COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1963/106

LONGFORD GRAVITY SURVEY, VICTORIA 1960

by

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SUMMARY

This Record describes a gravity survey made by the Bureau of Mineral Resources in the Longford area of Gippsland, Victoria during 1960.

The purpose of the survey was to obtain more complete gravity information over the eastern part of the Baragwanath Fault Block as an aid to the elucidation of local geological structures.

The results indicate that the eastern extremity of the Block is separated from the main part by a small sunken area, and that the Rosedale Fault, which as a major tectonic feature bounds the Block on the north, dips less steeply east of a north-trending cross-fault immediately west of the survey area.

1. INTRODUCTION

Gravity surveys have been conducted in the Latrobe Valley of Gippsland, Victoria, over a number of years in order to investigate the structure of brown coal measures (Thyer, 1944; Thyer and Williams, 1948; Neumann, 1951 and 1960; Neumann and Lonsdale, in preparation).

More-recent detailed gravity work has been done by the Bureau of Mineral Resources in the area south of the Rosedale-Sale road. This investigation was undertaken in response to a request by the State Electricity Commission of Victoria (SEC) for the purpose of delineating more-accurately Bouguer anomalies which had been outlined by earlier, less-detailed surveys.

The 1960 work described in this Record covered the eastern portion of the Baragwanath Fault Block. The area surveyed extended for three miles south of the Rosedale-Longford road and for four miles west of the South Gippsland Highway (see Plate 2).

Sixty-three gravity stations were established about a quarter of a mile apart along fire-breaks in pine plantations owned by Australian Paper Manufacturers Ltd.

The gravity survey was made by geophysicists A. Douglas and G.F. Lonsdale. The surveying, levelling, and preparation of base maps were done by the SEC Brown Coal Investigation Branch, Traralgon.

2. GEOLOGY

The geology of the area under discussion is shown on Plate 1 with geological boundaries mainly based on the Geological Map of Victoria, issued by the Victorian Department of Mines in 1955.

This plate shows that Tertiary rocks crop out over most of the survey area, with some more-recent alluvial deposits in the valley of the Latrobe River to the north. The Tertiary deposits consist mainly of 'terrestrial' clay, sand, and thick brown coal seams.

During and after the end of the depositional period faulting in the underlying strata produced local comparatively 'sunken' areas in which the Tertiary deposits are thicker than on the comparatively 'uplifted' or high-standing areas. Over these faults the Tertiary deposits may be also faulted or may be warped into monoclinal flexures.

The main depositional area of the Latrobe Valley Tertiary Basin is bounded on the west and north by the Yallourn Fault or Monocline and on the south by the Rosedale Fault, which crosses the survey area in an easterly direction. South of the Rosedale Fault, thinner Tertiary deposits overlie Jurassic arkosic sandstone of the Baragwanath Fault Block.

The term Baragwanath Fault Block is based on the results of gravity work, whilst the term Baragwanath Anticline (Thomas and Baragwanath, 1949-51) refers to the structure of the coal beds established by drilling in the area south of Longford. Geophysical investigations (Neumann, 1960; Neumann and Lonsdale, in preparation), together with the results of drilling by the SEC (Gloe, 1960), indicate that the structurally high position of the Baragwanath Fault Block is produced by block faulting of the underlying Jurassic strata rather than by anticlinal folding of those beds.

The Tertiary deposits are economically important owing to their thick brown coal seams. Near Yallourn and Morwell these coal seams occur near the surface, permitting open-cut mining. Towards the east, however, the coal seams in the main depositional area of the Basin are at greater depth. The thinner Tertiary rocks overlying the Baragwanath Fault Block are important owing to the possible presence of thick, good-quality coal seams at shallow depth.

3. DESCRIPTION OF GRAVITY RESULTS

The results of the 1960 Longford gravity survey are shown as Bouguer-anomaly contours in the area south-west of Longford outlined on Plate 2.

The sharp gradient trending east across the northern half of the map (Plate 2) area becomes less steep approaching the western margin of the 1960 survey area, where the -5 and -10-mgal contours show a definite shift to the south. The -15 and -20-mgal contours do not show this movement.

East of this displacement the -10-mgal contour resumes its easterly trend through the 1960 survey area for about five miles before turning sharply to the south-west through Craigs Swamp. However, the -5-mgal contour, after resuming the easterly trend for about one mile just south of the south-western corner of the 1960 survey area, turns southward towards Craigs Swamp and then continues in a south-westerly direction.

The -10-mgal contour line encloses a small, east-elongated 'high' with closure in the -6 and -5-mgal contours about two miles west of Coolun Goolun No. 1 bore. This 'high' is separated from the main gravity 'high' region by a saddle of about 3-mgal amplitude.

South of this 'high', and outside the survey area, the gravity anomaly values become increasingly negative towards the south-east with a gradient of about 3 mgal/mile.

4. INTERPRETATION OF GRAVITY RESULTS

Earlier gravity results in the Latrobe Valley of Gippsland suggests that, in this area, the Bouguer anomalies may be directly interpreted as representing structural deformities on the basis of Tertiary sediments of a density of about 1.9 g/cm^3 overlying a basement of density about 2.5 g/cm^3, the basement in this case being Jurassic sediments. The structural deformities may be assumed to be coincident with the topographical relief of the basement.

The gravity 'high' noted west of Coolun Goclun No. 1 bore can thus be interpreted as being produced by an east-elongated, high-standing block at the eastern extremity of the Baragwanath Fault Block, the more westerly portion of which has been described by Neumann (1960). Over this high-standing block the Tertiary sediments may be expected to show local doming, due to the effects of compaction.

This most easterly part of the Baragwanath Fault Block appears to be separated from the main part of the Block by a depressed area indicated by the gravity saddle mentioned in the previous section of this Record.

The Rosedale Fault, as established by drilling south of Longford, roughly follows the -15-mgal contour line within the steep gravity-gradient zone trending east across the survey area.

The displacement in the -5 and -10-mgal contours near the western part of the survey area is interpreted as being produced by a north-trending fault running approximately from Gravity Station 58-161 to mid-way between Gravity Stations 58-150 and 58-138. This inferred fault apparently has tilted the surface of the eastern extremity of the Baragwanath Fault Block down towards the south in comparison with the part of the Block farther west, decreasing the slope of the Rosedale Fault as indicated by the reduced gravity gradient in the survey area over the Fault.

5. CONCLUSIONS

The results obtained from the interpretation of the gravity data indicate the position of the Rosedale Fault in the Longford area, and suggest that it is dipping less steeply to the east of an inferred north-trending cross-fault immediately west of the survey area.

South of the Rosedale Fault the eastern extremity of the Baragwanath Fault Block has been indicated to be separated from the main part of the Block by a small sunken area. This eastern part of the Block is east-elongated and has apparently been comparatively tilted-down to the south along the north-trending cross-fault referred to above.

Doming of a local extent is likely in the Tertiary beds occurring over this part of the Block. This could be of importance in the search by the SEC for thick, good quality coal seams near the surface.

6. REFERENCES

GLOE, C.S. 1960 The geology of the Latrobe Valley coalfields. Proc. Aust. Inst. Min. Metall. 194, 57-125.

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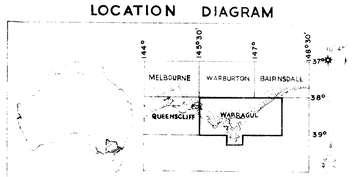
THOMAS, D.E. and BARAGWANATH, W.	1949-1951	Geology of the brown coals of Victoria. Min. geol. J. 3 (6); 4 (1); 4 (2); 4 (3).
THYER, R.F.	1944	Preliminary geophysical survey, Morwell brown coal field, Victoria. Bur. Min. Resour. Aust. Rec. 1944/41 (unpubl.).
THYER, R.F. and WILLIAMS, L.W.	1948	Gravity survey of brown coal deposits, Morwell, Victoria, January-February, 1948. Bur. Min. Resour. Aust. Rec. 1948/81 (unpubl.).

WARRAGUL
VICTORIA

DROUIN · Tynong · Longwarry · Bayles · Catani · Yanathan · Monomeith · KORUMBURRA · Nyora · Bena · Korumburra · Leongatha · WONTHAGGI · Wonthaggi · Inverloch · Cape Patterson · Rokeby · Buln Buln · Drouin · Warragul · Darnum · Yarragon · Trafalgar · Moe · Yallourn · Morwell · Thorpdale · Boolarra · Mirboo Nth · Mirboo · Toongabbie · Glengarry · Traralgon · Flynns Ck · Rosedale · Rosedale No.1 270′ · Kilmany · Sale · Montgomery · Longford · LAKE WELLINGTON · LAKE VICTORIA · REEVE BEACH · MILE · NINETY · Fault · Block · Fault · Baragwanath · MERRIMANS CREEK · MONKEY CREEK · Area covered by drawing Plate 2 · Carrajung · Balook · Strzelecki Ranges · Beech Hill 1880 · Mt Best 1126.4′ · Darriman · Darriman No.1 Bore T.D. 7730′ · Yarram · Alberton · Woodside No.1 Bore T.D. 6008′ · Woodside No.2 Bore T.D. 8862′ · ST MARGARETS · Port Albert · Welshpool · Tobra · Fish Creek · Torwin Meadows · Torwin · Meeniyan · LITTLE SNAKE I. · SUNDAY I. · SNAKE ISLAND · LIPTRAP · YANAKIE · Mt Singapore 477′ · CORNER INLET · Sandy Pt · WARATAH BAY · Cape Liptrap · RABBIT I. · SEAL ON DIRECTION I. · WILSONS PROMONTORY · South Peak 1247′ · BASS STRAIT

G93-27 MOE · G93-28 ROSEDALE · G93-29 SALE · G93-30 STOCKYARD · G93-24 MIRBOO NTH · G93-25 CARRAJUNG · G93-26 STRADBROKE · G93-45 ALBERTON · G93-46 FOSTER

LOCATION DIAGRAM



REFERENCE TO AUSTRALIA 4-MILE MILITARY MAP SERIES

LEGEND

- Tertiary, reef of siliceous limestone
- " terrestrial sediments
- " basalt
- Jurassic
- Lower Devonian / Silurian
- Ordovician
- Granite

LEGEND

- Bore in ft.
- First-class road
- Second-class road
- Third-class road
- Railway
- Explanation bdy.
- Cadastral bdy. or miscellaneous
- Indefinite
- Anticline
- Local gravity anomaly

GEOLOGY AND MAJOR TECTONICS

SCALE IN MILES

0 2 4 8 12 16 20

MAP DATA

PROJECTION: Transverse Mercator, Australian Spheroid

DETAIL: Planimetry from Royal Australian Survey Corps Warragul 4 miles to 1 inch map

Geology from geological map of Victoria by Department of Mines, Victoria 1955 and geological and topographical plan of part of South Gippsland by H. HERMAN, 1952.

Geophysical (gravity and seismic) information on structural features by BMR surveys 1948-1956.

DROUIN Royal Australian Survey Corps 1 mile to 1 inch map. G93-46 FOSTER Previously published BMR Bouguer anomaly 1 mile to 1 inch map.

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS J55/B2-22
ACCOMPANY REC/1970 No.19-3/106

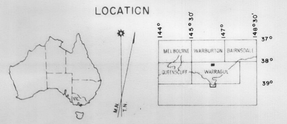
ROSEDALE – LONGFORD AREA, GIPPSLAND, VIC.
BOUGUER ANOMALIES

SCALE IN MILES

½ 0 ½ 1 1½ 2 2½

CONTOUR INTERVAL 1 MILLIGAL

LOCATION



REFERENCE TO AUSTRALIAN NATIONAL 4-MILE MAP SERIES

COMPILED DECEMBER 1959
REVISED DECEMBER 1960

MAP DATA

CONTROL: STATE ELECTRICITY COMMISSION OF VICTORIA FIELD SURVEYS.

DETAIL: PLANIMETRY FROM S.E.C. OF VIC. DRAWING Nº B.C.I. 5-5-9 AND B.C.I. 5-3-5. GEOPHYSICAL DATA FROM BMR SURVEY.
GRID – TRANSVERSE MERCATOR, AUSTRALIAN SERIES, ZONE 7 (VALUES IN FEET)

RELIABILITY: PLANIMETRIC – ACCURATE
GEOPHYSICAL – DETAILED GRAVITY

LEGEND

TOPOGRAPHY

- RAILWAY
- ROAD
- WATERCOURSE
- TOWNSHIP
- COAL BORE
- BM BENCH MARK
- TRIG. STATION

GRAVITY

- BMR STATION
- RELATIVE BOUGUER ANOMALY (MILLIGALS)
- ELEVATION
- ISOGALS
- HIGH ANOMALY
- LOW ANOMALY

EXPLANATION

RELATIVE BOUGUER ANOMALIES ARE BASED ON THE OBSERVED GRAVITY VALUE OF 980,021·2 MILLIGALS AT B.M.R. PENDULUM STATION Nº 2, YARRAM, VIC.

FOR THE CALCULATION OF BOUGUER ANOMALIES $\sigma = 2{\cdot}0\ G/CM^3$ HAS BEEN ADOPTED AS AN AVERAGE ROCK DENSITY.

ELEVATION DATUM – VICTORIAN RAILWAY DATUM

TO CONVERT TO BOUGUER ANOMALIES RELATIVE TO THEORETICAL VALUES ON INTERNATIONAL ELLIPSOID (DENSITY $\sigma = 2{\cdot}67\ G/CM^3$) SUBTRACT FROM VALUES SHOWN $(0{\cdot}514\,\sigma\,h)$ MILLIGAL, WHERE 'h' IS THE STATION ALTITUDE IN FEET ABOVE SEA LEVEL

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS J55/B2-23

To accompany Record No. 1963/166