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MR. W.G. GOYDER

MILANG GRAVITY SURVEY SOUTH AUSTRALIA

by
W.F. Stackler, Fh.D
Geosurveys of Australia Limited

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Geosurveys of Australia Limited

on behalf of

MR. W. G. GOYDER

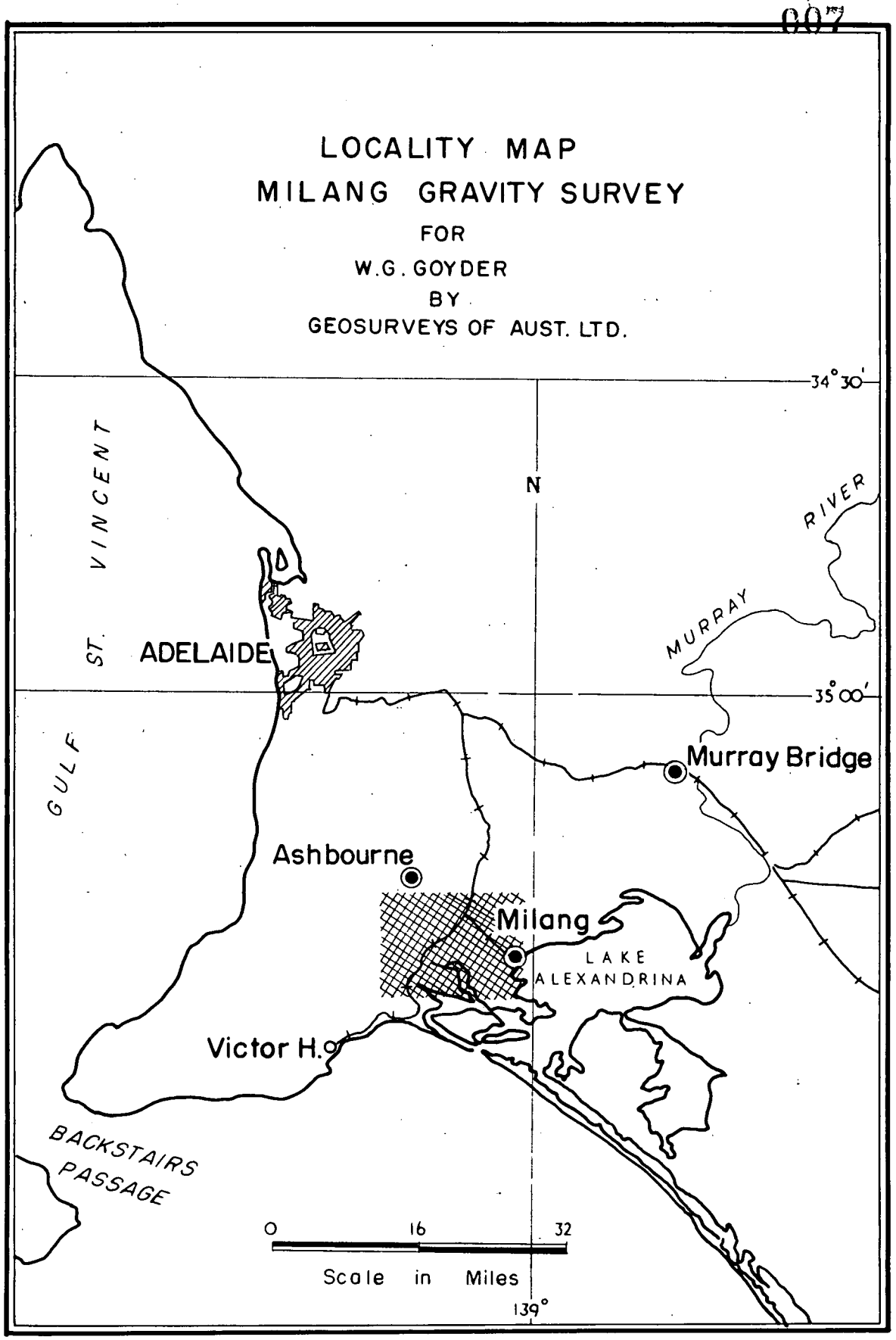
(October, 1963)

LIST OF CONTENTS

ABSTRACT

A gravity survey in the Milang area was conducted by Geosurveys of Australia Limited during June and July, 1963. The survey occupies the eastern flank of Mt. Lofty Ranges in the above area and additionally the extension in the plains up to Lake Alexandria and the Lower Murray River.

In the south-western part of the project the Bouguer Anomaly Map reveals sufficient relationship with the principal known geological features and, therefore, permits definite conclusions concerning geological information in the plains being covered by late Cainozoic sediments. It was possible to outline a small region for detailed exploration.


LOCALITY MAP
MILANG GRAVITY SURVEY
FOR
W.G. GOYDER
BY
GEOSURVEYS OF AUST. LTD.
34°30'
N
ST. VINCENT
GULF
ADELAIDE
RIVER
MURRAY
35°00'
Murray Bridge
Ashbourne
Milang
LAKE
ALEXANDRINA
Victor H.
BACKSTAIRS
PASSAGE
0
16
32
Scale in Miles
139°

WGG. 5.

I. INTRODUCTION

The Milang Prospect is situated on the Fleurieu Peninsula and west of Lake Alexandria, South Australia, about 40 miles south of Adelaide. The prospect area covered by this report is indicated on the Locality Map (WGG.5) and involves about 200 square miles.

Prior to the present gravity survey little geophysical survey work had been undertaken in the project area. A few gravity stations by the Mines Department of South Australia have been observed, the results of which could not be found in the files and cannot, therefore, be considered here. A reconnaissance aeromagnetic survey (of 1956) is too broad to be of real assistance in the present survey.

Geologically the area has been mapped in detail (Hortwitz, and Thomson, 1960).

II OPERATIONAL PROCEDURES.

The survey was completed during June and July 1963 by letter of agreement from Mr. W.G. Goyder, Adelaide. J. Radus was responsible for the field operation and gravity observation. R. Monsma and B. Bell carried out the elevation surveys by optical methods. W.F. Stackler, Ph.D. supervised all phases of the operation and was responsible for compilation and completion of the final report.

Two hundred and twenty-six stations were established to blanket the area. A tie to a governmental network was not possible. Gravity values were observed using the Worden Gravimeter No. 215, which has a scale division factor of 0.1089 milligals. The gravimeter used was calibrated, before and after the survey, on the B.M.R. Calibration Range, Kensington Gardens to Norton Summit Hotel, Adelaide. This has a gravity difference of 62.61 milligals. Both calibrations provided identical results, demonstrating the scale division factor to be constant during the survey.

Elevations were obtained by optical levelling checks being possible by

loop closure and tying to existing bench marks of railway and highways. The locations of the stations were established using the Military Map sheet Milang, (scale one mile to one inch).

III REDUCTION OF DATA

(a) Drift Control and Sub-Base Details.

A grid of sub-base stations was established to provide instrumental drift control. Details of these stations are shown on the Base Closure Map (WGG.6-G). Base and/or Sub-base repeat readings were observed at travelling time intervals of 2 hours or less. Main Base is station 10 on the Goolwa bench mark which was given an assumed observed gravity of 0.00 milligals. Three sub-bases are tied by runs, re-runs and loop closures to the main base. These stations are:--

Station No. 9 Sub-base on the Milang bench mark.
Station No. 125 Sub-base Finnis.
Station No. 105 Sub-base on the road crossing east of Giles Hill.

The correct locations of these base stations and of all field stations are plotted on the Elevation and Location Map (WGG.2-G). The loop tie between the three sub-bases was perfect and no adjustment for loop closure was necessary. Observed gravity difference was run three times (independently) between the main-base and the sub-base 125, resulting in 25.18, 25.18 and 25.17 milligals. A direct tie between the main base and the sub-base in Milang was not possible because of the intervention of the Finnis River. The excellent tie between main-base and sub-base 125, as shown, has permitted the open loop against Milang bench mark.

As the Base Closure Map is a calculation map, all values are in terms of scale division of the instrument used (=0.1089 milligals). A multiplication of these values by this factor would convert all figures to milligals.

(b) Elevation Correction.

A Bouguer Anomaly Map has been prepared applying the surface

density 2.67 in conformity with the requirements of the International Gravity Service. If subsequently the survey is tied to the Pendulum Network the Bouguer Map supplied will have only a constant difference relative to the network and this can be readily adjusted.

(c) Latitude Correction.

As referred to above under "Operational Procedure", all stations were established using the one inch to one mile Military Map sheet Milang.

The plotting accuracy is within 200 feet for each station. From this map each latitude correction was calculated using the theoretical formula from W.D. Lambert and F.W. Darling (1931).

IV ACCURACY OF DATA.

The accuracy of the final results is a function of all surveying errors in gravity, elevation and latitude. Because of the improvements in modern gravimeters, the observed gravity after instrumental drift has been applied has an accuracy of $\pm$ 0.03 milligals or better.

All stations belong to closed loops in elevation survey and have optically levelled values, the accuracy of which is 0.5 feet or better. Converted into gravity terms this is $\pm$ 0.03 milligals. As described previously, the station locations have a plotting accuracy of 200 feet. If in the extreme the 200 feet error was wholly latitudinal this in terms of gravity amounts to $\pm$ 0.04 milligals.

Errors in gravity, elevation and latitude together, therefore, give an average probable error of

$$(0.03^2 + 0.03^2 + 0.04^2)^{1/2} = 0.06 \text{ milligals.}$$

V REGIONAL GEOLOGY (R.C. Sprigg)

The Milang prospect straddles the eastern boundary fault of the Mt. Lofty Ranges.

Within the ranges a core of Archaean schists and gneisses is enveloped

by Upper Proterozoic to Lower Palaeozoic sediments and metasediments which dip steeply eastwards in the marginal range areas. Bedrock trends approximate NE-SW. Granitic rocks intrude the extreme eastern marginal zones of the ranges and outcrop in the Encounter Bay region immediately south-west of the prospect.

Permian "fossil" glacial valleys extend transversely to the general strike of the range, namely south-east to north-west. These valleys are choked with glacial debris including relatively thick accumulations of glacio-fluvial sands, clays and varved deposits. Boulder clays are developed extensively and erratic boulders are concentrated particularly about the walls and floors of the fossil glacial valleys. Ice movement was from the south-east and has distributed "erratic" boulders north-west away from points of origin. Little information is available as to depths of the glacial valleys, or as to what extent the valleys were fjordic, or otherwise invaded by the sea. Within the Mt. Lofty Ranges, the soft sediments of the glacial infill are deeply eroded out below the level of the general pre-Tertiary plateau surfaces, and much of the original valleys probably extended 1000 or more feet below such levels. In the Hindmarsh Valley to the immediate south-west of the prospect, one well encountered bedrock at approximately 2000 feet below plateau level.

In the prospect area, within the ranges, two principal fossil valleys are developed. These are now occupied respectively by the Tookayerta and Giles Creeks.

Beyond (to the east of) the ranges, no sediments older than Oligo-Miocene sandy (littoral) limestones occur in outcrop in the area except south-east of Strathalbyn (in the Angas River bed). These are Kanmantoo (Lower Palaeozoic) metasediments.

Permian sediments are presumed to underlie the plains area reasonably extensively beneath Milang to Currency Creek.

The Mt. Lofty Range boundary fault in this region trends reasonably directly via Currency Creek and Finniss to the east of Strathalbyn. Easterly downthrow of the pre-Tertiary erosion surface in the Gemmel Hill-Strathalbyn zone probably approximates 600 feet.

VI RESULTS AND INTERPRETATION.

The principal results of the Milang gravity survey are summarized in the form of a Bouguer Anomaly Map (WGG.3-G). This supported the accompanying Elevation and Location Map (WGG.2-G), the Base Closure Map (WGG.6-G) and the tabulated Principal Facts (Appendix I).

(a) Gravity Results.

The Bouguer Anomaly Map reveals the general gravitational pattern of the area and additional stations would not alter the broader features at all significantly.

The lowest Bouguer gravity values (less than -3 milligals) coincide with the arm of the Finnis River extending into the Murray lakes area, whereas the highest values occur across the boundary escarpment of the Mt. Lofty Ranges where they locally exceed +12 milligals within a mile of the boundary fault.

Two gravity anomalies can be clearly recognised and are separated by a general trend which agrees closely with the south-eastern boundary of the Mt. Lofty Ranges in this region. This locus of well-defined change extends SW-NE between Goolwa and Strathalbyn.

In the range province the observable dominating anomalies form an intersecting pattern of relative N-S (or NNE-SSW) gravity ridging separated by NW-SE dissecting minima.

In the plains province (to the south-east) a very pronounced gravity "trough" trends NW-SE approximately along the course of the Finnis arm and is bounded by relative "highs" on both margins. That to the south rises more steeply and attains a relative gravity difference exceeding possibly 10 milligals in 3½ miles. To the north the maximum difference does not exceed about 6 milligals in 3 miles. Secondary "ridging" is developed on both margins of the principal gravity minima, but this appears to diminish and/or disappear a few miles from the range boundary Secondary minima are developed adjacent to the Ranges, respectively two miles south of Currency Creek and also about 3 miles south of

Strathalbyn. 013

(b) Interpretation

The western (range) province: As this area is principally underlain by metamorphic bedrock, which either outcrops or forms the floors of Permian glacial valleys, discussion is herein restricted to an interpolation of data of interest in respect to geological prediction relative to the adjacent plains area.

The Bouguer gravity pattern exhibits direct and obvious relationships with the principal features of the geological map (Milang 1-Mile Sheet). Outcrops of bedrock (pre-Upper Palaeozoic) all accompany prominent gravity maxima. Permian glacial debris-filled valleys, extending primarily SE to NW are loci of gravity minima to the extent of 4-6 milligals. The surveys however, are not detailed enough to characterise all the glacial-filled valleys, but the available correlation is undoubtedly good.

The extent and intensity of the respective gravity minimum relevant to each of the Tookayerta and Giles Creek fossil valley systems is presumed principally to reflect differences in valley depth. This would indicate that the northern or Finniss River system was locally deeper and also steeper-walled. Where the bedrock ridge west of Giles Hill juts into the Finniss River Valley considerably steepened gravity gradients (5 milligals in half on one mile) would be as expected in this situation where eroding glaciers were pressed against an obvious promontory. Assuming a density contrast of 0.4 between metamorphic bedrock and Permian glacial valley infill, this would indicate a remnant valley depth of about 1,000 feet or more in this situation. A more accurate calculation is only possible if additional stations are available. In this respect it is of importance that the drilling in the Hindmarsh Valley about 20 miles to the south-west of the survey area revealed valley bottom to be almost 2000 feet below local plateau erosian surface level. ? The present depth estimate, then, would appear not unreasonable.

The south-eastern province: East of the principal locus of gravity change extending between Currency Creek and Strathalbyn, the north-west - south-east trending gravity minima is dominating. Geologically the feature almost certainly represents the south-easterly extension of the Permian glacial valley system as present beneath the plains. These deposits have been thrown down beyond the limit of the Mt. Lofty Ranges escarpment fault. Direct comparison with the extent of the valley depth development is complicated by the intervention of a zone of granite intrusion along the east border of the Ranges seen locally as at south of Goolwa. No gravity observations have been carried out over these granites to determine the nature of their relative anomaly in relation to the host metasediments. Both pluton granites and granitisational bodies have been observed in the eastern escarpment marginal zone. Gravity-wise the pluton granites may well be relatively "negative" while the granitisational developments are likely to be relatively more positive. These uncertainties make it difficult to interpret the smaller anomalies noted in the Currency Creek south vicinity, and also south of Strathalbyn where granites may well be present beneath the surface, but does not outcrop.

Interest in exploration for deeper sedimentary section undoubtedly centres about the Finniss "minimum". To the north, bedrock does outcrop at low levels east of range escarpment fault and is exposed in deep creeks. However, secondary block faults may be present beyond these exposures.

The Finniss "minimum" accords with the general Permian fossil valley system generally in southern coastal South Australia. Beyond the ranges to the west (Yorke Peninsula and Troubridge Island in Gulf St. Vincent) and possibly also within the range province on Fleurieu Peninsula, glacial marine sands and shales have been deposited within the valley system. As such, these deposits represent the principal potential for thicker sedimentary developments within the prospect area.

A notable feature of the anomaly is that it does not directly line-up with either the Tookayerta or the Finniss River fossil valley systems,

although possibly by coincidence, the Finniss minimum taken in conjunction with the Currency Creek south minimum, does appear to be offset about 3 miles south-west from the trends of the foregoing valley systems. This would require very extensive post Permian transcurrent faulting to account for such sinistral displacement. There is no known geological evidence for this in this region.

The predicted Finniss Arm buried glacial valley has a width of the order of 5 to 6 miles. Gravity gradients on the south-west are relatively steeper than on the north-east. The maximum localised gravity differential in relation to this presumed buried valley is of the order of 10 milligals in a cross-sectional distance of about 2 miles. Depth estimates based on these figures (and spread of stations) are now impossible. The nature of the feature causing such anomaly is almost certainly a sloping valley wall which, if steep (as part of a U-shaped valley), may approximate a fault-escarpment anomaly in form, or, if more gentle, would produce a gentle spread anomaly suggestive of deeper burial.

The general overall anomaly (5 to 10 milligals) would suggest a fossil valley depth of more than 1000 feet, assuming a density contrast of 0.4.

The depth of burial of the valley system is even harder to assess without assumptions that go beyond possible usefulness at this stage.

The broadness of Bouguer anomalies to the east and north-east of the presumed buried valley would favour somewhat deeper sedimentary (overmass) burial in this direction beneath the Murray Plains. The areas were inundated by Tertiary seas, but it is known that granite outcrops in one of the eastern lakes of the Murray mouth system.

If as is assumed from the rather compelling evidence of the Bouguer gravity data that relatively deep sedimentation is contained within the Permian fossil valley system, then it is within this that potential structural and/or stratigraphic-type traps should be sought. Almost certainly the deepest sedimentary section must be expected beneath the

Finniss Arm. However, the presumed glacial valley infilling correlates with the rather smooth trough-like gravity minimum rather lacking in internal indication of structure. About station 246 near the Clayton Trig a slight "reversal" is apparent and this well may be a site for the most useful exploratory stratigraphic well.

VII SUMMARY

The gravity survey has satisfactorily characterised the pattern of anomalies in and beyond the Mt. Lofty Range escarpment region across to the lakes of the Murray River mouth.

The Bouguer anomalies within the limits of the Ranges are closely equated to sediment-filled Permian (fossil) glacial valleys eroded out of metamorphic, early Palaeozoic bedrock.

The sub-fossil valley system can be traced satisfactorily to the south-east where the principal valley trends beneath the Finniss Arm. Gravity maxima flank the Finniss Arm minimum and may to some extent reflect basement topography. No indication of depth to bedrock can be predicted with any certainty in the plains area, but the 5 to 10 milligal relative anomaly of the "buried valley" of the Finniss Arm would accord with an additional depth of sediments of more than 1000 feet in this zone. A detailed profile as shown on the Bouguer Map over this part of the minimum would result in a more accurate determination.

A stratigraphic test is recommended near Clayton Trig, where a deeper sedimentary section could conveniently be investigated over a minor gravity "ridging".

VIII ACKNOWLEDGEMENTS.

Appreciation is expressed for the assistance provided by Mr. R.C. Sprigg in the nature of background information for the geological

interpretation of the rather unusual anomalies located and expected in this area.

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SENIOR GEOPHYSICIST

Approved by:

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IX REFERENCES

HORTWITZ, R.C., and THOMSON, B.P., 1960. Milang 1-Mile Geological Map Sheet. Geological Survey of South Australia.

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APPENDIX I

TABLE OF PRINCIPAL FACTS

019

Prospect: Milang

Sta.	Latitude	Longitude	Elev. (Feet)	Obs.Grav. Difference Against s*.10	Obs Grav 979,	Bouguer
1	35° 18.27'	138° 53.12'	304.72	-37.92		-1.04
2	18.66'	52.98'	291.39	-36.51		-0.98
3	19.10'	52.81'	276.09	-34.47		-0.47
4	19.53'	52.63'	259.04	-31.68		+0.68
5	19.98'	52.46'	242.21 -3.54?	-28.68		+2.04
6	20.39'	52.25'	223.15	-26.34		+2.64
9	24.69'	58.46'	102.16 (3.54)	-14.94	776.77	+0.69
10	~~30.17'~~ 30.37	~~46.28'~~ 47.17	~~138.25~~ 109.82 (10.28)	+ 0.00	791.71	~~+10.02~~ 8.02 +8.02
51	20.21'	53.07'	222.15	-27.90		+1.29
52	20.03'	53.70'	254.93	-30.27		+1.14
53	20.04'	54.50'	249.03	-30.10		+0.93
54	20.07'	55.28'	227.33	-29.03		+0.66
55	20.49'	55.87'	220.63	-27.87		+0.82
56	21.10'	56.24'	184.33	-24.79		+0.86
57	21.75'	56.52'	160.83	-22.90		+0.42
58	21.84'	57.35'	157.28	-22.95		+0.02
59	21.94'	58.38'	129.83	-21.56		-0.38
60	22.19'	58.90'	128.53	-21.28		-0.53
61	22.84'	58.85'	116.78	-19.32		-0.20
62	23.46'	58.54'	110.18	-17.41		+0.45
63	24.02'	58.36'	125.03	-16.86		+1.09
67	20.94'	52.70'	224.24	-25.60		+2.66
68	21.39'	53.32'	211.98	-24.15		+2.74
72	24.68'	57.20'	116.54	-16.17		+0.34
73	24.57'	56.48'	132.19	-16.66		+0.94
74	24.47'	55.78'	136.94	-16.24		+1.79
75	24.40'	54.92'	134.34	-16.38		+1.59
76	24.29'	54.23'	138.19	-17.48		+0.88
77	24.18'	53.50'	153.19	-18.62		+0.80
78	24.05'	52.80'	161.72	-17.59		+2.52
79	24.05'	52.00'	166.89	-19.21		+1.21
80	24.04'	51.29'	165.24	-19.10		+1.23
81	24.04'	50.50'	171.40	-19.79		+0.91
82	23.85'	49.72'	105.49	-16.24		+0.78
83	21.53'	52.39'	224.49	-24.13		+3.32
84	22.19'	52.22'	197.04	-21.33		+3.53
85	23.43'	51.62'	183.32	-21.36		+0.93
86	22.80'	51.51'	188.63	-21.32		+2.17
87	24.50'	51.50'	156.89	-18.82		+0.36
88	25.00'	51.98'	153.61	-19.43		-1.15
89	25.67'	52.35'	144.44	-19.30		-2.52
90	26.02'	52.60'	143.47	-19.47		-3.25
91	26.33'	52.43'	138.63	-18.63		-3.14
92	35° 26.54'	138° 53.11'	132.85	-18.07		-3.23

020

Prospect: Milang

Sta.	Latitude	Longitude	Elev. (Feet)	Obs.Grav. Difference Against St.10	Obs Grav 979, Bouguer
93	35° 27.17'	138° 53.17'	123.97	-16.54	-3.12
94	27.55'	53.72'	124.94	-15.98	-3.04
95	27.83'	53.27'	117.88	-15.51	-3.40
96	27.35'	54.40'	119.78	-15.43	-2.52
97	27.06'	55.08'	114.78	-14.72	-1.69
98	26.85'	55.66'	111.30	-13.73	-0.62
99	26.97'	56.48'	106.39	-12.25	+0.39
100	26.38'	56.69'	110.62	-12.85	+0.89
101	20.17'	51.90'	265.75	-29.26	+2.60
102	19.80'	51.61'	293.38	-31.27	+2.77
103	19.57'	51.35'	338.28	-33.99	+3.07
104	19.14'	50.93'	382.46	-36.60	+3.72
105	18.86'	50.72'	449.26 (343.56)	-40.48 751.23	+4.25
106	18.65'	50.45'	534.66	-45.71	+4.43
107	18.82'	50.04'	508.42	-43.45	+4.88
108	19.03'	49.94'	598.32	-48.43	+5.00
109	19.16'	49.45'	464.32	-39.77	+5.44
110	19.07'	49.10'	473.08	-39.90	+5.95
111	18.87'	48.68'	421.52	-36.93	+6.11
112	19.00'	48.44'	523.27	-47.13	+1.84
113	19.12'	48.12'	586.54	-51.66	+0.93
114	19.08'	47.60'	572.89	-50.32	+1.51
115	19.03'	46.97'	535.40	-48.34	+1.31
118	20.40'	46.72'	439.80	-36.95	+5.02
119	20.93'	46.80'	336.86	-29.78	+5.26
120	20.95'	47.07'	265.86	-25.60	+5.15
121	21.30'	47.60'	264.06	-24.37	+5.77
122	21.43'	48.28'	247.24	-25.44	+3.51
123	21.68'	48.59'	266.89	-26.19	+3.59
124	22.22'	49.00'	284.33	-25.19	+4.87
125	22.50'	49.20'	236.44 (130.74)	-25.18 766.53	+1.61
126	22.89'	49.46'	215.66	-24.59	+0.39
127	23.27'	49.78'	187.04	-22.86	-0.12
128	23.09'	50.17'	196.72	-23.95	-0.38
129	23.07'	50.78'	214.04	-22.99	+1.65
130	23.03'	51.25'	187.88	-21.65	+1.48
131	22.97'	51.90'	179.77	-21.83	+0.89
132	22.99'	52.19'	173.18	-20.95	+1.36
133	23.10'	52.82'	169.69	-18.23	+3.71
134	23.21'	53.45'	164.19	-18.48	+2.98
135	23.28'	53.86'	151.34	-18.31	+2.28
136	23.40'	54.50'	152.63	-18.32	+2.17
137	23.46'	54.90'	141.94	-18.22	+1.55
138	23.54'	55.41'	143.60	-18.51	+1.24
139	23.62'	55.80'	144.60	-18.93	+0.77
140	23.69'	56.26'	135.70	-18.69	+0.37
141	23.77'	56.72'	121.95	-18.07	+0.06
142	35° 23.86'	138° 57.33'	120.95	-17.97	-0.03

Prospect: Milan

Sta.	Latitude	Longitude	Elev. (Feet)	Obs.Grav. Difference Against st.10	Bouguer
143	35° 24.07'	138° 57.80'	129.61	-17.91	+0.25
151	19.40'	50.57'	470.18	-40.86	+4.35
152	19.84'	50.20'	405.52	-36.78	+3.92
153	20.47'	49.60'	394.19	-37.59	+1.54
154	20.76'	49.52'	356.53	-35.59	+0.88
155	21.15'	49.43'	322.31	-33.12	+0.74
156	21.44'	49.30'	304.10	-31.49	+0.86
157	21.72'	49.32'	280.37	-29.25	+1.28
158	22.18'	49.33'	263.76	-27.46	+1.43
159	22.62'	48.88'	273.02	-27.49	+1.32
160	22.77'	48.16'	211.84	-22.87	+2.06
161	22.93'	47.72'	229.50	-23.75	+2.01
163	23.17'	47.30'	277.32	-24.74	+3.56
164	23.47'	46.78'	295.66	-23.16	+5.81
165	23.75'	46.47'	321.00	-23.30	+6.80
166	23.86'	46.00'	272.86	-18.01	+9.04
167	24.16'	46.03'	315.35	-20.84	+8.34
168	24.44'	46.40'	305.71	-21.90	+6.29
169	24.70'	46.70'	309.25	-21.86	+6.19
170	25.40'	46.92'	244.41	-19.11	+4.04
171	25.73'	46.93'	209.49	-16.24	+4.36
172	26.19'	46.79'	191.18	-14.86	+3.98
173	26.47'	46.52'	183.46	-12.84	+5.14
174	26.80'	46.18'	182.08	-11.55	+5.87
175	27.15'	46.10'	149.50	- 8.45	+6.53
176	27.64'	45.62'	197.65	- 9.30	+7.87
177	27.87'	45.70'	211.71	- 9.90	+7.78
178	28.18'	45.96'	179.81	- 8.39	+6.95
179	28.60'	46.20'	157.51	- 7.10	+6.30
180	28.94'	46.40'	173.01	- 7.49	+6.35
181	29.52'	46.63'	150.14	- 4.93	+6.72
182	29.94'	46.87'	130.56	- 2.74	+7.13
183	25.77'	56.88'	111.43	-13.81	+0.85
184	25.24'	57.00'	112.77	-14.88	+0.61
185	25.10'	56.34'	119.06	-15.27	+0.79
186	25.42'	55.79'	115.40	-14.46	+0.92
187	25.60'	55.18'	123.60	-15.40	+0.23
188	25.79'	54.46'	144.11	-16.22	+0.44
189	26.00'	53.81'	136.97	-17.54	-1.68
190	26.20'	53.33'	139.30	-18.59	-2.87
191	24.30'	49.40'	182.90	-23.87	-2.85
192	24.66'	48.90'	196.40	-23.74	-2.41
193	24.98'	48.42'	223.40	-24.00	-1.51
194	27.12'	47.08'	163.88	-12.84	+3.04
195	27.22'	47.85'	150.69	-12.70	+2.25
196	27.50'	48.50'	146.35	- 9.91	+4.38
197	27.69'	49.12'	149.10	- 8.17	+6.02
198	35° 28.07'	138° 49.55'	112.60	- 6.34	+5.12

022

Prospect: Milang

Sta.	Latitude	Longitude	Elev. (Feet)	Obs.Grav. Difference Against St.10	Bouguer
199	35° 28.22'	138° 50.37'	123.60	- 9.45	+2.46
200	28.33'	51.03'	112.94	-11.08	+0.03
201	23.59'	45.60'	334.36	-22.64	+8.48
202	23.40'	45.22'	362.32	-23.40	+9.67
203	22.96'	44.92'	354.75	-27.11	+6.13
204	22.60'	44.73'	414.22	-30.58	+6.73
205	22.29'	44.67'	496.10	-34.68	+7.99
206	21.90'	44.52'	526.76	-39.79	+5.27
207	21.35'	44.23'	607.16	-44.99	+5.67
208	20.95'	44.36'	625.03	-46.90	+5.40
209	20.53'	44.68'	622.58	-48.14	+4.61
210	20.20'	45.06'	539.41	-45.51	+2.72
211	23.37'	44.92'	342.11	-23.99	+7.91
212	23.47'	44.50'	447.94	-32.17	+5.94
213	23.67'	44.03'	436.65	-29.94	+7.21
214	23.92'	43.75'	453.55	-29.36	+8.45
215	24.46'	43.86'	428.06	-27.01	+8.50
216	24.79'	43.78'	423.79	-25.96	+8.83
217	25.13'	43.70'	418.39	-24.57	+9.41
218	25.60'	43.47'	351.28	-20.27	+9.02
219	26.03'	43.43'	313.93	-16.05	+10.39
220	26.58'	43.39'	292.89	-13.78	+10.61
221	26.98'	43.52'	371.71	-17.92	+10.63
222	27.28'	43.46'	365.98	-18.14	+9.65
223	27.76'	43.38'	313.01	-14.79	+9.14
224	28.07'	43.30'	483.58	-20.87	+12.84
225	19.84'	45.05'	578.92	-49.02	+1.78
226	19.44'	45.11'	485.72	-44.40	+1.68
227	19.04'	45.14'	464.76	-43.89	+1.51
228	18.42'	45.43'	465.68	-44.59	+1.73
229	18.54'	46.04'	458.57	-41.34	+4.38
230	18.90'	46.52'	418.55	-38.12	+4.69
231	28.16'	43.80'	521.48	-25.10	+10.77
232	28.27'	44.50'	273.30	-11.05	+9.77
233	28.35'	45.07'	191.67	- 8.05	+7.75
234	28.43'	45.58'	162.98	- 8.17	+5.80
235	28.50'	51.66'	112.10	-12.19	-1.37
236	28.60'	52.46'	110.83	-12.84	-2.24
237	28.88'	53.00'	106.61	-13.20	-3.25
238	27.37'	57.02'	104.51	-11.88	+0.08
239	27.94'	57.34'	104.14	-11.39	-0.26
240	28.46'	57.06'	104.82	-11.14	-0.70
241	28.88'	57.04'	122.52	-12.19	-1.29
242	29.21'	57.67'	125.90	-10.85	-0.21
243	29.53'	58.35'	102.34	- 7.97	+0.80
244	29.50'	59.00'	114.76	- 8.53	+1.03
245	28.80'	56.18'	114.55	-12.68	-2.15
246	35° 28.60'	138° 55.58'	109.07	-12.34	-1.85

Prospect: Milang

023

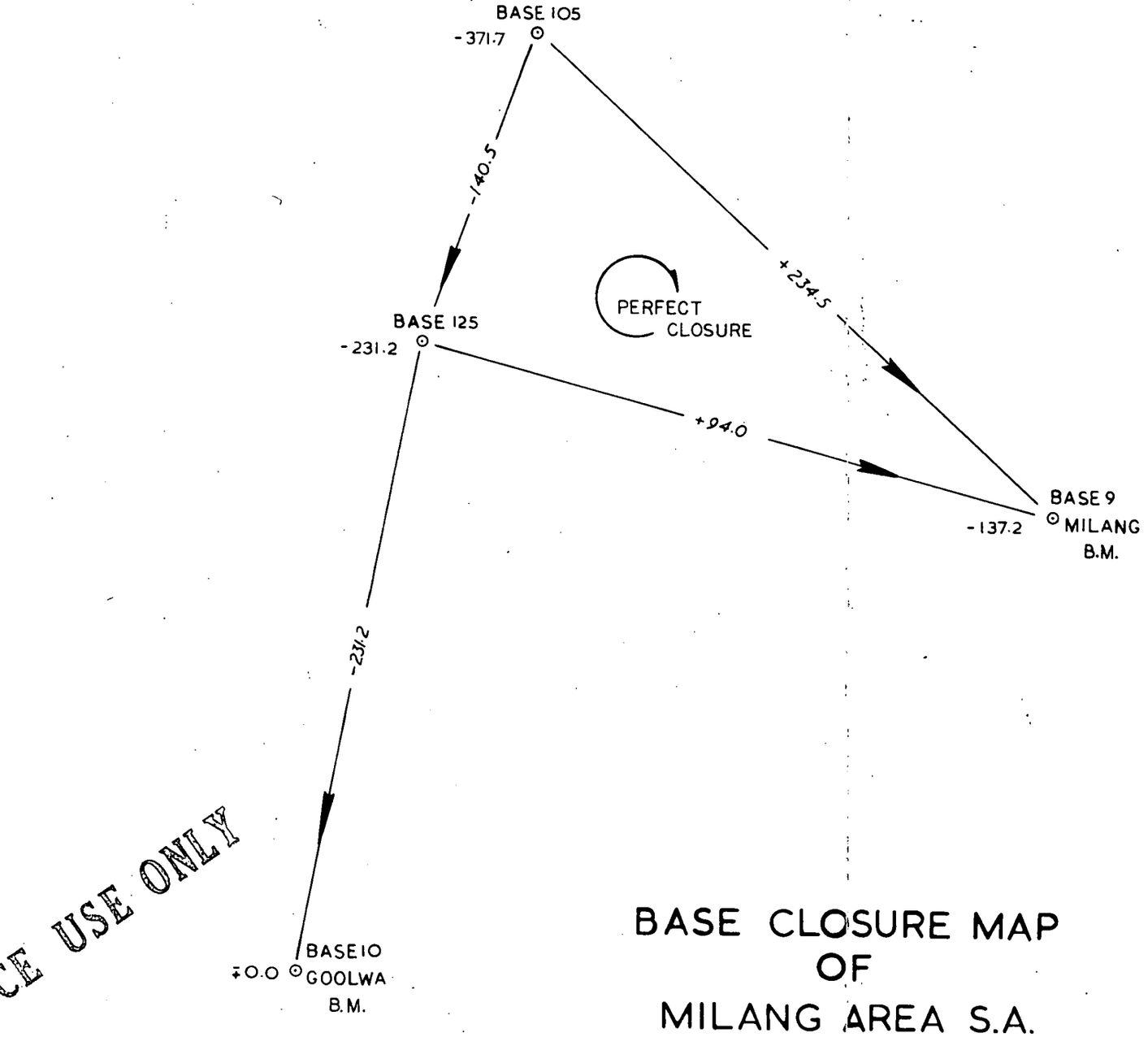
Sta.	Latitude	Longitude	Elev. (Feet)	Obs.Grav. Difference Against St.10	Bouguer
247	35° 29.07'	138° 55.43'	106.12	-12.35	-2.70
248	29.53'	55.33'	107.99	-12.49	-3.38
249	28.47'	54.94'	110.81	-13.24	-2.46
250	28.28'	54.21'	117.41	-14.55	-3.10
251	27.92'	53.90'	117.53	-15.09	-3.13
252	28.60'	54.11'	113.14	-14.12	-3.38
253	28.89'	53.72'	121.15	-14.21	-3.41
254	28.10'	55.87'	110.70	-12.67	-1.37
255	27.46'	56.05'	107.36	-13.07	-1.06
256	25.36'	47.90'	211.99	-21.40	-0.13
257	25.98'	47.98'	185.83	-19.91	-1.09
258	26.14'	48.62'	189.92	-18.14	+0.70
261	26.86'	48.50'	175.78	-14.42	+2.55
262	26.65'	49.34'	168.68	-15.10	+1.74
263	26.53'	50.04'	163.58	-16.53	+0.17
264	26.24'	50.80'	145.21	-18.04	-2.03
265	26.10'	49.95'	155.67	-17.72	-0.88
266	25.94'	49.28'	172.10	-18.89	-0.84

138°45' 138°50' 138°55'

35°20'

35°25'

35°30'



NOTE

ALL VALUES IN SCALE UNITS FOR WORDEN 215 WITH 0.1089 S.D. FACTOR.

BASE CLOSURE MAP OF MILANG AREA S.A.

BY

GEOSURVEYS (AUST) LTD.

REFERENCE

INTERPRETATION BY W.F.S.

DRAWN BY A. von S. DATE Oct '63

SCALE IN MILES

0 1 2 3 4

WGG/6/G

BOUGUER ANOMALY MAP OF MILANG AREA S.A. BY GEOSURVEYS (AUST.) LTD

REFERENCE

ELEVATION DATUM.. . . . . .
CONTOUR INTERVAL.. 1 m.g.l.
INTERPRETATION BY. W.F.S.
DRAWN BY J.W.B. DATE. Aug. '63.

GRAVITY ANOMALY MAXIMUM . . .

MINIMUM . . . .

SCALE IN MILES

0 1 2 3 4

GENERAL POSITION OF ESCARPMENT (LATE CAINOZOIC) FAULT.

ZONE OF STEEPER GRAVITY GRADIENT

GOOLWA OR LOWER MURRAY RIVER DETAILED GRAVITY PROFILE RECOMMENDED

LAKE ALEXANDRINA

HINDMARSH ISLAND

SIR RICHARD PENINSULA

MUNDOO ISLAND

138° 45′ 138° 50′ 138° 55′

35° 20′ 35° 25′ 35° 30′

23 DEC 1963
SA 11/5/91
Enveloped
10-321

WGG/3/G

321-1

ELEVATION AND LOCATION MAP OF MILANG AREA S.A BY GEOSURVEYS (AUST) LTD

REFERENCE

ELEVATION DATUM. RAILWAY LEVELS
CONTOUR INTERVAL. —
INTERPRETATION BY. —
DRAWN BY. JDS DATE. Aug '63

SCALE IN MILES

0 1 2 3 4

WGG/2/G

321-2

138° 45′ 138° 50′ 138° 55′
35° 20′ 35° 25′ 35° 30′

Strathalbyn
Milang
Clayton
Goolwa
Finniss

GEMMEL HILL
GILES HILL
GILES CREEK
TOOKAYERTA
DEEP CREEK
CREEK
CURRENCY CREEK
SWAMP
FINNISS RIVER
ANGAS RIVER
LAKE ALEXANDRINA
GOOLWA OR LOWER MURRAY RIVER
HINDMARSH ISLAND
SIR RICHARD PENINSULA
MUNDOO ISLAND
SOUTHERN OCEAN

1 304·72 · 2 291·39 · 3 276·09 · 4 259·04 · 5 242·21 · 6 223·15 · 67 224·24 · 68 211·98 · 83 224·49 · 84 197·04 · 85 183·32 · 86 188·63 · 87 156·89 · 88 153·61 · 89 144·44 · 90 143·47 · 91 138·63 · 92 132·85 · 93 123·97 · 94 124·94 · 95 117·88 · 96 119·78 · 97 114·78 · 98 111·30 · 99 106·39 · 100 110·62 · 51 222·15 · 52 254·93 · 53 249·03 · 54 227·33 · 55 220·63 · 56 184·33 · 57 160·83 · 58 157·28 · 59 129·83 · 60 128·53 · 61 116·78 · 62 110·18 · 63 125·03 · 72 116·54 · 73 132·19 · 74 136·94 · 75 134·34 · 76 138·19 · 77 153·19 · 78 161·72 · 79 166·89 · 80 165·24 · 81 171·40 · 82 105·49 · 9 102·16 · 101 265·75 · 102 283·38 · 103 338·28 · 104 382·46 · 105 449·28 · 106 534·66 · 107 508·42 · 108 598·32 · 109 464·32 · 110 473·08 · 111 421·52 · 112 523·27 · 113 586·54 · 114 572·89 · 115 535·40 · 118 439·80 · 119 336·86 · 120 265·86 · 121 264·06 · 122 247·24 · 123 266·89 · 124 284·33 · 125 236·44 · 126 215·66 · 127 187·04 · 128 196·72 · 129 214·04 · 130 187·88 · 131 179·77 · 132 173·18 · 133 169·69 · 134 164·19 · 135 151·34 · 136 152·63 · 137 141·94 · 138 143·60 · 139 144·60 · 140 135·70 · 141 121·95 · 142 120·95 · 143 129·61 · 151 470·18 · 152 405·52 · 153 394·19 · 154 356·53 · 155 322·31 · 156 304·10 · 157 280·37 · 158 263·76 · 159 273·02 · 160 211·89 · 161 229·50 · 163 277·32 · 164 295·66 · 165 321·00 · 166 272·86 · 167 315·35 · 168 305·71 · 169 309·25 · 170 244·41 · 171 209·49 · 172 191·18 · 173 183·46 · 174 182·08 · 175 149·50 · 176 197·65 · 177 211·71 · 178 179·81 · 179 157·51 · 180 173·01 · 181 150·14 · 182 130·56 · 183 111·43 · 184 112·77 · 185 119·06 · 186 115·40 · 187 123·60 · 188 144·11 · 189 136·97 · 190 139·30 · 191 182·90 · 192 196·40 · 193 223·40 · 194 163·88 · 195 150·69 · 196 146·35 · 197 149·10 · 198 112·60 · 199 123·60 · 200 112·94 · 201 334·36 · 202 362·32 · 203 354·75 · 204 414·22 · 205 496·10 · 206 526·76 · 207 607·16 · 208 625·03 · 209 622·58 · 210 539·41 · 211 342·71 · 212 447·94 · 213 436·65 · 214 453·55 · 215 428·06 · 216 423·79 · 217 418·39 · 218 351·28 · 219 313·93 · 220 292·89 · 221 371·71 · 222 365·98 · 223 313·01 · 224 483·58 · 225 578·92 · 226 485·72 · 227 464·76 · 228 465·68 · 229 458·57 · 230 418·55 · 231 521·48 · 232 273·30 · 233 191·67 · 234 162·98 · 235 112·10 · 236 110·83 · 237 106·61 · 238 104·51 · 239 104·14 · 240 104·82 · 241 122·42 · 242 125·90 · 243 102·34 · 244 114·76 · 245 114·55 · 246 109·07 · 247 106·12 · 248 107·99 · 249 110·81 · 250 117·41 · 251 117·53 · 252 113·14 · 253 121·15 · 254 110·70 · 255 107·36 · 256 211·99 · 257 185·83 · 258 189·92 · 261 175·78 · 262 168·68 · 263 163·56 · 264 145·21 · 265 155·67 · 266 172·10