TR17_110_112

21. Geophysical survey, Pipeclay Lagoon, South Arm.

D.E. Leaman

The regional gravity survey of Leaman (1972) indicated some thick accumulations of Tertiary materials around Pipeclay Lagoon. The principal anomaly was at Clifton Beach with a lesser anomaly west of Cremorne. The scale of the anomalies suggested several hundred metres of clay. To substantiate this supposition seismic spreads were fired at Clifton Beach and at a peninsula west of Cremorne. The spread at Clifton Beach was located off centre because it was not expected that the main refractor would be observed with a central spread. The seismic information was then used as a control on material type and thickness to the base at one point, for a more detailed gravity survey. Three gravity traverses were completed the locations of which are shown in Figure 30.

SEISMIC REFRACTION SURVEY

Clifton spread. This spread gave up to 80 m of material with a velocity 1830 m/s. The interface dips eastward at about 10°.

Peninsula spread. This spread gave more than 50 m of material with a velocity 1500-1600 m/s and only at the western end of the spread was a higher velocity recorded. The interface must dip very steeply eastward.

The results suggest clay-weathered Permian siltstone or dolerite, or clay-weathered basalt, at Clifton Beach and sands and sandy clays at the peninsula.

GRAVITY SURVEY

The three gravity profiles are shown in Figure 30. All observations have been corrected for elevation and position and a terrain correction (19 km radius) has been made. The Bouguer anomalies have been adjusted for regional effects using the information of Leaman (1972) and only the residual anomaly profiles are given. Figure 30 also shows, in general terms, the type of structural solutions possible, with the only difference between locations being scale.

Section 1, Clifton Beach. Assuming an average density of 2570 kg/m^3 for Permian rocks, 2900 kg/m^3 for dolerite and 1970 kg/m^3 for Tertiary clays (density information from Leaman, 1972), at least 650 m of Tertiary material is implied on the graben hypothesis and about 500 m on the valley hypothesis. The value is reduced in the valley model since any dolerite would be eroded through, assuming no faulting, and therefore no positively attracting component would be present at depth in the centre of the model. The gradients present imply very steep sides to the basin and in view of the scale of the feature the valley model seems implausible without a major fault component. An unusual feature of this section is the asymmetry on the eastern side. Most Tertiary basins in southern Tasmania are found to have a western asymmetry. The eastern asymmetry could be related to a thickening wedge of dolerite that might be left in valley erosion. However, more pertinent is the seismic information, since any reasonable model requires more than 400 m of sediment at the position of the spread and therefore the 2400 m/s velocity must represent a material such as weathered basalt. If a significant amount of basalt is present (50-100 m) then not only are the thickness estimates reported here absolute minima but the profile asymmetry may be explained, especially if the basalt thins eastward. Since this explanation still leaves the steep eastern gradient, an unusual feature for Tertiary basins, then a graben solution seems most likely.

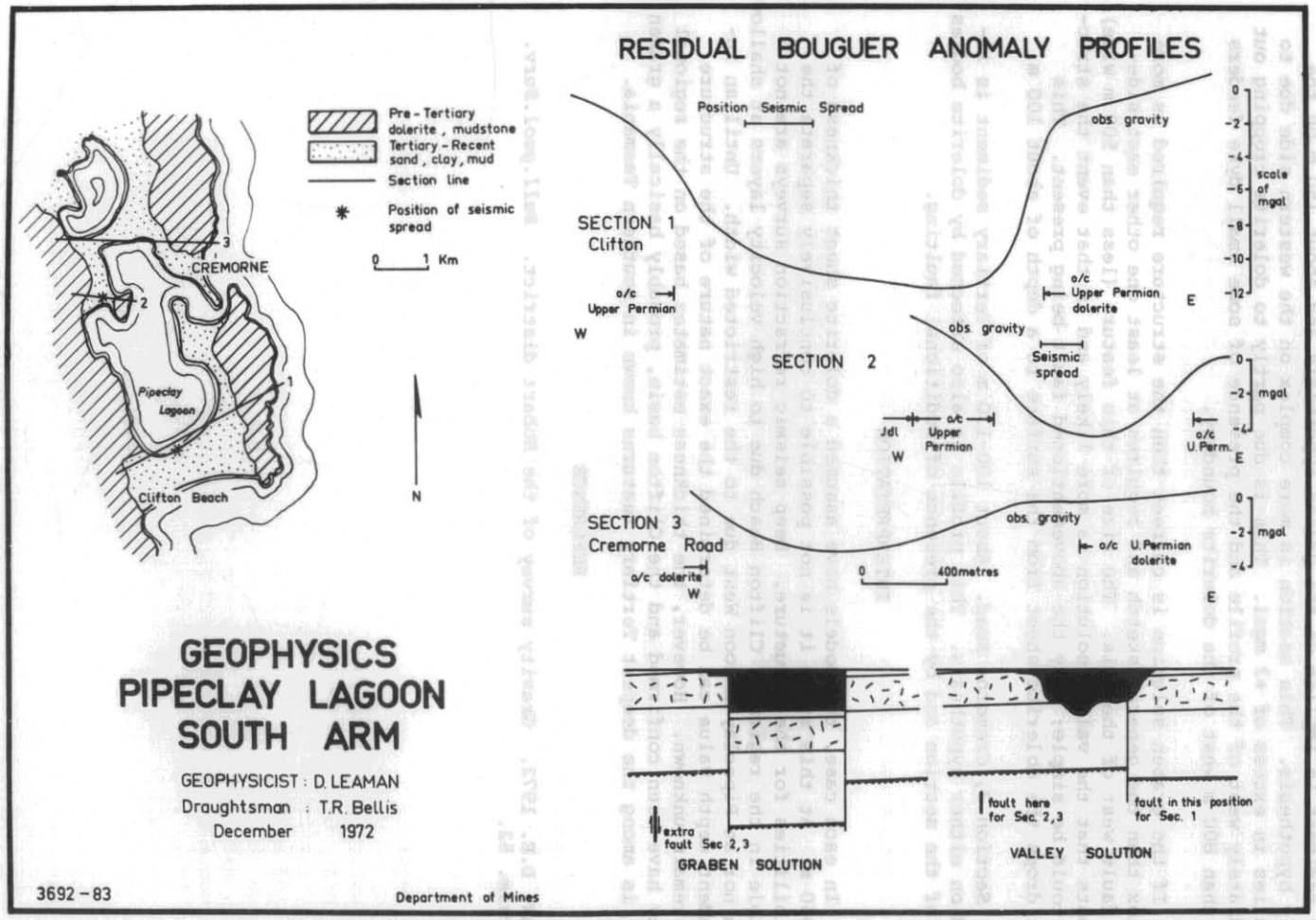

Figure 30.

5 cm

Section 2, Pipeclay Lagoon West. A thickness of at least 200 m of Tertiary sediment is implied on the graben hypothesis and about 150 m on the valley hypothesis. This section is more complex on the western side due to anomalies in excess of +3 mgal. This is due partly to dolerite cropping out immediately west of the profile and the presence of some small dyke feeders less than 800 m west of the dolerite boundary.

If the graben solution is correct then the structure required is more complex than the general sketch and requires at least one other east-side-down fault west of the axis. The size of this feature (less than 500 m wide) suggests that the valley solution is more likely and in that event the structure could be simple; only the abovementioned fault being present. This fault drops the dolerite sheet from the surface to a depth of about 100 m.

Section 3, Cremorne Road. About 100-130 m of Tertiary sediment is implied on either hypothesis. This profile is also affected by dolerite bodies west of the section and by the presence of additional faulting.

INTERPRETATION

In each case, the models have assumed a dolerite sheet thickness of 300-350 m. At this stage it is not possible to conclusively separate the possibilities for the structure. Deep seismic refraction surveys are not possible in the region of Clifton Beach due to high velocity layers at shallow depth nor at Pipeclay Lagoon West due to the restricted width. Until an independent depth value can be determined the exact nature of the structure will remain unknown. However, the thickness estimates based on the regional survey have been confirmed and the Clifton basin, probably basically a graben fill, is among the deepest Tertiary features known in southern Tasmania.

REFERENCE

LEAMAN, D.E. 1972. Gravity survey of the Hobart district. *Bull.geol.Surv. Tasm.* 52.