

# GEOPHYSICS & COMPUTATION

TR16-83-85

## 14. Gravity survey, Great Forester River area, north-eastern Tasmania.

D.E. Leaman

M. Jordan

Indications of a buried lead system were found during preliminary work in connection with a systematic study of the structure and hydrology of the Tertiary sediments north of Scottsdale. It was therefore necessary to locate such leads in order to provide adequate control of the drilling programme. The filling material is clay with coarse sand horizons thought to contain large volumes of groundwater.

The principal lead was associated with the Great Forester River although others were suspected further west. Some drilling, seismic and resistivity work (W.R. Moore and P.C. Stevenson, pers. comm.) had located zones of thick fill but did not provide any idea of the special relationships and form of the filled valley system.

The aim of this survey was therefore to delineate the lead system and provide drilling objectives. The gravity method was obviously suitable as the filling material has a significant density contrast with the country rocks.

### GRAVITY SURVEY

The basic grid of stations, at intervals of approximately 1.8 km, was installed by Leaman, Symonds and Shirley (1973). This basic survey has been supplemented over the region of Tertiary sedimentation north of Scottsdale and east of Bridport. The overall station coverage is indicated in Figure 19, 20. The supplementary stations are related to tie-stations in the major survey, and the latter are based on B.M.R. isogal stations at Launceston and St Helens (for details see Leaman *et al.*, 1973; Leaman and Symonds, 1974). The figures present the total Bouguer anomaly and residual Bouguer anomaly. The regional field indicated in Figure 19 is that derived by Leaman *et al.*, (1973). The density value used in the Bouguer reduction is  $2.67 \text{ g/cm}^3$  and a 19 km terrain correction has been applied to all stations.

### INTERPRETATION

The slate, phyllite, sandstone and mudstone, of the Mathinna Beds, forming part of the 'basement' of the region have densities ranging from  $2.5\text{--}2.8 \text{ g/cm}^3$ . The granitic rocks forming the remainder of the 'basement' have densities in the range  $2.6\text{--}2.7 \text{ g/cm}^3$ . The Bridport granodiorite is the only intrusive rock to have a density greater than the assumed density. The density of the Tertiary sands is unknown but by analogy with known deposits the bulk wet density would be about  $2.00\text{--}2.20 \text{ g/cm}^3$ . Finer sands are known to have a density of  $2.10 \text{ g/cm}^3$ .

The residual Bouguer anomaly shows a double valley-basin system with maximum anomalies of  $-4$  to  $-5$  mgal. Seismic work along the coast verifies the embayment as having margins at about the  $-2$  mgal contour, a maximum thickness of fill material of about 90 m, and that the granite/Mathinna Beds contact occurs between the valleys indicated. The gravity survey along the coast also indicates a stream bifurcation about a spur.

In the southern part of the region two parallel valley systems are indicated, one of which corresponds to the Jetsonville area and the other to north Scottsdale. Both leads are steep sides and the eastern feature terminates on granite immediately south of the surveyed area. The north Scottsdale lead appears to contain a greater thickness of fill material, possibly up to 180-200 m, based on the maximum anomaly of -5 mgal. A number of distinct tributaries to this basin are indicated in the anomaly pattern. The Jetsonville lead, as a whole, appears narrower and shallower. It has fewer obvious tributaries. Its principal 'tributary' runs east-west towards an apparent termination of the north Scottsdale lead. This 'tributary' is narrow and obviously deep as it has a basic anomaly of -3 mgal. Indeed, as will be inferred subsequently, this 'tributary' is probably the main channel with the Jetsonville lead being merely a broader but subsidiary feature. There is some doubt as to the connection of this east-west feature with the north Scottsdale feature. However it seems unlikely that the eastern outlet on the coast is directly connected with the north Scottsdale basin even though there are anomaly indents which could reflect such a connection. The anomaly values north of the region of connection are between 0 and -1 mgal which means that it is unlikely that any deep channel passes N-S unless it is extremely narrow. Two cross traverses do not reflect significant anomaly variation for this to be a reasonable solution. By comparison the east-west feature and the north Scottsdale lead connect in a region of about -2 mgal. This connection appears much more likely even though a narrow valley is indicated.

On the Waterhouse Road the wide eastern part of the anomaly has been examined by seismic methods which indicate about 80-90 m of fill. This is supported by a -2.2 mgal anomaly. Assuming a contrast of  $-0.67 \text{ g/cm}^3$  this anomaly could be produced by 80 m of light sand fill. A problem does arise in relation to the granite outcrops which occur on and near the Waterhouse Road and the Forester River between the two outlets. The anomaly here has a value of -1 to -2 mgal and appears exceptionally low for outcropping granite. For example, in the east and south-east, areas of significant granite outcrop have anomalies of -0.5 to +1 mgal and similarly the ridge of granite which separates the Jetsonville and north Scottsdale depressions has anomalies of the order of -0.5 to +0.5 mgal. The granitic area to the south and east of Bridport, also shows anomalies of -0.5 to +0.5 mgal. The granite, actually a granodiorite, is slightly denser (by  $0.01-0.02 \text{ g/cm}^3$ ) than the Bouguer assumption and should therefore give slightly positive values. That parts are negative reflects the negative attraction of adjacent lighter materials. Hence for an area of granite outcrop to show anomalies of -1 to -2 mgal suggests either that there is little granite present, even though patches may occur over a wide area or that deep filled leads and tributaries enclose the granite outcrops and thereby diminish its anomaly. Conversely the presence of granite and/or a narrow channel will diminish the negative attraction a lead might produce. For these reasons it is considered possible that the main lead as continued from north Scottsdale east to the Jetsonville lead proceeds north to a point south of the Waterhouse Road and then passes east to the main tributary on the embayment.

The western tributary on the embayment is indicated on the road and coast traverses, but limited seismic work on the road does not suggest a sufficient channel depth and hence this 'outlet' may be just two tributaries, one flowing north and the other south. Against this argument is the gravity anomaly which definitely suggests the possibility of a deep narrow outlet and further seismic work is definitely required to establish whether sufficient channel depth is present.

If the river system was as projected then large meanders with a wave-

length of 10-12 km are implied. The amount of water required to carve such a system is enormous. However two points of confirmation of such an interpretation are needed - in the western outlet and in the possible valley connection south of the Waterhouse Road. Either channel is likely to be deep and very narrow.

In those regions where the Mathinna sediments occur then anomalies are always positive and range to +3 mgal. This suggests that the rocks in this region have bulk densities substantially higher than the assumed density.

REFERENCES

LEAMAN, D.E.; SYMONDS, P.A.; SHIRLEY, J.E. 1973. Gravity survey of the Tamar Region, northern Tasmania. *Bull.geol.Surv.Tasm.* 55.  
LEAMAN, D.E.; SYMONDS, P.A. 1974. Gravity survey of north-eastern Tasmania. *Bull.geol.Surv.Tasm.* 57.

Resistivity traverses using the Wenner configuration, with an electrode spacing of 15 m, were run across the area. The location of the traverses and the profiles derived from the resistivity data are shown in Figure 21. The figure also shows a contour map of the resistivity values, with 10 Ω-m and 20 Ω-m values indicated. Values of more than 20 Ω-m appear to be related to either exposures of near exposures of granite. The higher the resistivity value the nearer the granite to the surface or the thicker or more massive the granite is exposed.

The general features on the profiles reflect deeper granite and lack of variation between many adjacent low resistivity values in areas where the granite is exposed. Such 'flat' effects are only common in areas where the resistivity values are less than 15 Ω-m and values below 10 Ω-m are related to areas with thickest cover.

Two principal regions of low resistivity have been located, one in the north, and one in the far south, of the area. Other minor patches of low resistivity occur but these may possibly be related to creek or swamp features and not thickness of cover.

Resistivity depth profiles, using the Wenner configuration, were used to check the thickness of cover at the southern anomaly. The profiles indicated in Figure 12. The profiles did not provide evidence of any significant weathering in the profile.

SEISMIC SURVEY

Seismic work was undertaken to provide a check on depth of sand and an indication of the simplicity of the geologic situation. The covering material, sand at the surface, has a seismic velocity of 1,600-1,800 m/s, while the lower layer (granite) has seismic velocities of 4,000-5,000 m/s. The velocities are distinct in every case and there is no evidence to suggest a weathered or graded profile. All spreads were placed in zones where the resistivity traverses gave very low values which were considered to be due to thick cover. Details of the seismic spreads are shown in Figure 21.

Traces to the north of the area, adjacent to the track from the Russell River and Boulder point on the coast east of Mt Williams were also examined by depth methods. Dunes to the north, near Batters Point, have been found to contain fine grains of calciferous and it was desired to know the

# OLD FORESTER RIVER : GRAVITY SURVEY

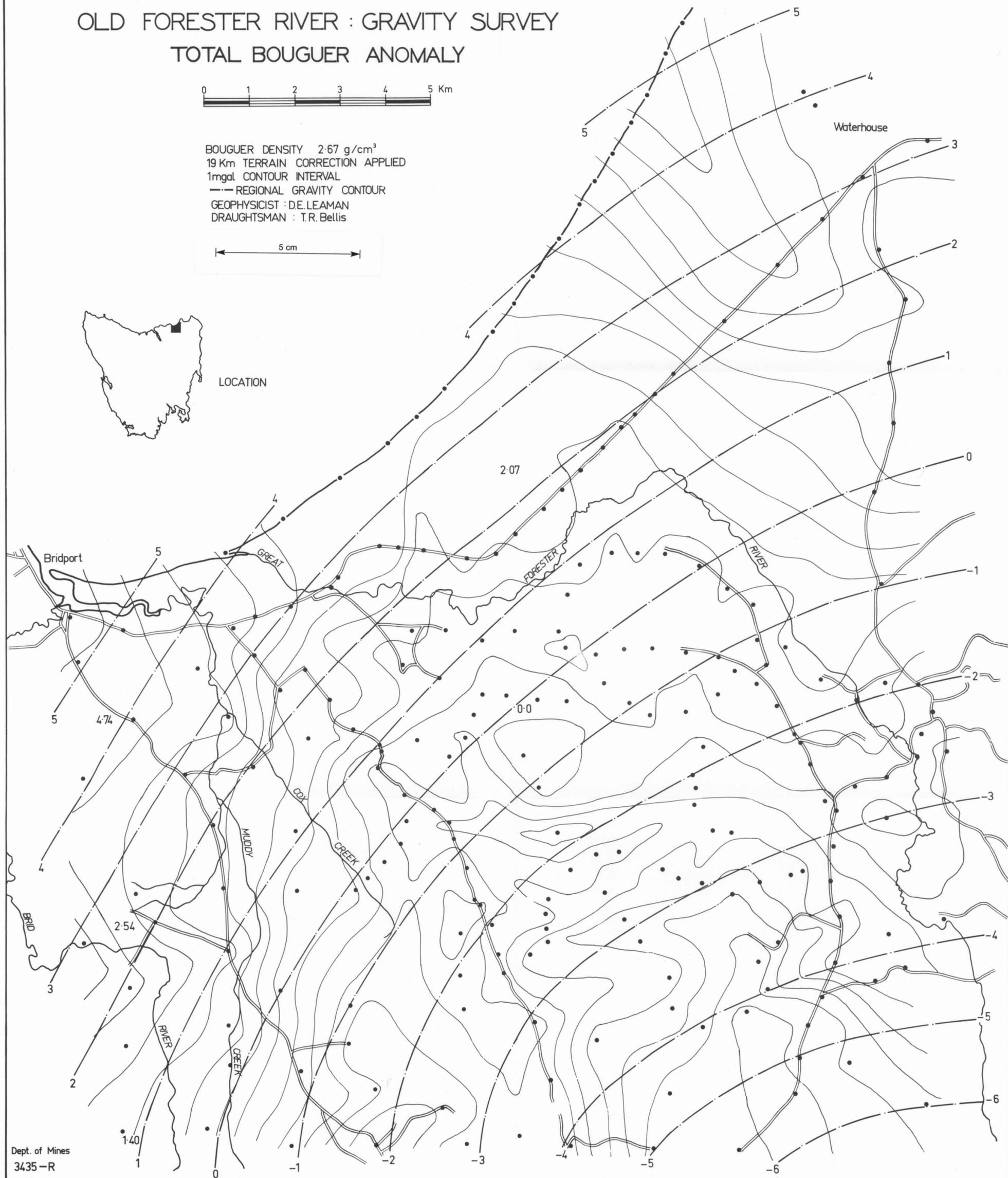
## TOTAL BOUGUER ANOMALY



BOUGUER DENSITY 2.67 g/cm<sup>3</sup>  
 19 Km TERRAIN CORRECTION APPLIED  
 1mgal CONTOUR INTERVAL  
 - - - REGIONAL GRAVITY CONTOUR  
 GEOPHYSICIST : D.E. LEAMAN  
 DRAUGHTSMAN : T.R. Bellis



LOCATION



Dept. of Mines  
 3435-R

TR16-83-85

Tech. Rep. Dep. Mines Tasm. 16.

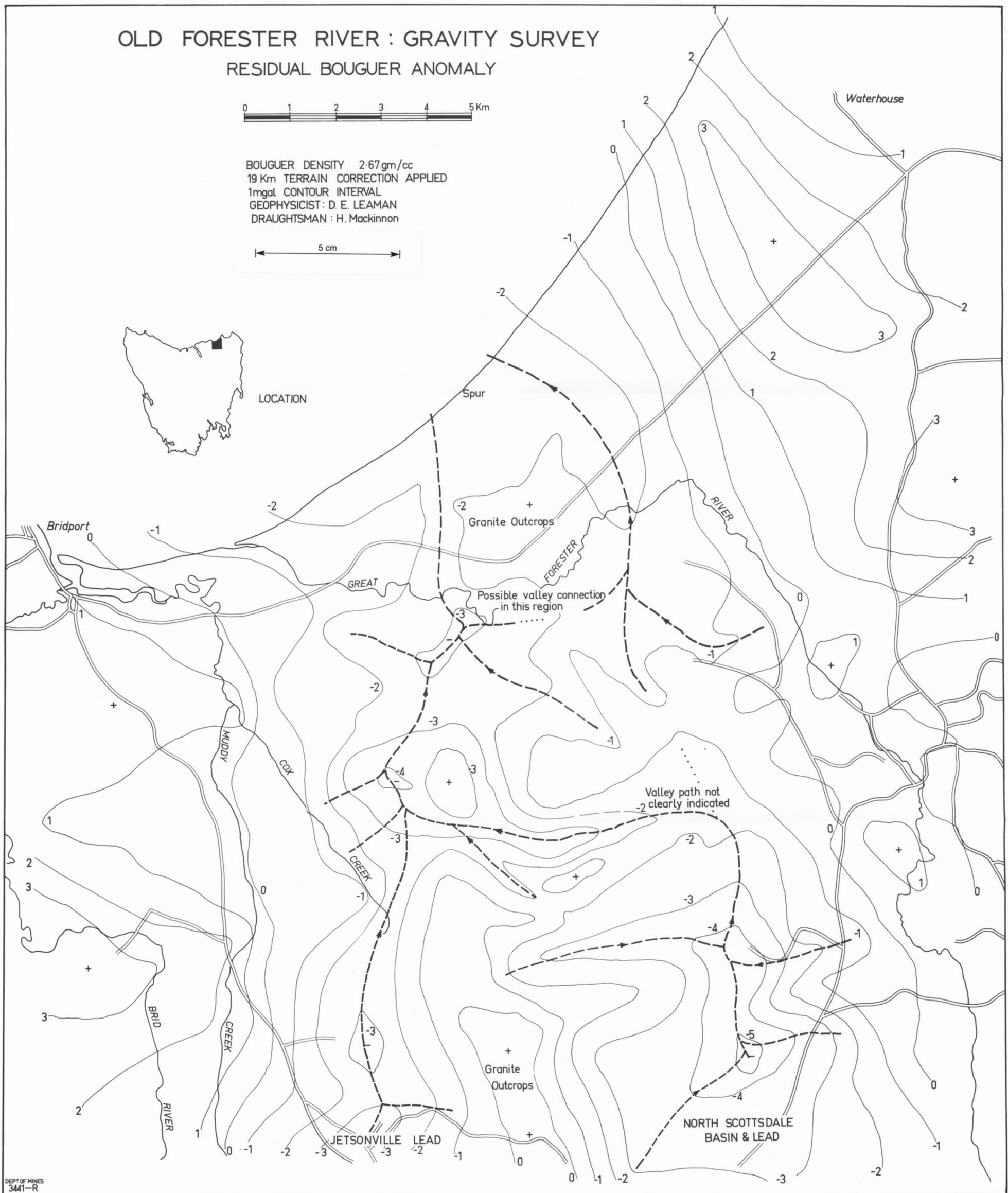
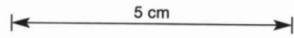
Figure 19.

# OLD FORESTER RIVER : GRAVITY SURVEY

## RESIDUAL BOUGUER ANOMALY



BOUGUER DENSITY 2.67 gm/cc  
 19 Km TERRAIN CORRECTION APPLIED  
 1mgal CONTOUR INTERVAL  
 GEOPHYSICIST : D. E. LEAMAN  
 DRAUGHTSMAN : H. Mackinnon



DEPT OF MINES  
 3441-R

Figure 20.

TR16-83-85

Tech. Rep. Dep. Mines Tasm. 16.