DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 82/40

NORTHERN ST. VINCENT BASIN GRAVITY SURVEY 1981/2

GEOLOGICAL SURVEY

by

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DME.EL.782

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DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept.Bk.No. 82/40
DME. No. EL 782
Disk No. 33

NORTHERN ST. VINCENT BASIN GRAVITY SURVEY 1981/2

ABSTRACT

Problems associated with the mining and combustion of coal from the Bowmans deposit have led to the search for a viable alternative. One potential area lies to the north of the Bowmans and Whitwarta deposits in the Northern St. Vincent Basin. A gravity survey was designed to outline pre-Tertiary basement topography as a guide to locating exploration drillholes. The gravity survey indicates several areas of low residual gravity probably due to a greater thickness of sediments which are possibly coal bearing.

INTRODUCTION

In March 1981 two short gravity traverses were read to test the suitability of the gravity method in defining pre-Tertiary basement topography. Results from these traverses showed good correlation between the gravity response and the drilling information. Because of this the Electricity Trust of South Australia (ETSA) requested a gravity survey over prospective coal bearing areas in Exploration Lease 782 (Fig. 1). This was carried out between August and December, 1981.

Brown coal had been discovered in the Northern St. Vincent Basin during the course of drilling for water in the early part of the century. Except for the Bowmans, Clinton and Whitwarta areas, which have extensive drillhole information, little is known about the extent and quality of coal in the surrounding regions.

The Bowmans coal deposit contains high amounts of sodium (average Na/Ash 0.12-0.16) which presents problems of boiler fouling, while the high sulphur content (average 3-5%) may cause pollution problems (Meyer, 1976). The aim of this survey was to discover other deposits in the Northern St. Vincent Basin with a lower impurity content.

The Bouguer gravity contours show a strong gravity gradient with values decreasing to the east, probably resulting from a deep-seated change of density within the earth's crust. This gradient has the effect of masking variations due to near-surface features such as coal basins. A regional gravity gradient had to be evaluated and subtracted from the Bouguer gravity before an interpretation based on residual values could be arrived at.

SURVEY PROCEDURE

1. Surveying

Stations were pegged by the Electricity Trust of South Australia Survey Branch commencing in June 1981 and ending in November 1981.

The area of investigation includes extensive grain-producing properties, so an irregular grid was chosen to minimise damage to planted paddocks. Roads and fence lines running east-west and approximately one kilometre apart were chosen for the traverses and were pegged at approximately 500 m intervals. Pegs were levelled by theodolite and tied to Department of Lands Bench Marks. Aerial photo mosaics at a scale of 1:50 000 were supplied by ETSA to the South Australian Department of Mines and Energy for station location purposes. Five areas were surveyed with pegs labelled as follows:

AREA	ETSA PREFIX	SADME GRAVITY FILE	NO. OF STATIONS
AVON	A	81E2 - 0000	396
BALAKLAVA	B	81E2 - 1000	508
BLYTH	C	81E2 - 2000	667
LOCHIEL	L	81E2 - 3000	148
BRINKWORTH	E	81E2 - 4000	311
See locality plan Fig. 1			TOTAL 2030

2. Gravity

(a) Instrument Used

A La Coste and Romberg Gravity Meter serial number 212 with a calibration factor of 1.058 milligals per division was used throughout this survey. This calibration factor is based on the ADELAIDE gravity stations 6091.0108 and 6091.0208. The claimed repeat accuracy for this meter in field conditions is ±0.01 milligals.

(b) Field Procedure

Gravity readings were taken at each of the surveyed stations. Repeat readings were taken after 1-1.5 hours to determine drifts which were generally small (<0.05 milligals). Readings at points between repeated stations were then adjusted assuming linear drift. Stations repeated for drift control purposes were used to construct a network tie diagram and errors around closed loops were reduced using the least mean squares method described by A.E. Smith 1951.

DATA REDUCTION AND INTERPRETATION

All gravity values, elevations and positional data were processed by a Tektronix 4051 micro-computer and Bouguer anomaly values were derived for a range of densities. Values calculated for 2.67 tonnes/m^3 were plotted at mapped station locations by the Government Data Processing Centre's Calcomp plotter. Because of the low relief no terrain corrections were made.

In order to remove the strong gravity gradient a regional gravity surface was calculated, using known depths to basement from drilling and outcrop information. These depths were each divided by 30 (this factor is related to the mass deficiency due to unconsolidated sediments beneath the observation point, assuming an infinite area of extent. In practice 30 metres of unconsolidated material with a difference in density to the basement of 0.79 tonnes per m^3 causes an anomaly of one milligal) and the resultant number was added to the Bouguer gravity value for that point. These values were then contoured to show a regional gravity surface, which was used to obtain estimated regional values at all gravity station locations. The estimated regional values were then subtracted from the Bouguer values giving residual gravity values, which were plotted and contoured.

RESULTS

Bouguer gravity and residual gravity plans, which have been previously described, are presented in Figures 2 and 3. Examination of the residual gravity map shows numerous sites meriting investigation. Areas of lower residual gravity were selected as areas with probable greater thickness of unconsolidated sediments which are possibly coal bearing.

The accuracy of the residual gravity map in defining pre-tertiary basement topography is dependent on the drill hole information available when constructing the regional gravity surface. As more drilling results become available through the Electricity Trust exploration programme more precise estimates of depth to basement will be possible.

ACKNOWLEDGEMENTS

I thank B.E. Milton and D. McPharlin of the South Australian Department of Mines and Energy for their assistance in all aspects of this project. I also thank A. Muir of the Electricity Trust Coal Resources Branch for information and assistance provided.

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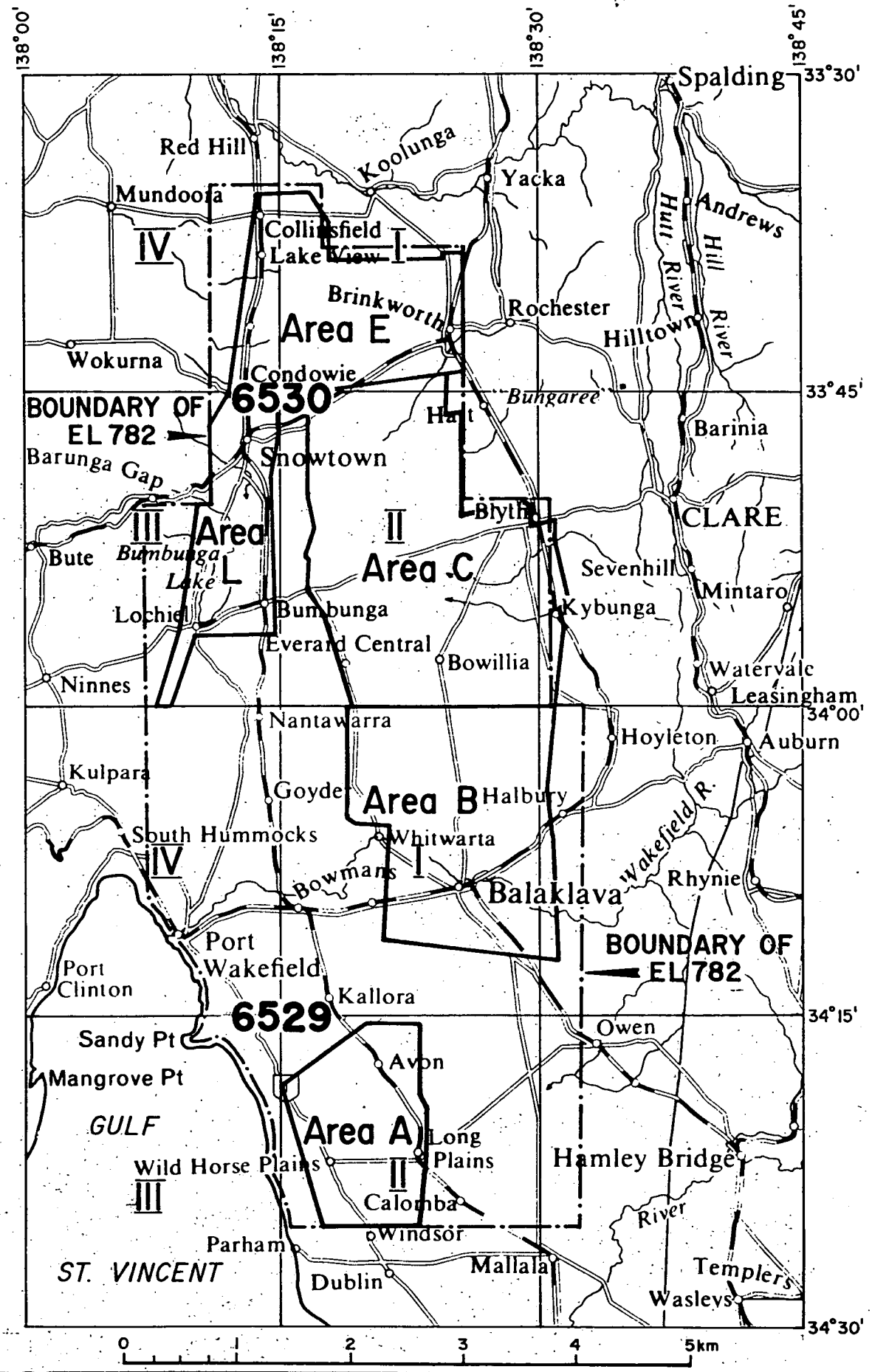
G.T. GALBRAITH
per Dm'o

REFERENCES

Meyer, G.M., 1976. Tertiary Brown Coal Deposits in the Northern St. Vincent Basin, South Australia. unpublished report S.A. Dept. Mines Rept. Bk. 796.

Smith, A.E., 1951. Graphic Adjustment by Least Squares. Geophysics, 26: 222-227.



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COMPILED G.T.G. | C.D.O. 13-7-82 DATE

DRAWN A.F. | SCALE 1:500 000

DATE 24-3-82 | PLAN NUMBER S16100

CHECKED

NORTHERN ST. VINCENT BASIN GRAVITY SURVEY
EL 782
LOCATION OF SURVEY AREAS AND 1:50000 SHEET INDEX

2755

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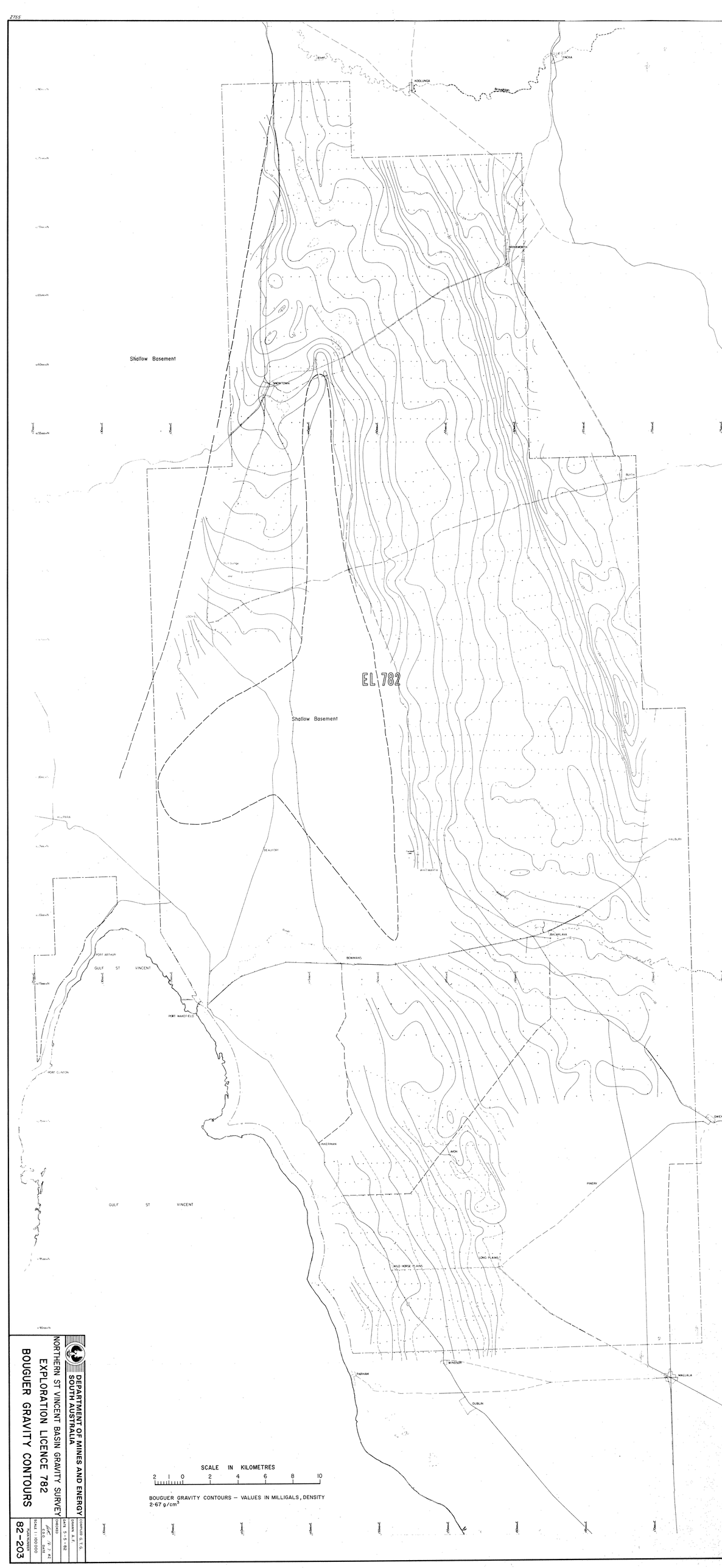

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NORTHERN ST VINCENT BASIN GRAVITY SURVEY

EXPLORATION LICENCE 782

BOUGUER GRAVITY CONTOURS

82-203

COMPILED	G. T. O.
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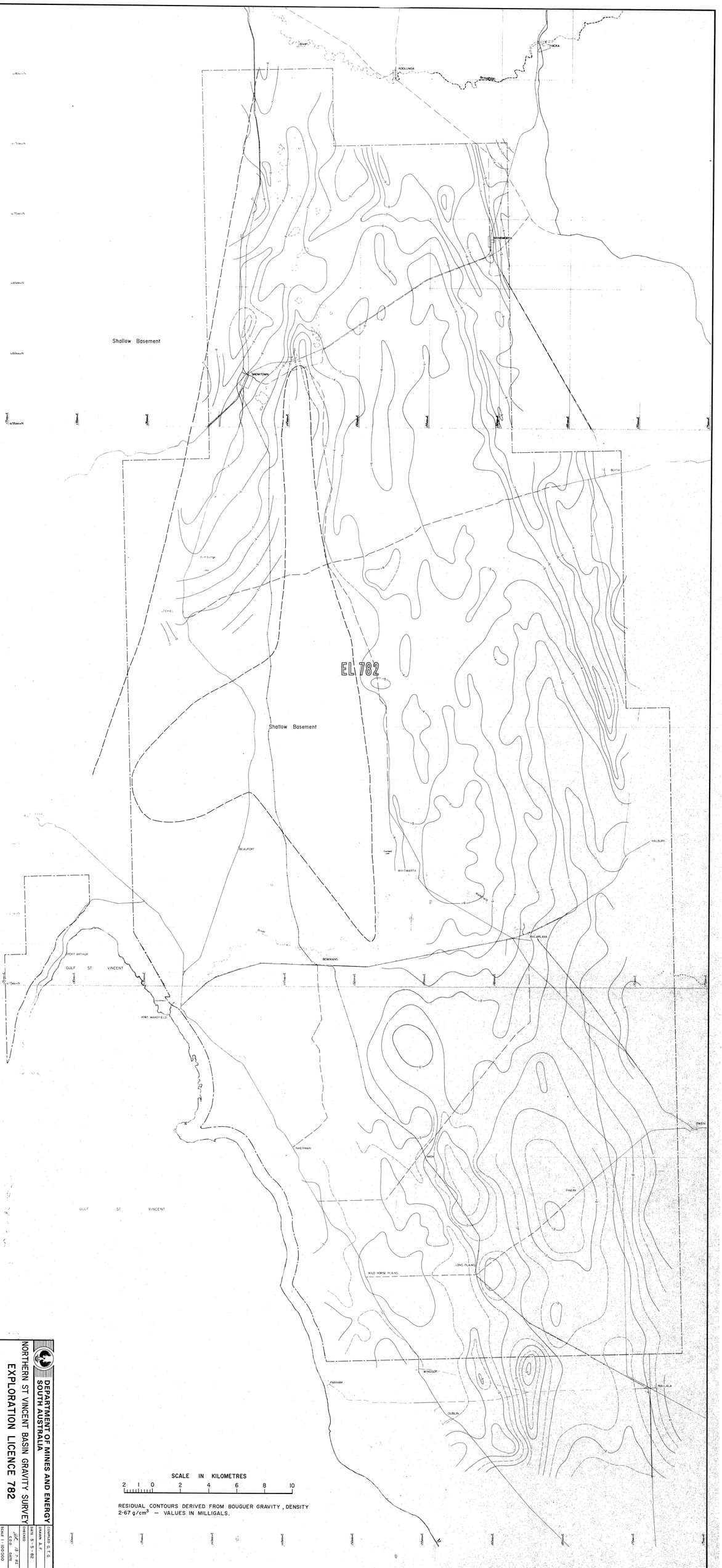
PLAN NUMBER	
SCALE	1:100 000



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NORTHERN ST VINCENT BASIN GRAVITY SURVEY

EXPLORATION LICENCE 782

RESIDUAL GRAVITY CONTOURS

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DATE	
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PROJECTION	
PLAN NO.	82-204