

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

*Petroleum Search Subsidy Acts*  
PUBLICATION No. 49

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

**Exmouth Gulf Marine Seismic Survey  
Whaleback Seismic Survey**

**OF**

**WEST AUSTRALIAN PETROLEUM PTY LIMITED**

*Issued under the Authority of the Hon. David Fairbairn  
Minister for National Development  
1964 '9*

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

MINISTER: THE HON. DAVID FAIRBAIRN, D.F.C., M.P.

SECRETARY: SIR HAROLD RAGGATT, C.B.E.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

DIRECTOR: J. M. RAYNER

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Canberra A.C.T.*

## FOREWORD

Under the Petroleum Search Subsidy Act 1959-1961, agreements relating to subsidized operations provide that the information obtained may be published by the Commonwealth Government six 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; Exmouth Gulf Marine Seismic Survey, and Whaleback 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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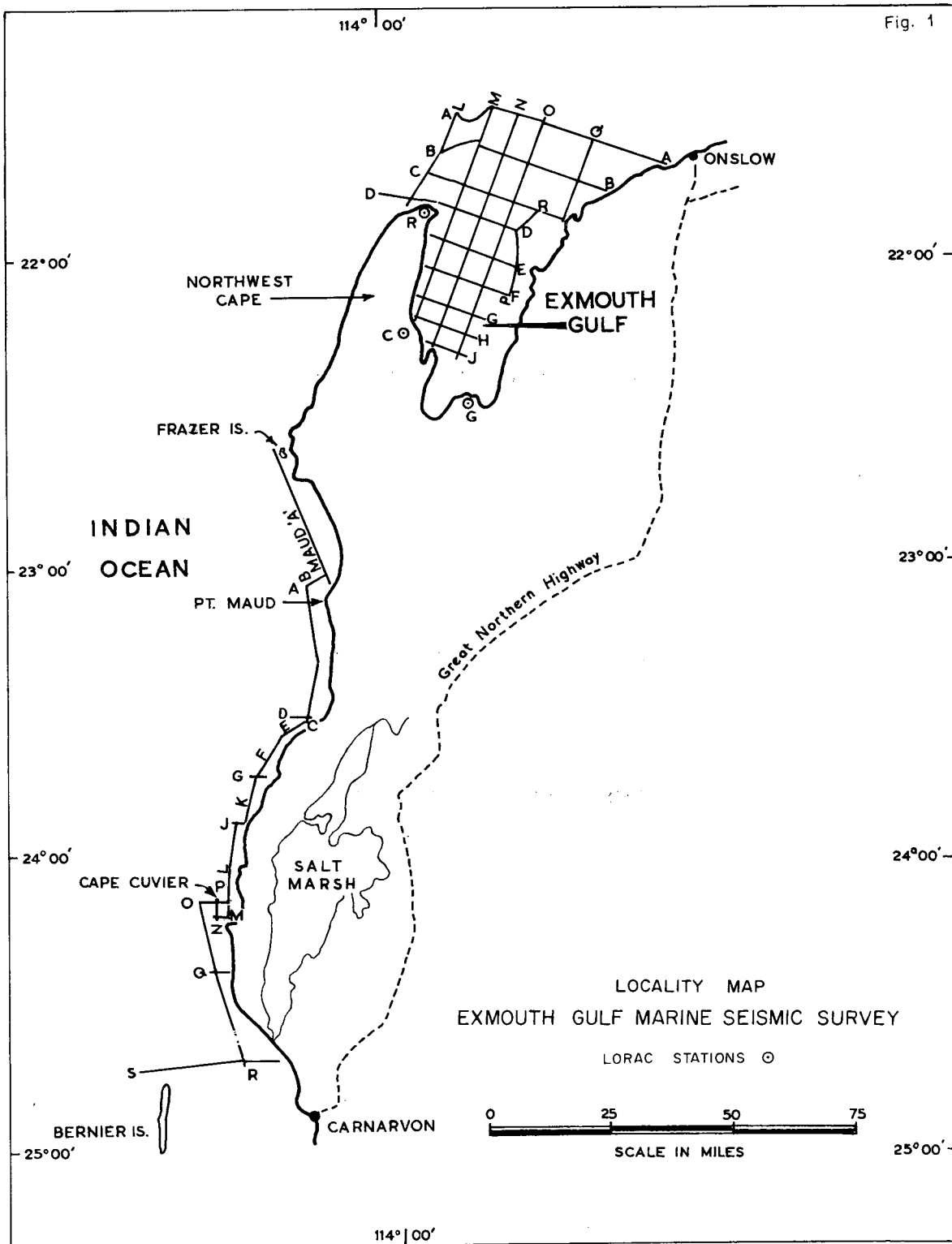
EXMOUTH GULF MARINE SEISMIC SURVEY

by

WEST AUSTRALIAN PETROLEUM PTY LIMITED

SUMMARY OF DATA AND RESULTS

Fig. 1



## EXMOUTH GULF MARINE SEISMIC SURVEY

### SUMMARY OF DATA AND RESULTS\*

#### SUMMARY

A reconnaissance marine reflection seismic survey was conducted in 1961 by Seismograph Service Limited for West Australian Petroleum Pty Limited. The survey took place within the Carnarvon Basin in Western Australia, and covered Exmouth Gulf and the open coastal waters along the west coast of Western Australia from Frazer Island to Bernier Island (see Fig. 1). The project areas fall within Permit to Explore 28H.

The survey was a two-boat operation. In the Exmouth Gulf area the survey was controlled by a Lorac radio navigational system, and along the west coast positioning was determined by sextant angle measurements to shore beacons and landmarks. All shots were recorded on magnetic tapes which were processed into variable-area record sections.

The purpose of the survey was to obtain additional information on the regional geology and to map the extension of known structures in the North-West Cape region of the Carnarvon Basin. Information was also sought on the nature of the pre-Cretaceous to post-Palaeozoic faulting. The survey commenced on 15th July, 1961, and terminated on 20th August, 1961; a total of 753 miles of traverse was shot.

The survey indicated that Exmouth Gulf is essentially synclinal in character in the Cretaceous and Tertiary sediments. Several major pre-Cretaceous fault trends which had already been mapped on land with the seismograph were followed beneath the Gulf. A pre-Cretaceous anticlinal axis underlies the Cape Range Anticline both to the north and to the south of the surface expression of the structure. An anticline was located trending north in the eastern part of the Gulf. A Cretaceous anticline near and parallel to the coast near Cardabia may be the extension of the Rough Range Anticline.

To the south of Point Maud, the survey provided a much-needed tie between the Rough Range-Cape Range area and the structurally complex area round the Salt Marsh. Some structural features were found in this southern area and the trend of major faults was established.

The geophysical operation undertaken in the Exmouth Gulf area, Western Australia, was subsidized under the Petroleum Search Subsidy Act 1959.

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\*Abstracted from Final Report "Reflection Seismograph Survey, Exmouth Marine (74) and Cuvier Marine (75) Reconnaissance Projects, Carnarvon Basin, Western Australia", by D.N. Smith, West Australian Petroleum Pty Limited, and R.D. Lugg, Seismograph Service Limited.

## METHODS OF OPERATION

### General Data

Operator:	West Australian Petroleum Pty Limited, 251 Adelaide Terrace, Perth, W.A.
Contractor:	Seismograph Service Limited, Keston, Kent, England.
Location:	Exmouth Gulf and offshore from Frazer Island to Bernier Island, Western Australia.
Basin:	Carnarvon
Tenement Holder:	West Australian Petroleum Pty Limited

Details of Petroleum Tenement: Permit to Explore 28H

### Field Operations

Date survey commenced:	15th July, 1961
Date survey completed:	20th August, 1961
No. of days on survey:	37
No. of days lost because of bad weather:	2 1/2
No. of days lost because of repairs to craft:	2
Coverage:	753 miles
Recording time:	171 3/4 hours
Average shots per shooting day:	99.3
Total explosive used:	50,990 lb.
Position fixing:	Lorac and visual survey of shore beacons

### Equipment

Recording boat:	35-ton landing craft
Shooting boat:	45-foot launch
Mother ship:	300-ton fishing vessel



Geophones:	24 Gulf pressure geophones at 110-foot intervals, suspended 10 feet below the surface.
Amplifiers:	Type AAZ (Seismograph Service Limited)
Tape Recorders and Playback:	DS7 and DS8
Displays:	SSL density modulated display, and VAX variable area display.

### RESULTS

Three structure maps have been made of the project area. The best defined of these is the 'B' horizon (Plate 1), which is believed to approximate the basal Cretaceous unconformity. The 'A' horizon is frequently a reasonably strong reflector and is believed to be within the Upper Cretaceous Korojon Calcarenite. The pre-Cretaceous map (Plate 2) consists of phantoms in various areas which are not related to each other. The time intervals between these three structure maps have also been mapped.

Upper Cretaceous and basal Cretaceous horizons are essentially conformable in the area. The main structural features in these beds are expressed as (i) a possible closure near Muiron Islands, (ii) a seaward extension of the north end of the Cape Range Anticline, and (iii) a syncline east of the Cape Range axis.

Unlike the Cretaceous and Tertiary sediments, the pre-Cretaceous horizons are displaced by down-to-the-west faults, including the Rough Range Fault. Three closed anticlinal anomalies were mapped in Exmouth Gulf, and a possible closure was found near Cape Cuvier. Extensions of the Cape Range and Rough Range Anticlines and of the Dingo Syncline were demonstrated.

### REFERENCES

- |                                      |        |   |
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LINEHAN, A.L.,	1958 :	Seismograph survey, the North-West Cape area. (G.S.I. Report for WAPET). (Unpubl.).
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ADDITIONAL DATA FILED IN THE  
BUREAU OF MINERAL RESOURCES

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

- (i) Final Report 18 pp.
  - Appendix 1 - Field Operations 3 pp.
  - Appendix 2 - Lorac Positioning System 1 p.
  - Appendix 3 - Land Reference Points 1 p.
  - Appendix 4 - Lines Shot 1 p.
- (ii) List of illustrations in Final Report
  - Location map showing lines shot
  - Location of shotpoint with relation to ship location
  - Position of cable at time of release and at time of shot
  - Combined response curves for amplifier, hydrophone, and playback filtering
  - Comparison between dynamic correction cam and Rough Range Nos 1 and 9 velocity function
  - Composite velocity function based on Rough Range Nos 1 and 9
  - Rough Range Nos 1 and 9 velocity function
  - Record cross section Exmouth Line J
  - Record cross section Exmouth Line G
  - Record cross section Exmouth Line C
  - Record cross section Exmouth Line B
  - Record cross section Maude Line A
  - Record cross section Cuvier Line O
  - Record cross section Cuvier Line M
  - Map C - 2758 - D1: Phantom Horizon A
  - Map C - 2758 - D2: Phantom Horizon B
  - Map C - 2758 - D3: Pre-Cretaceous Structure
  - Map C - 2758 - D4: Time interval between Horizons A and B
  - Map C - 2758 - D6: Depth of water
- (iii) Maps and record sections by Seismograph Service Limited
- (iv) Lorac pre-plot co-ordinates
- (v) Lorac computation data sheets
- (vi) Observer's reports

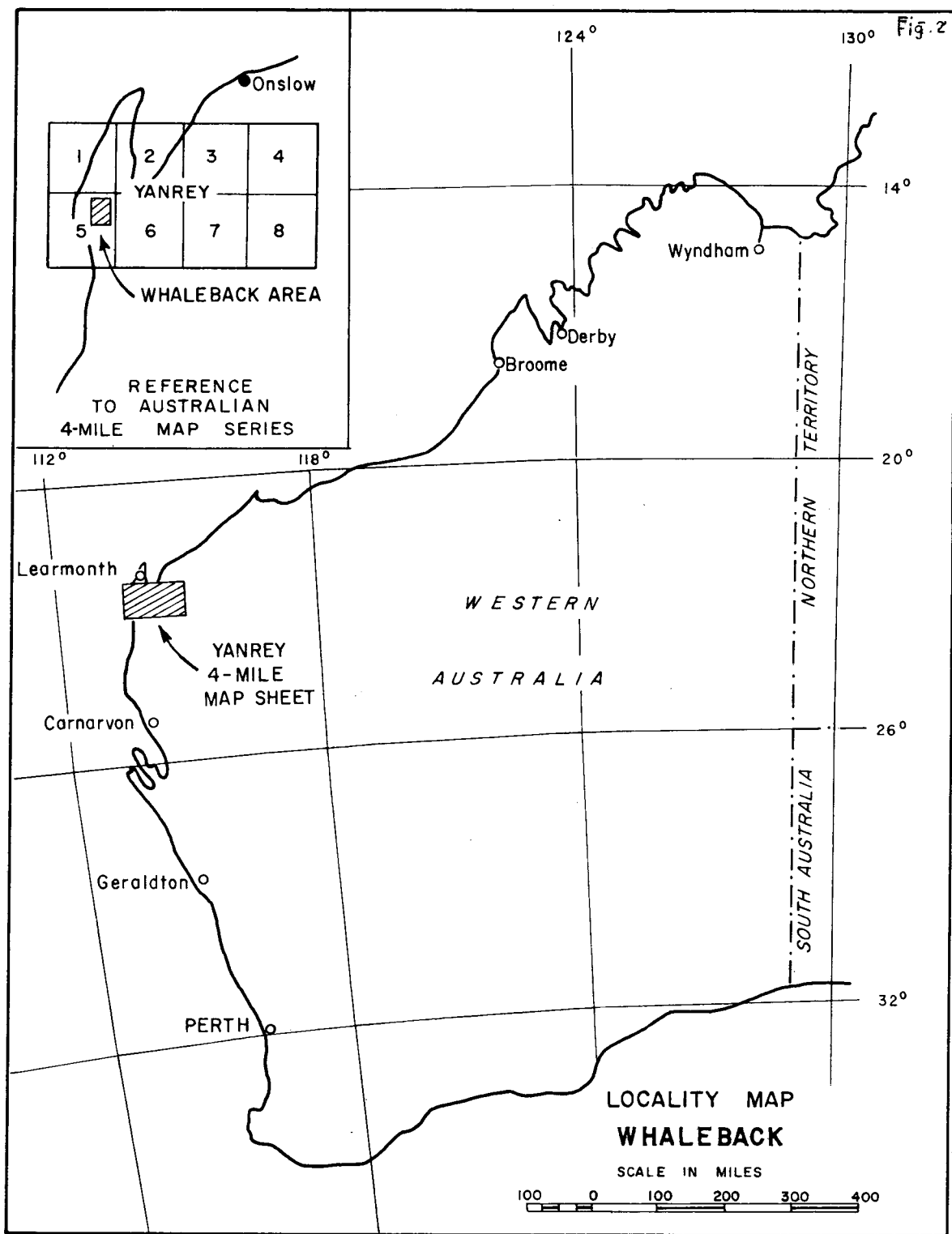


WHALEBACK SEISMIC SURVEY

by

WEST AUSTRALIAN PETROLEUM PTY LIMITED

SUMMARY OF DATA AND RESULTS



## WHALEBACK SEISMIC SURVEY

### SUMMARY OF DATA AND RESULTS\*

#### SUMMARY

A detailed reflection seismograph survey of the Whaleback area of the Carnarvon Basin (see Fig. 2), was conducted in 1962 for West Australian Petroleum Pty Limited by Geophysical Service International. The project area falls within Permit to Explore 28H.

The purpose of the survey was to confirm and map a structure previously indicated by seismic work, with the objective of selecting a well location. A seismic line was also shot over the Rough Range Anticline as part of this project, to tie Rough Range South No. 5 Well into this area. The survey commenced on 12th September, 1962 and terminated on 9th November, 1962, after covering 69 1/2 miles of reflection traverse.

The survey showed that good reflection records can be obtained in the Whaleback area by the use of shothole patterns and large seismometer arrays containing 24 to 36 elements.

The record quality allowed the construction of reliable maps which confirmed the presence of the Whaleback Anticline, but this structure is smaller than was anticipated. Closures at Whaleback were mapped in Cretaceous and Palaeozoic horizons. Prominent reflection horizons were identified and a tie was made to Rough Range South No. 5 Well.

The geophysical operation undertaken in the Whaleback area, Western Australia, was subsidized under the Petroleum Search Subsidy Act 1959-1961.

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\* Abstracted from Final Report "Whaleback Seismic Survey, Carnarvon Basin, Western Australia", by F. Muir, J.R.H. McWhae, R.E. Sheriff, West Australian Petroleum Pty Limited, and E.R. Denton, 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 622)
Location:	Whaleback area, about 150 miles north of Carnarvon, Western Australia.
Basin:	Carnarvon
Tenement Holder:	West Australian Petroleum Pty Limited

Details of Petroleum Tenement: Permit to Explore 28H

### Field Operations

Date survey commenced:	12th September, 1962
Date survey completed:	9th November, 1962
Total time spent on project:	436 hours
Coverage:	69 1/2 miles of reflection traverse
Recording time:	326 1/4 hours
Total number of profiles:	329
Total number of holes drilled:	8378
Total footage drilled:	175,045 feet
Total drilling time:	1193 1/4 hours
Total number of shots fired:	337
Total explosive used:	59,835 lb.

### Equipment

General:	3 Mayhew-1000 drills mounted on L.H.C. Model R-190 trucks equipped for air and water drilling
	1 Bedford 4 x 4 RHLS truck for Shooter
	1 Bedford 4 x 4 RHLS truck for Recorder



- 1 I.H.C. AA120 cable truck
- 1 I.H.C. AA120 survey truck
- 1 I.H.C. AA120 for Party Chief
- 1 Land Rover for Supervisor
- 3 I.H.C. R-190 water trucks
- 1 Bedford 4 x 4 RHLS supply truck
- 1 Kitchen caravan
- 2 Office caravans
- 1 Mechanics caravan
- 1 D-4 Caterpillar-Bulldozer and lowboy tractor
- 1 D-6 Caterpillar-Bulldozer
- 1 Land Rover for bulldozer personnel

Recording:

- 24-Channel TI-7000 KB amplifiers
- 1 TI-RS8U Oscillograph
- 1 Techno ATC magnetic recorder
- 6 Cables 1500 feet
- 3 Refraction cables with 500-foot intervals
- 24 Dayton 4.5 cps. seismometers
- 3 Time break radios.

### RESULTS

Four structure maps of the survey area have been prepared.

#### Base of Cretaceous Toolonga Calcilutite Map (Pl. 3)

The Toolonga reflection had good character and continuity over most of the prospect and the Toolonga map is considered to be reliable. The reflection can be followed continuously across most of the faults which affect the deeper beds. The horizon shows a structural "high" in the Whaleback area, definitely separated from the Midway Anticline.

#### Basal Cretaceous Unconformity Map (Pl. 4)

The basal Cretaceous unconformity is sometimes a good reflection and sometimes not visible at all. Overall the map is considered reliable in dip direction and rate, although its depth may be in error by a few cycles.

#### Lower Cretaceous Isochor Map

This map was prepared from the above two maps. It is regarded as generally reliable though not precisely accurate. The notable feature of the map is the thin cover over the Whaleback Anticline.

### Palaeozoic Structure Map (Pl. 5)

Pre-Cretaceous data are generally sparse and of poor quality, and the Palaeozoic structure map is regarded as of poor reliability. The pre-unconformity data indicate a pre-Cretaceous anticline underlying the Whaleback Anticline.

### Tie to Rough Range South No. 5

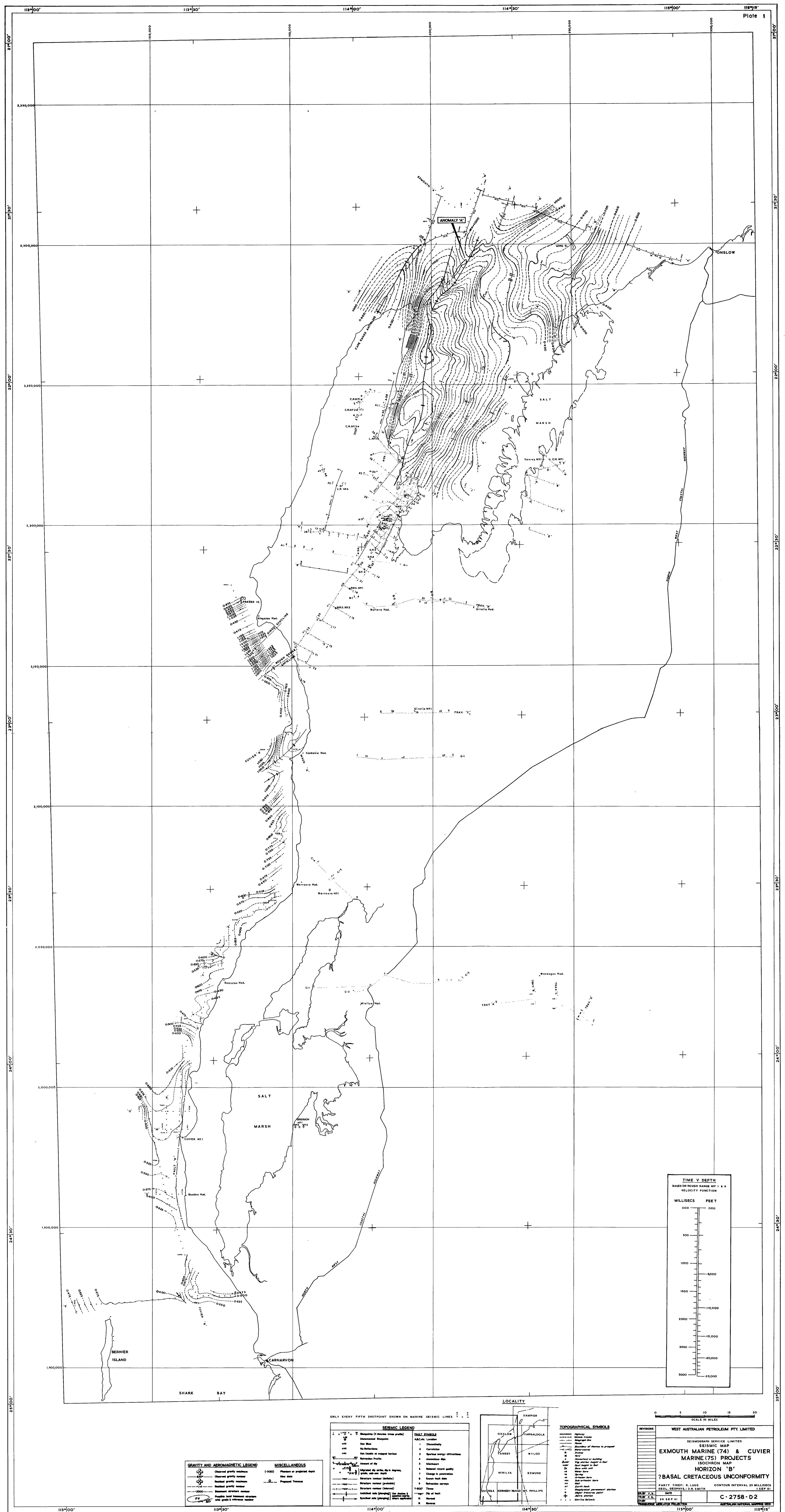
The Rough Range South No. 5 Well was drilled in 1956 to a total depth of 4760 feet. Seismic line 67 which passes through this location indicates that the Rough Range Fault which was encountered in the well at 3721 feet is a low-angle thrust.

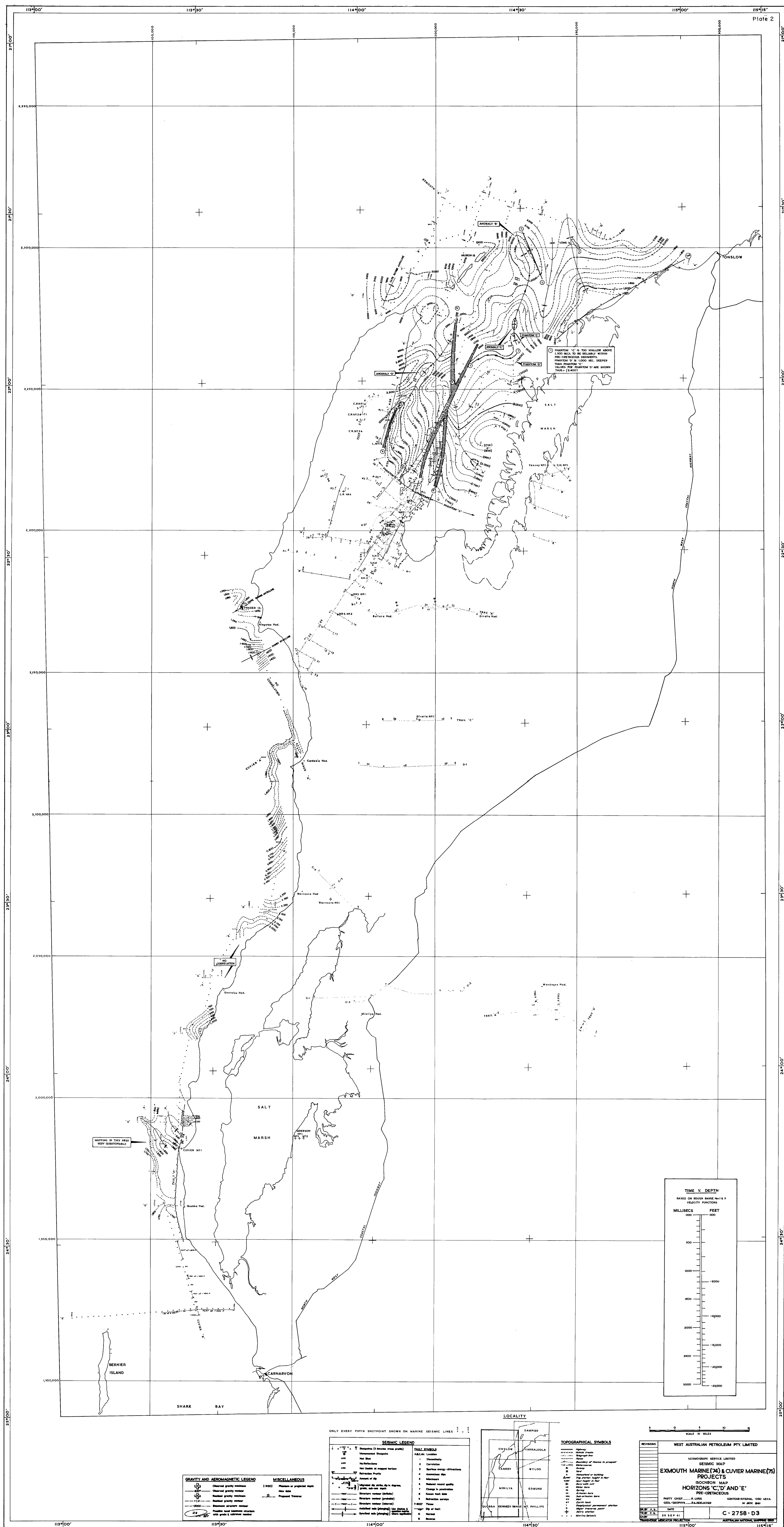
The Toolonga reflection permitted a fairly reliable tie to be made.

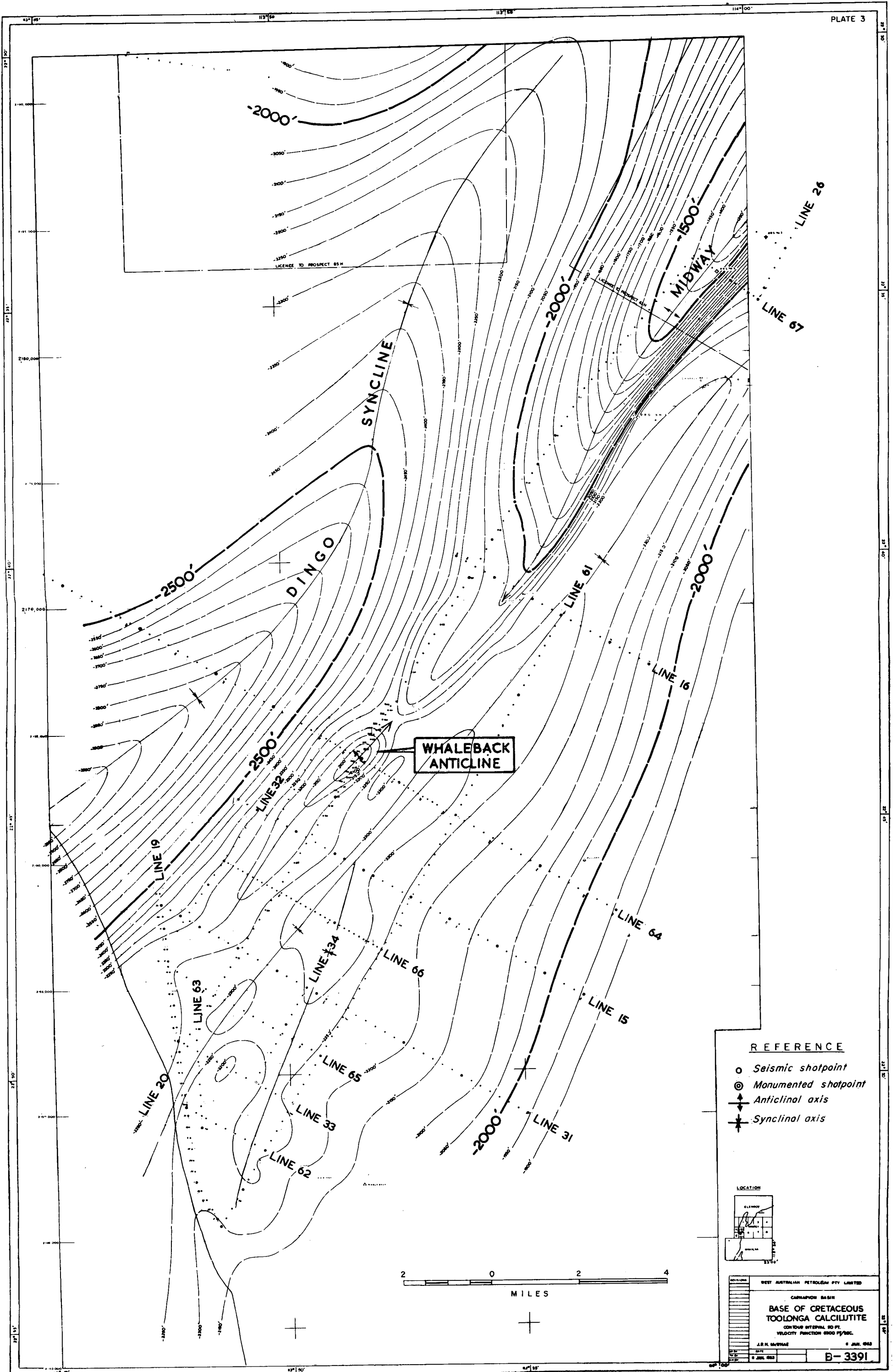
### ADDITIONAL DATA FILED IN THE BUREAU OF MINERAL RESOURCES

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

- (i) Final Report 6 pp.
  - Tables : 1 - Operational statistics 1 p
  - 2 - Survey personnel and vehicles 1 p
- (ii) List of illustrations in Final Report
  - Plates:
    - 1 - Location of Whaleback Area
    - 2 - Spread arrangement
    - 3 - Shothole and geophone configuration
    - 4A- Response of arrays
    - 4B- Response of arrays
    - 5 - Filter characteristics
    - 6 - A.G.C. characteristics
    - 7 - Dynamic corrections
  - Enclosures:
    - 1 - Line 20, SP64-SP102 (1320 ft interval); B-3389
    - 2 - Line 20, SP92-SP102R ( 660 ft interval); B-3390
    - 3 - Portion of C-3124 (Line 67), B-3384
    - 4 - Line 64, B-3386
    - 5 - Line 61, B-3387
    - 6 - Line 66, B-3385
  - Maps:
    - 1 - Base of Cretaceous Toolonga Calcilutite, B-3391
    - 2 - Basal Cretaceous unconformity, B-3391-D1
    - 3 - Isochor map, B-3391-D2
    - 4 - Palaeozoic structure, B-3391-D3
- (iii) Observer's field sheets
- (iv) Migrated depth sections
- (v) Variable area presentation
- (vi) Contour maps

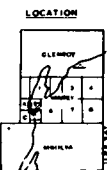




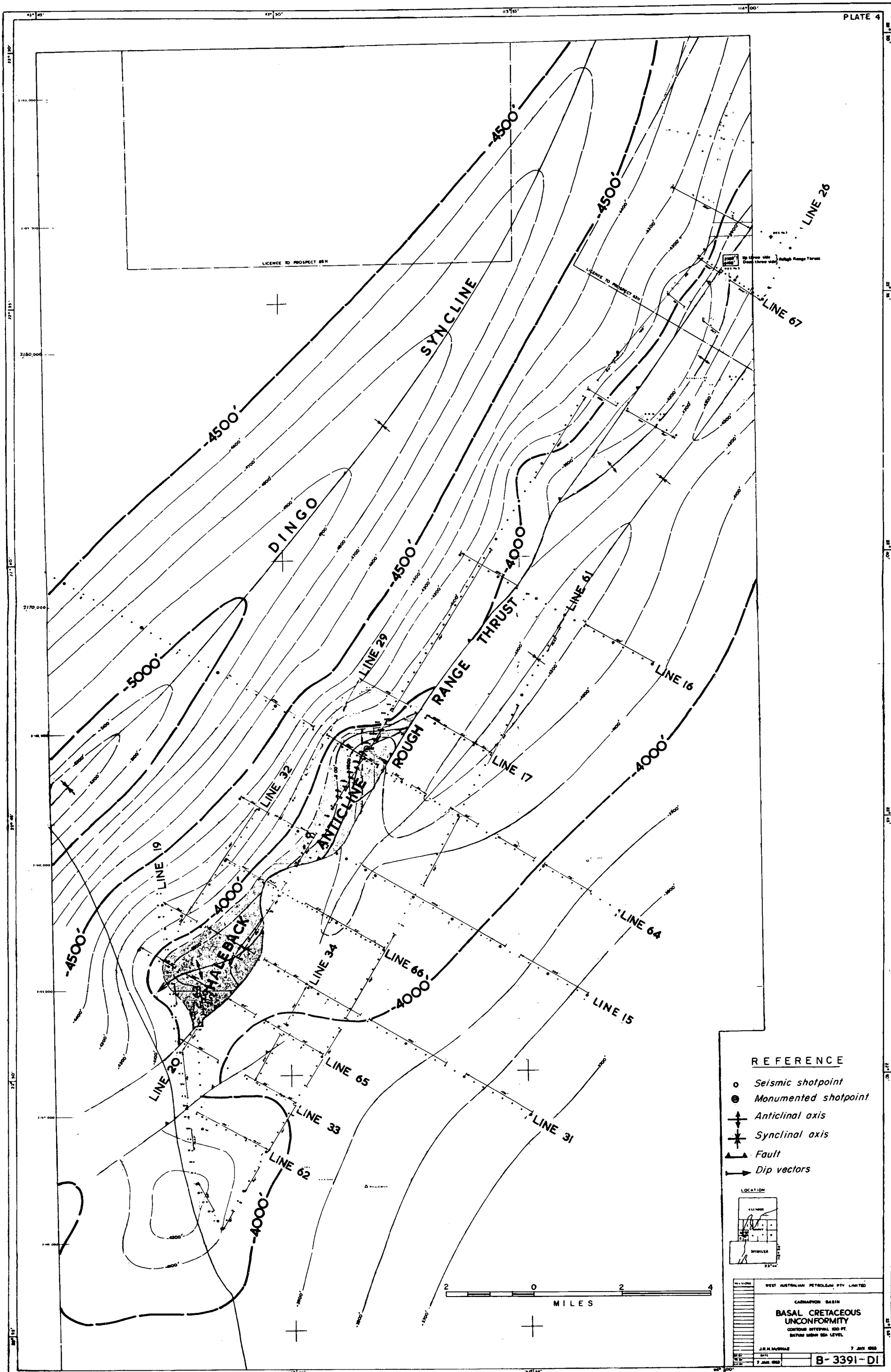


REFERENCE

- Seismic shotpoint
- ⊙ Monumented shotpoint
- ↕ Anticlinal axis
- ↕ Synclinal axis

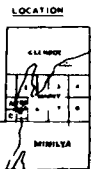


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CARNARVON BASIN	
BASE OF CRETACEOUS TOOLONGA CALCILUTITE	
CONTOUR INTERVAL 50 FT.	
VELOCITY FUNCTION 8500 FT/SEC.	
J.R.H. McWHIR	6 JAN. 1968
B-3391	



REFERENCE

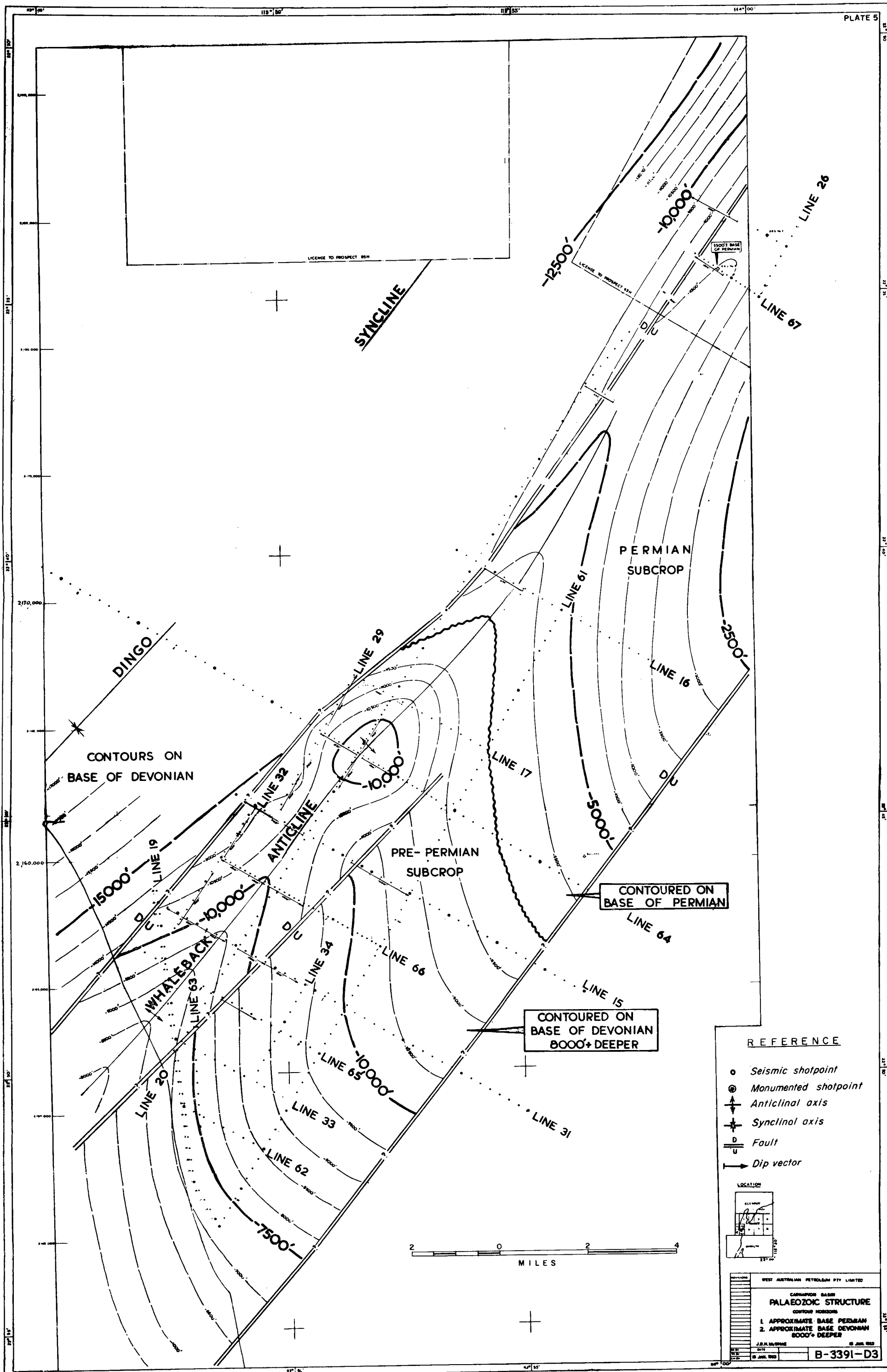
- Seismic shotpoint
- Monumented shotpoint
- ⊕ Anticlinal axis
- ⊖ Synclinal axis
- Fault
- Dip vectors



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CARNARVON BASIN  
BASAL CRETACEOUS  
UNCONFORMITY  
CONTOUR INTERVAL 500 FT.  
DATUM: MEAN SEA LEVEL.

J.R. H. MURRAY 7 JAN 1968  
B-3391-DI



REFERENCE

- Seismic shotpoint
- ⊙ Monumented shotpoint
- ↗ Anticlinal axis
- ↖ Synclinal axis
- D Fault
- Dip vector



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CARNARVON BASIN	
PALAEOZOIC STRUCTURE	
CONToured HORIZONS	
1. APPROXIMATE BASE PERMIAN	
2. APPROXIMATE BASE DEVONIAN 8000'+ DEEPER	
J.B.H. MURPHY	10 JUL 1963
B-3391-D3	