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RECORD No. 1966/184



**REGIONAL GRAVITY TRAVERSES,
SOUTH - EASTERN NSW 1966**

by

J.R.H. van Son

The information contained in this report has been obtained by the Department of National Development as part of the policy of the Commonwealth Government to assist in the exploration and development of mineral resources. It may not be published in any form or use in a company prospectus or statement without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

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Plate 1. Locality map (Drawing No. I55/B2-26-1)

SUMMARY

A regional, ground gravity survey was made to establish gravity stations as control for the gravity work to be done later in the year on the 1966 helicopter gravity training survey in the neighbourhood of Batemans Bay, Royalla, Crookwell, Wallendbeen, Batlow, and Rand.

Sixty-seven new gravity stations were established and ties were made to fifteen existing gravity stations.

1. INTRODUCTION

A regional road gravity survey was made between the 25th January and the 31st March 1966 to establish gravity stations to control the gravity work to be done by the 1966 helicopter gravity training survey party. The original request by this party was for observed gravity values at sites near their six planned main camps in the neighbourhood of Batemans Bay, Royalla, Crookwell, Wallendbeen, Batlow, and Rand.

During the road survey 67 new gravity stations were established. About 90% of these stations were easily accessible to the helicopter. Ties were made to 15 existing gravity stations including Isogal base stations. The traverses covered during this survey are shown in Plate 1.

2. TECHNICAL DETAILS

Planning of the survey

The regional ground party was to go ahead and establish gravity stations at intervals of about 25 miles until the six required stations were established. Each of the gravity stations occupied would be at a site with known elevation and with easy access to the helicopter. Descriptions of all stations occupied would be forwarded to the helicopter party as the survey progressed.

It was also decided that, subject to availability, two gravity meters would be read simultaneously on this survey in an attempt to learn more about the relative performance of different gravity meters.

Work accomplished

Sixty-seven gravity stations were established along the traverses shown in Plate 1. Approximately 75% of these stations were established on sites with known elevations, such as bench-marks of the New South Wales Lands Department, the Snowy Mountains Hydro-electric Authority, railway stations, etc.

Fifteen previously established gravity stations were re-occupied.

The gravity work was connected to BMR Isogal base stations in Wagga Wagga (5099.9906), Canberra (6491.0304), and Albury (6591.1136).

A gravity station (6491.0103) at Bombala airstrip, which was read during the Isogal survey, was re-occupied, as was also the Bombala pendulum station (5099.9903). A number of stations read during 1959 (Flavelle, 1966) were also re-occupied.

During the survey the gravity stations were plotted on the maps listed in Appendix 3.

Gravity meters used and their performances

During the major part of the survey, two gravity meters were read simultaneously at each gravity station. The 'repeat' method was used in which observations were made at station A, B, A, B, C, B,

etc. The same tripod set-up was used for both instruments. The first traverse (Canberra-Braidwood-Batemans Bay) was measured with the La Coste & Romberg gravity meters G20 and G101. Both these gravity meters are temperature controlled instruments (van Son, in preparation). Discrepancies in values between the intervals measured by these instruments ranged from 0.01 to 0.08 mgal.

After this traverse was completed, meter G20 was handed over to the helicopter party and was replaced by the Sharpe Canadian gravity meter 145. The Sharpe 145 is an unheated quartz gravity meter. Apart from the traverse Cooma-Bombala-Batemans Bay (which was measured by meter G101 only) the combination of meter G101 and the Sharpe 145 was maintained over the remainder of the survey. The operating procedure was the same as used previously. Discrepancies in intervals, measured by these two different types of gravity meters between two consecutive gravity stations, range from 0.01 to 0.14 mgal. One cause of these discrepancies is probably the calibration factor of the Sharpe 145 (the value used was 0.10642 mgal/counter division), but there must also be other contributing causes of which no clear explanation is available. At this stage it can only be stated that no two of the three gravity meters used on this survey are in consistent agreement.

The gravity intervals between some of the stations occupied during this survey had been measured during previous surveys. In Table 1 the intervals as measured by meter G101 are compared with earlier values.

Table 1

Gravity Station	Gravity interval in mgal	
	1959 (W260)*	1966 (G101)
5903.0048 (Junee)		
5903.0136 (Goulburn)	-80.86	-81.04
5903.0156 (Cooma)	+86.65	+86.97
5099.9903 (Bombala Pend)	+93.23	+93.22
	1959 (W169)*	1966 (G101)
5904.0005 (Yass)		
5904.0008 (Binalong)	-10.33	-10.33
5904.0011 (Wallendbeen)	+13.07	+13.02
5904.0013 (Cootamundra)	+20.38	+20.36
	1965 (USAF/ BMR)**	1966 (G101)
6491.0204 (Canberra)		
6591.1136 (Albury)	+210.41	+210.22 via Goulburn +210.15 via Cooma
* Flavelle (1966)		
** Shirley (1966)		

The discrepancies between the results of meters W260 and G101 and of meters W169 and G101 are not unexpected (Barlow, in preparation). The discrepancy between the 1965 USAF/BMR value for the interval Canberra to Albury and that given by meter G101 may require further investigation, preferably measurement of this interval using other La Coste & Romberg gravity meters.

Computations

Of the three gravity meters used during this survey, the La Coste & Romberg G101 was the only instrument used throughout the survey. For the time being the calculated observed gravity values are based on the measurements of this instrument only.

Although this survey was connected to the BMR pendulum station No. 3 in Bombala, the observed gravity value of this station was not used in the computation as a fixed value, because the Isogal survey (Barlow, in preparation) did not occupy this site. However, the calculated value is 979,744.64 mgal as against a 1962 revised pendulum value of 979,744.7 mgal (Dooley, 1965).

The Isogal survey made only one single observation at station 6491.0103 (Bombala airstrip). Because of this single observation, only a preliminary observed gravity value was given by the Isogal survey for this station. This value, however, was not accepted as a fixed value for the regional survey described in this Record.

The observed gravity values of the stations of this survey have been adjusted between the Isogal values of the following stations:

6491.0304 (Canberra)	: Observed gravity value 979,615.92 mgal
5099.9906 (Wagga Wagga)	: Observed gravity value 979,672.56 mgal
6591.1136 (Albury)	: Observed gravity value 979,771.56 mgal

Loop closures measured by the La Coste & Romberg G101 and the Sharpe 145 are shown in Plate 1.

As the gravity stations established during this survey will be incorporated in the helicopter work, no attempt will be made here to reduce the field observations beyond the stage of observed gravity values. These values are shown in Appendices 1 and 2.

3. RECOMMENDATIONS

Gravity stations 6604.0083 ...87, 89 ...91, located along the road from Nimmitabel, via Bombala and Bega, to Moruya could not be plotted accurately on the Bega 4 miles to 1 inch map. This map, which was printed in 1942, does not show recent road constructions and alterations and therefore lacks details that are important for plotting gravity stations. Furthermore, most of the above-mentioned stations do not have measured elevations. For some of these stations, the elevations will be available in the near future since they are located next to State Survey Mark (SSM) bench-marks which have not yet been levelled. For other stations, the elevations

1. *Chlorophyll a* (Chl *a*)

- 10

APPENDIX 1List of gravity stations

Station No.	Observed gravity value ^{xx} (mgal)	Elevation (Standard Datum) (ft)
6604.0001	979,594.96	2270.6
0002	593.23	2266.9
0003	601.39	2400.3
0004	648.82	2140.2
0005	742.26	-
0006	821.90	128.2
0007	739.90	841.6
6604.0010	979,581.22	2578.9
0011	580.17	2600.0
0012	600.48	2551.8
0013	630.68	2579.1
6604.0022	979,574.29	2187.8
0023	564.38	2111.1
0024	507.86	2660.0
0025	472.46	2910.0
0026	557.83	-
0027	546.36	-
0028	560.47	1632.8
0029	571.76	2068.9
0030	548.57	2265.2
0031	593.24	1530.8
0032	650.15	814.5
0033	667.54	940.1
0034	687.53	703.6
0035	700.53	759.4
0036	691.70	895.0
0037	670.82	1099.9
0038	699.47	919.7
0039	706.18	1073.0
0040	750.58	704.7
0041	743.92	-
6604.0050	979,594.84	x
0051	603.75	1406.6
0052	649.03	1059.0
0053	659.01	-
0054	664.09	745.0
0055	678.43	-

Station No.	Observed gravity value ^{xx} (mgal)	Elevation (Standard Datum) (ft)
6604.0056	979,678.67	-
0057	684.42	589.8
0058	741.82	548.4
0059	731.00	-
0060	757.98	520.0
0061	738.20	681.0
6604.0070	979,659.44	971.7
0071	603.36	2547.0
0072	665.27	1047.3
0073	656.08	1255.4
0074	581.59	-
0075	539.68	3592.4
0076	482.75	-
0077	499.78	4590.8
0078	510.40	4131.0
0079	571.58	3306.4
0080	533.39	4226.3
0081	618.56	2998.8
0082	628.72	3506.0
0083	681.42	-
0084	719.64	-
0085	738.71	x
0086	707.02	x
0087	779.02	-
0088	889.71	-
0089	873.13	-
0090	855.05	-
0091	889.43	-
0092	869.20	13.8
0093	845.15	122.8

Note: x elevations being obtained from NSW Railway Department and
NSW Lands Department

xx datum Isogal values

- elevations not available

APPENDIX 2List of re-occupied stations

Station No.	Observed gravity value ^{xx} (mgal)
5099.9903	979,744.64
5099.9906	672.56 (Isogal value)
5103.0055	979,729.90
5903.0048	979,645.59
.0136	564.50
.0156	651.45
5904.0005	979,592.78
.0008	582.44
.0011	595.47
.0013	615.84
6491.0103	979,731.56
6491.0304	615.92 (Isogal value)
6591.1136	979,771.56 (Isogal value)
6606.0706	979,555.86 (Helicopter station)
6606.9106	817.88 (Helicopter station)

Note: Gravity stations 5099.9903 (BMR pendulum station No. 3, Bombala) and 6491.0103 (Bombala airstrip) have at this stage no true Isogal value. The observed values shown are a result of measurements made with the La Coste and Romberg gravity meter G101 during this survey.

xx datum Isogal values

APPENDIX 3

List of maps on which the gravity stations were plotted

Map	Scale
CANBERRA	
GOULBURN	
COOTAMUNDRA	1:250,000
WAGGA WAGGA	
JERILDERIE	
WANGARATTA	
BEGA	4 miles = 1 inch
ULLADULLA	
MORUYA	1 mile = 1 inch
BATLOW	
CUMBERLAND	1 mile = 1 inch
CABRAMURRA	Snowy Mountain
TANTANGARA	Hydro-Electric Authority
EUCUMBENE	
GLADSTONE	

None of the 4 miles and 1 mile to 1 inch maps used in this survey show sufficient detail required for accurate plotting. Station locations on these maps are approximate locations only.

APPENDIX 4Survey logistics

Party symbol	:	70G24
Party strength	:	1 geophysicist (J. van Son)
Duration of survey	:	25.1.66 until 31.3.66
Days lost	:	19 (no vehicles available)
Party vehicle	:	Falcon station wagon ZIS707 (25th and 26th January) Falcon Sedan ZSN298 (15th February to 31st March)
Miles of traverse	:	1250 miles (approximately)
New gravity stations established	:	67
Gravity stations re-occupied	:	15
Observed gravity values	:	Based on Isogal values for the stations - 6491.0304 (Canberra): 979,615.92 mgal 5099.9906 (Wagga Wagga): 979,672.56 mgal 6591.1136 (Albury): 979,771.56 mgal
Elevations	:	Standard Datum
Instruments used	:	La Coste and Romberg G20 (25th and 26th January) La Coste and Romberg G101 (25th January to 31st March) Sharpe 145 (17th February to 24th March)
Calibration factors	:	La Coste and Romberg G20 and G101, maker's calibration tables Sharpe 145, $k = 0.10642$ mgal/ counter division (Canberra calibration range, 1st January)
Operating procedure	:	'Repeat' method (A, B, A, B, C, B, C, etc.)
Survey serial number	:	6604
Station descriptions and elevations:	:	BMR File No. 66041
Gravity field sheets and drift sheets	:	BMR File No. 66042
Observed gravity values	:	BMR File No. 66043

