T/13P Pt 2 P.

104001

REGIONAL GEOLOGY

GIPPSLAND BASIN

OFFSHORE AUSTRALIA

VARIANT WORK PROGRAM

VIC P/12, T13P PERMIT AREAS

Union Texas Australia Inc.
June, 1984

104002

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NOTE: CONTENTS = LIST OF ENCLOSURES

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INTRODUCTION

Based on the compilation of stratigraphic and structural information previously submitted as an Interim Report of Geology, a suite of 1:250,000 regional maps has been prepared.

Seven of the maps represent offshore Gippsland Basin paleogeography from Early Cretaceous to Middle Miocene. The remainder of the map suite consists of a variety of regional structure, isopach, sand distribution, thermal maturity, and organic content portrayals which, in combination, suggest relative prospectivity of areas in the offshore.

It is emphasized that all regional maps are based mainly on the data represented by the six regional correlation sections previously constructed. These include fifty-four offshore wells, of which thirty-seven include paleontological (chronostratigraphic) information. The geologic intricacies of the various productive fields in the offshore Gippsland Basin have not been incorporated in the regional maps. Likewise, local structural information based on geophysical interpretations has not been incorporated. The regional geologic study presented here is therefore intended to permit generalizations regarding basic parameters influencing the prospectivity of the Latrobe Group, Gurnard Formation, Lakes Entrance Formation, and Gippsland Limestone about the basin.

PALEOGEOGRAPHY

Early Cretaceous

Paleogeography prevailing during deposition of the Lower Cretaceous Strzelecki Group has been inferred from only eleven offshore wells, all but one of which are located in the northern portion of the offshore basin. The Strzelecki Group is typified as a mineralogically and texturally immature clastic succession among these wells.

Sand percentage of the penetrated Strzelecki section ranges from 30 (Gannet-1) to 90 (Moray-1). Paleontological analyses indicate that the Strzelecki Group is of continental paleoenvironmental identity.

Distribution of sand percentages among the wells which penetrated the Lower Cretaceous suggest a northwest-trending Early Cretaceous basin bordered by continental clastic deposits (sand percentage less than 80%), grading basinward into a relatively narrow zone of basin-margin conglomeratic sediments (sand percentage greater than 80%).

The orientation and lithologic variation of the inferred Early Cretaceous basin are in agreement with published interpretations that the offshore Gippsland Basin was at this time a rift basin subject to a northeast/southwest tensional regime. According to this model, the zone of conglomeratic Strzelecki clastics most likely represents fault-related fanglomerates of the rift-basin margin.

Available well data do not permit determination of the lithologic/ paleoenvironmental identity of the Strzelecki Group in the axial portion of the inferred basin. Hypothetically, a relatively deep-water, restricted basin of organic shale deposition could have existed in this area. In this regard, it is of interest to note that most of the known oil accumulations overlie this central area, while the major gas fields overlie the zone of continental Strzelecki deposition.

Late Cretaceous (Top Campanian)

Paleogeography as inferred from the subject wells penetrating the Top Campanian (intra-Latrobe) surface suggest an east/southeast-trending depositional basin including several progradational deltaic lobes oriented transversely to the basin axis.

The central portion of the Late Cretaceous basin was characterized by pro-deltaic deposition, with sand percentages ranging from 40 to 60%. A zone of continental deposits flanking the basin is represented in the area of Pisces-1 and Helios-1.

Of greatest interest with regard to exploratory potential are the inferred progradational lobes which include delta-front and proximal pro-delta sands (sand percentages greater than 60). One such lobe can be inferred in the northeastern portion of the basin, where recent oil discoveries have reportedly been made in the Campanian section (Basker-1 and Manta-1).

An item of interest is the appearance of relatively high sand percentage in the pro-deltaic Late Cretaceous sediments along the oil-prolific north/south-trending zone between Kingfish and Tuna Fields. This suggests the presence of a relatively proximal (shallow-water) environment of Late Cretaceous pro-deltaic deposition along a trend normal to the basin axis. This in turn implies the persistent influence of a north/south-trending basement high, perhaps inherited from the Paleozoic structural grain of the region.

Latest Cretaceous (Top Maastrichtian)

Regional well control indicates a Latest Cretaceous east/west-trending basin of deposition of Latrobe Group clastics, the east/southeastern basin margin having been emergent and subject to continental sedimentation.

Progradational lobes represented by delta-front deposits (sand percentage greater than 60) and proximal pro-delta sands (sand percentage greater than 40) surround the basin, as best documented along its east/southeast flank.

As in the case of the Late Cretaceous (Top Campanian) paleogeography, a large expanse representing the delta-front facies occurs in the area of the Basker-1 and Manta-1 discoveries.

The influence of Latest Cretaceous volcanism along the northern basin margin is represented in the Emperor-1 well, where approximately 63 meters of volcanics are interbedded with uppermost Cretaceous pro-deltaic sediments.

Latest Paleocene

Paleogeography as inferred from the subject wells describes an east/west-trending basin of Upper Latrobe Group clastic deposition. The area represented by shaly (sand percentage less than 40) pro-deltaic sediments is markedly less than that of the earlier paleogeographic models of Latrobe Group paleoenvironments. This indicates progressive basinward progradation of deltaic environments during the course of Latrobe Group deposition.

Except where eradicated by subsequent post-Latrobe erosion, the distribution of Latest Paleocene paleoenvironments indicates that the offshore basin was bounded by a delta-plain facies, this grading basinward into delta-front lobes which were generally transverse to the basin margins.

Prominent erosional incisions of the Latest Paleocene map surface occur (1) in the vicinity of Marlin Field, where the north/south-trending Marlin Channel has eradicated Paleocene Latrobe sediments; and (2) in the vicinity of Kingfish Field, where a poorly-defined apparent channel cuts the Top Paleocene surface. The latter channel, reportedly filled by coarse sandstones, may in fact be a part of the Upper Latrobe Group.

Latest Eocene (Top Eocene Unconformity)

Paleogeography representing the regional erosional episode which occurred following deposition of both the Upper Latrobe Group and the succeeding Middle/Upper Eocene Gurnard Formation reflects two successive basinal trends. The earliest of these, representing the uppermost Latrobe Group's depositional regime, is east/west, the Eocene Latrobe sediments being

represented almost entirely by the delta-plain and delta-front facies. Progradation of the latter proximal environments had progressed across the breadth of the basin, with only one northern zone of pro-deltaic sedimentation remaining (Albatross-1).

Cessation of Latrobe Group sedimentation was brought about by regional southward tilting of the basin about a persistent east/west axis. This resulted in Eocene submarine canyon erosion and deposition along north/south trends: The earliest such canyon is the Tuna-Flounder Channel, filled with Lower Eocene marine sandstones. The Marlin Channel lies immediately west of the latter, and is filled with Upper Eocene marine shales. An aforementioned possible post-Latrobe channel in the vicinity of Kingfish Field is filled with ?Eocene coarse sandstones.

Post-Latrobe submarine channel deposition was followed by regional uplift and deposition of the highly glauconitic Upper Eocene Gurnard Formation near mean sea level. Renewed uplift during Latest Eocene time resulted in erosion and local eradication of the Gurnard Formation.

The latter phase of uplift was induced by northwest-directed tectonic compression associated with opening of the Tasman Sea. The consequent northeast-trending Latest Eocene structural grain is indicated by the corresponding trends of preservation/absence of the Gurnard Formation. The northeast fold trend is locally evidenced by the Top Latrobe surface throughout the offshore Gippsland Basin.

Latest Oligocene

Oligocene deposits in the offshore Gippsland Basin include the Lakes Entrance Formation, an inner shelf calcareous shale/claystone unit, and the lowermost Gippsland Limestone, an open marine carbonate unit. The formational boundary between the latter formations is time-transgressive.

Paleogeographic reconstruction of the Latest Oligocene surface indicates the dominance of Lakes Entrance clastic deposition: only a relatively small east/west-trending zone of Gippsland Limestone deposition is represented, in

the Bream-Kingfish area. This suggests a mainly inner-shelfal paleo-environmental regime at this time. In the south-central portion of the basin, the Lakes Entrance deposits are relatively silty to sandy (Moray-1 and Pike-1) and, toward the southeastern limit of well control, the basal Lakes Entrance consists of a glauconitic greensand member (Pisces-1 and Helios-1).

Middle Miocene

Subsidence and continued marine incursion are evidenced by the predominance of open marine Gippsland Limestone deposition by Mid-Miocene time. Local submarine channel deposition is exemplified by the Kingfish Channel; it is likely that such channels are numerous about the basin.

There are several broad areas representing continued inner-shelfal Lakes Entrance clastic deposition; these areas may reflect broad residual or rejuvenated structural highs inherited from the previous (Latest Eocene) northwest/southeast compressional episode.

As in the Latest Oligocene paleoenvironmental model, areas representing a relatively silty to sandy facies of Lakes Entrance deposition occur in the southern portion of the basin. In Moray-1, the Mid-Miocene Lakes Entrance Formation is described as silty, and in Bluebone-1 it is described as consisting predominantly of argillaceous glauconitic sandstone (61 meters in thickness) with high porosities.

At Mid-Miocene level, the Gippsland Limestone has been described as loose calcarenite (143 meters thick) in Mullet-1.

ADDITIONAL REGIONAL GEOLOGIC MAPS

Structure/Subcrop, Top Latrobe Unconformity

The map generally depicts an east/southeast-plunging synformal surface, the simplicity of which is interrupted only by the Marlin and Tuna-Flounder erosional channels and a northeast-trending transverse ridge extending along the trend of the major oil fields of the basin.

Over much of the map area, the Latrobe Group delta-plain facies subcrops to the Top Latrobe Unconformity. Notably high sand percentages (greater than 80%) occur in this facies in the central and east-central portions of the basin.

In the southern portion of the map area, continental Latrobe Group sediments subcrop to the Top Latrobe Unconformity, as may also be the case in the area of Groper-1 and 2.

The Latrobe delta-front facies subcrops to the Top Latrobe Unconformity in the west-central and northwestern portions of the map area, with notably high sand percentages (greater than 80%) in the vicinity of Kingfish Field.

The Top Latrobe Unconformity ranges in depth from 610 meters (Golden Beach-1A) to 2804 meters (Hapuku-1).

Base Latrobe Delta-Front Facies

This map serves to show regional structure of an intra-Latrobe zone which is not incised by the Top Latrobe Unconformity. In general, it portrays a southeast-plunging synclinorium, with subsidiary southeast-plunging folds in the central and northwestern portions of the map area. The depth of this surface ranges from 838 meters (Albatross-1) to 3065 meters (Hapuku-1).

The Base Delta-Front surface is thermally mature (vitrinite reflectance greater than 0.45) over much of the map area.

Isopach: Top Latrobe-Base Delta-Front Facies

This map describes thickness variations of the most sandy interval (delta-plain plus delta-front facies) of the Latrobe Group. Thickness of this interval ranges from 43 meters (Mullet-1) to 704 meters (Golden Beach-1A).

A relatively thin zone trends vaguely north/northeastward across the central portion of the map area, subdividing the central east/southeast-trending thick zone into three subsidiary thick zones.

Gurnard Sandstone Distribution/Thickness

The map shows two major areas of distribution of glauconitic sandstones of the post-Latrobe Gurnard Formation in the offshore basin.

A northeast-trending elongate zone of Gurnard sandstone occurs between Groper-2 in the southwest to the area of Sweep-1 and Hammerhead-1 in the northeast. A second area lies in the southeastern portion of the map area (Helios-1 and Pisces-1).

Net Gurnard sand thickness ranges from 2 meters (Groper-2) to 30 meters (Gurnard-1) among the subject wells.

Gurnard sandstone is also present in the coastal zone along the northwest portion of the map area. The oil accumulation of Lakes Entrance Field is reservoired in a thin Gurnard sandstone which pinches out in a northwestward direction.

Depth to Thermal Maturity

The basis for this map is the ten-well geochemical study completed by Gearhart Services Ltd. as part of the Variant Work Program.

Thermal maturity is defined in this study as vitrinite reflectance equal to or greater than 0.45. This value was attained, among the ten subject wells, at depths ranging from 1395 meters (Perch-1) to approximately 2550 meters

(Hapuku-1).

Latrobe Group depositional facies in which thermal maturity is attained ranges from the pro-delta facies (northwest portion of map area) to the delta-plain and continental facies (southeastern portion of map area).

The available control indicates an east/southeast-plunging synformal thermal maturity surface.

Total Minus Residual Organic Carbon (Latrobe Group)

This map is based on pyrolysis data concerning ten wells, as provided by Gearhart Services Ltd.

Averages of T.O.C. minus R.O.C. (percent) for all analyzed samples from the Latrobe Group indicate a northward increase in "volatile" organic content across the basin. Percentages of Latrobe T.O.C. minus R.O.C. range from 0.02% in Moray-1 to 3.83% in Barracouta-1.

Though based on relatively little analytical control, the implication of the mapped T.O.C. minus R.O.C. distribution is that greater amounts of land-derived organic materials were introduced from northward fluvial source areas than from source areas of the Southern Platform region.

Total Minus Residual Organic Carbon
(Latrobe Delta-front Facies)

The Latrobe delta-front facies was considered separately, in terms of "volatile" organic content, because of its indicated relatively high organic percentages.

T.O.C. minus R.O.C. (percent) averages among the ten wells analyzed by Gearhart Services Ltd. range from 0.04% (Hapuku-1) to 6.4% (Barracouta-1).

Values increase northwestward about a northwest-trending axis passing between Kingfish and Mackerel Fields.

Distribution of mapped values indicates increasing organic content of Latrobe delta-front sediments toward the margins of the Latrobe depositional basin.

FAVORABLE EXPLORATORY AREAS (by Stratigraphic Unit)

Eight maps summarizing exploratory play potential of the several Gippsland Basin stratigraphic units have been prepared by utilization of the above-described regional maps of favorable parameters. It is again emphasized that these generalizations regarding play potential do not include consideration of local structure (as determined from seismic interpretation) or detailed geologic information on the productive fields.

Three maps depicting favorable intra-Latrobe play potential have been prepared: Lower Latrobe Group (Campanian)-Stratigraphic Plays; Lower Latrobe Group (Campanian) - Structural plays; and Upper Latrobe Group-Structural Plays. Two maps concern favorable Top Latrobe play potential: Top Latrobe Unconformity - Structural Plays; and Top Latrobe Unconformity - Stratigraphic Plays.

Two maps represent favorable structural and stratigraphic play areas for the Gurnard Formation greensands. A final map indicates favorable play areas with reference to the Lakes Entrance Formation and Gippsland Limestone. These maps are briefly discussed individually as follows.

Lower Latrobe Group (Campanian) - Structural Plays

The map represents two favorable parameters: regional structural highs of the Base Latrobe Delta-Front surface, (the deepest regional structure map) and distribution of Campanian Latrobe Group sands (sand percentage of Campanian section greater than 60).

Common occurrence of the two parameters is found in the vicinity of the Seahorse, Hammerhead, and Kahawai wells.

Lower Latrobe Group (Campanian) - Stratigraphic Plays

The map depicts two favorable parameters, both of which are structure-independent: Zones of "shaling out" of proximal pro-deltaic Campanian sediments by interdigitation with distal pro-deltaic shales; and limits of the

hypothetical Lower Cretaceous Strzelecki rift-basin shales.

Two areas representing common occurrence of both mapped parameters are (1) the proximal pro-deltaic Campanian depocenter in the vicinity of the Basker-1 and Manta-1 discoveries; and (2) a narrow trilobate belt of Campanian proximal pro-deltaic/delta-front sediments in the vicinity of Kingfish Field and Selene-1.

Upper Latrobe Group - Structural Plays

This map represents five parameters: Structure of Base Latrobe Delta-Front Facies; Latrobe delta-front facies sand percentage greater than 70; Latrobe T.O.C. minus R.O.C. greater than 1%; Latrobe delta-front facies T.O.C. minus R.O.C. greater than 1%; and Base Latrobe Delta-front Facies below thermal maturity.

Three relatively small areas represent common occurrence of all five parameters, while two relatively large, possibly untested areas represent common occurrence of all parameters except "Latrobe T.O.C. minus R.O.C. greater than 1%". Two additional areas represent common occurrence of structural highs, high sand percentage, and thermal maturity.

Top Latrobe Unconformity - Structural Plays

This map depicts six potentially significant parameters: (1) Structural highs of Top Latrobe Unconformity; (2) Absence of Gurnard sandstones; (3) Subcrop of Latrobe delta-front facies to Top Latrobe Unconformity; (4) Latrobe T.O.C. minus R.O.C. greater than 1%; (5) Latrobe delta-front facies T.O.C. minus R.O.C. greater than 1%; and (6) Distribution of hypothetical Strzelecki rift-basin shales.

The first five of the above parameters display common occurrence over broad areas in the northwest portion of the offshore basin. Other relatively large areas represent common occurrence of four or fewer of the first five parameters. The latter areas include the major productive oil fields of the offshore basin, where the favorable parameters include only structural highs

and Strzelecki shales (hypothetical) in some cases, and all parameters except "T.O.C. minus R.O.C. greater than 1%" (Latrobe and Latrobe delta-front facies) in others (Kingfish and West Kingfish).

Top Latrobe Unconformity - Stratigraphic Plays

This map represents four favorable parameters: (1) Relatively thin areas of the Top Latrobe to Base Latrobe delta-front facies interval (independent of structure); (2) Absence of Gurnard sandstone; (3) Latrobe delta-front facies T.O.C. minus R.O.C. greater than 1%; and (4) Base Latrobe delta-front facies below thermal maturity.

Three relatively small, untested areas in the northwestern portion of the offshore basin represent common occurrence of all four of the above parameters; larger and more central areas include the first three parameters.

Gurnard Formation - Structural Plays

The map shows four favorable parameters: (1) Structural highs, Top Latrobe Unconformity; (2) Gurnard sandstone greater than 15 m. thick; (3) Latrobe T.O.C. minus R.O.C. greater than 1%; and (4) Subcrop of Latrobe delta-front facies to Top Latrobe Unconformity.

Several areas along the northeast-trending locus of Gurnard sandstone represent common occurrence of the first two, plus one of the latter two, of the above parameters. Smaller areas in the central and northeastern portions of the offshore basin represent common occurrence of only the first two parameters.

Gurnard Formation - Stratigraphic Plays

This map includes four parameters: (1) Structural highs, Top Latrobe Unconformity; (2) Zone of pinchout of Gurnard sandstone (15 m thick to absent); (3) Latrobe T.O.C. minus R.O.C. greater than 1%; and (4) Subcrop of Latrobe delta-front facies to Top Latrobe Unconformity. Several relatively narrow areas along the flanks of the regional Gurnard sandstone trend

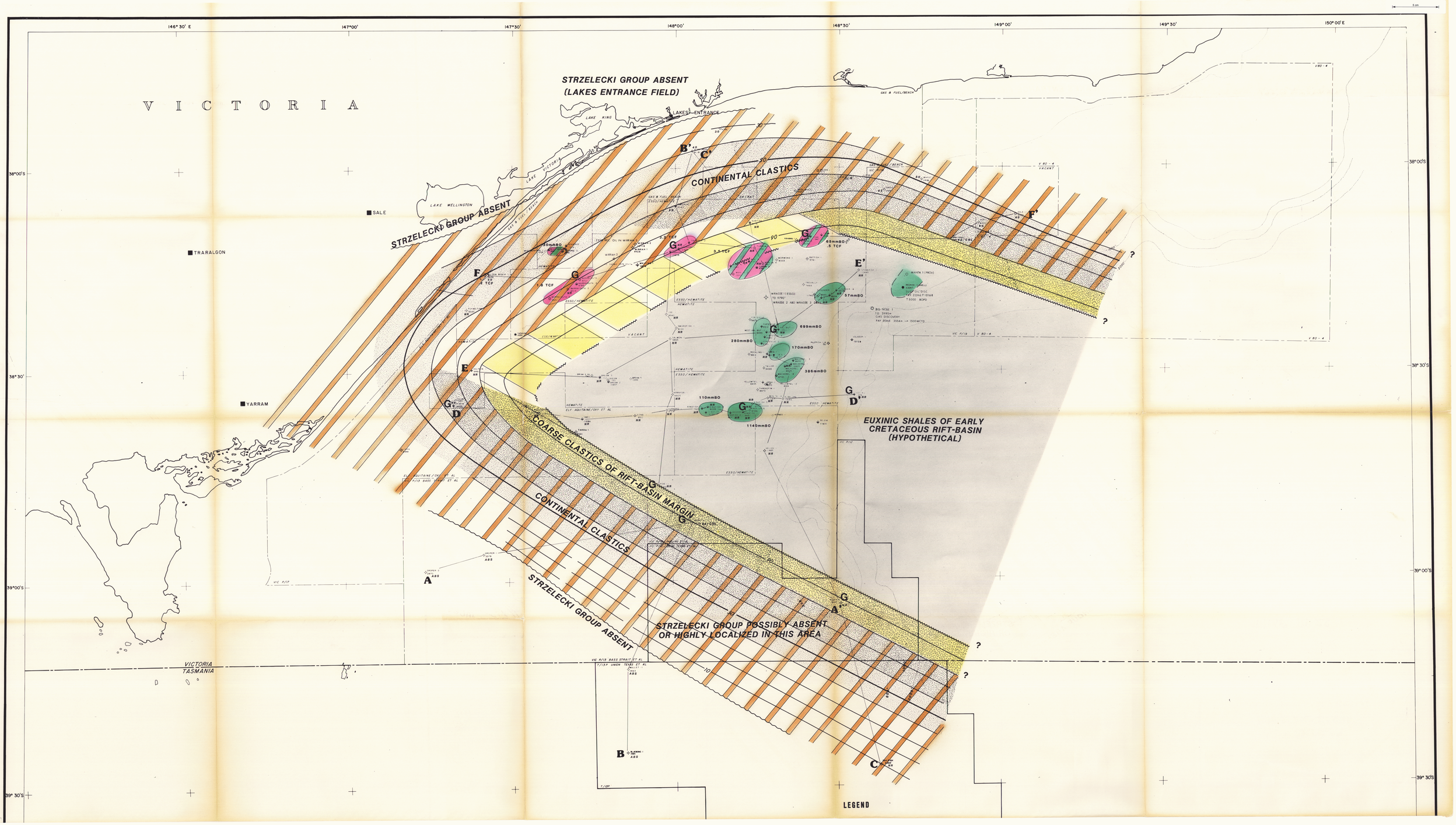
represent common occurrence of the first two of the above variables, plus one of the latter two. A broad area southwest of Pisces-1 represents common occurrence of only the first two of the above parameters.

Lakes Entrance Fm. and Gippsland Limestone

On the Southern Platform, broad areas of possibly favorable stratigraphic or structural exploratory potential are associated with the Lakes Entrance Fm. and Gippsland Limestone. This is suggested, though surely ill-defined, by four wells.

Moray-1 encountered a 537-meter silty Lakes Entrance section. Bluebone-1 encountered 60 meters of glauconitic Lakes Entrance sandstone, reportedly with high porosities. Pisces-1 penetrated a 12-meter glauconitic sandstone at the base of the Lakes Entrance Formation. Mullet-1 encountered a basal Gippsland Limestone section consisting of 143 meters of reportedly loose calcarenite.

The above lithologic data suggest the possibility of exploratory potential in the Lakes Entrance Fm. and Gippsland Limestone on the Southern Platform. Given the paucity of well control and consequent uncertainty regarding the distribution of these potential reservoir facies, and also the lack of indicated source rocks in this area, the favorability of any prospects developed in this domain appears to be highly questionable.



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VICTORIA
STRZELECKI GROUP ABSENT
(LAKES ENTRANCE FIELD)
LAKES ENTRANCE
LAKE KING
LAKE VICTORIA
LAKE WELLINGTON
SALE
TRARALGON
YARRAM
STRZELECKI GROUP ABSENT
CONTINENTAL CLASTICS
COARSE CLASTICS OF RIFT-BASIN MARGIN
CONTINENTAL CLASTICS
STRZELECKI GROUP ABSENT
STRZELECKI GROUP POSSIBLY ABSENT
OR HIGHLY LOCALIZED IN THIS AREA
EUXINIC SHALES OF EARLY
CRETACEOUS RIFT-BASIN
(HYPOTHETICAL)
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TASMANIA
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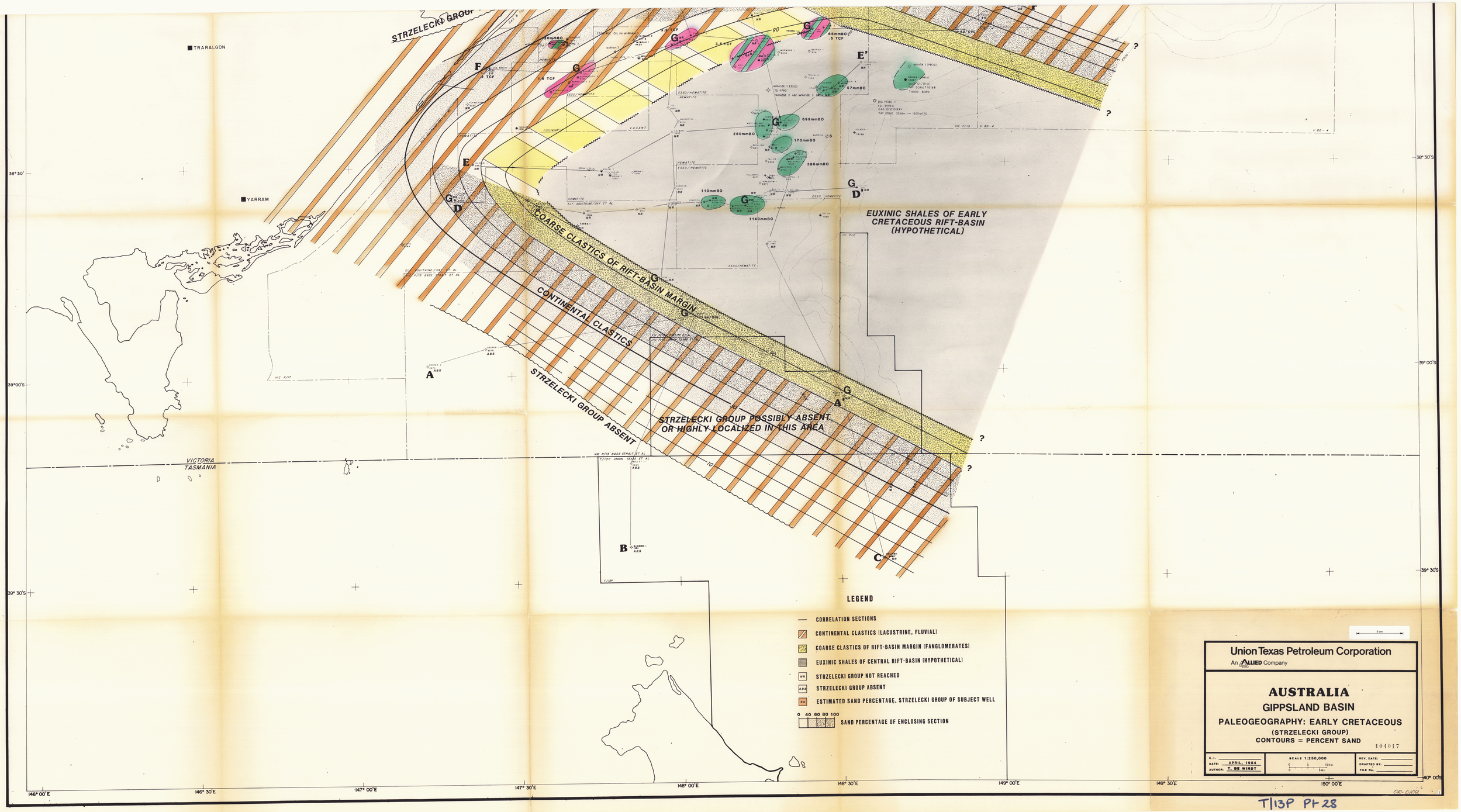
699mmBO
280mmBO
170mmBO
386mmBO
110mmBO
1140mmBO
LEGEND


STRZELECKI GROUP
TRARALGON
YARRAM
VICTORIA
TASMANIA
EUXINIC SHALES OF EARLY CRETACEOUS RIFT-BASIN (HYPOTHETICAL)
COARSE CLASTICS OF RIFT-BASIN MARGIN
CONTINENTAL CLASTICS
STRZELECKI GROUP ABSENT
STRZELECKI GROUP POSSIBLY ABSENT OR HIGHLY LOCALIZED IN THIS AREA
LEGEND
CORRELATION SECTIONS
CONTINENTAL CLASTICS (LACUSTRINE, FLUVIAL)
COARSE CLASTICS OF RIFT-BASIN MARGIN (FANGLOMERATES)
EUXINIC SHALES OF CENTRAL RIFT-BASIN (HYPOTHETICAL)
STRZELECKI GROUP NOT REACHED
STRZELECKI GROUP ABSENT
ESTIMATED SAND PERCENTAGE, STRZELECKI GROUP OF SUBJECT WELL
0 40 60 80 100
SAND PERCENTAGE OF ENCLOSING SECTION
Union Texas Petroleum Corporation
An ALLIED Company
AUSTRALIA
GIPPSLAND BASIN
PALEOGEOGRAPHY: EARLY CRETACEOUS
(STRZELECKI GROUP)
CONTOURS = PERCENT SAND
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DATE: APRIL, 1984
AUTHOR: T. DE WINDT
SCALE 1:250,000
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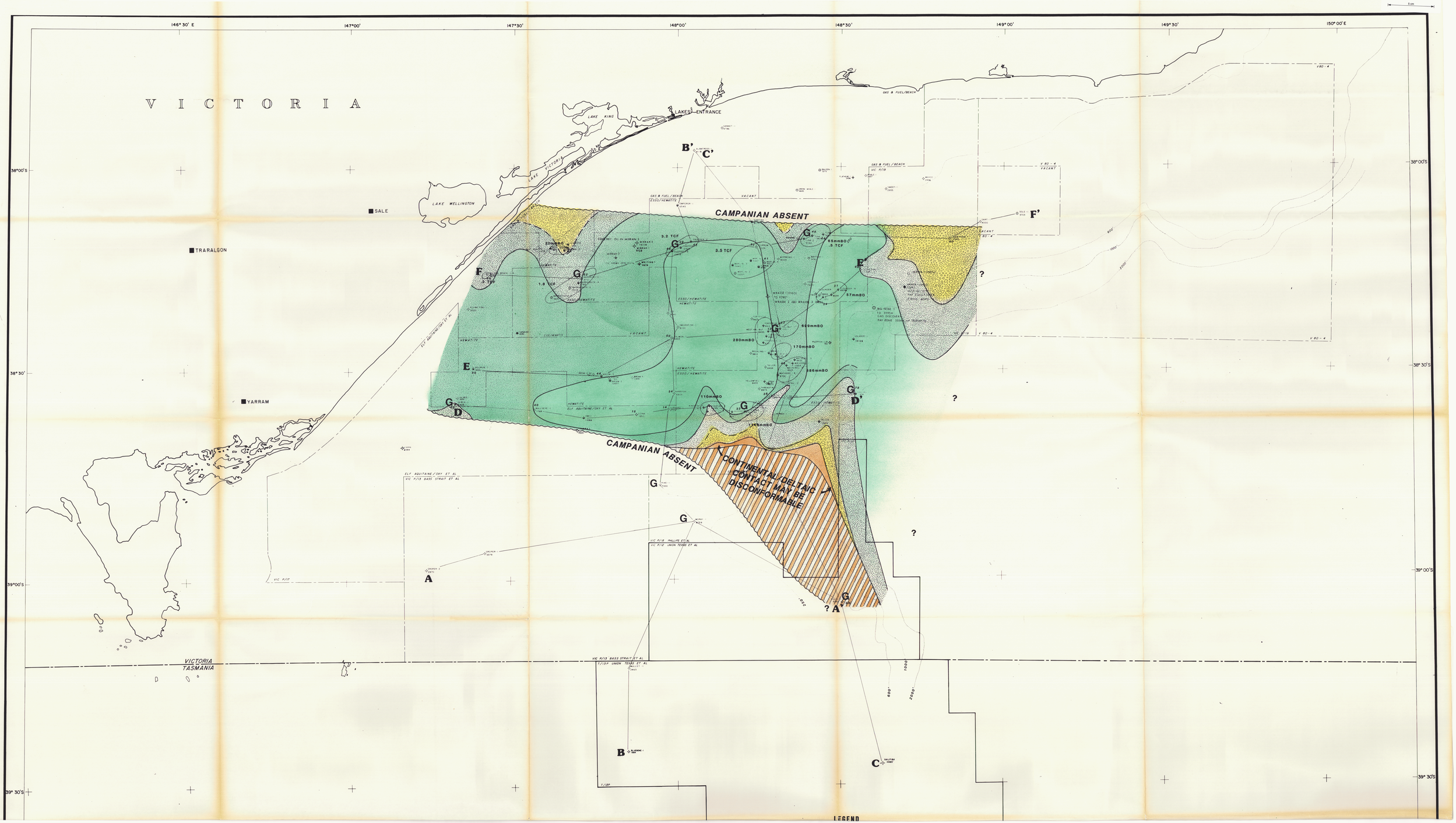

VICTORIA
LAKES ENTRANCE
LAKE KING
LAKE VICTORIA
LAKE WELLINGTON
SALE
TRARALGON
YARRAM
CAMPANIAN ABSENT
CAMPANIAN ABSENT
CONTINENTAL/DELTAIC CONTACT MAY BE DISCONFORMABLE
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TASMANIA
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LEGEND

TRARALGON

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VICTORIA
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149° 30'E

150° 00'E

40° 00'S

ELF AQUITAINE/OKY ET AL

VIC P/13 BASS STRAIT ET AL

VIC P/17

VIC P/18 PHILLIPS ET AL

VIC P/10 UNION TEXAS ET AL

T/13P UNION TEXAS ET AL

T/13P

V 80-4

3.2 TCF

3.5 TCF

1.8 TCF

3.7 TCF

95mmBO

57mmBO

669mmBO

280mmBO

170mmBO

386mmBO

110mmBO

114mmBO

ESSO/HEMATITE

HEMATITE

VACANT

WRASSE 1 (ESSO)
TD 9790'
WRASSE 2 ABD WRASSE 3 DRY

BIG NOSE 1
TD 3979m
GAS DISCOVERY
RAY ZONE ESSO/BHP

CAMPANIAN ABSENT

CONTINENTAL/DELTAIC CONTACT MAY BE DISCONFORMABLE

A

B

C

D

D'

E

F

G

?

LEGEND

- CORRELATION SECTIONS
- CONTINENTAL FACIES
- DELTA-PLAIN FACIES
- DELTA-FRONT FACIES
- SANDY (PROXIMAL) INTERVAL OF PRO-DELTA FACIES
- PRO-DELTA FACIES

0 40 60 80 100
34 46 65 90
SAND PERCENTAGE OF ENCLOSING SECTION

Union Texas Petroleum Corporation
An ALLIED Company

AUSTRALIA
GIPPSLAND BASIN
PALEOGEOGRAPHY: LATE CRETACEOUS
(TOP CAMPANIAN)

10401S

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DATE: APRIL, 1984
AUTHOR: T. DE WINDT

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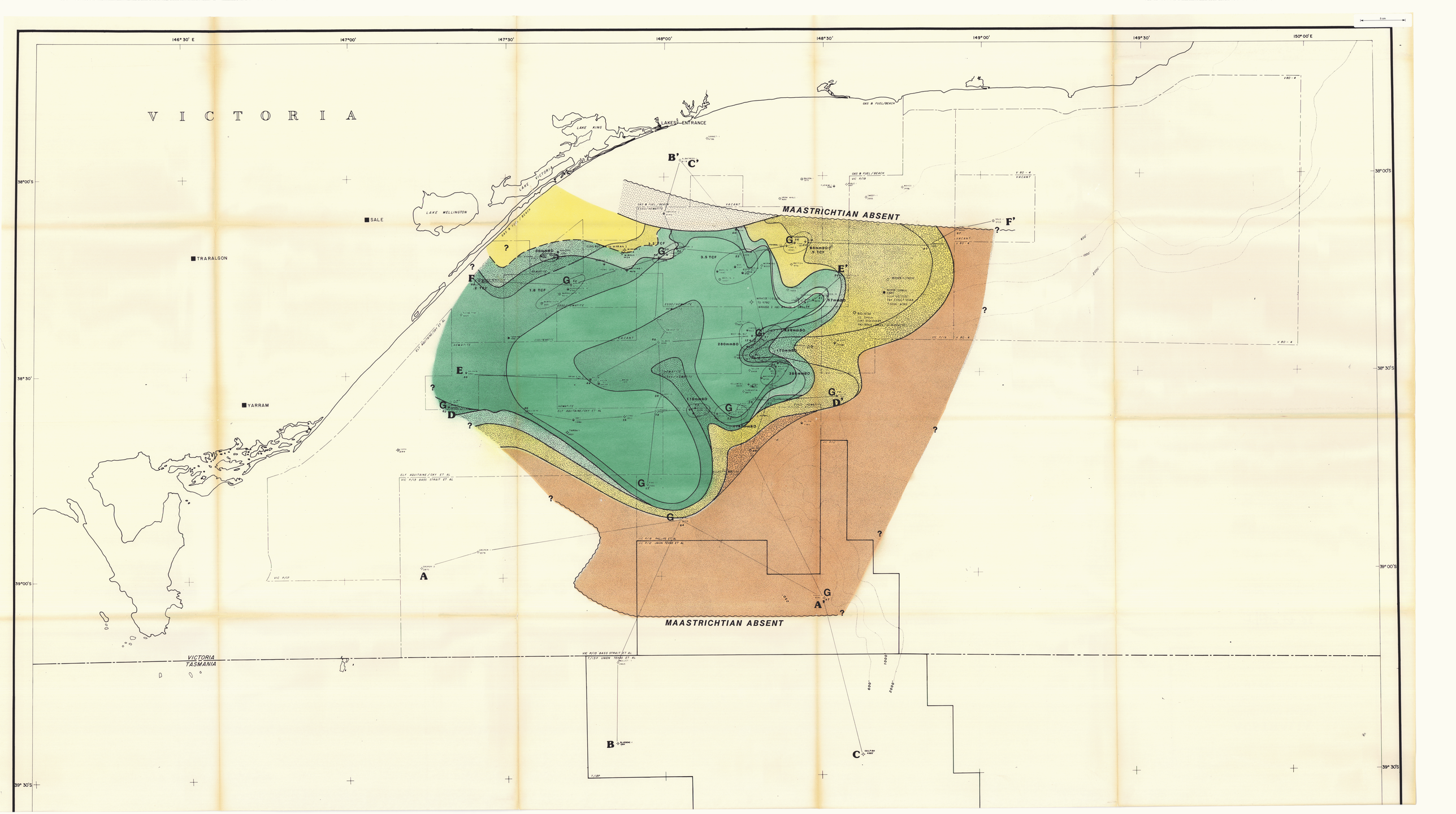

VICTORIA
LAKES ENTRANCE
LAKE KING
LAKE VICTORIA
LAKE WELLINGTON
SALE
TRARALGON
YARRAM
MAASTRICHTIAN ABSENT
MAASTRICHTIAN ABSENT
VICTORIA
TASMANIA
146° 30' E
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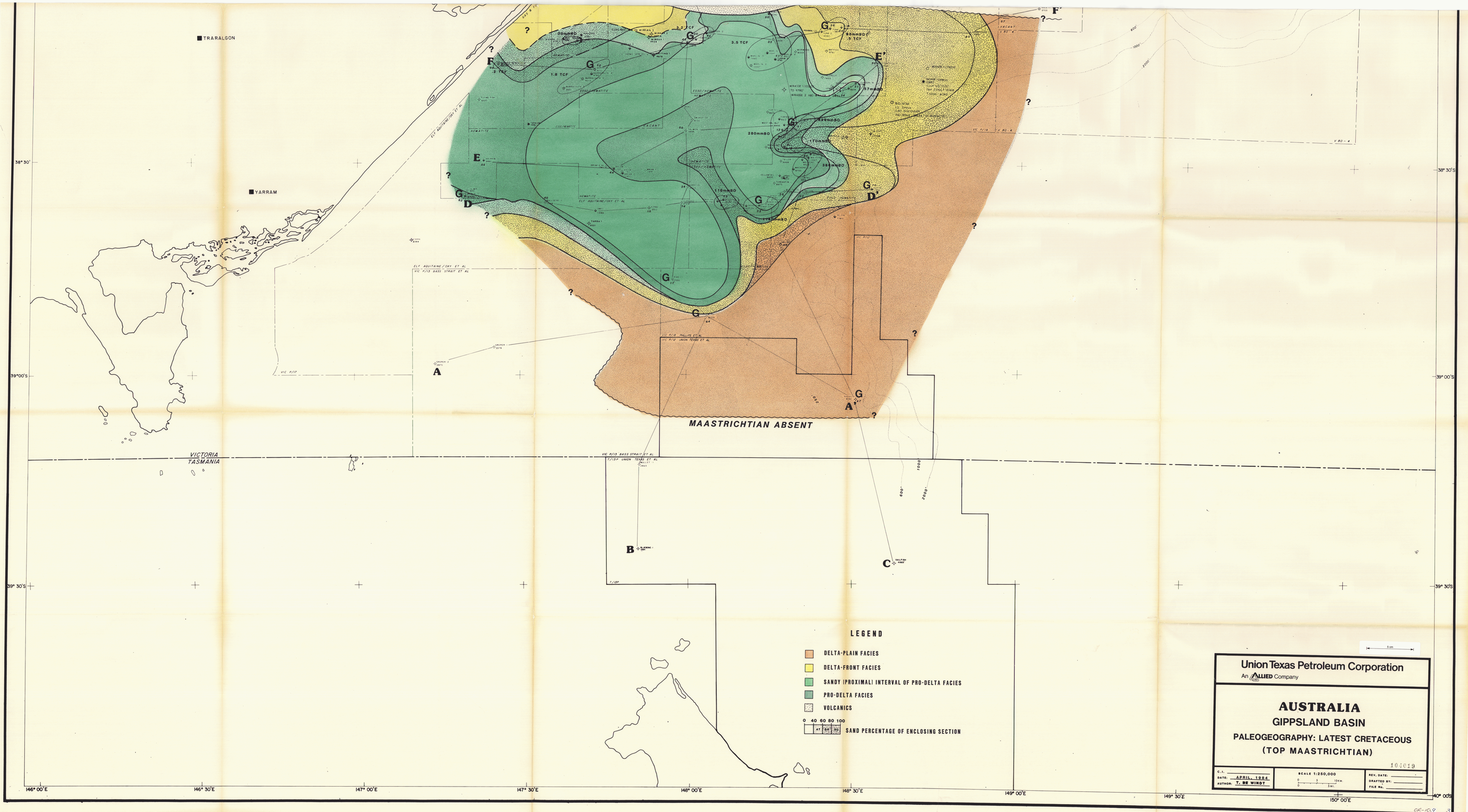
3.5 TCF
1.8 TCF
280mmBO
110mmBO


TRARALGON
YARRAM
VICTORIA
TASMANIA
MAASTRICHTIAN ABSENT
A
A'
B
C
D
D'
E
E'
F
F'
G
38° 30'
39° 00'S
39° 30'S
40° 00'S
146° 00'E
146° 30'E
147° 00'E
147° 30'E
148° 00'E
148° 30'E
149° 00'E
149° 30'E
150° 00'E
LEGEND
DELTA-PLAIN FACIES
DELTA-FRONT FACIES
SANDY (PROXIMAL) INTERVAL OF PRO-DELTA FACIES
PRO-DELTA FACIES
VOLCANICS
0 40 60 80 100
SAND PERCENTAGE OF ENCLOSING SECTION
Union Texas Petroleum Corporation
An ALLIED Company
AUSTRALIA
GIPPSLAND BASIN
PALEOGEOGRAPHY: LATEST CRETACEOUS
(TOP MAASTRICHTIAN)
104019
C.I.
DATE: APRIL, 1984
AUTHOR: T. DE WINDT
SCALE 1:250,000
REV. DATE:
DRAFTED BY:
FILE No.

T/13P Pt 28



VICTORIA
LAKES ENTRANCE
LAKE KING
LAKE VICTORIA
LAKE WELLINGTON
SALE
TRARALGON
YARRAM
UPPER PALEOCENE ABSENT
UPPER PALEOCENE ABSENT
UPPER PALEOCENE ABSENT
VICTORIA
TASMANIA
146° 30' E
147°00'
147°30'
148°00'
148°30'
149°00'
149°30'
150°00' E
38°00'S
38°30'
39°00'S
39° 30'S
A
A'
B
B'
C
C'
D
D'
E
E'
F
F'
G


UPPER PALEOCENE ABSENT
UPPER PALEOCENE ABSENT
UPPER PALEOCENE ABSENT
TRARALGON
YARRAM
VICTORIA
TASMANIA
A
A'
B
C
D
D'
E
E'
F
G
38° 30'
39° 00'S
39° 30'S
40° 00'S
146° 00'E
146° 30'E
147° 00'E
147° 30'E
148° 00'E
148° 30'E
149° 00'E
149° 30'E
150° 00'E
LEGEND
DELTA-PLAIN FACIES
DELTA-FRONT FACIES
SANDY (PROXIMAL) INTERVAL OF PRO-DELTA FACIES
PRO-DELTA FACIES
0 40 60 80 100
37 49 66 81
SAND PERCENTAGE OF ENCLOSING SECTION
Union Texas Petroleum Corporation
An ALLIED Company
AUSTRALIA
GIPPSLAND BASIN
PALEOGEOGRAPHY:
LATEST PALEOCENE
104020
C.I.
DATE: APRIL, 1984
AUTHOR: T. DE WINDT
SCALE 1:250,000
REV. DATE:
DRAFTED BY:
FILE No.

T/13P Pt 28

VICTORIA

146° 30' E
147°00'
147°30'
148°00'
148°30'
149°00'
149°30'
150° 00' E
38°00'S
38° 30'
39°00'S
39° 30'S

LAKE KING
LAKES ENTRANCE
LAKE VICTORIA
LAKE WELLINGTON
SALE
TRARALGON
YARRAM
VICTORIA
TASMANIA

EOCENE ABSENT

TUNA-FLOUNDER CHANNEL: MASSIVE MARINE SANDSTONE

MARLIN CHANNEL: MARINE SHALE

EOCENE ABSENT

COARSE SS.

EOCENE ABSENT

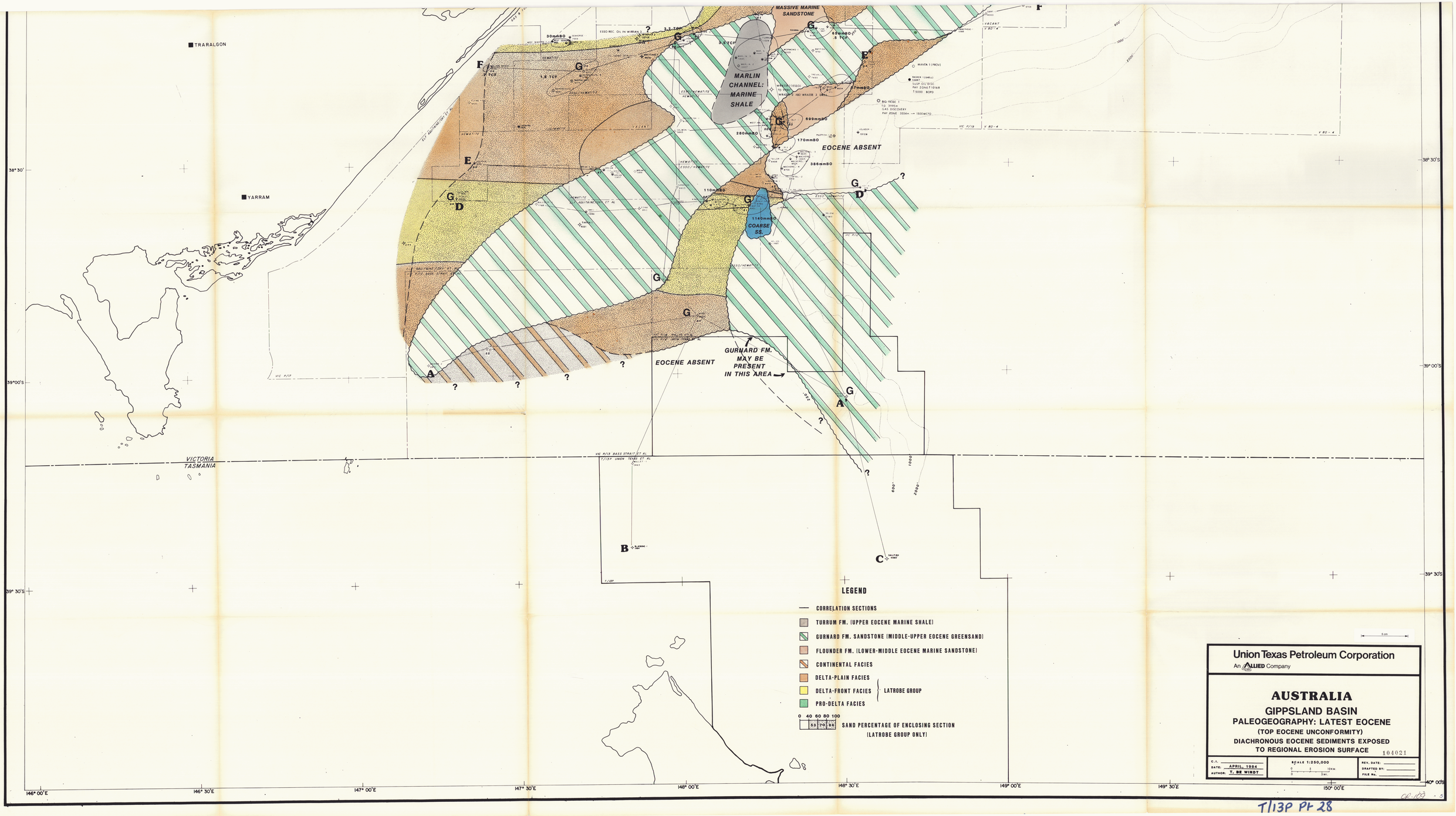
GURNARD FM. MAY BE PRESENT IN THIS AREA

A
B
B'
C
C'
D
D'
E
F
F'
G

30mmBO
3.2 TCF
1.8 TCF
3.9 TCF
65mmBO
.5 TCF
17mmBO
699mmBO
280mmBO
170mmBO
386mmBO
110mmBO
1140mmBO

LEGEND

— CORRELATION SECTIONS



TRARALGON
YARRAM
VICTORIA
TASMANIA
MASSIVE MARINE SANDSTONE
MARLIN CHANNEL: MARINE SHALE
EOCENE ABSENT
COARSE SS.
GURNARD FM. MAY BE PRESENT IN THIS AREA
EOCENE ABSENT
30mmBO
65mmBO
699mmBO
280mmBO
170mmBO
386mmBO
110mmBO
1140mmBO
LEGEND
CORRELATION SECTIONS
TURRUM FM. (UPPER EOCENE MARINE SHALE)
GURNARD FM. SANDSTONE (MIDDLE-UPPER EOCENE GREENSAND)
FLOUNDER FM. (LOWER-MIDDLE EOCENE MARINE SANDSTONE)
CONTINENTAL FACIES
DELTA-PLAIN FACIES
DELTA-FRONT FACIES
PRO-DELTA FACIES
LATROBE GROUP
0 40 60 80 100
53 70 84
SAND PERCENTAGE OF ENCLOSING SECTION (LATROBE GROUP ONLY)
Union Texas Petroleum Corporation
An ALLIED Company
AUSTRALIA
GIPPSLAND BASIN
PALEOGEOGRAPHY: LATEST EOCENE
(TOP EOCENE UNCONFORMITY)
DIACHRONOUS EOCENE SEDIMENTS EXPOSED TO REGIONAL EROSION SURFACE
104021
C.I.
DATE: APRIL, 1984
AUTHOR: T. DE WINDT
SCALE 1:250,000
REV. DATE:
DRAFTED BY:
FILE No.
38° 30'
39° 00'S
39° 30'S
146° 00'E
146° 30'E
147° 00'E
147° 30'E
148° 00'E
148° 30'E
149° 00'E
149° 30'E
150° 00'E
40° 00'S

T/13P Pt 28

VICTORIA

LAKES ENTRANCE

LAKE KING

LAKE VICTORIA

LAKE WELLINGTON

SALE

TRARALGON

YARRAM

146° 30' E

147°00'

147°30'

148°00'

148°30'

149°00'

149°30'

150° 00' E

38°00'S

38° 30'S

39°00'S

39° 30'S

OLIGOCENE ABSENT

3.2 Tcf

30mmBO

3.5 TCF

65mmBO
.5 TCF

.2 TCF

1.8 TCF

57mmBO

699mmBO

170mmBO

386mmBO

180mmBO

1140mmBO

OLIGOCENE ABSENT

LAKES ENTRANCE GREENSAND MBR.
BELOW TOP OLIGOCENE SURFACE

LAKES ENTRANCE GREENSAND MBR.
AT TOP OLIGOCENE SURFACE

OLIGOCENE ABSENT

VICTORIA
TASMANIA

A

A'

B

B'

C

C'

D

D'

E

E'

F

F'

G

VACANT

V 80-4

VIC P/19

VIC P/13

VIC P/12

VIC P/10

GAS & FUEL/BEACH

ESSO/HEMATITE

HEMATITE

ESSO REC. OIL IN WIRRAL-1

WIRRAL-1

WIRRAL-2

WIRRAL-3

WIRRAL-4

WIRRAL-5

WIRRAL-6

WIRRAL-7

WIRRAL-8

WIRRAL-9

WIRRAL-10

WIRRAL-11

WIRRAL-12

WIRRAL-13

WIRRAL-14

WIRRAL-15

WIRRAL-16

WIRRAL-17

WIRRAL-18

WIRRAL-19

WIRRAL-20

WIRRAL-21

WIRRAL-22

WIRRAL-23

WIRRAL-24

WIRRAL-25

WIRRAL-26

WIRRAL-27

WIRRAL-28

WIRRAL-29

WIRRAL-30

WIRRAL-31

WIRRAL-32

WIRRAL-33

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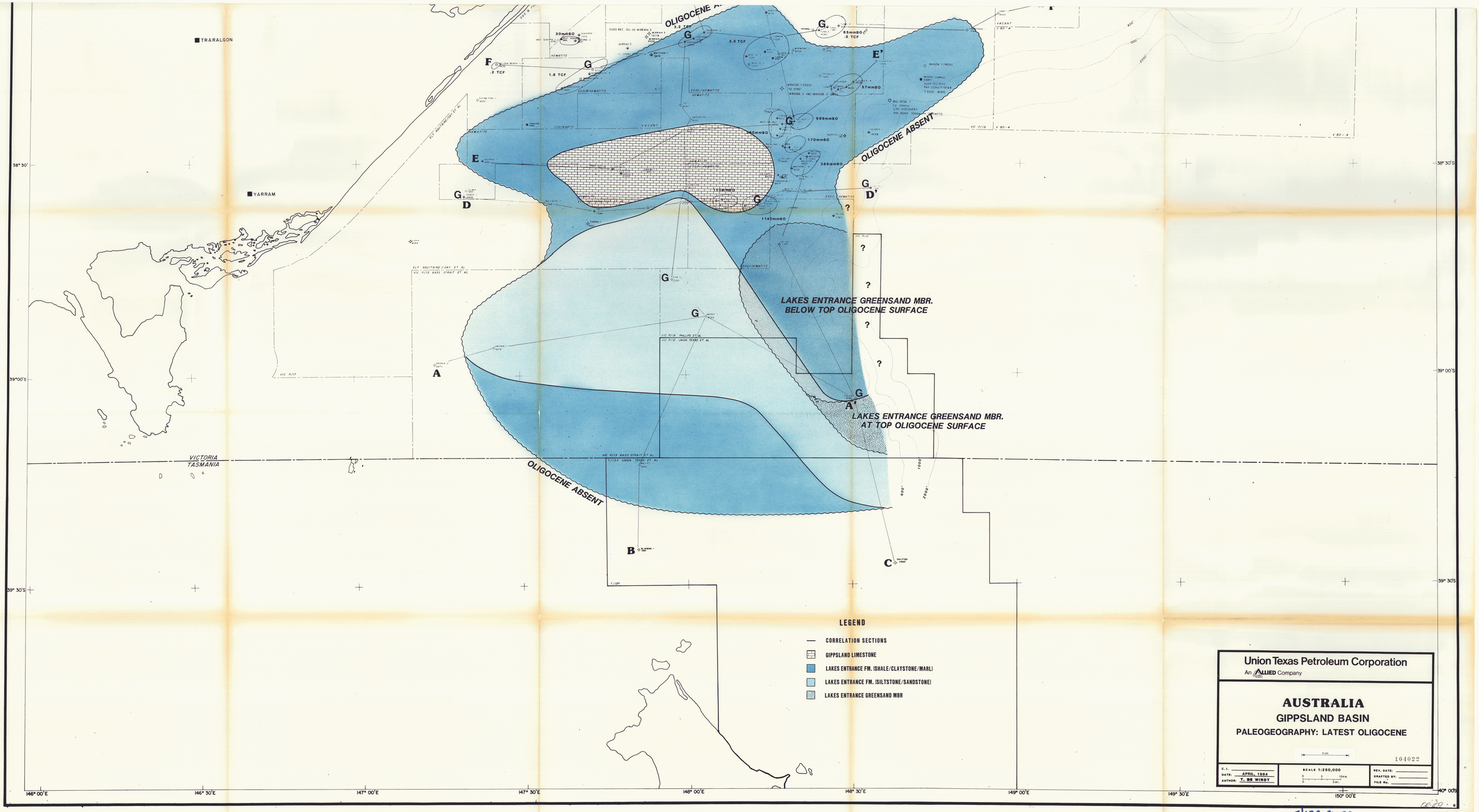
WIRRAL-37

WIRRAL-38

WIRRAL-39

WIRRAL-40



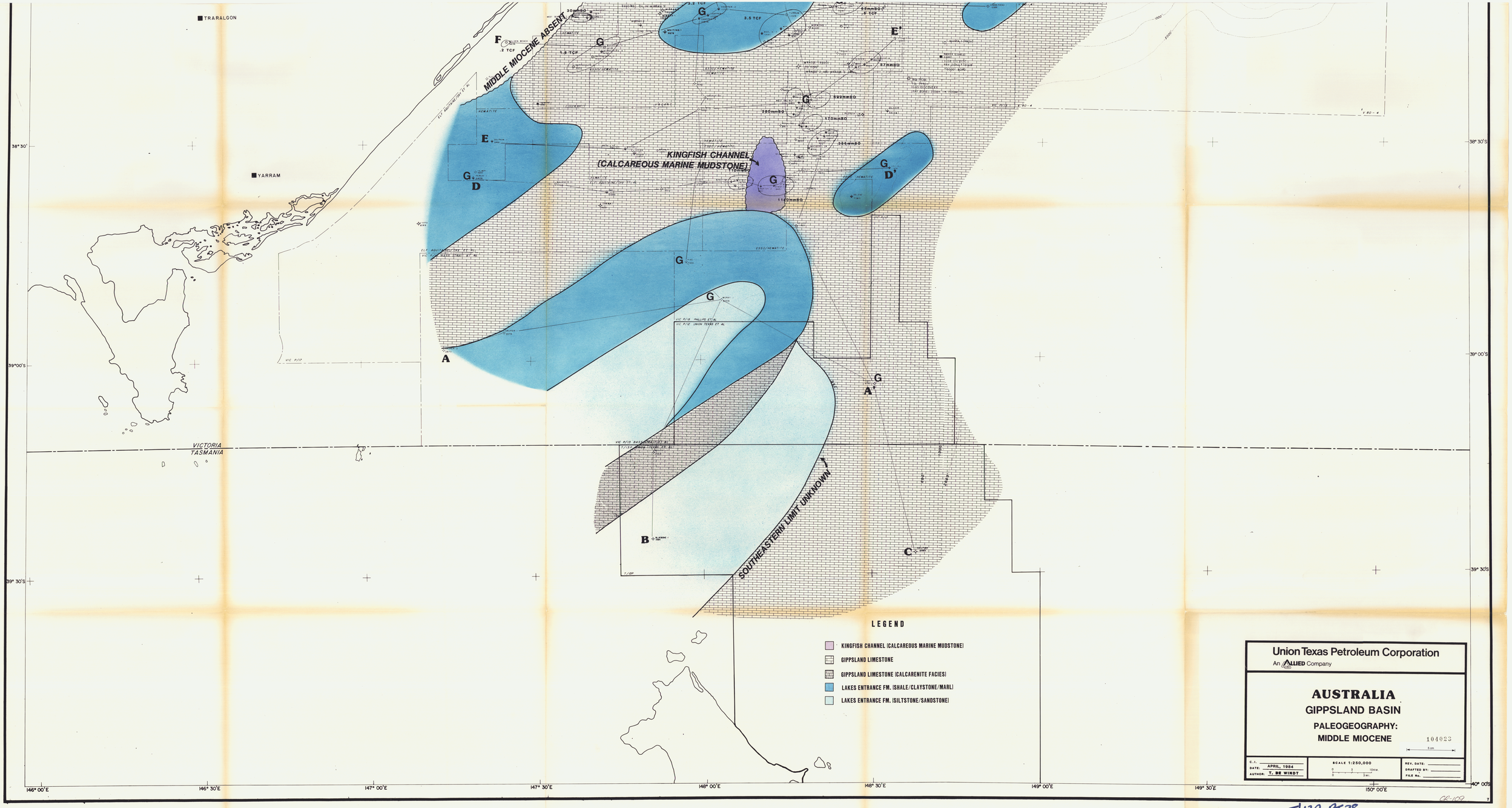
TRARALGON
YARRAM
VICTORIA
TASMANIA
OLIGOCENE ABSENT
OLIGOCENE ABSENT
LAKES ENTRANCE GREENSAND MBR.
BELOW TOP OLIGOCENE SURFACE
LAKES ENTRANCE GREENSAND MBR.
AT TOP OLIGOCENE SURFACE
A
A'
B
C
D
D'
E
E'
F
G
LEGEND
CORRELATION SECTIONS
GIPPSLAND LIMESTONE
LAKES ENTRANCE FM. (SHALE/CLAYSTONE/MARL)
LAKES ENTRANCE FM. (SILTSTONE/SANDSTONE)
LAKES ENTRANCE GREENSAND MBR
Union Texas Petroleum Corporation
An ALLIED Company
AUSTRALIA
GIPPSLAND BASIN
PALEOGEOGRAPHY: LATEST OLIGOCENE
104022
C.I.
DATE: APRIL, 1984
AUTHOR: T. DE WINDT
SCALE 1:250,000
REV. DATE:
DRAFTED BY:
FILE No.
146° 00'E
146° 30'E
147° 00'E
147° 30'E
148° 00'E
148° 30'E
149° 00'E
149° 30'E
150° 00'E
38° 30'
39° 00'S
39° 30'S
40° 00'S

T/13P Pt 28

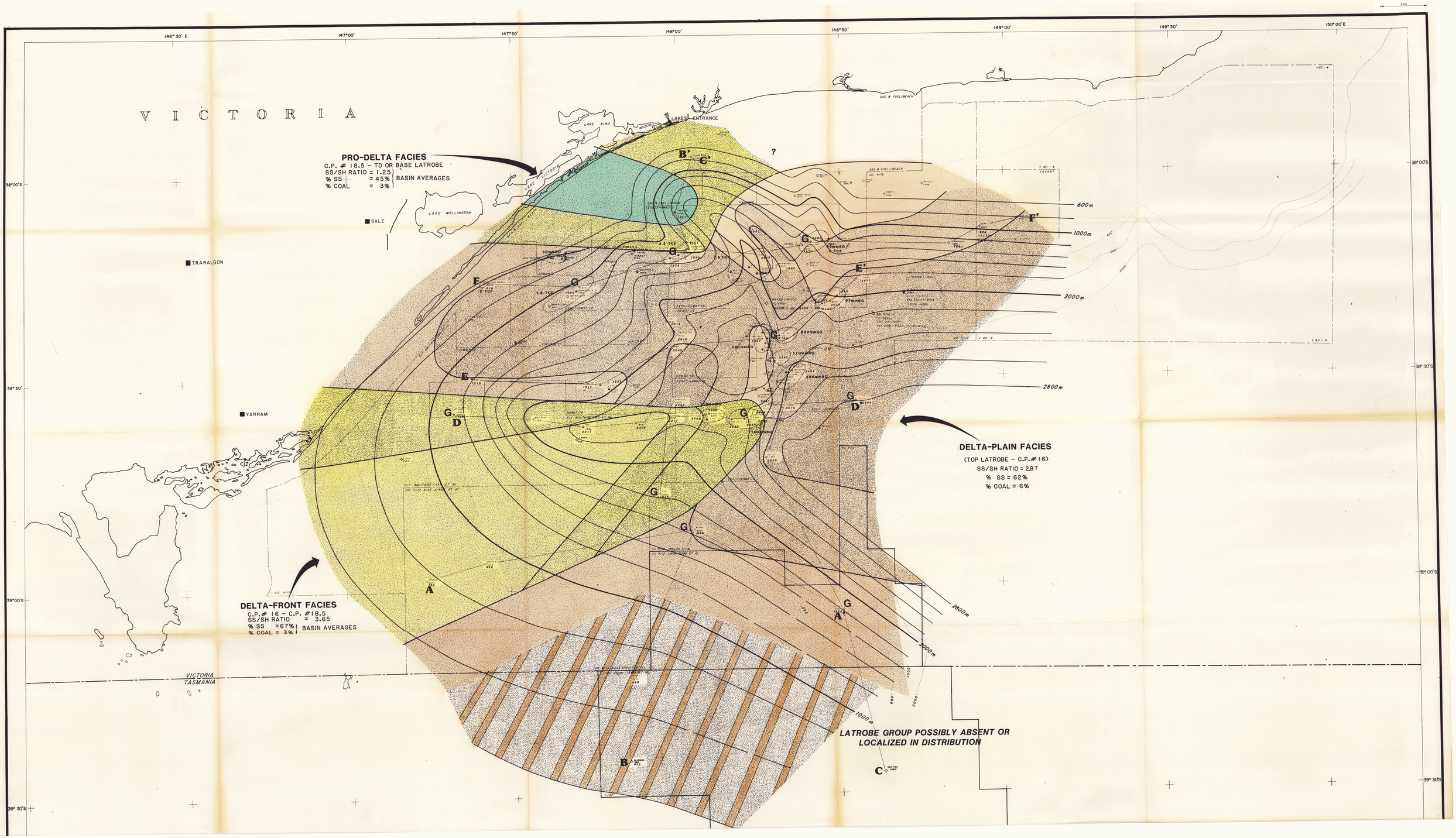
VICTORIA

146° 30' E
147°00'
147°30'
148°00'
148°30'
149° 00'
149°30'
150° 00' E
38°00'S
38° 30'
39°00'S
39° 30'S

LAKES ENTRANCE
LAKE KING
LAKE VICTORIA
LAKE WELLINGTON
SALE
TRARALGON
YARRAM
GAS & FUEL/BEACH
VIC P/19
VIC P/17
VIC P/18 PHILLIPS ET AL
VIC P/2 UNION TEXAS ET AL
VIC P/13 BASS OIL
T/19 Esso-Hematite et al
T/29
VACANT
ESSO/HEMATITE
ELF AQUITAINE/TNT ET AL
BASS STRAIT ET AL
ESSO/BHP
HEMATITE
GOLDEN BEACH
SUNFISH
MARLIN
WIRRAH
WIRRAH 1 AND WIRRAH 1A
KINGFISH
KINGFISH 1
KINGFISH 2
KINGFISH 3
KINGFISH 4
KINGFISH 5
KINGFISH 6
KINGFISH 7
KINGFISH 8
KINGFISH 9
KINGFISH 10
KINGFISH 11
KINGFISH 12
KINGFISH 13
KINGFISH 14
KINGFISH 15
KINGFISH 16
KINGFISH 17
KINGFISH 18
KINGFISH 19
KINGFISH 20
KINGFISH


TRARALGON
YARRAM
MIDDLE MIOCENE ABSENT
KINGFISH CHANNEL
(CALCAREOUS MARINE MUDSTONE)
SOUTHEASTERN LIMIT UNKNOWN
VICTORIA
TASMANIA
A
A'
B
C
D
D'
E
E'
F
G
38° 30'
39° 00'S
39° 30'S
40° 00'S
146° 00'E
146° 30'E
147° 00'E
147° 30'E
148° 00'E
148° 30'E
149° 00'E
149° 30'E
150° 00'E
LEGEND
KINGFISH CHANNEL (CALCAREOUS MARINE MUDSTONE)
GIPPSLAND LIMESTONE
GIPPSLAND LIMESTONE (CALCARENITE FACIES)
LAKES ENTRANCE FM. (SHALE/CLAYSTONE/MARL)
LAKES ENTRANCE FM. (SILTSTONE/SANDSTONE)
Union Texas Petroleum Corporation
An ALLIED Company
AUSTRALIA
GIPPSLAND BASIN
PALEOGEOGRAPHY:
MIDDLE MIOCENE
104023
C.I.
DATE: APRIL, 1984
AUTHOR: T. DE WINDT
SCALE 1:250,000
REV. DATE:
DRAFTED BY:
FILE No.

T/13P PT28



VICTORIA
PRO-DELTA FACIES
C.P. # 18.5 – TD OR BASE LATROBE
SS/SH RATIO = 1.25
% SS = 45%
% COAL = 3%
BASIN AVERAGES
DELTA-PLAIN FACIES
(TOP LATROBE – C.P.# 16)
SS/SH RATIO = 2.97
% SS = 62%
% COAL = 6%
DELTA-FRONT FACIES
C.P.# 16 – C.P. #18.5
SS/SH RATIO = 3.65
% SS = 67%
% COAL = 3%
BASIN AVERAGES
LATROBE GROUP POSSIBLY ABSENT OR LOCALIZED IN DISTRIBUTION
LAKES ENTRANCE
LAKE KING
LAKE VICTORIA
LAKE WELLINGTON
SALE
TRARALGON
YARRAM
VICTORIA
TASMANIA
600m
1000m
2000m
2800m
146° 30' E
147° 00'
147° 30'
148° 00'
148° 30'
149° 00'
149° 30'
150° 00' E
38° 00' S
38° 30' S
39° 00' S
39° 30' S

TRARALGON

YARRAM

VICTORIA
TASMANIA

38° 30'

39° 00'S

39° 30'S

146° 00'E

146° 30'E

147° 00'E

147° 30'E

148° 00'E

148° 30'E

149° 00'E

149° 30'E

150° 00'E

40° 00'S

1000m

2000m

2800m

400m

DELTA-PLAIN FACIES
(TOP LATROBE – C.P.# 16)
SS/SH RATIO = 2.97
% SS = 62%
% COAL = 6%

DELTA-FRONT FACIES
C.P.# 16 – C.P. #18.5
SS/SH RATIO = 3.65
% SS = 67% } BASIN AVERAGES
% COAL = 3% }

LATROBE GROUP POSSIBLY ABSENT OR LOCALIZED IN DISTRIBUTION

LEGEND

- G — GEARHART GEOCHEMICAL/PYROLSIS ANALYSES (TOTAL OF 10 WELLS)
- CORRELATION SECTIONS
- CONTINENTAL FACIES
- DELTA-PLAIN FACIES
- DELTA-FRONT FACIES
- PRO-DELTA FACIES
- 0 40 60 80 100 — SAND PERCENTAGE RANGE OF SUBCROPPING UNIT

Union Texas Petroleum Corporation
An ALLIED Company

AUSTRALIA
GIPPSLAND BASIN

STRUCTURE/SUBCROP MAP, TOP LATROBE UNCONFORMITY, SHOWING FACIES IDENTITY AND SAND PERCENTAGE RANGE OF SUBCROPPING LATROBE UNIT
(MEASURED DEPTH IN METERS) 104024

C.I. ____
DATE: MAY, 1984
AUTHOR: T. DE WINDT

SCALE 1:250,000
0 5 10 KM.
0 5 MI.

REV. DATE: ____
DRAFTED BY: ____
FILE No. ____

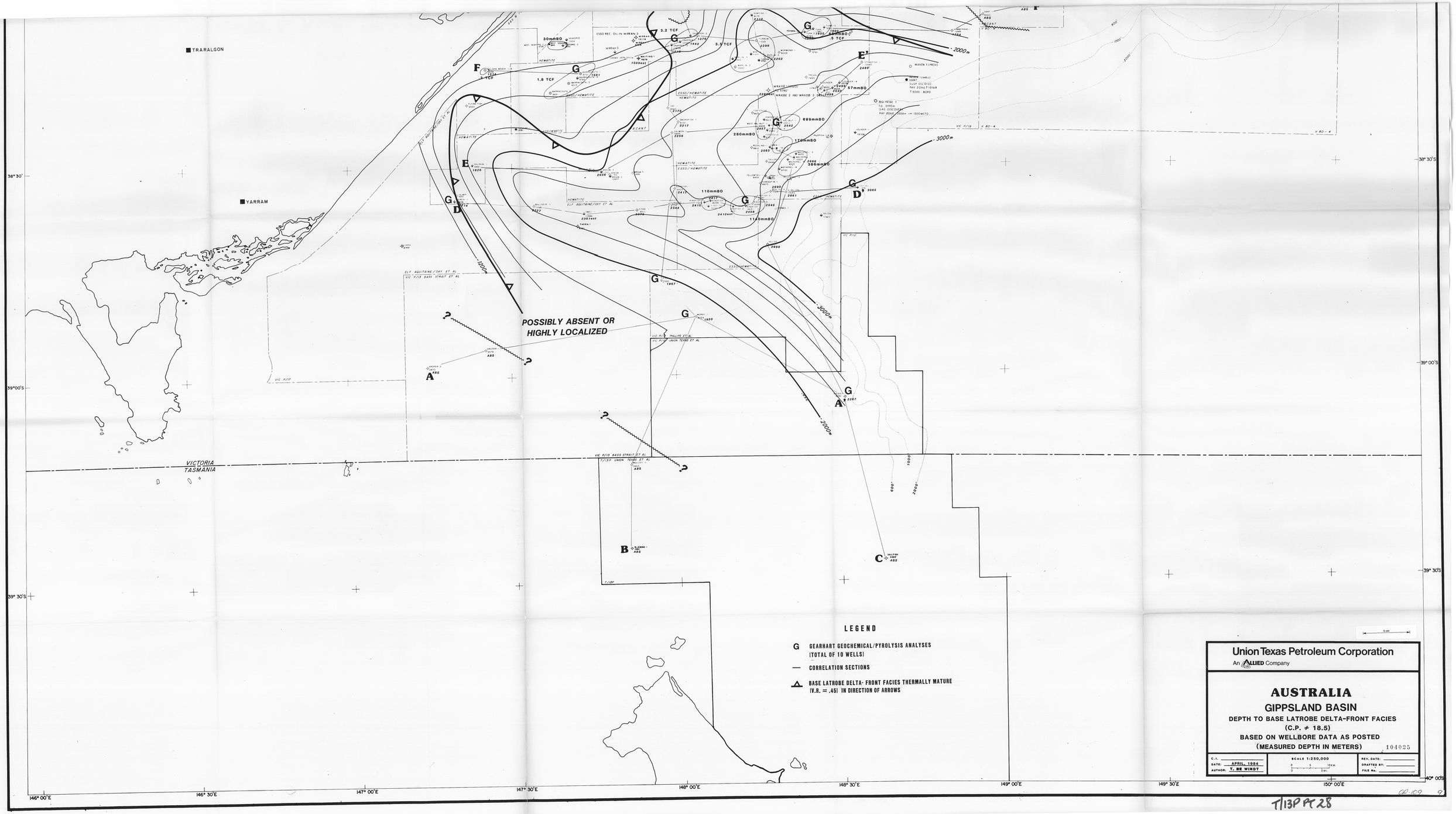
T/13P PT23

VICTORIA

146° 30' E
147°00'
147°30'
148°00'
148°30'
149°00'
149°30'
150° 00' E
38°00'S
38° 30'
39°00'S
39° 30'S

LAKE KING
LAKES ENTRANCE
LAKE VICTORIA
LAKE WELLINGTON
SALE
TRARALGON
YARRAM
VICTORIA
TASMANIA

GAS & FUEL/BEACH
WEST SEAHORSE
SEAHORSE
WIRRAH 3
WHITING 1
BARRACOUTA 1
BARRACOUTA A 1
FLYING FISH
KINGFISH 1
SNAPPER 1
SNAPPER A 1
SNAPPER A 2
SNAPPER A 3
SNAPPER A 4
SNAPPER A 5
SNAPPER A 6
SNAPPER A 7
SNAPPER A 8
SNAPPER A 9
SNAPPER A 10
SNAPPER A 11
SNAPPER A 12
SNAPPER A 13
SNAPPER A


TRARALGON
YARRAM
VICTORIA
TASMANIA
POSSIBLY ABSENT OR HIGHLY LOCALIZED
LEGEND
G GEARHART GEOCHEMICAL/PYROLYSIS ANALYSES (TOTAL OF 10 WELLS)
CORRELATION SECTIONS
BASE LATROBE DELTA- FRONT FACIES THERMALLY MATURE (V.R. = .45) IN DIRECTION OF ARROWS
Union Texas Petroleum Corporation
An ALLIED Company
AUSTRALIA
GIPPSLAND BASIN
DEPTH TO BASE LATROBE DELTA-FRONT FACIES
(C.P. # 18.5)
BASED ON WELLBORE DATA AS POSTED
(MEASURED DEPTH IN METERS)
104025
C.I.
DATE: APRIL, 1984
AUTHOR: T. DE WINDT
SCALE 1:250,000
REV. DATE:
DRAFTED BY:
FILE No.
146° 00'E
146° 30'E
147° 00'E
147° 30'E
148° 00'E
148° 30'E
149° 00'E
149° 30'E
150° 00'E
38° 30'S
39° 00'S
39° 30'S
40° 00'S

T/13P PT 28

VICTORIA

LAKES ENTRANCE

LAKE KING

LAKE VICTORIA

LAKE WELLINGTON

SALE

TRARALGON

YARRAM

VICTORIA
TASMANIA

146° 30' E
147°00'
147°30'
148°00'
148°30'
149°00'
149°30'
150° 00' E

38°00'S
38° 30'S
39° 00'S
39° 30'S

GAS & FUEL/BEACH

ESSO/HEMATITE

VACANT

V 80 - 4

VIC P/19

ELF AQUITAINE/DEV ET AL
VIC P/13 BASS STRAIT ET AL

VIC P/19 PHILLIPS ETAL
VIC P/13 UNION TEXAS ET AL

VIC P/13

ESSO REC. OIL IN URBAN 1

WAASE 1 (ESSO)
IN 1600'
WAASE 2 AND WAASE 3 DRILLED

MANTA 1 (PROV)

RAINER 1 (SHELL)
3085.5m
GAS OIL OWC
PAY ZONE T.0068
T.5000 BOPD

BIG HOSE 1
3995m
DISCOVERY
Top Latrobe 3554m → 1500 MCFD

30mmBO
110mmBO
280mmBO
170mmBO
685mmBO
45mmBO
354mmBO
1149mmBO

3.2 TCF
3.8 TCF
1.8 TCF
.2 TCF

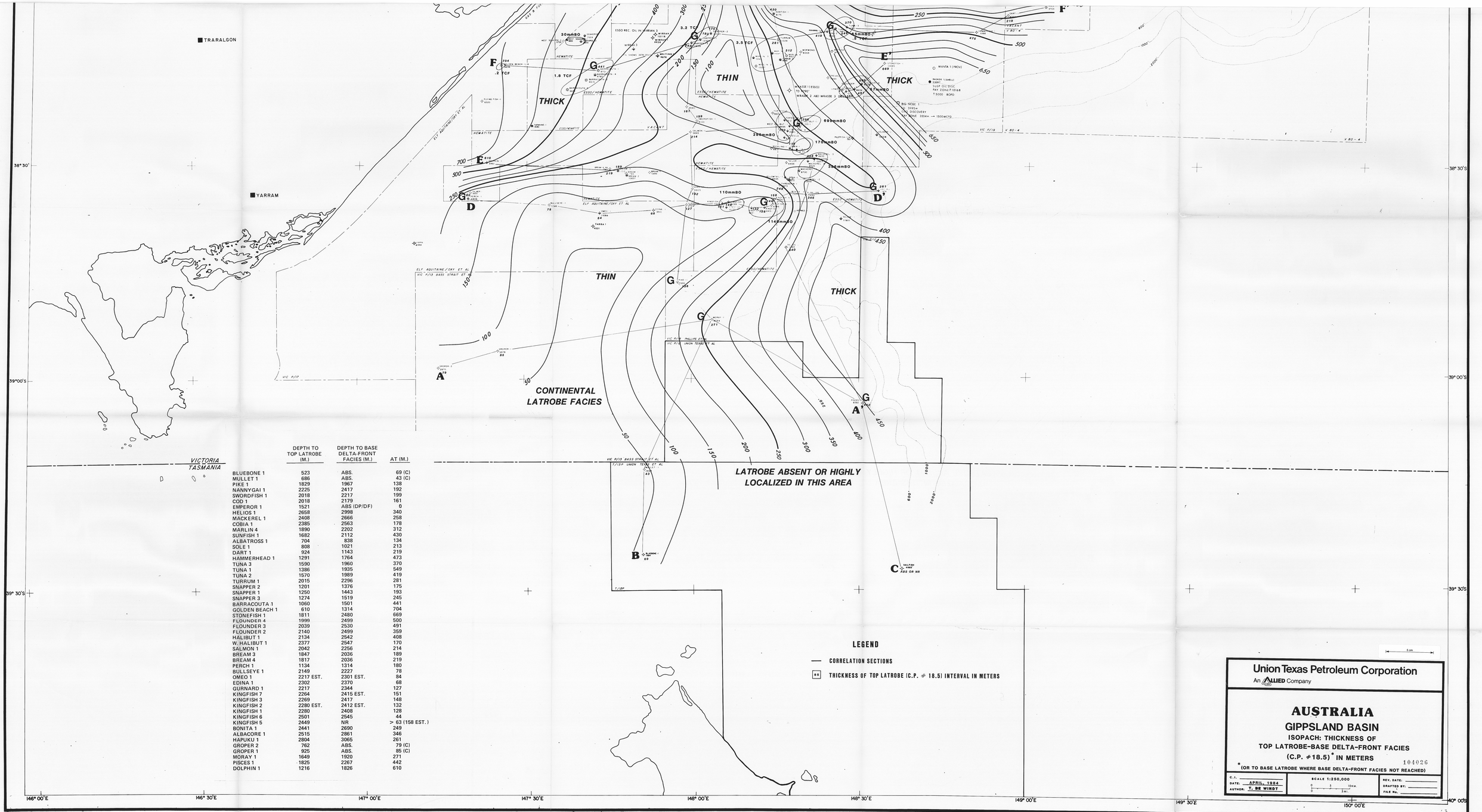
THICK
THIN
THICK
THIN
THICK

CONTINENTAL
LATROBE FACIES

LATROBE ABSENT OR HIGHLY
LOCALIZED IN THIS AREA

A A'
B B'
C C'
D D'
E E'
F F'
G G'

	DEPTH TO TOP LATROBE (M.)	DEPTH TO BASE DELTA-FRONT FACIES (M.)	AT (M.)
BLUEBONE 1	523	ABS.	69 (C)
MULLET 1	686	ABS.	43 (C)
PIKE 1	1829	1967	138
NANNYGAI 1	2225	2417	192
SWORDFISH 1	2018	2217	199
COD 1	2018	2179	161
EMPEROR 1	1521	ABS (DP/DF)	0
HELIOS 1	2658	2998	340
MACKEREL 1	2408	2666	258
COBIA 1	2385	2563	178
MARLIN 4	1890	2202	312
SUNFISH 1	1682	2112	430
ALBATROSS 1	704	838	134
SOLE 1	808	1021	213
DART 1	924	1143	219
HAMMERHEAD 1	1291	1764	473
TUNA 3	1590	1960	370
TUNA 1	1386	1935	549
TUNA 2	1570	1989	419
TURRUM 1	2015	2296	281
SNAPPER 2	1201	1376	175
SNAPPER 1	1250	1443	193
SNAPPER 3	1274	1519	245
BARRACOUTA 1	1060	1501	441
GOLDEN BEACH 1	610	1314	704
STONEFISH 1	1811	2480	669
FLOUNDER 4	1999	2499	500



	DEPTH TO TOP LATROBE (M.)	DEPTH TO BASE DELTA-FRONT FACIES (M.)	AT (M.)
BLUEBONE 1	523	ABS.	69 (C)
MULLET 1	686	ABS.	43 (C)
PIKE 1	1829	1967	138
NANNYGAI 1	2225	2417	192
SWORDFISH 1	2018	2217	199
COD 1	2018	2179	161
EMPEROR 1	1521	ABS (DP/DF)	0
HELIOS 1	2658	2998	340
MACKEREL 1	2408	2666	258
COBIA 1	2385	2563	178
MARLIN 4	1890	2202	312
SUNFISH 1	1682	2112	430
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SOLE 1	808	1021	213
DART 1	924	1143	219
HAMMERHEAD 1	1291	1764	473
TUNA 3	1590	1960	370
TUNA 1	1386	1935	549
TUNA 2	1570	1989	419
TURRUM 1	2015	2296	281
SNAPPER 2	1201	1376	175
SNAPPER 1	1250	1443	193
SNAPPER 3	1274	1519	245
BARRACOUTA 1	1060	1501	441
GOLDEN BEACH 1	610	1314	704
STONEFISH 1	1811	2480	669
FLOUNDER 4	1999	2499	500
FLOUNDER 3	2039	2530	491
FLOUNDER 2	2140	2499	359
HALIBUT 1	2134	2542	408
W. HALIBUT 1	2377	2547	170
SALMON 1	2042	2256	214
BREAM 3	1847	2036	189
BREAM 4	1817	2036	219
PERCH 1	1134	1314	180
BULLSEYE 1	2149	2227	78
OMEO 1	2217 EST.	2301 EST.	84
EDINA 1	2302	2370	68
GURNARD 1	2217	2344	127
KINGFISH 7	2264	2415 EST.	151
KINGFISH 3	2269	2417	148
KINGFISH 2	2280 EST.	2412 EST.	132
KINGFISH 1	2280	2408	128
KINGFISH 6	2501	2545	44
KINGFISH 5	2449	NR	> 63 (158 EST.)
BONITA 1	2441	2690	249
ALBACORE 1	2515	2861	346
HAPUKU 1	2804	3065	261
GROPER 2	762	ABS.	79 (C)
GROPER 1	925	ABS.	85 (C)
MORAY 1	1649	1920	271
PISCES 1	1825	2267	442
DOLPHIN 1	1216	1826	610

T/13P Pt 28

GURNARD FM. PRESENT AS
SS IN LAKES ENTRANCE FIELD

VICTORIA

LAKES ENTRANCE

LAKE KING

LAKE VICTORIA

LAKE WELLINGTON

SALE

TRARALGON

YARRAM

VICTORIA
TASMANIA

146° 30' E
147°00'
147°30'
148°00'
148°30'
149°00'
149°30'
150° 00' E

38°00'S
38° 30'S
39°00'S
39° 30'S

A
B
C
D
E
F
G
A'
B'
C'
D'
E'
F'

3.2 TCF
3.5 TCF
2 TCF
1.8 TCF
.5 TCF
30mmBO
57mmBO
693mmBO
280mmBO
170mmBO
380mmBO
10mmBO
140mmBO

0
15
30
1000
2000

?

VIC P/17
VIC P/13 BASS STRAIT ET AL
T/13P UNION TEXAS ET AL
VIC P/12
V 80 - 4
VACANT
VIC P/19
ESSO/HEMATITE
HEMATITE
GAS & FUEL/BEACH
ESSO ESL OIL IN GURNARD 1
ELF AQUITAINE (OPT.) ET AL
VIC P/13 BASS STRAIT ET AL
VIC P/13 PHILLIPS ETAL
T/13P UNION TEXAS ET AL
GURNARD 1
GURNARD 2
GURNARD 3
TARRA 1
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