

COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Petroleum Search Subsidy Acts

PUBLICATION No. 50

**SUMMARY OF DATA AND RESULTS
CARNARVON BASIN, WESTERN AUSTRALIA**

**Wandagee Ridge Seismic Survey
Salt Marsh Seismic Survey**

OF

WEST AUSTRALIAN PETROLEUM PTY LIMITED

*Issued under the Authority of the Hon. David Fairbairn
Minister for National Development*

1964
76

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

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THIS REPORT WAS PREPARED FOR PUBLICATION IN THE PETROLEUM EXPLORATION BRANCH

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Canberra A.C.T.*

FOREWORD

Under the Petroleum Search Subsidy Act 1959, agreements relating to subsidized operations provided that the information obtained may be published by the Commonwealth Government twelve months after the completion of field work.

The growth of the exploration effort has greatly increased the number of subsidized projects and this increase has led to delays in publishing the results of operations.

The detailed results of subsidized operations may be examined at the offices of the Bureau of Mineral Resources in Canberra and Melbourne (after the agreed period) and copies of the reports may be purchased.

In order to make the main results of operations available early, short summaries are being prepared for publication. These will be grouped by area and date of completion as far as practicable. Drilling projects and geophysical projects will be grouped separately. In due course, full reports will be published concerning those operations which have produced the more important new data.

This Publication contains summaries of data and results of two geophysical operations undertaken in the Carnarvon Basin, Western Australia: Wandagee Ridge Seismic Survey, and Salt Marsh Seismic Survey. The information has been abstracted by the Petroleum Exploration Branch of the Bureau of Mineral Resources from final reports furnished by West Australian Petroleum Pty Limited.

J.M. RAYNER
DIRECTOR

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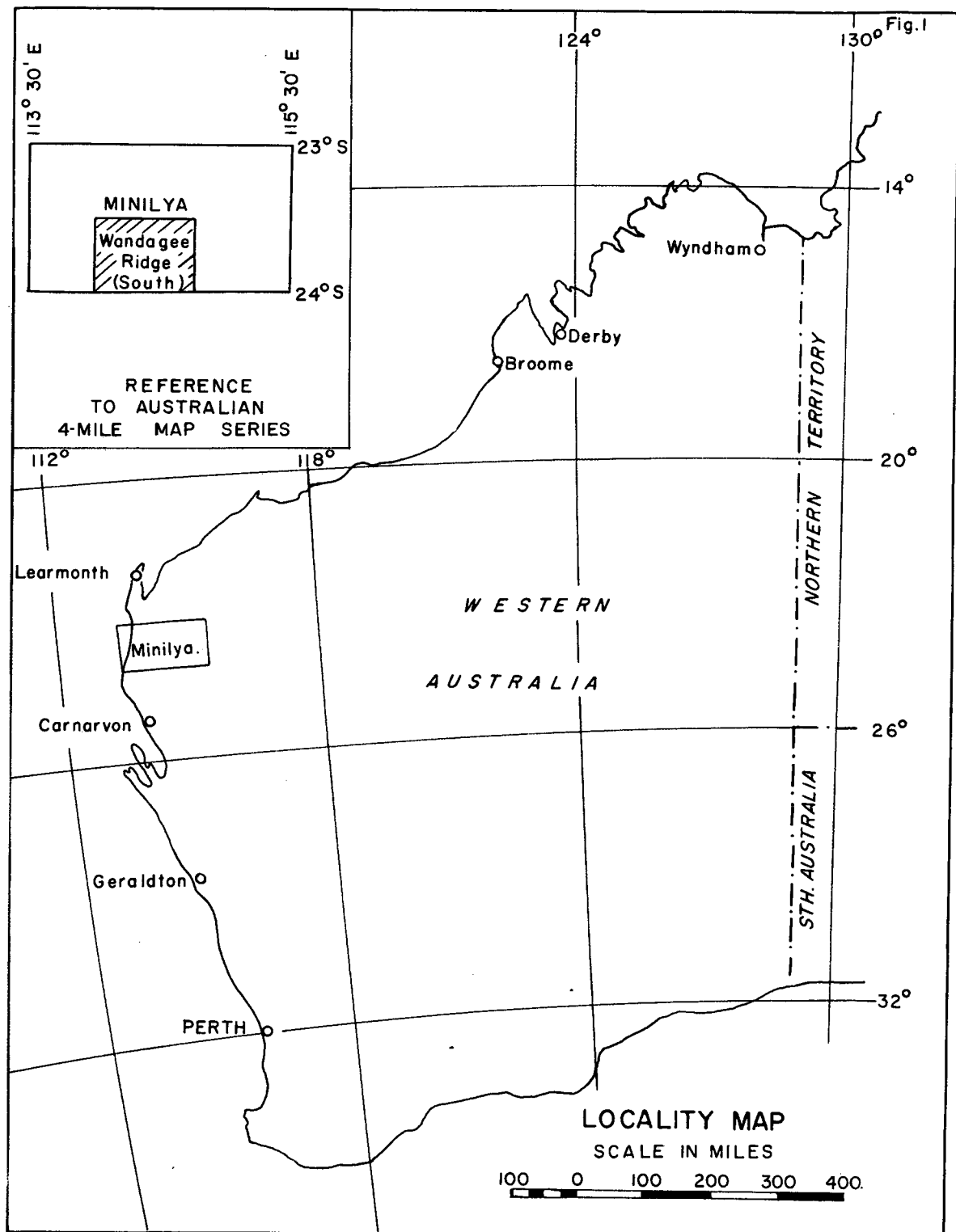
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WANDAGEE RIDGE SEISMIC SURVEY

by

WEST AUSTRALIAN PETROLEUM PTY LIMITED

SUMMARY OF DATA AND RESULTS



WANDAGEE RIDGE SEISMIC SURVEY

SUMMARY OF DATA AND RESULTS *

SUMMARY

A reconnaissance seismograph survey of the Wandagee area of the Carnarvon Basin (see Figs 1, 2) was carried out by Geophysical Service International, Party 621, for West Australian Petroleum Pty Limited between November, 1961 and February, 1962. The project area falls within Permit to Explore 28H.

The survey was designed to map the structure and the stratigraphy of the Wandagee Ridge (South) area of the Carnarvon Basin. The survey commenced on 9th November, 1961, and terminated on 7th February, 1962, after covering 115 1/2 miles of reflection traverse and 33 1/3 miles of refraction traverse.

The results of these reflection and refraction surveys were combined with other geophysical data to produce an overall interpretation.

There are two distinct areas of interest separated by the Wandagee Fault. The Wandagee Fault is a large down-to-the-east normal fault in the pre-Cretaceous section, with reverse movement occurring later than the Cretaceous. Devonian rocks are present at shallow depth on the west side of the fault, but there are probably 10,000 feet of Permian on the east side.

East of the Wandagee Fault the north-south trending Quail Anticline was partly delineated. It is suggested that this anticline closes in Permian and perhaps in Carboniferous-Devonian horizons.

The geophysical operation undertaken in the Wandagee Ridge area, Carnarvon Basin, Western Australia, was subsidized under the Petroleum Search Subsidy Act 1959.

* Abstracted from Final Report "Wandagee Ridge (South) Seismic Reconnaissance - Project No. 78, December, 1961 - February, 1962," by R.G. Dennison, West Australian Petroleum Pty Limited, and J.W. Warwick, Geophysical Service International.

METHODS OF OPERATION

General Data

Operator:	West Australian Petroleum Pty Limited, 251 Adelaide Terrace, Perth, W.A.
Contractor:	Geophysical Service International, S.A. (Party 621)
Location:	Wandagee and Minilya region, centred about 110 miles north-north-east of Carnarvon, W.A.
Basin:	Carnarvon
Tenement Holder:	West Australian Petroleum Pty Limited
Details of Tenement:	Permit to Explore 28H.

Field Operations

Date survey commenced: 9th November, 1961

Date survey completed: 7th February, 1962

	<u>Reflection</u>	<u>Refraction</u>
Total time spent on project (hours):	537.75	96.75
Recording time (hours):	376.00	80.50
Travel time (hours):	62.50	11.50
Time lost because of weather (hours):	25.00	0.75
Other time lost (hours):	74.25	4.00
Coverage (miles):	115.50	33.34
No. of profiles:	489	82
No. of holes drilled:	6,980	99
Footage drilled:	154,570	8,885
Drilling rate (ft/hr):	120.3	31.5
No. of shots fired:	587	84
Explosives used (lb.):	120,103	18,703
No. of structure holes drilled:	3	
Total footage of structure holes:	3,104	

Equipment

General:

Drills:	3 Mayhew-1000 air-water combination rotary drilling rigs, mounted on three I.H.C. Model R-190 trucks
Shooting:	1 Bedford 4 x 4 truck
Recording:	1 Bedford 4 x 4 truck
Surveying:	1 I.H.C. R-120 pick-up
Cable truck:	1 I.H.C. R-120 pick-up
Party Chief:	1 I.H.C. R-120 pick-up
Water trucks:	3 I.H.C. R-190 trucks
Caravans:	2 Office 1 Kitchen 1 Mechanics shop
Bulldozer:	1 D-6 Caterpillar

Recording:

Amplifiers:	24-Channel T.I. Series 7000 KB amplifiers
Cameras:	Oscillograph T.I. RS8U and SIE-TRO-6
Magnetic recorder:	Tape Recorder Techno ATC (moveable head)
Cables:	3 - 1500-foot cables, portable 3 - 1500-foot cables, heavy duty 10 - Refraction cables, 500-foot intervals
Geophones:	24 - Dayton 4.5 cps seismometers 3 - Time break radios 432 - Electrotech S-32, 27 cps, geophones.

GEOLOGY

General

Geological surface mapping of the Wandagee area shows Cretaceous and post-Cretaceous rocks blanketing the surface west of the major north-south trending Wandagee Fault. Permian is exposed throughout the area east of the fault with the exception of small isolated patches of Cretaceous and Quaternary cover. Numerous surface faults are seen in the Permian, mostly trending in a north-south direction (see Fig. 2).

Stratigraphy

The Palaeozoic stratigraphic section in the Wandagee area is based on the out-crop section 50 miles east and is as follows :

<u>Age</u>	<u>Name</u>	<u>Thickness</u> (feet)	<u>Lithology</u>	<u>Remarks</u>
	Byro Group	4200	Dark siltstone, shale, dirty sandstone, rare calcareous bed	Exposed at surface. Weak oil source potential (1)
PERMIAN				
	Wooramel Group	700-1000	Sandstone, shale, and siltstone	Good porosity
	Callytharra Formation	500- 700	Limestone, siltstone, greywacke	(2)
	Lyons Group	4600	Tillite, sandstone, siltstone	Varies greatly in thickness (3)
UNCONFORMITY				
CARBONIF- EROUS - DEVONIAN		7200 ⁺	Sandstone, limestone, dolomite, conglomerate, and siltstone	Primary objective. Source and reservoir potential
	Dirk Hartog Limestone	?	Limestone, siltstone, sandstone	Source and reservoir potential
SILURIAN				
	Tumblagooda Sandstone	0-4000	Porous feldspathic sandstone and siltstone, often red	Good porosity. Not present on eastern margin of basin
PRE- CAMBRIAN			Sediments, metamorphics, and igneous rocks	

(1) Footnote by Bureau of Mineral Resources:

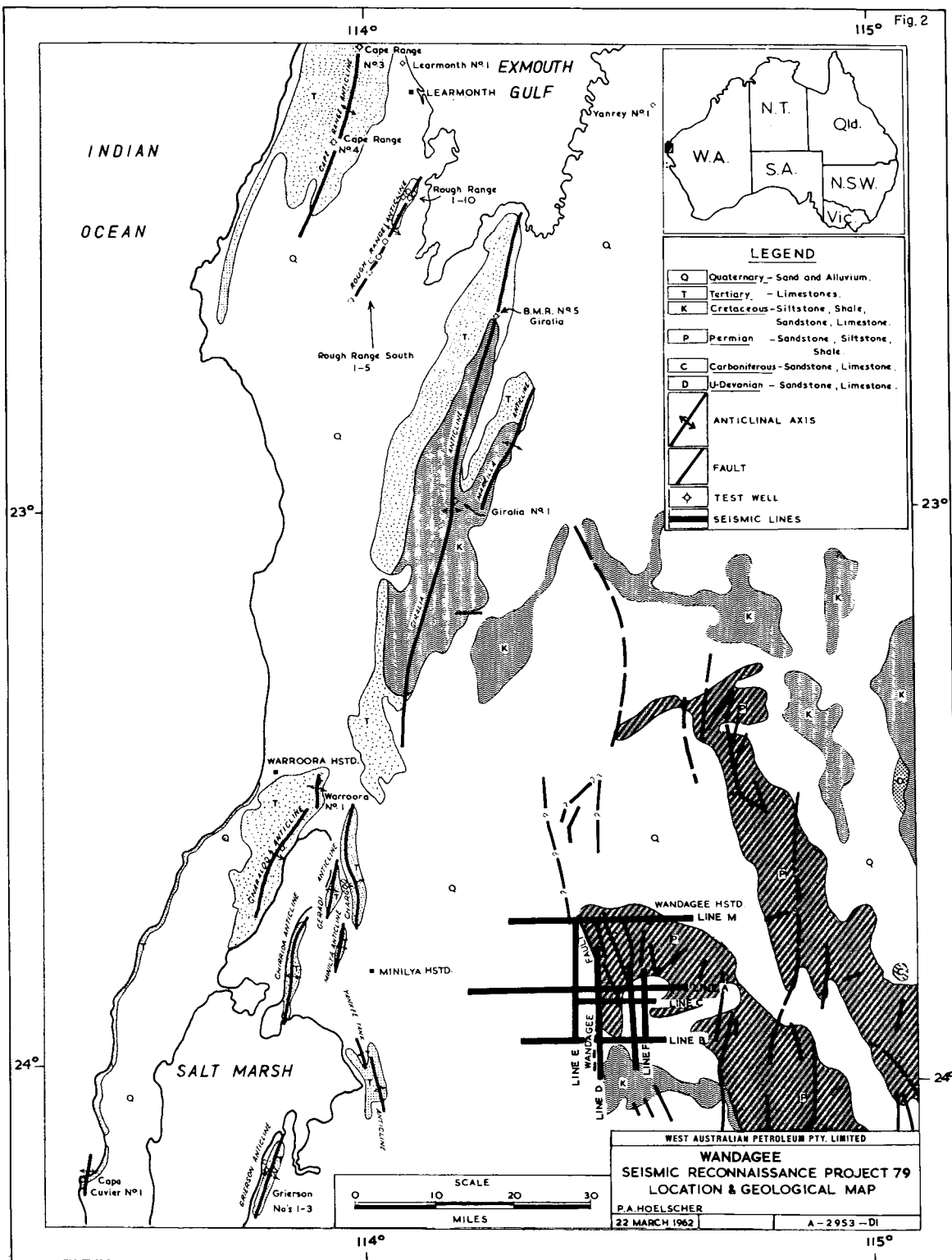
The Byro Group includes some formations of moderate porosity that in favourable positions may form reservoirs.

(2) Footnote by Bureau of Mineral Resources:

The Callytharra Formation has good source potential particularly in its basinward development, as in BMR, No. 9 (Daurie Creek).

(3) Footnote by Bureau of Mineral Resources:

The Lyons Group includes marine shale and limestone, and porous sandstone; it must be considered to have moderate source and reservoir potential.



RESULTS

Wandagee Fault

The results of the survey clearly show the Wandagee Fault as a large normal fault, downthrown to the east in pre-Cretaceous section. The vertical displacement of this fault in the Palaeozoic is at least 5000 feet, and could be in excess of 10,000 feet. In as much as Cretaceous lies against Permian on the surface, reverse fault movement has occurred in post-Cretaceous time. Similar reverse movement has been dated post-Miocene in the Rough Range area.

The Wandagee Fault divides the area into two separate geological prospects.

(i) West of Wandagee Fault:

A total of 193 reflection shotpoints (48 miles) and one refraction line of 21 shots constitute the current seismic work done west of the Wandagee Fault, excluding the Salt Marsh area.

Two reflection horizons were mapped in the area: (a) the basal Cretaceous which is identified by core holes and (b) an unidentified reflection of Silurian age.* These horizons indicated gentle west dip in the basal Cretaceous and steeper dip in the Palaeozoic section.

Two core holes were drilled as a part of this seismic survey by one of the portable shot-hole drills as an aid to stratigraphic identification. The core holes substantiated a Carboniferous-Devonian section at shallow depth.

The refraction programme was designed to investigate refractors at the location of Core Hole No. 1, (S.P. 258, Line A); three refractors were mapped.

A stratigraphic hole, located at Core Hole No. 1, was recommended on the basis of this survey. Wandagee No. 1 Well was drilled to the total depth of 3521 feet during April - June, 1962. Traces of gas were observed in the basal part of the marine siltstone unit (3070-3098 feet) in the Tumblagooda Sandstone. No other hydrocarbons were present in the penetrated well section (Pudovskis, 1962).

(ii) East of Wandagee Fault:

The geophysical work on the east side of the Wandagee Fault included 62 miles of reflection work and two refraction lines totalling 63 shots. The deepest reliable horizon mapped (Pl. 3) is believed to represent reflections from the Callytharra Formation of Permian age. Reflections below this event are difficult to detect; however a form line picture of the deeper events has been attempted (Pl. 4).

The Callytharra map (Pl. 2) shows a large anticlinal axis plunging to the north; this has been named the Quail Anticline.

* This horizon was thought to be Devonian when the seismic work was done but the Wandagee No. 1 Well showed it to be Silurian.

The two refraction lines were shot in a north-south direction; three refractors were mapped.

Core Hole No. 2, located at S.P. 291, Line A, was drilled in this area to the total depth of 1013 feet in the Permian Byro Group.

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| PUDOVSKIS, V., | 1961: | The Lower Cretaceous in Cape Range wells. <u>Unpubl. report for West Australian Petroleum Pty Limited.</u> |
| PUDOVSKIS, V., | 1962: | Wandagee No. 1 Well Completion Report. <u>Unpubl. report for West Australian Petroleum Pty Limited.</u> |

ADDITIONAL DATA FILED IN THE BUREAU OF MINERAL RESOURCES

The following additional data relating to the Wandagee Ridge Seismic Survey have been filed in the Bureau of Mineral Resources, Canberra, and are available for reference:

- | | |
|--|-------|
| (i) Final Report | 7 pp. |
| Appendix 1 : Details of seismic reconnaissance survey | 8 pp. |
| Appendix 2 : Details of gravity survey | 3 pp. |
| Table 1 : Statistical data | 1 p. |
| Table 2 : Personnel and equipment | 1 p. |
| (ii) List of illustrations in Final Report | |
| Plates 1 : Locality map | |
| 2 : Spread arrangement for continuous correlation | |
| 3 : Shothole configuration and seismometer array | |
| 4 : Typical response curves of filters | |
| 5 : Details of velocity cam | |
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| 7 : Composite of Wandagee area maps, B-3037 | |

Enclosures:

- | | |
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| 1 : | Surface geology - Wandagee Area, C-2898 |
| 4 : | Structural contours on |
| | (i) Callytharra (Permian) east of Wandagee Fault; |
| | (ii) Dirk Hartog Limestone (Silurian) west of Wandagee Fault, C-3017 |

- 5 : Structural contours on basal Cretaceous,
C-3019
- 6 : Approximate Basement configuration,
C-3020
- 7 : Relative amplitude response curves for
shot hole pattern and seismometer arrays
- 8 : Integration of reflection and refraction data,
Line D
- 9 : Uphole velocity surveys
- 10 : T-delta-t analysis, Line D
- 11 : Velocity profile, Line F
- 12 : Noise analysis, Line A
- Also : Migrated depth cross-sections (Reflection).
Refraction time - distance plots and depth
sections.

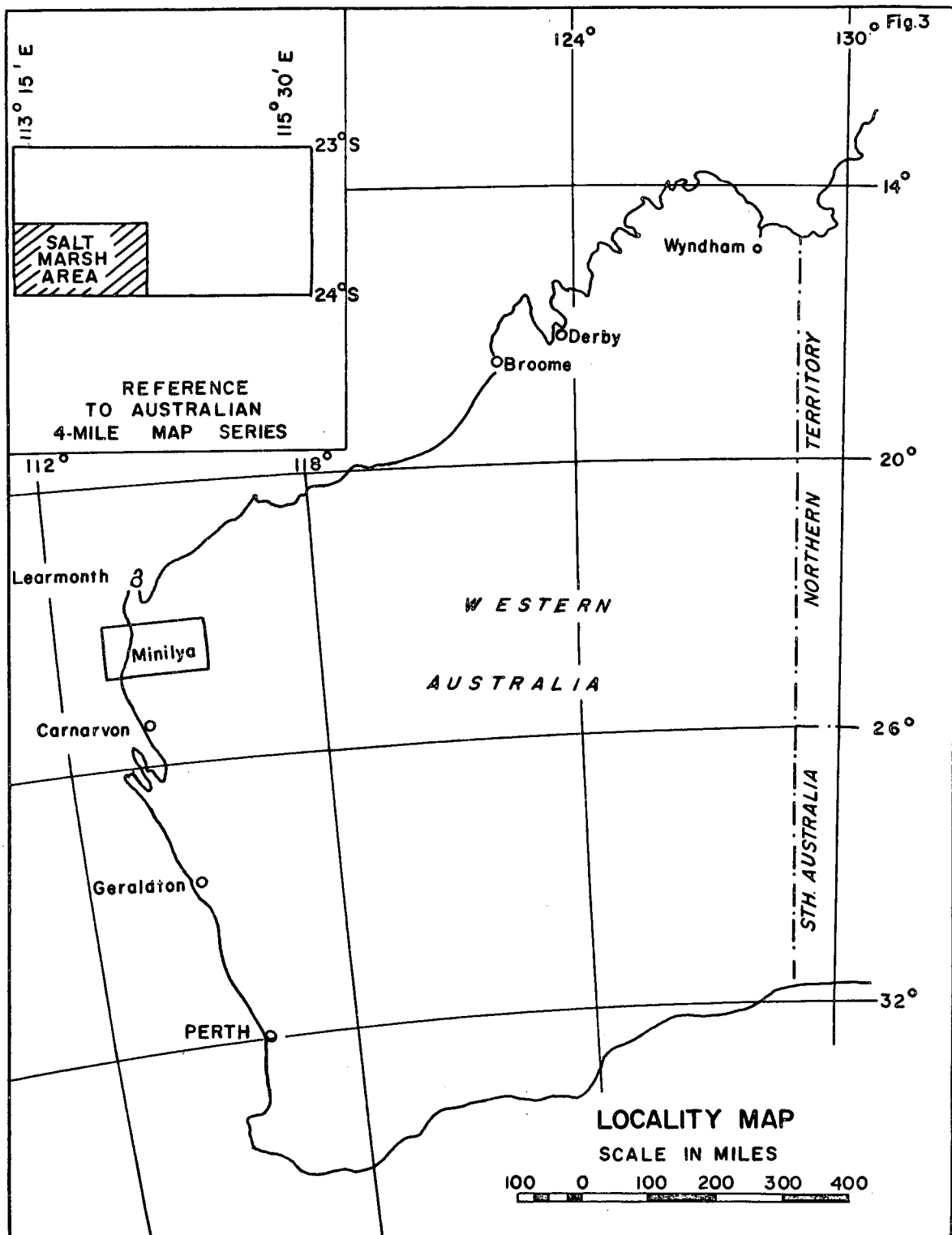
- (iii) Drillers' logs
- (iv) Surveyors' notebooks
- (v) Recorder's field sheets
- (vi) Variable area record sections

SALT MARSH SEISMIC SURVEY

by

WEST AUSTRALIAN PETROLEUM PTY LIMITED

SUMMARY OF DATA AND RESULTS



SALT MARSH SEISMIC SURVEY

SUMMARY OF DATA AND RESULTS *

SUMMARY

A reconnaissance seismograph survey of the Salt Marsh area of the Carnarvon Basin (see Figs 3, 4) was conducted by Geophysical Service International, Parties 621 and 622, for West Australian Petroleum Pty Limited between November, 1961 and February, 1962. The project area falls within Permit to Explore 28H.

The objective of the survey was to obtain information on the regional structure and stratigraphy of the Salt Marsh area of the Carnarvon Basin by reflection and refraction methods. A specific object was to determine the value of refraction methods in mapping high velocity Palaeozoic carbonates or basement. The survey commenced on 19th November, 1961, and terminated on 26th February, 1962, after covering 74 1/4 miles of reflection traverse and 37 1/2 miles of refraction traverse.

The survey showed that refraction methods were successful in the Salt Marsh area. Shallow Palaeozoic refractors (13,500 ft/sec. and 15,500 ft/sec.) can be followed, while a refractor of 20,500 ft/sec., thought to be a Carboniferous limestone, provides the probable limit to the penetration of refracted waves. Reflection technique is sometimes limited because of interference from multiple reflections.

As a result of the reconnaissance survey, it is concluded that in the Salt Marsh area, the anticlines which are manifested at the surface by Tertiary and Cretaceous structures, are underlain by tilted Palaeozoic fault blocks.

The Salt Marsh seismic survey in the Carnarvon Basin, Western Australia, was subsidized under the Petroleum Search Subsidy Act 1959.

* Abstracted from Final Report "Salt Marsh Seismic Reconnaissance - Project No. 79, Carnarvon Basin, W.A.," by P.A. Hoelscher, West Australian Petroleum Pty Limited, and J.W. Warwick and P.H. Hunnicutt, Geophysical Service International.

METHODS OF OPERATION

General Data

Operator:	West Australian Petroleum Pty Limited, 251 Adelaide Terrace, Perth, W.A.
Contractor:	Geophysical Service International, S.A. (Parties 621 and 622)
Location:	Northern end of the Salt Marsh, mid-way between Carnarvon and Learmonth and about 70 miles south of Exmouth Gulf.
Basin:	Carnarvon
Tenement Holder:	West Australian Petroleum Pty Limited
Details of Tenement:	Permit to Explore 28H.

Field Operations

Date survey commenced:	19th November, 1961	
Date survey completed:	26th February, 1962	
	<u>Reflection</u>	<u>Refraction</u>
Total time spent on project (hours):	493.50	106.50
Recording time (hours):	320.00	84.50
Travel time (hours):	62.75	22.00
Time lost because of weather (hours):	2.00	0.00
Other time lost (hours):	108.75	0.00
Coverage (miles):	74.25	37.50
No. of profiles:	307	57
No. of holes drilled:	4,772	95
Footage drilled:	96,930	6,575
No. of shots fired:	359	62
Explosives used (lb.):	77,750	19,654
Average shot-size (lb.):	216.6	317.0

Equipment

General:

Drills:	3 Mayhew-1000 air-water combination rotary drilling rigs, mounted on three I.H.C. Model R-190 trucks
Shooting:	1 Bedford 4 x 4 truck
Recording:	1 Bedford 4 x 4 truck

Surveying:	1 I.H.C. Model AA-120 pick-up
Cable truck:	1 I.H.C. Model AA-120 pick-up
Party Chief:	1 I.H.C. Model AA-120 pick-up
Supply truck:	1 Bedford 4 x 4 truck
Water trucks:	3 I.H.C. Model R-190 trucks
Caravans:	2 Office 1 Kitchen 1 Mechanics shop 1 Playback
Bulldozer:	1 D-6 Caterpillar
Recording:	
Amplifiers:	24 - Channel HTL 7000 KB
Cameras:	HTL-RS8U Oscillograph SIE-TRO-6 Oscillograph
Magnetic recorder-playback:	Techno T.L.-401C with 408B-A.T.C.
Geophones:	432 - Electrotech S-32, 27 cps. 29 - Dayton GS-13V, 4 cps. 1 - Electrotech S-31 (uphole)
Cables:	3 - 1625-foot portable reflection, and 12 - 1545-foot road refraction cables
Radios:	1 - AWA Teleradio 5A 2 - Traeger Transceivers 51 MA

GEOLOGY

General

The Carnarvon Basin is an intracratonic basin in which 35,000 feet of mainly marine rocks have been deposited from early Palaeozoic time onwards. The basin is marginal to the coast of Western Australia and is about 500 miles long and up to 200 miles wide; the land area is about 45,000 square miles. The Salt Marsh area is fairly central to the western sub-basin bounded by the Wandagee Ridge.

Stratigraphy

The stratigraphic section in the Salt Marsh area, as indicated by outcrop and wells, is as follows :

<u>Age</u>	<u>Formation</u>	<u>Thickness*</u> (feet)	<u>Remarks</u>
Quaternary	Sand, clay, alluvium	20	Covers about half the area
	"Coastal Limestone"	60 CC	Only deposited in a narrow coastal belt
Tertiary	Trealla Limestone	45	Hard crystalline limestone exposed on surface anticlines
	Giralia Calcarenite	155	Exposed in several anticlines
Tertiary - Upper Cretaceous	Cardabia Group	131 CC	Predominantly calcareous, exposed in several anticlines
-----UNCONFORMITY-----			
Cretaceous	Winning Group	1324 G	Siltstone and limestone; includes Bird-rong Formation (aquifer, reservoir bed at RR) at base
--MARKED ANGULAR UNCONFORMITY--			
Permian	Lyons Group	3826 W	Greywacke, tillite, siltstone, etc.
? L. Carbon- iferous	Unnamed unit	1041+W	Siltstone, greywacke, limestone
? U. Devonian	Gneudna Formation	957 PH	Limestone, dolomite, shale
M. Silurian	Dirk Hartog Limestone	2425+DH	Limestone, dolomite, shale
? L. Silurian	Tumblagooda Sandstone	648+PH	Sandstone and siltstone
Precambrian			Schist, granite and metasediments

* Thickness of sections drilled in the following wells:

CC WAPET Cape Cuvier No. 1, T.D. - 1152 feet

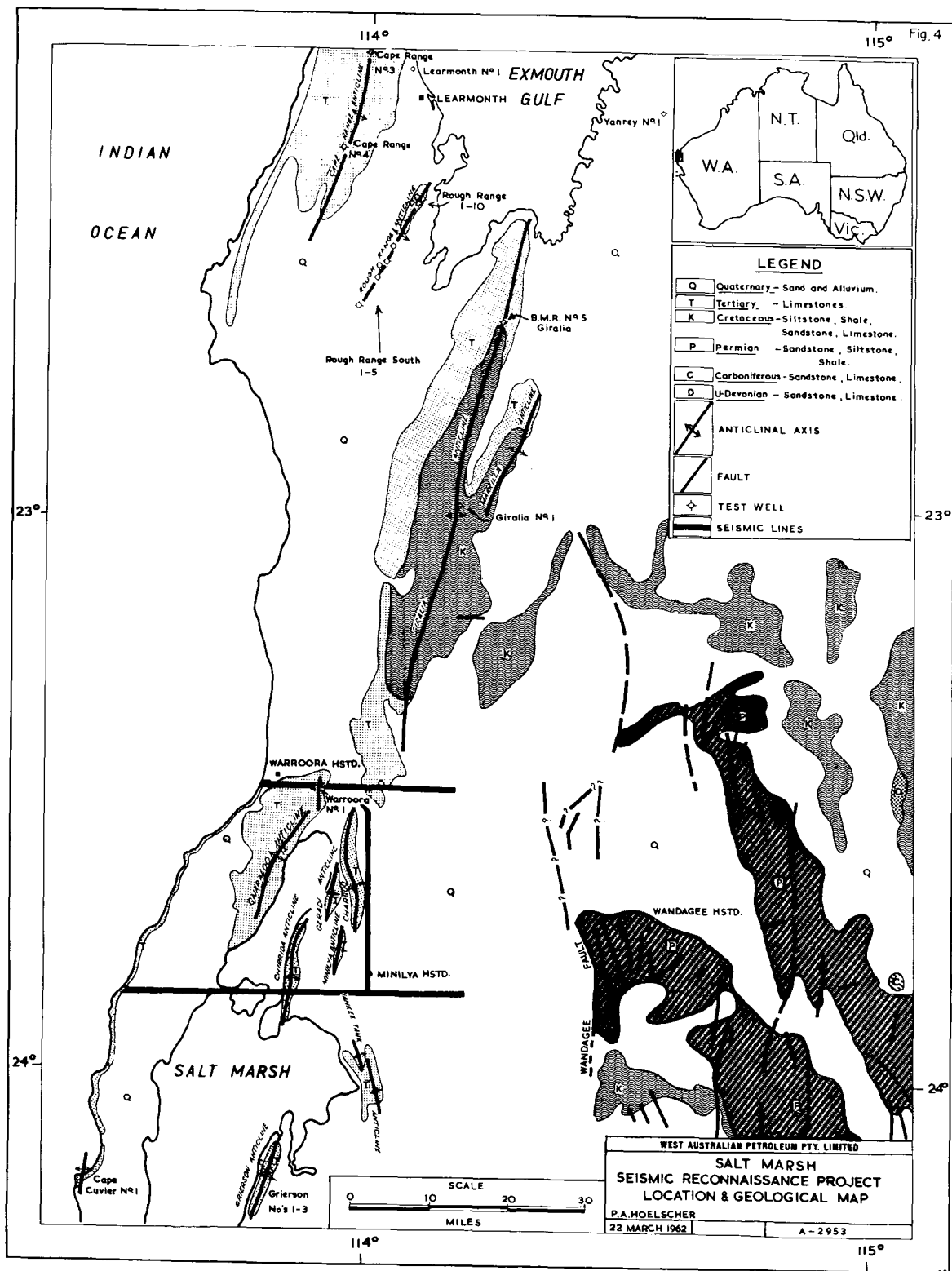
W WAPET Warroora No. 1, T.D. - 5897 feet

G WAPET Grierson No. 2, T.D. - 1487 feet

PH Pelican Hill Bore, 50 miles south-west of Salt Marsh area, T.D. - 2961 feet

DH WAPET Dirk Hartog No. 17B, 150 miles south of Salt Marsh area,
T.D. - 4703 feet

RR WAPET Rough Range No. 1, 75 miles north of Salt Marsh area,
T.D. - 14,408 feet



The only deep well within the Salt Marsh area is Warroora No. 1 which was drilled to 5992 feet in 1955. This well spudded in the Korojon Calcarenite (Cretaceous) and passed from Cretaceous Birdrong Formation into Lower Permian Lyons Group at 1125 feet. It entered shales of possible Carboniferous age at 4951 feet, in which formation it remained to total depth.

Cretaceous sediments overlie the Palaeozoic in the area with a very prominent angular unconformity at depths ranging between -1500 feet and -2000 feet. The basal Cretaceous Birdrong Formation contained oil in Rough Range No. 1, but in all other wells in that area and in the Salt Marsh area it contained only salt or brackish water.

Structure

At least ten separate surface anticlines have been mapped in the Tertiary limestones around the Salt Marsh. They have a characteristic north-north-east trend and are apparently related to faults in the Palaeozoic sediments. A north-north-west trend also is indicated by the south-east plunge of the Warroora axis and by a westward offset of the Chargoo axis aligned with the south-east plunge of the Warroora axis (see Fig. 4).

The Salt Marsh survey has confirmed that there are probably no unfaulted anticlines in the Palaeozoic sediments of this area. Pre-Cretaceous east-west tensional stress has produced a system of north-north-east striking gravity faults which down-throw Palaeozoic sediments to the west by several thousand feet at each fault. Compression in the late Cretaceous, continuing until at least after the Miocene, has partly reversed the original throw and folded the surface anticlines.

No major Palaeozoic hinge-line was located. A large fault or downwarp had been thought necessary to account for the differing Palaeozoic sections penetrated by Warroora No. 1 Well and the Cape Cuvier and Grierson wells. In the latter wells the Devonian directly underlies the Cretaceous but at Warroora about 5000 feet of Permian and Carboniferous section was drilled without ever reaching the Devonian. Such a hinge zone was not found and it seems that the additional section in Warroora No. 1 Well is caused by displacement of the Warroora Fault increasing to the north-east between Cape Cuvier and Warroora, and/or an approximately east-west fault or flexure between Minilya Line A and the Cape Cuvier and Grierson wells.

RESULTS

Basal Cretaceous Structure

The Basal Cretaceous structure map (Pl. 5) is based on fair to good quality data and relative depth values shown on the map are reliable.

Palaeozoic Structure

No continuous reflection phantom could be carried in the pre-Cretaceous because of faulting and severe multiple interference. The Palaeozoic structure map (Pl. 6) is shown by dip vectors; the reflection lines are too widely spaced to allow contouring.

Some apparent reversals of dip beneath surface anticlines are diffractions associated with Palaeozoic faulting. Near the Warroora Anticline the 20,500 feet per second refractor has been displaced down to the west by at least 3000 feet between Line F and the west end of Line C. Most of this displacement appears to occur at the Warroora Fault. There is evidence of only one other small (400 ft) down-to-the-west displacement west of Line F, in the vicinity of S.P. 223, Geradi Line C.

The Warroora No. 1 Well did not reach the 20,500 feet per second refractor which might be Precambrian basement but is more likely Palaeozoic carbonate or anhydrite. Carbonate rocks are widespread (both vertically and horizontally) in the Palaeozoic of the Carnarvon Basin. Although carbonate velocities in Western Australia are usually between 17,000 feet per second and 19,000 feet per second, the 20,500 feet per second refractor is tentatively correlated with either the Silurian Dirk Hartog Limestone or the Carboniferous Moogooree Limestone, with preference given to the latter.

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ADDITIONAL DATA FILED IN THE BUREAU OF MINERAL RESOURCES

The following additional data relating to the Salt Marsh Seismic Survey have been filed in the Bureau of Mineral Resources, Canberra, and are available for reference:

(i) Final Report	16 pp.
Tables 1 : Stratigraphy of Salt Marsh area	1 p.
2 : Statistics	1 p.
3 : Survey personnel	1 p.
4 : Mobile equipment	1 p.
5 : Recording equipment	1 p.

(ii) List of illustrations in Final Report

- Plates 1 : Locality map
- 2 : Geological map, A-2953
- 3 : Shothole patterns
- 4 : Spread arrangements for continuous correlation
- 5 : Normal movement graphs
- 6 : Filter characteristics
- 7 : AGC recovery times
- 8 : Uphole survey, Minilya Line A
- 9 : Shothole and seismometer arrays used for limestone shooting
- 10 : Migration by "Ray-Stretching Technique"
- 11 : Suggested shooting scheme for three refractors in Carnarvon Basin

Enclosures:

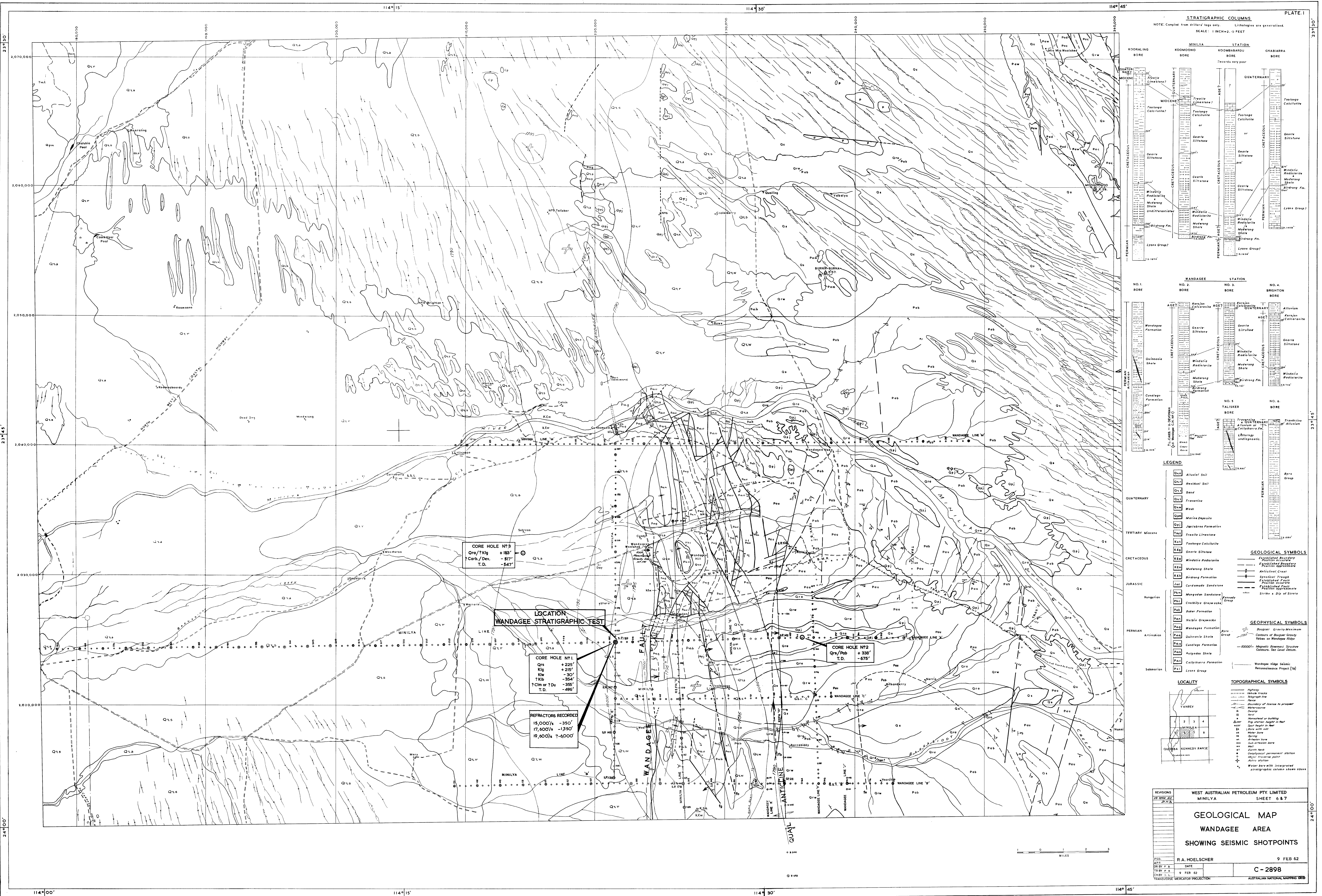
- 1 : Basal Cretaceous structure map, C-2978
- 2 : Palaeozoic structure map, C-2925
- 3 : Geradi-Minilya Line A Cross-section
- 4 : Geradi Line C - Minilya Line L Cross-section
- 5 : Geradi Line B Cross-section
- 6 : Geradi Lines D and E Cross-section
- 7 : Geradi Lines G and H Cross-section
- 8 : Geradi Line F Cross-section
- 9 : Geradi Line F Refraction Time - Distance Plot, with depth interpretation of 20,500 feet per second refractor, by Hale's method
- 10 : Geradi Line F Refraction data used in depth interpretation of 20,500 feet per second refractor, by Hale's method
- 11 : Geradi Line C Time-Distance Plot and depth interpretation, by Baumgarte - Ansel Method
- 12 : Geradi Line C, noise shots SP. 181
- 13 : Relative amplitude response curves for various shothole configurations and seismometer arrays

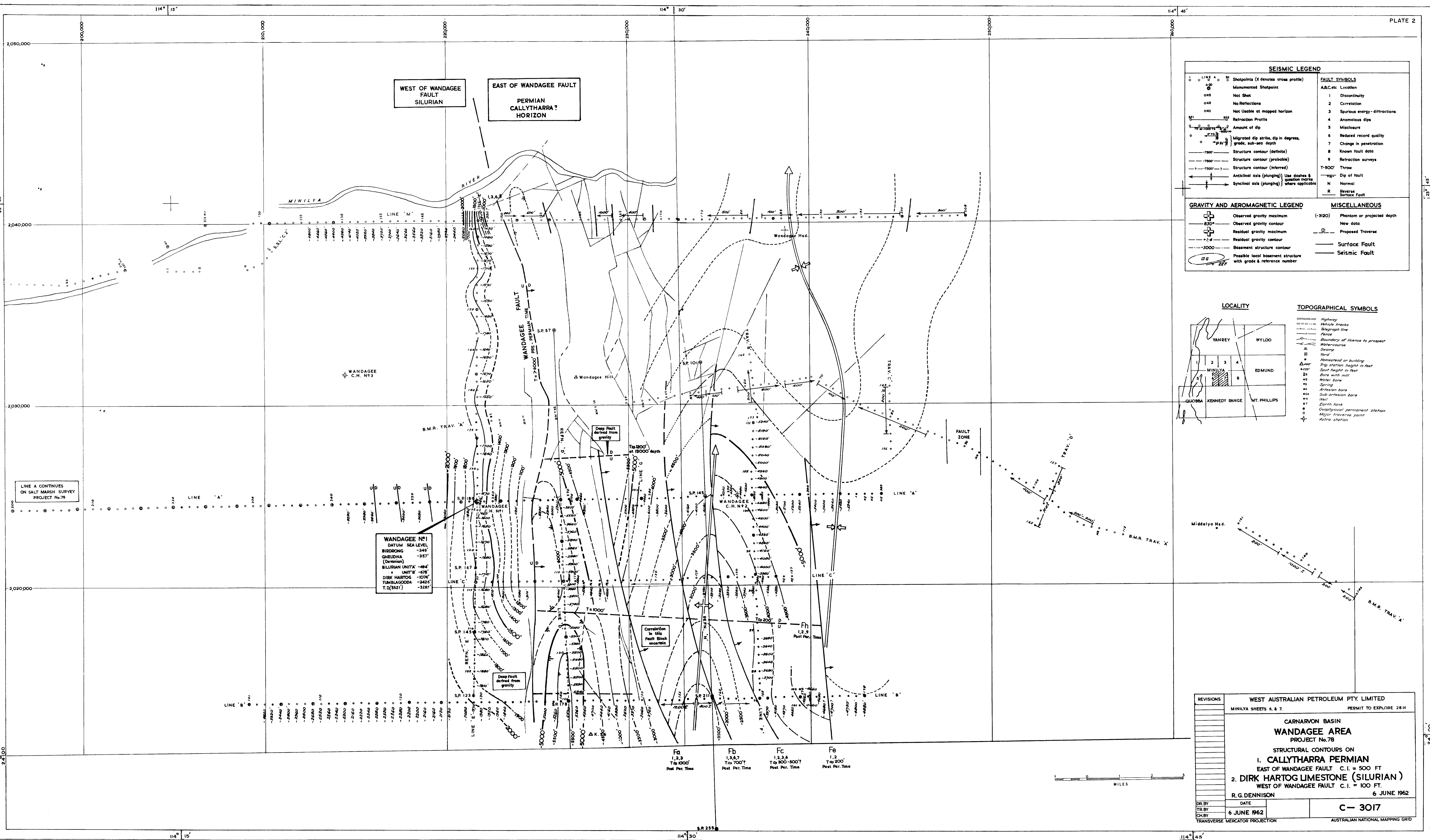
(iii) Drillers' logs

(iv) Surveyors' notes

(v) Recorder's field sheets

(vi) Record sections





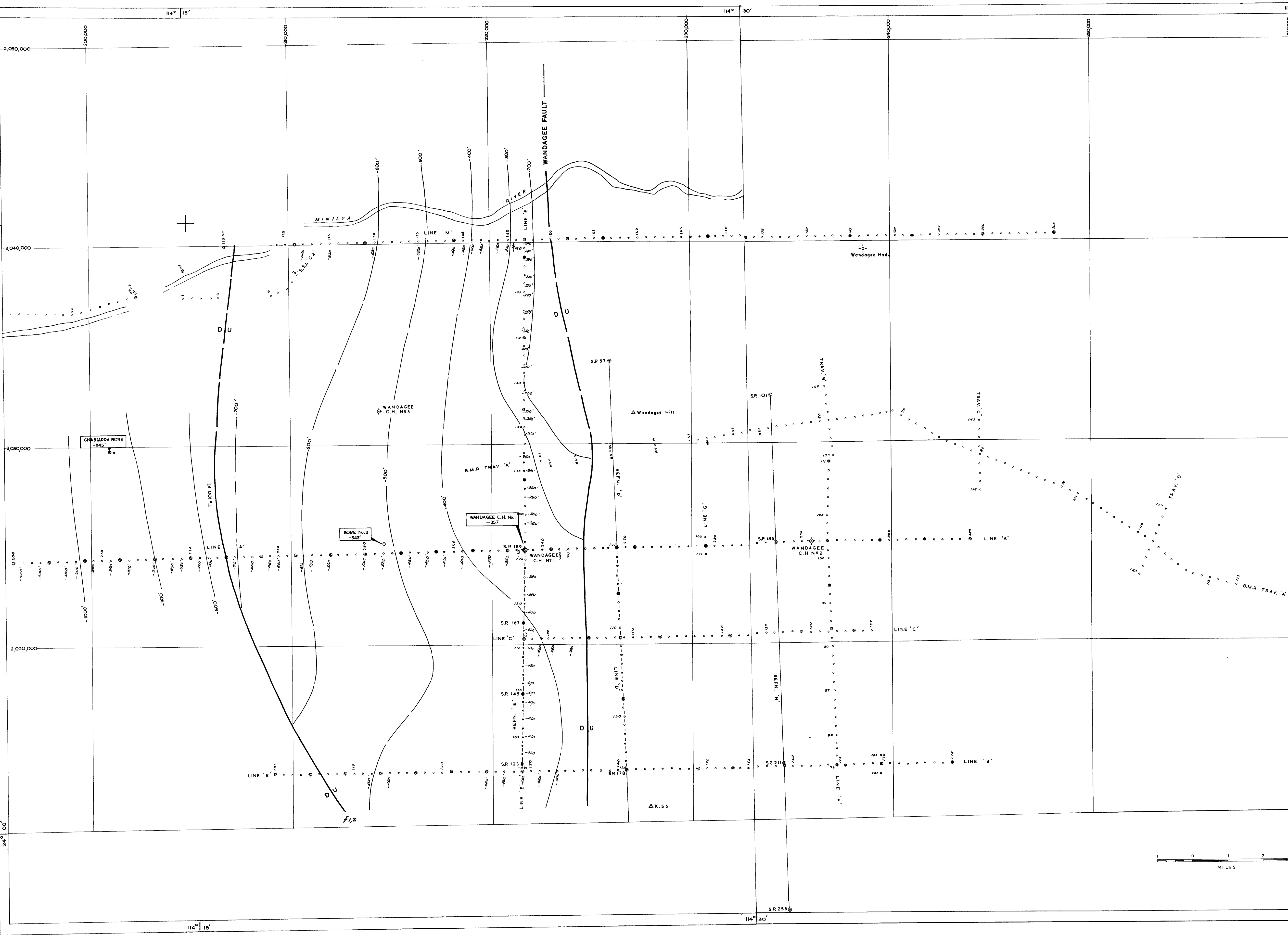
SEISMIC LEGEND	
○ LINE A	Shotpoints (X denotes cross profile)
○ MON	Monumented Shotpoint
○ NS	Not Shot
○ NR	No Reflections
○ NU	Not Usable at mapped horizon
— REF	Refraction Profile
— D	Amount of dip
— M	Migrated dip strike, dip in degrees, grade, sub-sea depth
— S	Structure contour (definite)
— P	Structure contour (probable)
— I	Structure contour (inferred)
— A	Anticlinal axis (plunging)
— S	Synclinal axis (plunging)
— T	Throw
— N	Normal
— R	Reverse

GRAVITY AND AEROMAGNETIC LEGEND	
— G	Observed gravity maximum
— G	Observed gravity contour
— G	Residual gravity maximum
— G	Residual gravity contour
— G	Basement structure contour
— G	Possible local basement structure with grade & reference number

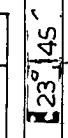
MISCELLANEOUS	
— D	Phantom or projected depth
— D	New data
— D	Proposed Traverse

LOCALITY	
YANREY	WYLOO
MINILYA	EDMUND
QUOBBA	KENNEDY RANGE
	MT. PHILLIPS

TOPOGRAPHICAL SYMBOLS	
—	Highway
—	Vehicle tracks
—	Telegraph line
—	Fence
—	Boundary of licence to prospect
—	Watercourse
—	Swamp
—	Yard
—	Homestead or building
—	Trig station height in feet
—	Spot height in feet
—	Bore with mill
—	Water bore
—	Spring
—	Artesian bore
—	Sub-artesian bore
—	Well
—	Earth tank
—	Geophysical permanent station
—	Major traverse point
—	Astro station



REVISIONS		WEST AUSTRALIAN PETROLEUM PTY. LIMITED	
		MINILYA SHEETS 6 & 7	
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CARNARVON BASIN			
WANDAGEE AREA			
PROJECT No. 78			
STRUCTURAL CONTOURS ON			
BASAL CRETACEOUS			
CONTOUR INTERVAL 100'			
R.G. DENNISON		6 JUNE 1962	
DR. BY	DATE	C - 3019	
TR. BY	6 JUNE 1962		
CHK. BY			
TRANSVERSE MERCATOR PROJECTION		AUSTRALIAN NATIONAL MAPPING GRID	



LOCALITY

TOPOGRAPHICAL SYMBOLS

Highway
Vehicle tracks
Riaghth line
Fence
Boundary of licence to prospect
Watercourse
Swamp
Yard
Homestead or building
Trig station height in feet
Bare height in feet
Bare with mill
Water bore
Spring
Artesian bore
Sub-artesian bore
Earth tank
Geophysical permanent station
Major traverse point
Astro station

YANREY
WYLOO
MINILYA
EDMUND
JOBBA
KENNEDY RANGE
MT. PHILLIPS

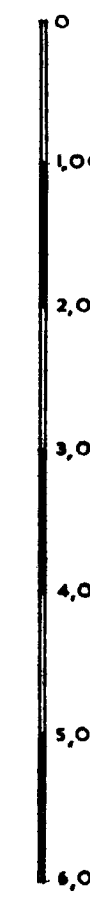
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5 6 7 8

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

REVISIONS	WEST AUSTRALIAN PETROLEUM PTY. LIMITED		
	MINILYA SHEETS 6 & 7.		PERMIT TO EXPLORE 28 M
	CARNARVON BASIN WANDAGEE AREA PROJECT No.78 APPROXIMATE BASEMENT CONFIGURATION SUGGESTED BY GRAVITY AND SEISMIC		
	R.G. DENNISON		6 JUNE 1962
DR BY	DATE		C - 3020
TR BY			
CH BY	6 JUNE 1962		
TRANSVERSE MERCATOR PROJECTION		AUSTRALIAN NATIONAL MAPPING GRID	

STRATIGRAPHIC COLUMN

WARROORA N°1
G.L. 84'



SEISMIC LEGEND	
○ LINE A	Shotpoints (X denotes cross profile)
○ LINE B	Monumented Shotpoint
○ LINE C	Not Shot
○ LINE D	No Refractions
○ LINE E	Not Usable at mapped horizon
○ LINE F	Refraction Profile
○ LINE G	Amount of dip
○ LINE H	Migrated dip strike, dip in degrees, grade, sub-surface depth
○ LINE I	Structure contour (definite)
○ LINE J	Structure contour (probable)
○ LINE K	Structure contour (inferred)
○ LINE L	Anticline axis (plunging)
○ LINE M	Synclinal axis (plunging)
○ LINE N	Use dashes & question marks where applicable
○ LINE O	Throw
○ LINE P	Dip of fault
○ LINE Q	Normal
○ LINE R	Reverse
○ LINE S	Surface Fault

TOPOGRAPHICAL SYMBOLS	
—	Highway
—	Vehicle track
—	Boundary line
—	Fence
—	Boundary of licence to prospect
—	Watercourse
—	Swamp
—	Wood
—	Homestead or building
—	Trig station height in feet
—	Spot height in feet
—	Bore with mill
—	Water bore
—	Spring
—	Artesian bore
—	Well
—	Earth tank
—	Geophysical permanent station
—	Major traverse point
—	Astro station

REVISIONS

WEST AUSTRALIAN PETROLEUM PTY. LIMITED

MINILYA SHEET 516 PERMIT TO EXPLORE 28 H

GEOPHYSICAL SERVICE INTERNATIONAL PARTY 621

STRUCTURE MAP

SALT MARSH (79) PROJECT

BASAL CRETACEOUS UNCONFORMITY

CONTOUR INTERVAL 100 FT.

PARTY CHIEF: J.W. WARWICK

COMPANY REP: P.A. HOELSCHER

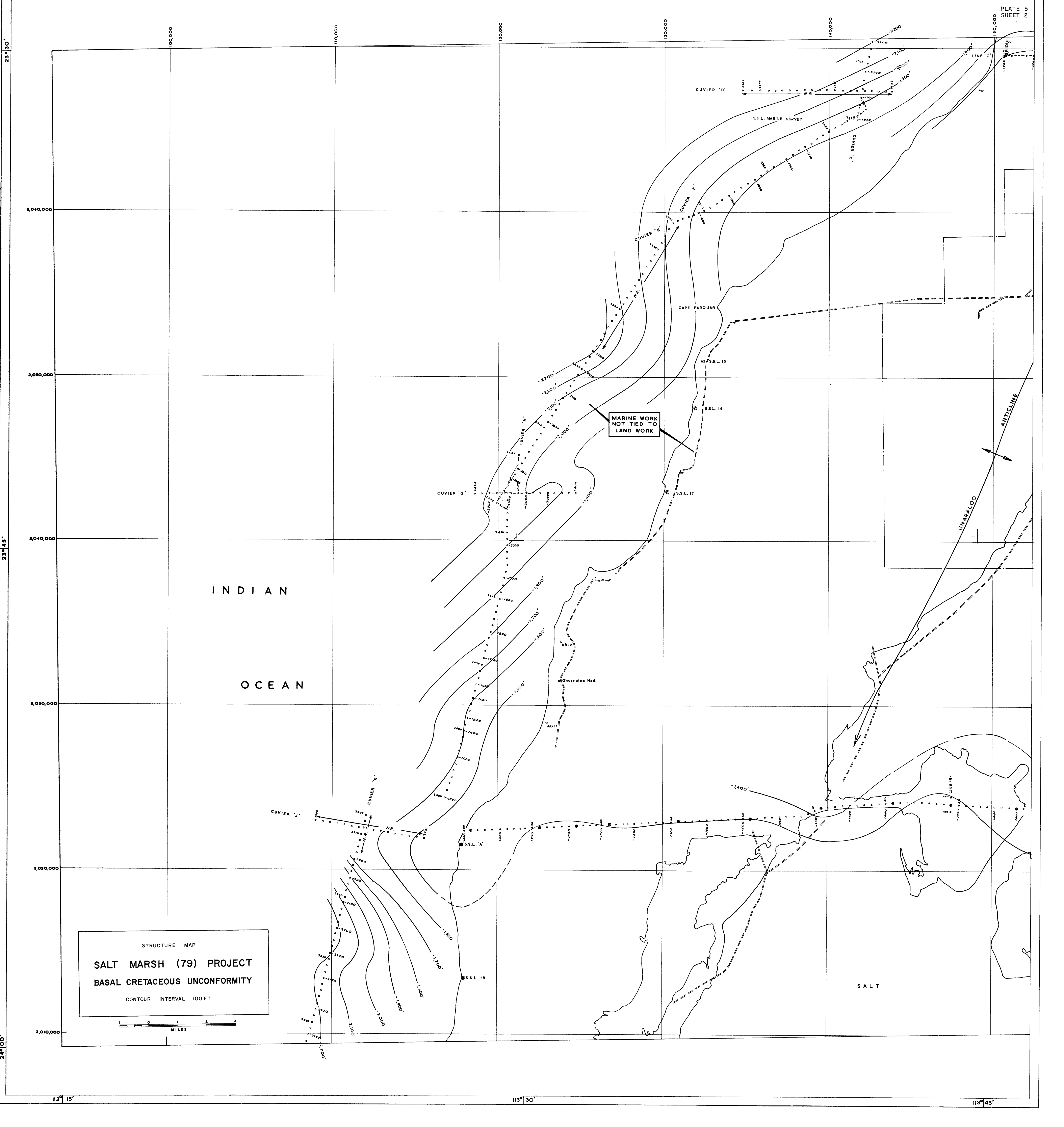
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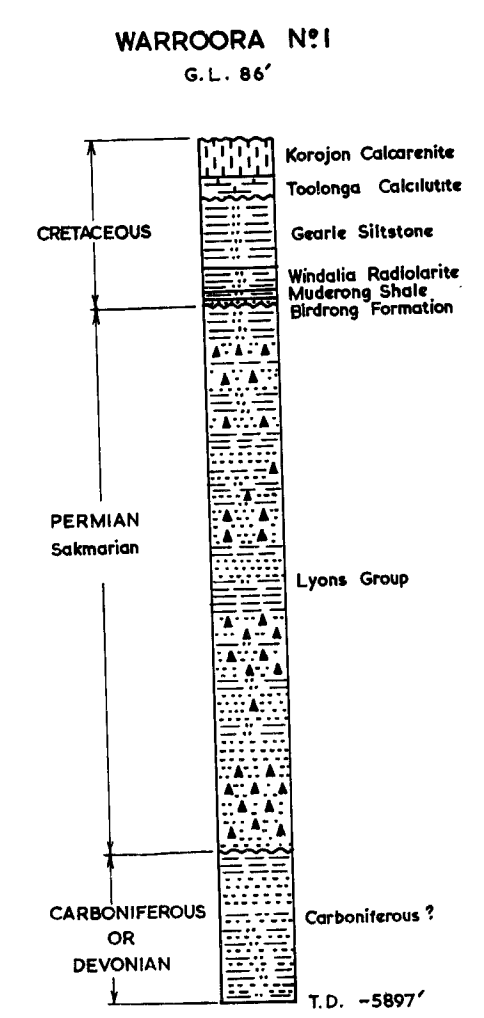
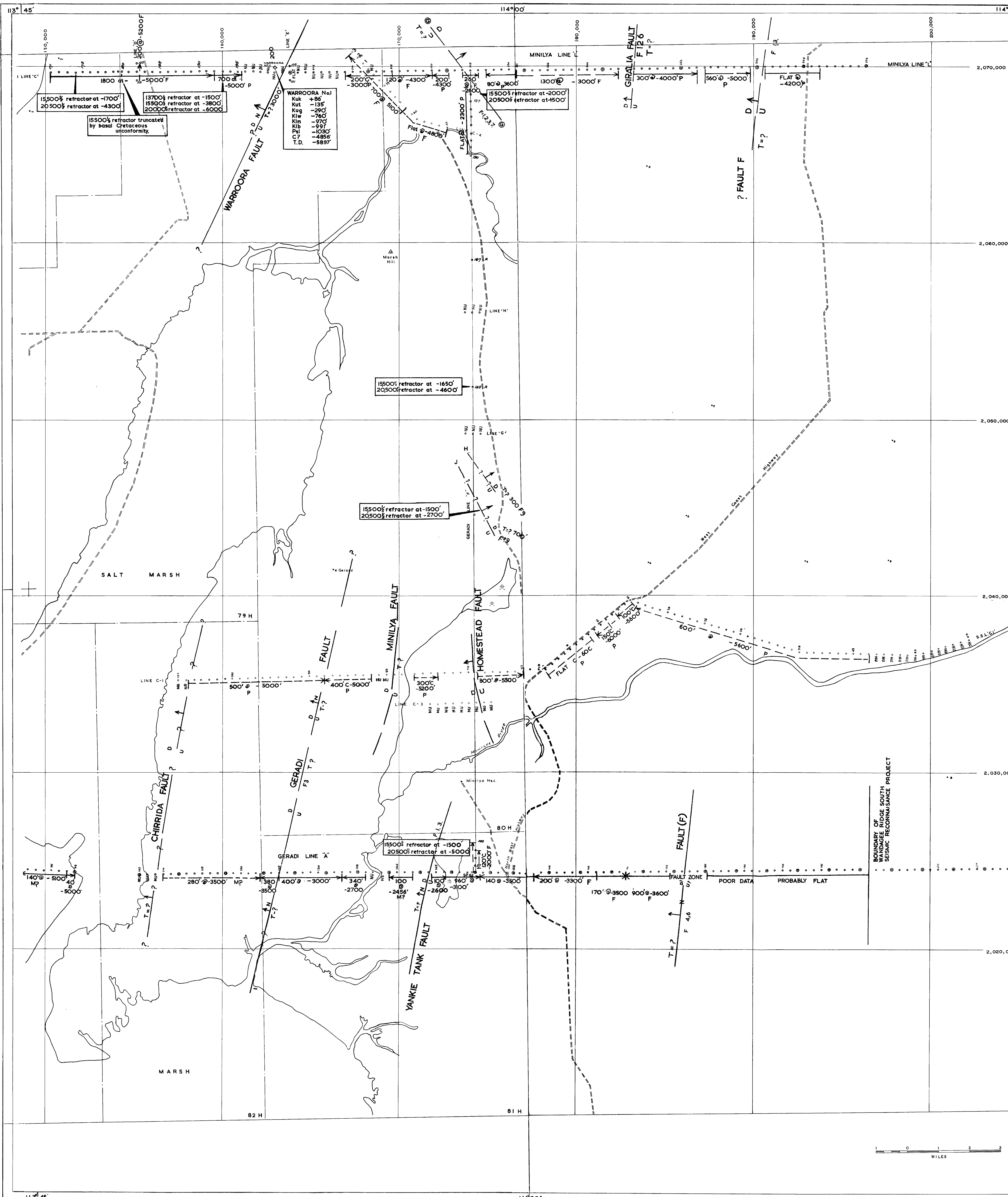
C-2978

TRANSVERSE MERCATOR PROJECTION

AUSTRALIAN NATIONAL MAPS LTD







SEISMIC LEGEND	
LINE A	Shotpoints (X denotes cross profile)
ASB	Monumented Shotpoint
ONS	Not Shot
NR	No Reflections
NU	Not Usable at mapped horizon
REF	Refraction Profile
Amount of dip	
Migrated dip strike, dip in degrees, grade, sub-sea depth	
Structure contour (definite)	
Structure contour (probable)	
Structure contour (inferred)	
Anticline axis (plunging)	Use dashes & question marks
Synclinal axis (plunging)	where applicable
FAULT SYMBOLS	
1	Discontinuity
2	Correlation
3	Spurious energy-diffractions
4	Anomalous dips
5	Misclosure
6	Reduced record quality
7	Change in penetration
8	Known fault data
9	Refraction surveys
T-500'	Throw
Dip of fault	
N	Normal
R	Reverse

GRAVITY AND AEROMAGNETIC LEGEND	
Observed gravity maximum	
Observed gravity contour	
Residual gravity maximum	
Residual gravity contour	
Basement structure contour	
Possible local basement structure with grade & reference number	

LOCALITY	
YANREY	
MINILYA	
EDMUND	
QUORBA	
KENNEDY RANGE	
MT. PHILLIPS	

TOPOGRAPHICAL SYMBOLS	
Highway	
Vehicle tracks	
Relief line	
Boundary of licence to prospect	
Watercourse	
Swamp	
Yard	
Household or building	
Trig station height in feet	
Spot height in feet	
Bore with seal	
Water bore	
Spring	
Artesian bore	
Sub-artesian bore	
Well	
Earth tank	
Geophysical permanent station	
Major traverse point	
Air station	

REVISIONS	
MINILYA SHEET 5.5.	PERMIT TO EXPLORE 28 H
GEOPHYSICAL SERVICE INTERNATIONAL S.A. PARTY 621	
STRUCTURE MAP	
SALT MARSH (79) PROJECT	
PRE-CRETACEOUS STRUCTURE	
PARTY CHIEF: J. WARWICK	
CLIENT REP: P.A. HOELSCHER	
31 MARCH 1962	
DATE	
5 JUL 61	
TRANSVERSE MERCATOR PROJECTION	
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AUSTRALIAN NATIONAL MAPPING BOARD	

