1979/32. Structural assessment, Cooks Marsh area.

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Abstract

Regional gravity survey coverage and two seismic reflection soundings in the Cooks Marsh area indicate that the dolerite sheet encountered by drilling is thick (>250 m) and that a feeder for the sheet underlies the Green Hill region.

INTRODUCTION

A stratigraphic bore hole at Cooks Marsh [EP12650675] encountered dolerite at 69 m and was abandoned at 94 m when the character of the material suggested a substantial intrusion. A reflection seismic survey was undertaken to confirm whether the sheet encountered was thick and general.

GEOLOGY

Permian rocks are exposed in a low-lying basin along the Jordan River north of Apsley (Forsyth *et al.*, 1976). The region is strongly faulted and intruded by dolerite, although only minor protrusions are to be found in the Permian rocks near Apsley. However, drilling within the Permian at EP12650675 encountered dolerite at about 69 m. The Permian rocks exposed near the drill site are Middle-Upper Permian or Cascades/ Malbina correlates (using the notation of the Hobart area). The last Permian drilled was, using the notation of Forsyth *et al.* (1976), P*l* or limestone, calcareous siltstone and sandstone. All the Permian drilled is believed to be younger than the Berriedale Limestone (S.M. Forsyth, pers. comm.).

GEOPHYSICS

Gravity survey

Prior to the present seismic soundings, only a regional gravity survey had been undertaken in the area (Ruswandi, 1977). The semiquantitative interpretation offered by Ruswandi suggested that the base level anomalies of + 1 mgal was compatible with 600 m of Permian rocks and <300 m of dolerite. The dolerite was included in the model on the broadest of structural/gravity requirements and no independent proof of its presence then existed. However the implication was clear. If dolerite was present anywhere in the Permian rocks north of Apsley, it would be found to be a general sheet occurrence, with the possible exception of a small area north of Munros Hill, where the base values are as low as - 1 to - 2 mgal. Such values suggest little dolerite. The mapping presented by Forsyth *et al.* near EP127100 implies structural complexity and sheet intrusion in the Permian. This sheet may be small but the gravity values should be checked in detail before drawing further conclusions. In addition, the anomaly increase to + 5 mgal centred at EP107075 suggested the presence of a major feeder. Further, the variation in anomaly across the exposed Permian rocks is consistent with variation due to topographic reasons in Permian cover, rather than variation in sheet thickness although these are likely to be swamped by the effect of the nearby feeder. The present author concurs with the basic interpretation offered by Ruswandi with the above comments.

Seismic survey

Reflection methods, given appropriate field techniques and processing back up, form the most direct and reliable approach to this class of problem. Unfortunately processing back up is not yet available to us and unless a good visually acceptable analogue representation of reflectors can be obtained in the field little interpretation can be offered. In this case, two sites (Site 1; EP120063: Site 2; EP123065) along the Lower Marshes Road were attempted using various charge types and sizes, geophones and array spacings. Several records were taped for future processing should funds permit and such processing will upgrade the interpretation offered below.

The best results were obtained using small, deeply laid charges of two detonators with 14 Hz single geophones and spaced at 4 m intervals. Although results from each site varied in quality and would certainly be improved with processing, especially removal of static, they were consistent.

Approximate reflector times are:

1.	50 - 70 ms	* major reflection
2.	140 - 150 ms	* major reflection
3.	220 - 230 ms	(possible multiples)
4.	310 ms	(possible multiples)
5.	360 - 380 ms	

The lower figures are from site 2 and reflect shallowness of rock. About 20-25 ms was typically lost on overburden at site 1 and 10 - 15 ms at site 2.

The time thicknesses between reflectors is thus estimated at

5 - 12 ms	for soil, fill, very weathered rock
20 - 25 ms	for layer 2 (to 70 ms)
45 - 50 ms	for layer 3 (to 150 ms)
~40 ms	for layer 4 (assuming no multiples)
~45 ms	for layer 5 (assuming no multiples)
~35 ms	for layer 6 (assuming no multiples)

Velocities recorded during the survey indicate low values for the soil and weathered rock (~1000 m/s) and moderate values for the Permian bedrock (~3200 m/s; 2700 - 3200 m/s range).

These values suggest cover thicknesses of up to 12 m of soil (especially at site 1) and about 70 m for layer 2. Reflection 2 thus coincides closely with the top of the dolerite as drilled after allowing for elevation, and if a typical velocity for massive dolerite is assumed, layer 3 (dolerite sheet) must be at least 270 m thick. Layer four must represent further Permian rocks; thickness about 120 m. The nature of layers 5 and 6 is, of course, quite unknown but if the Permian succession is relatively normal then the base of layer four would be the lower limestone (Darlington equivalent). This should be a good reflector if present. Layer 5 could then represent the lower siltstone and layer 6 the basal suite (thicknesses: 5, ~130 m; 6, ~100 m). The total section from the surface, including dolerite, could approximate 700 m.

CONCLUSION

The dolerite encountered at Cooks Marsh near Apsley appears to be the roof of a substantial intrusion. Reflections recorded nearby are consistent

with a full Permian sequence, if it is assumed to be comparable with that in Northern Tasmania. However basement may be represented by a shallower reflector. The interpretation offered presumes that each event noted is individual and not a multiple of the strong dolerite interface reflections. It is possible that one or all of the later events (220, 310, 360 ms) are multiples. Processing will be necessary in order to resolve this doubt.

REFERENCES

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