the State of South Australia pursuant to the provisions of the Petroleum Act, 1940 HEREBY VARY THE CONDITIONS of Petroleum Exploration Licence No. 33 of which:

- Median Oil N.L. of 127 Essex St., Wembly W.A. 6014,
- Marvel Petroleum N.L. of 5th Floor, 55 St.George's Terrace Perth W.A. 6000,
- First Australian Resources N.L. of 1st Floor, 28 The Esplanade, Perth W.A. 6000,
- Geometals Oil Exploration Ltd. of 28 The Esplanade, Perth W.A. 6000,
- Heron Petroleum Pty. Ltd. of 9th floor, 220 St George's Terrace, Perth W.A. 6000,
- Monitor Exploration Pty. Ltd. of 9th floor, 220 St. George's Terrace, Perth W.A. 6000,
- Gulf Resources N.L. of 9th Floor, 82 Elizabeth St., Sydney N.S.W. 2000,
- Southern Cross Exploration N.L. of 82 Elizabeth St., Sydney N.S.W. 2000, and
- Antarctic Petroleum Pty. Ltd. of 5th Floor, 55 St George's Terrace, Perth W.A. 6000 are the registered holders, as follows:-

Varied Conditions

The Licensees shall comply with all the conditions specified in Petroleum Exploration Licence No. 33 dated 25/6/85, except that in accordance with section 17(3) of the Petroleum Act, 1940 condition 2 (b) is hereby cancelled and replaced by:

b) in the second year of the term of the licence, the completion of 40 line kilometres of seismic acquisition, processing and interpretation, plus further seismic (to substitute for the previous commitment to drill one stratigraphic hole to 900 metres), such that the estimated minimum expenditure on these exploratory operations shall be $280,000 (two hundred and eighty thousand dollars);

N.B. Field acquisition of the additional seismic to commence by 25/9/87.

SIGNED, SEALED AND DELIVERED by the said MINISTER OF MINES AND ENERGY at ADELAIDE this 27th day of August 1987

MINISTER OF MINES AND ENERGY

THE MINISTER OF MINES AND ENERGY

LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

24 October 1987

The Director - General
South Australian Department of Mines and Energy
P.O. Box 151
EASTWOOD SA 5063

Attn: Mr R. Laws - Director, Oil, Gas and Coal

Re: PEL 33 - NINTH QUARTERLY REPORT
25 JUNE TO 24 SEPTEMBER 1987.

Dear Sirs,

During the ninth quarter, the Denman "B" Seismic Survey was shot using Vibroseis, weight drop and dynamite as trial energy sources. This seismic substitutes (with the Department's consent) for the Year 2 drilling programme which was originally scheduled for June, 1987. Various in-line source and receiver arrays were tested, from five to forty metres in length.

Processing of the Denman "B" Survey data has started at Horizon Exploration Australia Pty. Ltd. in West Perth. The Final Acquisition and Processing reports will be forwarded when completed.

Reprocessing of the original 40km Denman Seismic Survey for refraction information was also under way at Horizon Exploration Pty. Ltd. during the Quarter and subsurface maps using the information from Lines D87-01, 02 and 03 were compiled. The tie line, D87-04, was completed after the end of the Quarter. The refraction information is thought to be reliable as there is great redundancy in the data.

Every eighth shot record was inspected and its first breaks digitized. Travel time plots of the picks were output and the velocities of the three layers and the thicknesses of two layers were calculated.

There is uncertainty about the absolute depth to the deep refractor because of a near-surface low-velocity layer, possibly the Madura Shale. We have however carried our assumed velocities consistently through the area so relative depths should not be in error.

A report containing the final refraction maps will be forwarded in the near future.

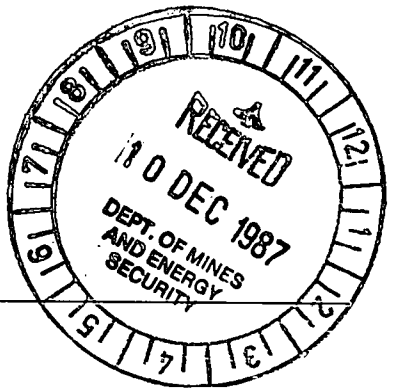
Expenditure for the Quarter is:

Data Review and Overheads	$15,125.00

Sincerely,

David W. Lappi

David W. Lappi
Managing Director



LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telex: AA 197188 (Mulinv) Telephone: (09) 324 1280 Facsi

27/2/76/1

March 16, 1988

The Director General
Department of Mines & Energy
Petroleum Division
PO Box 151
EASTWOOD SA 5063

Attn: Mr. R. Laws - Director, Oil, Gas & Coal Division
Re: PEL 33 - TENTH QUARTERLY REPORT
25 SEPTEMBER 1987 TO 24 DECEMBER 1987

Dear Sirs,

During the tenth quarter, seismic processing continued on both the Denman and Denman "B" Seismic Surveys.

The refraction processing of the Denman (40km) Survey was completed allowed us to produce a depth map at the top Cambrian refractor. The absolute depth of this refractor is uncertain, however, the changes in relative depth throughout the area should be fairly reliable.

The Denman Seismic Survey reflection data was reprocessed by GeoSystems using improved velocity picks with much better (although still poor) results, allowing us to start an interpretation of the reflection data.

The Denman "B" survey data underwent extensive tests to compare the weight-drop, Vibroseis and dynamite sources and differing receiver arrays. It appears that dynamite gave poor results, with weight-drop being selected in the field to do production shooting. Processing centre playbacks of the data indicate that Vibroseis may also be a suitable seismic source for the area. Another result of processing centre tests is that receiver arrays spread over 40 metres appeared to give better data than shorter of longer arrays. The production shooting used five metre groups. None of the sources or receiver arrays gave good results however, and seismic reflection methods will continue to be an expensive geophysical method yielding poor results.

Please find enclosed the following items relating to our exploration in PEL 33:

a) Denman Seismic Survey Final Acquisition and Processing Report
b) Denman Seismic Survey Interpretation Report incorporating Refraction processing and interpretation map
c) Denman Seismic prints Lines D87-01, 02, 03, & 04
d) Denman "B" Seismic Survey Acquisition Report
e) Denman "B" Seismic Survey Quality Control Report
f) Denman "B" Seismic Survey Acquisition Contract
g) Denman "B" Seismic prints Line DB87-05
Final Stack & Tau-P Stack

RECEIVED
21 MAR 1988
DEPT. OF MINES AND ENERGY SECURITY

Expenditure during the quarter is:

Geophysical Studies and Overheads	$15,125.00

Total cumulative expenditure for the permit thus far:

Year 1	$ 73,500.00
Year 2	326,750.00
Year 3 Ninth Quarter	15,125.00
Year 3 Tenth Quarter	15,125.00
	$430,500.00

Sincerely,

David W. Lappi

David W. Lappi
Managing Director

00240

MEMORANDUM

Petroleum Exploration Licence No. 33

A variation of Licence Conditions to take effect from ....24. MARCH..1988..... is hereby entered upon the Petroleum Register.

SR 27/2/76
24/3/88

Ron Payne
MINISTER OF MINES AND ENERGY

THE MINISTER OF MINES AND ENERGY
ADELAIDE

PETROLEUM ACT, 1940

I, RONALD GEORGE PAYNE, Minister of Mines and Energy in the State of South Australia pursuant to the provisions of the Petroleum Act, 1940 HEREBY VARY THE CONDITIIONS of Petroleum Exploration Licence No. 33 of which:

- Median Oil N.L. of 127 Essex St., Wembly W.A. 6014,
- Marvel Petroleum N.L. of 5th Floor, 55 St. George's Terrace, Perth W.A. 6000,
- First Australian Resources N.L. of 1st Floor, 28 The Esplanade, Perth W.A. 6000,
- Geometals Oil Exploration Ltd. of 4th Floor, 28 The Esplanade, Perth W.A. 6000,
- Heron Petroleum Pty. Ltd. of 9th Floor, 220 St. George's Terrace, Perth W.A. 6000,
- Monitor Exploration Pty. Ltd. of 9th Floor, 220 St. George's Terrace, Perth W.A. 6000,
- Gulf Resources N.L. of 9th Floor, 82 Elizabeth St., Sydney N.S.W. 2000,
- Southern Cross Exploration N.L. of 82 Elizabeth St., Sydney N.S.W. 2000, and
- Antarctic Petroleum Pty. Ltd. of 5th Floor, 55 St. George's Terrace, Perth W.A. 6000 are the registered holders, as follows:-

Varied Conditions

The Licensees shall comply with all the conditions specified in Petroleum Exploration Licence No. 33 dated 25/6/85, except that in accordance with section 17(3) of the Petroleum Act, 1940 condition 2 (c) is hereby cancelled and replaced by:

b) in the third year of the term of the licence, a minimum of 2500 metres of drilling involving up to fourteen shallow wells, such that the estimated minimum expenditure on these exploratory operations shall be $400,000 (Four hundred thousand dollars);

N.B. Drilling of the first of the fourteen shallow wells to commence by 24/6/88.

SIGNED, SEALED AND DELIVERED
by the said MINISTER OF MINES
AND ENERGY at ADELAIDE this
24. day of ...MARCH....1988

MINISTER OF MINES AND ENERGY



LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telex: AA 197188 (Mulinv) Telephone: (09) 324 1280 Facsimile: (09) 322 1219

April 24, 1988

The Director General
Department of Mines and Energy
Oil, Gas and Coal Division
P.O. Box 151
EASTWOOD SA 5063

Attn: Mr. R. Laws - Director, Oil, Gas and Coal Division
Re: PEL 33 - ELEVENTH QUARTERLY REPORT
25 DECEMBER, 1987 TO 24 MARCH, 1988

Dear Sirs,

During the Eleventh Quarter, the Joint Venture decided to drill a series of exploration wells on targets delineated by satellite remote sensing, air photos, aeromagnetics, radiometrics, and reflection and refraction seismic surveys.

Application to SADME to substitute drilling for seismic was made and granted during the quarter. Application to drill up to eight exploration wells was made in March, 1988. Drilling contractors were contacted to locate a suitable drilling rig. The high level of activity among drillers caused delays in locating a suitable (available) drilling rig.

A number of suitable rigs have been located and negotiations with the drilling contractors are proceeding.

The expenditure during the Quarter is:

Data Review, Overheads and Contractor Selection	$ 15,125.00

Total Cumulative Expenditure for the Permit is:

Year 1	$ 73,500.00
Year 2	326,750.00
Year 3 Ninth Quarter	15,125.00
Year 3 Tenth Quarter	15,125.00
Year 3 Eleventh Quarter	15,125.00
	$ 445,625.00

Sincerely,

David W. Lappi

David W. Lappi
Managing Director

LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telex: AA 197188 (Mulinv) Telephone: (09) 324 1280 Facsimile: (09) 322 1219

June 21, 1988

The Director General
Department of Mines & Energy
PO Box 151
EASTWOOD SA 5063

Attn: Mr. R. Laws - Director, Oil Gas & Coal Division
Re: APPLICATION FOR EXTENSION TO COMPLETE PERMIT YEAR 3 COMMITMENTS - PEL 33

Dear Bob,

The PEL 33 Joint Venture respectfully requests an extension of time to commence the current Permit Year remaining commitment, the 1988 Denman Multi-Well Exploration Drilling Programme.

Difficulties in obtaining a drilling rig appropriate for this shallow, multi-well drilling with the right "availability window" have led to this application.

We request that the commencement date for the drilling be extended from June 24, 1988 to August 1, 1988, which should give us ample time to moblilize and commence the drilling we are contemplating.

Sincerely,

David W. Lappi

David W. Lappi
Managing Director
for and on behalf of the PEL 33 Joint Venture

LAPP Resource Consultants Pty. Ltd.

127 Essex Street,
Wembley, Western Australia 6014
Australia

Telex: AA 197188 (Mulinv) Telephone: (09) 324 1280 Facsimile: (09) 322 1219

June 23, 1988

The Director General
Department of Mines and Energy
Oil, Gas and Coal Division
P.O. Box 151
EASTWOOD SA 5063

Attn: Mr. R. Laws - Director, Oil, Gas and Coal Division
Re: PEL 33 - THIRD ANNUAL REPORT
25 MARCH, 1988 TO 24 JUNE, 1988

Dear Sirs,

During the Twelveth Quarter, preparations were made to drill up to eight exploration wells in the Permit.

The Joint Venture obtained permits to occupy Australian National Railway land at Denman. SADME obtained the required clearances for drilling from the Department of Environment and complied with requirements of the Aboriginal Heritage Act, 1988 on behalf of the Joint Venture. This drilling programme is the first programme in South Australia to come under the new Aboriginal Heritage Act, 1988. SADME's assistance in these matters is very much appreciated.

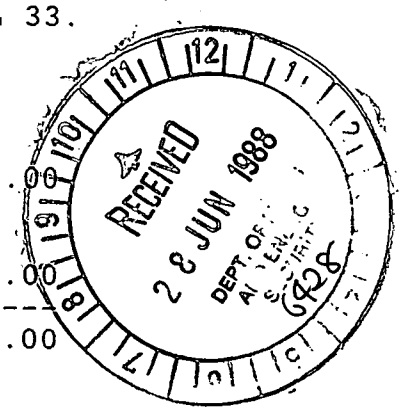
Drilling contractors quoted on suitable drilling rigs for the drilling programme. The high level of activity among drillers caused delays in locating a suitable (available) drilling rig, however All Terrain Drilling in association with Colby Drilling Company have finally been selected to drill the wells.

All Terrain's Mayhew 1000 rig equipped with a Mayhew 2000 rotary table and suitable BOPs/diverters will be used for the field work with logistics and back-up support supplied by Colby Drilling Company's Perth offices. The rig and associated equipment remains subject to SADME approval.

An application to delay the start of the drilling programme to the end of July was made in June to allow time for the rig to complete its current drilling and mobilize to PEL 33.

The expenditure during the Quarter is:

Data Review, Overheads and Contractor Selection	$ 15,500.00
1988 Denman Drilling Project (Estimated Cost)	175,000.00
	$ 190,500.00



Total Cumulative Expenditure for the Permit is:

Year 1			$ 73,500.00
Year 2			326,750.00
Year 3	1st Qtr	$ 15,125	
	2nd Qtr	15,125	
	3rd Qtr	15,125	
	4th Qtr	190,500	

			235,875.00

		TOTAL:	$ 636,625.00

Sincerely,

David W. Lappi

David W. Lappi
Managing Director

FAXED 1/9/88

LAPP Resource Consultants Pty. Ltd.

127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

00247

August 30, 1988

The Director-General
Department of Mines & Energy
191 Greenhill Road
PARKSIDE SA 5063

Attn: Mr. R.A. Laws - Director Your Ref: SR 27/2/76 Vol 2 RAF:AM
Re: PEL 33 Year 3 Extension

Dear Sirs,

Thank you for your letter of August 19, 1988 reminding me of the need to apply for a further extension of Year 3.

I apologize for not doing so earlier, however I have been in constant contact with various members of your department advising them of the progress of our preparations to drill. I now realize that I should have been routing most correspondence through The Director-General.

The Operator, LRC has signed a drilling contract on August 18, 1988 with Fletcher Drilling Services Pty. Ltd. on behalf of the PEL 33 JV for drilling to commence no later than September 15, 1988. This follows our long and detailed discussions with two other contractors, who for various reasons, were unable to sign drilling contracts with us at the last minute.

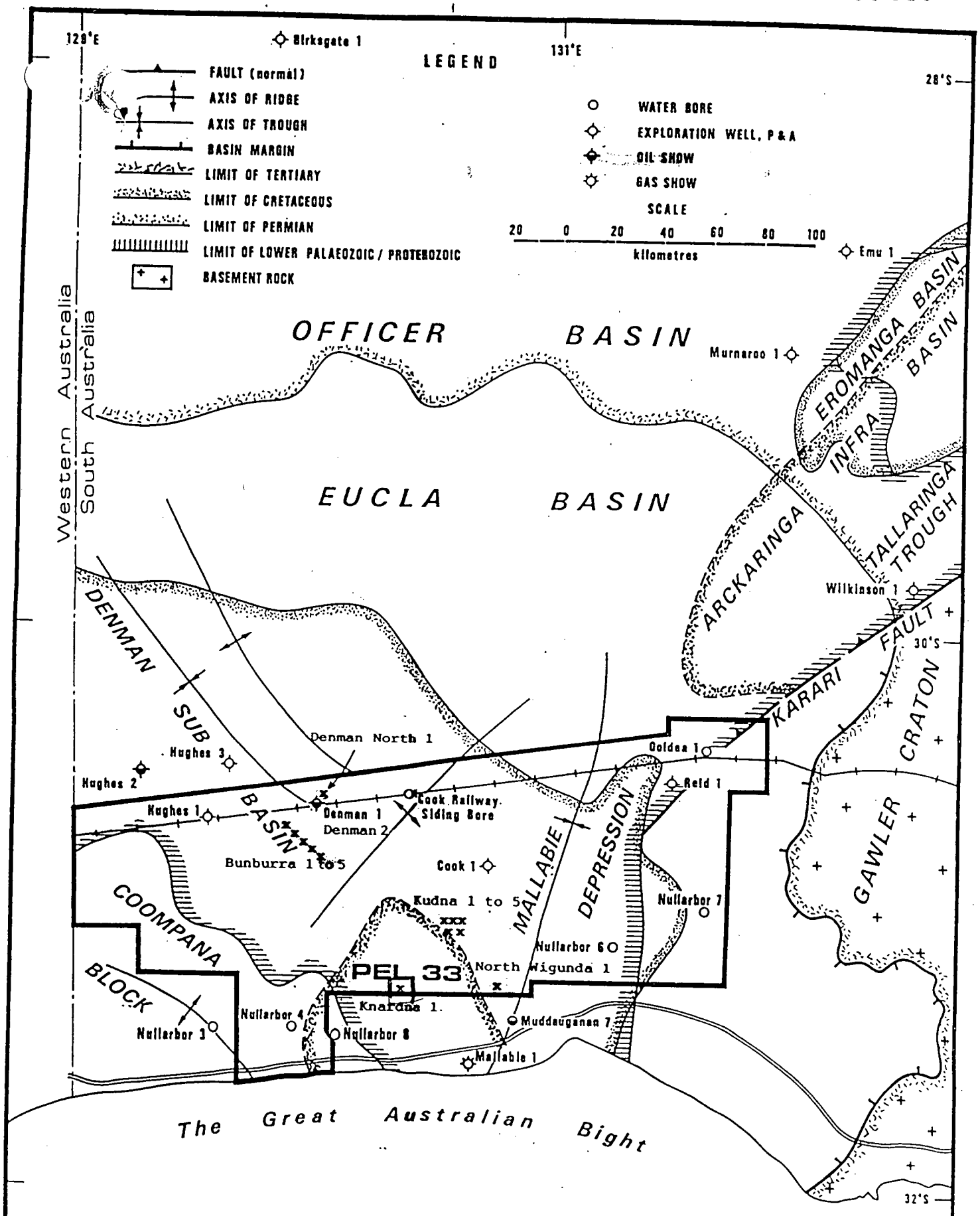
Details of the contractor, rig and equipment have been previously forwarded to Mr. Richard Hancock on 19/8/88 along with the advice that we had signed a contract with Fletcher Drilling. Fletcher operate a Gardener-Denver 2500 rig which is conventional rig mounted on a highly mobile trailer well-suited to drilling the wells in our programme.

I drove to PEL 33 last week to assess the logistics, access, and stake the well locations. All the proposed wells are easily accessible on existing roads and tracks except for Knardna 1, which proved to be difficult to locate on the ground. Our 1978 air photos showed a track leading from the Cook road westward along the northern boundary of the Nullarbor National Park, however on the ground in 1988 the track proved impossible to locate, at least from the Cook road. Since access to this site is difficult, the Joint Venture will concentrate its efforts on the other wells in the proposed programme and leave Knardna 1 for drilling in another programme.

Sincerely,

David W. Lappi

David W. Lappi
Managing Director



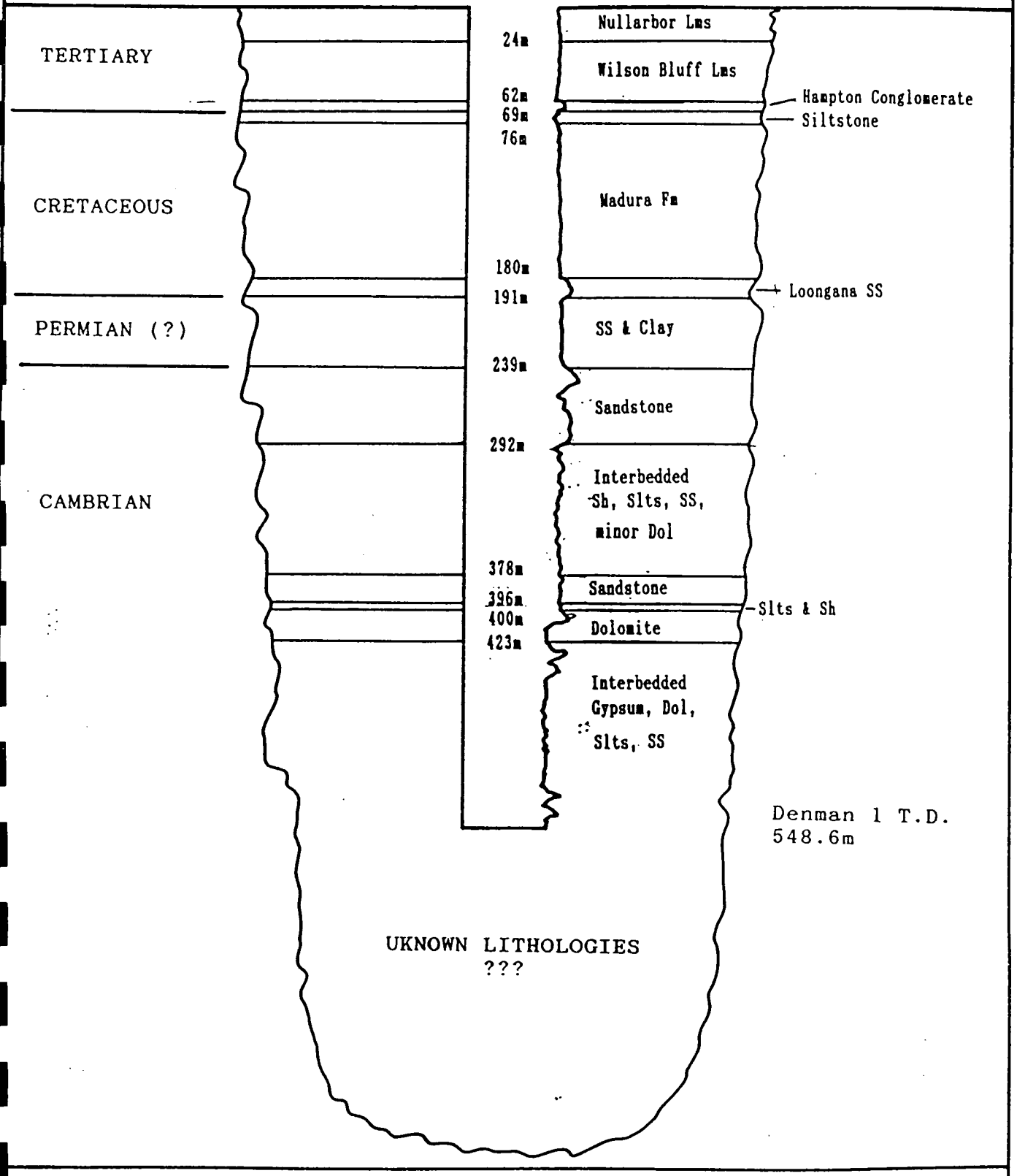
TECTONIC ELEMENTS

PEL 33 - EUCLA/OFFICER BASINS

SOUTH AUSTRALIA

This map was prepared by J.K. Geary Pty Ltd

LAPP Resource Consultants Pty. Ltd.
March, 1987



DENMAN 2 PREDICTED SECTION

Figure 2

00250

LAPP Resource Consultants Pty. Ltd.

127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

September 27, 1988

The Director General
Department of Mines and Energy
Oil, Gas and Coal Division
P.O. Box 151
EASTWOOD SA 5063

Attn: Mr. R. Laws - Director, Oil, Gas and Coal Division
Re: PEL 33 - Extension to Complete Year 3 Commitments.

Dear Sirs,

The PEL 33 Joint Venture hereby applies for an extension of time to commence completion of the Year 3 work commitments, which consists of drilling a number of wildcat exploration wells.

The extension of time to commence the drilling is requested to October 1, 1988. The earlier extension which we requested was granted to August 1, 1988. Delays to the programme were initially caused by the lack of a suitable rig and by the last-minute withdrawal of two of the contractors who had been previously selected to do the drilling.

The drilling contractor (Fletcher Drilling Services Pty. Ltd.) is now on site and is preparing to spud the first well, Denman North 1, which should be spudded by Friday, 30/9/88 at the latest.

Sincerely,

David W. Lappi

David W. Lappi
Managing Director



LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

December 7, 1988

The Director General
Department of Mines and Energy
Oil, Gas and Coal Division
P.O. Box 151
EASTWOOD SA 5063

Attn: Mr. R. Laws - Director, Oil, Gas and Coal Division
Re: PEL 33 - Future Programme

Dear Sirs,

Enclosed is a letter of today's date which I have sent the PEL 33 Joint Venture.

Given the withdrawal of the majority of the participants, I do not believe that the remaining parties will vote to continue on their own. Farmin partners are unlikely to be forthcoming.

I am reluctantly recommending that the Joint Venture surrender the Permit.

Please forward the appropriate forms to effect the surrender.

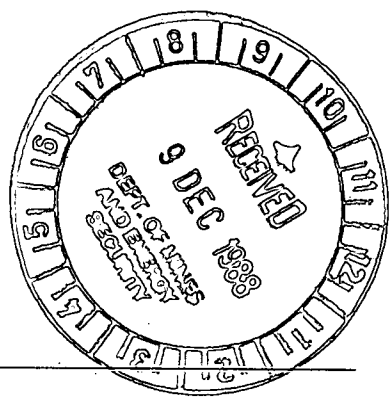
Sincerely,

David W. Lappi

David W. Lappi
Managing Director

JH → GH for response telling him how he can surrender PEL 33.

Rec'd GH 30/12/88.



LAPP Resource Consultants Pty. Ltd.
127 Essex Street,
Wembley, Western Australia 6014
Australia
Telephone: (09) 387 7327

December 7, 1988

Antarctic Petroleum Pty. Ltd.
& Marvel Petroleum N.L.
76 Thomas Street
WEST PERTH WA 6005

Attn: Mr. S. L. Thomas

Gulf Resources N.L.
8th Floor
143 Queen Street
MELBOURNE VIC 3000

Attn: Mr. N. Morris

Monitor Exploration P/L,
Garda P/L & Heron Petroleum P/L
9th Floor
220 St. George's Terrace
PERTH WA 6000

Attn: Mr. T. Ellyard

Oil Venturers Pty. Ltd.
C/- Nelson Wheeler
Ground Floor
28 The Esplanade
PERTH WA 6000

Attn: Mr. K. Lynne

First Australian Resources NL
19th Floor
221 St. George's Terrace
PERTH WA 6000

Attn: Mr. D. Jendry

Mr. Alan Burns &
Treenbrook Pty. Ltd.
4th Floor
160 St. George's Terrace
PERTH WA 6000

Mr. Derek R. Gascoine
239 St. George's Terrace
PERTH WA 6000

Geometals Oil Ex. Ltd.
4th Floor
28 The Esplanade
PERTH WA 6000

Attn: Mr. J.T. Kopcheff

Southern Cross Ex.
9th Floor
82 Elizabeth Street
SYDNEY NSW 200

Attn: Mr. B. Ganke

Re: Status of PEL 33

Dear Partner,

Since my last letter to the JV on November 14, 1988, Geometals Oil Exploration N.L. has also voted to withdraw.

Oil Venturers has today informed me by phone that they will probably be withdrawing from the permit.

The remaining parties in the Permit are:

Gascoine, D.R.	2.5%	(?)
Gulf Resources	5.0	
Southern Cross	5.0	
	12.5%	

Previous discussions with Gulf Resources N.L. indicate that they would be prepared to continue with the "Taipan farmout option" on a limited, one-well basis if the other remaining parties also chose to continue.

Taipan Petroleum Pty. Ltd. are not able to offer farmin drilling on a "turnkey" rate on a one-well basis. They propose drilling on a daily rate of $2,000 per day (includes fuel, normal bit wear and labour) on a one-well basis. Fully-cored diamond drill holes to the Loongana Sandstone are expected to take seven days to drill to 100 metres, case and drill to TD. Mob and demob are also at the rate of $2,000 per day, with total mob and demob costs being $8,000 from Perth to PEL 33 and back via road. Cement, casing, drilling mud, water, wireline logging, and geological supervision will all be at cost (expected to be about $15,000 per well).

The Year 3 commitment which remains to be fulfilled is 2,500 metres of drilling with pro-rata relinquishments for drilling less than the 2,500 metres. The Year 4 commitment is two 1,000 metre wells. We are now approximately half way through Year 4.

Given the above withdrawals, and the significant exploration expenditure required to keep the permit in good standing, the Operator recommends that the Permit be surrendered.

I will be forwarding the appropriate surrender documents to you in the near future for your signature under company seal. If any of the remaining parties wish to continue with the Permit instead of surrendering it, please contact me as soon as possible.

Yours faithfully,

David W. Lappi

David W. Lappi
Managing Director

00254

F00031

MEMORANDUM

This memorandum will confirm that on 18 APRIL 1989, I approved the cancellation of PEL 33 for failure to fulfil the third year licence work commitments.

The cancellation is effective immediately.

This memorandum is hereby entered on the Petroleum Register.

MINISTER OF MINES & ENERGY

18/4/89
GRH:LT