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TENEMENT: O.E.L. No. 22

TENEMENT HOLDER: General Exploration Company of Australia Ltd.

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Envelope No 19

REPORT ON GRAVITY SURVEY SOUTH-WEST OF MT. GAMBIER

SOUTH AUSTRALIA

Plans to Accompany Report:

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| G.E.A. No.3 | Gambier Northumberland Area Bouger Gravity Anomaly 1 inch to 1 mile. |
| G.E.A. No.7 | Bouger Gravity Map of South East South Australia and South west Victoria. |

# REPORT ON GRAVITY SURVEY SOUTH-WEST OF MT.GAMBIER SOUTH AUSTRALIA

## 1. INTRODUCTION

### A. Location:

The area surveyed during January and February 1960, some 150 square miles in extent, lies to the south and east of Mt.Gambier.

The survey was designed to cover an area in which preliminary bio-stratigraphic work by Mr. C.A. Abele, research student University of Adelaide, had indicated the presence of a structural "high" to the immediate south of Mount Salt Station. Subsequent more detailed work of a similar nature confirmed the existence of a closed anticlinal structure in this area and together with geological interpretation carried out by Mr. R.C. Sprigg, indicated the presence of further possible en-echelon anticlines.

### B. Survey Information:

An approximately north-south and east-west rectangular grid of roads was used for the survey, most of these being public roads but a few are tracks through private property.

Stations were spaced at approximate ½ mile intervals and were identified at road bends, intersections etc. on aerial photographs. These positions were transferred to a composite map at a scale of 2" = 1 mile, made up of portions of the Hundred maps of Benara, Blanche, Kongorong, McDonnell and Caroline. Reasonably accurate latitude corrections were thus possible.

Optical levelling of stations was carried out by Mr.K. Moody and with N.Dynne and J. Davis as assistants, using the Tacheometric method of levelling with a Wild T1 theodolite. Closure errors never exceeded 0.5 feet. All elevations are based on the railway benchmark No.317 at Burrungule railway station which value is 96.16 feet above low water mark Port Adelaide. (Information supplied by Engineers Section, South Australian Railway Department, Adelaide).

## II. GRAVITY OBSERVATIONS

Gravity observations were carried out using Worden Gravity Meter No. 215, while the makers scale factor of 0.09395 milligals /scale division, was used. Closures for "drift" were made at intervals not exceeding 2 hours. Closures in the northern part of the area were good, but further south toward the upper limit of the instrument, were not quite so small, due to a suspected mechanical fault in the inner dial mechanism. The instrument makers also suspect a small leak in the vacuum flask, which may cause erratic drift rates on temperature changes.

Difficulty was experienced in reading the meter on certain days, due to a slow but irregular oscillation of the beam, although closures were generally within reasonable limits. This effect, worse on some days than others, may be due to micro-seismic activity in the area. Similar effects were noticed by K.Richards, geophysicist, Frome Broken Hill Ltd, the previous leaseholders, who attributed the movement of the beam to small shock waves caused by large off-shore atmospheric disturbances. Strong gusty wind conditions, mainly from a south-west direction, were experienced during the whole period of the survey.

The observed gravity value (979999.8 milligals) of Station GK15 of the South Australian Mines Department regional gravity survey, corresponding to station 2-8 of Geosurveys survey, was used as gravity datum. A Bouger and elevation correction factor of 0.63 gravity units per foot, was used to conform with the former survey.

A major portion of the same area had been covered by a more detailed gravity survey by K. Richards, Frome Broken Hill Ltd. Unfortunately, this material was on the "restricted" file and only released to this company after the survey covered by this present report had been completed. Agreement between the two surveys is generally quite good although the Frome-Broken Hill survey shows more detail in some areas due to a closer spacing of stations (¼ mile intervals).

## III. INTERPRETATION

From a comparison of the Bouger anomaly map with either the factual geological map (South Australian Geological Survey 1-mile series 1951) or the interpretive geological map (Sprigg-Abele 1960), it is obvious that there is very little agreement between the two.

The prominent feature of the area is an east-west trending gravity maximum. To the south is a rather flatter minimum with a trend slightly north of west, while further toward the coast, gravity values increase again.

The closed anticlinal structure immediately south of Mt. Salt homestead, as delineated from factual bio-stratigraphic evidence, lies within the general central zone of lower gravity values. Its axial direction, (approximately north-west), appears to transgress the axis of the gravity minimum at a fairly sharp angle.

Further north, the general synclinal axis evident just north of Mt.Salt homestead, although complicated by numerous shallow undulations, crosses the prominent east-west trending gravity maximum at an angle of some $45^{\circ}$. The only area where the trend of gravity contours approximates known or interpreted geological trends is the area to the immediate east of Kongorong township. Although there is a parallelism between the two trends, an interpreted shallow syncline is not reflected by the gravity values. As suspected north-west trending fault in this area is also parallel to the contour trend.

To the north-west of Kongorong another approximately east-west trending gravity "high" appears to be in en-echelon arrangement with the main gravity "high" of the area.

The trend of contours in the southern portions of the area, appears to parallel the coastline fairly closely and this, together with the positive gradient seawards, indicates an influence due possibly to thinning of the crust toward the continental shelf, which is relatively near the present coastline in this area. Richards (Frome Broken Hill report) mentions the possibility that this effect could also be due to thinning of the sedimentary section in that direction.

Richards also did some detailed gravity surveys in the Tantanoola and Summer Hill areas. In both cases, close spacing of the gravity contours can be correlated with the Tantanoola and Nelson fault zones respectively, but the gravity values are higher on what are thought from geological and bore hole information, to be the downthrownsides of the respective faults. There have been some recent opinions (Sprigg-Boutakoff) that movement on the Kanawinka Fault may be of a reverse nature and the gravity evidence over the Tantanoola and Nelson faults suggests the possibility of a similar reverse movement on these. Possibly, movements of both normal and reverse nature at different geological periods, especially if proceeding contemporaneously with sedimentation, could adjust the relative portions of beds so as to give higher gravity values on the downthrown side. A third possible explanation is that the faults may have reversed angles of dip in depth (curved fault planes). Apparent reverse

movements at the surface on this type of fault become normal movements in depth and gravity observation stations on what appears to be the downthrown side at the surface, may actually lie vertically above the upthrown side in depth, resulting in higher gravity values.

The usual profile method of extracting the regional gravity was applied to the area without simplifying the picture, but merely had the effect of flattening out the Bouger gravity picture somewhat. Similarly, K. Richards applied several other methods of extracting the regional effect, eventually choosing the second derivative map as giving the best result. However, even this did not change the overall picture to any marked degree, although it did have the effect of bringing the contour direction more in the line with regional geological trends; that is, in a more north-westerly direction. Known and interpreted folds still are not reflected in the residual gravity pattern.

Richards explains the irregularities of the Bouger gravity contours as being due to two possible factors, firstly that non-sedimentary rocks may be reasonably close to the surface or secondly near surface density changes in the Gambier limestone due to underground cavities.

The most logical explanation may be that the "basement" is of a complex metamorphic nature, which fact, combined with the positive regional gradient seawards, due presumably to thinning of the crust toward the continental shelf, would mask effects due to structure in the overmass sediments (Jurassic? Lower Cretaceous and Tertiary) of the "Gambier Sunklands".

R.B. WILSON.

BURRUNGULE

MOUNT GAMBIER

MURRAWA

KROMELITE

KONGORONG

MT. SALT HS.

UMPHERSTONE BAY

PORT MacDONNELL

CAPE NORTHUMBERLAND

DANGER POINT

DISCOVERY BAY

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# GAMBIER NORTHUMBERLAND AREA

## BOUGER GRAVITY ANOMALY

## ISOGAL INTERVAL 5 GRAVITY UNITS

SCALE: 1 INCH = 1 MILE GEA 3

GEOSURVEYS AUST. LTD.

R.B. WILSON

GRAVITY DATUM STATION GK15 SA. DEPT. MINES
LEVELS RELATED TO PORT ADELAIDE DATUM

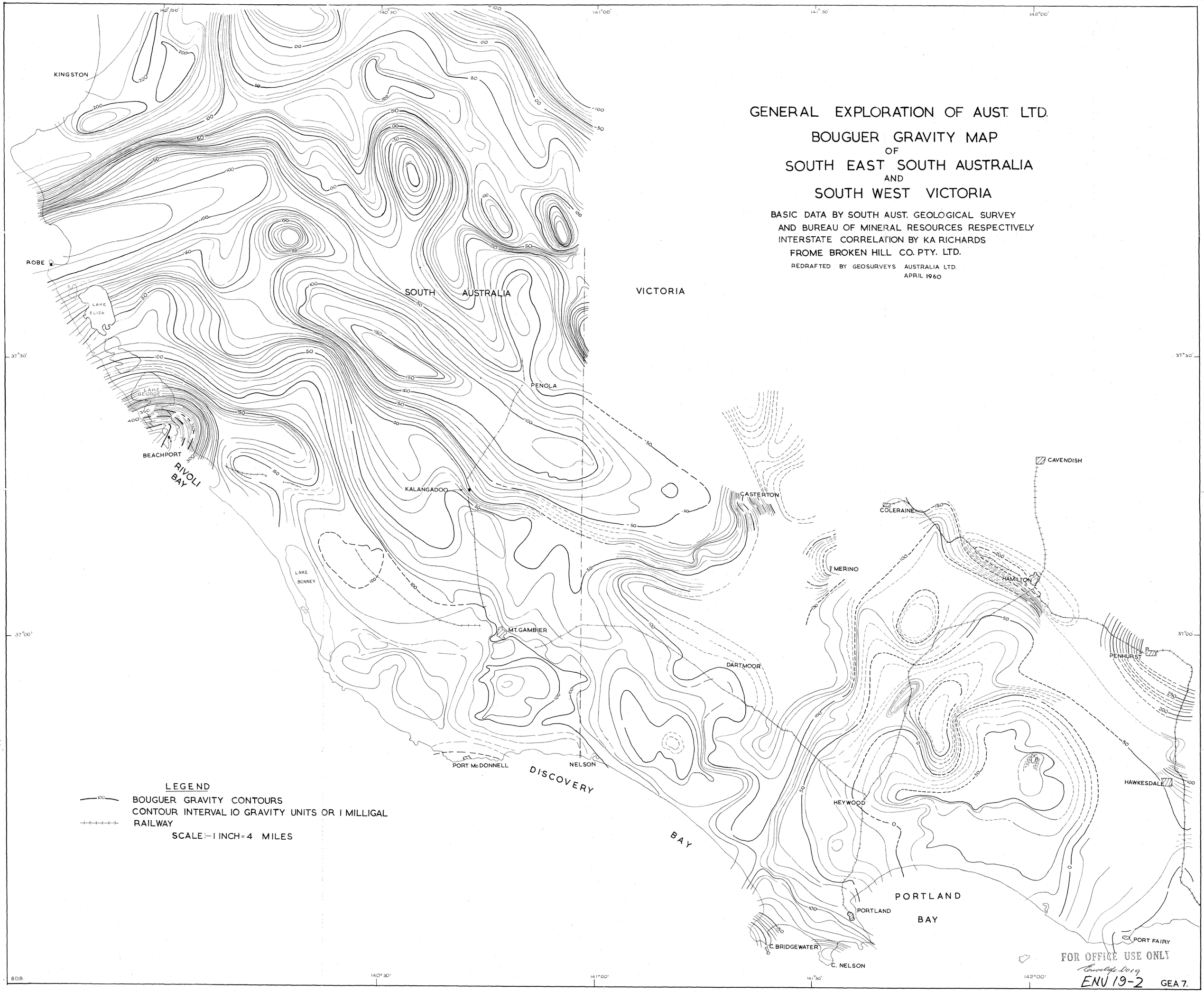
ENV 19-1

# GENERAL EXPLORATION OF AUST. LTD.

## BOUGUER GRAVITY MAP
OF
## SOUTH EAST SOUTH AUSTRALIA
AND
## SOUTH WEST VICTORIA

BASIC DATA BY SOUTH AUST. GEOLOGICAL SURVEY
AND BUREAU OF MINERAL RESOURCES RESPECTIVELY
INTERSTATE CORRELATION BY KA RICHARDS
FROME BROKEN HILL CO. PTY. LTD.

REDRAFTED BY GEOSURVEYS AUSTRALIA LTD.
APRIL 1960




LEGEND

—100— BOUGUER GRAVITY CONTOURS
CONTOUR INTERVAL 10 GRAVITY UNITS OR 1 MILLIGAL
RAILWAY
SCALE:- 1 INCH = 4 MILES



GEA 7.

B.D.B.