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RECORD NO. 1965/40

SOUTHERN CARNARVON BASIN SEISMIC SURVEY (TRAVERSE D, PELICAN HILL BORE)

WESTERN AUSTRALIA 1964

by

J.S. RAITT and A. TURPIE

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CONTENTS

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SUMMARY

A seismic reconnaissance traverse was surveyed for 20 miles along an east-west line, 10 miles north of Carnarvon, as part of a regional investigation of the southern part of the Carnarvon Basin, W.A. Both reflection and refraction techniques were used, and the results were correlated, where possible, with the known formations in the Pelican Hill bore.

Several reflecting horizons could be followed although reflections from below the level of the Cretaceous/Palaeozoic unconformity were badly interfered by multiples. The refraction method was successful, and recorded three main refractors with velocities of 14750 ft/sec, 18400 ft/sec, and 20,280 ft/sec.

The main feature of the section obtained is a broad antiform within the Palaeozoic sediments, shown particularly by the 20,280 ft/sec refractor, which is a good marker for structural mapping. This marker has been tentatively correlated with the Dirk Hartog Dolomite, which would suggest that the strata underlying the Gneudna Formation in the Pelican Hill bore belong to the Nanyarra Greywacke rather than the Tumblagooda Sandstone.

Overall the profile of the 20,280 ft/sec marker has a slight west dip from about 4000 feet at the eastern end to about 5000 feet at the western end of the traverse. The Cretaceous/Palaeozoic unconformity was fairly flat at a depth of about 1500 feet.

Indications from the reflection cross-section and from the profile of the 18,400 ft/sec refractor are that the sediments between the two above horizons are similar in structural attitude to the deeper horizon.

1. INTRODUCTION

During the months of July and August 1964, the No. 2 seismic party of the Bureau of Mineral Resources (B.M.R.) carried out a seismic survey along the southern boundary of Boolathana Station, 10 miles north of Carnarvon (Plate 1). The work done on this traverse (traverse D), forms part of a more general seismic investigation of the southern part of the Carnarvon Basin. In particular this traverse was designed to examine the stratigraphic and structural position of the Devonian sediments encountered in the Pelican Hill bore.

The traverse was laid along a fence track, but access was hampered by heavy rains, which flooded the many clay-pans along its length. Work was conducted from a camp situated on the traverse, where it crossed the north-west coastal highway 14 miles from Carnarvon.

Field operations commenced on 26th June and ended on 28th August.

Staff and equipment on the field party, and operational details, are listed in Appendices 1 and 2 respectively.

2. GEOLOGY

The absence of outcrops in the area has confined geological knowledge of the pre-Quaternary to evidence from numerous water bores and a few stratigraphic bores. A Cretaceous sequence with a slight, regional westerly dip unconformably underlies the Quaternary. In the immediate traverse area, this sequence is approximately 1400 feet thick.

The pre-Cretaceous formations likely to be encountered in this part of the Gascoyne basin are :

Age	Formation	Lithology	Max Known Thickness	Basis
Permian	Lyons Group	tillites, greywackes and siltstones	3800'	Warroora No. 1 (90 miles north of traverse).
Devonian	Gneudna Formation	limestones, siltstones and some shales	950'	Pelican Hill bore
	Nanyarra Greywacke (equivalent to Silurian Unit A., Pearson 1962)	Greywackes and siltstones	400'	Wandagee No. 1 (60 miles north of traverse).
Silurian	Dirk Hartog Dolomite	limestone, dolomites and shales	2400'	Dirk Hartog 17B (110 miles S.W. of traverse)
Ordovician?	Tumblagooda sandstone	sandstones, shales and siltstones	3500'+	outcrop in lower Murchison river area

Brickhouse No. 1 and other deep water bores to the east and south-east of the traverse penetrated the base of the Cretaceous and encountered occasional limestones, sandstones and shales. These strata were interpreted on lithological grounds by WAPET geologists (McWhae et al, 1958) as belonging to the Dirk Hartog Dolomite and the Tumblagooda Sandstone. Condon (1962) has interpreted these same rocks as being Devonian to Permian in age, and considers that in the traverse area, Devonian and Permian sequences, deepening and thickening to the east, are truncated at the unconformity at the base of the Cretaceous (Condon 1963).

In the Pelican Hill bore, two formations were recognised below the Cretaceous. The upper formation was correlated on palaeontological evidence with the Gneudna Formation (Thomas and Dickins, 1954), while the lower formation has been correlated lithologically with both the Nanyarra Greywacke (Thomas and Dickins, 1954) and the Tumblagooda Sandstone (McWhae et al, 1958).

Two stratigraphic bores, Warroora No. 1 and Wandagee No.1 were drilled by WAPET some 90 and 60 miles north of the traverse respectively. Below the Cretaceous, Warroora No. 1 encountered a thick (3800 ft) section of Permian Lyons Group overlying an unidentified (?) Carboniferous unit. Wandagee No. 1 however found a thin Devonian sequence overlying the Dirk Hartog Dolomite and the Tumblagooda sandstone.

The Tumblagooda Sandstone has generally been taken as economic basement for oil exploration due to its thickness and unprospective facies in outcrop, and has not been penetrated to any great depth. However indications of the depth of crystalline basement from gravity, aeromagnetic and seismic investigations suggest the possibility of further unknown formations below the Tumblagooda Sandstone. Any evidence of unconformity revealed by the seismic method would be positive evidence of a limit to the Tumblagooda Sandstone.

The main possibilities for oil accumulation in the area of the traverse lie in

(i) a deepening and thickening of the Devonian sediments identified in the Pelican Hill bore, which contain source and reservoir type rocks, beneath a thickening section of Permian rocks, as suggested by Condon (1963).

(ii) an inclusion of, or change to, source type rocks in the Dirk Hartog Dolomite (Condon 1962).

(iii) the presence of source type rocks in an unknown section below the Tumblagooda Sandstone.

3. PREVIOUS GEOPHYSICAL WORK

Seismic surveys have been conducted 90 miles north of traverse D by WAPET, on the Salt Marsh Project (Hoelscher et al, 1962) and Wandagee Ridge South Project (Dennison et al, 1962). In both instances west of the Wandagee Fault, reflections from the Palaeozoic sediments were masked by multiples from the base of the Cretaceous, but refraction methods recorded three good Palaeozoic refractors.

A series of north-north-east striking faults, mostly downthrown to the west by several thousand feet at each fault, was interpreted as existing in the Salt Marsh area (Hoelscher et al 1962). These faults were found to be associated with surface anticlines, which extend southwards to within 25 miles of traverse D.

To the south of the traverse area, the B.M.R. conducted a seismic survey approximately along latitude 26°40' (Bow and Turpie, 1964). Reflection methods were unsuccessful, but several refractors were recorded.

The velocities associated with the Palaeozoic formations in this part of the basin are

Formation	Velocity	Depth	Method of Measurement
(i) Hoelscher et al 1962 Salt Marsh Project			
Lyons Group	15,500 ft/sec	1500'	Refraction
? Dirk Hartog Dolomite) ? Carboniferous) Limestone)	20,500	5000'	"
(ii) Dennison et al 1962 Wandagee Ridge South Project			
Gneudna Formation	15,450	350'	Refraction
Dirk Hartog Dolomite	17,000	1350'	"
(iii) Pudovskis 1962 Well Completion Report - Wandagee No. 1			
Gneudna Formation	11,000-12,000	350'	
Nanyarra Greywacke	12,000-13,000	700'	Continuous Velocity Log
(equivalent to Silurian Unit A, Pearson 1962)			
Dirk Hartog Dolomite	19,000-14,000	1100'	
Tumblagooda Sandstone	14,000	2400'	
(iv) Pearson 1962 Well Completion Report - Quail No. 1			
Lyons Group	15,000-16,000	6892'	
Gneudna Formation	17,000	8892'	Continuous Velocity Log
Nanyarra Greywacke	17,000	10,111'	
Dirk Hartog Dolomite	20,000-17,500	10,518'	
Tumblagooda Sandstone	17,000	11,644'	
(v) Bow and Turpie 1964 Traverse A			
? Permian ? Devonian	11,600-12,700	700'	Refraction
Dirk Hartog Dolomite	19,400-14,500	1500'	
Tumblagooda Sandstone	13,550-14,700	?	

The B.M.R. has made total magnetic intensity measurements throughout the area, and an interpretation by J. Quilty indicates a depth to magnetic basement beneath the traverse, of between 10,000 and 12,500 feet.

A reconnaissance gravity survey, using an open network of stations was conducted by B.M.R. geophysicists (Chamberlain, Dooley and Vale, 1954), and an interpretation by Neumann shows a depth of section of about 14,000 feet beneath Pelican Hill bore, with a flat basement profile (Neumann 1963, unpublished).

4. OBJECTIVES

The general geological objectives of the seismic work to be carried out in the southern part of the Carnarvon Basin were:

(1) to investigate the extent and thickness of Palaeozoic sedimentation in the Carnarvon Basin south of the Gascoyne River.

(2) to investigate the sub-basinal structure of this area, with particular attention to the possible division of the Basin by a basement ridge beneath the Ajana-Wandagee gravity ridge.

(3) to disclose major structure and structural trends within the sedimentary section, and the tectonic relationships of such structure to the basement relief.

(4) to estimate the depth of crystalline basement at critical locations and compare results with gravity and magnetic interpretations.

Within these broad objectives, traverse D was designed specifically to investigate:

(1) the sedimentary section present at the Pelican Hill bore, and in particular whether the rocks of the Gneudna Formation in this bore are underlain by sediments belonging to the Nanyarra Greywacke or the Tumblagooda sandstone.

(2) the structural attitude of Devonian sediments in the Pelican Hill bore, and whether the Palaeozoic sequence and in particular the Devonian, may thicken and deepen to the east.

(3) whether there is any continuation at this latitude, of the system of faults interpreted by Hoelscher et al as existing in the Salt Marsh area; and whether this fault system could justify the correlation of the carbonate sequences existing at approximately equal depths in the Pelican Hill and Brickhouse No. 1 bores, as belonging to the Gneudna Formation and Dirk Hartog Dolomite respectively, or whether it is more likely that both carbonate sequences are of Carboniferous/Devonian age in agreement with Condon's interpretation of the basin (Condon 1963).

5. PROGRAMME

A. Proposed Programme

The programme designed to attain these objectives was as follows:-

(1) to shoot a reflection test in the vicinity of Pelican Hill bore, using 6 geophones per trace at 22 feet intervals. A deep hole (200-300 ft) should be shot to obtain best depth and charge.

(2a) if good reflections were obtained, 20 miles of reflection traverse would be shot heading approximately east from Pelican Hill bore.

(b) if good reflections were not obtained, a noise test would be shot, and geophone and hole arrays designed from the noise test would be tried to obtain usable reflections. If this were the case, then the traverse outlined in (a) would be shot.

(3) if good reflections were obtained, an extended spread velocity shoot would be carried out, where reflections are best, to assist in the resolution of primary and multiple reflections, and to provide a vertical velocity distribution.

(4) A refraction probe would be shot to correlate refraction velocities with the known geological strata in Pelican Hill bore. This probe was to be extended to penetrate to a massive refractor having a true velocity of 19,000 ft/sec or greater.

(5) if good reflections were not obtained by the end of the first week as in 2(b), then a refractor representing the uppermost pre-Cretaceous (Devonian? Carboniferous? Permian?) and the massive high velocity refractor would be continuously profiled for about 20 miles to the east from Pelican Hill bore.

B. Programme Carried Out

Tests to determine optimum charge, depth and instrument settings were carried out at shot point 52 using single holes and 6 geophones 22 feet apart per trace. These tests showed that the method produced reflections from fair to good quality, and several small shot-hole patterns were tried to see whether a significant improvement could be obtained with a larger, but still fairly small effort. As a result, profiling was commenced using a pattern of three holes, in line, 60 feet deep and 55 feet apart, together with the basic geophone group. Initially, this reflection profiling was only carried out between shot points 49 and 57 on traverse D, and shot points 1050B and 1056 on traverse DX1., which was a tie traverse to the Pelican Hill bore.

Equivalent reflection quality plus lack of dip in the recorded events, made cross-traverse DX1 the more suitable location for the velocity shoot, which was carried out centred on shot point 1054, with a maximum shot to geophone distance of 6600 feet.

A refraction probe was shot between shot points 52 and 76, and penetrated to a refractor having a true velocity of 20,280 ft/sec at a depth of about 5000 feet. First arrivals from this refractor did attenuate fairly rapidly with distance but it appeared to be a fairly good marker bed. Since the information being obtained by the reflection method was of doubtful quality, owing to interference by multiples, this marker was profiled continuously for 21 miles, with intermittent profiling on shallower refractors. Two shots with large shot to geophone distances were fired in an attempt to penetrate the 20,280 ft/sec refractor.

It was seen from the extended spread velocity shoot that multiple reflections created the main interference problem. In an attempt to attenuate these multiples and to improve the quality of the deeper section, it was decided to try the common depth point shooting technique (C.D.P.). As single holes were desirable to speed up the more extensive drilling programme required by this technique, noise recording was carried out at shot point 54 to determine whether the loss of noise cancellation in reducing the number of shot holes, could be compensated by increasing the geophone group size. As a result, single holes and 18 geophones, 11 feet apart, per trace were used for the C.D.P. shooting.

The normal reflection profiling, using single holes and 18 geophones per trace was continued between shot points 55 and 78, the shot points 55 to 57 being used to compare the effectiveness of the shot and geophone arrangements used in the initial shooting and the C.D.P. technique.

6. RESULTS

A. REFLECTION.

The noise recording carried out eastwards from shot point 54 showed that organised surface noise in this area did not constitute a major problem.

The initial tests, using 6 geophones 22 feet apart per trace, produced strong events between 0.3 and 0.5 seconds, and two weaker events between 0.9 and 1.4 seconds, but interference by events which were later proved to be multiples, occurred after 0.7 seconds. The two patterns tried, consisting of three holes in-line, 55 feet apart, and four holes 55 feet apart, perpendicular to the traverse, produced similar results and both showed an improvement on the single hole records, particularly in the later events. The three hole in-line pattern was chosen for the initial production shooting because of its smaller drilling requirements. However, the comparison shots between shot points 55 and 57 showed that record quality was not reduced by using single holes, when the geophone group was enlarged to 18 geophones, 11 feet apart.

Interference on the records occurred after 0.7 seconds throughout the traverse, and a deterioration in record quality occurred at shot point 53. This deterioration coincided with a decrease in first break velocities.

On the extended spread velocity shoot on traverse DX1, interference, mainly by multiple reflections, limited the number of traces over which events could be picked, and thus the accuracy of the results was lowered. The vertical velocity distribution obtained from the six events selected, and the maximum distance over which measurements were made (x), are shown in the following table :-

Event	Horizon	Va ft/sec	to m.sec	Z feet	Vi sec	X feet
1		6800	362	1231		3000
2	A	6900	412	1421	7600 7800	3000
3		7040	482	1697		3000
4		7190	831		12410	1800
5	C	9940	1049	5209	17180	4050
6	D	11650	1373	7992		3400

Event No. 4 is possibly a multiple reflection, but the measurement is not sufficiently accurate to allow a definite interpretation.

Horizons A, C and an additional horizon B were followed on the main section along traverse D, but horizon D was represented by an intermittent reflection of poor quality and could not be followed with any certainty. It is possibly concordant with horizon C. Horizons B and C are of poorer quality than the strong horizon A, and both were lost where they came within the zone where the first multiple of horizon A would appear. On the cross-traverse DX1, horizons A, C and D could be followed, although horizons C and D were of poor quality.

A group of strong events were recorded between 1.0 and 2.0 seconds on the section from shot point 58 to shot point 78, but these appear to be multiple reflections.

Diffraction patterns were recorded between shot points 51 and 55, and again between shot points 62 and 72.

The processing and stacking in the playback centre of the tapes from the C.D.P. shooting are not yet completed, and hence the results of this technique are not available.

B. REFRACTION

Four refractors, other than the sub-weathering, were recorded, and their profiles have been plotted on Plate 2. Their velocities, offsets and depths are as follows :-

Refractor	Velocity (ft/sec)	Double Offset (ft)	Approximate depth (ft)
V_1	7000	-	Sub-weathering
V_2	14,750	1800	1500
V_3	18,200-18,400	3600-4200	3500
V_4	20,280	10,800	4500
V_5 *	19,100		8000

* Validity doubtful

The offset distance for the refractor V_2 was measured directly from the extended spread shot on traverse DX1, where the corresponding reflection could be identified. This refractor was not recorded east of shot point 56, but an event with velocity between 10,000 and 12,000 ft/sec was recorded between the sub-weathering refractor and the 18,400 ft/sec refractor. This lower velocity event could not be profiled, as it was recorded as a main event for only 1200 to 1500 feet on each shot.

A slight variation in both velocity and offset distance was found in the profile segments of the 18,400 ft/sec refractor. This refractor also showed a very high rate of energy attenuation and could only be picked reliably over 4500 to 6000 feet on each record. Despite this energy attenuation however, this refractor still caused interference to the succeeding 20,280 ft/sec refractor, and a minimum shot to geophone distance of 28,800 feet was necessary to record the 20,280 ft/sec refractor clearly.

The 20,280 ft/sec refractor proved to be a good marker for structural mapping, in that its high velocity ensured that it was the initial event over large distances, and although it had a fairly high rate of energy attenuation (2.7 dbs per 1000 feet), at least two phases were always pickable across every record. Reciprocal time-ties for each record ensured that the same phase was picked throughout.

Records covering the marker on the western part of the profile showed a sudden energy loss occurring near shot point 52, and this was associated with an unusual discordance in the forward and reverse profiles.

Two shots fired in an attempt to penetrate the 20,280 ft/sec marker showed an apparently lower velocity event at greater depth, although there is insufficient information to determine whether or not this event came from a true refracting surface.

7. INTERPRETATION

On the cross-traverse DX1, horizons A, C and D are all flat at depths of 1400, 5200 and 8000 feet respectively.

On the main traverse, horizon A has a slight westerly dip of 1°30' between shot points 49 and 54, but reverses sharply to dip eastwards at 5° between shot points 54 and 56 (Plate 2). This profile is followed very closely by the 14,750 ft/sec refractor as far as shot point 56. East of this shot point the refractor was not recorded, but horizon A continues to shot point 78 with a fairly flat profile.

The profile of the 20,280 ft/sec refractor defined the main structural feature of the traverse. This consists of a broad anticlinal structure, flanked by two synclines, with a difference in depth between the deepest and shallowest points on the profile, of approximately 1200 feet. The general outline of this structure was reflected in the overlying profiles of reflecting horizons B and C, and in the profile segments of the 18,400 ft/sec refractor, although minor discordances in dip occur between each profile. On the western flank of the structure, between shot points 49 and 55, dips vary between 3° and 5° west, in marked disconformity with horizon A, but between shot points 55 and 70 all profiles are relatively flat. On the eastern flank, between shot points 70 and 79, the 20,280 ft/sec marker dips gently eastwards at 2°, while horizon B and the 18,400 ft/sec refractor remained fairly flat as far as shot points 75 and 74 respectively.

By correlation with the formations encountered in the Pelican Hill bore, horizon A and the 14,750 ft/sec refractor have been interpreted as representing the Cretaceous/Palaeozoic unconformity.

As the other horizons mapped are deeper than the bore, no other correlations with the formations in the bore were possible, and hence the attitude of the Devonian sediments occurring in the core is not directly known. However, the absence of any evidence of an unconformity below horizon A suggests that the attitude of the Devonian sediments is similar to that of the deeper horizons. This possibility is strengthened by the fact that the upper part of the Gneudna Formation found in the bore would then be truncated immediately to the east, at the unconformity at the base of the Cretaceous, which could account for (a) the absence of the 14,750 ft/sec refractor east of shot point 56, and the appearance of a lower velocity event in the same position, and (b) the relief on the unconformity near shot point 55. It therefore appears probable that over the length of the traverse, the Devonian sediments will have a slight dip to the west, similar to that of the deeper horizons.

The only pre-Devonian rocks with velocity ranges known to exceed 20,000 ft/sec in this area, are the Dirk Hartog Dolomite and metamorphic basement. The high rate of energy attenuation in the 20,280 ft/sec refractor is not consistent with a massive formation, and for this reason, the refractor is tentatively correlated with the Dirk Hartog Dolomite rather than basement.

The exact nature of the structure delineated by this refractor is not known. A fault has been tentatively postulated in the region of shot point 53 to account for the deterioration in reflection record quality, and the energy losses on the refraction records, and this could provide the western boundary of the structure. The evidence, however, is inconclusive. The diffraction patterns recorded in this part of the section and those recorded between shot points 62 and 72, appear to emanate from irregularities in the unconformity at the base of the Cretaceous.

The 18,400 ft/sec refractor indicates the presence of a thin but persistent layer, either near the top of the Dirk Hartog Dolomite, or within the lower part of the Devonian sequence, the Nanyarra Greywacke.

The problem of the different correlations of the carbonate sequences in the Pelican Hill and Brickhouse No. 1 bores cannot be resolved with the present information. However, a northerly dip of only 1° or less would be necessary to cut out the Devonian between the traverse and Brickhouse No. 1 bore, even if the 20,280 ft/sec refractor represented the top of the Dirk Hartog Dolomite. Alternatively if the formations in the Brickhouse bore belong to the Devonian, then the Dirk Hartog Dolomite would be flat or else dip southwards, in order to lie below the base of the Brickhouse bore. Both these possibilities seem equally feasible.

8. CONCLUSIONS

1. A high velocity refractor which is tentatively correlated with the Dirk Hartog Dolomite, was found below the base of the Pelican Hill bore, suggesting that the strata underlying the Gneudna Formation in the bore, belong to the Nanyarra Greywacke, rather than the Tumblagooda Sandstone.

2. A broad anticlinal feature with an approximate relief of 600 feet, has been demonstrated to exist in the high velocity refractor (Dirk Hartog Dolomite), immediately to the east of Pelican Hill bore.

3. In the immediate vicinity of the bore, a minimum depth of section of 5200 feet was demonstrated, of which 3800 feet are Palaeozoic sediments.

4. The Devonian sediments do not thicken and deepen to the east. There is probably a local thinning to the east of the bore, related to the anticlinal feature, but overall the Devonian and other Palaeozoic formations exhibit a slight dip to the west.

5. Evidence for faulting in the area is inconclusive, and no fault which could justify the different correlations of the carbonate sequences in the Pelican Hill and Brickhouse No. 1 bores, was found.

6. Record quality was too poor to draw any conclusions concerning the pre-Dirk Hartog Dolomite formations.

9. REFERENCES

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APPENDIX 1

STAFF AND EQUIPMENT

STAFF

Party Leaders	J. Valentine and A. Turpie
Geophysicists	J. Raitt
	B. Jones
Surveyors	J. Ritchie Dept. of Interior
	P. Pullinen Dept. of Interior
Clerk	I. Walker
Observer	R. Krege
Shooter	C. Wood
Driller Grade 2	J. Chandler
Drillers	K. Suehle
	J. Keunen
	L. Keast
Mechanic	E. McIntosh

EQUIPMENT

Seismic Amplifiers	'Texas Instruments' 8000 (Explorer)
Seismic Oscillograph	S.I.E. TR06
Magnetic Recorder	Electro - Tech DS7/700
Geophones	Electro - Tech 4.5 cycle - 26 x 4
	Electro - Tech 20 cycle - 122 x 6
	T.I.C. 20 cycle - 32 x 1
Drills	1 Mayhew 1000
	2 Careys

APPENDIX 2

OPERATIONAL DATA

Sedimentary Basin	Carnarvon
Area	Boolathanna Station
Camp Established	25th June
Shooting Commenced	26th June
Miles Surveyed	23.9 miles
Total Footage Drilled	33,313 feet
Explosives Used	25,580 lbs
Number of reflection spreads shot	49
Number of CDP reflection spreads shot	98
Number of refraction spreads shot	64
Miles traversed - reflection	12.6
Miles traversed - refraction	21.8
Datum level for corrections	M.S.L.
Weathering Velocity	1500 ft/sec
Sub Weathering Velocity	7000 ft/sec
Reflection static correction method	Uphole times and shallow reflection (Smith & Robertson 1963)
Refraction weathering control	Reflection spreads and weathering spreads

1. Normal Reflection Technique

Shot point interval	1800 ft.
Geophone Station interval	150 ft.
Shothole pattern	(a) 3 in line, 55 feet apart
	(b) single hole
Charge	(a) 3 x 10 lbs.
	(b) 30 lbs.

Depth	(a) 60 ft.
	(b) 120 ft.
Geophone Group	(a) 6 geophones, in line, 22 feet apart.
	(b) 18 geophones, in line, 11 feet apart.
Filters	Original 11K 125K
	Playback 27K 72K
Sensitivity	1 µv - 31 mv.
A.G.C.	1/1 125

(a) between shot points 49 and 57

(b) between shot points 57 and 78

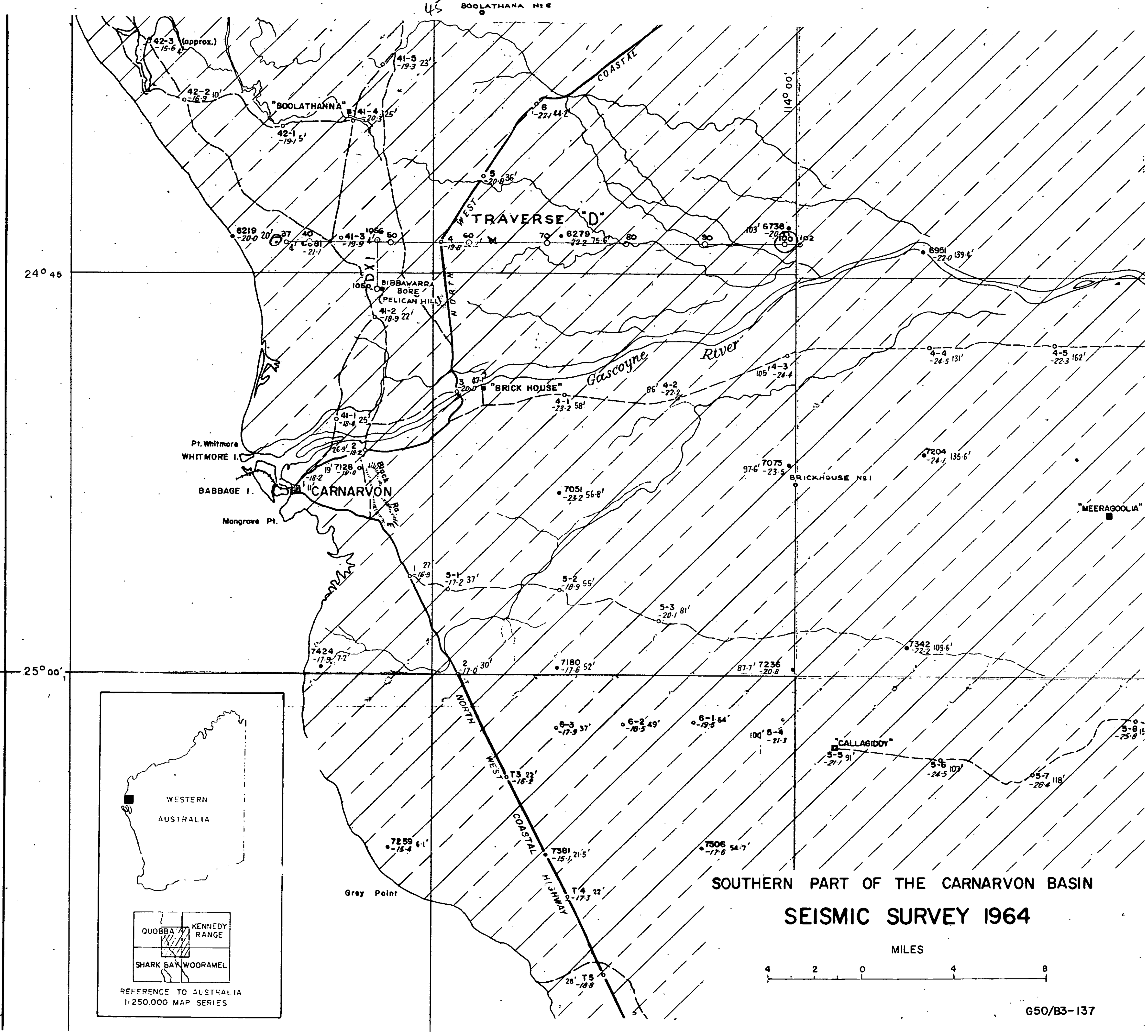
2. Refraction technique

Geophone Station Interval	300 feet
Geophone group	4, bunched
Filter	0, 40K
Charge sizes	10 lbs - 1350 lbs.
Shot to geophone distances	Refractor 1. 0 - 16200 feet
	Refractor 2. 0 - 16200 feet
	Refractor 3. 28,800 - 36,000 feet
	Refractor 4. 79,200 - 88,200 feet

3. Common Depth Point Technique

Shot point interval	300 feet
Charge	100 lbs
Depth	120 feet, except in near surface limestone areas where it varied from 70-108 feet.

Geophone Station Interval	300 feet
Geophone Group	18 geophones, in line, 11 feet apart.
Shot to geophone distances	750 feet to 7650 feet
Filters	18M 92K
A.G.C.	1/1 20
Sensitivity	$4 \mu v$ to 125 mv
Time break	Radio transmitted
Uphole Pulse	Cable transmitted



SOUTHERN PART OF THE CARNARVON BASIN

SEISMIC SURVEY 1964

CORRECTED RECORD SECTION

RECORDING INFORMATION

Magnetic Recorder ELT DS7/700

Amplifiers : 8000 Explorer

Filters : K22 125K

A.G.C. : 1/1 125

Gain Initial :–60

Final : Max

Geophones : EVS 2B–20c/s

Geophone pattern :

SPs 49–57 6/trace 22' apart in line

SPs 58–78 12/trace 11' apart in line

Station interval 150'

Shot-hole pattern :

SPs 49–57 3 holes in line 55' apart

Depth 60'

Charge 3 x 10lbs

SPs 58–78 1 hole depth 125' Charge 30lbs

PLAYBACK INFORMATION

Filters : 2/16–1/47

A.G.C. : Super Slow

Gain Initial :–40

Final :–20

Trip delay :– 2

Compositing : Nil

VELOCITY INFORMATION

Extended spread velocity shoot

SP 1054, Traverse DX1

HORIZONTAL SCALE

0 1000 2000 3000 4000 FEET

0 1800 3600

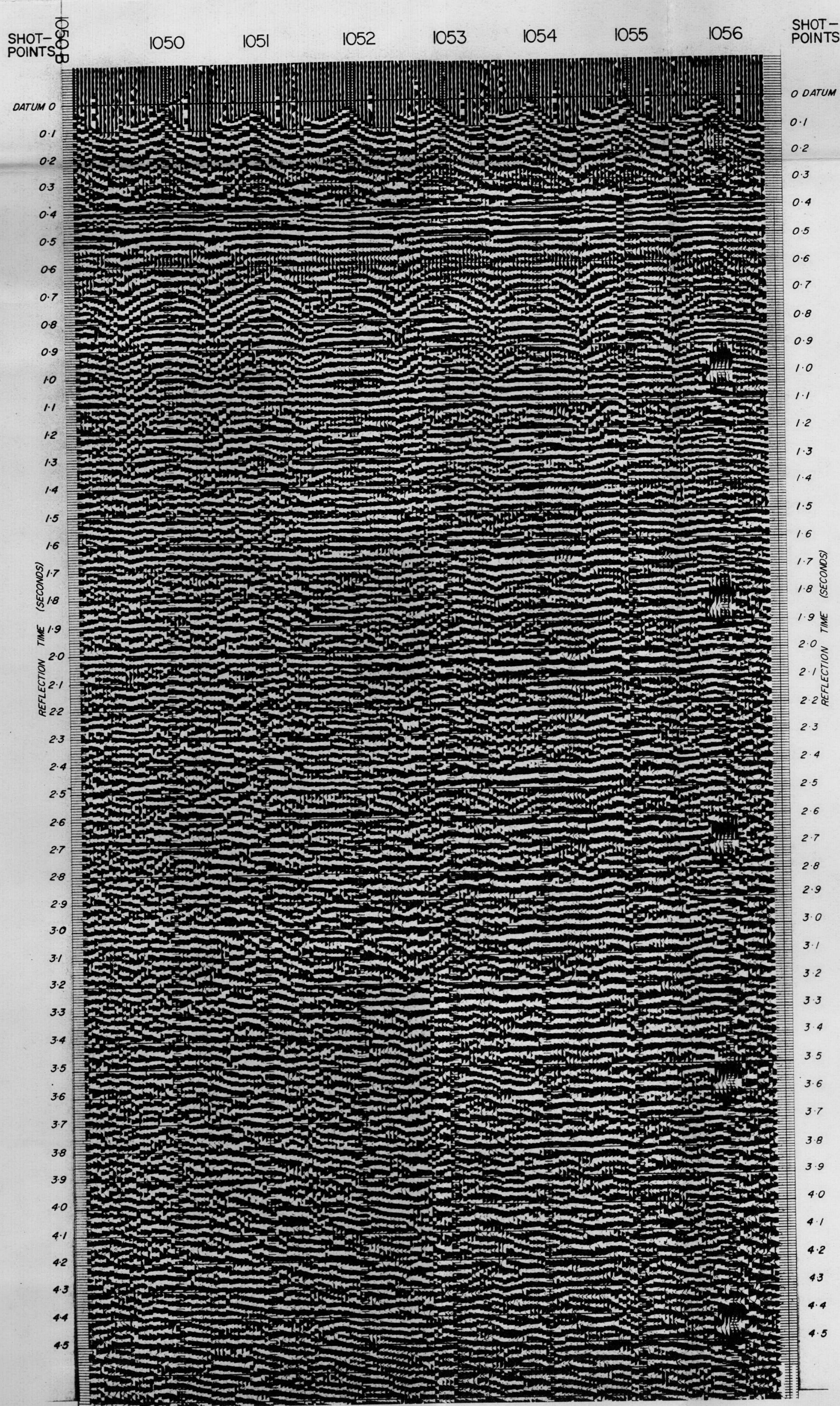
SOUTHERN CARNARVON BASIN

SEISMIC SURVEY 1964

TRAVERSE D

RECORDED BY: *Seismic Party No. 2*

SECTION BY: *Bureau of Mineral Resources*
Playback Centre S/E MS 42 G50/B3–148



CORRECTED RECORD SECTION

RECORDING INFORMATION

Magnetic Recorder ETL DS7/700

Amplifiers: 8000 Explorer

Filters: K22 125K

A.G.C.: 1/1 125

Gain Initial: −60

Final: Max

Geophones: EVS 2B-20 c/s

Geophone pattern:
6 / trace 22' apart in line

Shot-hole pattern:
3 holes in line 55' apart
Depth 60'
Charge 3 x 10lbs

PLAYBACK INFORMATION

Filters: 1/16 − 1/47

A.G.C.: Super Slow

Gain Initial: −40

Final: −20

Trip delay: −·2

Compositing: Nil

VELOCITY INFORMATION

Extended spread velocity shoot
SP1054

NOTE: SP1056 events at 1·0, 1·85, 2·7s etc caused by action of heat on magnetic tape

HORIZONTAL SCALE

0 1000 2000 3000 4000 FEET
0 1800 3600

SOUTHERN CARNARVON BASIN

SEISMIC SURVEY 1964

TRAVERSE DX1

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