DEPARTMENT OF MINES AND ENERGY

SOUTH AUSTRALIA

OPEN FILE ENVELOPE SERIES

CONTENTS ENVELOPE 465

TENEMENT: Not Related.

TENEMENT HOLDER: Delhi Australian Petroleum Ltd.

Envelope 465

003

STRZELECKI CREEK

HELICOPTER GRAVITY SURVEY

SOUTH AUSTRALIA

FOR

DELHI AUSTRALIAN PETROLEUM LTD.

PRELIMINARY REPORT

WONGELA GEOPHYSICAL PTY. LTD.
BRISBANE.
1965.

PREFACE

This preliminary report presents the results of the Strzelecki Creek Helicopter Gravity Survey carried out in 1964 for Delhi Australian Petroleum Ltd. by Wongela Geophysical Pty. Ltd.

These results will be combined with those of the Lake Gregory Helicopter Gravity Survey, currently in progress in an adjoining area. A comprehensive report covering both surveys and describing the operational procedures used will be submitted at a later date.

G. F. Lonsdale.

March, 1965.

CONTENTS

Appendices

Plates

ABSTRACT

In December 1964 Wongela Geophysical Pty. Ltd. conducted a helicopter gravity survey for Delhi Australian Petroleum Ltd. The survey is in their South Australian Oil Exploration Licence areas Nos. 20 and 21, and is located south and west of Dullingari No. 1 well.

Preliminary results of this survey indicate the presence of a large gravity low trending south-west across the survey area and flanked by gravity high areas. The northern gravity high area is fairly narrow and is bounded to the north by an apparently extensive gravity low. The two gravity low areas are tentatively considered to reflect areas of thick pre-Permian sedimentation.

1. INTRODUCTION

In the period 19th to 25th December, 1964, Wongela Geophysical Pty. Ltd. established 340 new gravity stations for Delhi Australian Petroleum Ltd. The area surveyed is in South Australia Oil Exploration Licences Nos. 20 and 21, and covers 2,500 square miles south and west of Dullingari No. 1 well. (Plate 1). Gravity stations were established on a four-mile rectangular grid, using a helicopter for transport.

The survey area lies in the south-western portion of the Great Artesian Basin. Most of the area is covered by north-easterly aligned sand dunes with a few exposures of Upper Cretaceous sediments such as those in the core of the Innamincka Dome to the north-east of the survey area.

The object of the gravity survey was to delineate the regional geological structure of the area; in particular, to locate large anticlinal structures which might provide hydrocarbon traps.

2. GEOLOGY

The Strzelecki Creek gravity survey area lies in the south-western portion of the Great Artesian Basin. Surface rocks include a few exposures of Upper Cretaceous Winton Formation sediments in the cores of the larger surface-expressed anticlines such as the Innamincka Dome. The area lies on the extreme south-east margin of the Simpson Desert and is covered mainly by sand dunes.

Bore hole data in Oil Exploration Licence areas Nos. 20 and 21 indicate a total Cretaceous and Jurassic thickness in the survey area of about 6,000 feet. The Triassic was penetrated in both the Innamincka No. 1 and Dullingari No. 1 wells, to the north-east of the survey area, and is expected to be present over much of the area. Permian sediments were found in both wells but those encountered in Dullingari No. 1 are much thicker than those in Innamincka No. 1. It appears that the

thinning at Innamincka No. 1 is the result of non deposition and/or erosion of the lower part of the section. In each well the Permian rests on a major angular unconformity. In Innamincka No. 1 the rocks below the unconformity are red-bed sandstones and shales probably of Devonian to Carboniferous age, whereas those below the unconformity in Dullingari No. 1 are Ordovician shales. These latter sediments are of major importance as potential hydrocarbon source rocks.

A number of large anticlinal structures are known in this area. Several of these structures have been investigated by seismic work and drilling, e.g. Innamincka, Betoota. It is possible that additional anticlinal structures are present in this portion of the Great Artesian Basin. These structures may provide suitable hydrocarbon traps.

3. PREVIOUS GEOPHYSICAL WORK

Gravity Surveys -

Limited regional gravity surveys have been carried out in the survey area by Frome-Broken Hill Pty. Ltd. and the South Australian Mines Department. The results of these surveys indicate the presence of a broad gravity low trending south-west across the survey area and flanked by gravity high areas.

During 1964, United Geophysical Corporation observed gravity at seismic shot points established during the Coopers Creek seismic survey in the area immediately north of the subject survey area. The preliminary results of this gravity survey indicate the presence of a large south-west trending gravity low flanked by gravity high features, the southernmost of which lies along the northern margin of the subject survey area.

A reconnaissance gravity survey using helicopters was carried out in 1962 by the Bureau of Mineral Resources, in conjunction with the Division of National Mapping, in the area immediately east of the subject survey. The results of this survey have not been published although a report is in preparation. (Barlow, 1965).

Seismic Surveys -

Several seismic surveys carried out nearby extend into the area.

The Diamantina River - McGregor Range seismic survey was carried out in 1963 for Delhi Australian Petroleum Ltd. by United Geophysical Corporation in the area north of the subject survey area. The survey delineated a south-westerly trending structural high on the northern margin of the subject area, flanked to the north by an area of thick pre-Permian sedimentation. These sediments have been equated with Cambrian sediments penetrated in the Gidgealpa No. 1 well.

Further work was carried out by United Geophysical Corporation in this area during 1964 (the Coopers Creek seismic survey). The results of this survey are not yet available.

Aeromagnetic Surveys -

Aero Service Limited flew an aeromagnetic survey for Delhi Australian Petroleum Ltd. in 1961-62. This survey covered that portion of the Great Artesian Basin in north-eastern South Australia (Delhi Australian Petroleum Ltd., 1962). The results of this survey were later reinterpretated by the Compagnie Générale de Géophysique (Delhi Australian Petroleum Ltd., 1963).

The results of this survey indicate the presence of a structurally high area extending south-westwards from Innamincka No. 1 to beyond Gidgealpa No. 1. Further to the south a number of generally north trending structural highs were indicated within the subject survey area.

4. DISCUSSION OF THE GRAVITY RESULTS

Preliminary gravity results are shown in the form of Bouguer anomalies on Plate 2, drawn on a scale of 1:253,440 and computed using a near surface rock density of 1.9 g/cm^3. Observed gravity values are based on the value of the BMR isogal survey station at Innamincka.

Final positions of the gravity stations have not yet been determined, pending the production of photocentre compilations for the area. Once these compilations are available it will be possible to plot the final station positions and hence determine final Bouguer anomalies.

Within the survey area the preliminary Bouguer anomalies are entirely negative and range from a minimum value of -38.4 mgal at station 9038 to a maximum value of -0.4 mgal at station 278.

The principal gravity feature delineated by the survey is an elongate south-west trending gravity low, the Tenappera Gravity Low (Barlow, 1965) which is flanked by a narrow gravity high, the Murteree Gravity Ridge, to the north and an extensive gravity high, the Naryilco Gravity Terrace (Barlow, 1965) to the south.

In the north-west of the survey area the Murteree Gravity Ridge is flanked by a gravity low region, the Nappermerrie Gravity Depression.

In the extreme south-west of the survey area is a west elongated gravity low, the Lake Blanche Gravity Low, which is a westerly extension of the Tenappera Gravity Low.

5. INTERPRETATION OF THE GRAVITY RESULTS

Pending the completion of the Lake Gregory Gravity Survey and the calculation of final Bouguer anomalies for this survey it is not possible to present a quantitative analysis of the gravity results. The following remarks thus constitute a general qualitative appraisal of the results of the survey.

Within the western area of the Great Artesian Basin and the eastern portion of the Amadeus Basin there appears, in general, to be good agreement between gravity features and known geological structure (Langron, 1962; Lonsdale and Flavelle, 1963; Ingall and Lonsdale, 1964; Gibb, 1965).

If this agreement is applicable also in the survey area, then it can be suggested that the Tenappera Gravity Low reflects an extensive area of thick sedimentation flanked by a platform-like area of thinner sedimentary section to the north which produces the Murteree Gravity Ridge and flanked to the south by an area of thin sedimentary section which produces the Naryilco Gravity Terrace. The sediments postulated to produce the Tenappera Gravity Low appear to extend to the west where they produce the Lake Blanche Gravity Low. The platform-like structural area postulated to give rise to the Murteree Gravity Ridge is bounded to the north by an apparent area of increasing sedimentary section which produces the Nappermerrie Gravity Depression.

It is tentatively suggested that the sediments postulated to give rise to the Nappermerrie Gravity Depression may, in part, be of Devonian - Carboniferous age, similar to those encountered in the Innamincka No. 1 well and/or Lower Palaeozoic sediments such as the Cambrian sediments encountered in the Gidgealpa wells. Similarly it is suggested that the sediments postulated to produce the Tenappera Gravity Low may, in part, be of Ordovician age, similar to the sediments of this age encountered in the Dullingari No. 1 and Orientos No. 1 wells.

6. CONCLUSIONS

The preliminary results of the Strzelecki Creek helicopter gravity survey indicate the presence of a large gravity low, the Tenappera Gravity Low, trending south-west across the survey area and bounded to the north and south by gravity high areas. The gravity high area to the north is fairly narrow and separates the Tenappera Gravity Low from the Nappermerrie Gravity Depression, an extensive gravity low developing to the north of the survey area.

The Tenappera Gravity Low and the Nappermerrie Gravity Depression are considered tentatively to reflect areas of thick pre-Permian sedimentation, and it is suggested from well data that these sediments may be in part of Ordovician age and of Devonian - Carboniferous and Cambrian age respectively.

There is evidence of an extension of the Tenappera Gravity Low towards the west.

G. F. Lonsdale

(G. F. Lonsdale)

L. N. Ingall

(L. N. Ingall)

7. REFERENCES

Barlow, B.C. 1965 1962 Experimental heighting and gravity survey of S.W. Queensland. Bur. Min. Resour. Aust. Rec. (in preparation)

Delhi Australian Petroleum Ltd. 1962 Interpretation of airborne magnetometer survey in South Australia. Aero Service Corp. Rep. (unpublished)*

1963 Re-interpretation de L'étude aéromagnétique exécutée dans le "Great Artesian Basin". Compagnie Générale de Géophysique Rep. (unpublished)

1964 Coopers Creek seismic and gravity survey 1964. United Geophysical Corp. Rep. (in preparation)

Gibb, R.A. 1965 Reconnaissance gravity surveys S.W. Queensland, 1957-61. Bur. Min. Resour. Aust. Rec. (in preparation)

Ingall, L.N. and Lonsdale, G.F. 1964 Dalhousie helicopter gravity survey, South Australia for French Petroleum Company (Aust.) Pty. Ltd. Wongela Geophysical Pty. Ltd. Rep. (unpublished)*

Langron, W. J. 1962 Amadeus Basin reconnaissance gravity survey using helicopters, Northern Territory, 1961. Bur. Min. Resour. Aust. Rec. 1962/24.

Lonsdale, G.F. and Flavelle, A.J. 1963 Amadeus Basin and South Canning Basin reconnaissance gravity survey using helicopters, Northern Territory and Western Australia, 1962. Bur. Min. Resour. Aust. Rec. 1963/152.

Patch, J.R. 1963 Diamantina River - McGregor Range seismic survey for Delhi Australian Petroleum Ltd. United Geophysical Corp. Rep. (unpublished)*

* This report will be issued as a Petroleum Search Subsidy Act publication.

APPENDIX A

Party Personnel

Wongela Geophysical Pty. Ltd.:

Supervisor	L. N. Ingall
Party Leader	G. F. Lonsdale
Party Manager	M. Brulhart
Observer	J. Almekinders
Computer	T. A. Magub
Helper	J. Harkins

Rotor-Work Pty. Limited:

Pilots	J. T. Ferguson
	H. G. M. Grieve
Engineer	J. P. Hilferty

APPENDIX B

Equipment

Geophysical Equipment:-

Gravity Meter - Worden No. 581

Calibration details are -

29-11-64 Brisbane BMR Calibration Range - 0.09720 mgal./sc.div.
5- 1-65 Brisbane BMR Calibration Range - 0.09718 mgal./sc.div.

Microbarometers - Mechanisms Ltd.

Serial Nos. 62/506, 62/507 and 62/508, calibrated in millimetres of mercury.

Vehicles:-

Two long wheel base Land Rovers
One long wheel base Toyota Land Cruiser

Helicopter:- (Rotor-Work Pty. Limited)

Bell 47G3B1 - VH-AHG.

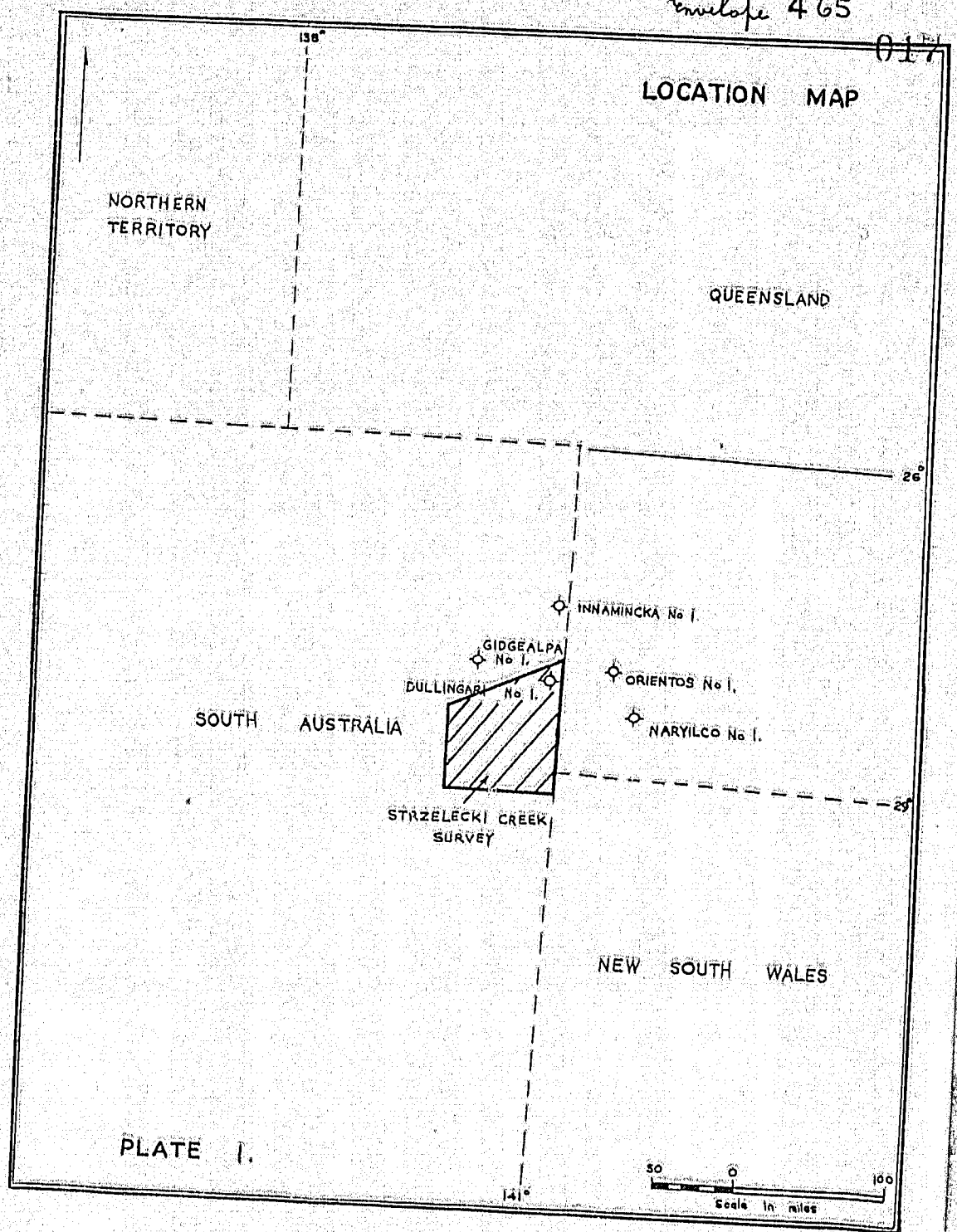
APPENDIX C

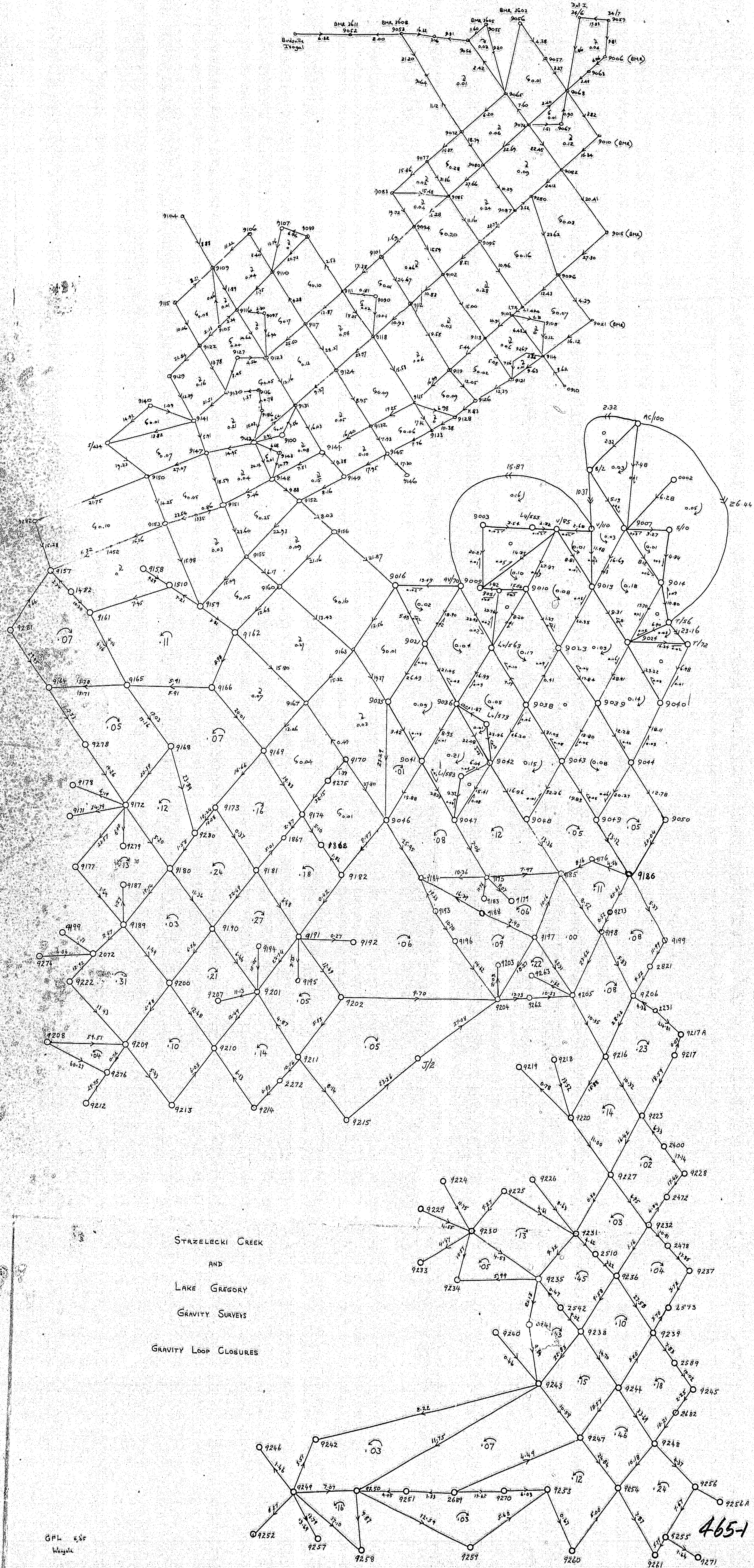
Survey Statistics

Survey commenced	19th December, 1964
Survey completed	25th December, 1964
Duration of survey	7 days
Operational days	7
Days lost	Nil
Chargeable new readings	352
Ties to existing surveys	12

Envelope 465

017





STRZELECKI CREEK

AND

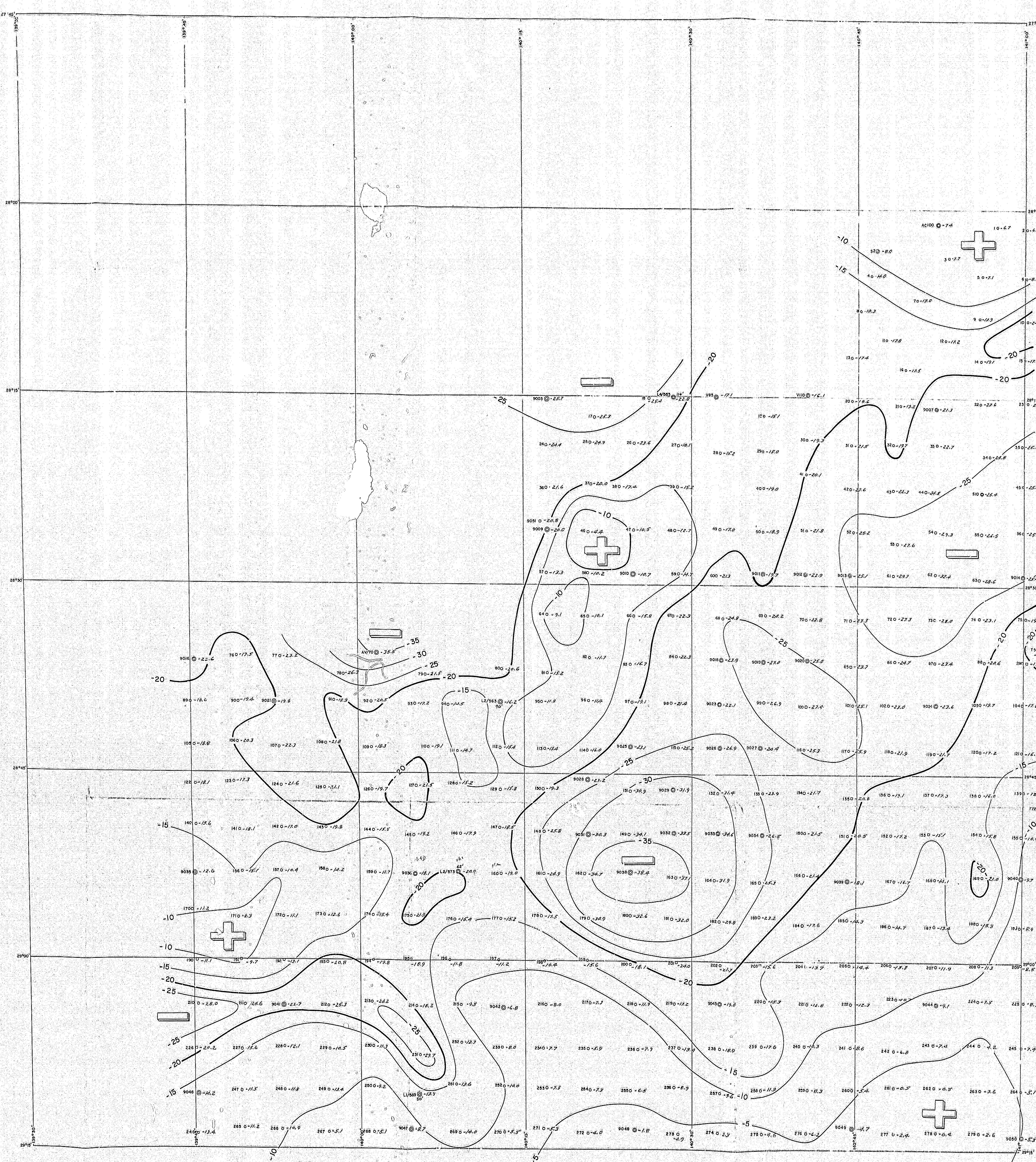
LAKE GREGORY

GRAVITY SURVEYS

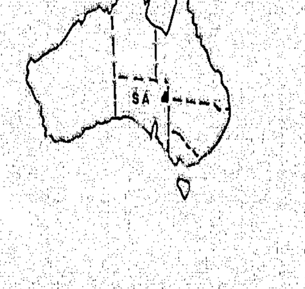
GRAVITY LOOP CLOSURES

GFL 6,65
Wangala

4651



LOCATION



GASON	INNAMINCKA	DURHAM DOWNS
KOPPERAMANNA	STRZELECKI	TICKALARA
MARREE	CALLABONA	MILPARINKA

LEGEND

GRAVITY

- Gravity Station
- -2.4 Relative Bouguer Anomaly (milligals)
- 734.0 Elevation
- ◎ Gravity Station Permanently Marked
- Isogals
- ✚ High Anomaly
- ▭ Low Anomaly

EXPLANATION

Bouguer anomalies calculated using an average rock density of 1.9 g/cm³

Elevation datum: L.W.O.S.T. Pt. Augusta = 2011.

STRZELECKI CREEK
HELICOPTER GRAVITY SURVEY
FOR
DELHI AUSTRALIAN PETROLEUM LTD.

PRELIMINARY BOUGUER ANOMALIES

SCALE OF MILES

4 0 4 8 12

PLATE 2.

WONGELA GEOPHYSICAL PTY LTD

Envelope 465

465-2