FEL Tech
D. Boyd.

Notes on the Interpretation of a Gravity Survey
carried out over the Willippa Anticline.

17 July 1996.

1. The gravity observations on which this interpretations is based were made by geophysicists of Mines and Energy South Australia, MESA.

The contour map and the positions of the stations at a scale of 1:50,000 has been provided by MESA together with the original data which was provided on a floppy disc.

The area described in this note, figure 1, lies between 139°8.5'E and 139°16'E and between 31°36'S and 31°42'S and covers an area of about one hundred and thirsty square kilometres.

For interpretation all maps were, where necessary, enlarged to a scale of 1:50,000 to make comparison easy and exact registration of different maps was made by matching longitude 139°10'E and 31°40'S.

The gravity station have been observed along the roads and tracks which is the most efficient way to carry out the initial survey. Most of the stations are about 500 metres apart along the roads except in those parts of the area where the gradient is steep and here the reading are about 250 metres apart.

2. The interpretation is in three parts;
   i. an account of modelling along profile AB,
   ii. comparison of the gravity contour map and the geological maps,
   iii. location of the magnetic bodies along a north south geological section which is 2 kilometres east of 139°10'E.

3. Interpretation

The principal gravity anomaly in the area is a low of about four milligals which lies close to the centre of the Willippa Anticline

The gravity anomaly has been modelled along line AB, see figure 1, the main purpose of the modelling being to estimate the depth to the top of the low density body.

The gravity gradient is key factor in determining the depth of the body; the gravity gradient is determined mainly by the depth of the body and the contrast in density between the body and the surrounding rocks - the bigger the density contrast the bigger the gradient, and the deeper the body the lower the gradient. It is important therefore to try to get a realistic estimate of the density contrast. Twenty eight density measurement are available from rocks of comparable nature from the Blinman No.2 Drill hole. The average density of the rocks from this hole are 2.68 gm/cc; the densities measured range from about 2.55 gm/cc to between 2.75 gm/cc and 2.8 gm/cc. If the negative gravity anomaly is due to salt it is possible that there will be a density contrast

of 0.5 to 0.6 gm/cc. If the anomaly is due to intra-formational density contrast it is possible that the anomaly is caused by a contrast of 0.25 gm/cc or even a little greater.

Modelling.

The gravity anomaly was modelled using "POTENT" modelling system.

As the strongest gradient is on the south side of the anomaly the initial model matched this to give the order of depth of the body. Figure 2 shows that the anomaly can be matched by a body which is at a depth of 190 metres if the density contrast is 0.3 gm/cc.

The modelling of the more complex anomaly is shown in figure3 and figure 4. The depth of the southern body is about 190 metres if the density contrast is 0.3 gm/cc and about 290 metres if the density contrast is 0.5 gm/cc.

(Note the shallow depth at point 620 is probably not significant and is likely to be the effect of small errors in the gravity value in two stations which are close together.)

Relation of Gravity Contour Map and the Geological Map

It should be noted that the gravity low appears to cross the axis of the anticline. In the east about longitude 139°14' the most intense anomaly is in the middle of the anticline. In the west between 139°10' and 139°12' it lies to the north of the axis and coincides with the upper part of the Wilyerpa glacial deposits; this anomaly appears to swing north eastward toward Castle Bore following the geological outcrop but as the contours are based on one point only, this could be misleading.

On the southern side of the anticline two negative anomalies south west and south of Willippa 1 Borehole are open to the east and west so that we do not know their shape. The southern anomaly appears to occur over about the same stratigraphic level as the longer anomaly to the north.

Geological Section.

A geometrical construction of a geological section was made along a north south line using the dips on the geological map, figure 5. This section suggests that the low gravity values north and south of the axis occur at about the same stratigraphic level. The modelling using POTENT shows that the source of the northern anomaly is shallow which may produce problems in the geological explanation of this body.

Depth extent of the anomalous body.

It is almost always much easier to make an estimate the depth to the top of a body than it is to estimate the depth to the bottom. This problem occurs because than part of the anomaly from the deeper part of the body is most evident on the flanks of the anomaly where the anomaly is most affected by adjacent bodies and structures. The depth extent depends on where the background level has been drawn. However in this

case there is no indication that there is an extensive fringe to the anomaly and the modelling appears to indicate that the low density body does not extend much below a depth of one and a half kilometres.

David Boyd
17th July 1996

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Figure 1 Bouguer Gravity Contours provided by MESA.

Figure 2. Preliminary interpretation of gravity anomaly on line AB; density contrast 0.3 gm/cc.

Figure 3. Interpretation of gravity anomalies on line AB; density contrast 0.3 gm/cc.

Figure 4. Interpretation of gravity anomalies on line AB; density contrast 0.5 gm/cc.

Figure 5. Geological Map with extra dip information.

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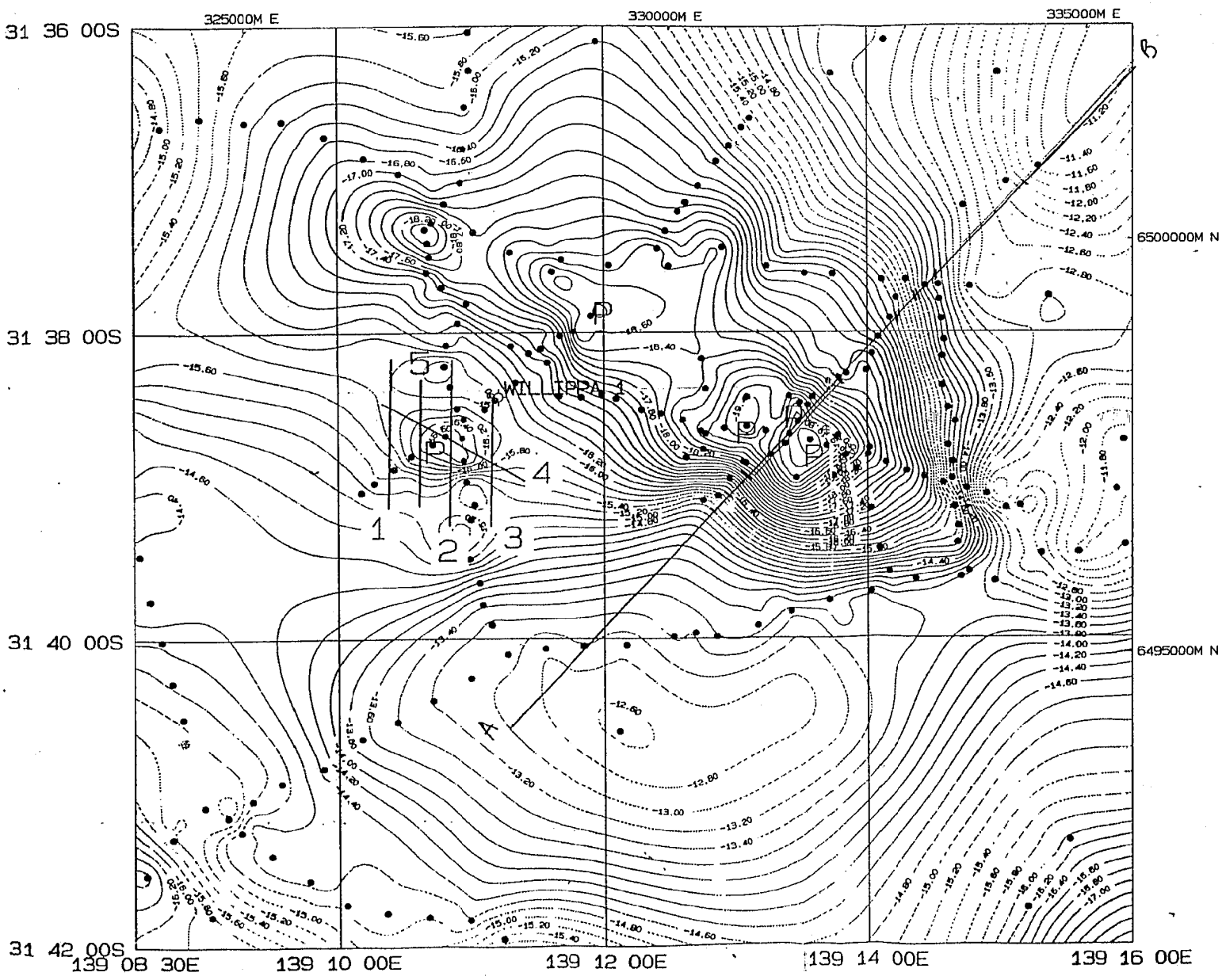
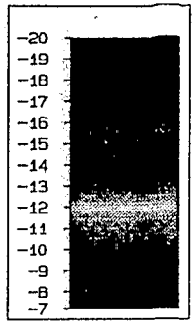
Working diagrams;

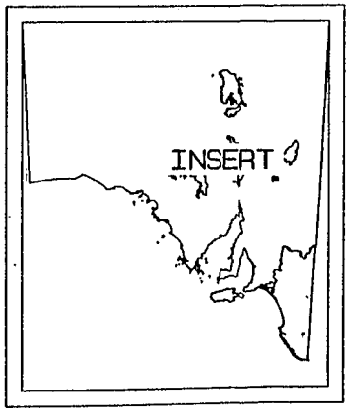
1. Enlargement of section of the MESA 1:250,000 geological map over the Willippa Anticline.

2. Geological section constructed using dip information from figure 5.

WILLIPPA







1: 50000

0 1 2 3 4

KILOMETRES

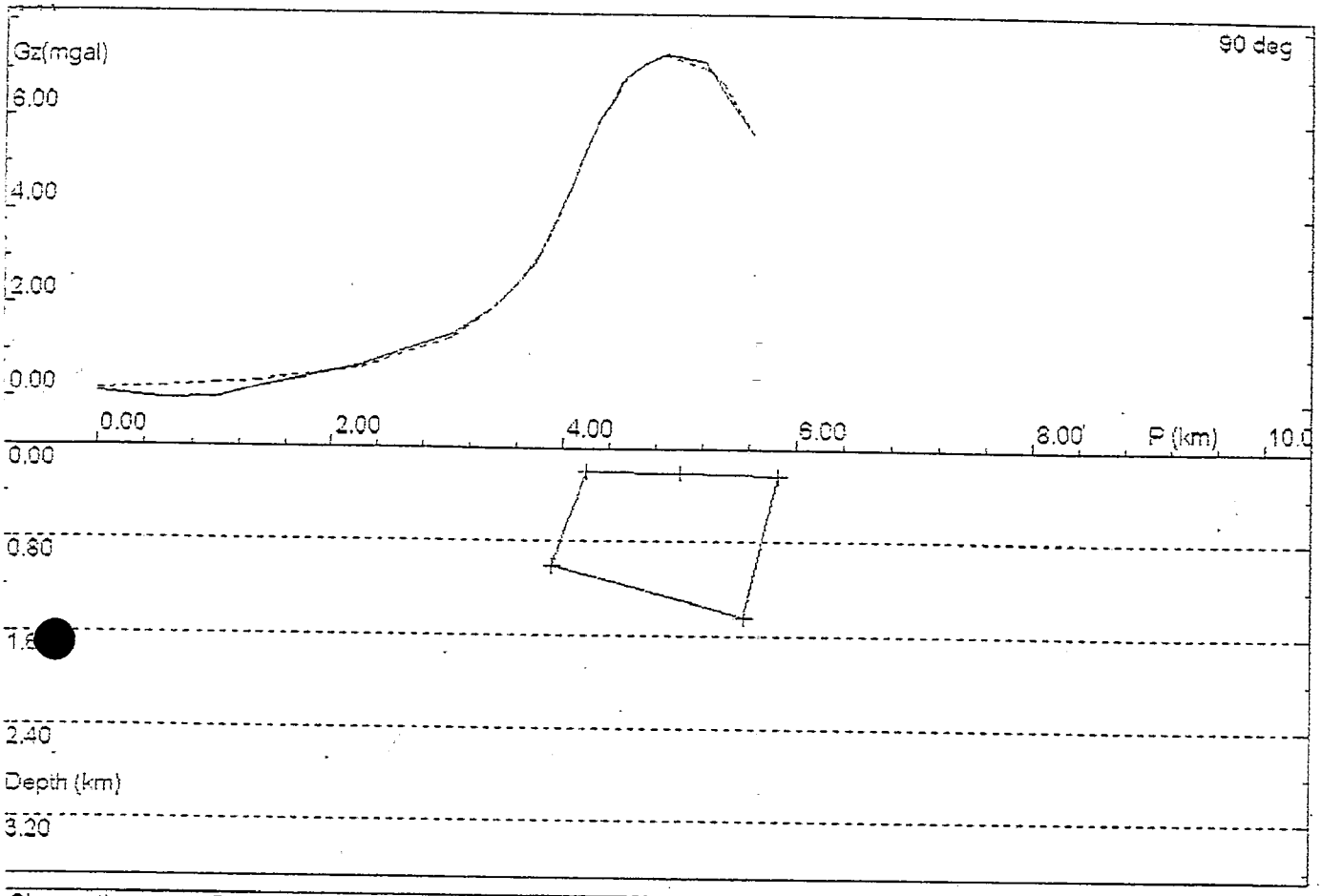
UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 141 00 00E

MINES AND ENERGY
SOUTH AUSTRALIA

PROPOSED GRAVITY TRAVERSES
CONTOUR INTERVAL 0.2 MGAL

DATE : OCTOBER 30, 1990	AUTHOR : ANDREW SHEARER
ORIGINAL SCALE : 1:50000	DRAFTED : PETROMETR SOFTWARE
MAP PROJECTION : UTM	MAP SPHEROID : ANS
C M : 141 00 00E	MAP ZONE : 54

Figure 2



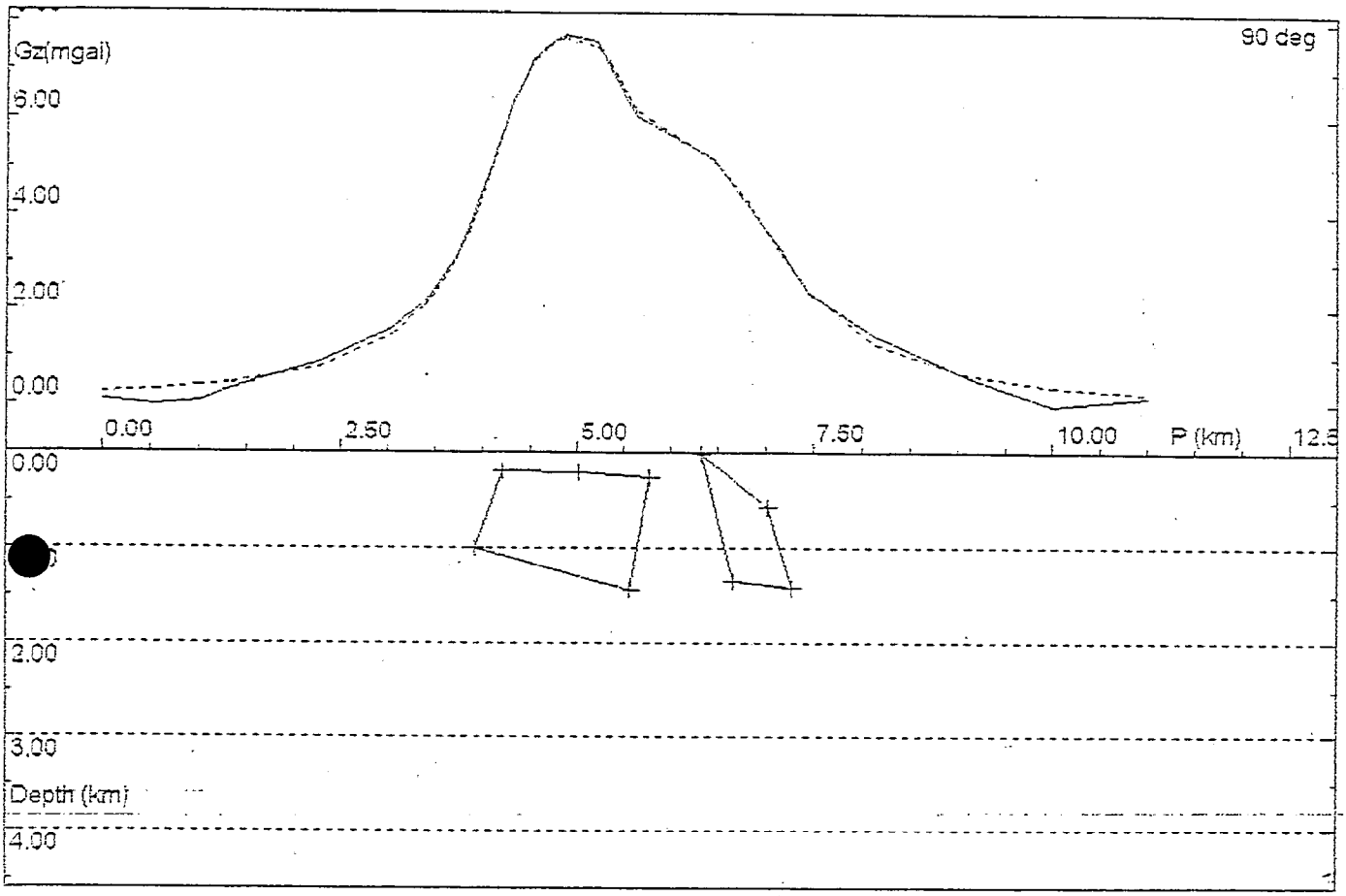
Observations: Profile due to□eric rudd□□□
Profile #1;
Model:
Calculation mode: Z gravity vector component

Observed: ——————— Calculated: ----------
Residual: ---------- Individual body: ----------

POTENT v3.04 Profile drawn at 11:67 02/04/1996 for David Boyd

Model RUD4 Density 0·3

Figure 3



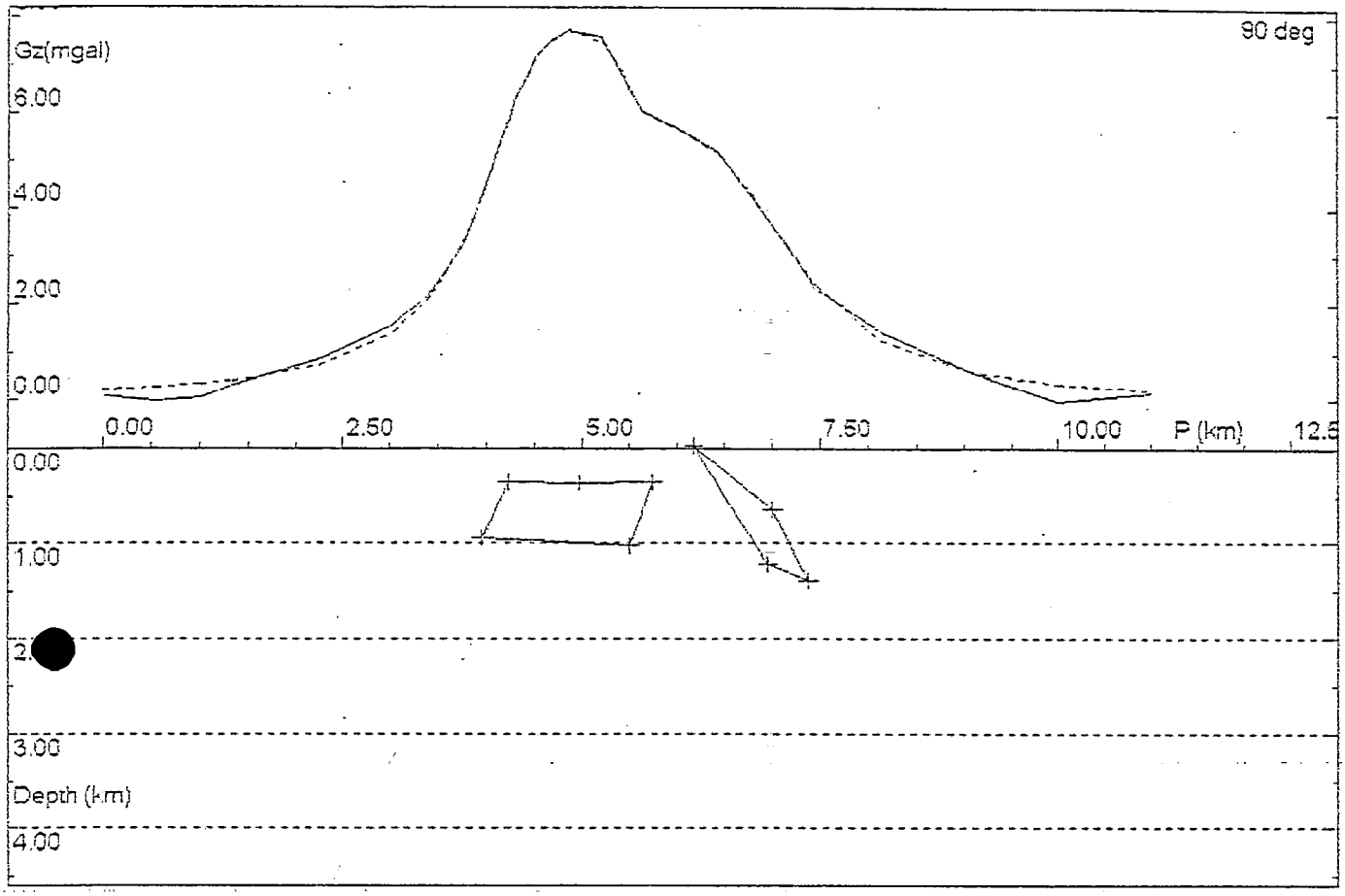
Observations: Profile due to□eric rudd□□□
Profile #1;
Model:
Calculation mode: Z gravity vector component

Observed: ———— Calculated: ----------
Residual: ---------- Individual body: ----------

POTENT v3.04 Profile drawn at 12:43 02/04/1996 for David Boyd

R-com 2 density contrast 0.3.

Figure 4



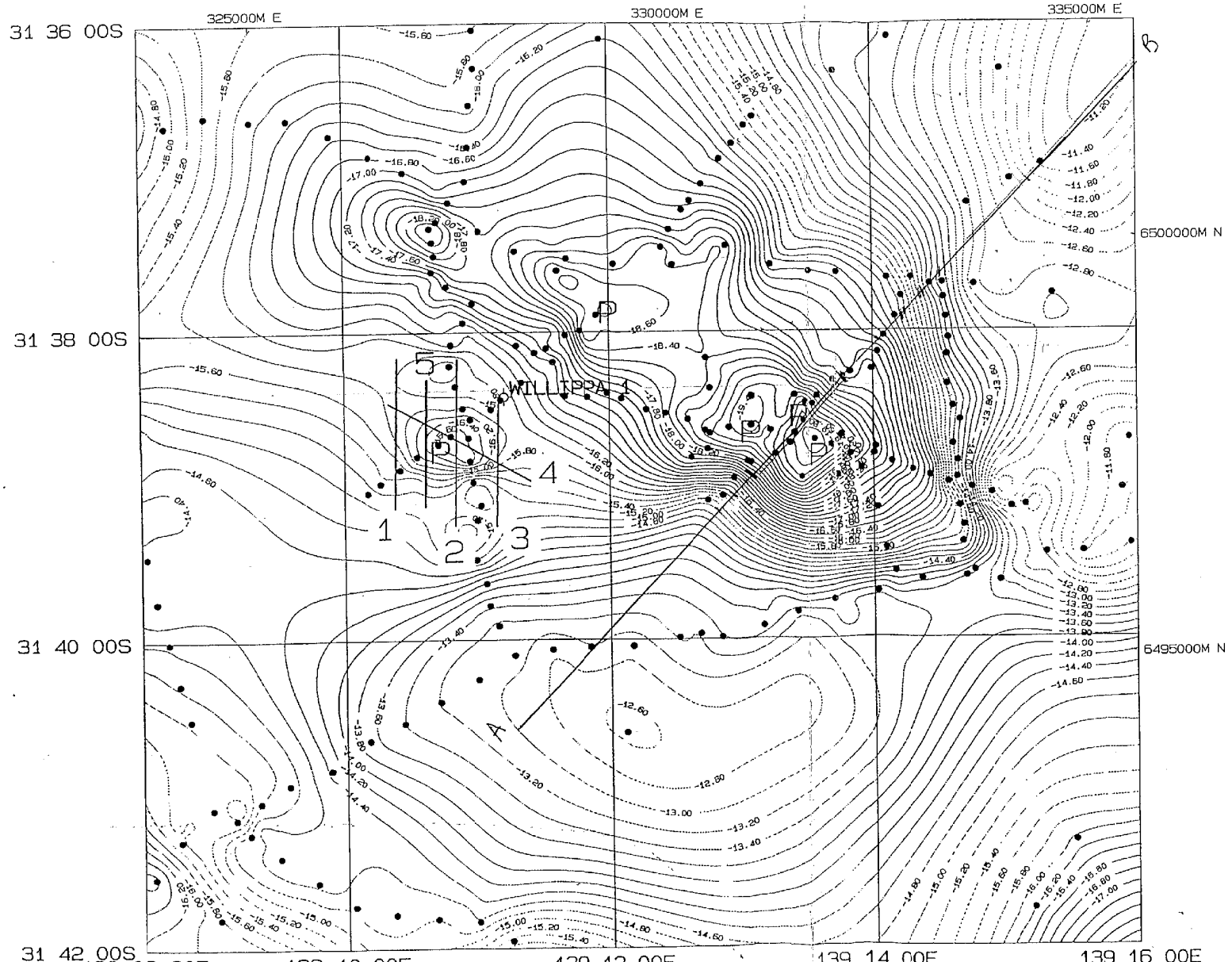
Observations: Profile due to□eric rudd□□□
Profile #1:
Model:
Calculation mode: Z gravity vector component

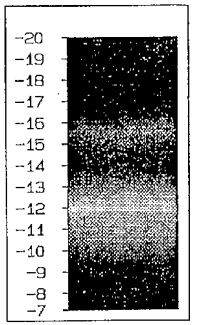
Observed: ——————— Calculated: - - - - - - - - - - - - - - - -
Residual: - - - - - - - - - - - - - - - - Individual body: - - - - - - - - - - - - - - - -

POTENT v3.04 Profile drawn at 12:31 02/04/1996 for David Boyd

com 4 density contrast 0.5

WILLIPPA





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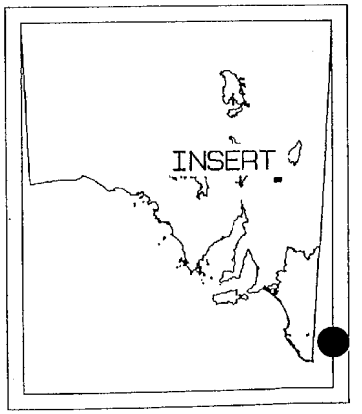

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