

Abstract

Seismic and gravity surveys of the Darwin Crater in western Tasmania show a closed basin filled with sediment. The basin depth is at least 230 m. Faulting in the area makes seismic refraction difficult and may make recognition of basement difficult when drilling.

INTRODUCTION

The Department of Mines commenced drilling the topographic feature known as the Darwin Crater [CP895155] (42°18.39'S 145°39.41'E) early in 1983. A seismic refraction survey was performed concurrently with the drilling to provide an estimate of the likely target depth. Gravity and magnetic surveys were performed after drilling. The drilling showed unconsolidated fill to a depth of at least 180 m.

The Darwin Crater is located about 35 km south-south-east of Queenstown and forms a thickly vegetated depression. A rough bulldozer track leads to the approximate centre of the crater from where two intersecting survey lines were cut (fig. 1). The survey lines were levelled and the positions of a number of points surveyed. The crater is an almost circular, gently sloping area surrounded by steeply rising topography. The cut lines terminated at the base of the steep slope.

Fudali and Ford (1979) report a previous gravity survey which showed a negative anomaly in the crater area. This previous survey was hampered by poor elevation control, the removal of an incorrect regional trend, and restricted terrain corrections. Insufficient data is available to allow this survey to be incorporated into any additional survey.

MAGNETIC SURVEY

The magnetic field was measured at each gravity station (fig. 1) using a proton magnetometer. The intersection of the survey lines was used as a reference point and read repeatedly to allow correction of the data. The resulting profiles showed no variation of more than 5nT.

SEISMIC SURVEY

A twenty-four channel seismic refraction spread was recorded along each of the survey lines. A geophone spacing of 30 m was used with shots at the centre of the spread (the intersection of the survey lines), at 350 m from the centre, and at 630 m from the centre. A reciprocal geophone was used for all but the centre shots.

The velocities ranged from 900 m/sec in the upper 20 m to 3000 m/sec at depth. The irregular travel-time plots suggest several faults within the crater area and indicate high velocity bands within the fill. The east-west spread has the most regular travel-time plot and gives a depth at the centre of the spread of approximately 180 m and at the ends of the spread (315 m from the centre) of approximately 160 m.

GRAVITY SURVEY

Eighty-five gravity stations were established along the two survey lines (fig. 1) using Sodin gravity meter number 183. Soft ground conditions at several places decreased the reading accuracy to about 0.1 mgal but in general the reading accuracy was 0.05 mgal or better. The station elevations (fig. 2) were determined with an accuracy of .05 m or better and the positions with an accuracy of 10 m or better. The data have been corrected for drift, latitude, elevation and terrain effects to a radius of 19 km. A density of 2.67 t/m³ was used for all corrections. The datum for the survey was station 8051.9905 at Gormanston.

The profiles of the Bouguer anomaly (fig. 3) show a low of about 4 mgal positioned near the centre of the area. The east-west profile appears to show a strong regional trend but the State gravity map shows that the trend in the area is a linear gradient of -0.5 mgal/km to 106° (true) in the crater area. This was removed from the corrected data to give residual profiles for modelling (fig. 4). The densities of 2.1 t/m³ for the fill and 2.6 t/m³ for country rock measured by Fudali and Ford (1979) were used for input to a two-dimensional polygon modelling program. The final models (fig. 5 and 6) show an asymmetric basin with a maximum depth of 230 m and a depth in the centre of 210 m. These depths are based on two-dimensional modelling and are minimum depths only.

CONCLUSIONS

The Darwin Crater is a closed basin at least 230 m deep. The faulting inferred from seismic data suggests that there may be extensive fracturing of the basement throughout the crater area. Any drill-hole seeking basement may enter fractured material causing problems in differentiating basement and fractured country rock forming the basin fill. A series of holes may need to be drilled to define the origin of the basin.

REFERENCE

FUDALI, R.F.; FORD, R.J. 1979. Darwin glass and Darwin Crater: a progress report. *Meteoritics* 14:284-296.

[13 January 1984]

GRAVITY SURVEY

Eighty-five gravity stations were established along the two survey lines (Fig. 1) using Jolly gravity meter number 185. Best ground conditions at several places decreased the reading accuracy to about 0.1 mgal but in general the reading accuracy was 0.05 mgal or better. The station elevations (Fig. 2) were determined with an accuracy of 0.5 m or better and the positions with an accuracy of 10 m or better. The data have been corrected for latitude, longitude, and height effects to a datum of 1956.

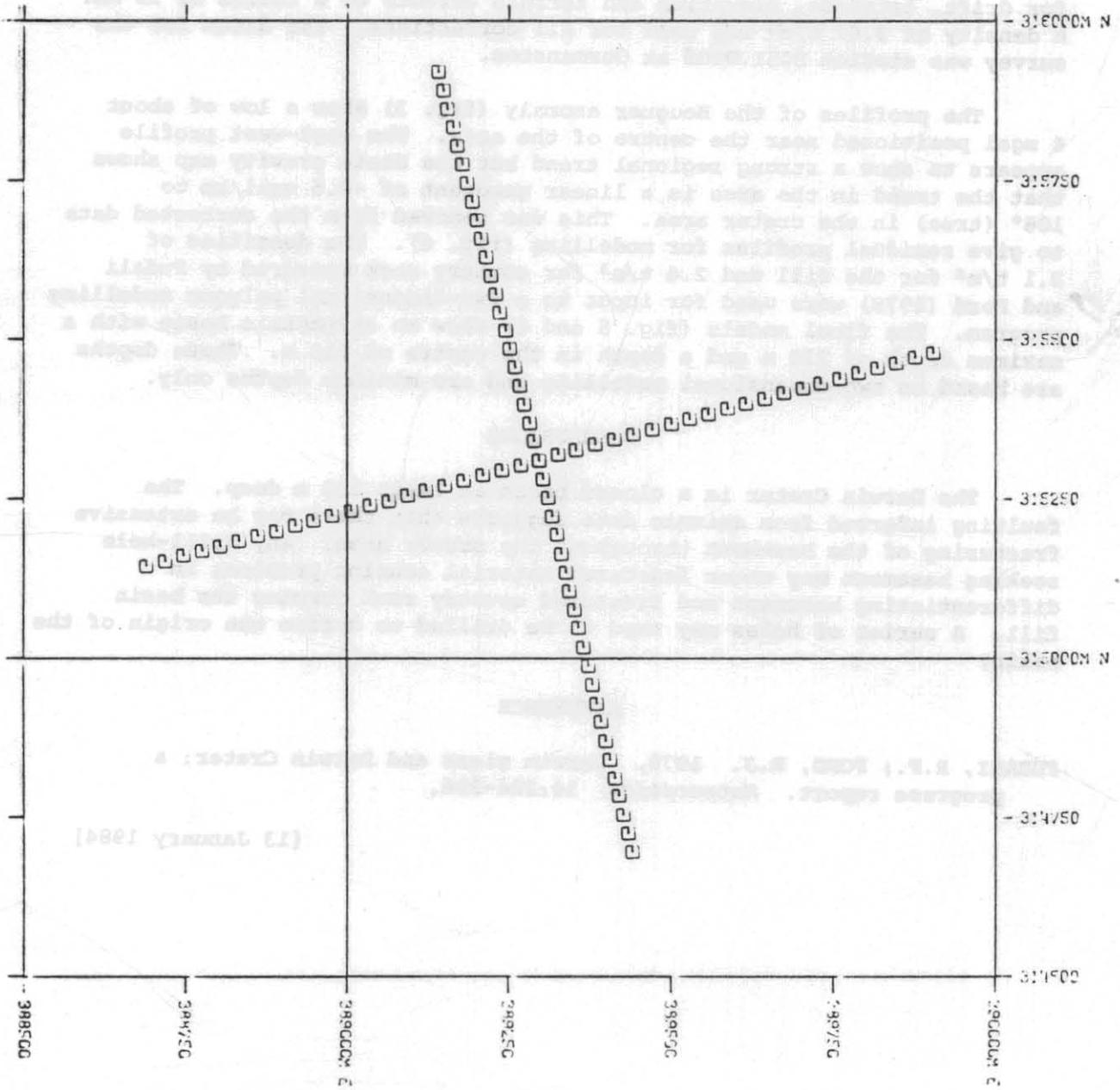
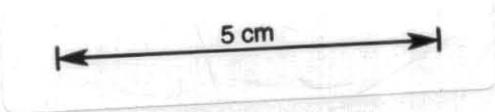
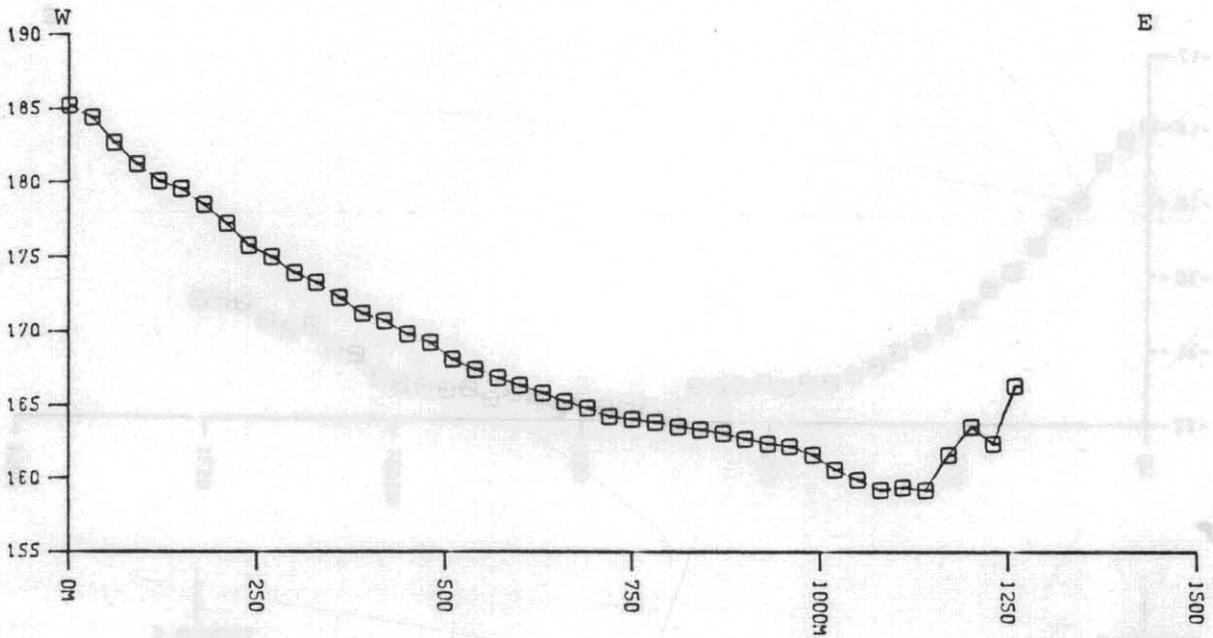


Figure 1. Gravity station locations

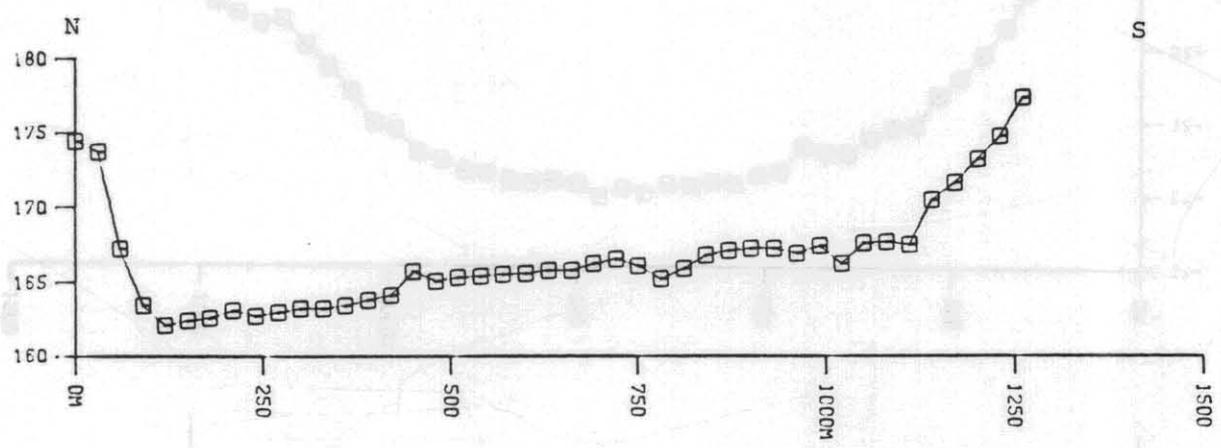
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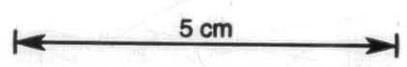
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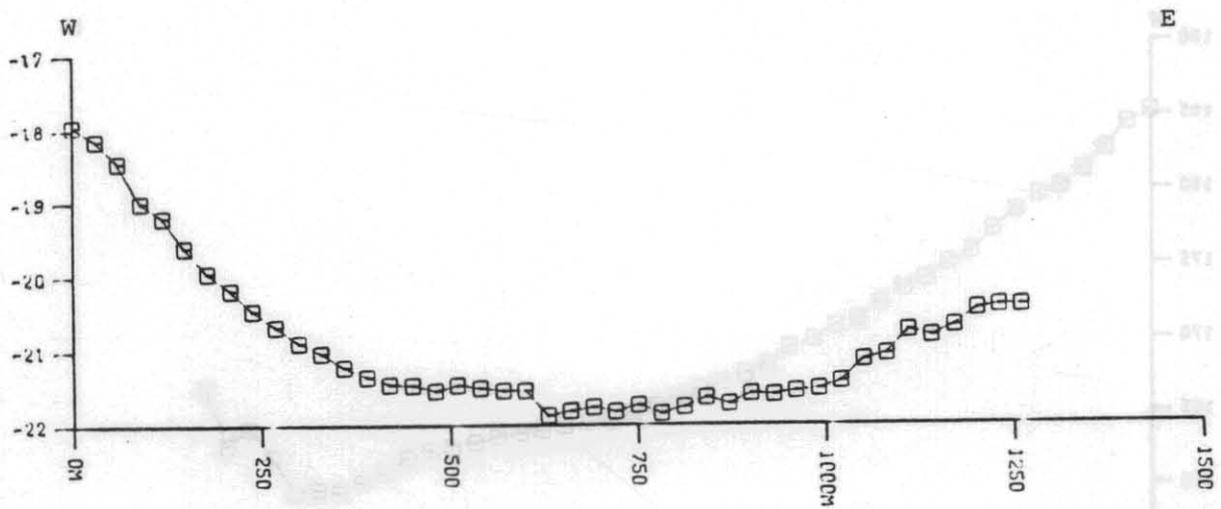


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389499M E
314096M N

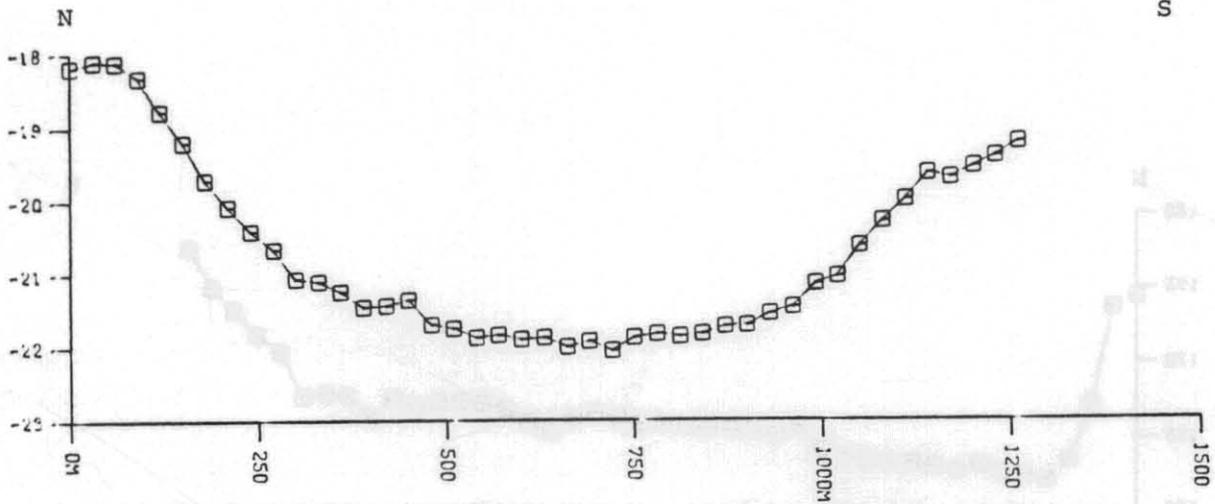
Figure 2. Gravity station elevations
Scale = 1:10 000





388689M E
315144M N

389903M E
315478M N



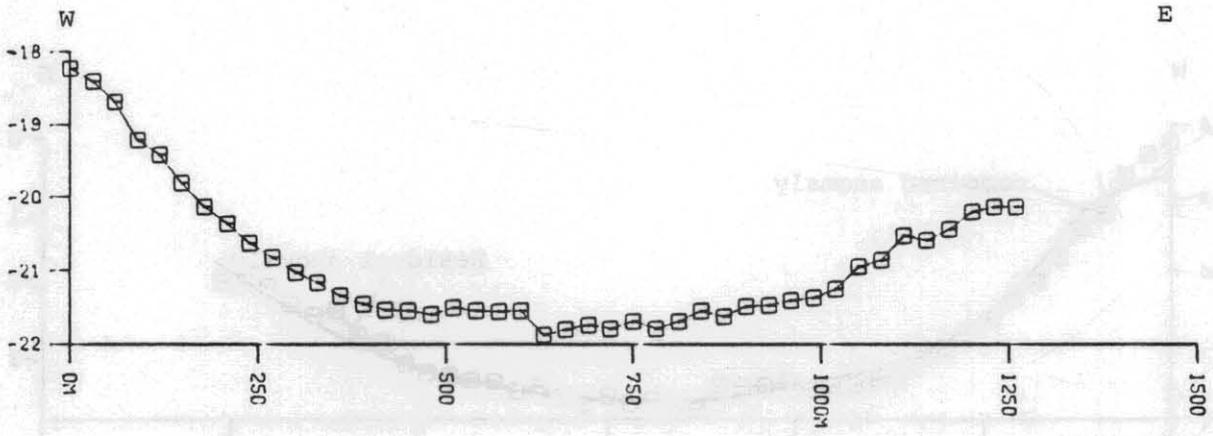
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315920M N

389409M E
314096M N

Figure 3. Bouguer anomaly profiles

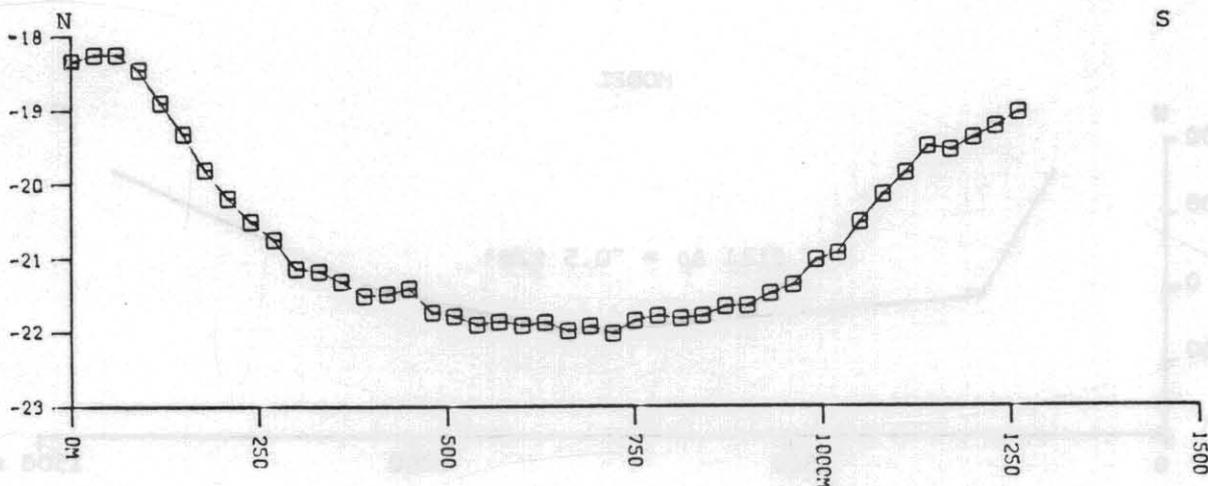
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5 cm



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315144M N

389903M E
315478M N



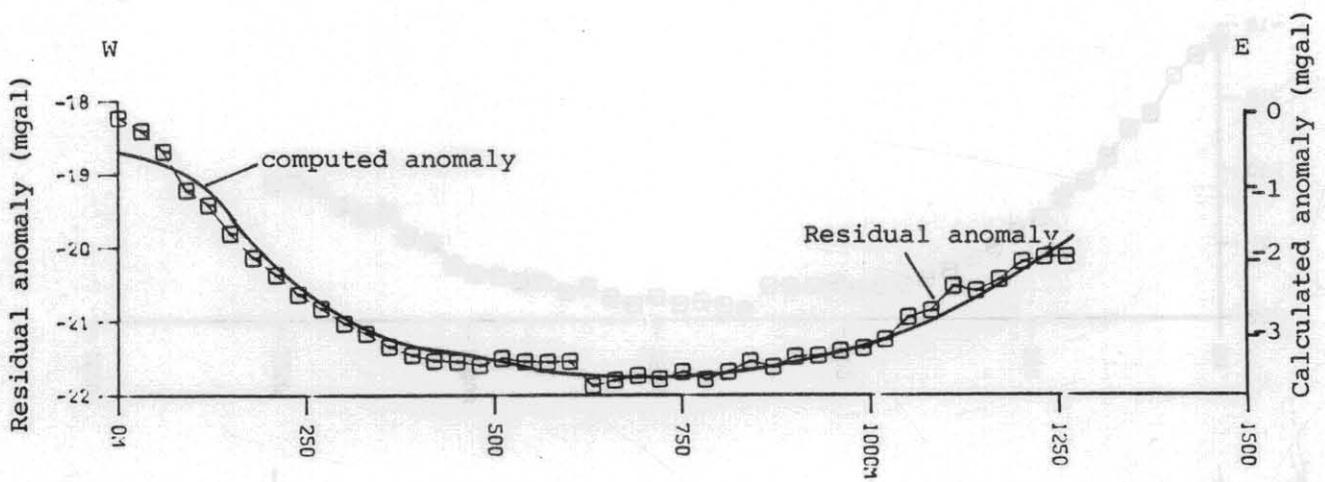
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389439M E
314696M N

Figure 4. Residual anomaly profiles

Scale = 1: 10 000





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315478M N

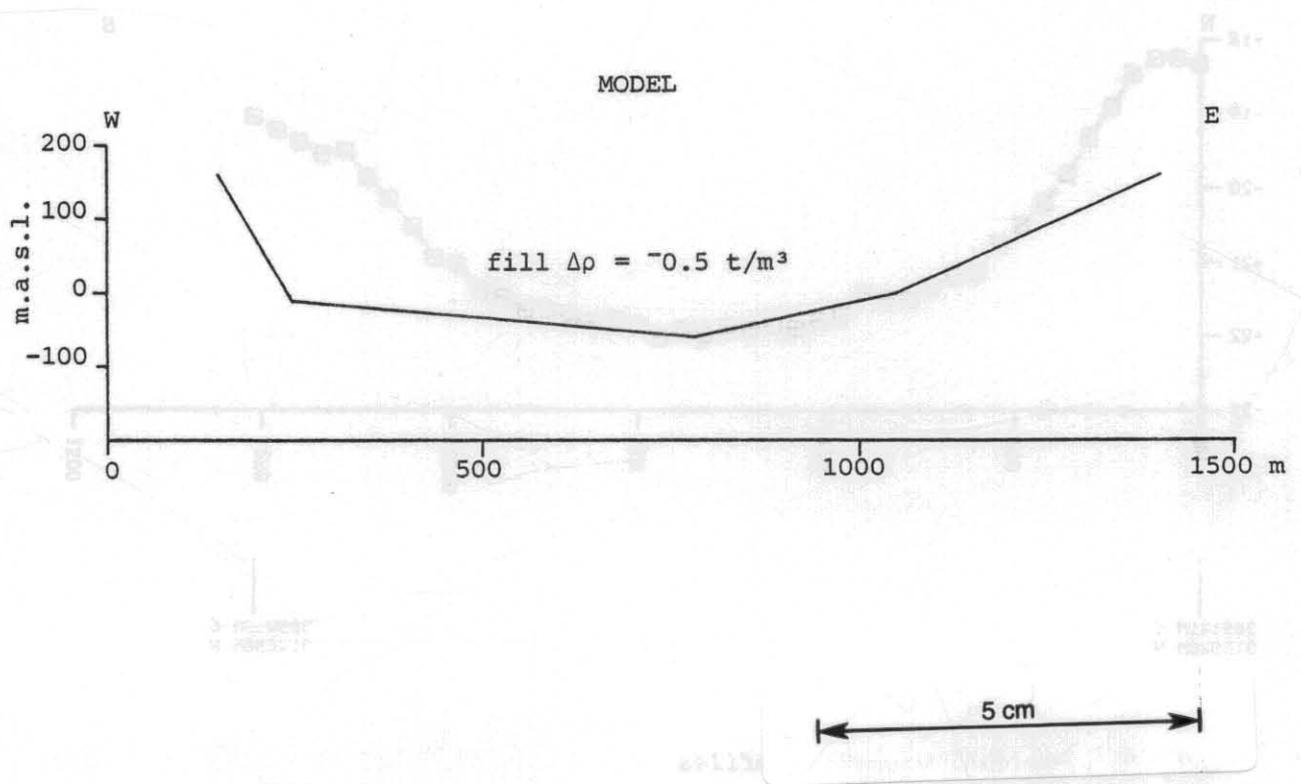
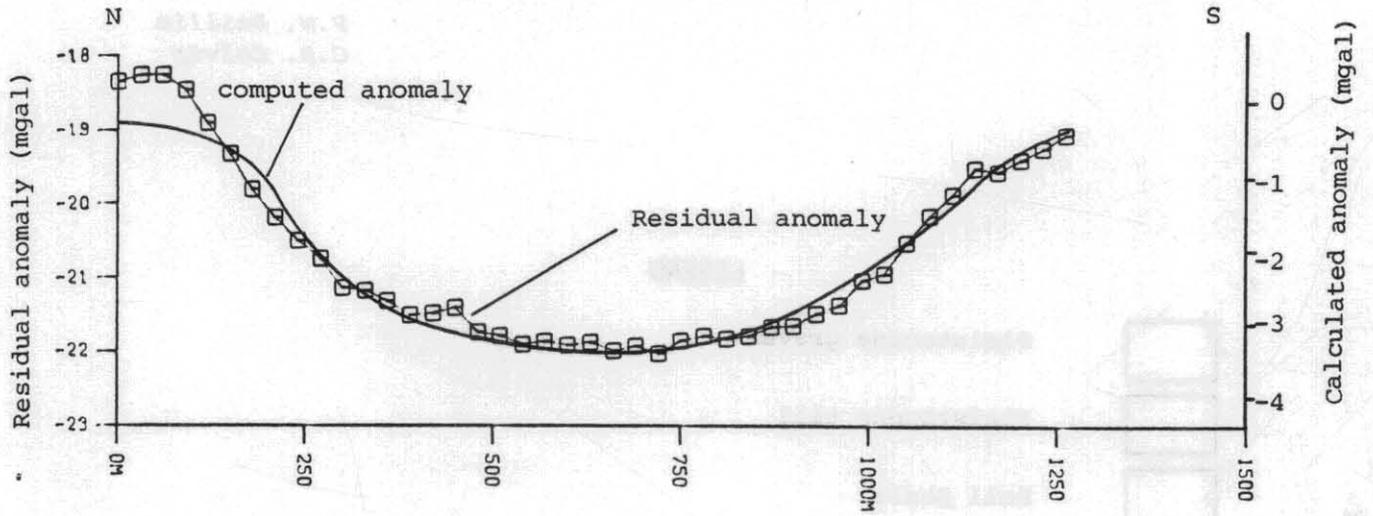
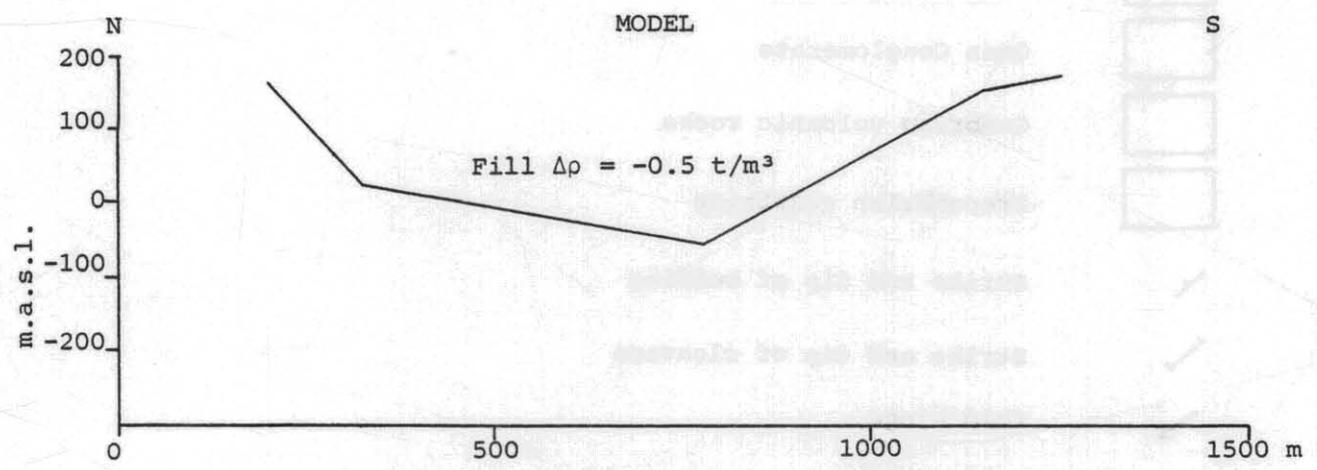


Figure 5. Residual anomaly, computed anomaly and model - west to east.



389141M E
315920M N

389439M E
314696M N



5 cm

Figure 6. Residual anomaly, computed anomaly, and model - north to south