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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record No. 1969 / 69

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Ngalia Basin Seismic Survey, Northern Territory 1967

by

P. Jones

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CONTENTS

ILLUSTRATIONS

SUMMARY

In September and October 1967, the Bureau of Mineral Resources carried out a short seismic survey in the Ngalia Basin in the Northern Territory. The general objective of the survey, which was to determine the extent of Lower Palaeozoic sedimentation in the area, was not achieved as it was not possible in the time available to tie the results with surface outcrops. However, the relatively simple reflection seismic method used proved effective in the area for delineating structure to considerable depth (about 12,000 ft) and showed the existence of a thick sedimentary sequence.

1. INTRODUCTION

During September and October 1967, the Bureau of Mineral Resources (BMR) carried out a reconnaissance seismic survey in the central part of the Ngalia Basin in the Northern Territory. This survey formed part of a comprehensive geological and geophysical investigation which BMR is carrying out in the Ngalia Basin.

Access to the survey area is provided by a good graded road from Alice Springs to Yuendumu Native Settlement and thence west along a track to Vaughan Springs (see Plate 1). The terrain of the area is generally flat; east-trending sand dunes in the western part of the area and low outcropping ridges in the central and northern portion provide the only significant relief. Vegetation is quite dense and consists mainly of eucalyptus trees, mulga scrub, and spinifex. Water supplies in the area are obtained mainly from bores as lakes and streams are normally dry except during extremely wet seasons.

Previous geophysical work has been carried out by the Pacific American Oil Company (1963, 1965) who have conducted aeromagnetic, seismic, and gravity surveys over part of the area. A small amount of reconnaissance geological work has also been carried out prior to 1967 (Cook, 1963; Cook & Scott, 1966).

2. GEOLOGY

General

The Ngalia Basin covers an area of about 7000 square miles. It lies approximately between latitudes 22° 10'S and 22° 55'S and between longitudes 130° 00'E and 133° 30'E. Its western margin is uncertain owing to poor outcrop. The basin, which is about 200 miles long and up to 50 miles wide, consists of a flat alluvial area bordered by prominent outcrops of Upper Proterozoic quartzite sandstone, dolomite, and shale, which crop out along its northern and southern margins. These Upper Proterozoic sediments unconformably overlie Lower Proterozoic metamorphics and granite intrusives.

Unconformably overlying the Upper Proterozoic sediments are Lower and Upper Palaeozoic sediments, which have been correlated with those of the Georgina and Amadeus Basin. It is suspected that the Ngalia, Georgina, and Amadeus Basins were portions of one large basin throughout much of their history, rather than isolated basins. Outcrops of the Palaeozoic formations frequently occur along the northern margin and sometimes within the basin. They appear to be strongly folded and faulted.

Stratigraphy

Eight sedimentary rock units have been recognised in the Ngalia Basin and they probably range in age from Upper Proterozoic to Upper Palaeozoic. Precambrian metamorphic and igneous rocks underlie the succession on both the northern and southern boundaries (Plate 2). It is estimated that at least 12,000 ft of sediments are exposed in the basin, and aeromagnetic data (Pacific American Oil Company, 1963) suggest that there may be up to 20,000 feet of sediments in the central part of the basin.

Table 1 is a stratigraphic column for the sediments of the Ngalia Basin, showing the suspected age and dominant lithology of each unit.

The Vaughan Springs Quartzite and the Djagamara Formation form prominent scarps and ridges along the northern margin of the basin; the Central Mount Wedge Beds do likewise along the southern margin.

The central part of the basin is covered with Cainozoic alluvium and little is known of the sedimentary sequence below this alluvium. No Mesozoic sediments have been mapped within the survey area.

Tectonics

Two major tectonic events appear to have affected the sediments of the Ngalia Basin. These gave rise to the major unconformities in the sedimentary sequence. The Mount Eclipse Sandstone (Table 1) was probably deposited under continental conditions contemporaneously with a major Upper Palaeozoic orogeny which affected the whole of the Ngalia Basin. This orogeny produced Jura-type folding in the area south of Yuendumu and thrusting or folding of the basement over sediments on the northern margin of the basin in the vicinity of Napperby Homestead. This major tectonic event also brought sedimentation in the Ngalia Basin to a close.

A possibility which has arisen from an interpretation of gravity work carried out in the area recently (Whitworth, in prep.) is that the northern overthrusting has tilted the basin down to the north and resulted in denudation of Palaeozoic sediments to the south thus leaving a wedge of largely Proterozoic sediments,particularly to the south, which is covered by alluvium and remaining floaters of Mount Eclipse Sandstone.

3. PREVIOUS GEOPHYSICS

Aeromagnetic surveys

Two aeromagnetic surveys have been carried out in the area of the Ngalia Basin.

In 1958 BMR carried out an airborne magnetic and radiometric survey of the Mount Hardy area west of Yuendumu (Carter, 1960). This survey covered the northern margin of the Ngalia Basin and the surrounding Precambrian basement complex. Pacific American Oil Company (1963) carried out a survey which covered nearly the whole of the Ngalia Basin.

The magnetic results in the western part of the area surveyed in 1963 showed that the southern part was dominated by large changes in magnetic intensity, whereas to the north and east the magnetic gradients were much smaller. Superimposed on the general gradient to the north and east were some smaller features. These smaller features were thought to represent fault blocks or horsts.

TABLE 1

Stratigraphy of the Ngalia Basin

Age	Formation	Lithology	Thickness (feet)
Lower Carboniferous	Mount Eclipse Sandstone	Terrestial sandstone	7000+
	— Unconformity —		
Ordovician (?)	Kerridy Sandstone	Sandstone	1000
	Djagamara Formation	Sandstone with shale	600
	— Disconformity —		
Cambrian	Bloodwood Formation	Siltstone, sandstone	400
	Walbiri Dolomite	Dolomite, with Siltstone	600
Upper Proterozoic	Yuendumu Sandstone	Sandstone	1000
	— Unconformity —		
	Mount Doreen Formation	Siltstone (tillite), with dolomite	400
	(Vaughan Springs Quartzite) (Central Mount Wedge Beds)	Quartzite, with basal conglomerate	1000

The magnetic anomaly features in the southern part of the area were interpreted as revealing a considerable amount of structure. The features, separated by north-east trending lineaments, are elongated in an east-west direction and are alternately broad and narrow in extent. The lineaments were interpreted as representing north-east trending faults and the relative anomaly features were considered to result from magnetic basement blocks with varying attitudes. The general dip of the blocks was considered to be to the north.

The magnetic anomaly features in the southern part of the area all give rise to estimates of shallow depth to magnetic basement. Depth estimates of deeper magnetic basement were obtained from the small anomaly features occurring on the broad gradient to the north and east of the basin. Maximum depths to basement of the order of 20,000 ft were indicated in this northern area.

An abrupt transition from large depth estimates in the central portion of the western area to shallow depth estimates in the north suggests the presence of a major fault zone controlling the northern margin of the sedimentary basin. Results obtained from the BMR survey (Carter, 1960) similarly suggest that the northern margin is faulted. According to the Pacific American Oil Company interpretation, the basinal portion of the area appears to be wedge-shaped with sediments thickening rapidly to the north.

The magnetic pattern in the eastern part of the area was relatively featureless but was bounded in both the north and south by sharp anomalies. Magnetic results suggest that the eastern part of the basin is markedly narrower than the western part. Large-scale faulting is indicated and suggests that the eastern area is more nearly in the form of a graben than the western area.

Owing to the narrowness of the eastern part of the basin and its lack of magnetic features, depth estimates in the eastern area were not considered to be so reliable, though a maximum thickness of sediments in excess of 8000 ft is indicated. At the extreme eastern end of the basin the estimated depths were all shallow, indicating that the basinal area is closed in this direction.

Gravity surveys

In 1965 BMR carried out a helicopter gravity survey, which covered the eastern part of the Ngalia Basin (Flavelle, 1965). In 1967 a further helicopter survey completed the coverage of the basin and its surrounds (Whitworth, in preparation). Detailed gravity profiles were made along their seismic lines by Pacific American Oil Company (1965) in 1964.

The reconnaissance gravity work has outlined a large regional gravity province called the Yuendumu Regional Gravity Low, which extends across north NAPPERBY, north MOUNT DOREEN, south MOUNT THEO, north LAKE MACKAY, and south-east HIGHLAND ROCKS. The axis of the Yuendumu Regional Gravity Low lies in an east-west direction and is concave to the south. The 'low' reaches nadirs of -100 mgal Bouguer anomaly on central NAPPERBY and north and west MOUNT DOREEN. It is flanked to the north by the

Willowra Gravity Ridge and to the south by the Papunya Gravity Ridge. The Willowra Gravity Ridge reaches a culmination of 0 mgal Bouguer anomaly and the Papunya Gravity Ridge reaches +40 mgals Bouguer anomaly.

The Ngalia Basin, as outlined from outcrop, lies within the Yuendumu Regional Gravity Low, but it occurs on the southern gradient, rather than along the axis of the 'low'. The 'low' would suggest that the basin is of far greater extent than its surface expression indicates, in which case basement rocks must have been thrust over the basin sediments along the northern margin. However, the gravity anomalies in central Australia are so large that it is likely that more deep-seated causes are responsible for portion of these anomalies.

The gravity work carried out by Pacific American Oil Company shows a steep northward decrease of gravity to a negative axis near or beyond the northern end of the lines of control. A residual gravity map made by subtracting the regional slope from the observed gravity shows strong shallow disturbances which it was believed were too sharp to have their origin as deep as the horizon mapped by the seismic survey. The presence of two thrust slices was suggested as one possible structure to account for these anomaly features.

Seismic surveys

The only seismic survey carried out to date in the Ngalia Basin was a reflection survey conducted in the Napperby area in late 1964 (Pacific American Oil Company, 1965). This work was carried out by Geophysical Associates Pty Ltd for the Pacific American Oil Company. A gravity survey was conducted concurrently with the seismic work using seismic shot-point locations as stations for gravity readings.

The continuous profiling technique was used in this survey with 1320-ft geophone-spreads. Recordings were taken using single holes 110 ft deep, and 12 geophones per trace, the geophones being at 11-ft intervals. No detailed experimental work was carried out to determine the optimum geophone/shot-hole arrangement. The arrangement used, however, was adequate to obtain fair quality records, presumably in an economical manner. Where record quality deteriorated, patterns of holes consisting of 3 to 5 holes in line and 50 ft apart were used, but it was found that little improvement in record quality resulted. Drilling conditions were generally good except where hard outcrops were crossed. In these areas the shot-hole depth was reduced to 20 ft. All shots were recorded using fast AGC, a 20 -c/s low-cut filter and a 90 -c/s high-cut filter. The playback filter settings used were 38 c/s low-cut and 65 c/s high-cut.

The results obtained were presented as a depth contour map based on an horizon tentatively identified as Lower Palaeozoic. However at the time the survey took palce very little was known of the geology of the Ngalia Basin and no effort was made to tie seismic results with surface outcrops so that little credence can be placed on this identification. The event mapped is of consistently good character and has good continuity, except where faulting was indicated. No other reflected events were mapped. Reflection events above the mapped horizon had fair continuity locally but lacked distinctive character, which made correlation difficult. Primary energy below the mapped event did not show good continuity or distinctive character.

Velocities used for the determination of depths were derived from a $t:\Delta t$ analysis.

The interpretation shown on the depth contour map shows a series of east-trending thrust sheets (the overthrust coming from the north) as the dominant structural feature in the basin. Normal faulting seems evident on the west portion of line 2 (see Plate 1). These faults may be associated with a prominent aeromagnetic 'high' north of line 2 and west of line 6. Maximum depths to the Lower Palaeozoic horizon were 12,000 ft on the northern end of line 3, and 13,000 ft at the intersection of lines 2 and 5 (see Plate 1).

Three areas of interest were defined by the seismic survey. The first, a seismic 'high' at the intersection of lines 2 and 6, has approximately 1000 ft of east dip, closure to the west through faulting of at least 2000 ft and approximately 800 ft of north dip. Approximately 400 ft of south dip is indicated on the seismic map, but faulting may occur on line 6 south of line 2 intersection. The structure lies about two miles south-east of a very prominent aeromagnetic 'high' in the area, and lies within a broad gravity 'low'.

The second structure of interest at the intersection of lines 2 and 4 has closures to the north, south, and east of over 2000 ft through faulting. Closure to the west is approximately 500 ft, again through faulting. The third structure is a gentle anticline on line 2 between lines 1 and 3.

4. OBJECTIVES OF SURVEY AND PLANNED PROGRAMME

Proposed programme

The general objective of the 1967 survey was to carry out a brief reconnaissance traverse within the Ngalia Basin, with particular reference to the extent of Lower Palaeozoic sedimentation in the area. The only previous seismic survey to be carried out in the Ngalia Basin was confined to the central portion of the basin. The BMR 1967 survey was confined to the central-western portion of the basin.

Specific objectives of the survey were as follows:

1. To develop a technique which would record reliable reflections from at least the Lower Palaeozoic sequence where it may exist in the Ngalia Basin.

2. To record all refractors to a probable basement refractor in the centre of the basin. (A probable basement refractor is defined as a refractor with a velocity of the order of 20,000 ft/s and showing little attenuation of energy at extended distances).

The programme was planned as follows:

a) To shoot a reflection traverse south from Lower Palaeozoic outcrops near Saltbush Bore (Plate 1) to approximately latitude 22° 30' S, a distance of 20 miles. A certain amount of experimental work was to be carried out to determine a suitable technique.

b) To shoot a refraction depth probe west from the above traverse along latitude 22° 30' to record all refractors to basement.

Actual programme carried out

The operational statistics of the survey are summarised in Appendix B.

In order to carry out programme item (a), Traverse A (see Plate 1) was surveyed from about six miles south of Saltbush Bore south to approximately latitude 22° 30'. Noise tests were carried out at SP 1602 and SP 1566 to determine optimum spacing for geophone groups. A short refraction probe was shot at the northern end of Traverse A to determine the refraction velocity of the Palaeozoic rocks cropping out in that area.

Programme item (b) was accomplished by the shooting of refraction Traverse B. About three miles of continuous reflection profiling were shot at the centre of Traverse B, crossing Traverse A, to assist in the correlation of reflection and refraction results. An expanded spread velocity shoot (Musgrave, 1962) was conducted between SP 2048 and SP 2052 on Traverse B and the velocity information obtained was incorporated in the $t:\Delta t$ analysis carried out for Traverse A.

5. TECHNIQUES

General

All shots throughout the survey were recorded both on magnetic tape using a DS7-7 recorder and on paper record using an SIE VT-6 oscillograph. The seismic amplifiers were Texas Instruments 8000. All equipment used is summarised in Appendix A.

All traverses on the survey were shot using an 1800-ft shotpoint interval. The datum used for corrections was 2000 ft above sea level.

Reflection traverses

Before reflection shooting was commenced on Traverse A (Plate 1) a series of noise tests was carried out at SP 1602 to determine a suitable geophone arrangement. As surface conditions changed appreciably along Traverse A from rocky, heavily timbered country in the north to sandy, spinifex country in the south a further series of noise tests was carried out at SP 1566. These noise tests indicated that the geophone pattern being used would still attenuate most of the noise present on the records.

Owing to the small drilling capability available to the party, Traverse A was shot mainly using single holes. Twenty four geophones per trace were used in two rows of twelve, the rows being 22 ft apart and the interval between geophones being 12½ ft. A few spreads were shot using three- or five-hole shot-patterns, the holes being parallel to the traverse, offset 50 ft, 50 ft apart, and 120 ft deep. A noticeable improvement in record quality could be seen on these records obtained using pattern shots.

A similar shot and geophone arrangement was used on reflection Traverse B. The expanded spread was shot using five-hole shot patterns at each shot-point.

Refraction

All refraction work on Traverse A and B was shot using a 300-ft geophone station interval with a spread length of 7200 ft. Charges varied from 10 to 1200 lb depending on the distance from shot to spread (zero to 12 miles) and the holes varied in depth between 75 to 120 ft.

In the refraction probe method employed on these traverses the two shot-points are maintained in fixed positions at the ends of the traverse and the geophone spread is moved successively between them. Thus the offset distance is constantly varied and a range of refractors is recorded shooting from both directions.

Refraction probes were shot on Traverse A between SP 1617 and SP 1621 and on Traverse B between SP 2032 and SP 2064. On Traverse B the refraction spread was moved successively by four reflection shot-point intervals (7200 ft) so that there was a common geophone for adjacent spreads.

6. RESULTS AND INTERPRETATION

Refraction Traverse B.

A large-scale refraction probe was surveyed between SP 2032 and SP 2068 on Traverse B (Plate 1). The shot-points were kept fixed at SP 2032 and SP 2068, about 12 miles apart, and the geophone spread was successively moved along the traverse in order to record all refractors to basement if possible.

Velocities of about 12,800, 14,500 and 19,800 ft/s were recorded. The depths of these refractors were calculated using vertical velocity data obtained from a $t:\Delta t$ analysis of reflections:

Refractor velocity (ft/s)	Average overburden velocity (ft/s)	Depth at SP 2032 (ft)	Depth at SP 2068 (ft)
12,800	10,000	330	125
14,500	12,200	1500	1100
19,800	14,100	8000	6400

These depths are only approximate and are included only to show the order of depth involved. This is particularly so in the case of the 19,800-ft/s refractor. Energy returns from this refractor were sometimes very low and it was not generally possible to pick first-breaks. Corrections applied to the phases picked, to reduce them to first-break times, were only very approximate in some cases.

Reflection Traverse B

About $3\frac{1}{2}$ miles of continuous reflection profiling was shot in the centre of Traverse B (Plate 5). One strong, essentially horizontal event was recorded across the traverse at a corrected reflection time of about 1.2 seconds. Velocities obtained from a $t:\Delta t$ analysis carried out on Traverse A indicate that this reflection time corresponds to a depth of about 9000 ft. There are indications of other, shallow reflection events but these are not continuous over any appreciable distance.

Velocity shoot, Traverse B

An expanded spread velocity shoot (Musgrave, 1962) was carried out on Traverse B centred on SP 2050 (Plate 6). A total of six events were picked at reflection times ranging from 0.503 to 1.427 seconds. Analysis of the results indicated that all these events were probably primary reflections. A table showing reflection time, depth, and average velocity associated with these events is given below:

Event	Reflection time (s)	Depth (ft)	Average velocity (ft/s)
1	0.503	3247	12910
2	0.612	4062	13275
3	0.687	4656	13555
4	0.794	5452	13733
5	1.205	9486	15744
6	1.427	11638	16311

Δt values calculated from the above velocities were in substantial agreement with those obtained from an analysis of reflections on Traverse A.

Correlation of reflection and refraction results, Traverse B

In order to correlate the reflection and refraction results obtained on Traverse B, a variable-area playback display was made of the refraction results. It was possible to see a reflection event on this display occurring at a record time of about 1.2 seconds, i.e. at about the same record time as the reflection recorded on Traverse B. This reflection event appeared to be associated with the 19,800-ft/s refraction event. It is therefore probable that the reflection and refraction events are associated with the same lithological unit in the section (there is, however, a difference in the depths calculated for the reflection and the refractor).

Any geological correlation of this reflection/refraction event is very difficult to make because of the presence of thick, well-cemented quartzites and dolomites in the Proterozoic and Palaeozoic sequences around the edges of the basin. Both these rock types could give rise to refraction velocities of the same order as an igneous or metamorphic basement, i.e. 19,000 to 20,000 ft/s. Irrespective of which of these rock types proves to be associated with the high velocity refractor, it would appear that there is a minimum of about 9000 ft of sediments in the vicinity of Traverse B.

Reflection Traverse A

About 21 miles of continuous reflection profiling was shot on Traverse A (Plate 4). The results obtained on the traverse were generally of fair quality and show the existence of a thick sedimentary sequence in the area. The section also illustrates that the area has suffered major faulting with some associated folding. It was not possible to say whether the faults were normal, reverse, or thrust faults from the evidence shown on the section. Between SP 1600 and SP 1621, two strong reflections were recorded between 0.65 to 0.85 second and 0.85 and 1.2 seconds respectively, plus some weaker, discontinuous shallow events. To the south between SP 1600 and SP 1559, only one strong event is present on the records between 0.8 and 1.4 seconds together with indications of some impersistent shallow events and a deeper, fairly strong event between SP 1569 and SP 1559. This deep event occurs at 1.05 seconds under SP 1559 and at 1.3 seconds under SP 1569. A migrated dip section (Plate 3) was drawn up for the whole of Traverse A using a Sinclair Dip Plotter.

Traverse A intersects Traverse B at SP 1579 (SP 2050 on Traverse B). In this region of Traverse A, only one strong, deep reflection is present on the section and this reflection can be correlated directly with the reflection/refraction event recorded on Traverse B. To the north between SP 1600 and SP 1621 and to the south between SP 1559 and SP 1569, two strong, deep reflections are present on the section. Owing to the presence of major faulting in the vicinity of SP 1569 and SP 1600 it is not possible to say which of the two strong events recorded at either end of the traverse correlates with the deep event recorded between SP 1570 and SP 1599. The strong events recorded on Traverse A were so similar in character that it was not possible to make a correlation on the basis of character.

Plate 3 illustrates that the section has a general north dip with some minor dip reversals imposed on it. Between SP 1600 and SP 1621 the deeper of the two strong events shows evidence of faulting. The downthrow of these faults is to the north and is of the order of 500 to 800 ft. Although these faults only appear on the deep event they appear to have had some influence on the younger sediments in the form of down-warping to the north. The major dip reversal which occurs in the two strong events between SP 1604 and SP 1601 is probably associated with the major fault which occurs to the south of that area.

Between SP 1570 and SP 1599, only one strong event is present and this event exhibits a dip to the north, the reflector increasing in depth from 7500 ft (1.0 s) under SP 1573 to 12,500 ft (1.6 s) under SP 1599. Broken continuity of events and an apparent displacement up to the north of correlateable events on the record section suggests further faulting in the vicinity of SP 1570 and SP 1569. To the south of this fault, between SP 1559 and SP 1569, two strong events are once again present on the records. These events dip to the north, the deeper of the two increasing in depth from 7800 ft (1.04 s) under SP 1559 to 10,000 ft (1.3 s) under SP 1568.

The shallow events which occur intermittently along the whole length of Traverse A appear to indicate structure similar to that indicated by the deeper, strong events.

Refraction Traverse A

The short refraction probe between SP 1617 and SP 1621 was shot to measure the refraction velocity of the Lower Carboniferous sandstone which crops out in that area. A near-surface velocity of 14,500 ft/s was recorded on this probe.

7. CONCLUSIONS

The general objective of the survey, to outline the extent of Lower Palaeozoic sedimentation in the area, could not be achieved in the time available. However, the reflection seismic method was shown to be effective in the area investigated for delineating structure to considerable depths (about 12,000 ft) even with a technique restricted to one hole per shot-point.

Refraction shooting showed that there is a refractor with a very high velocity at a depth of 8000 to 9000 ft in the area south of Saltbush Bore. If this refractor is of consistent velocity and is of widespread occurrence in the Ngalia Basin it could be a useful marker for mapping the basin, as there do not seem to be any refractors present with similar velocities.

The survey demonstrated that the northern margin of the Ngalia Basin has been affected by large-scale faulting with some associated folding. It was not possible to say whether the faults were normal, reverse, or thrust faults from the evidence shown on the section.

Any further seismic reconnaissance work in the basin should have the following major objectives:

1) To determine the geological correlation of the strong reflector/refractor recorded on Traverse B and on the central part of Traverse A.

2) To determine which of the two strong reflectors recorded at the north end of Traverse A can be correlated with this reflector/refractor.

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APPENDIX A

STAFF AND EQUIPMENT

Staff

Party leader	P. Jones
Geophysicist	D.H. Tucker
Observer	R. Krege
Clerk	B.C. Beaman
Shooter	H. Pelz
Toolpusher	B. Findlay
Drillers	A. Zoska
	K. Reine
Surveyor	P. Simms
Mechanic	E. McIntosh
Wages Hands	16 (including cook and cook's offsider)

Equipment

Magnetic recorder	Electro-Tech DS7-7
Seismic amplifiers	T.I. 8000
Oscillograph	SIE VT6
Transceivers	Traeger TM3 (3) Pye (3)
Geophones	Electro-Tech EVS-28, 20-c/s (798).
	Electro Tech EVS-8V, 4.5-c/s (104).
Cables	Vector 1/3 mile
Printing machine	Metem 20
Drills	Mayhew 1000 (1) Carey (1)
Workshop	On Bedford Chassis ZSU154 with alternator, compressor greasing unit, arc welder, grinding wheels, and band tools.

Vehicles

Function	Type	Registration No.
Party leader	International AB120 4 x 4, 1-ton utility	ZSU 098
Recording truck	International AB120 4 x 4, 1-ton utility	ZSU 230
Personnel carrier	Landrover, station wagon	ZSM 540
Personnel carrier	Landrover, station wagon	ZSM 540
Cable vehicle	Landrover L.W.B.	ZSM 454
Cable vehicle	Landrover L.W.B.	ZSM 549
Cable vehicle	Landrover panel van	ZSM 544

Function	Type	Registration No.
Flat-top	Bedford, 5-ton 4 x 4	ZSU 063
Flat-top	Bedford, 5-ton 4 x 4	ZSU 150
Workshop truck	Bedford, 5-ton 4 x 4	ZSU 154
Shooting truck	Bedford, 5-ton 4 x 4	ZSU 140
Water tanker	Bedford, 5-ton 4 x 4	ZSU 139
Water tanker	Bedford, 5-ton 4 x 4	ZSU 156
Water tanker	Bedford, 5-ton 4 x 4	ZSU 224
Carey rig	Bedford, 5-ton 4 x 4	ZSU 142
Mayhew rig	International R190, 4 x 4	ZDA 379

APPENDIX B

PARTY OPERATIONS

General

Sedimentary basin	Ngalia
Area of survey	Mt. Doreen 1:250,000 sheet
Camp site near	Vaughan Springs
Camp established	12 September 1967
Camp struck	10 November 1967
Miles of traverse surveyed	33
Miles of traverse shot	33
Topographic survey control	National Mapping 4-mile series, Department of Interior benchmarks.
Total footage drilled	26,620
Total number of holes	274
Explosives used	16,000 lb Geophex 2000 lb Ammonium Nitrate
Datum level for corrections	2000 ft above sea level
Weathering velocity	2500 ft/s
Sub-weathering velocity	8000 ft/s
Static correction method	Uphole times checked by first-breaks
Source of velocity distribution	t:Δt analysis
Shot-point interval	1800 ft

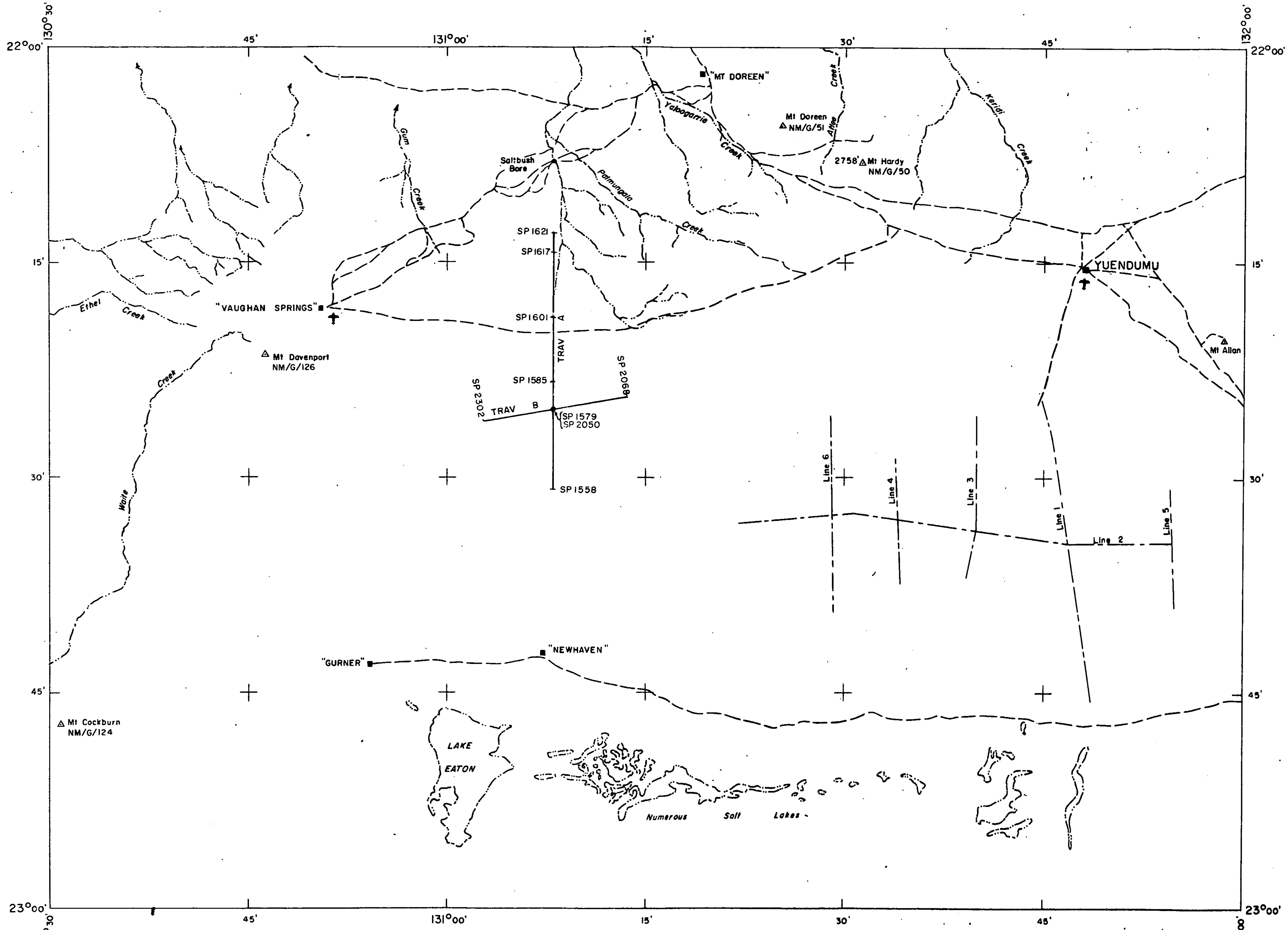
Reflection shooting data

Geophone group interval	150 ft
Geophone pattern	24 geophones/trace in two rows of 12, rows 30 ft apart, geophones 12½ ft apart.
Shot-hole patterns	Mainly single holes, 3 or 5 holes in line parallel to traverse, spacing 50 ft.
Number of shot-points shot	74
Number of miles traversed	24½
Common shooting depth	120 ft
Common charge size	50 lb
Usual recording filters	18K - 120K
Usual playback filters	27K - 72K

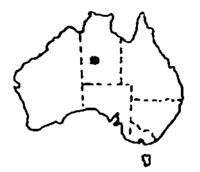
Refraction shooting data

Geophone group interval	300 ft
Geophone pattern	4 per trace in line perpendicular to traverse, spacing 22 ft.
Number of shot-points shot	4
Number of refraction traverses	2
Charge sizes	4 - 1200 lb
Usual recording filter	0 - 72K
Usual palyback filter	0 - 72K
Maximum shot - geophone distance	12 miles

PLATE I



LOCATION DIAGRAM



REFERENCE TO AUSTRALIA STANDARD 1:250,000 MAP SERIES : MT DOREEN

LEGEND

- Mission
- Homestead
- River or creek } Intermittent
- Lake } Intermittent
- Track
- Previous seismic survey

5 0 5 10 15 20 MILES

5 0 5 10 15 20 25 30 KILOMETRES

NGALIA BASIN SEISMIC SURVEY, 1967

LOCALITY MAP

TO ACCOMPANY RECORD No. 1969/69 GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS F52/B3-1

PLATE 2
REFERENCE
CAINOZOIC
Cz — Alluvium, aeolian sand, travertine (mainly overlying Palaeozoic and Upper Proterozoic sediments)
Cz/p€ — Alluvium, aeolian sand, travertine (mainly overlying Precambrian igneous and metamorphic rocks)
UPPER PALAEOZOIC
PzF — Unit F - Red-brown sandstone, conglomeratic
UNCONFORMITY
LOWER PALAEOZOIC
PzE — Unit E - Brown pebbly sandstone
PzD — Unit D - White or grey silicified sandstone
PzC — Unit C - Dolomite, limestone and siltstone
PzB — Unit B - Red-brown cross-bedded sandstone
UNCONFORMITY
UPPER PROTEROZOIC
ЁuA — Unit A Grey silicified sandstone
ЁuA' — Unit A' Pebbly siltstone, tillitic
UNCONFORMITY
UNDIFFERENTIATED PRECAMBRIAN
p€ — Igneous and metamorphic rocks
Geological boundary
Sub-surface geological boundary
Fault
GEOLOGY AFTER P. J. COOK
LOCALITY MAP
Darwin
NT
QLD
W A
SA
N S W
VIC
T
VAUGHAN SPRINGS
YUENDUMU
"NAPPERBY"
"AILERON"
"MOUNT WEDGE"
NEWHAVEN
GURNER
Mt Nicker
Mt Gurner
Mt Cockburn
Mt Freeling
Mt Harris
Central Mt Wedge
Lake Eaton (salt)
STUART HIGHWAY
22°10'
22°20'
22°30'
22°40'
22°50'
23°00'
22°41'
130°00'
130°30'
131°00'
131°30'
132°00'
132°30'
133°00'
133°30'
133°45'
MILES
KILOMETRES
GEOLOGY
TO ACCOMPANY RECORD NO. 1969/69
F52/B3-3


PLATE 3
TRAVERSE 'B'
SHOT POINT
DATUM 2000'
2000
4000
6000
8000
10000
12000
MIGRATED DIP SECTION TRAVERSE A
HORIZONTAL 0 900 1800 3600 5400 7200 9000 FEET
TO ACCOMPANY RECORD NO. 1969/69
F52/B3-5

PLATE 4

CORRECTED RECORD SECTION

RECORDING INFORMATION

Magnetic Recorder : DS7-7

Amplifiers : 8000 Explorer

Prefilters : Nil

Filters : K18 - K125

AGC : 1/1, 125

Gain Initial : -60 and -67

Final : 1-31

Geophones : EVS2B - 20c/s

Geophone Station Interval : 150'

Geophone Pattern :
24 trace in 2 rows of 12 in line
Rows 22' apart
Geophones 12 1/2' apart

Shot Hole Pattern : Single hole
Depth 120'
Charge 50lb

PLAYBACK INFORMATION

Filters : 1/25 - 1/78

AGC : Med

Gain Initial : -50

Final : -20

Trip Delay : 0·15s

Compositing : Nil

VELOCITY INFORMATION

t : Δt

HORIZONTAL SCALE

0 1000 2000 3000 4000
0 1800 3600

NGALIA BASIN
SEISMIC SURVEY, N.T., 1967

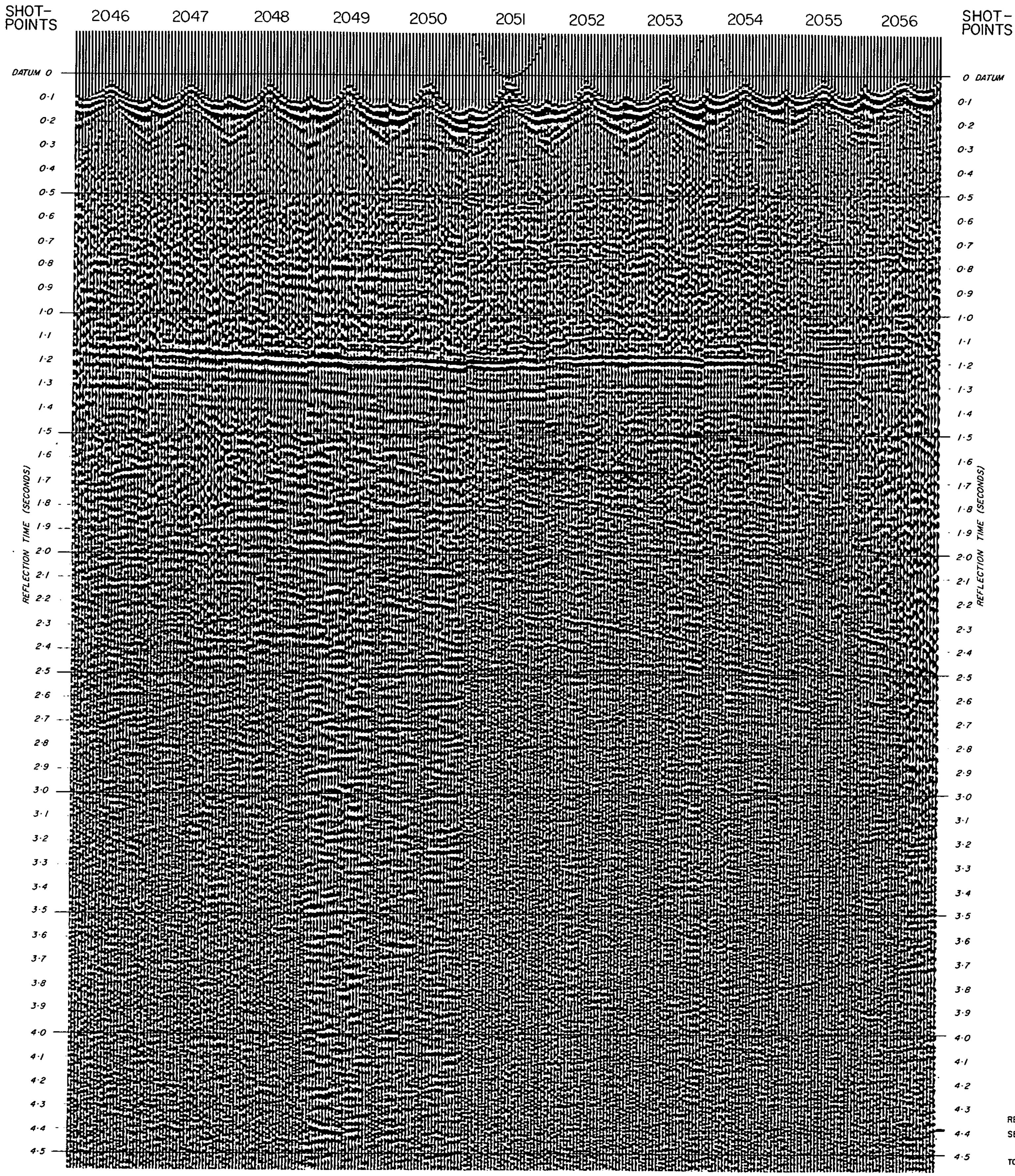
TRAVERSE A
SP1559 - SP1621

RECORDED BY: *Seismic Party No. 1*
SECTION BY: *Bureau of Mineral Resources Playback Centre SIE MS42*
TO ACCOMPANY RECORD No. 1969/69

F52/B3-11

PLATE 5

CORRECTED RECORD SECTION



RECORDING INFORMATION

Magnetic Recorder: DS7 – 7
Amplifiers : 8000 Explorer
Prefilters: Nil
Filters : K18 – K125
AGC : 1/1, 125
Gain Initial: –60 and –67
Final: 1–31
Geophones: EVS2B – 20c/s
Geophone Station Interval: 150'
Geophone Pattern:
24/trace in 2 rows of 12 in line
Rows 22' apart
Geophones 12 1/2' apart

Shot Hole Pattern: Single hole
Depth 120'
Charge 50 lb

PLAYBACK INFORMATION

Filters: 1/25 – 1/78
AGC : Med
Gain Initial: –50
Final: –20
Trip Delay : 0·15s
Compositing : Nil

VELOCITY INFORMATION

t·Δt and EXPANDED SPREAD AT SP2050

HORIZONTAL SCALE

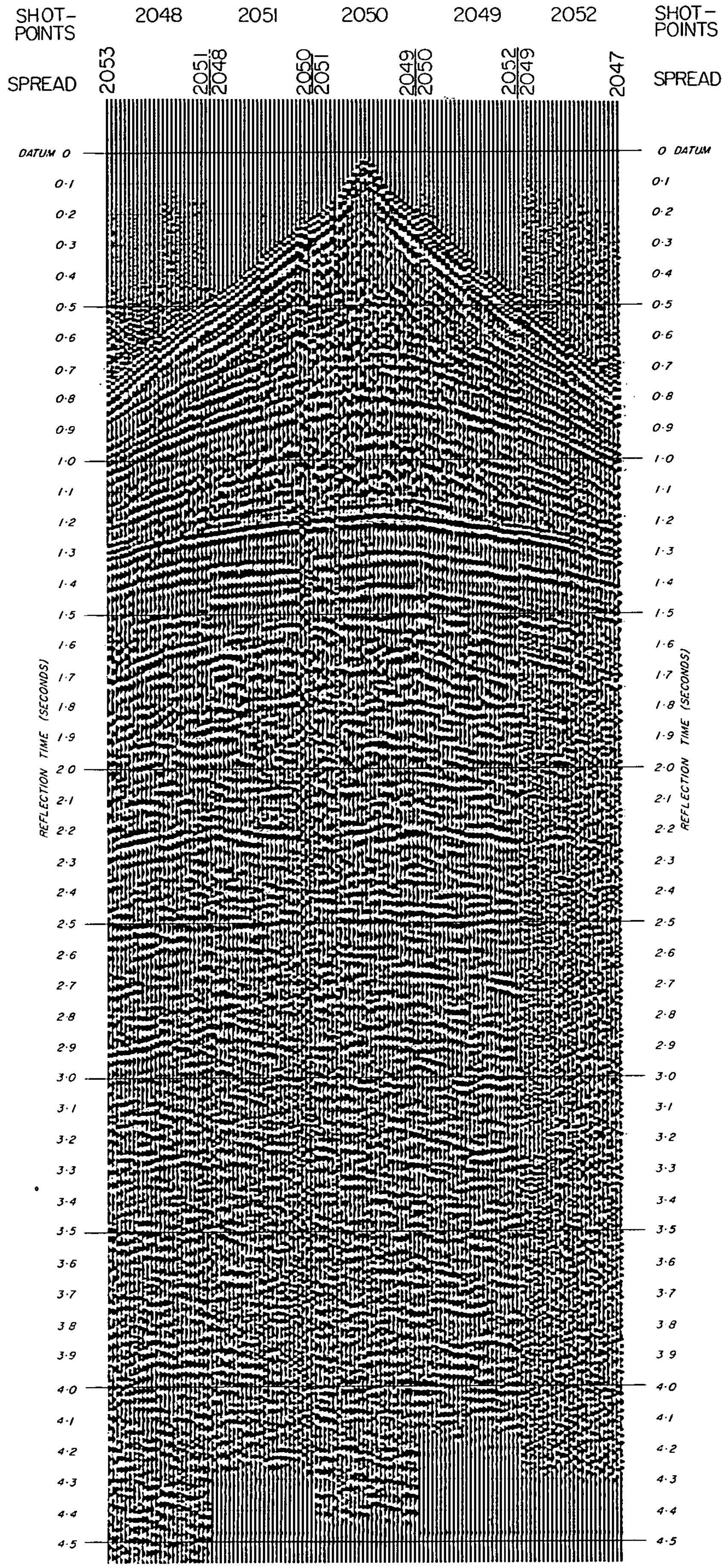
0 1000 2000 3000 4000 FEET
0 1800 3600

NGALIA BASIN
SEISMIC SURVEY, N.T., 1967
TRAVERSE B
SP2046 - SP2056

RECORDED BY: *Seismic Party No. 1*
SECTION BY: *Bureau of Mineral Resources Playback Centre SIE MS42*
TO ACCOMPANY RECORD No. 1969/69

F52/B3–12

PLATE 6



CORRECTED RECORD SECTION
(WEATHERING CORRECTIONS ONLY)

RECORDING INFORMATION

Magnetic Recorder : DS7-7
Amplifiers : 8CCO Explorer
Prefilters : Nil
Filters : K18-K72
AGC : 1/1, 125
Gain Initial : Various
Final : 1-31
Geophones : EVS2B - 20c/s
Geophone Station Interval : 150'
Geophone Pattern :
24/trace in 2 rows of 12 in line
Rows 22' apart
Geophones 12 ½' apart

Shot Hole Pattern :
5 holes, 50' apart in line
Depth 120'
Charge 5 x 20 lb

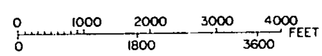
PLAYBACK INFORMATION

Filters : 1/25 - 1/78
AGC : Med
Gain Initial : -50
Final : -20
Trip Delay : 0·15-0·5s
Compositing : Nil

VELOCITY INFORMATION

Nil

HORIZONTAL SCALE



NGALIA BASIN
SEISMIC SURVEY, N.T., 1967

TRAVERSE B
EXPANDED SPREAD AT SP2050

RECORDED BY: *Seismic Party No. 1*
SECTION BY: *Bureau of Mineral Resources Playback Centre SIE MS42*
TO ACCOMPANY RECORD No. 1969/69

F52/93-13