COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1966/57

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OORAMINNA SEISMIC SURVEY, AMADEUS BASIN, NORTHERN TERRITORY 1962

by

F.J. MOSS

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CONTENTS

1966/57

ILLUSTRATIONS

SUMMARY

A seismic survey was made in the Ooraminna area of the Amadeus Basin, Northern Territory, by a seismic party of the Bureau of Mineral Resources, Geology and Geophysics, between 6th July and 29th August 1962. Reflection traverses were recorded between Deep Well and Alice Springs and across the culmination of the Ooraminna Anticline, and a refraction depth probe was recorded on the crest of the Ooraminna Anticline.

The purpose of the survey was to obtain information on the structure of the Basin in the eastern part of the Missionary Plain, and on the structure of the Ooraminna Anticline.

The Basin was shown to be generally synclinal between Deep Well and Alice Springs with a maximum sediment thickness of 20,000 feet north of the Ooraminna Anticline. Seismic evidence suggested that the uplift at Deep Well and the Ooraminna Anticline have resulted from thickening in a deep formation, which has been tentatively identified as the Bitter Springs Formation.

The survey was unsuccessful in relating reflectors in the cross-sections with outcropping formations in the MacDonnell Ranges and on the Ooraminna Anticline.

1. INTRODUCTION

A seismic survey was made in the Amadeus Basin in the area between Deep Well and Alice Springs by the Seismic Party No. 2 of the Bureau of Mineral Resources, Geology and Geophysics (BMR), from the 6th July to 29th August 1962. The lease (OP43) covering the survey is held by Magellan Petroleum (NT) Pty Ltd.

The survey was part of the BMR programme of seismic operations in the Amadeus Basin, which began in 1961 with a series of north-south traverses across the eastern part of the Basin between Alice Springs and Finke (Moss, 1962); this was followed in the same year by a short survey over the Palm Valley Anticline, 80 miles west of Alice Springs (Turpie & Moss, 1963). From 26th March to 3rd July 1962, a seismic survey was made in the Gosses Bluff area approximately 110 miles west of Alice Springs (Moss, 1964).

The results of the seismic reflection work carried out indicated that relatively simple techniques generally yielded reliable information in the sedimentary basin away from rock outcrops, but that more elaborate recording techniques were necessary for attempting to obtain reflections in the vicinity of surface structures. They also indicated that only limited results could be obtained by the seismic refraction method owing to the presence of shallow high velocity refractors in the areas tested.

The results from seismic traverses at Deep Well and Polhill in 1961 (Moss, 1962) indicated the probable margin of the Basin at Deep Well, a deepening of the Basin to the north of Deep Well, and a major reversal occurring in the section to at least 12,000 feet below the surface expression of the Ooraminna Anticline at Polhill. An event on the cross-section at Deep Well at a depth of about 5000 to 6000 feet at Shot-points 219-212 on Traverse G was considered to be an unconformity, which probably marked the Lower Palaeozoic/Upper Proterozoic boundary. No interpretation was offered as to the significance of low dip reflections recorded at times greater than 2 seconds on the Polhill traverse.

The seismic programme for the Ooraminna survey was planned to obtain information, additional to that obtained in 1961, on the structure of the Basin between Deep Well and Alice Springs and on the structure of the Ooraminna Anticline. In an attempt to obtain this information seismic reflection traverses were surveyed as follows:

(a) To connect the Deep Well and Polhill 1961 traverses.

(b) To extend the Polhill 1961 traverse northwards to Alice Springs.

(c) To cross the surface culmination of the Ooraminna Anticline, the traverse to start from a point on the main north-south traverse between Deep Well and Polhill.

A seismic refraction depth probe was surveyed on the outcropping Arumbera Sandstone, at the culmination of the Ooraminna Anticline, to investigate refractors in the Proterozoic formations below the Arumbera Sandstone.

2. GEOLOGY

A summary of the geology of the Amadeus Basin relative to the seismic survey has been given by Moss (1962). A report on the petroleum prospects of the Basin has been given by McNaughton (1962), and the geology of the Alice Springs area in particular has been outlined by Quinlan (1962). A regional geology map (after Quinlan, loc cit.) is shown in Plate 3. The geology of the area covered by the seismic survey (Plate 2) is taken from the photo-geological maps of the Alice Springs and Rodinga 1:250,000 map areas, which

were prepared by the Institut Francais du Petrole, Mission in Australia, and issued by the BMR (Scanvic, 1961). The stratigraphy of the Basin is shown in Appendix F.

The eastern part of the Missionary Plain Syncline is bounded in the north at Alice Springs by the MacDonnell Ranges and in the south at Deep Well by the Rodinga Block. Heavitree Quartzite, Bitter Springs Formation, and Pertatataka Formation, all of Upper Proterozoic age, and the Cambrian Pertaoorrta Group, which is exposed in the MacDonnell Ranges, appear to dip steeply southwards under more recent sediments, which are exposed on the Missionary Plain. Recent gravity evidence suggests, however, that the structure of the northern margin of the Basin is not so simple as that which is envisaged from a study of the surface geology (Langron, 1962 a). Sandstones and conglomerates of the Pertnjara Formation, of Devonian to Carboniferous age, are exposed on a large part of the Plain. These are covered in some areas by alluvium, sand, and sand dunes of Quaternary age. At Deep Well, Cambrian-Ordovician sediments of the Larapinta and Pertaoorrta Groups and the Mereenie Sandstone (?Silurian to Ordovician), which crop out in the James Ranges, dip northwards under the Pertnjara Formation sediments, which are exposed on the Plain to the north of the James Ranges.

The Ooraminna Anticline rises above the Missionary Plain and lies about midway between the Macdonnell and James Ranges. The rocks exposed on the Anticline range in age from the Cambrian Arumbera Sandstone exposed at the culmination of the Anticline, to the Cambrian Jay Creek Limestone, exposed on the flanks. Substantial thicknesses of the Upper Proterozoic Pertatataka, Areyonga, and Bitter Springs Formations were considered to be present below the Arumbera Sandstone. From considerations of salt-controlled structures that resulted from studies of the Goyder Pass diapiric structure, doubts arose as to the existence of the Ooraminna Anticline at depth in the Proterozoic formations. It was suggested that the Anticline could have a salt core and could even possibly be diapiric. It was alternately postulated as having a basement core. The time periods of the anticlinal growth and the relative altitude between the younger and older sediments are questions that have been raised regarding the Ooraminna Anticline on consideration of the first postulate.

No deep stratigraphic bores had been drilled in the north-eastern part of the Amadeus Basin until the recent Ooraminna No. 1 (Exoil N.L., 1962), and Alice No. 1 (Exoil N.L., 1963) bores, the results of which are summarised in Appendix D. Knowledge of the thickness of sediments and structure in the sediments under the Pertnjara Formation in the Basin, at the time of the seismic survey, was confined to that known from outcrop thickness measurements at the margins of the Basin and that shown by the previous seismic survey in 1961.

The principle tectonic episode in the Basin is post-Ordovician and pre-Pertnjara. It resulted in the formation of anticlinal structures, with elongated axes roughly parallel to the east-west axis of the MacDonnell Ranges at the northern margin of the Basin. The dips on these anticlinal structures are generally less than 45° although, locally, some steeper dips have been measured. Unconformities are known to exist in the sequence, but little is known of their extent and nature in the eastern part of the Amadeus Basin. In this area the attitudes of the formations that underlie the unconformity known to exist at the base of the Pertnjara Formation are not evident.

The petroleum prospects of the Amadeus Basin, in general, are discussed by Ranneft (1963), and his estimates of the potentials of the various formations in the sedimentary sequence are summarised in Appendix F.

3. PREVIOUS GEOPHYSICAL SURVEYS

Gravity

Gravity readings were taken at intervals along the railway line between Alice Springs and Deep Well by Sydney University geophysicists on a traverse that extended from Tennant Creek to Oodnadatta (Marshall & Narain, 1954). The station interval on this reconnaissance traverse was large (approximately 20 miles); thus the gravity results indicated only regional trends.

The BMR has conducted several reconnaissance gravity surveys in the Amadeus Basin between 1957 and 1962. The most recent of these were made in 1961 and 1962, using helicopters for transport (Langron, 1962 a; Lonsdale & Flavelle, 1963). The results of these helicopter gravity surveys have been integrated with those of previous ground surveys in the preparation of the Bouguer anomaly map shown in Plate 4. In the eastern part of the Basin, detailed gravity measurements were taken along the seismic traverses surveyed by the BMR in 1961 (Langron, 1962 b) and 1962 (Neumann, in preparation) and along existing roads around and over the Ooraminna Anticline in 1961 by Magellan Petroleum (NT) Pty Ltd (1961). Bouguer anomalies, derived by Neumann (in preparation) from compilation of all existing gravity data in the Ooraminna area, are included in Plate 2.

The helicopter gravity survey indicated general regionsl gravity trends in the Deep Well - Alice Springs area : namely, a general northerly gradient from Deep Well, a gravity 'low' just south of Alice Springs, and a steep southerly gradient north of Alice Springs. The fact that the main gravity gradient is to the north of the northern margin adds weight to a theory that the northern margin is a major overthrust. The station density of one reading per 50 square miles was intended only for investigation of the major structure of the Basin. Gravity results along the seismic traverses at Ooraminna together with those from the helicopter survey between Deep Well and Alice Springs are shown in profile form in Plate 5.

Langron (1962b) had postulated that a positive anomaly could be present at Polhill, but that the gravity expression of the Ooraminna Anticline was largely obscured by the large regional gravity gradient. He observed two residual gravity 'highs' on the steep regional gradient along seismic Traverse G, where the strike of the outcrops on the plunging 'nose' swung parallel to the traverse. This suggested that there could be two axes on the western extension of the Anticline. Neumann (in preparation) shows that features similar to those found in the gravity profiles along Traverse G are also found along Traverses GY and N. Gravity features associated with the Anticline have generally high Bouguer anomalies, but there are particular areas on the crest with associated negative anomalies. A negative anomaly on the culmination of the Ooraminna Anticline suggested that a core of low density material could be present. This postulate was confirmed when salt was found in the Ooraminna No. 1 well in the Bitter Springs Limestone.

Seismic

The BMR has made four seismic surveys within the northern part of the Amadeus Basin. Two of these surveys, at Palm Valley-Hermannsburg (Turpie & Moss, 1963) and at Gosses Bluff (Moss, 1964), were made in the western part of the Basin. In 1961, a seismic refraction survey was made in the Alice Springs Farm Area (Moss, 1963), where refractors, thought to represent the surface for deposition of Mesozoic sediments, were located at a depth of about 1000 to 1500 feet. Also in 1961, seismic reflection and refraction traverses were shot along the railway line to the south of Alice Springs at intervals as far as Finke (Moss, 1962). During this survey, the following traverses were recorded in the area between Deep Well and Alice Springs:

(a) At Deep Well - $5\frac{1}{2}$ miles of continuous correlation reflection profiling and a refraction depth probe.

(b) At Polhill - $9\frac{1}{4}$ miles of continuous correlation reflection profiling and a refraction depth probe.

Reflection traversing at Deep Well showed the existence of approximately 15,000 feet of sediments dipping northwards at about 8°. Owing to structural complexity immediately to the south of Deep Well in the Rodinga Block, it was impossible to extrapolate reflecting horizons to the surface and so positively identify them with outcropping formations. Tentative identification was made, however, of a reflector considered to be in the Lower Jay Creek Limestone on the basis of the stratigraphic position of the formations at the surface and of thicknesses previously measured at Mount Peachy 10 miles to the west of the Deep Well traverse.

At Polhill, reflection results showed that the axis of the Ooraminna Anticline was under Shot-point 118. South of this axis, the reflections showed strong southerly dip. Relatively low-dip reflections were recorded below the steeply dipping reflections at times greater than 2 seconds (approximately 16,000 feet), but no interpretation of these low dip reflections was made because of the limited available information. Furthermore, a gap of 10 miles between the Deep Well and Polhill traverses did not permit correlation of the reflections between the two cross-sections to be carried out with any certainty. The reflection quality deteriorated to the north of Shot-point 118, where only poor reflections were recorded from shallow depth. This portion of the traverse followed the strike of the outcrops as they swung north around the plunging nose of the Anticline.

Refraction depth probes at Deep Well and Polhill gave the folling information on refractors :

Location	Refractor velocity (ft/s)	Approx. depth (feet)	dip
Deep Well, SP 219	11,900	800	8°N
	19,500	2700	8°N
Polhill, SP 118	11,900	700	3°N
	19,750	2700	1°S

The high velocity refractor was tentatively identified as being in the Lower Jay Creek Limestone sequence. The application of the refraction method for investigation of deeper formations was found to be unsuitable in this area, where the shallow refractors have such high velocities.

4. OBJECTIVES AND PROGRAMME

Objectives of the survey

The objectives of the seismic survey in the Ooraminna area were outlined as follows:

(a) To determine the structure of the northern part of the Amadeus Basin between Deep Well and Alice Springs and attempt to relate reflectors in the section with outcrops of the MacDonnell Ranges.

(b) To define the Ooraminna Anticline in its underlying formations and attempt to relate reflectors with outcrops near the culmination of the Anticline.

(c) To measure the velocities of refractors in the Proterozoic sediments near the culmination of the Anticline.

Programme

To achieve the objectives, a programme of seismic reflection and refraction work was carried out. The traverses surveyed are shown in Plate 2.

Deep Well to Alice Springs. Continuous reflection profiling was carried out between Shot-point 209 of the 1961 Deep Well traverse and Shot-point 129 of the 1961 Polhill traverse and also northwards from a shot-point 1½ miles north of Shot-point 93 of the 1961 Polhill traverse to about 6 miles south of Alice Springs. This complete line has been designated Traverse G.

Ooraminna Anticline. A reflection traverse was surveyed east from Traverse G and north to the outcrops near the culmination of the Anticline. This line, designated Traverse GY, was continued across the culmination of the Anticline to the northwest, and down the northern flank. This continuation was designated Traverse N. A short traverse connecting Traverses GY and N was designated Traverse NX.

A refraction depth probe was recorded along Traverse NW on the Arumbera Sandstone outcrops, at the crest of the Anticline, in an attempt to seek refractors below this formation.

5. RESULTS AND INTERPRETATION

Field work

Appendices A, B, and C and the seismic survey operations chart (Plate 20) summarise the statistical information on the work done in the survey. The location of traverses and shot-points are shown in Plate 2.

The Deep Well to Alice Springs traverse, Traverse G, surveyed to link the 1961 Deep Well and Polhill traverses and to extend the 1961 Polhill traverse northwards towards Alice Springs, followed the railway line. Ease of access facilitated field operations. Generally, single deep holes were shot and reflections were recorded using six geophones per station at 22-ft intervals; geophone stations were 110 feet apart. Cross-traverse GX was surveyed at Shot-point 111 on Traverse G.

An expanded-spread velocity profile, centred on Shot-point 138 on Traverse G was shot with layout as shown in Plate 6. The recording conditions were good, with uniform elevation and weathering and reflectors having little or no dip.

Traverse GY was surveyed through heavy scrub and sand dunes, which presented access and drilling problems. Traverse N was surveyed along the Ulta Creek valley. It crossed the culmination of the Ooraminna Anticline and extended across the alluvium plain to the north of the Anticline. Drilling was extremely difficult in the gravels along the Creek; problems were mainly those due to loss of circulation. Gaps were left in the traverse where drilling was very difficult.

In the plain to the north of the Anticline, the alluvium cover apparently reaches a substantial thickness; there was a 200-ft to 400-ft thick low-velocity weathered layer. Only questionable reflections were obtained using the standard technique adopted for the survey and multiple-hole and geophone patterns were used at selected locations in

attempts to improve the reflection quality. However, no detailed experimentation was done to obtain the best shooting and recording conditions because of the limited time available for completion of the survey.

General

Small-scale cross-sections of seismic results for Traverse G and GY are shown in Plate 5. Reflection cross-sections for these traverses are shown in Plates 7 and 8 respectively. On these cross-sections, only the first legs of the main reflection events are plotted from the corrected variable-area reflection cross-sections, which are presented in Plates 9, 10, 11, and 13. Corrected variable-area reflection cross-sections for Traverses GX, NX, and N are shown in Plates 12, 14, 15, and 16. Corrected variable-area reflection cross-sections for the 1961 Deep Well and Polhill work are shown in Plates 9 and 11 and the results are included, for the sake of completeness, in the hand-plotted reflection cross-section shown in Plate 7 and in the small-scale cross-section shown in Plate 5.

The velocity profile records from the expanded spread at Shot-point 138 on Traverse G are shown in Plate 17 and the results of the vertical velocity determination in Plate 6. The average velocity down to a depth of 14,400 feet (approximately) is calculated as 16,400 ft/s. Poor reflections were recorded from below this depth, but they yielded insufficient information for velocity determination. However, by extrapolating the curves, an average velocity of 17,400 ft/s to a depth of 22,000 feet was estimated. The reflection time-depth scales on the corrected variable-area sections were extrapolated beyond 22,000 feet by assuming a uniform interval velocity of 20,300 ft/s in the section below 22,000 feet.

Individual traverses

Traverse G (SP 208-SP 130). Corrected variable-area cross-sections are shown in Plates 10 and 11 and a plotted section in Plate 7. This is the link between the 1961 work at Deep Well and Polhill. Excellent reflections with good continuous correlation were recorded.

There is no seismic evidence in this cross-section of strong tectonic deformation, but a very broad and gentle anticlinal reversal, here named the 'South Ooraminna Reversal' is evident with its crest at about Shot-point 196. A zone of thickening is evident between reflectors at about 1.3 to 1.4 seconds in the cross-section from Shot-points 206 to 192; pinchouts are evident at a reflection time of about 1.35 seconds below these two shot-points.

Reflectors recorded at times less than 2 seconds rise to the north from Shot-point 134 to form the southern flank of the Ooraminna Anticline; reflectors at times greater than 2 seconds have little or no dip in this section.

Many poor-to-questionable reflections appear in the section below 2.5 seconds reflection time. These events are considered likely to be reflections from features to the side of the traverse, multiple reflections, or reflections from within the Archaean basement complex. No structural significance is currently attached to these events.

Traverse G (SP 86-SP 47). A corrected variable-area cross-section is shown in Plate 11 and a plotted cross-section in Plate 7. This is the link between the 1961 work at Polhill and the steep-dipping northern marginal area of the Basin.

It will be recalled that the results at Polhill, after crossing the axial line of the Ooraminna Anticline and before moving clearly off the crestal area on to the northern flank (Shot-points 119 to 94), were very poor with many 'no-reflection' records. However, from Shot-point 86 for the 1962 work up to Shot-point 47, fair reflections were generally obtained and continuous correlation of most reflectors was observed over long portions of the traverse. Poor reflection areas were mainly associated with difficult near-surface conditions. Tentative correlation of reflections across the poor reflection zones have been made in plotting the cross-section in Plate 7.

Near Shot-points 86 to 80, reflections show steep north dip and are fairly conformable down to about 1.6 seconds reflection time. Deeper reflection events at about 2.0 seconds with low dip to the south are present under these steeply dipping events. A synclinal axis is evident under Shot-points 71 and 70. Probable diffractions can be seen on the variable-area cross-sections below this point, suggesting that minor faulting has occurred and affected the deeper reflectors. From Shot-point 64 northwards the reflectors show slight south dip to the Alice Springs area.

Poor reflections similar to those recorded south of the Ooraminna Anticline were recorded on this traverse with reflection times greater than 2.5 seconds. As before, no structural significance is currently attached to these events.

Traverse G (SP 32 - SP 17). No corrected variable area cross-section is available for this portion of the traverse, where the seismic reflection techniques tried gave no recorded reflections. The formations under the thick alluvium cover are known, from shallow stratigraphic bores, to dip steeply to the south.

The theory of the northern margin being a major overthrust, postulated from gravity evidence, could account for the inability to follow reflections towards the steep dipping near-surface and outcropping formations.

Traverse GX (SP 111EW and SP 4 - SP 1). A corrected variable-area cross-section is shown in Plate 12. This traverse was planned to measure plunge on the Ooraminna Anticline. Results were poor in the area on Traverse G near Shot-point 111 and were also poor on this cross-traverse. Reflections recorded at times of up to 1 second qualitatively indicated approximately 10 degrees of west dip at this point thus tending to confirm west plunge of the Anticline.

Traverse GY (SP 143EW and SP 1 - SP 63). A corrected variable-area cross-section is shown in Plate 13, and a plotted section in Plate 8. This traverse was planned to link Traverse G with Traverse N, which crossed the culmination of the Ooraminna Anticline. Reflection quality at the western end of the traverse was fairly good but deteriorated towards the north-east. Poor quality records were obtained when shooting in sand dunes and when close to the Ooraminna Anticline outcrops; both factors probably contribute to the deterioration.

The reflectors generally show west to south-west dip. From the take-off point on Traverse G, the results indicate thinning in the section towards the east to a depth of approximately 10,000 feet at Shot-point 143 EW and 8000 feet at Shot-point 18. Reflectors deeper than 10,000 feet are fairly flat over this section. From Shot-point 18 to Shot-point 38, there is north-east thinning of the entire section. The traverse swings to the north from Shot-point 38 and the reflectors generally show steeper south dip to Shot-point 51. Between Shot-points 51 and 53, the reflectors are almost flat, but no usable information was obtained north of Shot-point 53.

Traverse NX (SP 4 - SP 1). A corrected variable-area cross-section is shown in Plate 14. This cross-traverse was shot in an attempt to link the information from Traverses GY and N. However, with the techniques used, it falls within an area demonstrated by all three traverses as a 'no-reflection' area. The traverse has yielded no useful information.

Traverse N (SP 8 - SP 81). A corrected variable-area cross-section for SP 27 - SP 24 is shown in Plate 15 and for SP 34 - SP 32 in Plate 16. This traverse was planned to show the structural turn-over and the northern flank of the Ooraminna Anticline. The results were universally poor and neither objective was achieved. North of the surface crest of the Anticline, the questionable reflections that were recorded indicated, somewhat qualitatively, north dip to approximately Shot-point 76.

An effort was made to record reflections at Shot-point 76 using larger patterns of holes and geophones: 9 holes, depth 54 feet, in a diamond pattern with 22 feet between holes, and 18 geophones per trace laid in three lines 22 feet apart, with 6 geophones 22 feet apart in each line. Fair to poor quality reflections were recorded. These showed (in so far as a single record may show) slight north component of dip down to 2 seconds reflection time and slight south component of dip below 2 seconds. At Shot-point 77, a single deep hole was shot at a depth of 220 feet: 6 geophones per trace, 22 feet apart in line, were used. The quality of the results was comparable to the results of the 9-hole pattern at Shot-point 76, but the reflections indicated south dip throughout the record. Uncorrected records for Shot-points 76P and 77 are shown in Plate 18. Experimental shots at Shot-points 67 to 70, using patterns of holes and geophones comparable to those used at Shot-points 76P and 77, gave no improvement. This suggested that no single technique would give consistently good results in this area.

Traverse NW refraction traverse (Plate 19). Results obtained on recording with a maximum shot-point to geophone distance of $1\frac{3}{4}$ miles indicated that the refraction velocity in the Arumbera Sandstone was approximately 17,600 ft/s. The limitations on further refraction work, owing to general access problems and also to the location of the high velocity Lower Jay Creek Limestone outcrops, rendered attempts at penetration to deeper formation impractical.

Interpretation

The following features noted on Traverse G are illustrated in Plate 5.

A. Steeply dipping events that rise to form the northern flank of the James Ranges are observed in the cross-section at Deep Well. These events overlie a zone of thickening indicated by (3). The presence of reflections with little or no dip below this zone of thickening suggests that the uplift resulted from the movement of plastic material within the sedimentary section, and not from a deep-seated crustal movement. The Bitter Springs Formation has not been positively identified as the mobile bed, although this interpretation appears to be the most probable. Movement of plastic material in the shallower formations (resulting from compression of these formations) about an axis under Shot-point 207, during the initial upheaval at Deep Well, could account for the zones of thickening indicated by (1) and (2).

B. The 'South Ooraminna Reversal' is a very broad anticlinal feature with its crest at about Shot-point 196 on Traverse G. The reversal is evident to a depth of about 10,500 feet. A zone of thickening marked (4), evident at this depth, has probably resulted from movement of the same mobile bed that has caused the thickening marked (1).

C. The syncline between the Ooraminna Anticline and the 'South Ooraminna Reversal' is well defined to an approximate depth of 16,000 feet.

D. On the western plunge of the Ooraminna Anticline, where the traverse crosses the surface axis, the formations appear to be fairly conformable to a depth of 11,000 feet. The axis at depth corresponds to the position indicated on the surface. The steeply dipping events, which rise to form the southern flank of the Anticline, overlie a zone of thickening marked (5). The presence of low-dipping reflection events below this zone supports the hypothesis that the Anticline resulted from the movement of a plastic material within the sedimentary cross-section and that the basement continued relatively undisturbed below the Anticline as at Deep Well. The Bitter Springs Formation has not been positively identified as the mobile bed although this interpretation appears to be the most probable.

E. Reflection information to the north of the surface axis was very poor where the traverse ran along the strike of the outcrops, where the outcrops strike north-south on the broad plunging 'nose' of the Anticline.

F. The syncline north of the Ooraminna Anticline is well defined between Shot-point 86 and Shot-point 66 to a depth of approximately 20,000 feet. There appears to be general thickening on the northern flank of the syncline.

A zone of thickening marked (6) is observed under the steeply dipping events that rise to form the northern flank of the Anticline. Low-dipping reflection events are present below this zone of thickening. The situation is similar to that observed on the southern flank of the Anticline.

G. No correlatable reflections were recorded at the northern end of this traverse where low velocity alluvium covers the area.

Also included in Plate 5 are features noted on Traverse GY:

H. The cross-section generally indicates south to south-east dipping formations. Local thickening is observed in some shallower beds and thickening marked (7), similar to that noted on Traverse G at Deep Well and also to the north and south of the Ooraminna Anticline, is observed at the north-western end of this traverse near the Ooraminna Anticline.

6. CONCLUSIONS

The seismic reflection method gave excellent results using simple shooting and recording techniques in a large portion of the area surveyed. Poor reflection areas were found in the vicinity of structures rising above the Missionary Plain and along Traverse N in the plain north of the outcropping Cambrian formations of the Ooraminna Anticline. Alluvium and sand cover, along Traverse N, is 200 to 400 feet thick and has a seismic velocity of 2000 to 5000 ft/s. The poor reflection results on Traverse N may be largely due to high absorption of seismic energy by this cover.

The reflection survey indicated that the Amadeus Basin deepens northwards from Deep Well to the vicinity of the Ooraminna Anticline. Seismic evidence suggests that the uplift at Deep Well and the Ooraminna Anticline are the results of movement of plastic material in the sedimentary cross-section and not the result of deep-seated crustal movement. Although not positively identified by seismic methods, the Bitter Springs Formation is considered as the most likely mobile bed. The Basin deepens again to the north of the Anticline to a maximum depth of approximately 20,000 feet before getting shallower towards the MacDonnell Ranges at Alice Springs.

The relation between the reflectors in the cross-section and the outcrops of the MacDonnell Ranges was not established.

The Ooraminna Anticline was defined by the seismic reflecton work along Traverse G, but attempts to identify reflectors on Traverses GY and N with outcrops near the culmination of the Anticline were unsuccessful. The outcropping Arumbera Sandstone was found to have a refraction velocity of 17,600 ft/s at the crest of the Anticline, but measurement of the velocities of refractors in the underlying sediments was unsuccessful.

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APPENDIX A

Staff and equipment

Staff

Party leader	F. J. Moss
Geophysicists	K. F. Fowler (18th - 27th August 1962)
	G. Bow
Surveyors	T. Howard, R. Leetham) Department of Interior
Clerk	E. J. Quinn
Observers	G. L. Abbs & J. K Grace
Shooter	C. Wood
Toolpusher	J. G. Halls
Drillers	J. Chandler
	K. Suehle
Mechanics	I. D. Pirie
	E. McIntosh
Field hands	11

Equipment

Seismic amplifiers	HTL 7000B
Seismic oscillograph	Electro Tech ER66
Magnetic recorder	Electro Tech DS7
Geophones	Electro Tech 20c/s (reflection)
	TIC 6c/s (refraction)
Drills	2 Carey Type H1 (Bedford)
	1 Failing 750 (Bedford)
	Drills supplied by the Petroleum Technology Branch of the BMR.
Water tankers	3 Bedford 700 gallons
	1 Bedford 1000 gallons (flat top)
Shooting truck	Bedford 700 gallons.

A workshop truck, 5 landrovers, a 30-cwt utility truck, a number of trailers, and camping equipment completed the party equipment.

APPENDIX B

Table of operations

Sedimentary basin	:	Amadeus Basin, N.T.
Area	:	Alice Springs to Deep Well and Ooraminna Anticline
Camp sites	:	Polhill
Survey commenced	:	6th July 1962
Survey completed	:	29th August 1962
Miles surveyed	:	68½ miles
Topographic survey control	:	MSL Port Augusta railway levels
Total footage drilled	:	22,380 ft
Explosives used	:	8946 lb
No.of detonators used	:	371
Datum levels for corrections (above sea level)	:	Deep Well : 1500 ft ; Polhill : 1700 ft
Source of velocity distribution	:	Velocity profile

Reflection shooting data

Shot-point intervals	:	1320 ft
Geophone group (normal)	:	6 geophones per trace at 22-ft intervals
No. of holes shot	:	247 (including six 9-hole patterns)
Miles traversed	:	57 miles
Usual recording filter	:	K18K75
Usual playback filter	:	K24K57
Common charge sizes	:	30 lbs to 40 lbs

Refraction shooting data

Geophone group	:	2 per trace
Geophone group interval	:	220 ft
No. of holes shot	:	5
Usual recording filters	:	K0K57
Weathering control	:	First breaks

NOTE : For additional information refer to Plate 20.

APPENDIX C

Seismic shot-hole drilling statistics

Seismic Party No. 2, Period 5th July - 27th August 1962

Total footage drilled	22,380 ft
Total number of holes drilled	335
Average depth of holes	67 ft
Deepest hole drilled	220 ft
Travelling time and rigging up	158¾ hr
Time lost waiting on water	9¾ hr
Time lost repairs to drill	46¼ hr
Time lost because of rain	7¾ hr
Time lost repairs to rig engine	5 hr
Time lost waiting on surveyors	1¼ hr
Drilling time	418½ hr
No. of shifts worked	76
Maintenance to drill4	60½ hr
Bentonite used	20½ cwt
Drilling rate	53 ft/hr

Driller	Footage	No. of shifts	Footage/shift
J. Chandler	11,496 ft	36	319 ft
K. Suehle	10,884 ft	40	272 ft

APPENDIX D

Results of test wells, Ooraminna No. 1 and Alice No. 1

Two stratigrphic bores have been drilled in the Ooraminna area by Exoil N.L. (1962 & 1963) under a farmout agreement with Magellan Petroleum (NT) Pty Ltd since completion of the Ooraminna seismic survey.

Ooraminna No. 1. This well was drilled on the crest of the Ooraminna Anticline between Shot-points 29 and 30 on Traverse N of the Ooraminna seismic survey. Its location is : longitude 134°09'50"E, latitude 24°00'00"S.

The well, the first to be drilled in the Amadeus Basin in the search for petroleum, established the presence of hydrocarbons by a small flow of methane gas in a drill stem test in the Upper Proterozoic Areyonga Formation from a depth of about 3800 feet. The well also found salt in the Upper Proterozoic Bitter Springs Formation, in which it bottomed at 6107 feet.

Alice No. 1. This well was drilled in the basin north of the Ooraminna Anticline to test an anomaly defined by the gravity survey made by Magellan Petroleum (NT) Pty Ltd (1961). A seismic reflection survey made by Exoil N.L. postulated reef structure in the Jay Creek Limestone in the anomaly area. The well, at longitude 133°58'00"E, latitude 23°54'47"S, between Traverses G and N of the Ooraminna seismic survey was drilled to test this postulated reef.

The well encountered a small quantity of black asphaltic oil in dolomitic sand in the Upper Cambrian Goyder Formation at approximately 3500 feet. Oil bleeding cores were recovered from dolomite of the Jay Creek Limestone at about 6100 feet. The well bottomed in the Arumbera Sandstone at 7518 feet. This is the formation in which the Ooraminna No. 1 well was spudded.

APPENDIX E

Recommendations for further seismic reflection work

The following problems left unanswered by the seismic survey warrant further investigation.

1. Closure has been established in the north-south direction on the 'South Ooraminna Reversal' to a depth of approximately 10,500 feet. The formations overlying the zone of thickening at this depth are probably post-Arumbera in age. Establishment of complete closure on this structure by further seismic work could provide a drilling target for testing the Palaeozoic sequence.

2. Simple recording techniques were unsuccessfully used in attempting to obtain reliable reflection information in the following areas :

(a) At the southern end of Traverse G near Deep Well.

(b) North of the surface axis of the Ooraminna Anticline where Traverse G runs along the strike of the outcrops on the broad plunging nose of the Anticline.

(c) At the northern end of Traverse G near Alice Springs.

(d) On the crest of the Ooraminna Anticline on Traverse N.

(e) In the Missionary Plain north of the culmination of the Ooraminna Anticline on Traverse N.

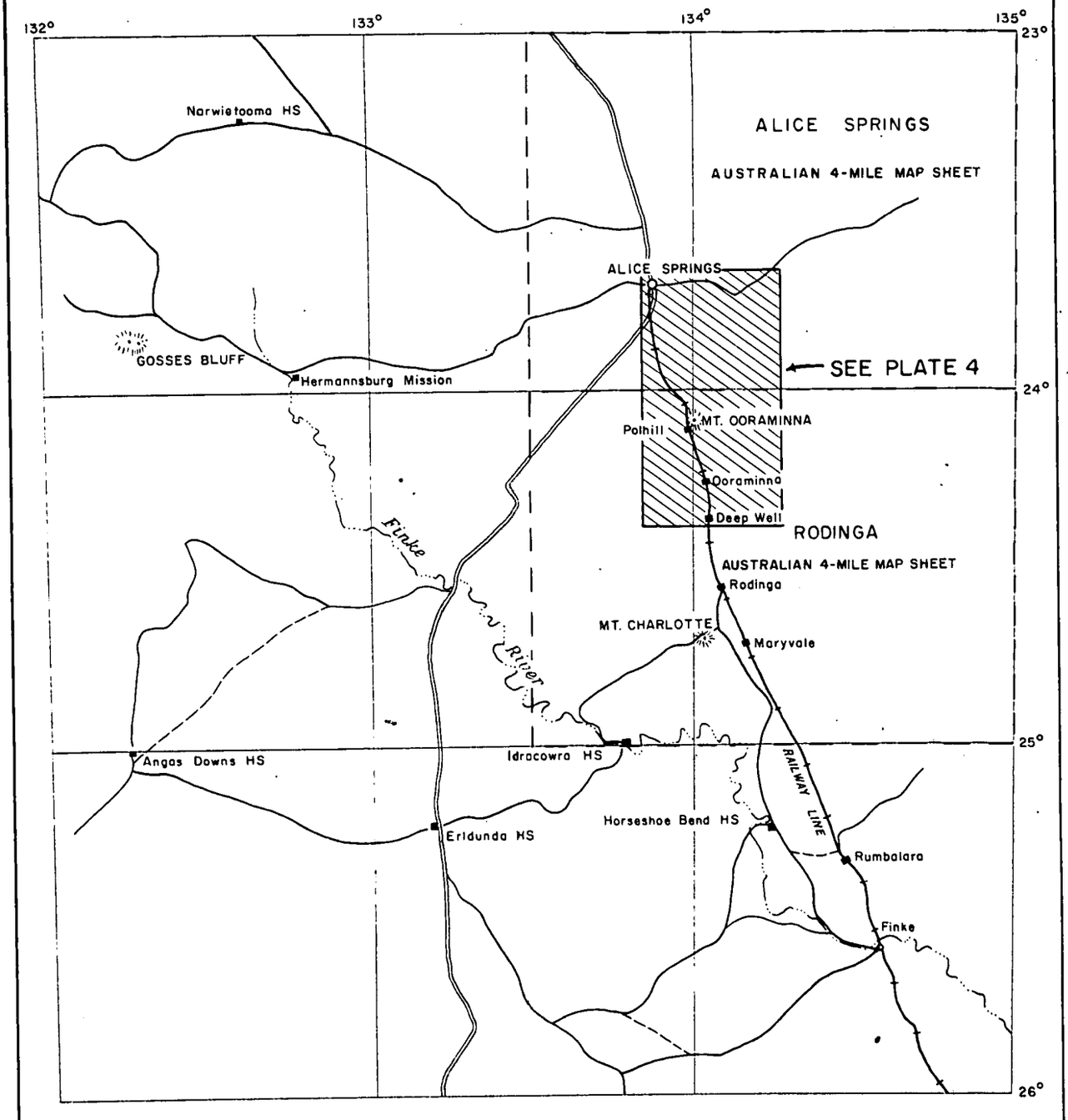
Experimental work, including the recording of noise profiles and the use of large patterns of shot-holes and geophones, in these poor reflection areas could lead to the establishing of techniques for recording fair quality reflections in these areas, where the structure of the Basin is not yet fully understood.

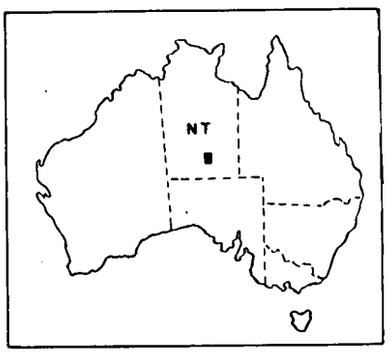
APPENDIX F

Stratigraphy and petroleum prospects of the Amadeus Basin

Age	Formation or Unit		Lithology	Maximum Thickness (ft)	Potential source rock	Potential reservoir rock	Potential cap rock	Aquifer	Residual Hydro-carbons	Glauconites	Evaporites abundant	Deposition
Quarternary to Upper Palaeozoic			Alluvium, evaporites, conglomerate, sandstone, siltstone.	530								CONTINENTAL
			UNCONFORMITY									
Devonian to Carboniferous	Pertnjara Formation		Conglomerate, sandstone sandy shale	20,000+?		X	X					
			UNCONFORMITY									
? Silurian to Ordovician	Hereenic Sandstone		Cross-bedded sandstone	3,200		X		X				
			UNCONFORMITY									
Cambrian to Ordovician	LARAPINTA GROUP	Stokes Formation	Silty shale, limestone, sandstone; fossiliferous	2,000	X	X	X				X	MARINE
		Stairway Sandstone	Sandstone, silty quartz greywacke	1,800+		X		X				
		Horn Valley Siltstone	Siltstone, sandstone, shale, limestone; fossiliferous	1,400	X	X	X		X	X		
		Jacoota Sandstone	Sandstone, scolithid tubes	3,000		X		X		X		
Cambrian	PETERMORTA GROUP	Goyder Formation	Sandstone, siltstone, shale, thin limestone at base	1,600		X		X		X		
		Jay Creek Limestone	Limestone, algal limestone, pelletoid limestone, shale, sandstone	3,000	X	X			X			
		Hugh River Shale	Shale, siltstone, sandstone, limestone, algal lenses	1,600	X		X					
		Arumbera Sandstone	Sandstone, conglomerate, silty quartz greywacke	2,300		X		X	X	X		
Upper Proterozoic	Pertatataka Formation		Silty shale, algal limestone, thin sandstone, dolomite	4,000	X	X	X		X			
	Arcyonga Formation		Sandstone, conglomerate, minor limestone, glacials	1,300+		X		X		X		
			UNCONFORMITY									
	Bitter Springs Formation		Limestone, algal limestone, silty shale, gypsum, dolomite salt	2,500+	X	X	X	X	X	X	X	
	Heavitree Quartzite		Sandstone, silicified sandstone, silty shale	1,500		X						
			UNCONFORMITY									
Archaean	Arunta Complex		Metamorphic and igneous complex									

PLATE I





OORAMINNA AREA
SEISMIC SURVEY
AMADEUS BASIN NT 1962

LOCALITY MAP

SCALE IN MILES

20 0 20 40 60 80

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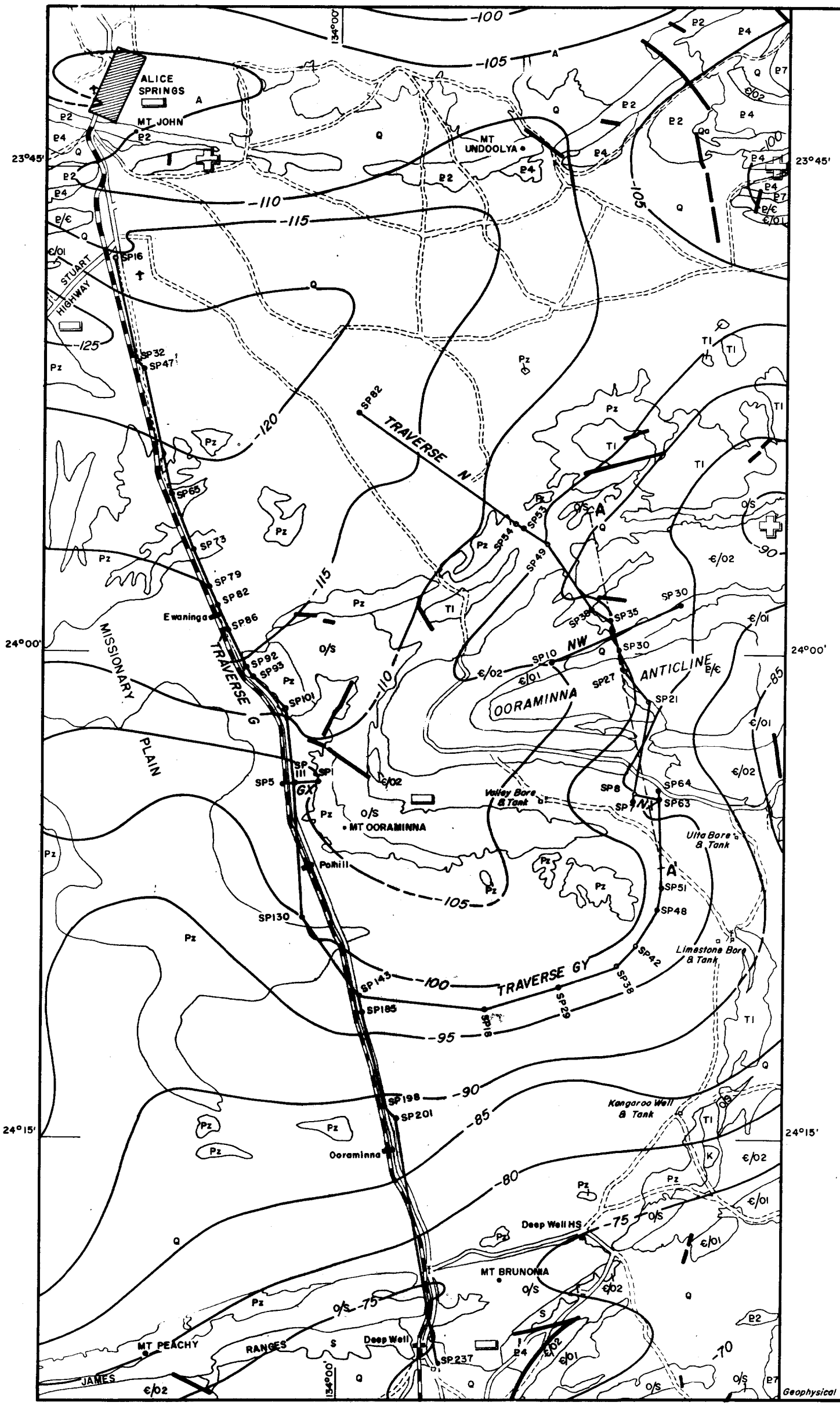
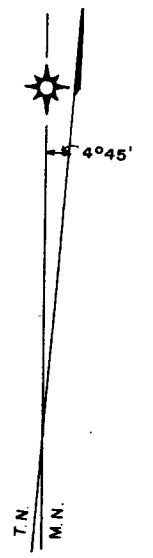
TO ACCOMPANY RECORD No. 1966/57

OORAMINNA AREA NT 1962

26

PLATE 2





LEGEND

	FORMATION	AGE
Qa	Sand and sand dunes, cover	QUATERNARY
Q	Alluvium	
Tl		TERTIARY
K		CRETACEOUS
Pz	Pertnjara Formation	DEVONIAN — CARBONIFEROUS
O/S	Mereenie Sandstone	? SILURIAN — ORDOVICIAN
€/02	Larapinta Group	CAMBRIAN-ORDOVICIAN
€/01	Pertaoorrta Group	
P/€	Arumbera Sandstone	CAMBRIAN
P 7	Pertatataka Formation	UPPER PROTEROZOIC
P4	Bitter Springs Formation	
P2	Heavitree Quarzite	
A	Basement	ARCHAEAN

- Fault
- Probable Fault
- Road
- Vehicular Track
- Railway Line
- SP86 Traverse
- A—A' Geological Cross-Section (See PLATE 5)
- -90 Gravity Contour, based on BMR Maps G53/B2-2 and F53/B2-14
- High Anomaly
- Low Anomaly

GEOLOGY, BOUGUER ANOMALIES, AND SEISMIC TRAVERSES

Geology after Institute Francais du Petrole (Scanvic, 1961)

MILES

5 0 5 10

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

F53/B3-59

TO ACCOMPANY RECORD No. 1966/57

PLATE 3

AMADEUS BASIN, N.T.

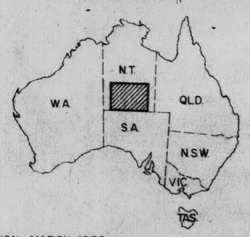
REGIONAL GEOLOGY

Geology after Quinlan (1962)

SCALE IN MILES

10 0 10 20 30 40 50 60

LOCATION



FIRST EDITION, MARCH 1960

MAP DATA

PROJECTION: LAMBERT CONFORMAL CONIC STANDARD PARALLELS 24°40' AND 27°20'.

CONTROL: ASTRONOMICAL FIXATIONS BY THE DIVISION OF NATIONAL MAPPING.

DETAIL: BASE MAP FROM 1:1,000,000 I.C.A.O. AERONAUTICAL CHARTS, (3231) LAKE MACKAY, (3232) ALICE SPRINGS, (3343) ODNADATTA (2ND EDITION) AND (3344) PETERMANN RANGES. GEOLOGY FROM DRAFT COPY BY BM.R. GEOLOGICAL BRANCH AT 12 MILES TO 1 INCH APPROXIMATE SCALE. PLANIMETRY FROM 1:1,000,000 I.C.A.O. CHARTS.

RELIABILITY: PLANIMETRIC – SKETCH
GEOLOGICAL – REGIONAL GEOLOGY

LEGEND

RECENT AND PLEISTOCENE	Deep weathering profile (laterite) Superimposed on formations concerned.	UPPER PALAEOZOIC	Sandstones, conglomerates, shales, "Pertnjara Series, Moreenie and Dulcie Sandstones.
	Aeolian sands.	ORDOVICIAN AND CAMBRIAN	Sandstone, limestone, dolomite, shale, quartz, greywacke; (includes members of "Parke Str." and Larapinta Groups and the "Sandover Beds.")
	Alluvium, wash, red earth soil, calcrete evaporites, clays, terrace gravels.	PROTEROZOIC	Sandstone, quartzite, shale, limestone, conglomerate, boulder beds.
TERTIARY	Chalcedony, calcareous silt, gypseous clays.	UNDIFFERENTIATED PRECAMBRIAN	Gneiss, schist, amphibolite, granite, granodiorite, basic intrusive pegmatites, dolerite, "Arunta Complex."
MESOZOIC AND PERMIAN	Undifferentiated sandstones, siltstones, claystones, also silty sandstones, boulder bed, arkose and conglomerate of "Finke Series."		Granite

STRUCTURES (after Brunnschweiler 1957)

Fault

AN Areyonga Nappe Thrust
BN Bletherskite " "
CN Chandler " "
TN Trickett Creek Disturbance

Anticline

Ana Angas North closure in L. Ordovician?
Ans Angas South " " L. Ordovician
Ga Gardiner " " M. Cambrian
He Henbury " " M. Cambrian
Hu Hughes " " M. Cambrian
Ja James " " M. Cambrian
Ke Kernot " " L. Ordovician?
Mc Maryvale " " U. Cambrian?
Oo Ooraminna " " L. Cambrian
Po Palm Valley " " U. Ordovician
Te Temple " " U. Cambrian
St Stokes Creek " " M. Cambrian?
Sm Storm Creek " " M. Cambrian
Wa Waterhouse " " M. Cambrian

Aeromagnetic flight line

Y X Cross-section referred to in Plate 5

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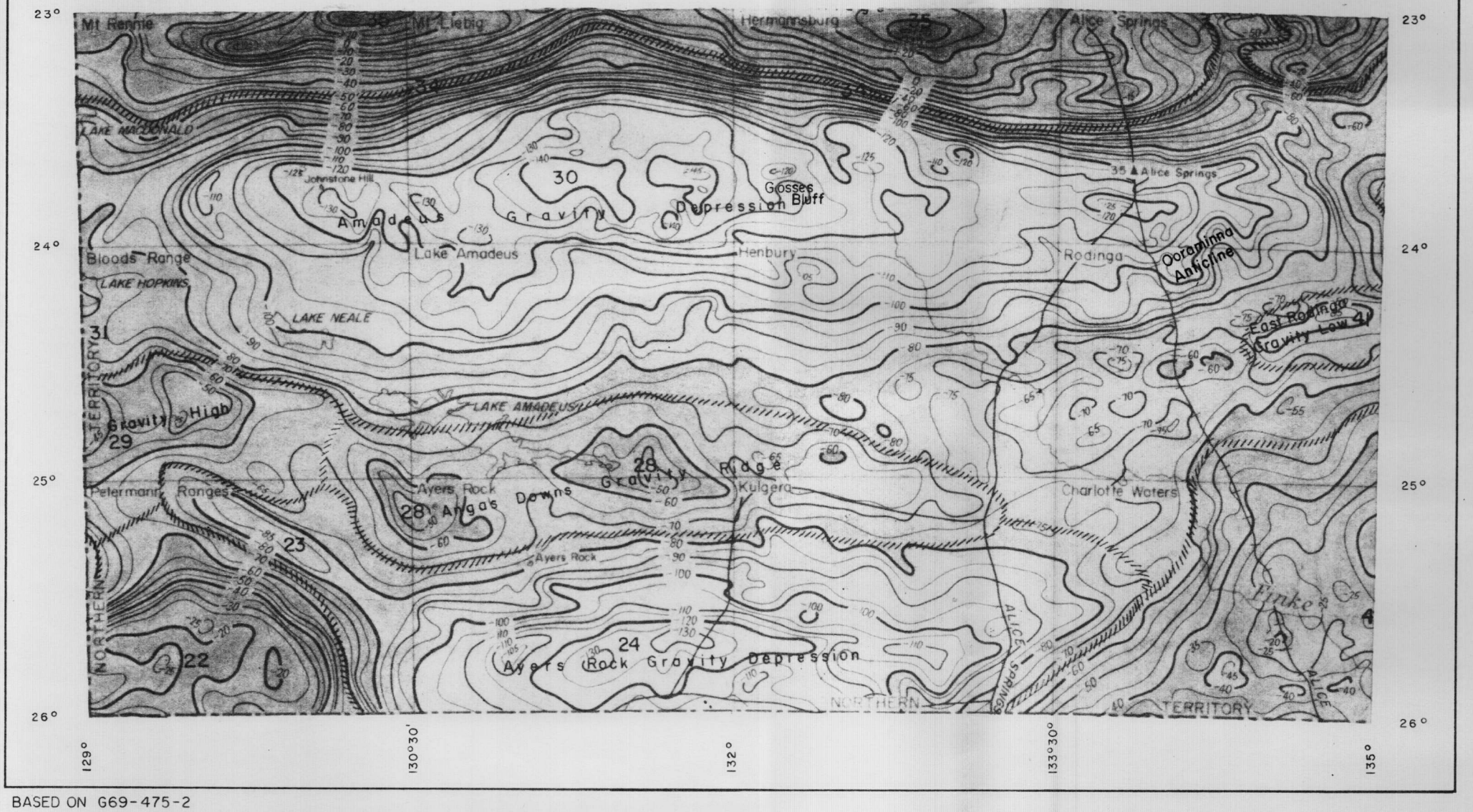
TO ACCOMPANY RECORD No. 1966/57

PLATE 4



BASED ON G69-475-2

LEGEND

- Isogals, values in milligals
- ▲ 35 — BMR gravity pendulum station
- □ — BMR gravity reading at aerodrome
- Ryan — BMR 1:250,000 gravity map area
- Gravity 'High'
- Gravity 'Low'
- 12 — Anomaly number
- Feature boundary

Source of gravity information
Reconnaissance Gravity Survey (1961-62)
Lonsdale and Flavelle, 1963

AMADEUS BASIN N.T.

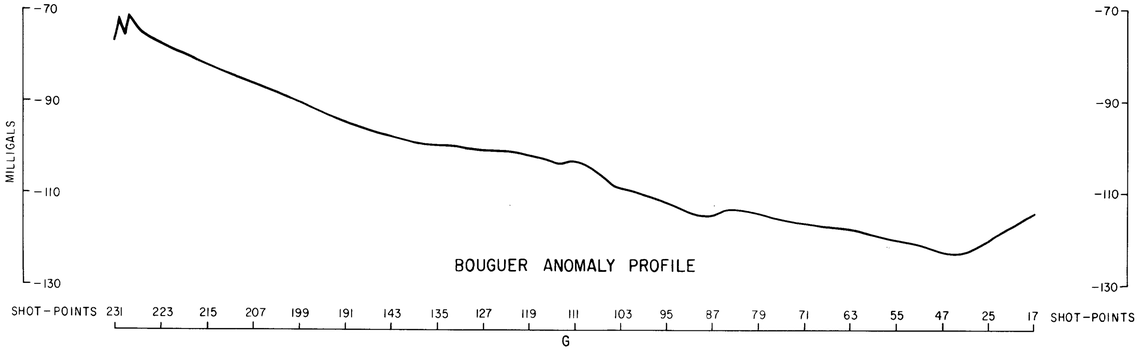
BOUGUER ANOMALIES

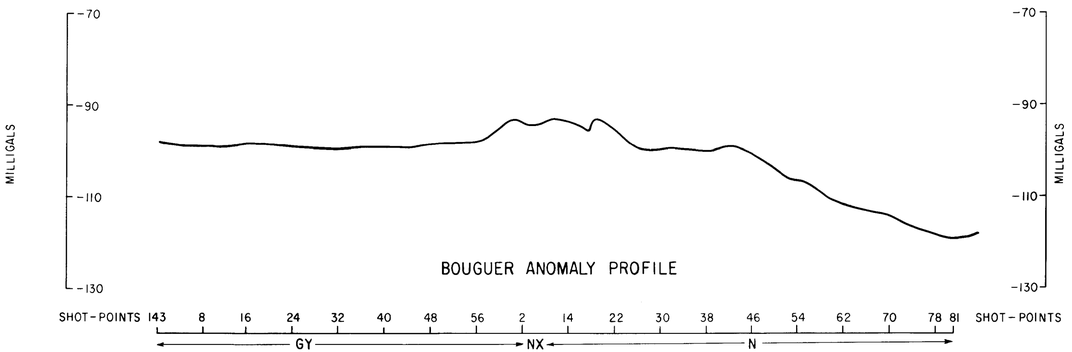
SCALE IN MILES
40 0 40 80 120

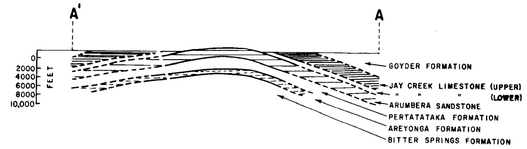
Reference – Division of National Mapping 40 miles to 1 inch topographic map
CONTOUR INTERVAL 5 MILLIGALS

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS F53/B3-27-1
TO ACCOMPANY RECORD No.1966/57

OORAMINNA AREA SEISMIC SURVEY, 1962.

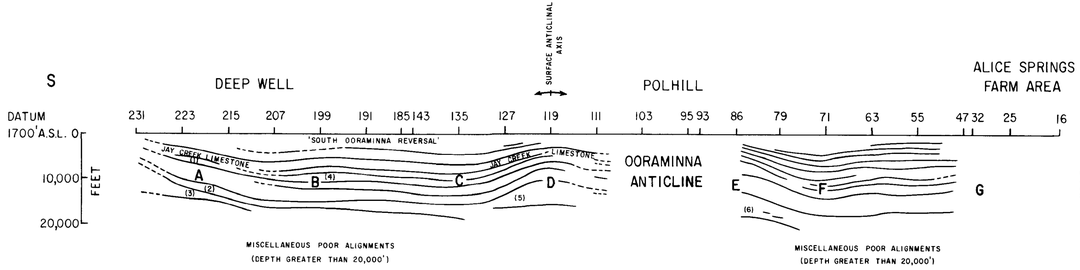




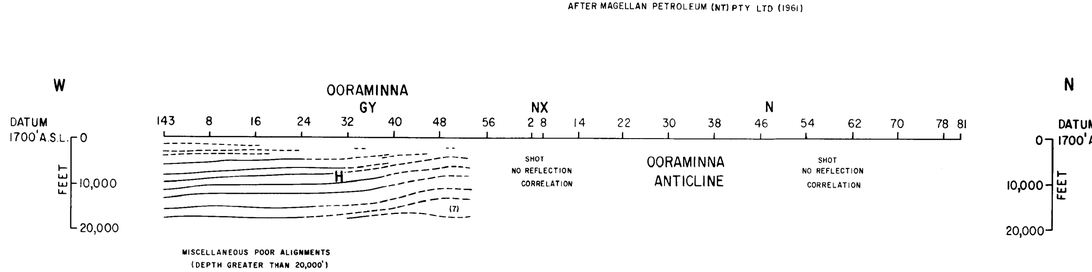


GEOLOGICAL CROSS-SECTION – OORAMINNA ANTICLINE

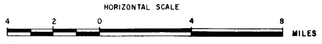
AFTER MAGELLAN PETROLEUM (NT) PTY LTD (1961)



SEISMIC CROSS-SECTION — TRAVERSE G



SEISMIC CROSS-SECTION — TRAVERSE GY



GEOLOGICAL, GRAVITY, AND SEISMIC CROSS-SECTIONS

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics F53/B3-61

TO ACCOMPANY RECORD No. 1966/57

OORAMINNA AREA, N.T. 1962

PLATE 6

TWO - WAY REFLECTION TIME (tc msec)

5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0

INTERVAL VELOCITY

AVERAGE VELOCITY

TIME-DEPTH

SPREAD LAYOUT

SP 135 SP 136 SP 137 SP 138 SP 139 SP 140 SP 141

SP 134 SP 135 SP 136 SP 137 SP 138 SP 139 SP 140

21,000
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000

INTERVAL VELOCITY (Vi ft/s) and AVERAGE VELOCITY (Va ft/s)

DEPTH BELOW DATUM

1700ft A.M.S.L.

2000 4000 6000 8000 10,000 12,000 14,000 16,000 18,000 20,000 22,000 24,000 26,000 28,000 30,000

DEPTH BELOW DATUM

(Based on G 85/3-18)

Time-Depth Curve (t-d)
Interval Velocity (Vi)
Average Velocity (Va)

VELOCITY AND TIME VERSUS DEPTH

AREA OORAMINNA NT

Basis t^2 Versus x^2

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

F 53/B3-60

TO ACCOMPANY RECORD No. 1966/57

OORAMINNA Seismic Survey 1962

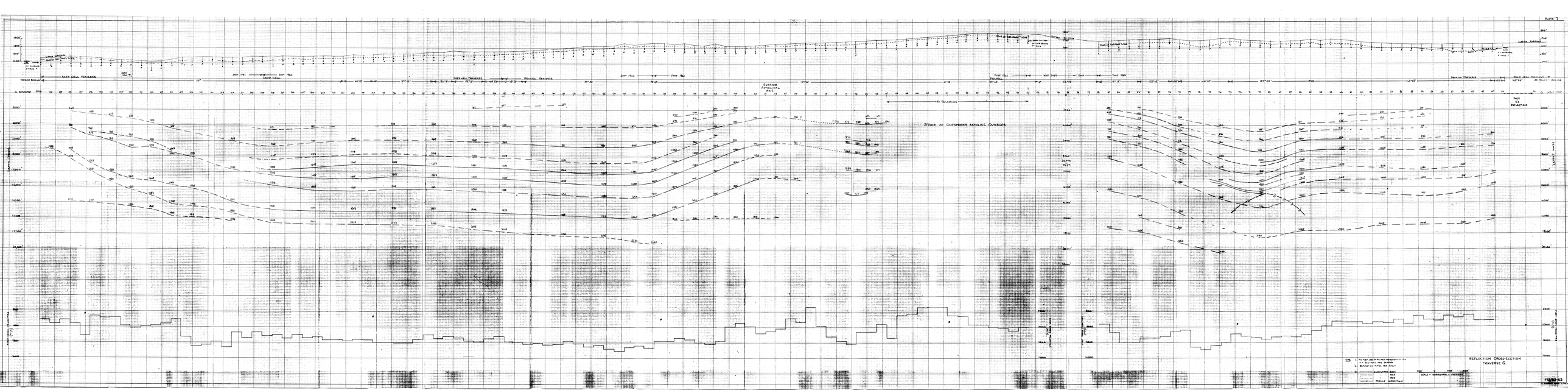
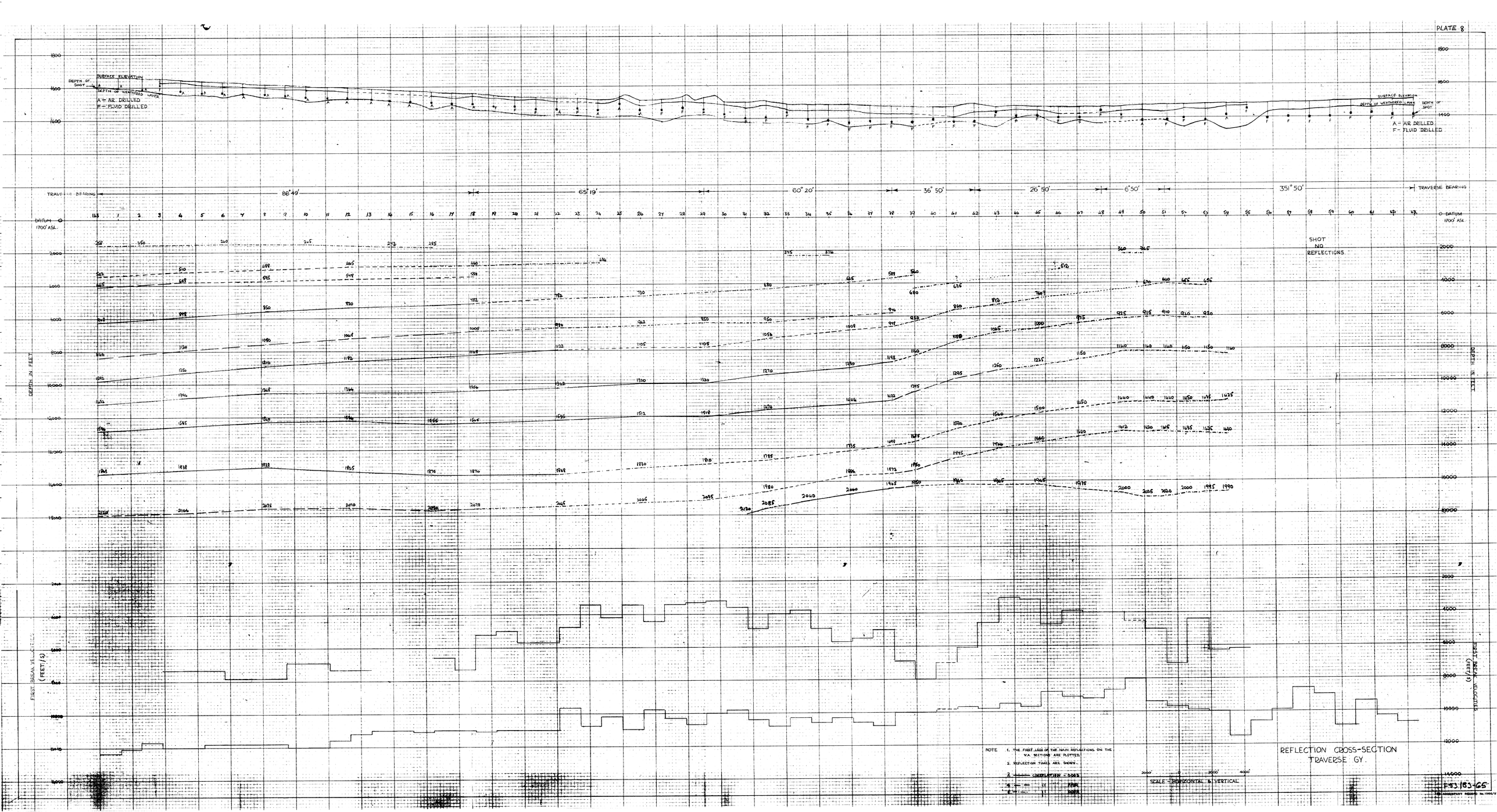

Stroke of Coramonia Anticline Outcrops
Surface Anticlinal Axis
Reflection Cross-section
Traverse G

PLATE 8



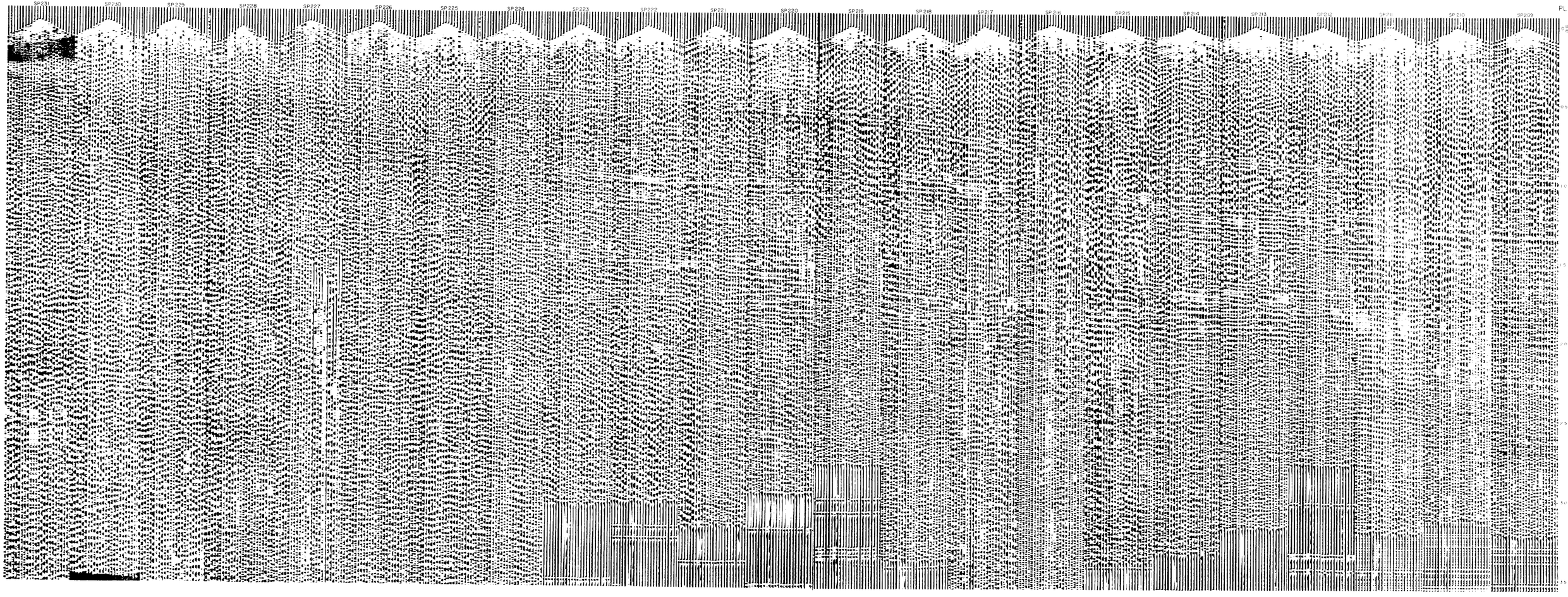
NOTE 1. THE FIRST LEGS OF THE MAIN REFLECTIONS ON THE V.A. SECTIONS ARE PLOTTED.
2. REFLECTION TIMES ARE SHOWN.
3. —— CORRELATION - DOUBLE
—— " " FAIR
—— " " POOR

REFLECTION CROSS-SECTION
TRAVERSE GY.

SCALE - HORIZONTAL & VERTICAL

F-53163-GS
GEOPHYSICAL RECORD No. 1966/8

PLATE 9



155/85 70

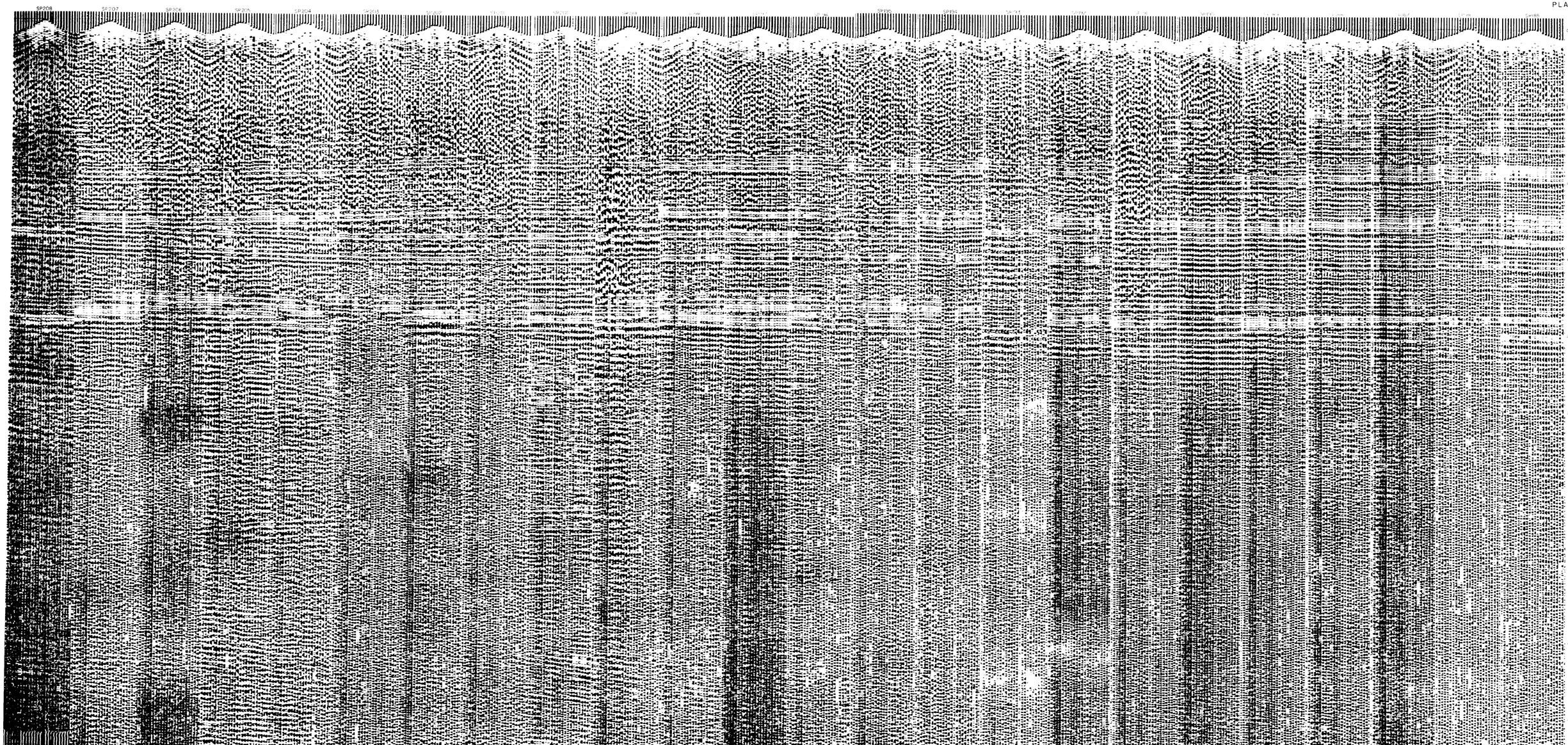
VARIABLE - AREA REFLECTION CROSS - SECTION

TRAVERSE G

SP 209 – 231 (1961)

TO ACCOMPANY RECORD No. 1966/57

PLATE 10

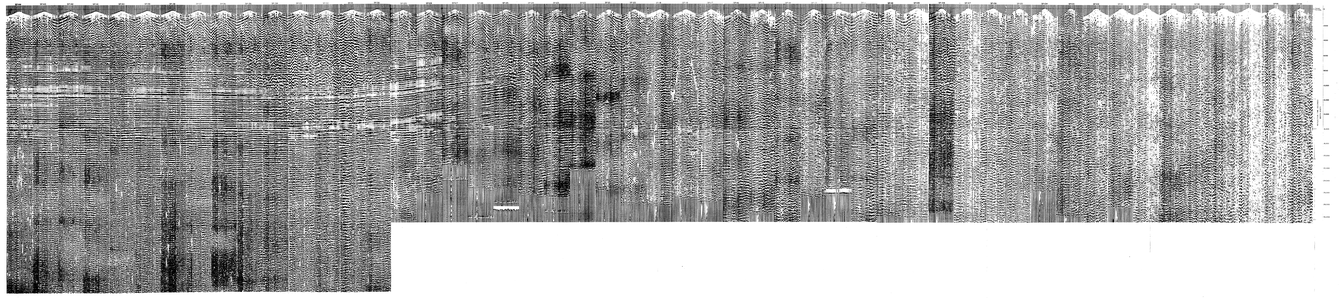


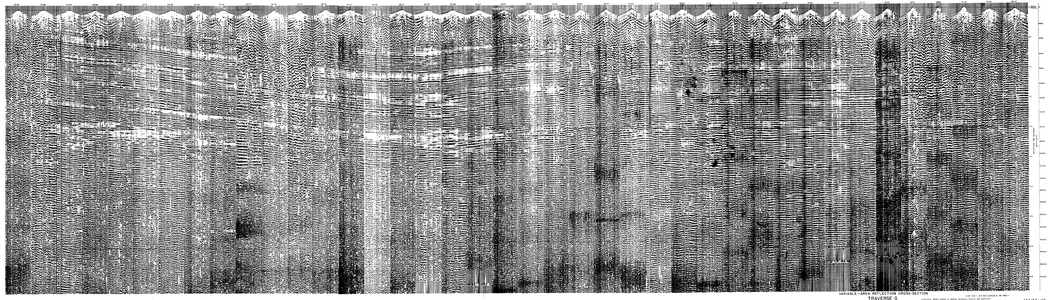
VARIABLE – AREA REFLECTION CROSS-SECTION

TRAVERSE G
SP185 – 208

TO ACCOMPANY RECORD No. 1966/57

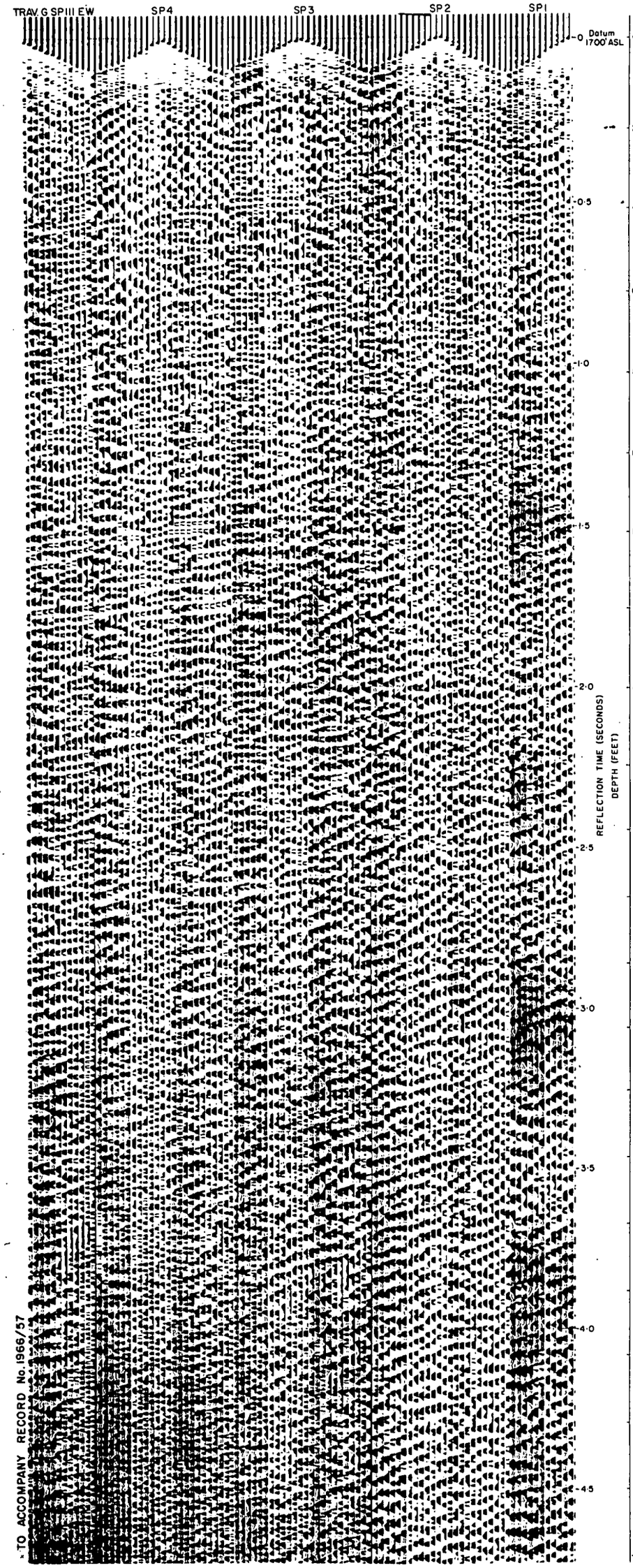
F53/B3-104





TRAVERSE G

PLATE 12



VARIABLE–AREA REFLECTION CROSS-SECTION TRAVERSE GX

SP GIIIEW, 4–1

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

F53/83-79

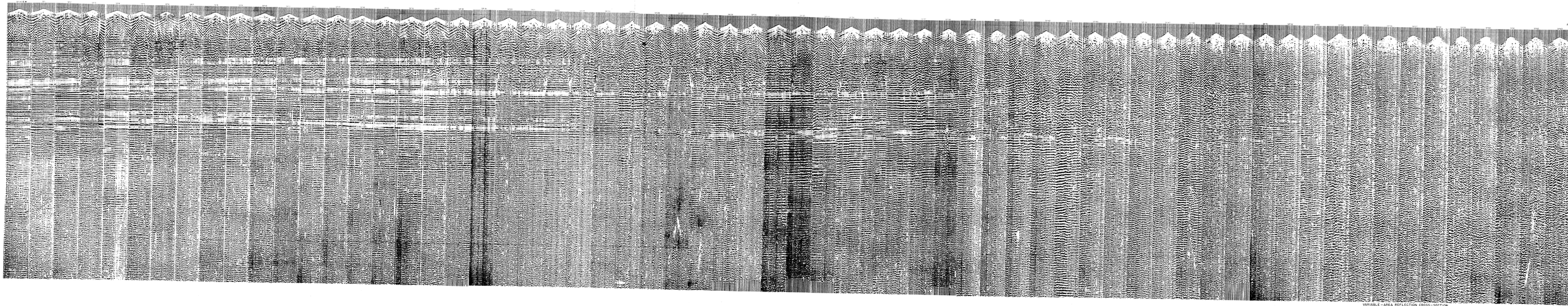


PLATE 13

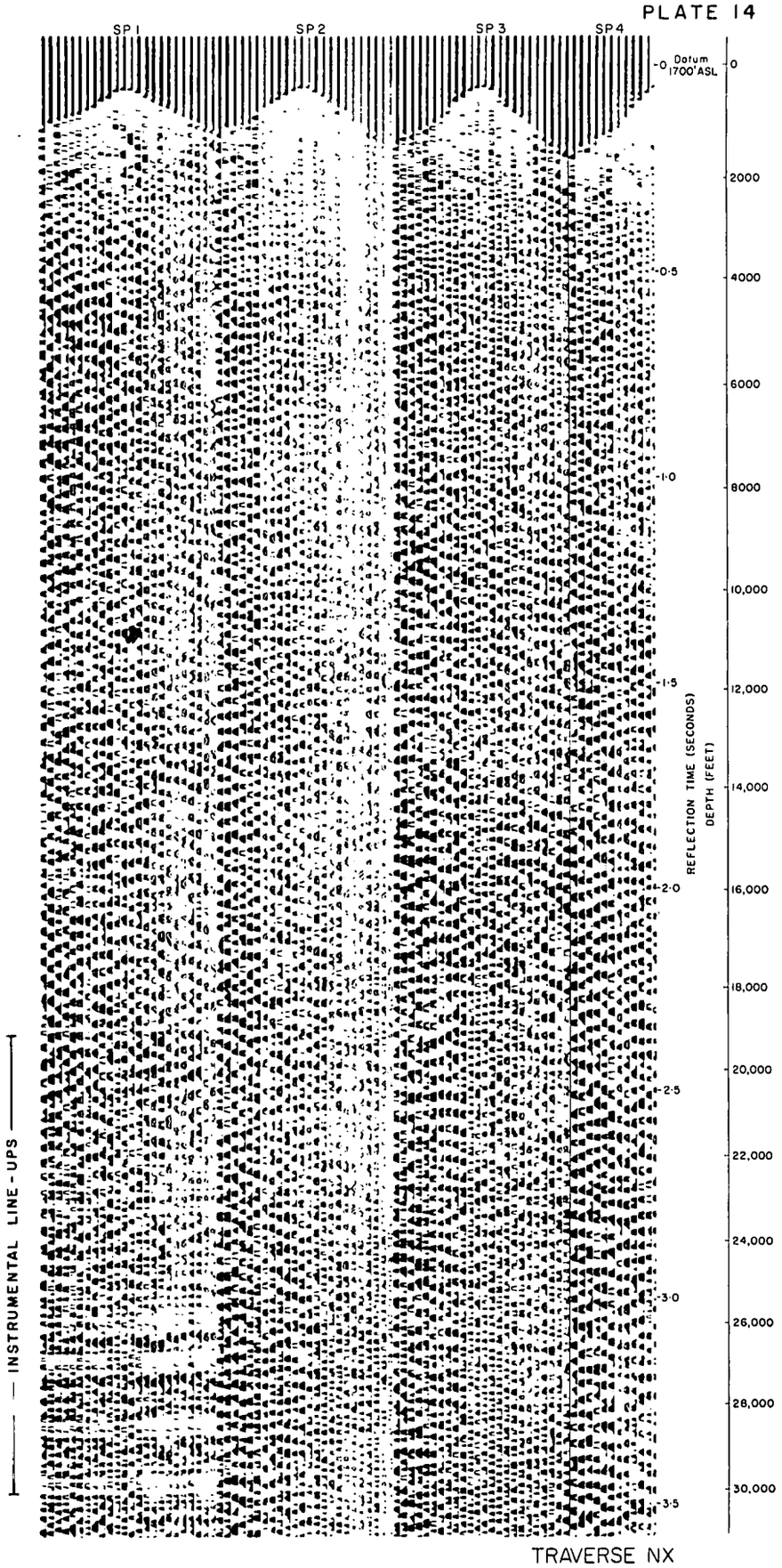
VARIABLE-AREA REFLECTION CROSS-SECTION
TRAVERSE GY

PROFILE OF
SHEARER ICE CAP

TO ACCOMPANY REPORT No. 1966/67

F53/83-GG

PLATE 14



TRAVERSE NX

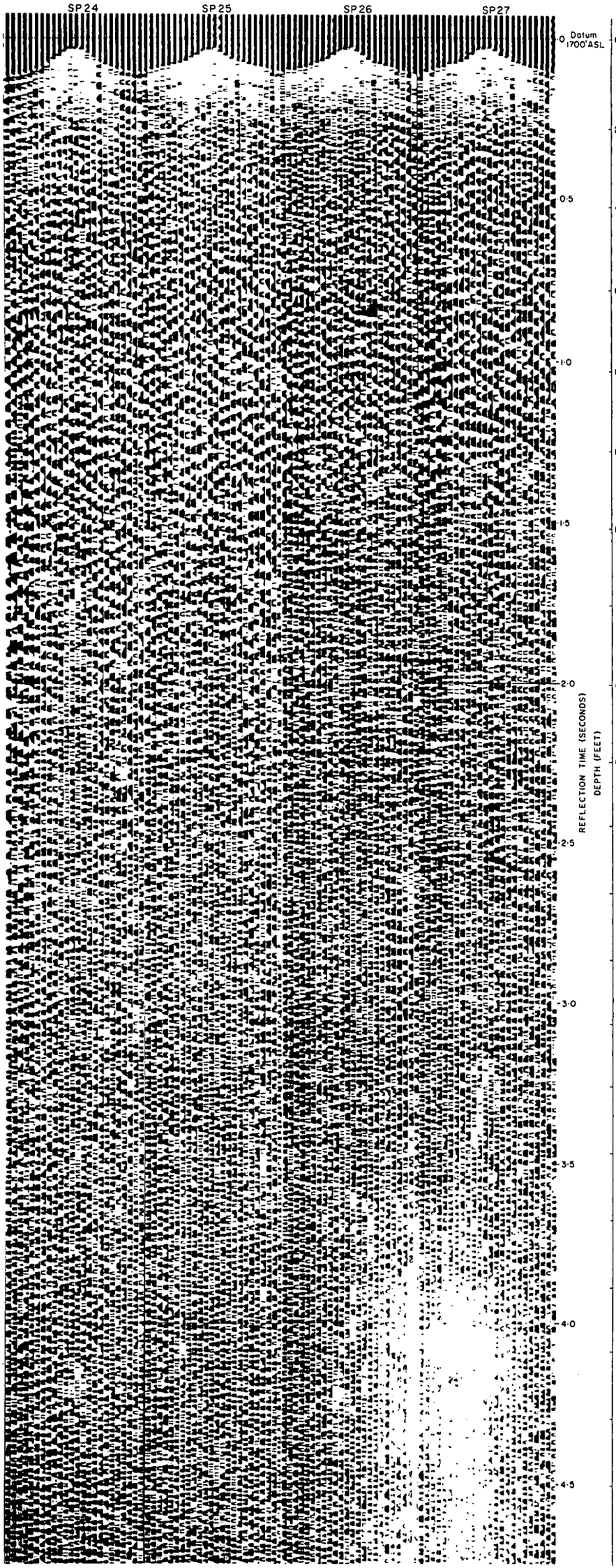
SP 4-1

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

F53/83-84

TO ACCOMPANY RECORD No. 1966/57

PLATE 15



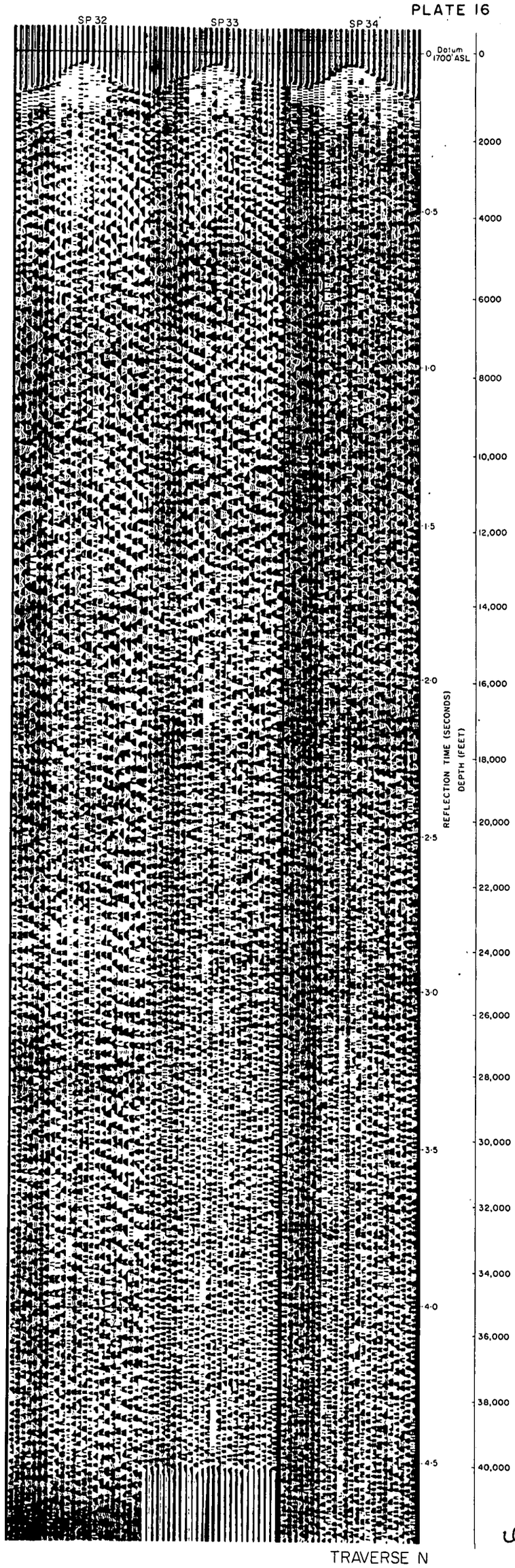
TRAVERSE N

SP 27 - 24

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

F53/83-85

PLATE 16



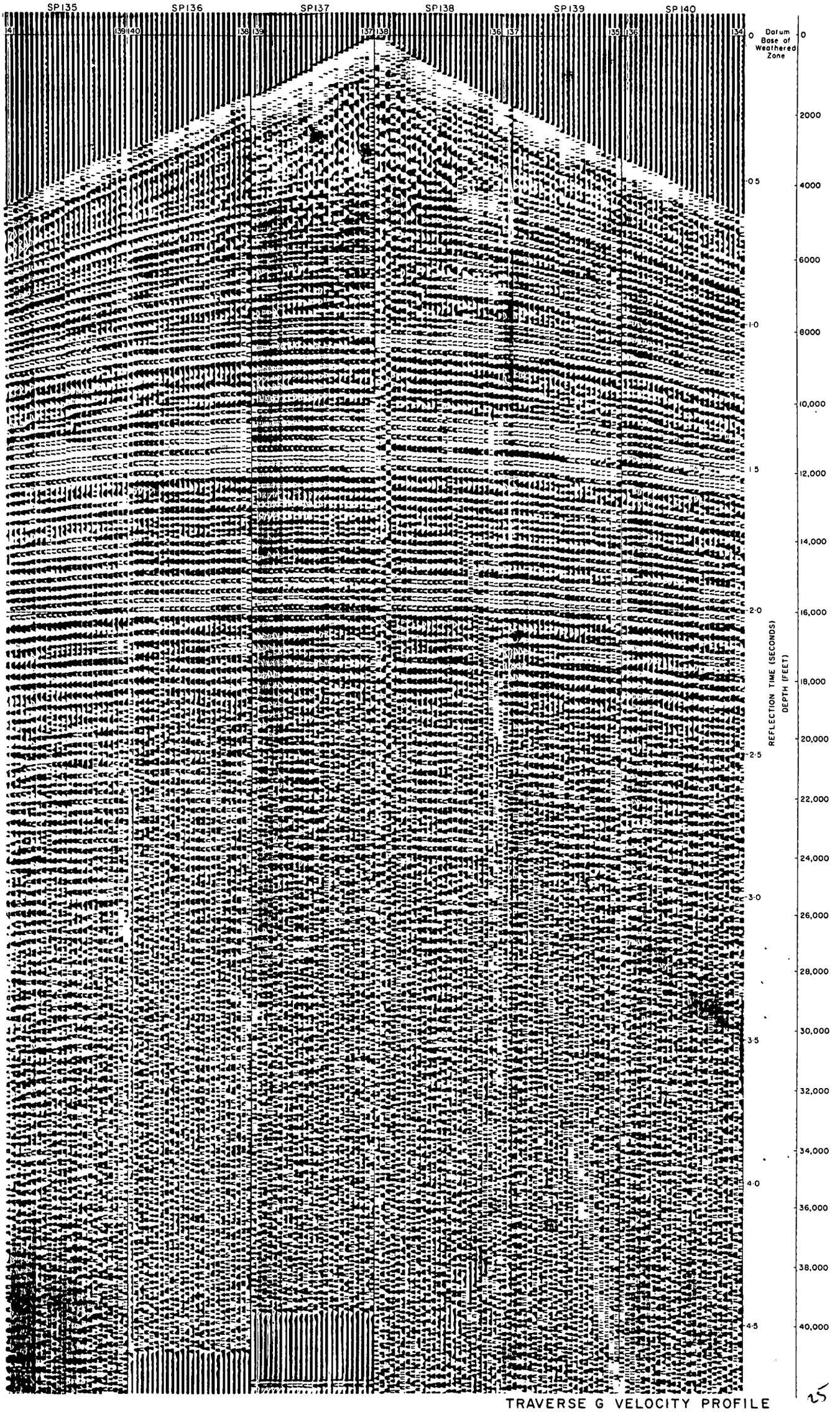
TRAVERSE N

SP 34 - 32

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

F53/83-86

PLATE 17



TRAVERSE G VELOCITY PROFILE

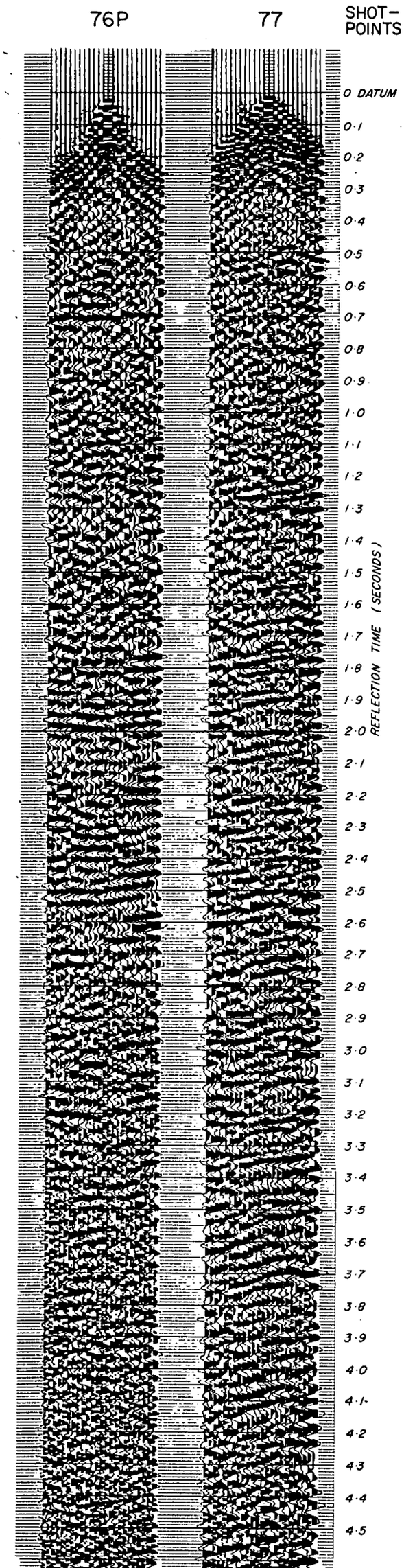
SP 140-135

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

TO ACCOMPANY RECORD No. 1966/57

F53/83-87

25



UNCORRECTED RECORDS

RECORDING INFORMATION

Magnetic Recorder : DS7-700

Amplifiers : 7000 B

Filters : K18-K75

A.G.C. : W.B.

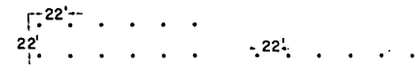
Gain Initial : -10

Final : -10

Geophones : T.I.C.-20 c/s

Geophone pattern :

SP76P SP77



Shot-hole pattern :

SP 76 P	SP 77
Depth 54'	Single, Depth 220'
Charge 9x3⅓	Charge 30lb

PLAYBACK INFORMATION

Filters : K20-K78

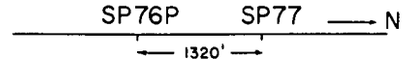
A.G.C. : S.S.

Gain Initial : -50

Final : -20

Trip delay : ·2 sec

Compositing : Nil



Variable-area reflection records

TRAVERSE N

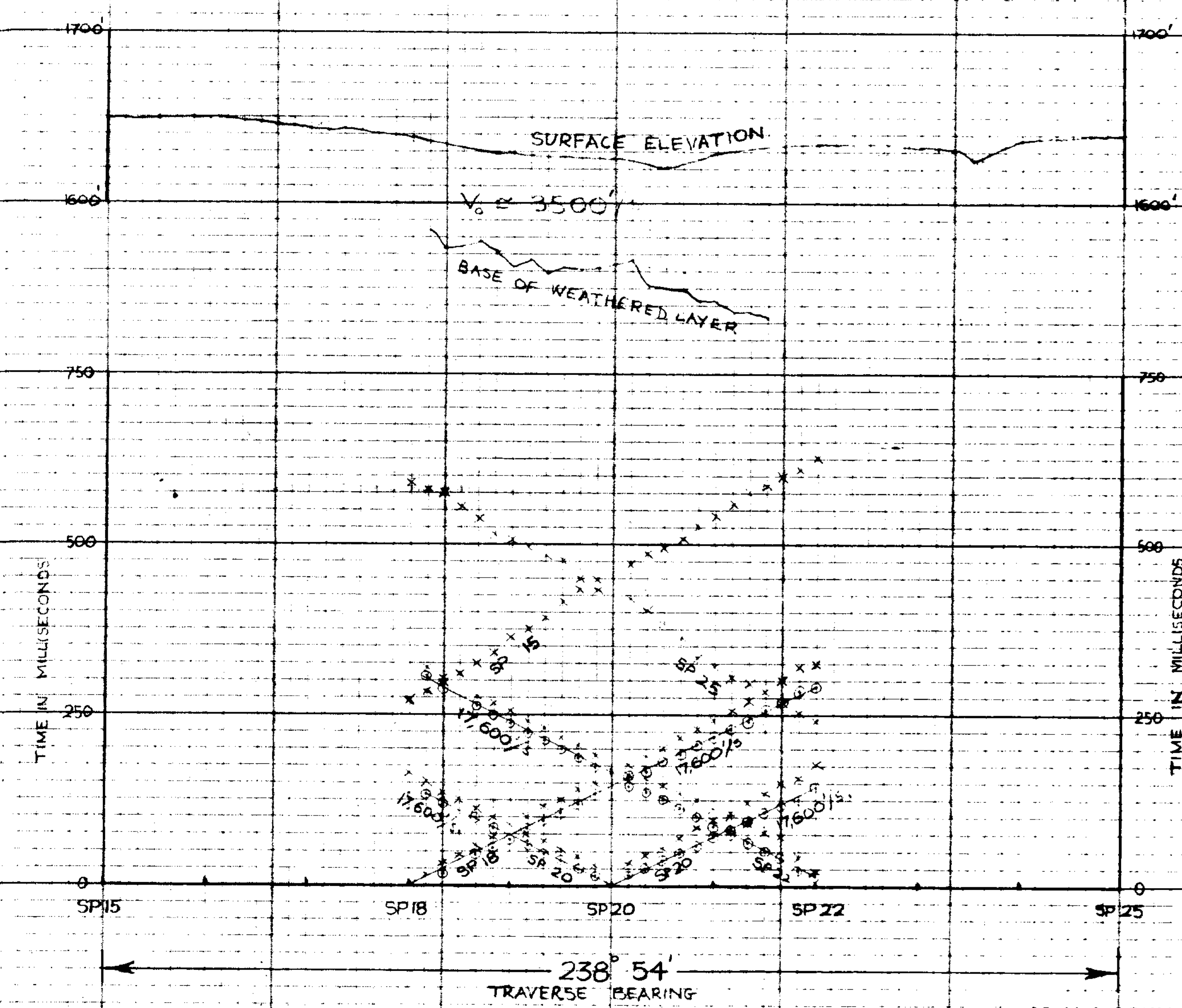
SP 76 P - 77

RECORDED BY: *Seismic Party No. 2*

SECTION BY: *Bureau of Mineral Resources*
Playback Centre SIE MS 42

F54/83-106

TO ACCOMPANY RECORD No. 1966/51



SP 18

t_o	13	15	35	44	60	72	88	100	114	124	138	151	—	177	187	201	216	230	243	257	270	284	300	320	325
W_c	—	15	16	—	15	17	19	16	19	17	18	17	—	15	19	20	22	25	24	27	28	28	33	36	33
t_c	—	—	19	—	45	55	69	84	95	107	120	134	—	162	168	181	194	205	219	230	242	256	267	284	292
	SP 18												SP 20												SP 22

SP 22

t_o	—	320	304	—	277	268	257	239	231	217	206	190	—	160	157	146	134	126	112	103	92	79	73	60	48
W_c	—	14	16	—	15	17	19	16	19	17	18	17	—	15	19	20	22	25	24	27	28	28	33	36	33
t_c	—	306	288	—	262	251	238	223	212	200	188	173	—	145	138	126	112	101	88	76	64	51	40	24	15
	SP 18												SP 20												SP 22

SP 20

t_o	164	149	136	124	114	99	88	75	66	54	43	32	—	31	45	57	70	84	96	105	121	134	150	161	178
W_c	—	14	16	—	15	17	19	16	19	17	18	17	—	15	19	20	22	25	24	27	28	28	33	36	33
t_c	—	135	120	—	99	82	69	59	47	37	25	15	—	16	26	37	48	59	72	81	93	106	117	125	145
	SP 18												SP 20												SP 22

SP 15

t_o	271	283	296	311	326	341	358	374	390	416	435	448	—	471	483	495	509	528	543	558	573	585	599	611	628
	SP 18												SP 20												SP 22

SP 25

t_o	590	579	576	557	536	513	509	496	484	474	449	435	—	421	404	383	363	333	320	306	296	284	270	255	243
	SP 18												SP 20												SP 22

SCALE

MILES 0 0.5 1

FEET 0 2200 4400

TIME/DISTANCE CURVES

TRAVERSE NW

F53/B3-66

OORAMINNA AREA SEISMIC SURVEY AMADEUS BASIN 1962

PLATE 20

YEAR 1962

SEISMIC PARTY Nº 2

MONTH	JULY = = = AUG = = = =
WEEK ENDING	6 13 20 27 3 10 17 24 31
SHOOTING LOCATION	OORAMINNA = = = = = = = = =
PETROL 1 DIV = 10 DRUMS —— STOCK --- CONSUMPTION	
DETONATORS 1 DIV = 50 DETS – – – LONG LEADS (100') ····· SHORT LEADS (5', 8', 30')	2600 2500 2400 2300 2200 4TH – 5TH JULY
EXPLOSIVES USED 1 DIV = 500 lb	TO OORAMINNA
REFRACTION HOLES SHOT 1 DIV = 1 HOLE	GOSSES BLUFF
LINE PEGGED AND LEVELLED 1 DIV = 10 MILES	MOVE FROM
REFLECTION HOLES SHOT 1 DIV = 20 HOLES	CAMP
HOLES DRILLED 1 DIV = 40 HOLES —— SINGLE HOLES ---- HOLES ON PATTERNS	
FOOTAGE 1 DIV = 1000 ft	
REMARKS	30th JULY – 3rd AUGUST FLY CAMP – ULTA CREEK END OF SURVEY 29th AUGUST

SEISMIC SURVEY OPERATIONS CHART

27

F53/B3–62

BASED ON G85-152

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics