046001

OTTER EXPLORATION N.L.

FINAL INTERPRETIVE REPORT

1980 FLINDERS SEISMIC SURVEY

AND PRIOR DATA

TASMANIA PERMIT - T13/P

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1.0 ABSTRACT

The T-13P permit is located in the southern Gippsland Basin, off the east coast of Tasmania, Australia.

As operator, Otter Exploration N.L. conducted the Flinders seismic survey in May 1980. This was the first data acquired in the permit since 1973. This report is on the integration and interpretation of this survey and previous seismic lines.

The southern shelf of the Gippsland Basin has been tested by three wells; Mullet, Bluebone and Sailfish. The first two of which tested stratigraphic plays and the third a reefal play. This "reef" proved to be a volcanic feature, while the Mullet and Bluebone plays were dry, either due to lack of seal or restricted migration.

The area mapped on this 1:25,000 interpretation contains several small structural and stratigraphic closures in the Latrobe Coal Measures (LCM) which are potential sites for oil fields.

The major closures need to be confirmed with an additional seismic survey at least, and one of them drilled to Basement. The T82A survey of about 250 km is designed to define four structures: Furneaux, Flinders, Muttonbird and South Muttonbird.

2.0 INTRODUCTION

This is the final interpretation report for the T13P Flinders Survey of May 1980. The survey was shot by Geophysical Service International on May 6, 7 and 8, 1980, and comprises 400.475 kilometres of 48 fold reflection data. The interpretation report is an integration of the new acquisition with original and reprocessed data from earlier surveys.

The permit is located east of the Furneaux Islands, north-east of Tasmania. It had been held prior to 1979 as four separate permits, in the east by Magellan Petroleum and in the west by Esso and BHP.

The permit includes much of the Southern shelf of the Gippsland Basin. The central Gippsland Basin is the site of the largest oilfields in Australia. The giant Kingfish field, containing reserves in excess of a billion barrels is centered at 30° 33'S and 148° 15'E. The northern boundary of T-13P is at 30° 15', just 80 kilometres south of this field.

To the west is the crystalline Bassian High, which is sub aerial in north-eastern Tasmania, the Furneaux Islands and Wilson's Promontory in Victoria. Eastwards the basin is step-faulted consequent to the Australia-New Zealand continental breakup. The blocks continue down the continental rise, and the basin is bounded by the Tasman Abyssal Plain.

Trending roughly west to east, near the Victoria Tasmania border is the Bass Canyon. Source and reservoir are provided by the Latrobe Group, also known as the Latrobe Coal Measures (L.C.M.). These comprise sands, shales and coal, deposited from the Upper Cretaceous through Eocene. Seal is sometimes provided within the Gippsland oil and gas fields by shales within this group. More commonly, seal is provided by the calcareous muds and marls of the Lakes Entrance Formation.

3.0 OBJECTIVES

The generally poor quality of seismic data in the permit dictates that further modern seismic work be done to map structural and stratigraphic objectives prior to drilling.

The possible structural traps are highs at the Top Latrobe Coal Measures, sealed by Lakes Entrance Formation shales or the Gippsland Limestone. This model is similar to the known hydrocarbon reservoirs in the central Gippsland Basin.

Stratigraphic plays are possible where the Latrobe Group wedges out against basement highs. Both Mullet 1 and Bluebone 1 are unsuccessful stratigraphic tests to the west of the main area of interest where the Latrobe Group thins and on laps Basement.

The 80F survey was performed with the following objectives :-

1) Stratigraphic
2) Reconnaissance
3) Data quality experiment

The stratigraphic objectives were to attempt to recognise the extent and nature of the Latrobe Group, Strzelecki Formation, Basement, Lakes Entrance Formation and Gippsland Limestone. The southern section of the permit had sparse seismic data, and the 80F survey was shot in a southward zig-zag pattern to maximize the stratigraphic detail along and across strike.

Reconnaissance objectives were also served by the survey. Knowledge of the far south of the permit was extremely sketchy, and based on only a few lines from 1970. In particular, 80F-7 and 80F-8 were intended as comparisons with M-23-T to M25T, and M40T, M41T & M60T.

The survey also included substantial areas of old, densely acquired data. Shooting was done through that to provide high quality data to assist in interpretation of the older sections.

Three generalized geologic sections (plates 1, 2 & 3) are presented to illustrate the stratigraphic and structural concepts as presently envisaged in the more prospective part of the permit. The locations of these sections are shown in Plate 4.

Plate 1. represents an interpreted geologic depth section which includes known stratigraphic information from the Bluebone 1 and Sailfish 1 wells. Bluebone was drilled to test a possible stratigraphic pinchout play. The well encountered a sandy Lakes Entrance section below the Gippsland limestone and the Latrobe Coal Measures reservoir section. The well may have been dry because of lack of seal. Pockets of Eocene L.C.M. are shown eastward on the section as derived from study of relevant seismic sections near this traverse.

Near the Sailfish well the basement sub-structure shows the effects of the breakup tectonics near the continental margin. A postulated thickening of L.C.M. occurs over these basement fault blocks affording numerous opportunities for hydrocarbon traps. These include draped horst blocks, stratigraphic pinchouts, fault traps and combination stratigraphic-structural traps controlled by permeability barriers. The most likely type of permeability barrier would be due to channel cut and fill of Eocene to Miocene age as found in the central Gippsland Basin.

Sailfish 1 bottomed in volcanic material of Oligocene to Miocene age after penetrating the Gippsland Formation. The Lakes Entrance Formation (Oligocene shale) and L.C.M. were not reached.

Plate 2 shows an interpreted geologic section in depth derived from line 80-F-1. This section traverses the Northern 1:25000 map sheet of this report in a SSW-NNE direction. The prospective L.C.M. reservoir section is shown to be thin (or absent) over large basement highs with rapidly thickening wedges in the down dropped areas. Plate 4a is an interpreted version of Line 80F-1 and shows the tectonic style and stratigraphy of the area. Note the appearance of a typical volcanic feature at SP 1280 near 1.0 second.

These interpreted horizons were converted to depth using the stacking velocities (as if they were average velocities) from the panels at the top of the section.

Plate 3 is a SW-NE section through the southern 1:25,000 map sheet of this report. It was derived from line M20T, a 1969 seismic line reprocessed in 1980. A thicker sequence of L.C.M. is interpreted to overlie the basement highs in this area and consequently the detailing of structural leads by seismic profiles is preferred in this area rather than on those leads on the Northern Sheet. The time horizons from line M20T (reprocessed version) were converted to depth using the stacking velocities (as if they were average velocities) in the panels at the top of the section.

4.0 PREVIOUS WORK

(a) Seismic Surveys

Seismic surveys were performed within the permit spanning the period 1965-1973. Dynamite, aquapulse and airgun sources were used, and the data were 6, 12 and 24 fold, respectively.

The existing seismic grid was moderately detailed along strike from Sailfish 1 (39° 27'S, 148° 40'E). In particular, there is the very comprehensive G series lines, shot for Planet in 1970, which are the basis for much of this interpretation.

(b) Reprocessing

Sailfish Lines G7, G35X, G37 and G39A were reprocessed by Geophysical Service International in Sydney in March 1980. Also the following Magellan lines shot in April 1969 were reprocessed :M15T, M20T, M22T, M24T, M30T, M33T, M34T, M35T, M39T, M40T, M41T, M55T, M56T, M57T, M58T, M59T, M60AT.

The seismic surveys above were originally processed in the late 1960's to early 1971. Software and display hardware used to process data has dramatically improved in the last ten years. As a consequence the 1980 reprocessed data show a marked increase in quality.

(c) Drilling

Three wells have been drilled in the permit.Sailfish 1 was drilled by Planet in 1973 to test a postulated reef play in the Oligocene or Miocene. This well was abandoned in a volcanic pile without encountering hydrocarbons or Latrobe Coal Measures. Two Esso wells, Bluebone 1 and Mullet 1 tested shallow stratigraphic plays and were dry. These wells on the western shelf margin did penetrate sandstones of the Eocene Latrobe Coal Measures.

5.0 INTERPRETATION

5.1 Regional Stratigraphy

The deepest recognizable event on the seismic data in T13P is interpreted to be basement. This is strongly faulted, and is possibly similar to outcropping quartzite and schists on the Furneaux Islands.

Basement is overlain by the Strzelecki Formation in the north Gippsland Basin and comprises greywackes and shales of Lower Cretaceous age. The Strzelecki Group may exist in T13P, but in the absence of satisfactory well data or seismic marker characteristics it cannot be confidently mapped.

The Strzelecki Formation is a possible hydrocarbon source, even though in the central Gippsland Basin it is considered economic basement. In the central basin its depth of burial is substantial (>5000m) in a high temprature gradient. However, if present in T13P it is much shallower and thus likely to be a valid source.

The orange-marked "Basement" horizon may be seismic basement, or possibly top of Strzelecki Formation. Plate 5 illustrates seismic horizon depths and identification.

The Latrobe Group (or Coal Measures) has been postulated as the source for the Gippsland oil-gas accumulation and also contains the main reservoirs. In the central basin, this group is a complex of fluvial and deltaic clastic sediments. It contains sands, coals and some shales. The group is terminated in the Eocene by the Gurnard Formation, a shale formed during a marine transgression.

The Gurnard Formation is important in some of the Bass Strait Fields and acts as a seal.

The Latrobe undergoes a facies-change into a shallow marine environment in the south-east of the basin. The absence of well control prevents any conclusions as to the presence of this marine sequence in T13P. The marine facies is expected to be a good potential hydrocarbon source.

The Strzelecki Formation and Latrobe Group cannot be separated on available seismic data. Their combined thickness is an indication of available source, and this is mapped in the Basement-Top Latrobe Coal Measures isochron.

The Latrobe Group is overlain unconformably by Oliogocene shales of the Lakes Entrance Formation. These shales are discontinuously overlain by lenses of volcanic material.

Overlying the volcanics and Lakes Entrance Formation is the Miocene Gippsland Limestone, which is interpreted to act as a seal.

5.2 STRUCTURAL FEATURES

Ther permit structure is dominated by a narrow NNW-SSE shelf, bounded by probable strike-slip faults. These fault-bounded basement highs are draped by Strzelecki Formation and Latrobe Coal Measures.

Movement along faults slowed by the Eocene, and stopped during the Oliogocene. As the seals are Oliogocene Shales and Miocene limestones, rupture of traps by faulting is expected to be unlikely.

The reader is referred to the excellent Robertson Research Report, included under this Report as Appendix III for a review of regional geology.

Mapping of the Latrobe Group has revealed 23 features which are possible hydrocarbon traps. These features are indicated on map sheets 19 and 20 and described in Appendix 2. They are mainly structural, and are usually associated with drape over the basement highs.

The most prominent of the leads are known as Furneaux (19), Flinders (18), Muttonbird (12) and South Muttonbird (23).

5.3 WELL TIES

There is poor correlation of seismic horizons to nearby wells. Attempts have been made to run Cultus Pacific trade data from Hapuku 1 and Kingfish. However the Bass Canyon lies along the northern permit boundary, preventing any but jump correlations to T13P markers. These jump correlations were coupled with general character to identify the seismic markers.

This "general character" included the high reflectivity of and unconformity at the Top Latrobe Coal Measures, and the existence of volcanic extrusions at the near base Miocene level. These extrusions appear as lenses on seismic sections.

In the western part of the permit Mullet and Bluebone were drilled. These wells intersected a thin section of Latrobe group and running seismic results from these wells cannot reliably be extrapolated to the east.

The interpretation thus relies on jump correlations and marker horizon estimates based on North Gippsland characteristics.

5.4 SEISMIC MARKERS

The seismic markers were run on the sections and interpreted according to the following scheme.

Mid-Miocene

Yellow - a strong high frequency shallow continuous reflection.

Near Base Miocene

Green - strong high frequency and coincident with the top of volcanic lenses often present in the section.

Top Latrobe Coal Measures

Purple - very strong, medium frequency, and below volcanics. High amplitude due to impedence contrast between marls and coal, and a marked angular unconformity with downlapping miocene on top of a conformable Latrobe sequence.

Basement

Orange Low frequency, erratic amplitude.

Magellan data has magnetic profiles which are useful for identifying early Miocene lavas.

5.5 DATA INTEGRATION

Interpretation of the area required integration of data taken over fifteen years. Apart from the 80F survey, these were lines from (?) 1967 to 1973, acquired for Esso-BHP, Planet and Magellan.

Integrating such data has proved difficult for the following reasons :

i) Differences in processing. The actual processing on earlier programs is poorly documented. Generally it was unsophisticated, lacked adequate velocity and filtering parameters were often destructive.

ii) Display variations. The sections have variable area, VA-wiggle and variable density on a variety of time scales.

iii) Water replacement statics were applied, but not necessarily annotated on the old data. On two lines (G-37 & M21T), pushdown of strata occurs in a zone of anomalous water depth, which suggests that the present correction is inadequate. The lack of static annotation caused interpreters considerable delay.

iv) A variety of energy sources and instrumentation resulted in varying phase and frequency response of field recording.

5.6 SOURCE FORMATIONS

Strzelecki Formation Marine greywackes and marls from the Lower Cretaceous. These might not exist in the southern Gippsland Basin, and in the absence of seismic well evidence, cannot be mapped. The Strzelecki Formation can be considered as possible source in T-13P but not in the central basin.

Latrobe Group Fluvial and deltaic sediment in central Gippsland Basin are up to 5000m thick and range in age from Upper Cretaceous through to Eocene.

In the south east of the Basin it is supposed that Latrobe Group undergoes a change to a shallow marine facies. The only evidence that the Latrobe Group are still coal measures is their high reflectivity on the sections interpreted.

The probable source and reservoir thickness has been mapped with the Basement to Top Latrobe Coal Measures isochron.

5.7 SEAL FORMATIONS

Lakes Entrance Formation - oligocene shales. This overlies the Latrobe Group unconformably, and was deposited during the Oligocene marine transgression.

Latrobe Group - Gurnard Formation

The end of the Latrobe Group was marked by a brief marine transgression during which at least 40 metres of marine shales were deposited. These act as a seal within the Latrobe Group, and are frequently important in the north Gippsland oil fields.

Basement

Stratigraphic traps may exist along the margins of basement highs. These traps are expected to be sealed vertically by the Lakes Entrance Formation and laterally where the Latrobe Group wedges out against the Basement.

The basement is expected to be similar to outcropping basement on Cape Barren Island where, it is composed of metasediment overlying impermeable granite.

5.8 IGNEOUS EXTRUSIONS - near base Miocene.

These are common throughout the permit, and have been mistaken for reefs. Some have magnetic susceptability, cause magnetic anomalies and can so be identified. The Plant survey of 1970 also included magnetic profiles which are displayed on the sections.

5.9 REGIONAL DIP

Regional dip on the Latrobe Group is to the east so that critical closure is often required to the West.

Faulting is predominately N-S, however, allowing an ideal situation for fault traps and associated anticlinal and stratigraphic plays.

5.10 USE OF COMPUTER

Most of the interpreted data was digitized, processed and posted using the system owned by Wescom Pty. Ltd. of Peppermint Grove, Western Australia.

The system permits the production of post-plots, precise digitization of data, depth conversion, arithmetic manipulation and production of posted contour maps.

On this project, about 110 lines were digitized, had static corrections applied, and were posted onto 1:25000 sheets.

6.0 CONCLUSIONS

6.1 LEADS

6.1.1 Structural

The most significant structural leads can be observed on the southern Top Latrobe Coal Measures (Sheet 6). They are leads 18 and 19, named Furneaux and Flinders respectively, and are centered at 39° 34'S, 148° 43'E and 38° 32's, 148° 42'E. Also on this sheet, lead 12 involves a significant structural high.

The Flinders lead (lead 19) has a thin cover (approx. 50ms) of Latrobe Group. It has a possible 50ms of closure, and area of 4 km^2. The Furneaux lead (lead 18) has a thicker section (200 msec) of Latrobe Group, but the closure is reduced to 30ms. Both prospects are updip from substantial thicknesses of Latrobe Group and are optimally located to receive hydrocarbons.

Leads 18 and 19 may prove to be one large area of closure bounded approximately by 148° 45'E, 39° 32'S; 148° 41'E, 39° 31'S; 148° 40'E, 39° 32'S; 148° 42'E, 39° 36'S, and 148° 45'E, 39° 35'S.

Further seismic coverage would lead valuable velocity information which may make this area considerably more attractive than presently mapped. Extreme area of closure may be as great as 20 square kilometres.

Other leads in the southern sheet include lead 12, centered at 39° 41'S, 148° 44'E. This is indicated only by line G-37 and could be created by a replacement static problem.

On the other hand, if lead 20 proves to be real, it may be continuous with lead 13 and another structurally high area to the north. Closure against basement on the fault to the west could give an areal closure of around 12 square kilometres. Again, only further seismic will verify this.

6.1.2 Stratigraphic

Lead #9, 10 and 11 are all stratigraphic plays which rely upon overlying Gurnard or Lakes Entrance Formations pinching the Latrobe Group out onto Basement.

Of the three, lead 9 is the largest of 6 km^2 and 120ms of closure. The migration pathway is restricted, and may not permit accumulation of hydrocarbons from a great area. However, there are possibly 700ms of Latrobe Group sediments within the reservoir, which could conpensate for restricted migration from the east.

Leads 10 & 11 are more open to hydrocarbon migration, but are each less than 1 km^2 and have small vertical closure.

6.2 Seismic Data Quality

The seismic data coverage on some of the permit is on a tight grid. In particular, the G-lines are only one or two kilometres apart. However, they were recorded in the late 60's and early 70's and are of poor quality compared to todays standards.

The 1980 reconnaissance survey is mainly an open zig-zag of lines with only one loop closure. It was however, the backbone of the interpretation, especially for locating basement. This improved reliability is due to the use of airgun arrays with a 96 trace cable, and to state-of the-art processing. Subroutines such as velocity filtering, wavelet designature, velocity analysis, multiple removal and migration are now normally used in production processing, but were mainly unavailable in 1970. The use of 48 fold data now, in place of 12 and 24 fold data, has also increased the signal to noise ratio.

The older data from the late 60's and early 70's was shot 12 and 24 fold using either aquapulse or airgun. The processing sequence that was performed was unsophisticated when compared to modern capabilities although it was the "State-of-the Art" at the time. Insufficient and variable documentation caused difficulties in working with these data.

In contrast, the section (80 F-I) presented as Plate 5B shows the good quality data that can be obtained with careful application of modern sophisticated processing. Plate 5A is a version of the same line displayed prior to migration. The comparison of 5A with 5B shows the value of migration in the permit because of the steep dips, discontinuous water bottom and diffractions due to faults, unconformities and other causes. The parameters for the various surveys are documented in Appendix I. Included are acquisition, processing and display details.

7.0 RECOMMENDATIONS

1) A grid of new data is necessary over structural features noted previously. The depth to basement is such that a long cable be used, that is at least 2400m.
This 250 km T82A survey is shown on sheets 19 and 20.

Acquisition should be 96 trace, 48 fold, 4 msec recording, using a 2400 or 3200 meter cable and airgun source. This should then be processed as 96 trace data, using such routines as velocity filter, designature, dense velocity analyses, demultiple and migration.
Display should be VA-wiggle at 10 centimeters/second.

2) Processing experiments from the above should be preserved for inclusion in reports.

3) Magnetic surveys should be done in conjunction with seismic to help identify Tertiary basalts or volcanics. It is essential that a base station be established near the area to record diurnal drift and magnetic storms to enable proper data correction to be performed.

4) Rapid variations in velocity due to water depth variations and facies changes indicate that tight velocity control is necessary . Using this information, a good time-to-depth conversion is possible.

APPENDIX 1

Date acquisition, processing and display parameters 1967-81.

1. SAILFISH MARINE SEISMIC SURVEY

Company	Planet/NSW Oil & Gas
Lines	G-1 - G-41
Date	November 1970
Field Parameters	Airgun, 10 liter array
	24 fold
	1400m cable
	Shot by Teledyne
Processing	Poorly documented
	Decon 280 msec operator
	15-45 filters in first second
	15-40 to 2 Secs.
	No AGC
	Processed by G.S.I.
Display	VA only
	10 TPI
	3 3/4 IPS

Lines G7,G35, G37 & G39 reprocessed in Sydney by G.S.I. March 1980.

2. EAST GIPPSLAND BASIN

Company	Magellan Petroleum Southern Pty. Ltd.
Lines	M. T.
Date	April 1969
Field Parameters	Aquapulse
	48 fold, 48 trace
	2400m cable shot by Western
Processed By	G.S.I. 1969
	4:1 vertical stack
	VA only display
Reprocessed by	GSI 1980
Lines	M22T
	33 - 35
	40, 41, 55-58, 15
Processing	Designature
	Velocity Scan
	Replacement Statics
	DAS
Display	VA-Wiggle

3. 80-F FLINDERS 1980 SEISMIC SURVEY

Company	Otter Exploration N.L.
Lines	80F-1 to 80F-13
Date	May 1980
Field Parameters	96 trace 48 fold 2400m cable 23 liter
	airgun array source
Processing	Velocity filter
	Designature
	Velocity Scan
	Stack, filter and scale

4. NORTH-EAST FURNEAUX

Company	Magellan Petroleum Aust. Ltd.
Lines	NEF-1 to 8
Date	May 1973
Acquisition Parameters	48 trace 24 fold 2400m cable
	Airgun source 20 litres
	Shot by G.S.I.
Processing	Deconvolution before and after stack
	Filter 10-40 Hz.
Display	VA-Wiggle 3 3/4" per second.

5.

Company	Esso Standard Oil (Australia)
Lines	EC-160-163
Date	Unknown
	Dynamite 6 fold shooting by Western
	Geophysical Co.
	Variable density display.

6.

Lines	EH 181, EH 182
	Aquapulse 12 fold, shot by WGC for
	Esso in August, 1980
	Processing includes a 10-25 filter,DBS,
	Stack, DAS, filter by GSI

APPENDIX 2

ANALYSIS OF STRUCTURAL CLOSURES
NORTH 1:25000 Sheet (19)

STRUCTURE	AREA km^2	VERTICAL CLOSURE msec	EVIDENCE	SOURCE	COMMENTS
1	1½	20	Turnover on G-33	4-6 km^2 approx 200 msec thick	Migration from east blocked by basement highs.
2	4	40	Turnover on G33, G35X	10 km^2 of very thin formation	As above
3	2	20	Turnover on G31 SP50 G32 SP5 30-60	10 km^2	Source and reservoir less than 20 msec thick
4	2	10	G26, G41 Turnover	Thin source to North	
5	1	20	G15, SP60 80F2 turnover		Good migration pathway from east
6	2	20	G22, SP 30 G36, SP240 turnover		
7	1½	20-40	EC-162 SP 7110	Abundant source thickness	Data very poor
8.	1½	20		30 msec of source	Could be a nose.
9.	6	100	Seismic section poor	Poor migration pathway, but abundant source	Stratigraphic trap from Latrobe pinchout.
10.	½	30	Pinchout on G33	Abundant source to east, with easy migration	Stratigraphic Trap
11.	1½		G34 SP72½ and G38 SP39 pinchouts	Abundant, with easy migration	Stratigraphic Trap

SOUTH 1:25000 SHEET (20)

STRUCTURE	AREA km^2	VERTICAL CLOSURE msec	EVIDENCE	SOURCE	COMMENTS
12	2½	40	637 turnover	Abundant source to east	Muttonbird lead could be associated with a waterbottom irregularity.
13	1	20	G3, G4 turnover	Abundant source to east	
14	1½	20	Turnover on G5, M40T, 80F5	Isolated from source by basement high	
15	1½	20	G5, G39 show turnover	Abundant source to east.	
16	½	10		Abundant source to east.	
17	1½	20	80F4,M55T with high at intersection	Abundant source to east.	
18.	4	25	G10, G9, G34 M55T all show turnover	Abundant source to east	Flinders Lead

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ROBERTSON RESEARCH (AUSTRALIA) PTY. LIMITED

REPORT NO. 540

PROJECT NO. 1146

APPRAISAL OF PETROLEUM POTENTIAL OF EXPLORATION PERMIT T13P IN THE BASS STRAIT, TASMANIA

by

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FIGURES

1. LOCATION OF T13P AND MAJOR GEOLOGICAL FEATURES
2. INTERPRETIVE SECTION THROUGH NORTHERN PART OF T13P - missing

1. CONCLUSIONS AND RECOMMENDATIONS

The petroleum potential of Permit T13P is evaluated by consideration of the similarities and differences between it and the central deep of the Gippsland Basin to the north. Although the gross stratigraphic sequence in T13P is similar to that of the Gippsland Basin, sufficient difference exists, particularly as regards potential depositional environment and structural style, to require that it be evaluated largely on its own merit. Petroleum prospects range from largely stratigraphic plays on the edge of the continental shelf, in water depths of 100-200 metres, to structural/stratigraphic plays on the continental shelf edge and slope, in water depths of 150-700 metres.

The existing three shallow wells and the old, relatively sparse seismic data provide very little information on the sediments, and exploration targets cannot be adequately defined. Renewed exploration effort should be initially aimed at elucidating the structure and stratigraphy of the shelf margin, since this is critical to the exploration potential of the block as a whole. For this purpose, the proposed reprocessing of old data and a new seismic survey are considered justified.

2. INTRODUCTION

The permit area lies to the south of the Gippsland Basin (between Tasmania and Victoria) in which the most important oil fields in Australia, as well as several large producing gas fields, are located. These fields, of relatively large dimensions, were discovered more than 10 years ago. Further exploration achieved only minor success until recently when, using the state-of-the-art geophysical technology and encouraged by more favourable economic conditions, exploration resulted in new discoveries and extensions to existing pools. Although relatively small, they are significant and economic.

In view of advances in technology and the urgent demand for petroleum resources, our present knowledge of the geology of this area indicates that it is reasonable and logical to undertake further study and petroleum exploration of this permit.

3. PREVIOUS EXPLORATION

Most of the present permit area was previously held in separate permits by Esso/BHP and Magellan Petroleum. Seismic surveys led to the drilling of three wells within the permit boundary. The two Esso/BHP wells (in 1969) in the extreme northwest corner of T13P were very shallow stratigraphic pinchout prospects which proved to be dry, possibly owing to the absence of a seal, and more likely as a result of excessive distance from a suitable source of hydrocarbons. The other shallow well, drilled in 1971, tested a seismic anomaly having some reef-like characteristics, but encountered instead a local buildup of volcanic material.

Seismic survey control is rather sparse in large portions of the permit, particularly in the southern half. The surveys were run prior to 1971 except for a small survey along the northern margin of the present permit in 1973. The definition and resolution of these data cannot be compared to modern seismic survey and processing results.

4. SOURCE OF DATA

This report is based on brief examination of the seismic record sections, maps and reports of surveys within and contiguous with T13P, plus perusal of well completion reports of the three wells. Background information on the geology and hydrocarbon fields of the Gippsland Basin and regional geology was obtained from published literature, mainly in the APEA Journals and the A.I.M.M. volume on Petroleum, Economic Geology of Australia and Papua New Guinea, 1976.

5. GEOLOGICAL SETTING

The Gippsland Basin consists of two platform areas and a deep east-wes Central Basin (Figure 1). The Central Basin, which contains all the oil and gas fields discovered to date, opens and deepens towards the east, and is separated from the platform areas by faulted hingelines. The Northern Platform trends east-west and extends onshore. The Southern Platform impinges on the Victorian coastline to the north of the Bassian Rise, which separates the Gippsland Basin from the Bass Basin. Southeastwards, it merges into the shelf zone along the eastern continental margin. Permit T13P extends from the eastern part of the southern platform southward along the continental shelf. This shelf zone, where water depths are relatively shallow, covers 75 percent of the permit. The easternmost portion of the permit lies on or beyond the continental shelf break, in water depths of 100 to 1,000 metres.

6. GEOLOGY OF T13P AS RELATED TO CENTRAL GIPPSLAND BASIN

Sediments deposited in T13P were probably derived from Palaeozoic rocks and granites similar to those which provided the coarse-grained erosion products in the Central Basin. Permo-Triassic rocks have not been recognised in the Gippsland Basin, but they are present in eastern Tasmania, and they are known to contain small oil and gas accumulations elsewhere on the eastern side (Bowen Basin) of the Australian continent.

Lower Cretaceous Strzelecki Group rocks or equivalent, in which hydrocarbon shows have been found in the Otway Basin, are thin or absent on the platform/continental shelf, but are probably thick along the downfaulted continental margin in the eastern part of T13P.

Continental drift between Australia and New Zealand commenced in Upper Cretaceous time, followed by separation from Antarctica in

early Tertiary time. These events resulted in the generation of two distinct structural styles in the Gippsland Basin:

(a) NW-SE trending normal faults, caused by tensional stress during the early stages of continental breakup (early Cretaceous to early Eocene).

(b) E-W wrench faults, with associated NE-SW en echelon anticlines, initiated at the end of Eocene time and rejuvenated in the Miocene.

The Central Basin acquired a large part of its present shape and character by subsidence and faulting in late Cretaceous to Eocene time. The continental margin in T13P was also established at this time, and exhibits features typical of a rifted 'Atlantic-type' margin. These include normal down-to-the-sea step fault blocks, a major 'breakup' unconformity at the top of the supposed Strzelecki Group, seaward thickening of the post-breakup sequence, and possible dip reversals on the continental slope. Anticlinal structure characteristics of the Central Gippsland Basin are not recognised in T13P.

In the Central Basin, an enormous thickness of non-marine and shallow marine sediments, the Latrobe Group, accumulated in a fluvial and delta plain environment. This Group comprises a repetitive sequence of sands, silts, minor shales and coals, and contains large quantities of land-derived organic matter. The sands, laid down by a system of braided streams flowing from the northwest, have excellent reservoir characteristics. Beyond the steep-sloped delta front, which remained close to or west of the present shelf edge, deposition of marine sediments appears to have been minimal.

As the typical alluvial and delta plain facies of the Latrobe Group are known only in the area northwest of Permit T13P, the nature of

the Latrobe Group sediments in this permit is uncertain. There are indications that although most of the sediments in the Central Basin were derived from the highlands to the north and west, some sediments were eroded from the Bassian Rise and the Southern Platform. The Bluebone and Mullet Wells, in the northwest corner of the permit, encountered silty sands (with poor permeability) of fluvial origin in the Latrobe Group. It seems likely that most of the Latrobe sediments in the western part of T13P were derived locally and are of relatively low energy, non-marine facies. However, a thick sequence of probably Latrobe equivalent sediments is postulated on the continental slope (Figure 2), and may be derived from the north; it could be quite different from those encountered by previous drilling in the permit. Rather poor quality seismic data indicates a thick, lower, acoustically transparent sequence overlain by a relatively thin high amplitude, variable continuity section, becoming less continuous eastward. The section is tentatively interpreted as fine clastics overlain by marginal marine sands, rather than a pro-delta/delta plain sequence.

The Lakes Entrance Formation is present over all or most of the shelf area of T13P, except when eroded by channels at the top of the overlying sequence and, as in the Gippsland Basin, can be expected to provide a vertical seal on Latrobe reservoirs. However, it appears to thin by downlap over the continental slope, and may be absent in places in the extreme east of the permit. In this case, seal would be dependent on the presence of impermeable carbonates in the overlying Gippsland Limestone, which prograded over the continental margin in late Miocene time.

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7. CHARACTERISTICS OF THE OIL AND GAS FIELDS OF GIPPSLAND BASIN

The major accumulations of oil and gas occur immediately below the eroded surface of the Latrobe Group sediments where they are sealed both vertically and horizontally by the overlying Lakes Entrance shales in a variety of stratigraphic unconformity and structural traps.

The major oil fields are confined to the south central part of the Deep Basin and the traps are partly structurally and partly stratigraphically controlled. Truncation of the rising reservoir beds at the erosional surface of the Latrobe Group provides critical closure. The oil is derived from the non-marine lower part of the Latrobe Group (Upper Cretaceous and Palaeocene).

Several favourable factors account for the presence of large productive pools in this part of the basin:

(a) A large quantity of land-derived organic matter was deposited and preserved in the Latrobe Group. The geothermal gradient in the Gippsland Basin is higher than normal, allowing maturation of hydrocarbons at relatively shallow depths of burial.

(b) The pattern of braided stream deposition facilitated lateral updip migration of hydrocarbons over a large drainage area. Fresh water intake of the exposed Latrobe aquifers in the onshore area to the northwest provides an active artesian system for maintaining the water drive below the hydrocarbon column.

(c) Regional shear zones and normal cross-faults in the Latrobe Group contribute toward migration of hydrocarbons.

046032

(d) Widespread effective claystone cap-rocks overlie the erosion surface and in-fill the channels in the Latrobe Group.

(e) Structural traps were formed by the processes of wrench-fault tectonics during the mid-Miocene, prior to the maturation and migration of hydrocarbons.

(f) Maturation and migration took place as the Latrobe-Lakes Entrance sequence was buried by the Gippsland Limestone and younger rocks.

The major gas fields are concentrated in the northwestern sector, where the traps are structurally controlled and erosion at the top of the Latrobe Group is minimal. This gas is derived from the coal measures in the upper part (Eocene) of the Latrobe Group.

In addition, small pools of both oil and gas are found within the Latrobe Group complex, primarily in the northeastern sector, in anticlinal structures where the seal is an interbedded shale.

8. PETROLEUM PROSPECTS IN T13P

8.1 SOURCE ROCKS

The thickness of sediment above the basement in T13P begins to approach that of the Central Basin only in the eastern part of the permit on the continental margin. The exploration potential of the permit area depends greatly on the presence of adequate source rock sequences on this margin. Seismic data and the configuration of the present day shelf suggest that down-faulting and thickening of the section is present (Figure 2). An increase in marine influence in the Latrobe Group is possible in the eastern part of T13P, since this area was probably more accessible to the open sea than the partly enclosed central basin to the north; this would enhance source rock potential.

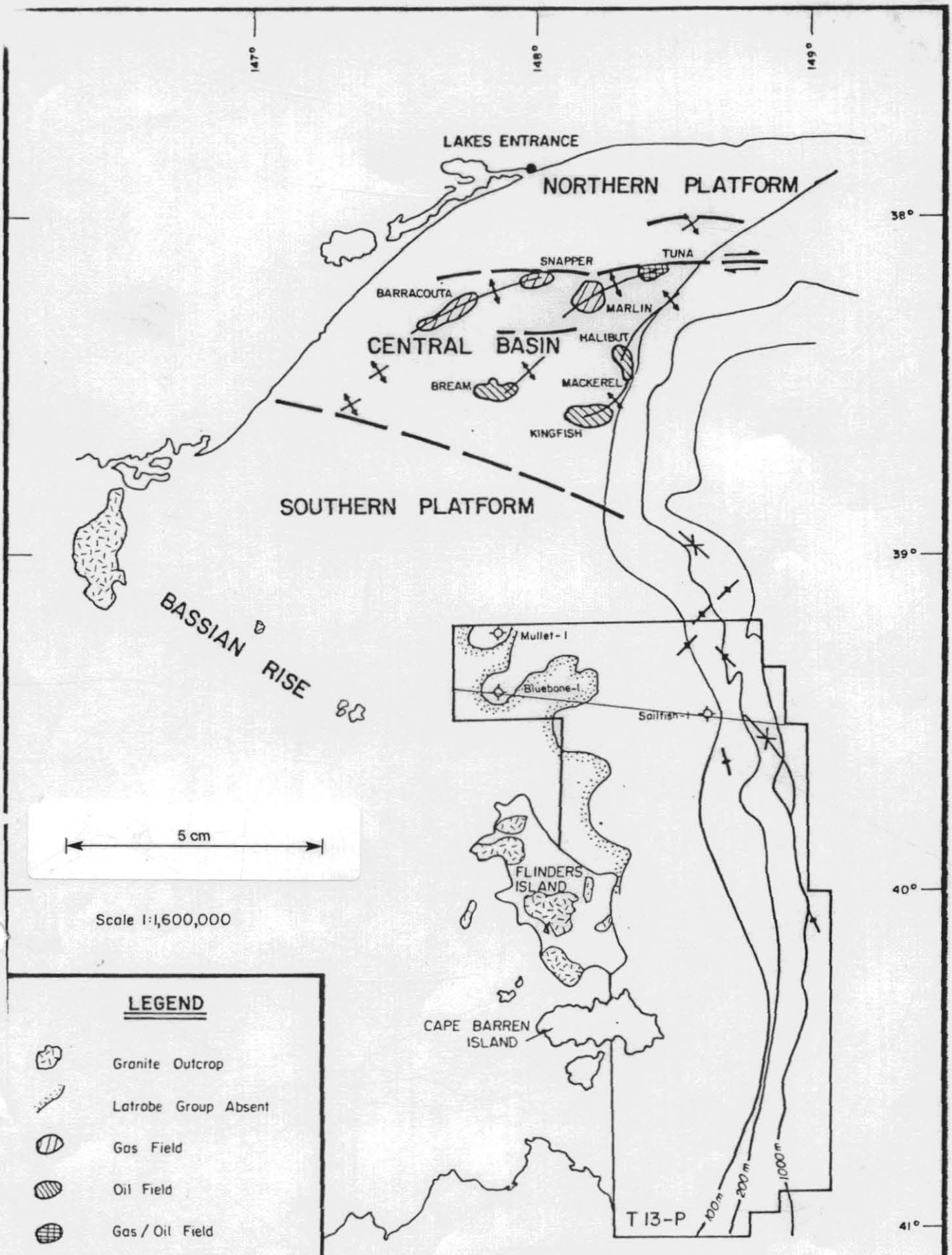
8.2 RESERVOIRS

Delta facies typical of the Central Basin are not anticipated in the Latrobe Group in the western part of T13P. However, the upper part of the postulated thick Latrobe section in the eastern part of the permit may comprise coastal clastic facies, including beaches and bars, which would constitute adequate reservoirs. The growth of reef structures in Miocene or younger time on the shelf edge is not considered a strong possibility. The Sailfish well proved that reef-like features on seismic sections may be caused by volcanic mounds, and there is doubt that water temperatures and other oceanographic conditions were ideal for reef growth on this margin.

8.3 TRAPS

The existing seismic data is inadequate for mapping traps in the Latrobe and older sequences in T13P. At the same time as basin-forming faulting was taking place in the central basin, faulting was also dissecting the southern platform margin. At least two intersecting structural trends are apparent, one of which is probably comparable with the normal faults of the central basin. The other is parallel to the productive anticlines in the central basin, but is believed to be of a quite different origin and type.

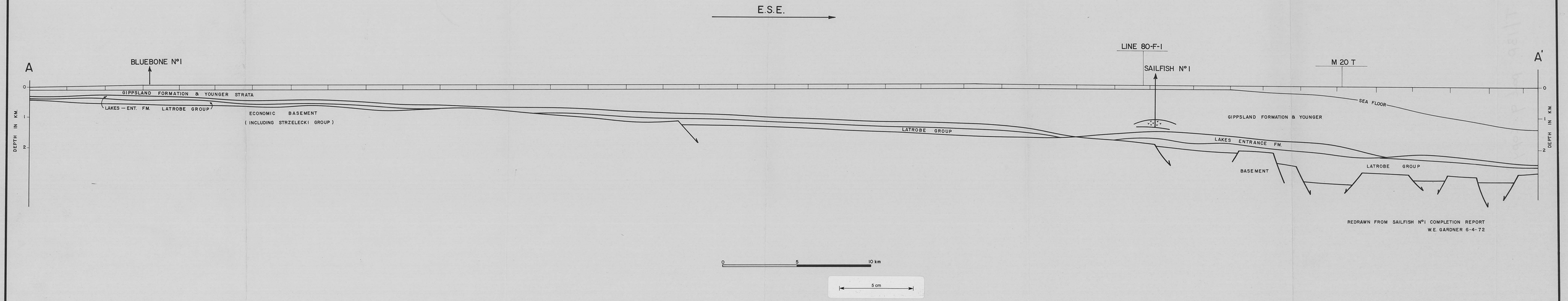
Stratigraphic pinchouts on the upper platform will be dependent on long distance migration from beyond the shelf break, but may constitute valid targets on the platform margin when lateral and vertical seal is enhanced by channelling. Further prospects may be present in Latrobe Group sandstones on the continental slope, when dip reversals are provided by drape or growth above basement fault blocks, and sediment pinchouts of postulated shallow marine clastics may be present.



LOCATION OF T13-P AND MAJOR GEOLOGICAL FEATURES

Figure 1.

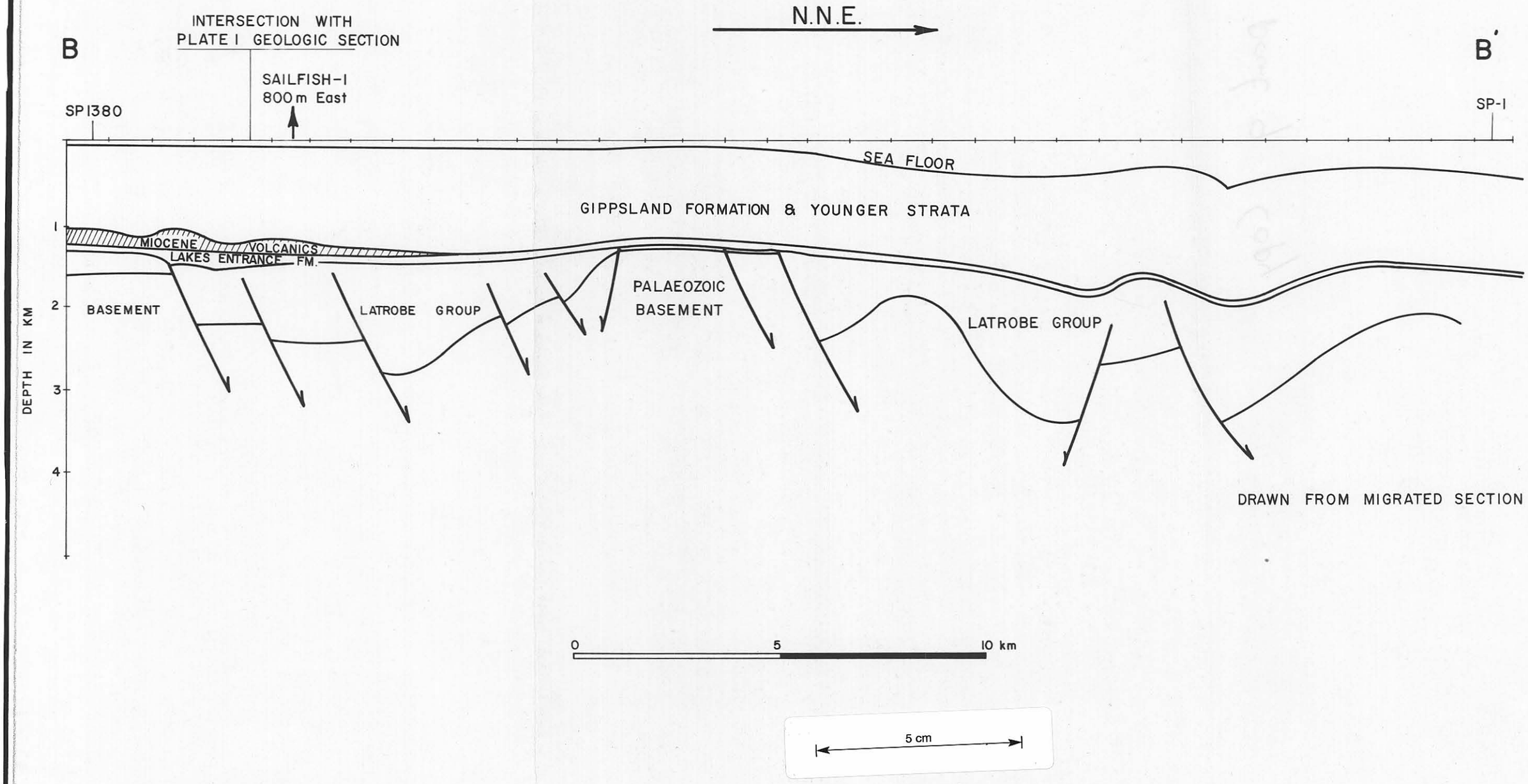
C46035



REDRAWN FROM SAILFISH N°1 COMPLETION REPORT
W.E. GARDNER 6-4-72

Plate 1 OR-098.

LINE 80F-1



DRAWN FROM MIGRATED SECTION

0 5 10 km

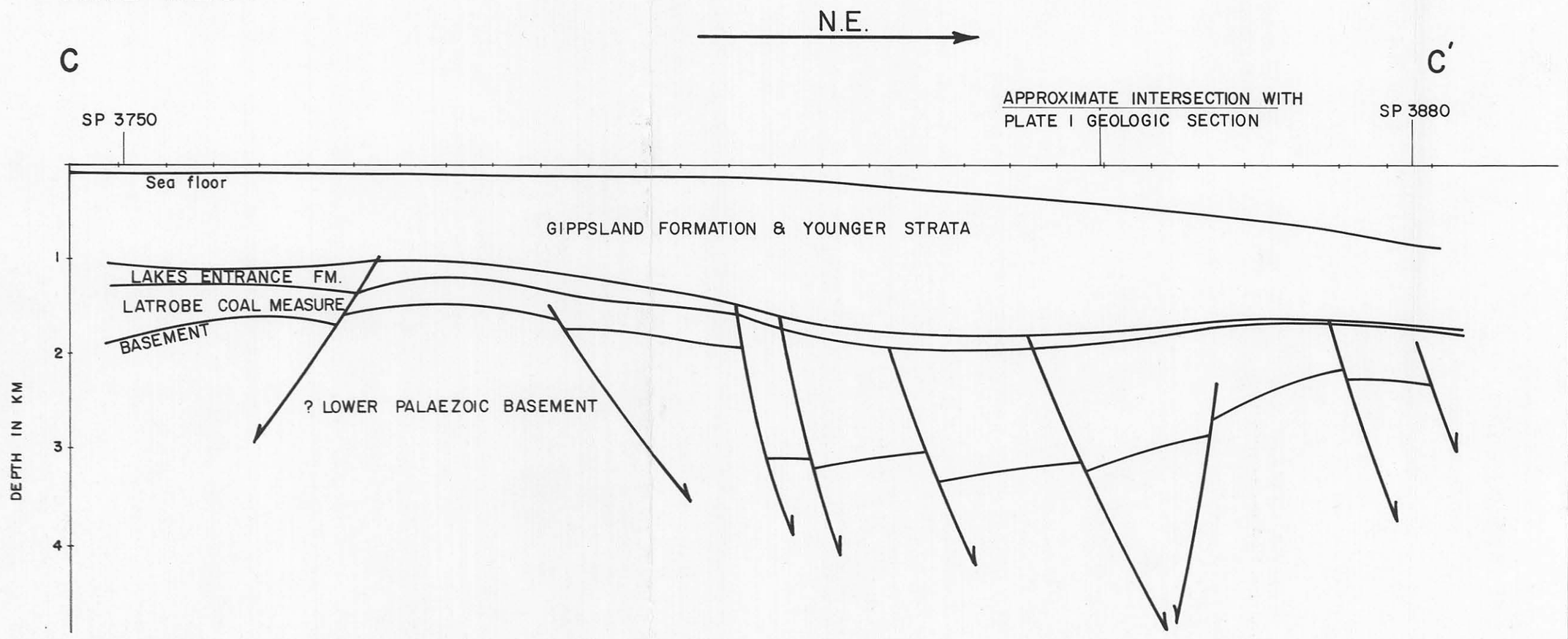
5 cm

046036

Plate 2

OR-098.

LINE M20T



HORIZONTAL SCALE 1 : 100 000
VERTICAL SCALE 1 : 50 000

0 5 10 km

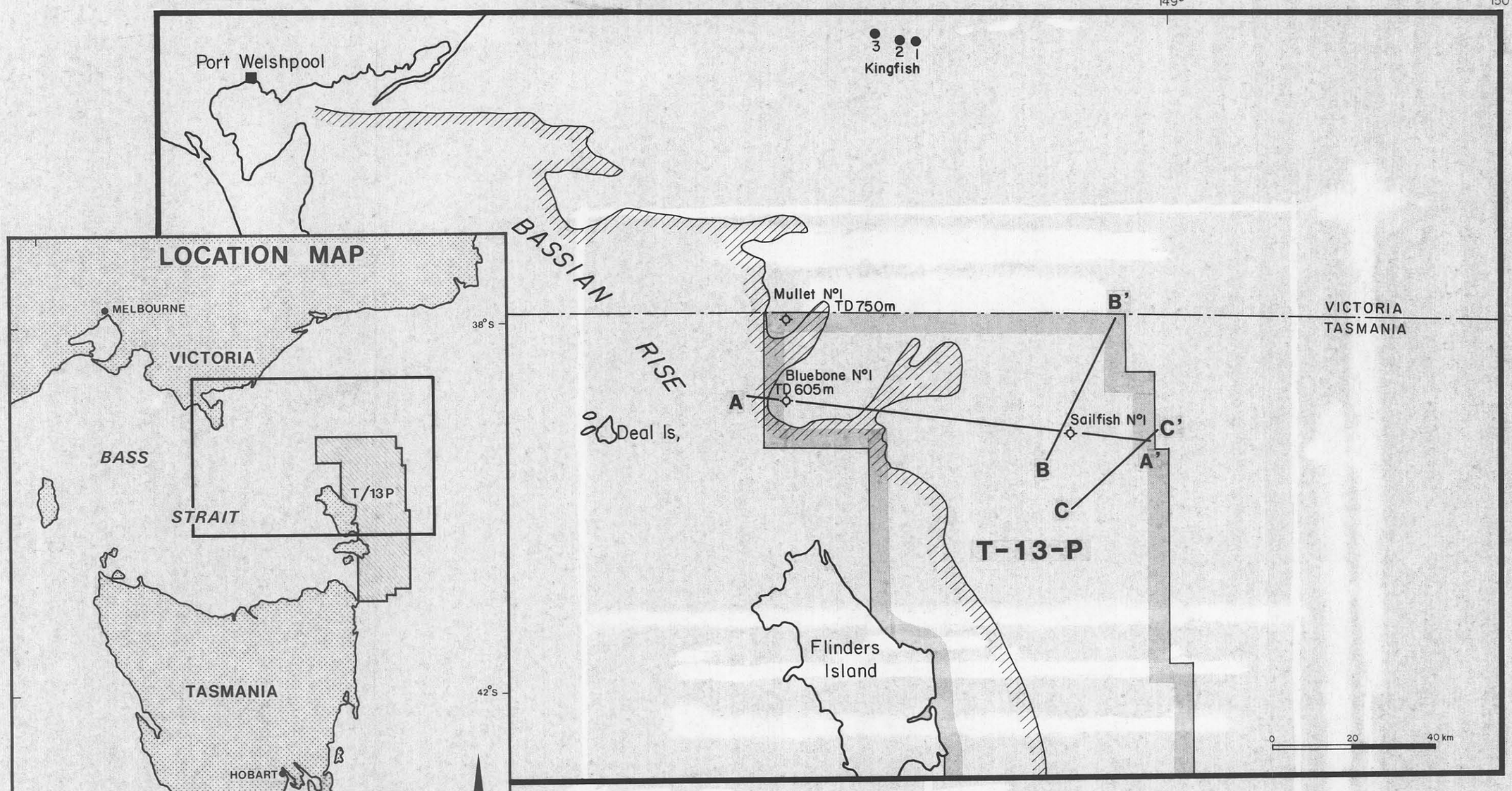
5 cm

046037

Plate 3. OR-098.

OR-098.

Plate 4 LOCATION MAP:GEOLOGICAL CROSS SECTIONS



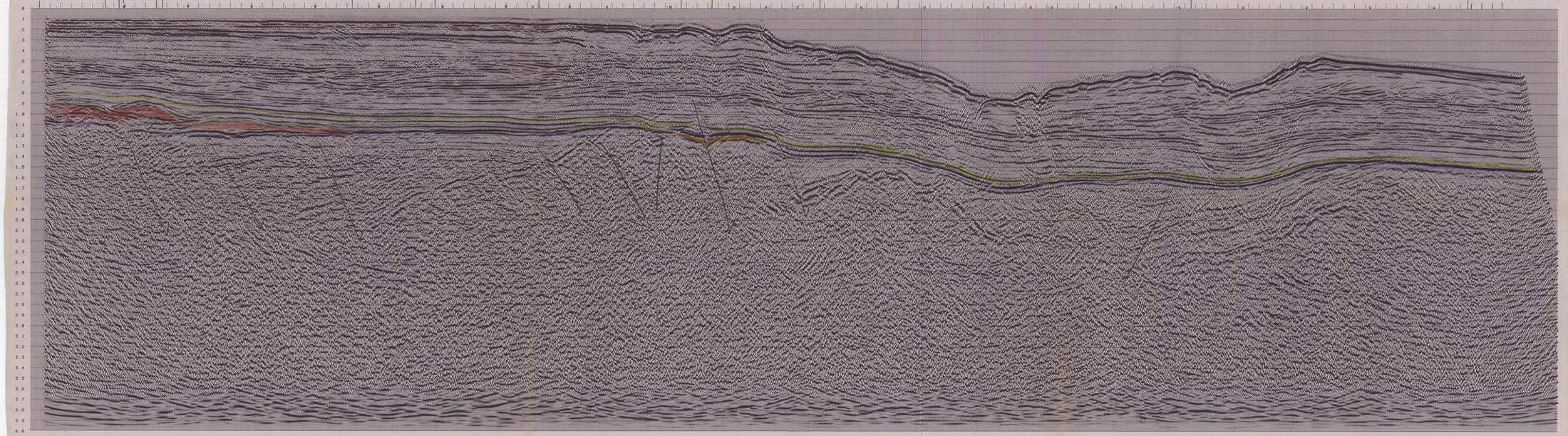
046038

5 cm

T/13P pad 9 (Copy)

NNE

5 cm



OTTER EXPLORATION N.L.

AREA T/13P-FLINDERS

LINE 80F-1

SHOTPOINTS 1-1380

WAVE EQUATION MIGRATION FINITE DIFFERENCE METHOD

FIELD DATA

CREW - EUGENE MCDERMOTT II PARTY 2951 — DATE - 6TH. MAY 1980.

CABLE — GROUP INTERVAL - 25 M. — LENGTH 2400 m.
DEPTH 10 - 12 m. — NO. OF GROUPS = 96

SOURCE — TYPE AIRGUN — CAPACITY 1450 cu. ins.
DEPTH 7 m. — OFFSET 246 M.
SHOTPOINT INTERVAL - 25 M.

SYSTEM — TYPE DFS V 9 TRACK — FORMAT - SEGB
RECORD TIME - 7 SEC. — SAMPLING 2 MSEC.
FILTER HI 128 Hz 72 db/oct
Lo 8 Hz. 18 db/oct

PROCESSING

1. DEMULTIPLEX(on 1 of) (1008 SHP) SUBMARINE 1248 SHP
2. AIRGUN DELAY - 51ms.
3. STATICS SHIFT 12 ms (SOURCE & CABLE DEPTHS)
4. RESAMPLE TO 4 ms
5. COMMON DEPTH POINT GATHER
6. DECONVOLUTION (SPIKED)
   SP ALL NO OF FILTERS 1
   WHITE NOISE 1%
   FILTER LENGTH 320 ms.
   GAP LENGTH
7. VELOCITY ANALYSIS
8. ZMULT
9. VELOCITY ANALYSIS
10. NORMAL MOVEOUT
11. MUTING
12. CDP SUM 48 FOLD
13. DECONVOLUTION (GAPPED)
    SP ALL NO OF FILTERS
    WHITE NOISE 1%
    FILTER LENGTH ms
    GAP LENGTH ms

14. TIME VARIANT FILTERING

TIME (SEC.)	FILTER (HZ.)
0.0	15-60
1.0	12-55
2.0	10-50
3.0	10-40
4.0	10-40

15. SCALE
16. TIME VARIANT SCALING (500ms gate)
17. DIGISTAK
18. MIGRATION - LAYER THICKNESS = 40 ms.

V = VELOCITY ANALYSIS LOCATION

19. DISPLAY

046039

HORIZONTAL SCALE	10 in/inch
VERTICAL SCALE	10 cm /sec

PROCESSED BY digicon SINGAPORE

DATE 4TH FEBUARY 1982.

QUALITY CONTROL CHECK

DISPLAY & DRAFTING	Yeo
SEISMIC	Ng
PARTY CHIEF	Davidson
INDEX NO.	

OR-098

Plate 5a

T/13P pnl 9 Copy 1

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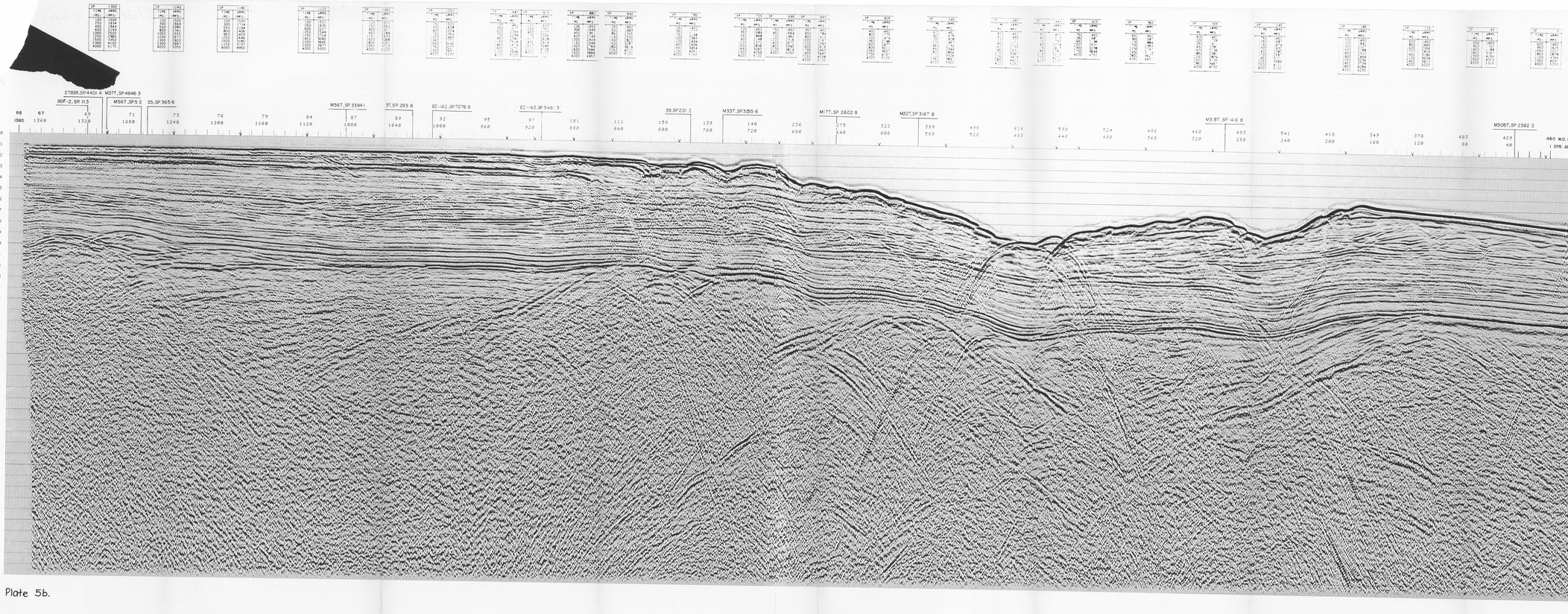

Plate 5b.

NNE

5 cm

OTTER EXPLORATION N.L.
AREA T/13P - FLINDERS
LINE 80F-1
SHOTPOINTS 1-1380

ZMULT STACK

FIELD DATA

CREW - EUGENE MCDERMOTT II PARTY 2931 DATE - 6TH. MAY 1980.

CABLE: GROUP INTERVAL 25 M. DEPTH 10-12 m. LENGTH 2400 m. NO OF GROUPS 96

SOURCE: TYPE AIRGUN DEPTH 7m. SHOTPOINT INTERVAL 25 M. CAPACITY 1450 cu. ins. OFFSET 246 M

SYSTEM: TYPE DFS V 9 TRACK RECORD TIME 4-0 SEC. FILTER Hi 128 Hz 7.2 db/oct Lo 8 Hz 18 db/oct FORMAT SEGB SAMPLING 2 MSEC.

PROCESSING

1 DEMULTIPLEX (2 in 1 adj trace sum) EXPONENTIAL GAIN 0.8 ms. GATE 0-2.5 sec.
2 AIRGUN DELAY -51 ms.
3 STATICS SHIFT 12 ms. (SOURCE & CABLE DEPTHS)
4 RESAMPLE TO 4 ms.
5 COMMON DEPTH POINT GATHER
6 DECONVOLUTION (SPIKED) SP ALL NO OF FILTERS 1 WHITE NOISE 1% FILTER LENGTH 320 ms. GAP LENGTH
7 VELOCITY ANALYSIS
8 ZMULT
9 VELOCITY ANALYSIS
10 NORMAL MOVEOUT
11 MUTING
12 COP SUM 48 FOLD
DECONVOLUTION (GAPPED) SP ALL NO OF FILTERS WHITE NOISE 1% FILTER LENGTH ms GAP LENGTH ms
13 TIME VARIANT FILTERING

TIME (SEC.)	FILTER (HZ.)
0.0	15 - 60
1.0	12 - 55
2.0	10 - 50
3.0	10 - 40
4.0	10 - 40

SCALE
14 TIME VARIANT SCALING (500 ms. gate)
DIGISTAK
MIGRATION LAYER THICKNESS ms
VELOCITY ANALYSIS LOCATION
15 DISPLAY

HORIZONTAL SCALE 10 ft./cm.
VERTICAL SCALE 10 cm./sec.

PROCESSED BY digicon SINGAPORE
DATE 15TH. JANUARY 1982.

QUALITY CONTROL CHECK
DISPLAY & DRAFTING Helen
SEISMIC Tony
PARTY CHIEF Christina
INDEX NO.

Plate 5b.

OR-098.

148°30' 148°32' 148°34' 148°36' 148°38' 148°40' 148°42' 148°44' 148°45'

-39°15' -39°16' -39°18' -39°20' -39°22' -39°24' -39°26' -39°28' -39°30'

HORIZON ABSENT

HORIZON ABSENT

SAILFISH 1

LOCATION MAP

MELBOURNE
VICTORIA
BASS STRAIT
T/13P
TASMANIA
HOBART

OTTER EXPLORATION N.L.

T/13P TASMANIA

TIME STRUCTURE MAP

NEAR BASE MIOCENE (NORTH)

Sheet 3

SCALE 1:25,000

2 Km

1 Miles

AUTHOR A.SABITAY	DATUM :
DRAFTED BY	DATE :
TO ACCOMPANY	

5 cm

T/13P pmd Copy

OE-098

C46041

148°35′ 148°36′ 148°38′ 148°40′ 148°42′ 148°44′ 148°46′ 148°48′ 148°50′

-39°30′ -39°32′ -39°34′ -39°36′ -39°38′ -39°40′ -39°42′ -39°44′ -39°45′

100 125 150 200 300 400 500 600 700

G-14 G-13 G-12 G-11 G-10 G-9 G-8 G-7 G-6 G-5 G-4 G-3 G-2 G-1

80F-5 80F-4 80F-6 80F-3

M57T M19T M58T M59T M39T M20T M38T M21T M35T M40T M22T M37T M59T M60T M39T M55T

G69A-315 G70A-315 G68A-315 EH-181

5 cm

LOCATION MAP

MELBOURNE VICTORIA BASS STRAIT T/13P TASMANIA HOBART

OTTER EXPLORATION N.L.

T/13P TASMANIA

WATER DEPTH

(SOUTH)

Sheet 2

SCALE 1:75,000

2 Km

1 Miles

AUTHOR A.SABITAY	DATUM
DRAFTED BY	DATE
TO ACCOMPANY	

SHEET 2

046042 OR-078

T/13P proof 9 Copy

148°30' 148°32' 148°34' 148°36' 148°38' 148°40' 148°42' 148°44' 148°45'

-39°15' -39°16' -39°18' -39°20' -39°22' -39°24' -39°26' -39°28' -39°30'

SAILFISH 1

5 cm

LOCATION MAP

MELBOURNE
VICTORIA
BASS
STRAIT
T/13P
TASMANIA
HOBART

OTTER EXPLORATION N.L.
T/13P TASMANIA

WATER DEPTH
(NORTH)
Sheet 1

SCALE 1:25,000
2 Km
1 Miles

AUTHOR A.SABITAY	DATUM
DRAFTED BY	DATE
TO ACCOMPANY	

T13P pad 9 Copy)

046043

OR-098.

148°35' 148°36' 148°38' 148°40' 148°42' 148°44' 148°46' 148°48' 148°50'

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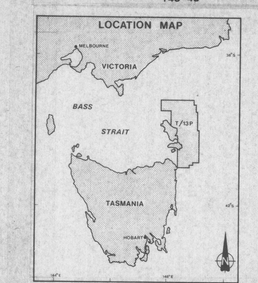
LOCATION MAP



OTTER EXPLORATION N.L.

T/13P TASMANIA

TIME STRUCTURE MAP

NEAR BASE MIOCENE

(SOUTH)

Sheet 4

5 cm

SCALE 1:25,000

0 2 Km

0 1 Miles

AUTHOR: A.SABITAY	DATUM
DRAFTED BY	DATE
TO ACCOMPANY	

SHEET 4

046044

OR-098

T/13P pcd 9 copy 1

HORIZON MAY BE ABSENT

HORIZON MAY BE ABSENT

HORIZON ABSENT

SAILFISH 1

5 cm

LOCATION MAP

MELBOURNE
VICTORIA
BASS STRAIT
T/13P
TASMANIA
HOBART

OTTER EXPLORATION N.L.

T/13P TASMANIA

TIME STRUCTURE MAP

TOP LATROBE COAL MEASURES (NORTH) Sheet 5

SCALE 1:25000
2 Km
1 Miles

AUTHOR: A.SABITAY
DATUM:
DRAFTED BY:
DATE:
TO ACCOMPANY:

SHEET 5

7113P poly copy 1

OR-098

046045

148°35' 148°36' 148°38' 148°40' 148°42' 148°44' 148°46' 148°48' 148°50'

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046046

LOCATION MAP

OTTER EXPLORATION N.L.

T/13P TASMANIA

TIME STRUCTURE MAP

TOP LATROBE COAL MEASURES (SOUTH)

Sheet 6

SCALE 1:25,000

0 2 Km

0 1 Miles

AUTHOR A.SABITAY

DRAFTED BY

TO ACCOMPANY

5 cm

OR-098

T/13P pmd 9 Copy 1

148°30' 148°32' 148°34' 148°36' 148°38' 148°40' 148°42' 148°44' 148°45'

-39°15' -39°16' -39°18' -39°20' -39°22' -39°24' -39°26' -39°28' -39°30'

NEAR BASE MIOCENE HORIZON ABSENT

NEAR BASE MIOCENE HORIZON ABSENT

TOP LATROBE COAL MEASURES HORIZON ABSENT

ISOCHRON NEAR BASE MIOCENE AND BASEMENT

SAILFISH 1

OTTER EXPLORATION N.L.

T/13P TASMANIA

ISOCRON

NEAR BASE MIOCENE–
TOP LATROBE COAL MEASURES
(NORTH) Sheet 7

SCALE 1:25,000
2 Km
1 Miles

AUTHOR A.SABITAY
DRAFTED BY
TO ACCOMPANY

5 cm

LOCATION MAP

MELBOURNE
VICTORIA
BASS STRAIT
T/13P
TASMANIA
HOBART

T/13P good to Lopt

OR-098

046047 SHEET 7

148°35' 148°36' 148°38' 148°40' 148°42' 148°44' 148°46' 148°48' 148°50'

-39°30' -39°32' -39°34' -39°36' -39°38' -39°40' -39°42' -39°44' -39°45'

THICK
THIN

OTTER EXPLORATION N.L.
T/13P TASMANIA
ISOCHRON
NEAR BASE MIOCENE–TOP LATROBE COAL MEASURES
(SOUTH) Sheet 8

LOCATION MAP

MELBOURNE
VICTORIA
BASS
STRAIT
T/13P
TASMANIA
HOBART

SCALE 1:25,000
0 2 Km
0 1 Miles

AUTHOR A.SABITAY
DATUM
DRAFTED BY
TO ACCOMPANY

5 cm

046648

SHEET 8 OR-098

T13P pg 9 COPY 1

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-39°15′ -39°16′ -39°18′ -39°20′ -39°22′ -39°24′ -39°26′ -39°28′ -39°30′



LOCATION MAP

OTTER EXPLORATION N.L.

T/13P TASMANIA

MID MIOCENE (NORTH)

Sheet 9

SCALE 1:25,000

2 Km

1 Miles

AUTHOR: A.SABITAY	DATUM:
DRAFTED BY:	DATE:
TO ACCOMPANY	

OR-098. SHEET 9

5 cm

T/13P Pmd 9 Copy 1

148°35' 148°36' 148°38' 148°40' 148°42' 148°44' 148°46' 148°48' 148°50'

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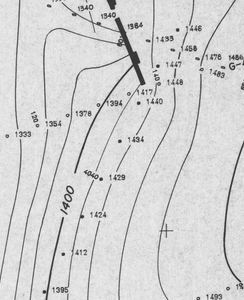
LOCATION MAP



OTTER EXPLORATION N.L.

T/13P TASMANIA

MID MIOCENE (SOUTH)

Sheet 10

SCALE 1:25,000

AUTHOR A.SABITAY

DRAFTED BY

TO ACCOMPANY

5 cm

046050

T/13P Poly Cont

OR-098

148°30' 148°32' 148°34' 148°36' 148°38' 148°40' 148°42' 148°44' 148°45'

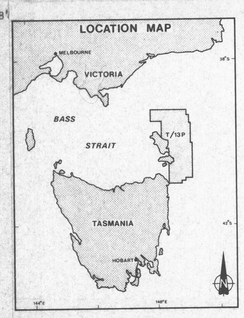
-39°15' -39°16' -39°18' -39°20' -39°22' -39°24' -39°26' -39°28' -39°30'

TOP LATROBE COAL MEASURE HORIZON ABSENT

ISOCHRON MID-MIOCENE AND BASEMENT

SAILFISH 1

LOCATION MAP



OTTER EXPLORATION N.L.

T/13P TASMANIA

ISOCHRON

MID MIOCENE-
TOP LATROBE
COAL MEASURES
(NORTH) Sheet 11

SCALE 1:25,000

0 2 Km

0 1 Miles

AUTHOR: A.SABITAY	DATUM:
DRAFTED BY:	DATE:
TO ACCOMPANY	

SHEET 11

5 cm

T/13P pt 9 Copy 1

OR-098

040051

148°35' 148°36' 148°38' 148°40' 148°42' 148°44' 148°46' 148°48' 148°50'

-39°30' -39°32' -39°34' -39°36' -39°38' -39°40' -39°42' -39°44' -39°45'

THICK
THIN
200
300
400
500
100
120
140
180
220
260

G-15 G-14 G-13 G-12 G-11 G-10 G-9 G-8 G-7 G-6 G-5 G-4 G-3 G-2 G-1

M57T M19T M59T M39T M20T M27T M38T M38T M27T M66T M39T M66T M59T M38T M27T M66T

80F-5 80F-4 80F-3 EH-181 669A-316

LOCATION MAP

VICTORIA
MELBOURNE
BASS STRAIT
T/13P
TASMANIA
HOBART

OTTER EXPLORATION N.L.

T/13P TASMANIA

ISOCHRON

MID MIOCENE–
TOP LATROBE COAL
MEASURES

(SOUTH) Sheet 12

SCALE 1:25,000
2 Km
1 Miles

AUTHOR A.SABITAY
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TO ACCOMPANY

5 cm

046052 SHEET 12

OR-098

T/13P Prog Copy 1

148°30' 148°32' 148°34' 148°36' 148°38' 148°40' 148°42' 148°44' 148°45'

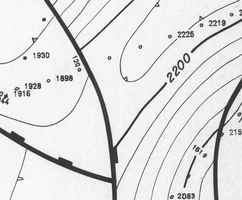
-39°15' -39°16' -39°18' -39°20' -39°22' -39°24' -39°26' -39°28' -39°30'



148°35' 148°36' 148°38' 148°40' 148°42' 148°44' 148°46' 148°48' 148°50'

-39°30' -39°32' -39°34' -39°36' -39°38' -39°40' -39°42' -39°44' -39°45'

LOCATION MAP



OTTER EXPLORATION N.L.

T/13P TASMANIA

BASEMENT

(SOUTH)

046054

Sheet 14

SCALE 1:25,000

0 2 Km

0 1 Miles

AUTHOR A.SABITAY

DRAFTED BY

TO ACCOMPANY

5 cm

SHEET : 14 OR-098.

T/13P p-19 (047)

TOP LATROBE COAL MEASURE HORIZON MAY BE ABSENT

TOP LATROBE COAL MEASURE HORIZON MAY BE ABSENT

TOP LATROBE COAL MEASURE HORIZON ABSENT

THIN

THICK

SAILFISH 1

EH-182

EC-160

EC-161

EC-162

NEF-10

NEF-11

NEF-8

80F-1

80F-2

80F-3

G669A-315

ET-83R

LOCATION MAP

MELBOURNE

VICTORIA

BASS STRAIT

T/13P

TASMANIA

HOBART

OTTER EXPLORATION N.L.

T/13P TASMANIA

ISOCHRON

TOP LATROBE COAL MEASURES-BASEMENT

(NORTH) Sheet 15

SCALE 1:25,000

2 Km

1 Miles

AUTHOR: A.SABITAY

DRAFTED BY:

DATE:

TO ACCOMPANY

5 cm

T/13P Prod'n Copy

OR-098

C4606

148°35' 148°36' 148°38' 148°40' 148°42' 148°44' 148°46' 148°48' 148°50'

-39°30' -39°32' -39°34' -39°36' -39°38' -39°40' -39°42' -39°44' -39°45'

OTTER EXPLORATION N.L.

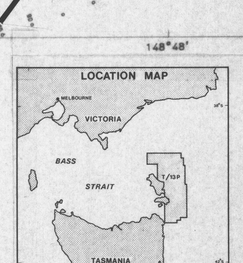
T/13P TASMANIA

ISOCHRON

TOP LATROBE COAL MEASURES-BASEMENT (SOUTH)

Sheet 16

LOCATION MAP



SCALE 1:25,000

0 2 Km

0 1 Miles

AUTHOR A.SABITAY

DATUM

DRAFTED BY

TO ACCOMPANY

5 cm

046056

CR-098

T/13P pack (cont)



T/13P Prod 9 Copy!

046057

OR-098

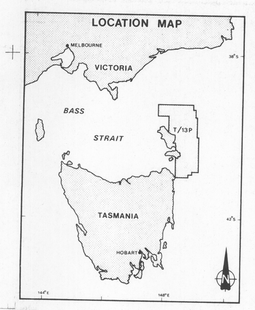
BASEMENT HORIZON SUBCROP

LATROBE COAL MEASURES
NOT PRESENT

BASEMENT HORIZON SUBCROP

LATROBE COAL MEASURES
NOT PRESENT

LOCATION MAP



OTTER EXPLORATION N.L.

T/13P TASMANIA

TOP LATROBE
COAL MEASURES
(SOUTH)

046058 Sheet 18

SCALE 1:100 000

0 4 8 Km

0 4 Miles

AUTHOR A.SABITAY

DRAFTED BY

TO ACCOMPANY

5 cm

T13P pool 9 Copy

OR-098

HORIZON MAY BE ABSENT

HORIZON MAY BE ABSENT

HORIZON ABSENT

SAILFISH 1

T82A-12 (15.5 Kms)

T82A-10 (15.5 Kms)

T82A-1 (4.5 Kms)

T82A Survey

5 Lead

LOCATION MAP

MELBOURNE
VICTORIA
BASS STRAIT
T/13P
TASMANIA
HOBART

OTTER EXPLORATION N.L.
T/13P TASMANIA
TOP LATROBE
GROUP LEADS
046059 (NORTH) Sheet 19

SCALE 1:25,000
2 Km
1 Miles

AUTHOR A.SABITAY | DATUM
DRAFTED BY | DATE
TO ACCOMPANY

5 cm

SHEET 5

T/13P pkg Copy

OR-098

T82A-1 (4.5 Kms)

T82A-12 (5.5 Kms)

T82A-10 (5.5 Kms)

T829A-3 (8.0)

T82A-5 (9.25)

T82A-7 (9.0)

T82A-9 (9.0)

T82A-11 (9.0)

T82A-17 (6.75)

T82A-13 (6.75)

T82A-15 (8.0)

T82A-2 (9.25)

T82A-4 (10.5 Kms)

T82A-6 (11.5 Kms)

T82A-8 (11.5 Kms)

T82A-12 (5.0 Kms)

T82A-19 (6.5)

T82A-21 (6.0)

T82A-23 (6.0)

T82A-25 (6.0)

T82A-27 (6.0)

T82A-29 (6.0)

T82A-31 (6.0)

T82A-33 (6.0)

T82A-14 (9.0 Kms)

T82A-16 (7.0)

T82A-18 (9.0 Kms)

T82A-20 (8.0 Kms)

FURNEAUX

FLINDERS

MUTTONBIRD

MUTTONBIRD SOUTH

18

19

20

21

22

17

16

15

14

13

12

23

669A-316

80F-14

80F-5

80F-4

80F-3

80F-6

EH-181

EH-181

M57T M19T M58T M57T M20T M58T M59T M39T M20T M58T M59T M39T M20T M58T M59T M39T M22T M60T M39T M22T M60T M39T M22T M60T M39T M21T M60T M39T M21T M60T M39T M21