COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1962/117

WANDAGEE HILL/MIDDALYA SEISMIC REFLECTION SURVEY, WESTERN AUSTRALIA 1955

by

E. R. SMITH

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SUMMARY

A reflection seismic traverse was recorded between Wandagee Hill and Middalya in the Carnarvon Basin, Western Australia, during October 1955 by the Bureau of Mineral Resources. The object of the survey was to assist in interpreting gravity results in the region. Prior to this survey the interpretation of the geology suggested that the deepest part of the Palaeozoic basin was in the Wandagee Hill area, but gravity results indicated that a basement ridge may exist in this same area.

The seismic results indicate a sedimentary thickness of at least 17,000 ft between Wandagee Hill and Middalya and possibly 24,000 ft thickness to the east of Middalya. Although no useful information was obtained in the immediate vicinity of Wandagee Hill, extrapolation of results from farther east, suggests that the basement may be as shallow as 6000 ft just west of Wandagee Hill. This would confirm the interpretation of the gravity results at this location.

The seismic cross-section shows that there may be a large elevation of the basement over a region about 20 miles west of Middalya between Shot-points 90 and 113. Although there is no direct evidence of this in the gravity results, it may be related to faulting, particularly a fault four miles east of Middalya that is indicated both by surface geology and by gravity results.

1. INTRODUCTION

During October 1955 a seismic party of the Bureau of Mineral Resources undertook field work in the Wandagee/Middalya area, 100 miles north-east of Carnarvon, Western Australia, (see locality map, Plate 1). Reflection profiling was carried out along the main road between Wandagee Hill and Middalya, and also east of Middalya. The traverses are shown on Plate 1.

A detailed gravity traverse (Plate 7) was made along this road in 1951, but it could not be interpreted consistently with the geology accepted at the time (Chamberlain, Dooley, and Vale, 1954). It was considered that a seismic reflection cross-section along the same traverse might help in interpreting the gravity results. Later geological data have enabled a possible reconciliation to be made between the gravity and geological interpretations.

Field operations commenced on the 3rd October and ended on the 5th November. During this time the equivalent of 26 miles of reflection profiling was shot. The party was equipped with a 24-channel TIC seismograph, model 521, mounted in a darkroom cabin on a four-wheel-drive Morris Commercial truck.

Two Failing-750 drilling rigs and three 700-gallon water tankers were used to drill the shot-holes. Other vehicles used by the party were a 700-gallon water tanker as shooting truck, a workshop truck, two supply vehicles, four Land Rovers, and a utility.

The staff consisted of geophysicists, E.R. Smith (party leader) and M.J. Goodspeed, radio technician (as observer), shooter, two drillers, two drill assistants, surveyor, assistant surveyor, two mechanics, cook and offsider, and eight field assistants.

The party camped in the shearers' quarters at the Wandagee woolshed, about one mile west of Wandagee Hill.

Copies of the results of the survey were made available to the operating company, West Australian Petroleum Pty Ltd.

2. GEOLOGY

The Carnarvon (or North-West) Basin is a large sedimentary basin extending along the west coast of Australia from the Murchison River to Onslow. A detailed description of the geology of the Basin is given by Condon (1954). The following summary is taken chiefly from Condon's Report.

Two main systems of sedimentation are recognised in the Basin, viz. the Palaeozoic system and the Cretaceous-Tertiary system. The eastern margin of the Basin is bounded by Precambrian schist and granitic rocks. The Palaeozoic sediments crop out immediately west of the Precambrian rocks, forming a sequence ranging in age from middle Devonian to Permian. The possible thickness of sediments as measured in the outcrop area is 19,000 ft consisting of 4500 ft of Devonian, 2300 ft of Carboniferous, and 12,000 ft of Permian. The most westerly exposure of Palaeozoic rocks is in the Wandagee area, but holes drilled farther west in the Basin have proved that the Palaeozoic sediments extend at least to near the coast. The Cretaceous-Tertiary sediments overlie the Palaeozoic sediments unconformably and have a possible thickness of 3600 ft.

It was thought originally that there were no major unconformities within the Palaeozoic sediments. The regional dip of the Palaeozoic sediments is to the west, ranging from 40 degrees in the Devonian and Carboniferous sediments along the eastern margin to 3 or 4 degrees in the Permian sediments of the Middalya/Wandagee area. Therefore, assuming conformity between the Permian and Pre-Permian sediments, the Palaeozoic basin should consistently deepen westward, except where interrupted by faulting, to at least as far as the edge of outcrop of these sediments. In the Wandagee Hill/Middalya/Williambury area, the Basin would be deepest near Wandagee Hill, where, if outcrop thicknesses are maintained, roughly 18,000 ft of Palaeozoic sediments should be expected.

From 1950 to 1953, geophysicists of the Bureau of Mineral Resources conducted a gravity reconnaissance survey in the Carnarvon Basin (Chamberlain et al., 1954). This showed a series of positive gravity anomalies extending northward from about 30 miles east of Meedo Homestead, through Binthalya, Hill Springs, Wandagee Hill, Mia Mia, Marilla and east of Giralia Homestead. This line of gravity 'highs' was interpreted as being caused by a ridge of basement rocks extending in a northerly direction through the centre of the Carnarvon Basin. In the Wandagee Hill area, this interpretation could not be reconciled with the geology as outlined above. This was more clearly shown by a detailed gravity traverse that was situated along the road between Wandagee Hill and Williamsbury (Plate 7). It ran east from the supposed basement ridge to near the eastern margin of the sediments. The gravity profile shows a minim (indicating the greatest thickness of sediments) about 6 miles east of Middalya. East of this minimum the gravity profile rises steadily as far as the Precambrian basement outcrop; west of the minimum the profile rises to a maximum value just west of Wandagee Hill, suggesting a shallow basement near there.

During 1955, Condon and others re-examined many of the contacts between Permian and pre-Permian sediments near the eastern margin of the Basin. Some of these contacts had previously been considered as major faults, downthrown to the east by several thousand feet in some cases. The strata on the down-thrown side appeared to have been dragged into synclinal folds. However, from this more recent work, Condon (1955) draws the following conclusions:

(a) The Devonian/Carboniferous sediments were folded, probably partly by compaction and partly by sag of basement under load, and eroded nearly to their present level before the Permian.

(b) Several contacts, which were thought to be large faults, are abutment unconformities - at the time of deposition of the sediments the Basin floor at these places must have had a slope of more than 20 degrees.

(c) The Wandagee Hill positive gravity anomaly is probably caused by a ridge of basement rock, and the gentle gradient to the east (as well as that to the west) is a reflection of the shape of the basement.

The outcropping rocks along the seismic traverse were chiefly those of the Permian Byro Group, in particular the Cundlego Formation, consisting of quartz greywacke and siltstone, and the Bulgadoo Shale, consisting of carbonaceous shale and siltstone (Plate 1). In the vicinity of Wandagee Hill, the younger Permian formations crop out, including the Quinnanie Shale, the Wandagee Formation, the Norton Greywacke, and the Baker Formation of the Byro Group, and the Coolkilya Greywacke, the Mungadan Sandstone, and the Binthalya Sub-group of the Kennedy Group. The complete Permian sequence as seen and measured in outcrop in the Wandagee Hill/Williambury area (along the Minilya River) is given in Table 1. From the thickness of the formations given in the table, it can be expected that roughly 8000 ft of Permian sediments will be present below the major portion of the seismic traverse.

TABLE 1

Permian Formations of the Carnarvon Basin

Age	Group	Formation	Thickness (ft)	Lithology	Symbol
middle Permian	Kennedy	Binthalya Sub-group	--	Quartz sandstone and Quartz greywacke	Pat
		Mungadan Sandstone	145	Quartz sandstone	Pas
		Coolkilya Greywacke	? 620	Quartz greywacke, greywacke	Pal
Lower Permian (Artinskian)	Byro	Baker Formation	153	Siltstone, quartz greywacke	Pak
		Norton Greywacke	177	Greywacke, quartz greywacke	Pan
		Wandagee Formation	425	Siltstone, quartz greywacke	Pag
		Quinnanie Shale	515	Shale, thin quartz greywacke	Paq
		Cundlego Formation	1090	Quartz greywacke (some calcareous), siltstone	Pau
		Bulgadoo Shale	1000	Siltstone, carbonaceous shale, thin quartz greywacke	Pab
		Mallens Greywacke	?500	Quartz greywacke	Pam
		Coyrie Formation	855	Siltstone, quartz greywacke	Par
		Wooramel Sandstone	250	Quartz sandstone	Paw
		Cordalia Greywacke	35	Quartz greywacke	Pad
		Callytharra Formation	540	Calcarenite quartz greywacke, limestone.	Pac
Lower Permian (Sakmarian)	Lyons		4600	Silty and sandy tillite, quartz greywacke, varved siltstone, thin fossiliferous limestone.	Psl
		Harris Sandstone	280	Clean quartz sandstone	Psh

The Permian sediments in the Middalya/Wandagee Hill area are cut by numerous faults. The fault one mile west of Wandagee Hill appears from the surface geology to be a major one. However, the gravity profile fails to show a steep gradient that would be expected from a major fault. Condon (1955) suggests that this contact is related to an abutment unconformity on the eastern side of the basement ridge indicated by the gravity work. He states that 'the eastern slope of the basement ridge would need to be more than 20 degrees with the Palaeozoic sediments in on-lapping abutment unconformity against it'. There has probably been some later minor faulting, along this contact, caused by sliding along the unconformity during compaction. The many small faults immediately east of Wandagee Hill may be caused by similar slipping.

The other faults, farther east towards Middalya, are thrust faults which are down-thrown to the east and dip to the west, thus causing many repetitions of the sedimentary sequence in outcrop. With the possible exception of the fault four miles east of Middalya, the gravity profile fails to indicate any of these faults definitely. Apparently either their throws are too small to cause a measurable gravity anomaly, or they are confined to the Palaeozoic sediments and therefore do not indicate basement faulting. The fault four miles east of Middalya, with a throw of about 1200 ft measured from the surface geology, may be responsible for the change in gravity three-quarters of a mile east of the surface trace of the fault.

3. RESULTS

The reflection work was carried out mostly along the main road from Wandagee Hill through Middalya. Traverse A (Plate 1) commenced about two miles west of Wandagee Hill (Shot-point 28) and ran eastwards to Shot-point 69 and then south-eastwards to a point three miles west of Middalya Homestead (Shot-point 113). It was discontinued here but was recommenced one mile east of Middalya (Shot-point 131) and extended to the south-east for four miles to Shot-point 148. The seismic traverse therefore followed the detailed gravity traverse. Three short cross-traverses (B, C, and D, Plate 1) were also shot. Each of these was two miles in length and crossed the main traverse approximately at right angles at Shot-points 61, 80, and 102 respectively.

The results have been shown as cross-sections on Plates 2, 3, 4, 5, and 6. flection times have been converted to depths using an approximate velocity ditribution obtained from a statistical analysis of spread corrections. Reflections were graded according to Gaby's (1947) system, and have been migrated to approximately their true positions in space.

The quality of the seismic records obtained varied considerably, ranging from 'no-reflection' records to very good ones. From Shot-point 28 to Shot-point 53, only a few events were recorded; these were of poor quality and apparently have no significance. For this reason, only every fourth shot-point was drilled and shot. This portion of the traverse crosses the zone of intense faulting east of Wandagee Hill (Plate 1), and it seems probable that the faulting is the cause of the lack of recognisable reflected energy. Below Shot-points 75 and 97, reflections were fewer and of poorer quality than elsewhere. This may be related to surface conditions as the traverse here crosses the Joolabroo Formation, a Pleistocene deposit consisting of pebbly calcareous sand. Along the remainder of Traverse A and also on Traverses B, C, and D, reflections were generally plentiful.

Cross-section from Wandagee Hill to Middalya (Plate 2)

West of Middalya, reflections are recorded fairly consistently to 2.5 seconds or about 17,000 ft depth, and it would appear that sediments exist to this depth. Near Shot-points 61 and 100, many reflections were recorded at times later than 2.5 seconds, and these may indicate that west of Middalya the sediments extends below 17,000 ft.

There are no major angular unconformities indicated in the sediments above 17,000 ft depth. Thus, between Shot-points 58 and 69 the reflections show generally east dip, between Shot-points 69 and 89 they are mostly near-horizontal, and between Shot-points 89 and 113 they show dip to the north-west. These dips give the impression of a syncline along this portion of the traverse, but this could be a false impression as the reversal of dip at the eastern end coincides with a bend in the traverse at Shot-point 69. The reflections along Traverse B near Shot-point 61 (Plate 4) show dip to thenorth, giving a true dip to the north-east at this point. On Traverse C (Plate 5) the reflections are relatively poor but they indicate a flat cross-section; thus the general attitude of the beds in this area is horizontal. There is no definite general dip shown on Traverse D (Plate 6), although there is a suggestion of a syncline along it. The true dip in this area appears to be north-westerly. These true dips suggest there is a syncline with its axis plunging northwards.

Although it has been stated that there is no major unconformity shown in the sediments down to 17,000 ft, it is obvious that some of the beds are not strictly conformable. On the cross-sections that show dip, there is an increase in dip with depth. In the following table, the component and true dips measured where Traverse B and D cross Traverse A are given for different depths.

Depth (ft)	Shot-point 61			Depth (ft)	Shot-point 102		
	Component Dip		True Dip		Component Dip		True Dip
	Trav. A	Trav. B			Trav. A	Trav. D	
2500	2.3° N83E	0° N7W	2.3°N83E				
8000	6.5° N83E	5° N7W	8.0°N46E	7000	1° N53W	0° N23E	1° N67W
14,000	3° N83E	11° N7W	11.5°N8E	14,000	6.5°N53W	0° N23E	7° N67W

Near Shot-point 61, the dips quoted at 2500 ft depth have been taken from a poor reflection which, however, can be correlated over a number of shot-points (the correlation is shown on Plate 2). Reflections from below this depth down to a depth of about 7000 ft are conformable; below about 7000 ft depth the dips are slightly, but definitely, greater. Near Shot-point 102, there appears to be a similar angular unconformity at about 8000 or 9000 ft depth. A thickness of 8000 ft for the Permian sediments along this traverse appears reasonable from the thicknesses measured in outcrop (see Geology), so it seems likely that this slight angular unconformity is at the base of the Permian.

As already mentioned, reflections were recorded from below 17,000 ft near Shot-points 61 and 102. The seismic records at these two shot-points were the best obtained in the area, and this was one reason for locating cross-traverses at these shot-points. The good shooting conditions, resulting in high-quality records, are most likely the reason why energy alignments can be recognised at longer reflection times than in other parts of the traverse. It seems probable that after some experimentation, reflections would have been generally recorded from below 17,000 ft. There is no definite evidence to suggest that these deeper reflections are multiples.

The deep reflections (more than 17,000 ft depth) below Shot-point 102 are approximately conformable with reflections immediately above them and continue to about 25,000 ft depth. From Shot-points 60,61, and 62, reflections of reasonable quality were recorded to 4.5 seconds. Only those to 3.5 seconds or 24,000 ft depth have been plotted on the cross-section (Plate 2), but the others would come from depths as great as 30,000 ft. They show a marked unconformity with the shallower reflections. Because of their dip the plotted reflections have been migrated to a region below Shot-points 55 to 58. The reflections plotted along Traverse A show an average dip to the east of 18 degrees; those along Traverse B show an average dip of about 6 degrees to the north, but they are of poorer quality and the dips are more scattered. These figures give a true dip of 19 degrees (N 65°E) compared with 11.5 degrees or less in the shallower sediments. There are indications that this dip is increasing rapidly to the west. On Traverse A, a reflection of fair quality at 23,000 ft depth below Shot-point 59 shows a dip of 8 degrees, whereas three poor-quality reflections at 17,000 and 19,000 ft depth on the west side of the main group average 28 degrees dip. These reflections may directly represent the basement structure, or they may represent sediments that reflect the basement structure. They suggest there is a basement 'high' west of Shot-point 55.

<u>Cross-section south-east of Middalya</u> (Plate 3)

Along the portion of Traverse A south-east of Middalya, reflections continue to 3.5 seconds, particularly at the south-east end of the line, and possibly they indicate a sedimentary thickness of about 24,000 ft. The reflections are generally fewer and of poor quality between Shot-points 132 and 140; east of Shot-point 140 they improve in both quantity and quality. This change is quite striking on the cross-section, and as surface geology has indicated a fault near Shot-point 140 which is possibly confirmed by the gravity results, one is tempted to conclude that the seismic results indicate that the fault continues through the whole thickness of sediments. However, a more likely reason for the change in the cross-section is a change in the surface conditions, a change that naturally would be expected to occur at the surface trace of the fault. The shot-hole drill logs indicate that the formations below the surface sand are more shaly on the south-eastern side of the fault where the record quality is better. Because of the poor correlation of the reflections, it is not possible to recognise faulting in the cross-section.

The dips of the reflections are not very consistent, but it appears that the cross-section is close to horizontal

4. CONCLUSIONS

Because no useful information was obtained from the seismic survey in the vicinity of Wandagee Hill, the existence of a shallow basement ridge below this area has not been proved. However, the results farther east have generally confirmed the gravity results, and suggest a basement ridge in the Wandagee Hill area. The main conclusions drawn from the seismic survey are:

(a) Between Wandagee Hill and Middalya, thickness of sediments is at least 17,000 ft. South-east of Middalya it may be as much as 24,000 ft. This is close to the deepest part of the cross-section as predicted from the gravity results.

(b) Five miles east of Wandagee Hill the sediments are thinning to the west. Some deep reflections (at 20,000 ft) probably indicate basement structure, either directly or indirectly, and they suggest that this thinning may be quite rapid. If this basement rise continues to the west, a basement depth of 6000 ft could be expected below the gravity 'high' four miles west of Wandagee Hill. There is some evidence that the basement may rise more rapidly towards the west, in which case its depth below the gravity 'high' would be less than 6000 ft. The presumed basement dip measured, (average of 19 degrees and increasing to the west) appears sufficient to support Condon's suggestion of an abutment unconformity below Wandagee Hill.

(c) The west dip indicated five miles west of Middalya appears to conflict with the general conclusion of thickening sediments to the east. However, this could be related to the fault that is four miles east of Middalya. This fault is indicated both by surface geology and by gravity results, and is apparently a major one with a large up-throw to the west. Thus there could be a syncline west of this fault as is indicated by the seismic results.

5. REFERENCES

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CONDON, M.A.	1955	Personal communication.
CHAMBERLAIN, N.G., DOOLEY, J.C., and VALE, K.R.	1954	Geophysical exploration in the Carnarvon (N.W.) Basin, W.A. Bur. Min. Resour. Aust. Rec. 1954/44.
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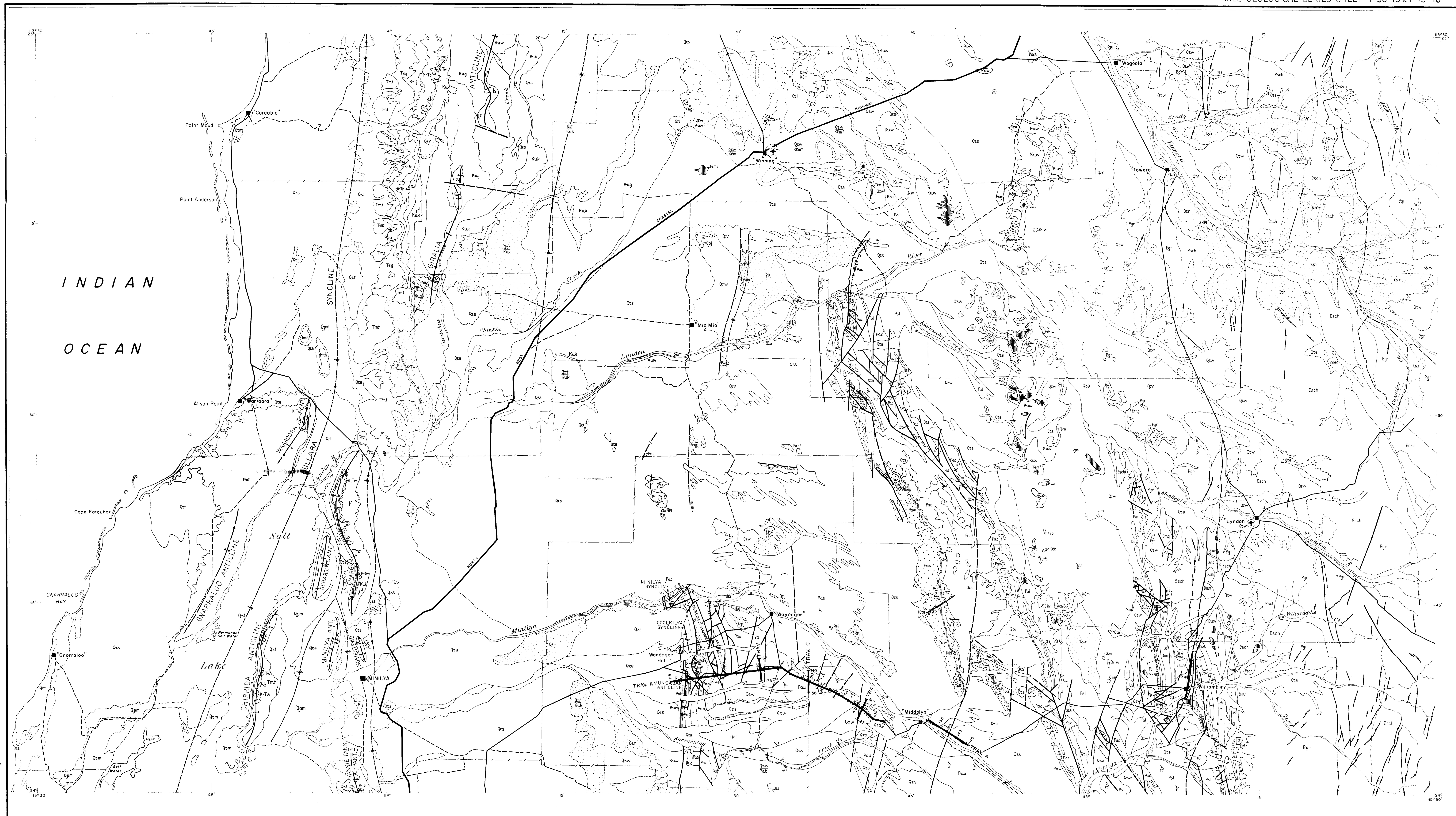
MINILYA

WESTERN AUSTRALIA

4 MILE GEOLOGICAL SERIES SHEET F50-13 & F49-16

FIRST EDITION APRIL 1954

PLATE 1



Reference

QUATERNARY	RECENT	Alluvium	Qra	Sand, clay, gravel
		Sand	Qrs	Sand, red & white
		Wash	Qrw	Gravel, sand
		Residual Soil	Qrr	Clay, sand
		Marine Deposits	Qrm	Shell beds, sand, calcarenite
		Lake Deposits	Qrl	Clay, evaporites
		Travertine	Qrt	Sandy banded limestone
	PLEISTOCENE	Marine Deposits	Qpm	Coquinoid calcarenite
		Joolabroo Formation	Qpj	Sand, gravel, travertine
		Sand	Qps	Red sand
TERTIARY	MIOCENE	Trealla Limestone	Tmt	Fossiliferous hard limestone
				Laterite
	EOCENE	Merlinleigh Sandstone	Tem	Quartz sandstone
		Giralia Calcarenite	Teg	Ferruginous calcarenite
CRETACEOUS-TERTIARY	DANIAN	Cardabia Group: Jubilee Calcarenite	K-Tj	Calcarenite
		Cashin Calcarenite	K-Tc	Calcarenite
		Pirie Calcarenite	K-Tp	Calcarenite, friable
		Wadera Calcarenite	K-Tw	Calcarenite, hard & friable
CRETACEOUS	UPPER	Korojon Calcarenite	Kuk	Coquinoid calcarenite
		Winning Group: Gearle Siltstone	Kug	Bentonitic siltstone
		Windalia Radiolarite	Kuw	Radiolarite & chert
	LOWER	Muderong Shale	Klm	Bentonitic shale
		Birdrong Formation	Klb	Sandstone, glauconitic sandstone & greensand
PERMIAN	ARTINSKIAN	Kennedy Group: Binthalya Subgroup	Pat	Quartz greywacke & quartz sandstone
		Mungadan Sandstone	Pas	Quartz sandstone
		Coolkilya Greywacke	Pal	Quartz greywacke
		Byro Group: Baker Formation	Pak	Siltstone & quartz greywacke
		Norton Greywacke	Pan	Quartz greywacke
		Wandagee Formation	Pag	Siltstone & quartz greywacke
		Quinnanie Shale	Paq	Carbonaceous shale
		Cundlego Formation	Pau	Quartz greywacke, some calcareous, & siltstone
		Bulgadoo Shale	Pab	Carbonaceous shale
		Mallens Greywacke	Pam	Quartz greywacke
		Coyrie Formation	Par	Siltstone & quartz greywacke
		Wooramel Sandstone	Paw	Quartz sandstone
		Cordalia Greywacke	Pad	Quartz greywacke, some calcareous
		Callytharra Formation	Pac	Calcarenaceous greywacke, siltstone & limestone
	SAKMARIAN	Lyons Group	Psl	Marine glacial sediments, quartz greywacke & varved siltstone
		Harris Sandstone	Psh	Quartz sandstone
CARBONIFEROUS	? UPPER	Yindagindy Formation	Cuy	Greywacke & oolitic limestone
		Williambury Formation	Cuw	Greywacke & pebble conglomerate, siltstone
	LOWER	Moogooree Limestone	Clm	Hard limestone, some siliceous
DEVONIAN	UPPER	Willaraddie Formation	Duw	Greywacke, siltstone, conglomerate & thin limestone
		Munabia Sandstone	Dum	Quartz sandstone
	MIDDLE	Gneudna Formation	Dmg	Greywacke, limestone & siltstone
		Nannyarra Greywacke	Dmn	Greywacke & siltstone
PROTEROZOIC ?		Sediments	Psed	Quartzite, limestone, slate & greywacke
		Granite	Pgr	Granitic rocks
		Schist	Psch	Mica schist, talc schist, etc.

Highway
Mail Road
Vehicle track
Homestead
Aerodrome
Boundary fence
Lake intermittent
Swamp
Coral reef
Seismic traverse

Geological boundaries
Established boundary, position accurate
Established boundary, position approximate

Strike and dip of strata
20 Inclined
Established anticlinal crest - position accurate
Established anticlinal crest - position approximate
Established synclinal trough - position accurate
Established synclinal trough - position approximate
(showing direction of plunge)
Dyke

Faults
D/U Established fault - position accurate (showing dip of fault plane and up and downthrown blocks)
Established fault - position approximate
? Inferred fault
Type sections of formation
Pac Significant small outcrop (position shown by centre of symbol)

Compiled by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Topographic base compiled by the Lands and Survey Department, Western Australia, from air photographs. Air photography, complete vertical coverage at 1:50,000 scale by the Royal Australian Air Force. Printed for the Bureau of Mineral Resources by the Royal Australian Survey Corps. Transverse Mercator Projection.

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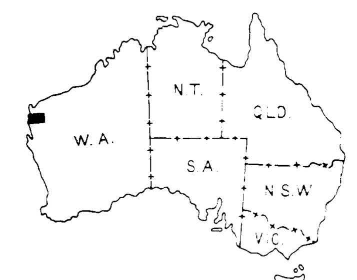

INDEX TO ADJOINING SHEETS
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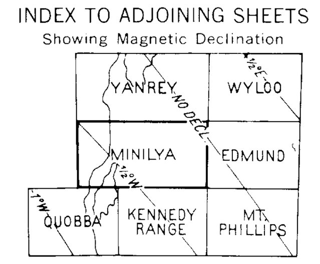

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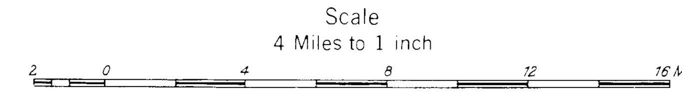
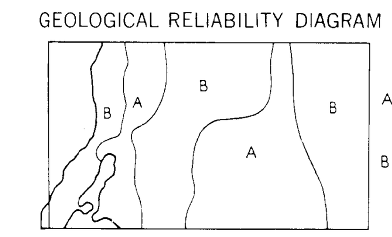


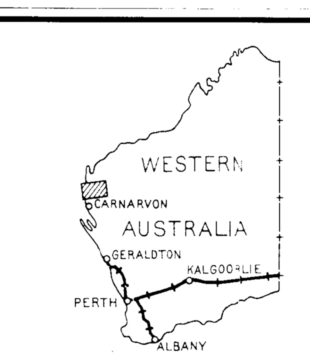
WANDAGEE HILL - MIDDALYA AREA, CARNARVON BASIN, W.A., 1955
SEISMIC REFLECTION SURVEY

LOCATION OF SEISMIC TRAVERSES IN RELATION TO SURFACE GEOLOGY

GEOLOGICAL RELIABILITY DIAGRAM



A Detailed reconnaissance using air photos
B Very few traverses, mainly photo - interpretation



Geology by: M. A. Condon, D. Johnstone, C. E. Prichard, M. H. Johnstone, G. A. Thomas, W. J. Perry, J. G. Best.

Compiled by: M. A. Condon.

Drawn by: H. F. Joechel.

To accompany Record No. 1962/117

G 98-42

DEPTH SCALE.
1" = 1000'
DATUM LEVEL
DRILL LOGS
NO REFLECTIONS
NOT SHOT
SURFACE ELEVATION.
FIRST BREAK VELOCITIES
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
15000
16000
17000
18000
19000
20000
21000
22000
23000


PLATE 2
WEST ⟵ ⟶ EAST
SURFACE ELEVATION
BASE OF WEATHERING LAYER
DATUM LEVEL
DRILL LOGS
DEPTH (FEET)
FIRST BREAK VELOCITIES
LEGEND
GOOD
FAIR
POOR
REFLECTION ACCURACY
UNCERTAIN REFLECTION
REFLECTION GRADE (GABY 1947)
REFLECTION TIME CORRECTED TO DATUM
TANGENT OF DIP ANGLE
WANDAGEE HILL – MIDDALYA AREA
CARNARVON BASIN, W.A.
SEISMIC REFLECTION SURVEY
TRAVERSE A, DIP PLOTTING
(REFLECTIONS MIGRATED AND PLOTTED IN APPARENT CORRECT POSITION)
12000'/sec
11000'/sec
10000'/sec
9000'/sec
HORIZONTAL AND VERTICAL SCALES IN FEET
1000 0 1000 2000 3000 4000
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
G 98–44
To accompany Record No. 1962/117

PLATE 3

To accompany Record No. 1962/117

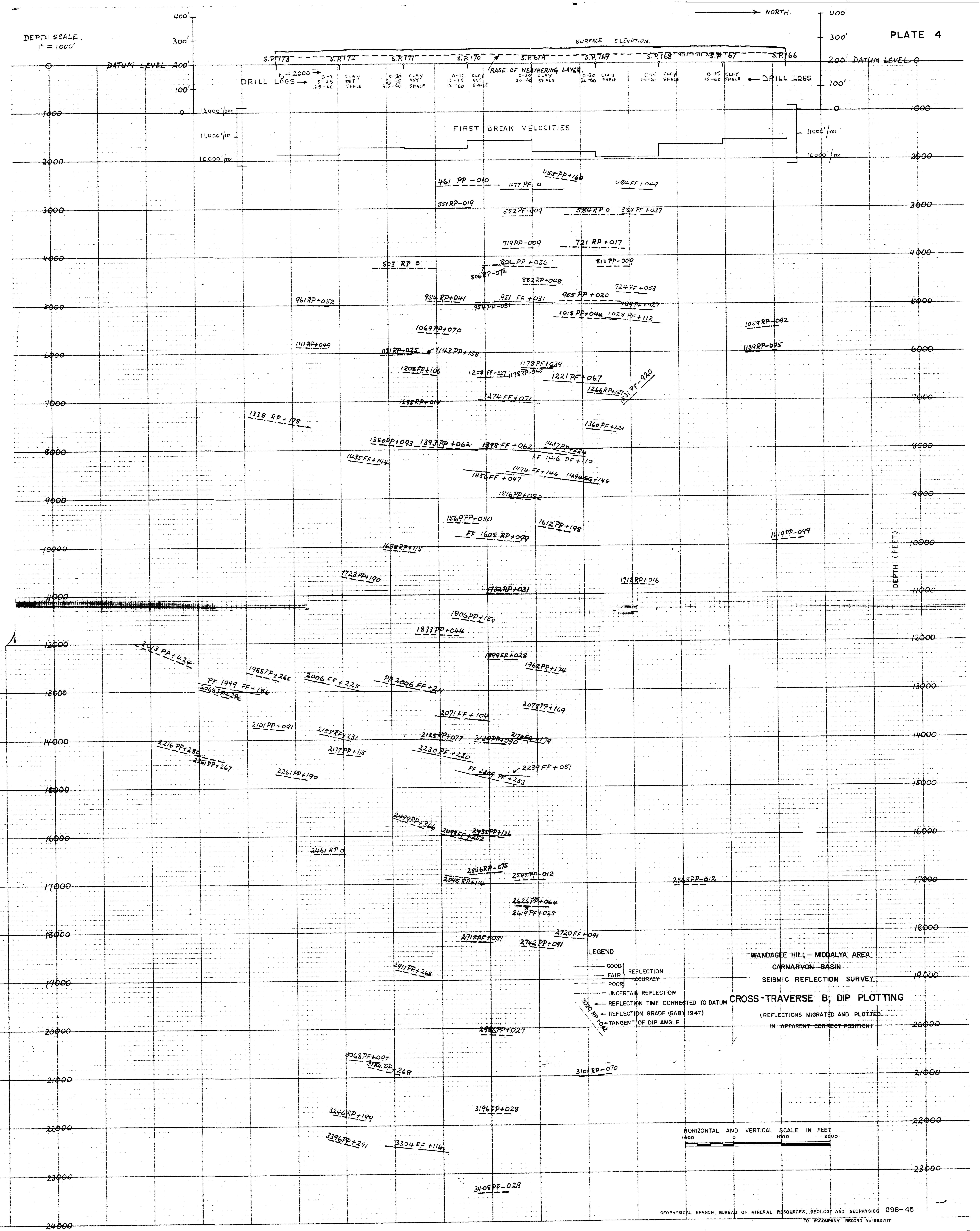


PLATE 4
DEPTH SCALE. 1" = 1000'
NORTH.
DATUM LEVEL 200'
SURFACE ELEVATION.
S.P.173
S.P.174
S.P.171
S.P.170
S.P.61A
S.P.169
S.P.168
S.P.167
S.P.166
BASE OF WEATHERING LAYER.
DRILL LOGS
FIRST BREAK VELOCITIES
12,000'/sec
11,000'/sec
10,000'/sec
DEPTH (FEET)
LEGEND
GOOD
FAIR
POOR
REFLECTION ACCURACY
UNCERTAIN REFLECTION
REFLECTION TIME CORRECTED TO DATUM
REFLECTION GRADE (GABY 1947)
TANGENT OF DIP ANGLE
WANDAGEE HILL – MIDDALYA AREA
CARNARVON BASIN
SEISMIC REFLECTION SURVEY
CROSS-TRAVERSE B, DIP PLOTTING
(REFLECTIONS MIGRATED AND PLOTTED IN APPARENT CORRECT POSITION)
HORIZONTAL AND VERTICAL SCALE IN FEET
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS G98-45
TO ACCOMPANY RECORD No 1962/117

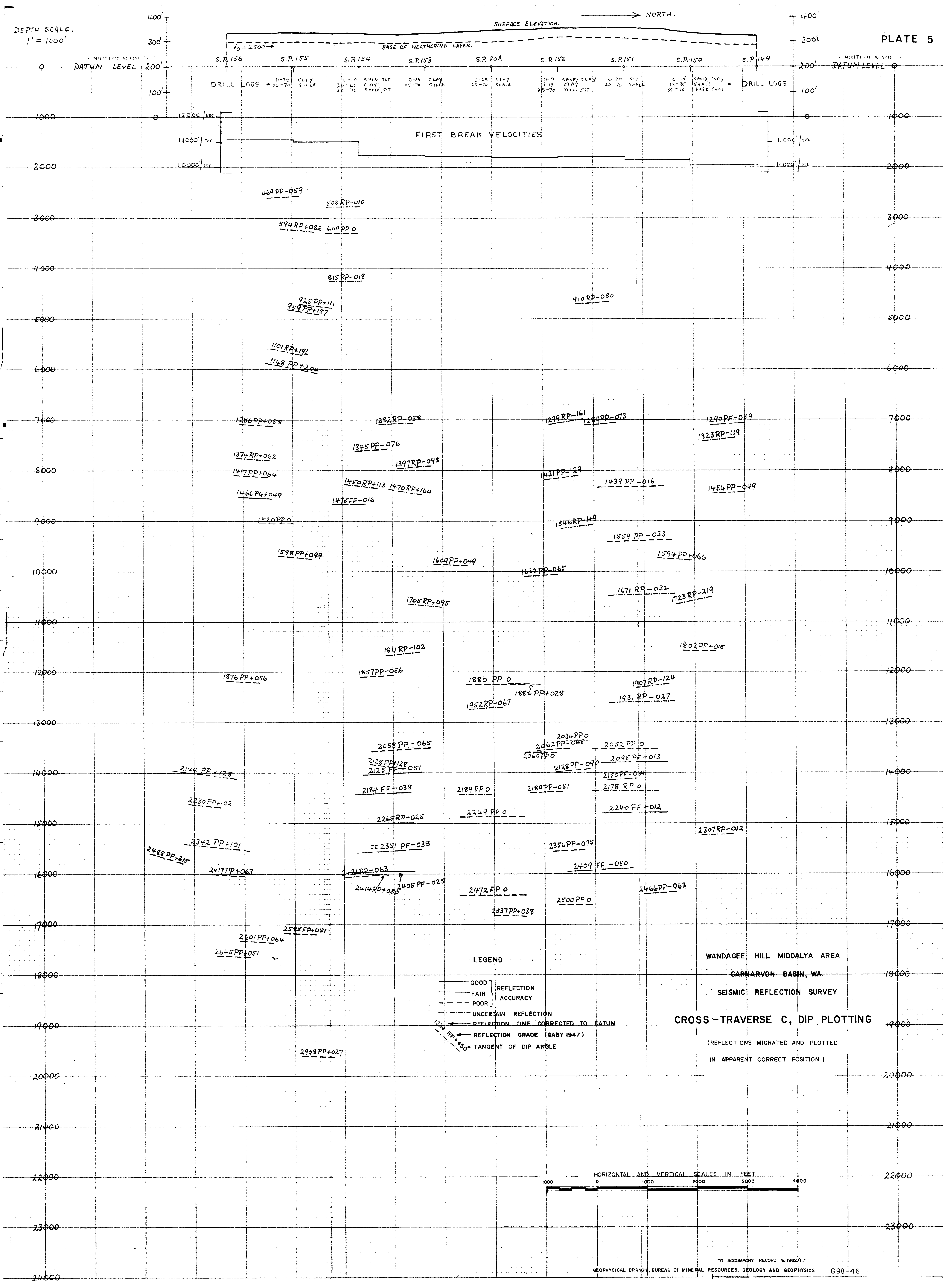
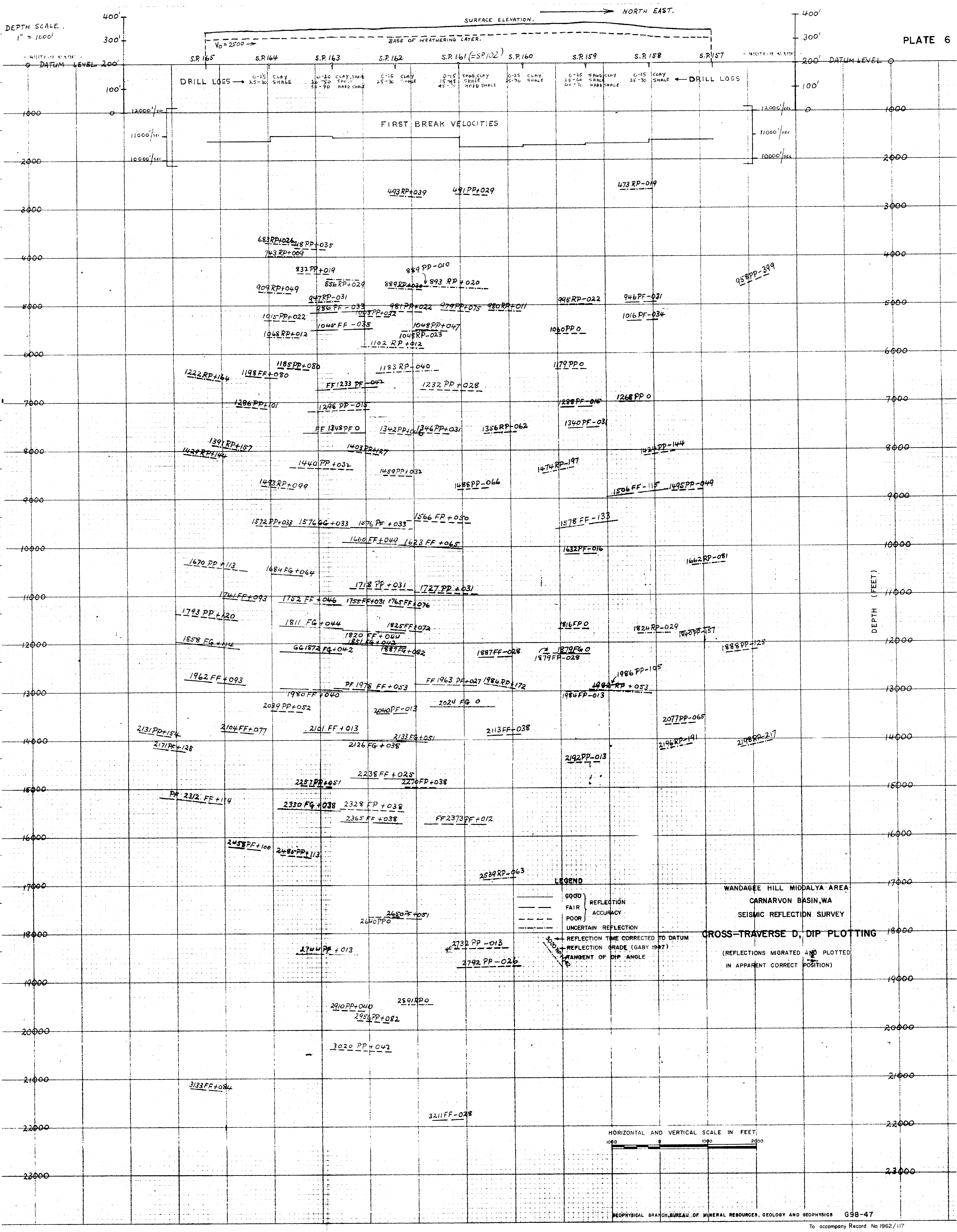


PLATE 5
DEPTH SCALE. 1" = 1000'
NORTH.
SURFACE ELEVATION.
BASE OF WEATHERING LAYER.
DATUM LEVEL
S.P. 156
S.P. 155
S.P. 154
S.P. 153
S.P. 80A
S.P. 152
S.P. 151
S.P. 150
S.P. 149
DRILL LOGS
FIRST BREAK VELOCITIES
LEGEND
GOOD
FAIR
POOR
REFLECTION ACCURACY
UNCERTAIN REFLECTION
REFLECTION TIME CORRECTED TO DATUM
REFLECTION GRADE (GABY 1947)
TANGENT OF DIP ANGLE
WANDAGEE HILL MIDDALYA AREA
CARNARVON BASIN, WA.
SEISMIC REFLECTION SURVEY
CROSS-TRAVERSE C, DIP PLOTTING
(REFLECTIONS MIGRATED AND PLOTTED IN APPARENT CORRECT POSITION)
HORIZONTAL AND VERTICAL SCALES IN FEET
TO ACCOMPANY RECORD No 1962/117
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
G98-46

PLATE 6



To accompany Record No. 1962/117

LEGEND

T	Tertiary
K	Cretaceous
P (Permian): Pab	Byro Group
P (Permian): Pac	Callytharra Formation
P (Permian): Psl	Lyons Group
C&D	Carboniferous & Devonian
C	Carboniferous
D	Devonian
pC	PRE CAMBRIAN

NOTE: *The geological section shown with the gravity profile is not intended as strict interpretation of the gravity results. It is based mainly on the geological report (Rec. 1954/36), but has been modified to conform with gravity and seismic information. The modifications are not necessarily the correct interpretation, but should be regarded as suggestions.*

HORIZONTAL SCALE IN MILES

2 0 2 4 6 8

CARNARVON BASIN

DETAILED GRAVITY SURVEY

WANDAGEE HILL TO WILLIAMBURY

GRAVITY AND GEOLOGICAL CROSS — SECTION WITH SEISMIC TRAVERSES

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G98-19-1

To accompany record No. 1962/117.