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1981/8. A seismic reflection traverse, Boobyalla Plains, north-east Tasmania.

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Abstract

A seismic reflection traverse at Boobyalla Plains has shown that the basin underlying the plain is bounded on the south by a steep, possibly step-faulted margin. The traverse, which terminated at the southern bank of the Ringarooma River, did not cross the northern margin of the basin. The depth to basement varies from a maximum of 900 m to less than 400 m over a horizontal distance of approximately 1.4 km as the southern margin of the basin is crossed. The sediments filling the basin show extensive channelling and channel-fill deposits, suggesting a high-energy environment with a possibility of reworking.

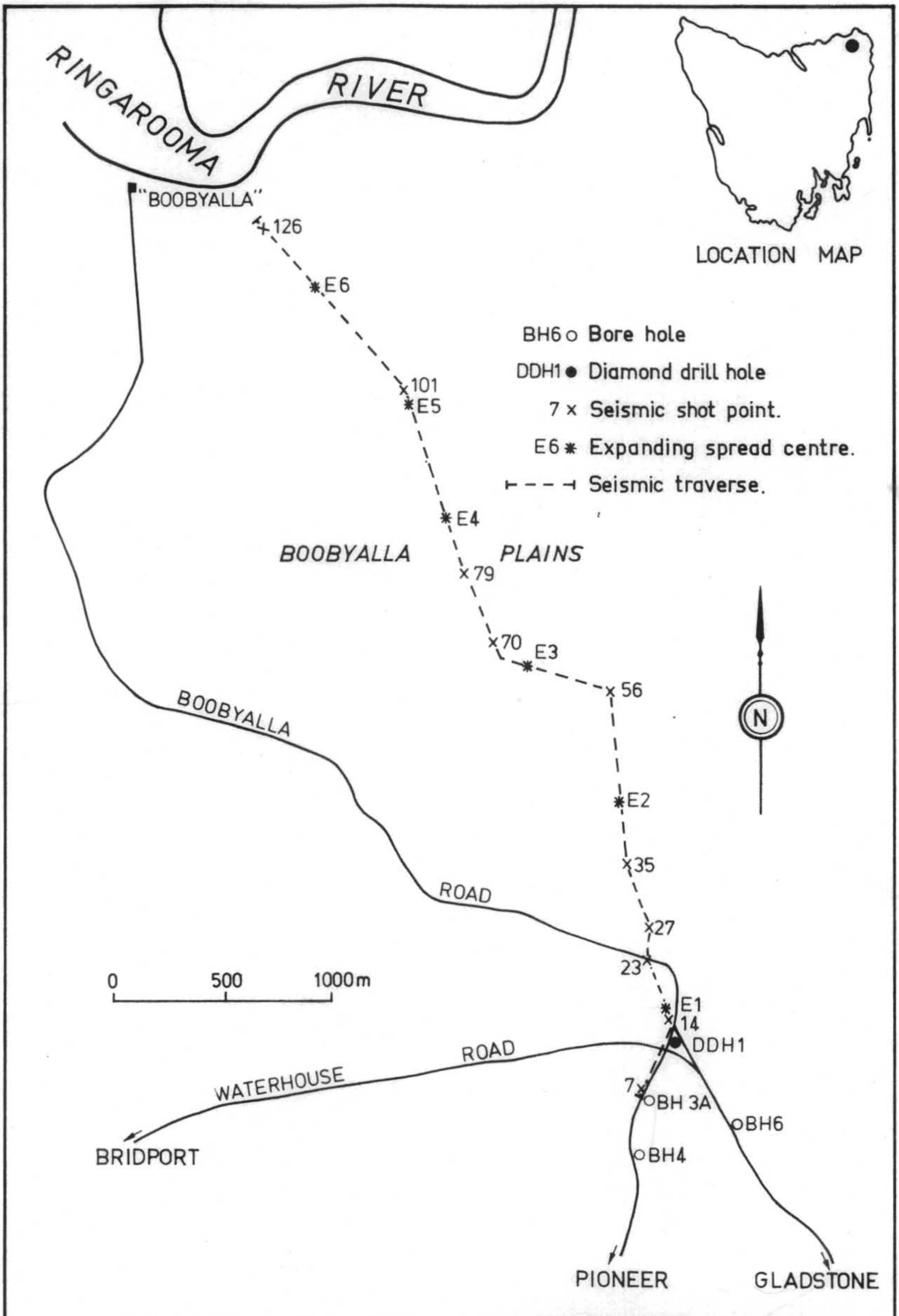
INTRODUCTION

Drilling for alluvial tin deposits in the Boobyalla area has shown a thickness of sediment in excess of 417 m under the Boobyalla Plains (Forsyth, 1980). Refraction seismic surveys in the area were initially intended to locate possible tin-bearing horizons and to determine the nature of dolerite found in a number of drill holes (Longman, 1969). The surveys were partially successful, and in addition to locating the dolerite, Longman reported that there was at least 150 m of sediments having a velocity between 1450 m/s and 1980 m/s. Gravity and magnetic surveys showed that a basement depth in excess of 400 m was not unreasonable (Leaman, 1973).

A series of closely spaced drill holes (fig. 1) show divergent results. Borehole 4 entered granite at 29.5 m, Hole 3A was still in sediment at 68.5 m, Hole 6 bottomed in Mathinna Beds slate at 74.5 m, and the diamond drill hole was still in sediments at 417.2 m. Moore and Leaman (1974) recorded several refraction seismic spreads and one reflection seismic spread in the area of the drill holes in an attempt to resolve the ambiguities. The refraction spreads failed to record basement arrivals but showed a sediment velocity between 1800 and 2400 m/s. A possible basement reflection was interpreted as implying a basement depth of between 550 and 660 m.

The open farmland of the Boobyalla Plains allows good vehicle access to most areas, and the traverse was thus organised as a series of straight line segments. Patches of swamp formed the main obstacle to vehicle access. The traverse was recorded on an eight channel DHR1632 using groups of 28 Hz geophones, positioned to act as a single geophone, at 10 m intervals. The shot-holes were 10 m from channel 1 and spaced 40 m apart to provide a single fold coverage. The holes were augered to a depth of 1.5 m, loaded with a 70 g gelignite charge, and tamped with sand. Recording duration was 4 seconds at a sample interval of 2 msec, using only an alias filter.

The expanding spreads were fired after preliminary processed data from the traverse was available. Recording duration was reduced to 2 seconds at a 1 msec sample interval using a 60 Hz to 250 Hz input pass-band. The spread used single 28 Hz geophones at an interval of 10 m and shots were paired at the nominal offsets to provide a pseudo 16-channel recording from the 8-channel system. The shot-hole depth was increased to 1.8 m with a charge size of 35 g of gelignite for the close shot positions, 70 g for the intermediate shot positions and 140 g for the far shot positions.



BOOBYALLA PLAINS SEISMIC REFLECTION SURVEY 1979-80

Geophysicist: R. Richardson

Figure 1.

5 cm

All data was processed by Geophysical Service International.

RESULTS

Constant gain filter tests (fig. 2) show a number of possible later arrivals. Although signal levels were small in the higher passbands, the signal to noise ratio was higher and the following filters were selected:

40 Hz - 120 Hz	0 msec - 300 msec
40 Hz - 80 Hz	350 msec - 400 msec
35 Hz - 80 Hz	400 msec - 2000 msec

These filter cut-offs indicate that input filtering between 60 Hz and 250 Hz would have improved the signal to noise ratio significantly. The expanding spreads were recorded with this revised passband.

The initial processed sections showed little continuity between each group of eight traces because of the use of velocity filtering in an attempt to remove low frequency noise and ground roll. The wavelength of this noise approached or exceeded the spread length, and the velocity filtering destroyed the reflection continuity. As an alternative to velocity filtering, bandpass filtering was used in conjunction with running mixing between traces and dip filtering.

Six expanding velocity spreads were recorded along the traverse to allow estimates of the velocity-reflection time function using constant velocity gathers. The major reflector times and corresponding average and interval velocities are given in Appendix 1. In all cases the sediment velocities were between 1500 and 2400 m/s and the basement velocity is in excess of 4000 m/s.

INTERPRETATION

The final processed section (fig. 3) shows a large number of reflectors, only some of which were noted on the expanding spreads. Although the velocities of 1500 m/s to 2400 m/s for the sediments agree with previous work, the velocities determined from the expanding spreads suggest some lateral velocity inhomogeneities. The unchanged average velocities across many of the reflectors in the sediments suggest that the reflectors are thin bands (less than ten metres assuming a frequency of 50 Hz and a velocity of 2000 m/s) of high or low velocity material. Such bands could be isolated pebble or sand layers or even basalt flows.

The average sediment velocity of approximately 2000 m/s means that basement depths in metres correspond to reflection times in milliseconds within an accuracy of ± 15%. The reflection from the basement is at 580 msec at expander 1, 890 msec at expander 2, 830 msec at expander 3, 840 msec at expander 4, 800 msec at expander 5, and 580 msec at expander 6. The basement rises steeply towards the south (low shot numbers), possibly with step faulting, and there are indications of a shallowing at the northern end of the basin. The sediments show a large amount of channelling and channel filling which indicates a high energy arrival with a possibility of reworking in some areas.

If the diamond drill hole is restarted, the depth to basement should be approximately 540 m. On completion of the hole a series of shots should be fired up the hole to provide accurate vertical velocity information for the sediments. Future reflection traverses in the area should use input filtering to increase signal to noise ratio, and preferably a small part of the line should be shot and part processed before the complete traverse is recorded.

REFERENCES

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LEAMAN, D.E. 1973. Summary of geophysical work, Gladstone area. *Tech. Rep.Dep.Mines Tasm.* 16:89-96.

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MOORE, W.R.; LEAMAN, D.E. 1974. Further geophysical work, Gladstone. *Tech.Rep.Dep.Mines Tasm.* 17:88-98.

[26 February 1981]

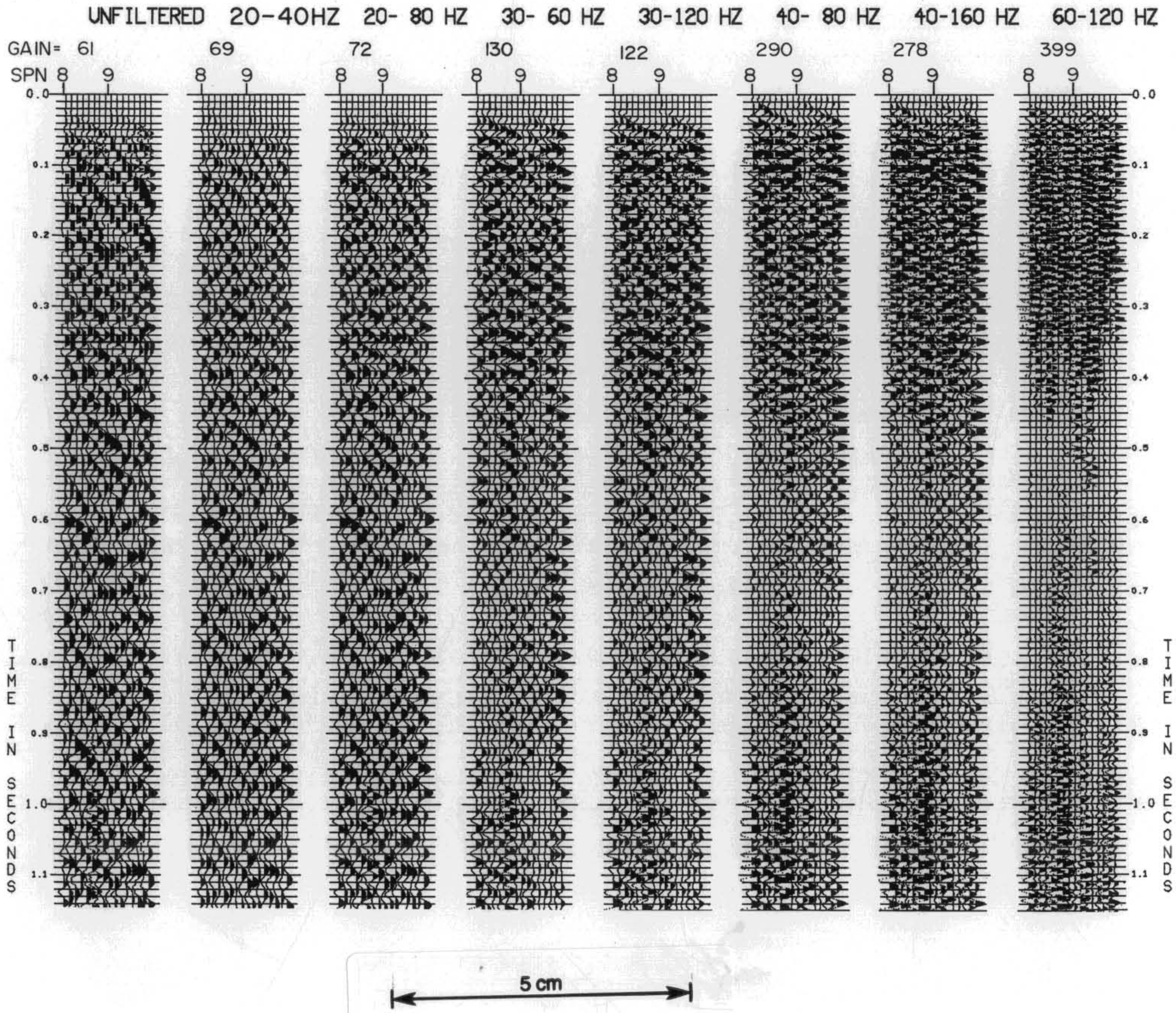

Figure 2. *Constant gain filter tests.*

TASMANIAN DEPT OF MINES
GLADSTONE SURVEY
SP.6 - SP.126
FINAL STACK

RECORDING PARAMETERS

1. INSTRUMENT-DHR 1632
2. 8 TRACE-1 FOLD
3. SPREAD-OFF END 40M.
4. 6X28HZ PHONES-TRACE
5. GROUP INTERVAL 10M.
6. SAMPLE RATE-2MSEC.
7. SOURCE-DYNAMITE
8. SHOT DEPTH-1.5METRES

NOVEMBER 1979

PROCESSING PARAMETERS

1. TVS-.8SEC.GATES
2. NMO
3. TVF-SEE PANEL
4. TVS-1SEC. GATES
5. RUNNING MIX& DIPFILT
6. FILM 25CM-SEC,5TR-CM.

G.S.I. SYDNEY JUNE 1980.

FILTERS APPLIED

40-120HZ. AT 300M.
40-80 HZ AT 350M.
35-80 HZ. AT 400M.

FIG 3

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/ 0

APPENDIX 1

Velocity - reflection time functions

EXPANDER 1

Reflection time (msec)	*Average velocity (m/s)*	*Interval velocity (m/s)*
450	2000	2000
580	2000	2000
850	2500-3000 (3000)	3300-4400 (4400)
1000	3000-3500 (3300)	3000-5500 (4600)

EXPANDER 2

Reflection time (msec)	*Average velocity (m/s)*	*Interval velocity (m/s)*
100	1500	1500
350	2000	2200
890	2000	2000
1200	2500-3000 (2800)	3600-4800 (4300)

EXPANDER 3

Reflection time (msec)	*Average velocity (m/s)*	*Interval velocity (m/s)*
150	1500	1500
640	2000	2100
830	2000-2500 (2100)	2000-3700 (2400)
1200	3000	3900-4500 (4400)

EXPANDER 4

Reflection time (msec)	*Average velocity (m/s)*	*Interval velocity (m/s)*
250	2000	2000
380	2000	2000
840	2100	2200
1200	2500-3000 (2900)	3200-4400 (4200)

EXPANDER 5

Reflection time (msec)	*Average velocity (m/s)*	*Interval velocity (m/s)*
200	2000	2000
480	2000	2000
750	2000	2000
800	2000	2000
920	2000-2500 (2400)	2000-4600 (4200)
1110	3000	4700-5800 (5000)

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Appendix 1 (contined)

EXPANDER 6

Reflection time (msec)	*Average velocity (m/s)*	*Interval velocity (m/s)*
110	2000	2000
380	2000	2000
450	2000	2000
580	2000-2500 (2100)	2000-3700 (2400)
700	2500	2500-4100 (4100)
920	3000	4200

Where the actual average velocity lies between two of the velocities used for constant velocity gathers, the range of values is given with the best estimate of the value in brackets.