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OR-279



The Prospectivity of Licenses
T/14P and T/18P, Bass Basin, Australia

Report by Roger B. Haston & John J. Farrelly

July 1991

Amoco Australia Petroleum Company

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INTRODUCTION

This report is an evaluation of the prospectivity of the Eastern View Coal Measures for economic gas reserves within the Amoco licenses T/14P and T/18P in the Bass Basin of Australia. Both licenses have drill or drop commitment deadlines of August 24, 1991. The evaluation of these licenses was undertaken to aid in this decision, fulfill the work program commitments for Year 5 in both licenses, and communicate our understanding of the basin to our joint venture parties. On June 24, 1991, Amoco informed the joint venture parties of its intention to relinquish the licences and is preparing to sell the acreage within the Yolla retention lease (authorized by the International Business Unit on June 28, 1991).

A lead map was constructed for licences T14/P and T18/P by scoping the existing data and identifying any and all possible 3-way and 4-way closures. Numbers were assigned to the leads, with no implied priority, in order to catalog them. Detailed maps were not constructed over each of the leads. Four leads were studied in detail to determine their viability. Three other leads (Ibis, Firetail, and Cormorant) proposed by SAGASCO in May, 1991 (Appendix 3), which they considered drillable, were also studied in detail. Amoco considered all to be high risk/low reserve leads as will be discussed below.

BACKGROUND

Amoco Australia Petroleum Company and South Australian Oil and Gas (now called SAGASCO) farmed into T/14P and T/18P in April of 1984 from the Bass Cue Group. In T/14P Amoco and SAGASCO assumed a farm-in obligation of \$7MM Australian (\$5.2MM U.S.) gross expenditure commitment which covered a \$4.6MM Australian (\$3.4MM U.S.) expenditure commitment to the government. In T/18P, Amoco and SAGASCO assumed a farm-in gross expenditure commitment; this license held a \$10.3MM Australian (\$7.6MM U.S.) expenditure commitment. After meeting the farm-in commitments, Amoco earned 50% of each license and SAGASCO earned 25% of each license. Amoco also had an interest in the T/22P licence which was subsequently relinquished.

When Amoco and partners acquired the licences, a total of 19 wells had been drilled in the basin. The Bass-1 well was drilled by Hematite and Esso in 1965 to test an Oligocene carbonate reef, which proved to be a thick sequence of pyroclastics. The other 18 wells targeted structural or stratigraphic traps within the Eastern View Coal Measures (EVCN). Of these wells, ten recovered hydrocarbons (primarily gas and gas condensate) by formation tests, however, none were economic discoveries. All of the hydrocarbon shows come from within the EVCN.

In 1984 and 1985, Amoco and partners acquired a 4000 km regional seismic grid in the basin and reprocessed 3000 km of existing data. These data were interpreted and used to formulate the drilling program. Regional maps on several horizons were constructed.

Three wells were drilled by the partnership within the T/14P and T/18P licenses. Yolla-1, the first well, spudded in June 1985 and drilled to a total depth of 10,981 ft. The well discovered hydrocarbons at two levels in the upper EVCN. Calculations made using log analysis data indicate 10 BCF of gas at the N. Asperus level. Pressure data indicates the bulk of the reserves, 282 BCF of gas, are at the L. Balmei level. There are still some questions about the reserves in the Yolla discovery, because the gas-water contact was never encountered and the well TDed in a thick volcanic section. The hydrocarbon potential below the volcanic section is still unknown.

The Tilana-1 was the second well drilled by the partnership, and was designed to test closure through the upper EVCN. The well spudded in September 1985 and drilled to a total depth of 12,796 ft. The well found no significant hydrocarbons, although limited gas flow was found in a drill stem test in the lower L. Balmei section.

The Koorkah-1 well was the final well drilled within the two licenses. The well spudded in November 1985 and drilled to a depth of 10,331 ft, testing closure in the upper EVCN. No hydrocarbons were present.

In 1986, a regional study of the basin was undertaken in an attempt to understand the basin configuration, facies relationships, and thermal maturation history of the basin.

In February 1990, Shell applied for and was granted an opportunity to farm-in to both T/14P and T/18P. Shell's commitment was to shoot 200 km of seismic in each block, after which time they could choose whether or not to participate in the licences. Shell shot the data in February 1990, and then after a study period decided to decline the farm-in in July 1990. In May 1990 the work program for T18 was revised by switching the renewal Year

4 well commitment with the renewal Year 5 study period; this made the obligations in both T14 and T18 equivalent (i.e. one well in each licence by 8/24/92).

The current structure of the partners interest is as follows. In T/14P Amoco 50.0000% (relinquishing), SAGASCO 13.8615%, Gas and Fuel Exploration 13.8615%, Petroz 5.0000%, Galveston 6.8300% (relinquishing) and Cultus 10.4470%. At this time it is not clear how the interests will be distributed after Amoco and Galveston relinquish. In T/18P Amoco 50.0000% (relinquishing), SAGASCO 15.0000%, Gas and Fuel Exploration 15.0000%, Petroz 5.0000%, and Cultus 15.0000%. At this time it is not clear how the interests will be distributed after Amoco relinquishes.

REGIONAL ANALYSIS

The scope of this study has been on cataloging and high-grading the structures in T/14P and T/18P, incorporating the 1990 Shell-acquired survey, and making a final assessment of the prospectivity of the area. No new regional time-structure maps were constructed from the TQH and TNK seismic grids, because these maps had been previously generated. A holistic approach has been used in this study to first determine the critical factors which make up a viable play, and then using these factors in analyzing each of the leads in the basin.

The Bass Basin is a relatively restricted narrow basin which formed during the Cretaceous and Paleogene. Very little structuring has occurred since the Paleogene. A Time-Structure map, constructed on the top of the basement, shows that the main axis of the basin runs northwest-southeast with an overall width of between 80-100 km. At its deepest point, the basin extends down to over 6.0 seconds ($\approx 17,000$ m).

Overlying the basement are the rocks of the Early Cretaceous Otway Formation, which are the main source material in the basin. The Late Cretaceous and Paleogene rocks of the Eastern View Coal Measures (EVCN) comprise the bulk of the sediments deposited in the basin. Although there is some source potential in the Eastern View Coal Measures, these rocks form the primary reservoir target. The general depositional setting for these rocks is fluvial-deltaic. The major sediment transport direction was from south to north, with a corresponding change in depositional facies from proximal to more distal northward. As expected in this type of environment, reservoir quality sands are thin, discontinuous, and difficult to predict. Overlying the EVCN is a thick sequence of Eocene shales referred to as the Demon's Bluff Formation, and the dominantly carbonate rocks of the Oligocene Torquay Group. There are many Tertiary volcanic flows, dikes, and sills throughout the Cretaceous and Paleogene sections.

Generalized isopach maps for the Upper EVCN constructed by M. Donaldson illustrates the filling of the basin through the Late Cretaceous and Paleogene. During the deposition of the L. Balmei and M. Diversus age strata, the basin was fairly restricted in nature, with the thickest section of sediment located in the northern portion of T14/P. By N. Asperus time, the sediment thicknesses are much more uniform, implying a more marine dominated environment.

Twenty-one wells have penetrated into the EVCN section, many of which had hydrocarbon shows. The shows in the wells have been dominantly gas, although some oil was seen in the Cormorant, Narimba, and Pipipa wells. All the shows come from the Upper EVCN section. The only well to discover significant hydrocarbon reserves is Yolla. Total reserves at Yolla have been calculated at 292 BCF with 282 BCF from the L. Balmei level and 10 BCF from the N. Asperus level. The Pelican-5 well in T/22P, encountered a significant gas-charged section, however, there was no suitable reservoir rock present due to very limited permeability ($k = 0.3$ millidarcies).

The present day maturation maps for the basin are a reasonable approximation of the kitchen during the Pliocene expulsion event, owing to the lack of recent tectonism. The strong terrigenous input combined with the bulk of the kitchen area lying within the gas window, as well as drilling results, suggest that there is little or no oil prospectivity in the basin.

A map of the fetch areas and migration pathways throughout the basin was constructed by analyzing the dip vectors taken from the time-structure map of the top of the basement. This method requires several assumptions: 1) structure is the primary control on the migration of the hydrocarbons through the basin, and 2) the structure in the basement adequately approximates the structure in the source interval. We feel that migration pathways map is a valid approximation of the migration history in the basin for the following reasons. The bulk of the basin deformation occurred during the Late Cretaceous and Paleogene. Therefore, the structure of the basement should roughly approximate that of the Early Cretaceous Otway Formation, which directly overlies the basement. Further, the present day structure is a valid approximation of the structure at the time of expulsion in the Pliocene, because there has been very little deformation in the Neogene.

The pink area outlined on the migration pathways map represents the generalized central kitchen area for the basin. In general, the wells which directly overlie the kitchen area or are on direct migration paths with large fetch areas had hydrocarbon shows. Wells which are far removed from the kitchen had no hydrocarbon shows (Dondu, Yurongi, Bass-2, and Koorkah). There are two notable exceptions to this trend, the Tarook and Bass-1 wells. The primary target of the Bass-1 well was what was thought to be an Oligocene carbonate buildup in the Torquay Group, but was actually a thick sequence of pyroclastic flows. There was no closure at the EVCM level at the drill location. The Tarook well was drilled off-closure in the EVCM and thus was not a valid structural test. Therefore, there is a strong correlation between hydrocarbon shows and distance from the kitchen. Long-distance and lateral migration are very inefficient in the Bass Basin, probably owing to the thin and discontinuous nature of permeable sands as well as the extensive volcanics throughout the EVCM.

In summary, there are three critical factors needed to make a valid hydrocarbon play in the Bass Basin: (1) the structural closure must have a rock volume greater than approximately 150,000 acre-ft, (2) the structure must vertically overlie the mature fetch area, because lateral migration is very inefficient, and (3) the structures must have formed in areas that were in a sand-prone, nearshore marine setting. The fluvial sands are sporadically distributed and relatively immature lithologically (Pelican analog). Without all three of these factors in place, the chances of a success are slim.

LEAD ANALYSIS

Although there are still many undrilled leads in the basin, they are all high risk/low potential in nature (100-300 BCF).

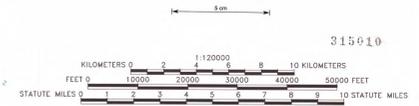
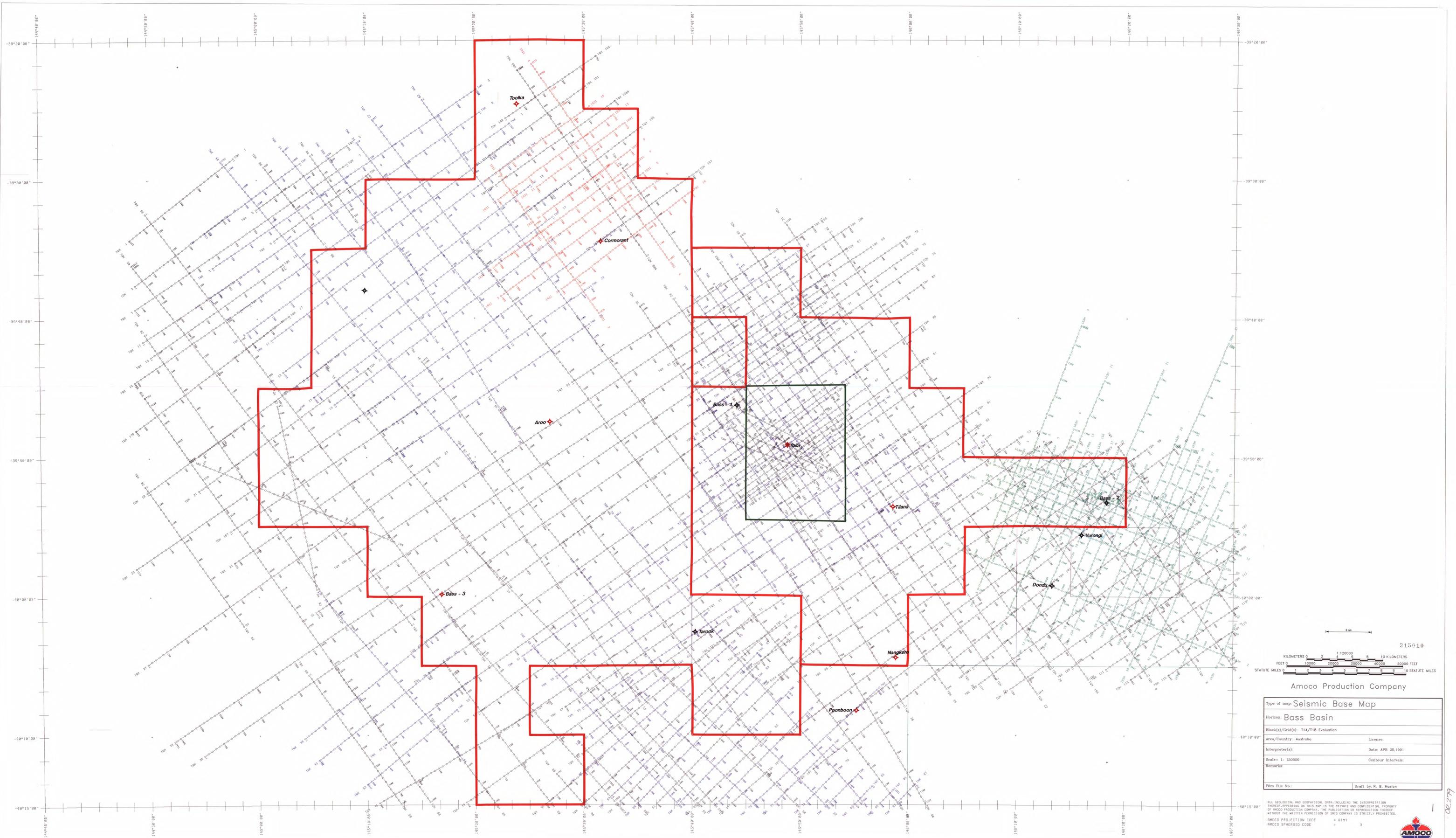
IBIS: The Ibis location is located one line north of the Bass-3 well, and is a basin margin fault play. The play concept at the Ibis location proposes to test closure "updip" from Bass-3 at the top of the EVCM level, as well as a stratigraphic pinchout play at the T. Longus level. On SAGASCO's time-structure map of the top of the EVCM, the Ibis location is 20 msec updip from Bass-3, which was dry. At this level, their play concept relies solely on the updip position of Ibis. On our interpretation of the Ibis-1 structure at the top of the EVCM, the Ibis location is, at best, 10 msec updip from the Bass-3 well, has only 10-15 msec of untested closure, and lies well off the crest of the structure. Even if the SAGASCO time-structure map is accepted, there are other serious problems associated with the play. Bass-3 has no pay zones, and any sands that may be present are likely to be of limited extent. Finally, it is not clear the the fault bounding the structure on the west is sealing. An Allen fault plane projection illustrates there is good communication across the fault at the top of the EVCM level.

The other play aspect of the Ibis location is the stratigraphic trap potential at the T. Longus level. This play is fraught with problems. First, the Ibis location is at best 3 msec updip from the Bass-3 location, and is not located at the apex of the feature. A fault separates the Ibis location from Bass-3 and is absolutely required to be sealing. However, this fault has only 3 msec of throw. The more significant fault to the east is required to be sealing in the south and permeable to the north. Structurally the play is tenuous at best.

FIRETAIL: The Firetail prospect was originally mapped by Shell in 1990. Shell's primary target was a faulted four-way closure in the Lower EVCM along the western basin margin. Shell did not pursue this play after acquiring a detailed 2-D seismic grid designed to define it. The largest closure is at the top of the Lower EVCM level, however, there is also closure at the top of the EVCM. The top of the EVCM is SAGASCO's primary target. Although the structure is valid, there are several reasons to reject this play: 1) The fetch area for the structure is extremely limited and requires long-distance migration (see Enclosure 9). 2) The Yurongi and Dondu wells, which lie in the migration path between the kitchen area and the Firetail structure, are dry holes. Further, both of these wells tested valid structures. 3) The proposed drilling location is only 20-25 msec updip for the Bass-2 well which was a dry hole. 4) Although there is a high quality 5 foot sand present at the top of the EVCM in Bass-2, the rock volume of reservoir quality material beneath the structure is insufficient for an economically significant accumulation.

CORMORANT AREA: Shell acquired 200 km of seismic in the Cormorant area of licence T18/P in 1990, but failed to find the area prospective and relinquished their interest. The joint venture parties were granted a one year extension of the drilling commitment in order to study the area. The main structure of interest is the sister feature west of the Cormorant structure. The Cormorant well had numerous gas shows throughout the Upper EVCM, however, the reservoir sands were very thin marine sands. There are several major problems with the Cormorant Sister structure play: (1) the crest of the structure is down-dip from the Cormorant structure and (2) there is no reason to believe that the sand thickness is significantly better several kilometers to the east of the Cormorant well. A

recoverable reserve level of 25 MMBO suggested by joint venture parties is clearly inadequate to support a multiplatform development scenario required to produce multiple, shallow thin sand units with very low IPs.



Amoco Production Company

| | |
|-------------------------------------|------------------------|
| Type of map: Seismic Base Map | |
| Horizon: Bass Basin | |
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| Area/Country: Australia | License: |
| Interpreter(s): | Date: APR 05, 1991 |
| Scale: 1:100000 | Contour Interval: |
| Remarks: | |
| Film File No.: | Draft by: R. B. Hasler |

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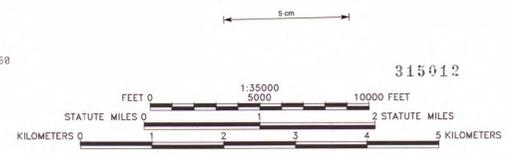
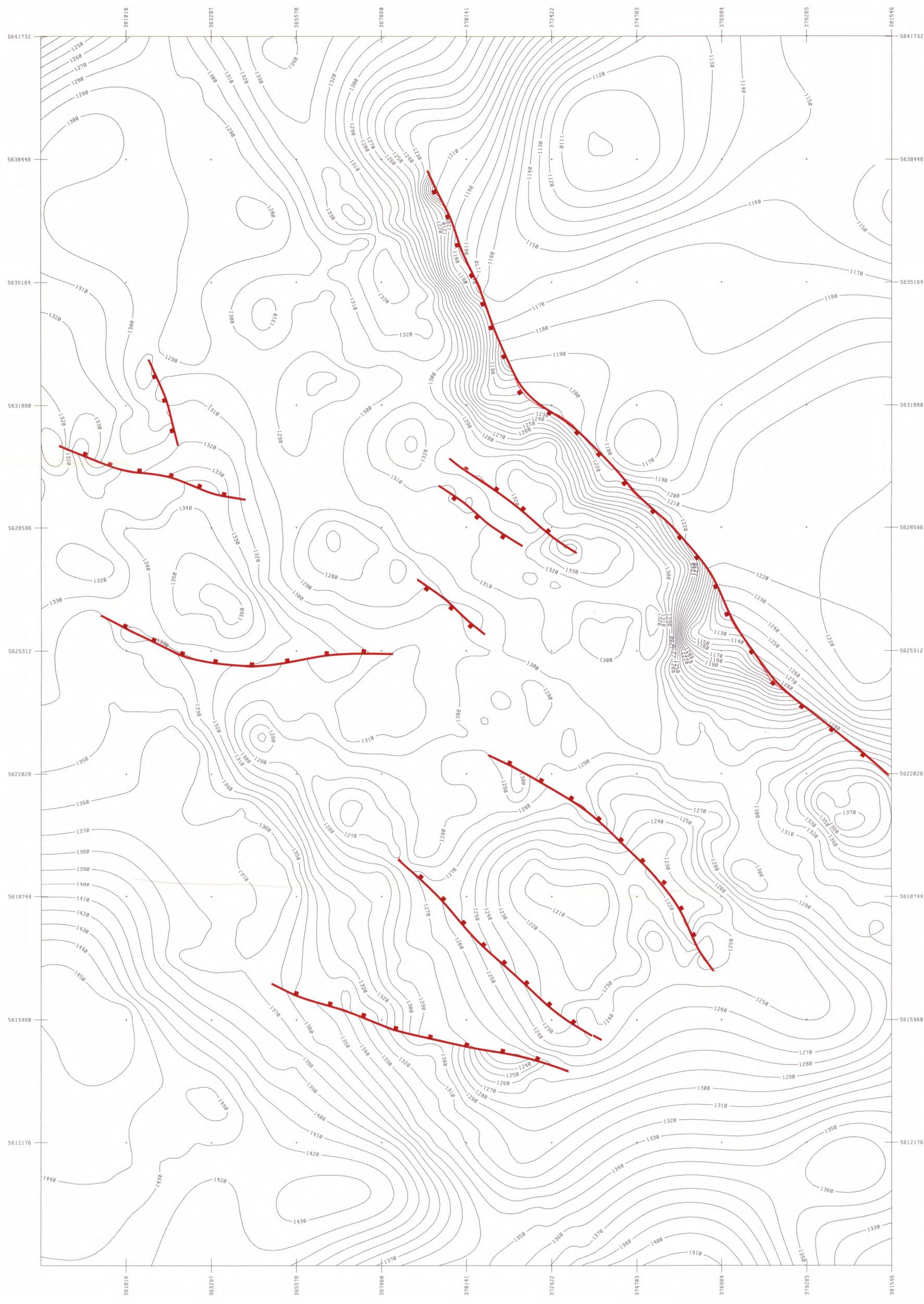


02-277

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315912

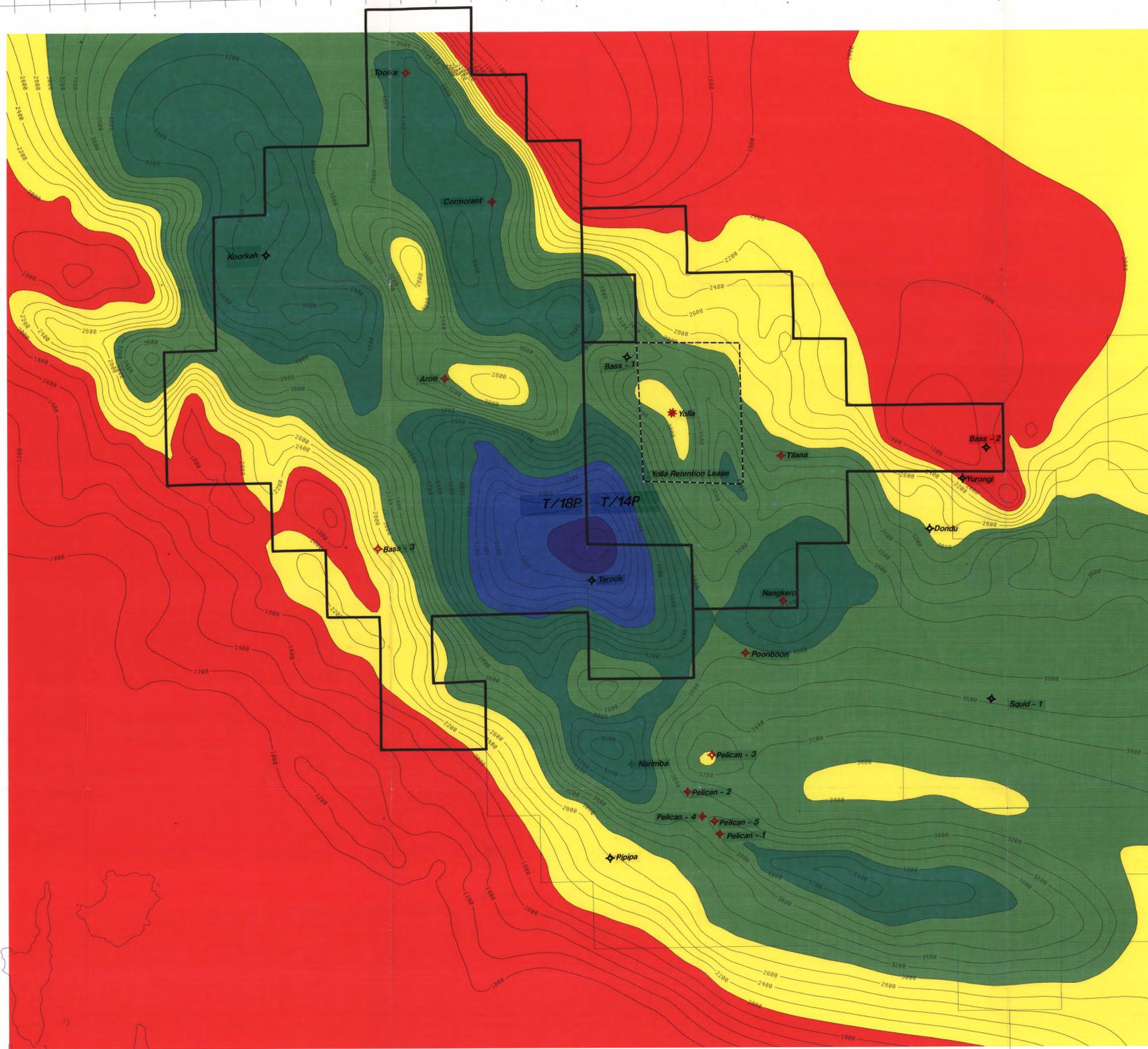
Amoco Production Company

| | |
|-------------------------------------|----------------------------|
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| Interpreter(s): Roger B. Haston | Date: JUN 10, 1991 |
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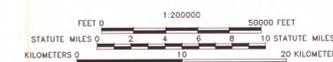
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- Dry Hole
- Gas Shows
- Oil Shows
- Economic Gas Reserves

5 km

315013



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| | |
|------------------------------|----------------------------|
| Type of map: Time-Structure | |
| Horizon: Basement | |
| Block(s)/Grid(s): Bass Basin | |
| Area/Country: Australia | License: |
| Interpreter(s): R. B. Hoston | Date: MAY 20, 1991 |
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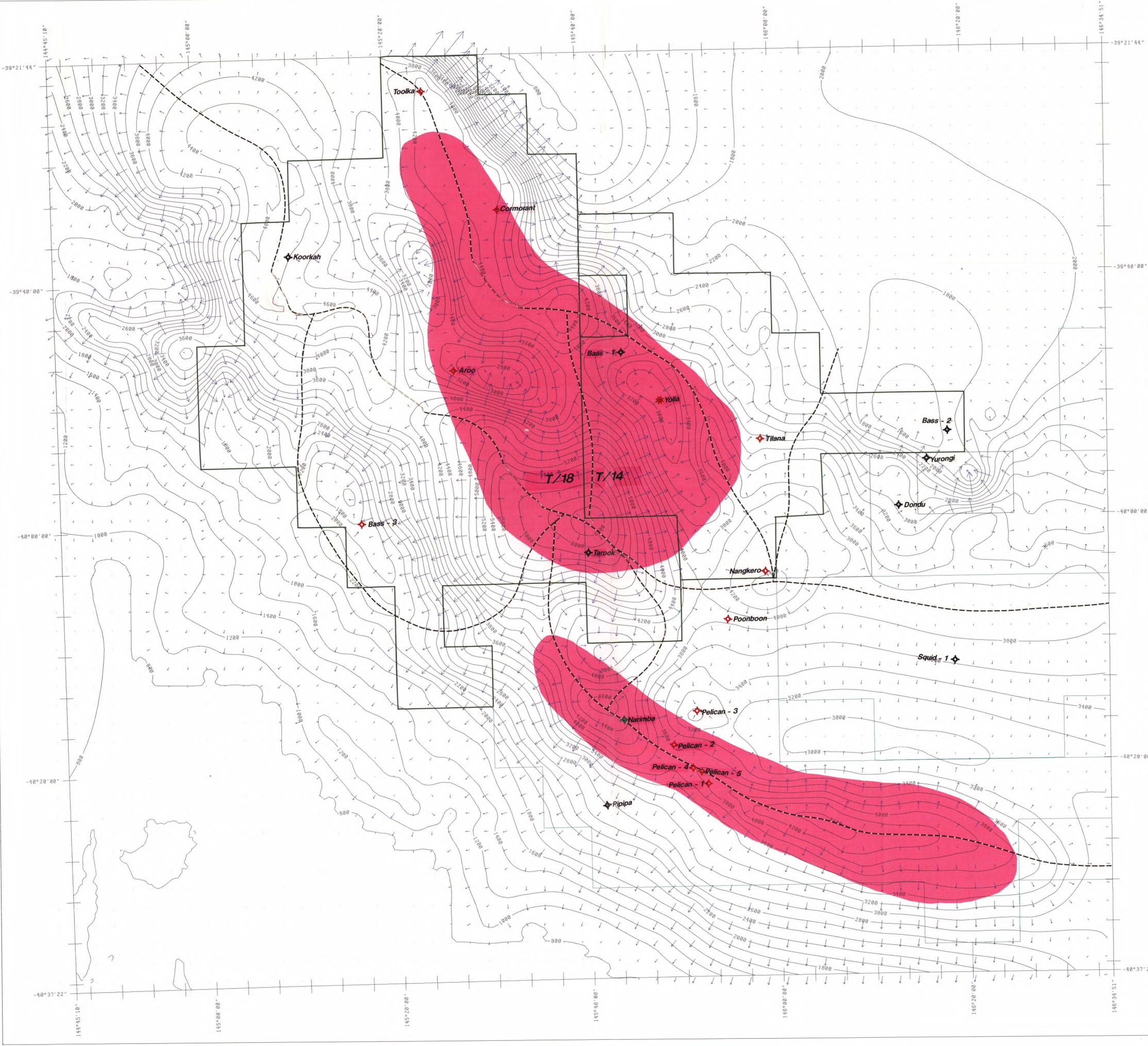


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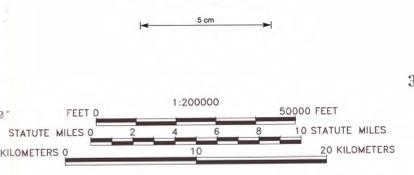
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| | |
|--|------------------------------|
| | Migration Divide |
| | Dry Hole |
| | Oil Shows |
| | Gas Shows |
| | Economic Gas Reserves |



315014

Amoco Production Company

| | |
|---------------------------------|-----------------------------|
| Type of map: Migration Pathways | |
| Horizon: Basement | |
| Block(s)/Grid(s): Bass Basin | |
| Area/Country: Australia | License: |
| Interpreter(s): Roger B. Haston | Date: MAY 30, 1991 |
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| Remarks: | |
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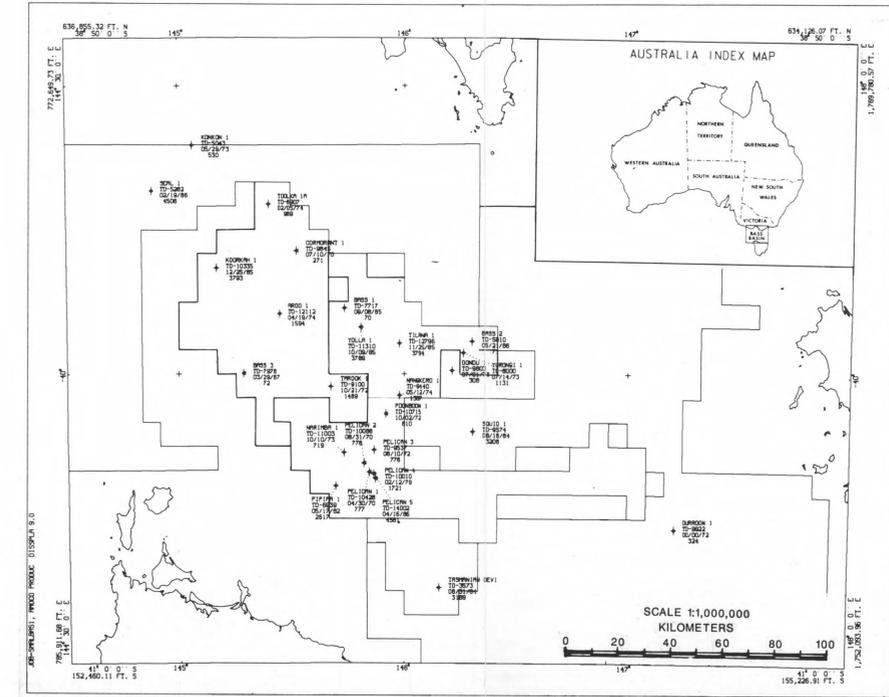
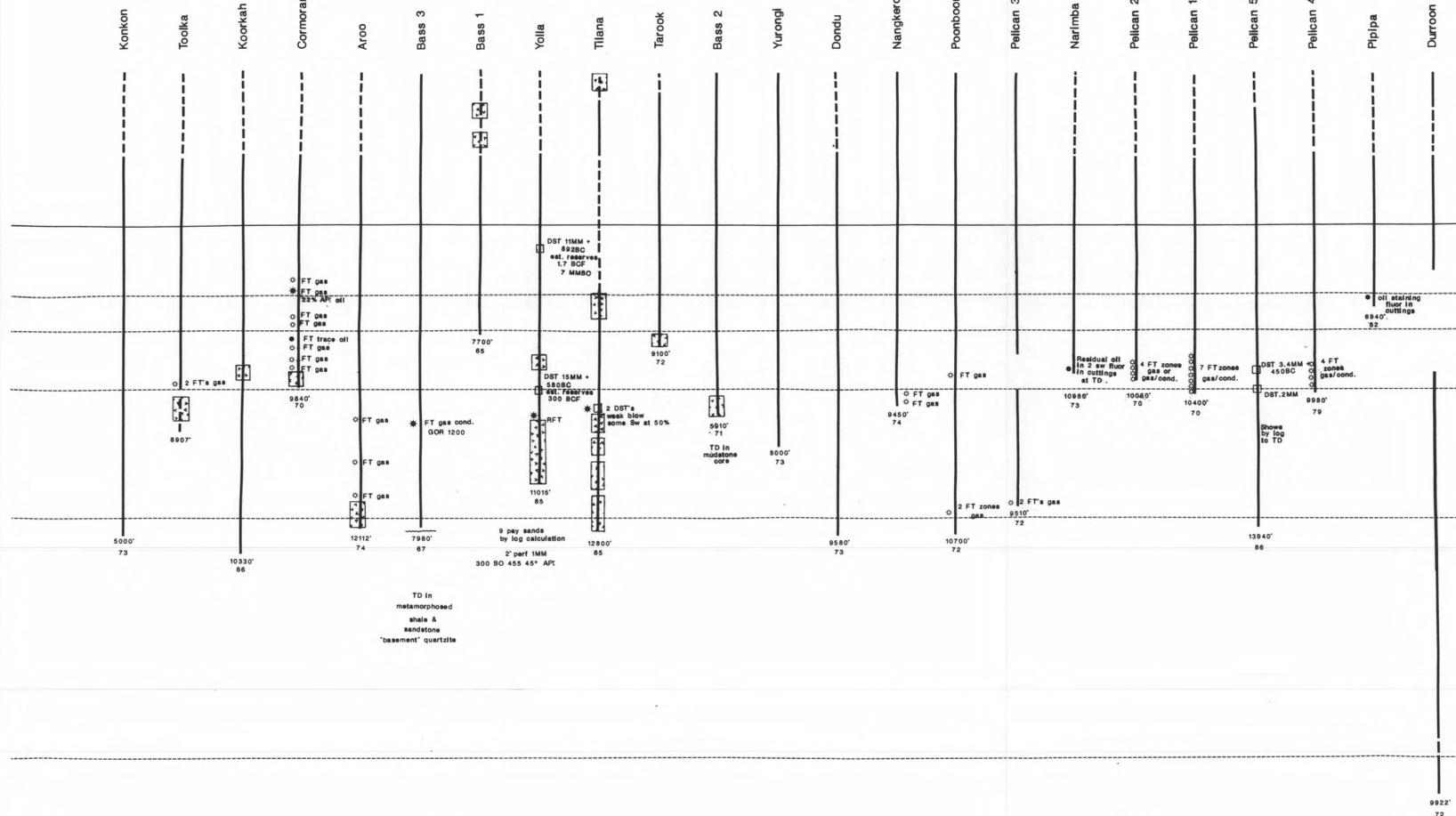
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0279

| AGE M.Y. | EPOCH | SPORE POLLEN ASSEMBLAGE ZONES | BASS BASIN STRATIGRAPHY |
|----------|------------------|-------------------------------|----------------------------|
| 24 | OLIGOCENE | | TOROUAY GROUP |
| 25 | | | |
| 30 | | | |
| 35 | EOCENE | UPPER N. ASPERUS | DEMON'S BLUFF |
| 37.5 | | MIDDLE N. ASPERUS | |
| 40 | | LOWER N. ASPERUS | |
| 45 | | P. ASPEROPOLUS | EASTERN VIEW COAL MEASURES |
| 50 | | UPPER M. DIVERSUS | |
| 54 | | MIDDLE M. DIVERSUS | |
| 55 | PALEOCENE | LOWER M. DIVERSUS | EASTERN VIEW COAL MEASURES |
| 60 | | UPPER L. BALMEI | |
| 65 | LATE CRETACEOUS | LOWER L. BALMEI | OTWAY |
| 70 | | T. LONGUS | |
| 75 | EARLY CRETACEOUS | T. LILLIEI | OTWAY |
| 80 | | N. SENECTUS | |
| 85 | | T. PACHYXINUS | |
| 90 | EARLY CRETACEOUS | C. TRIPLEX | OTWAY |
| 95 | | A. DISTOCARINATUS | |
| 100 | | P. PANNOSUS | |
| 105 | | C. PARADOXUS | |
| 110 | | C. STRIATUS | |
| 115 | | C. HUCHESI | |

VOLCANICS INTERMITTENTLY PRESENT THROUGHOUT OLI-GOCENE THROUGH EARLY CRT.



oil in FT
gas in FT
volcanics
color - age at TD
Amoco wells



315015

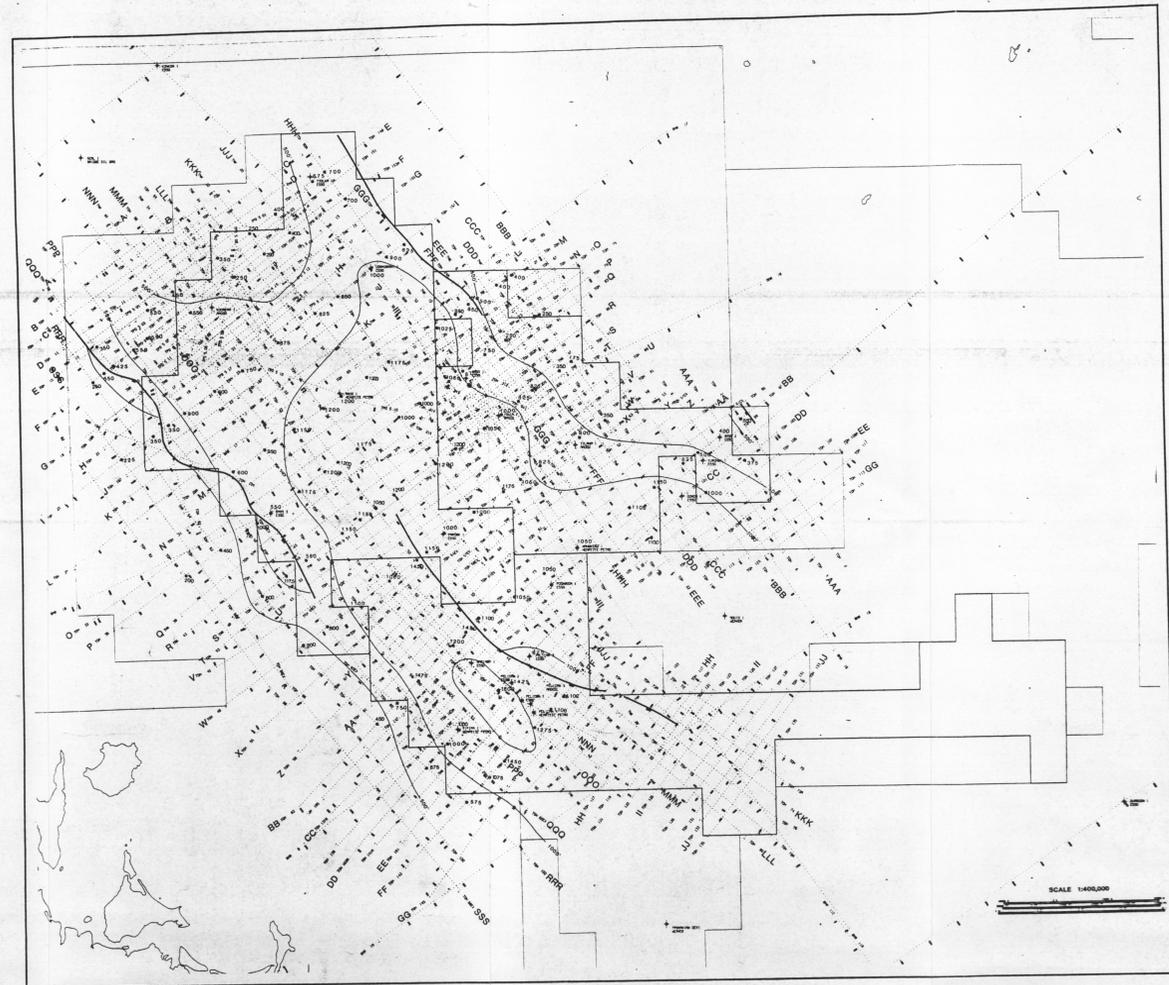
Amoco Australia Petroleum Company

BASS BASIN

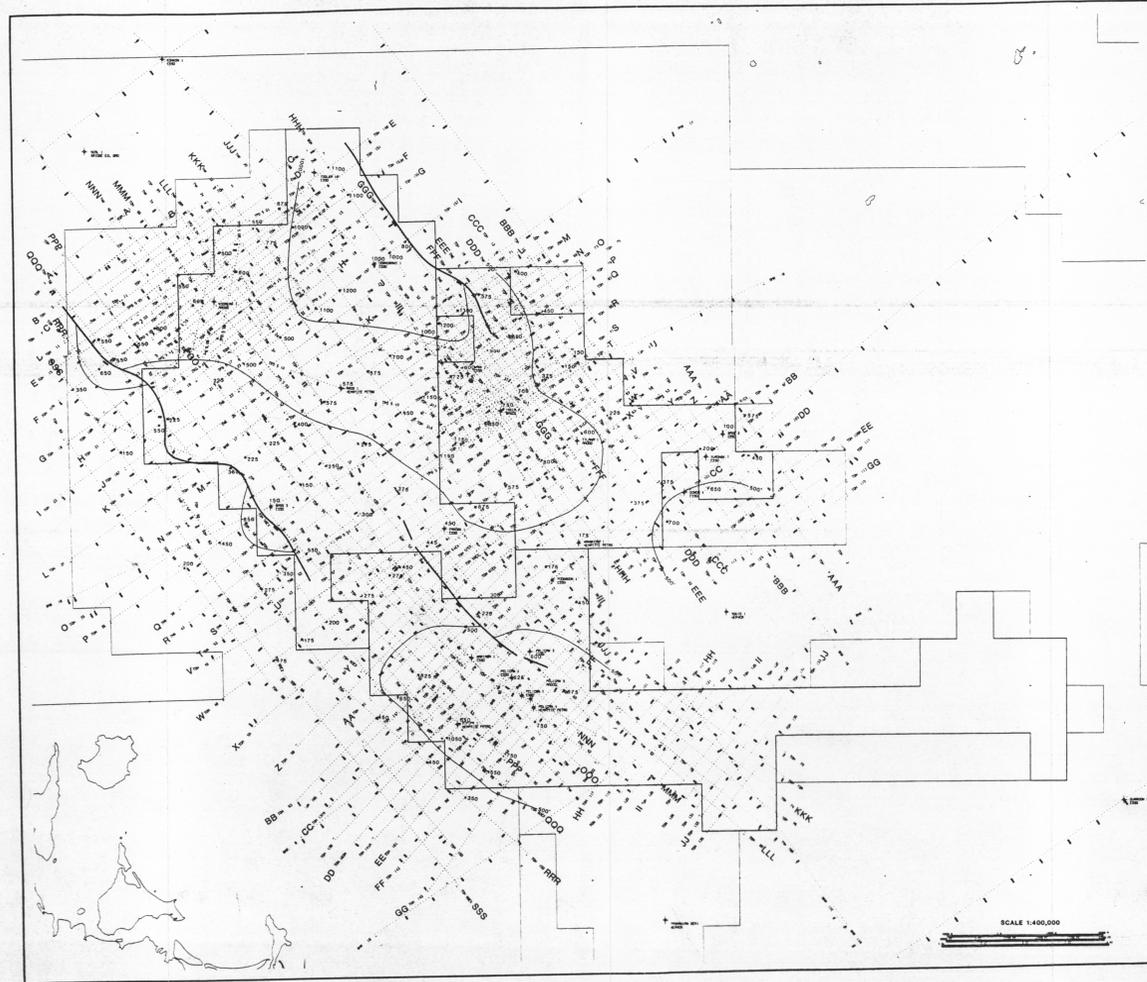
PENETRATED STRATIGRAPHY
SCHEMATIC WITH
HYDROCARBON OCCURRENCES

| | |
|------------------------------|---------------------|
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| Report No. R-87-051 | Contour Interval: |
| Enclosure No. 6 | Remarks: |

CR-279



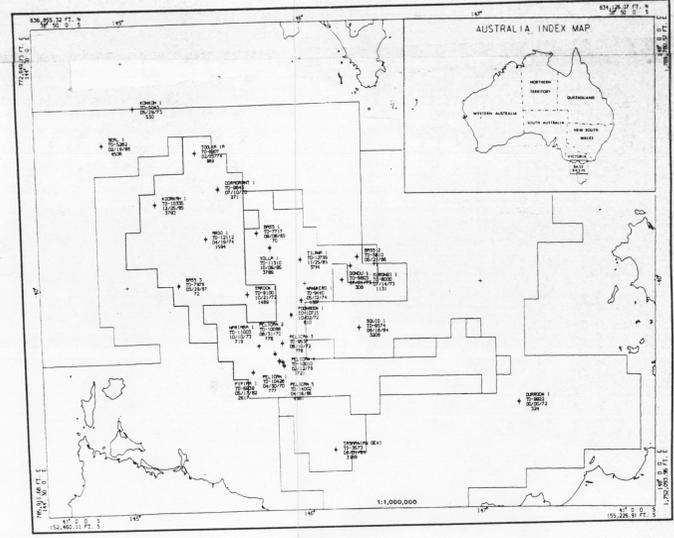
LOWER MIDDLE N. ASPERUS AND LOWER N. ASPERUS

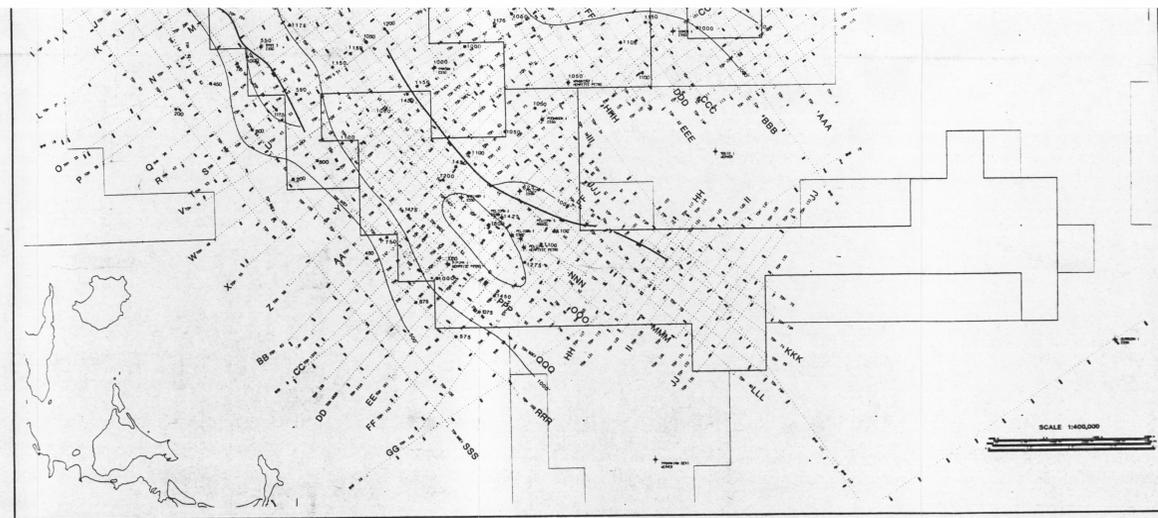


P. ASPEROPOLUS

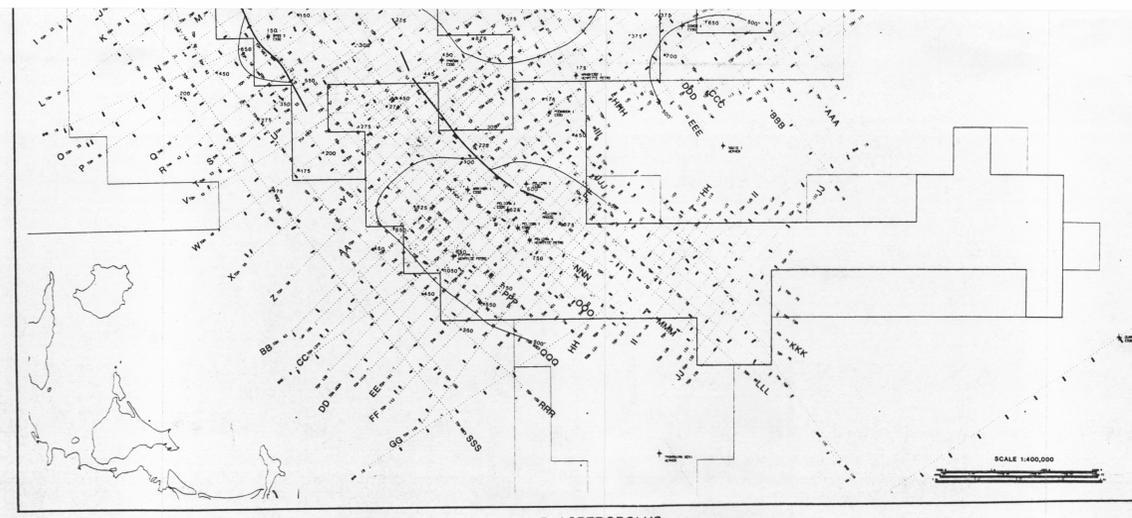


| AGE (MY) | EPOCH | SPORE POLLEN ASSEMBLAGE ZONES | BASS BASIN STRATIGRAPHY | COMBINATION |
|----------|------------------|-------------------------------|----------------------------|-------------|
| 35-40 | OLIGOCENE | | TORQUAY GROUP | |
| 35 | | UPPER N. ASPERUS | | |
| 35 | | MIDDLE N. ASPERUS | DEMON'S BLUFF | |
| 35 | | LOWER N. ASPERUS | | |
| 35 | | P. ASPEROPOLUS | | |
| 35 | | UPPER M. DIVERSUS | | |
| 35 | | MIDDLE M. DIVERSUS | | |
| 35 | | LOWER M. DIVERSUS | | |
| 35 | | UPPER L. BALVEI | | |
| 35 | PALEOCENE | | EASTERN VIEW COAL MEASURES | |
| 35 | | LOWER L. BALVEI | | |
| 35 | | T. LONGUS | | |
| 35 | | T. LULLIE | | |
| 35 | LATE | N. SENECTUS | | |
| 35 | | T. PACHYXENUS | | |
| 35 | CRETACEOUS | C. TRIPLEX | | |
| 35 | | A. DISTOCARPATUS | | |
| 35 | | C. PARADISIUS | | |
| 35 | | C. STRIATUS | | |
| 35 | EARLY CRETACEOUS | F. ASYMMETRICUS | OTWAY | |

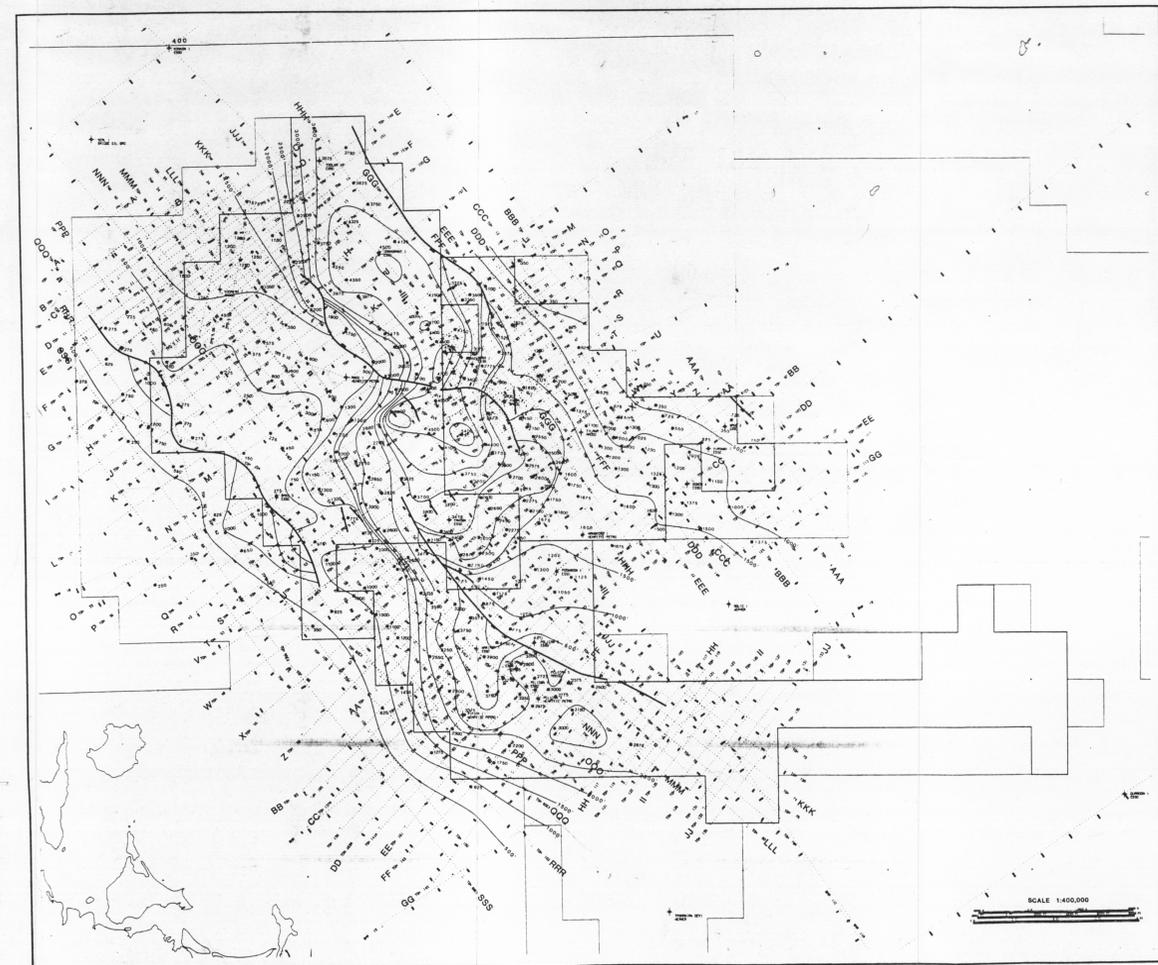




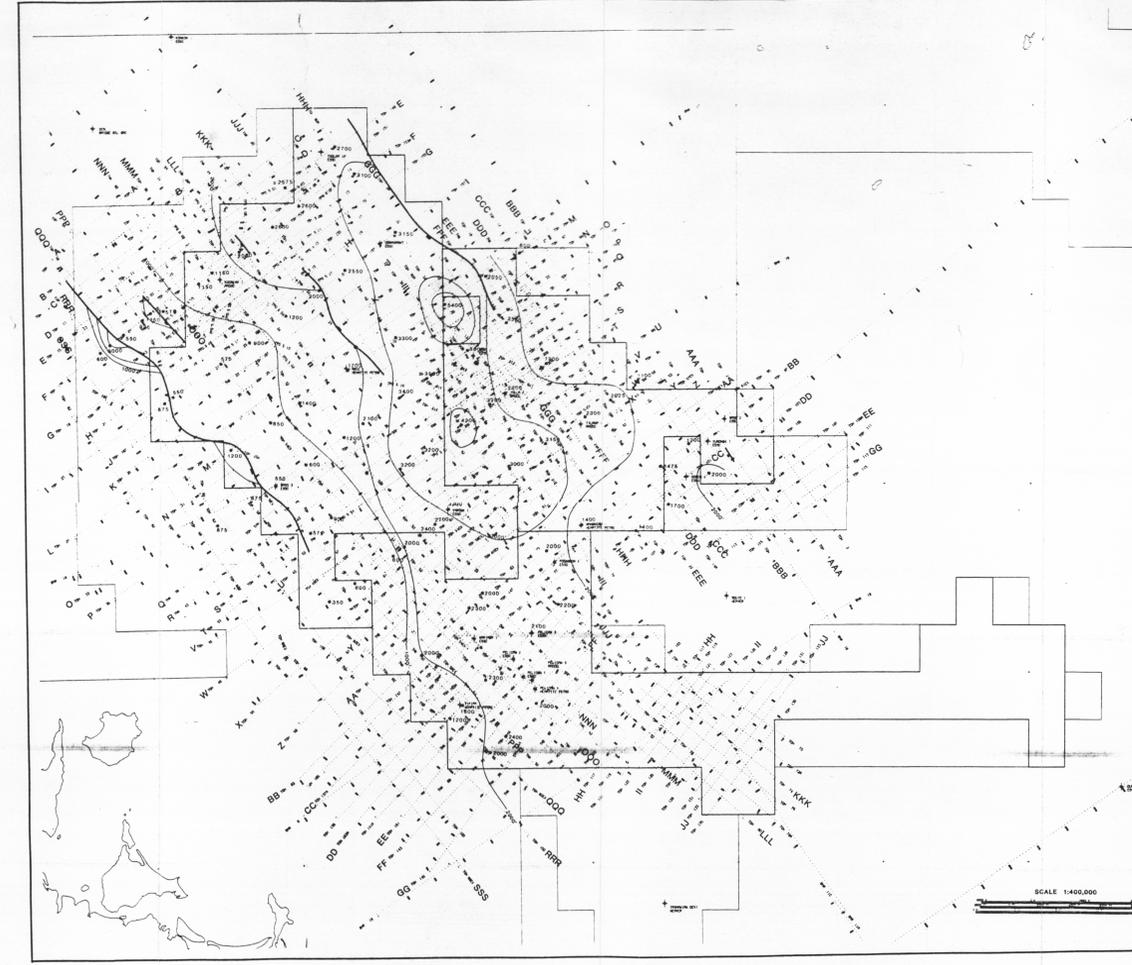
LOWER MIDDLE N. ASPERUS AND
LOWER N. ASPERUS



P. ASPEROPOLUS

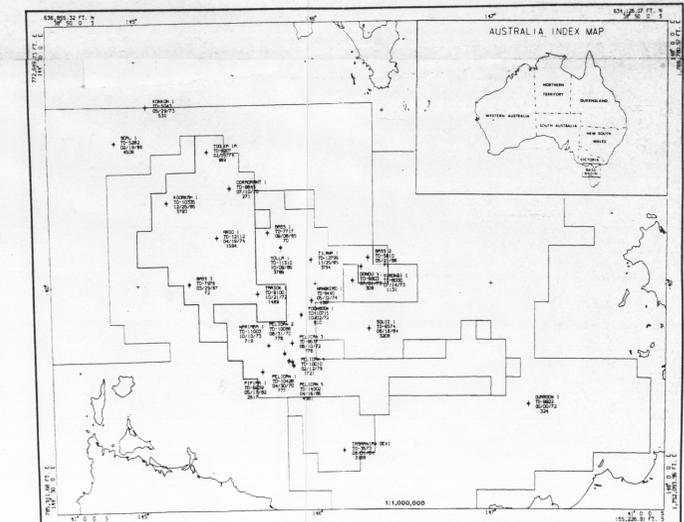


M. DIVERSUS



L. BALMEI

| | | | |
|----|--------------------|-------------------------------|------------------------|
| 14 | MIDDLE N. DIVERSUS | EASTERN VIEW COAL MEASURES | CORRELATION THROUGHOUT |
| 13 | LOWER N. DIVERSUS | | |
| 12 | UPPER L. BALMEI | | |
| 11 | PALEOCENE | | |
| 10 | LOWER L. BALMEI | | |
| 9 | T. LONGUS | | |
| 8 | T. LILLE | | |
| 7 | LATE | | |
| 6 | N. SENECAUS | | |
| 5 | T. PACHYKNAUS | | |
| 4 | CRETACEOUS | | |
| 3 | C. TAPLEY | | |
| 2 | A. DISTOCARNATUS | | |
| 1 | C. PARADONIS | | |
| 0 | EARLY CRETACEOUS | C. STRIATUS | OTWAY |
| | | F. ASYMMETRICAL | |



315916

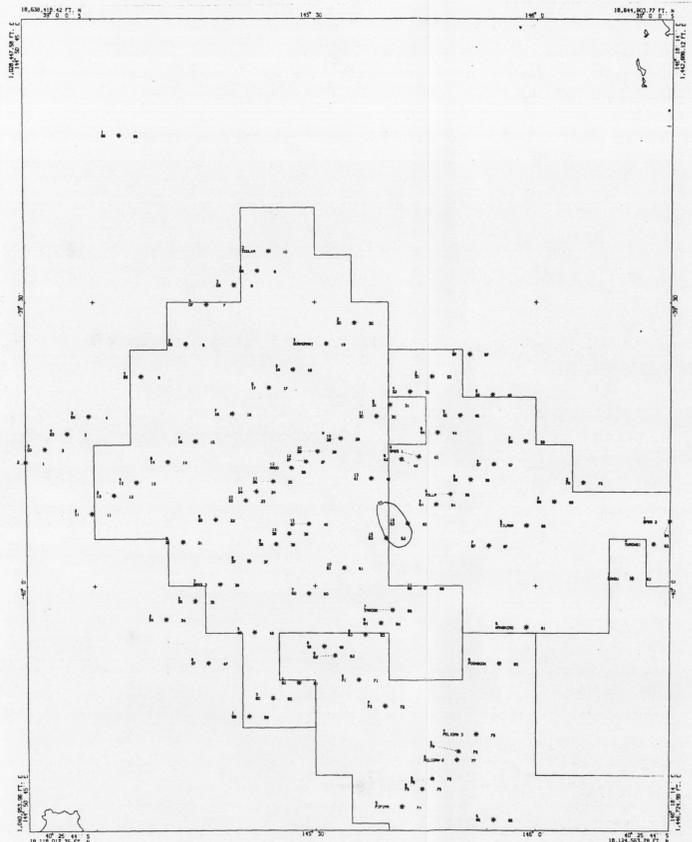

 Amoco Australia Petroleum Company

BASS BASIN
GENERALIZED
ISOPACH MAPS PANEL

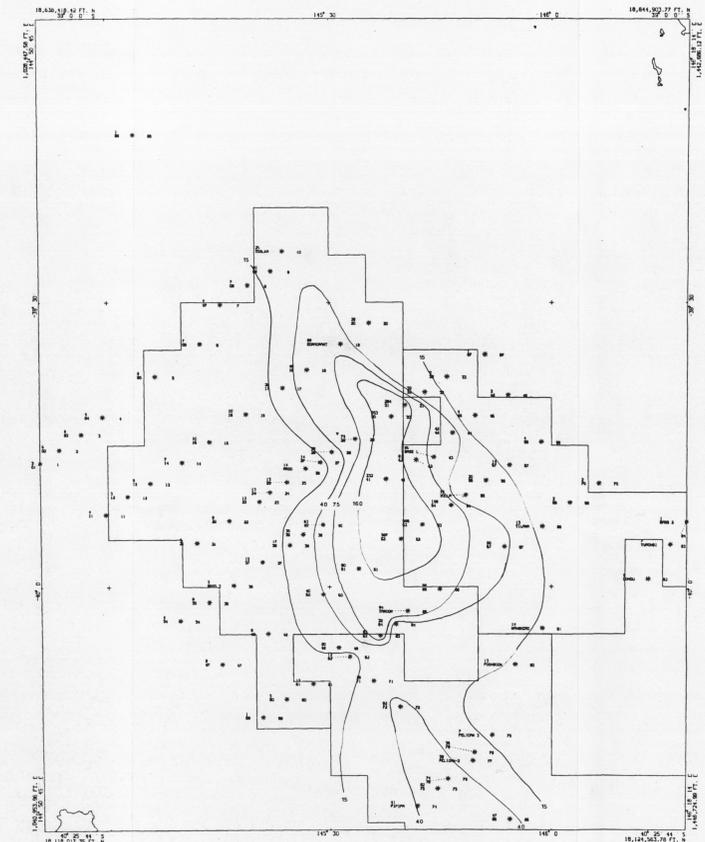
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| Interpreter(s): M. DONALDSON | Date: JAN., 1987 |
| Scale: 1:400,000 | Contour Interval: VARIABLE |
| Report No. | Enclosure No. |
| Film File No: FA-1556 | Remarks: |

HBL832 Enclosure 7

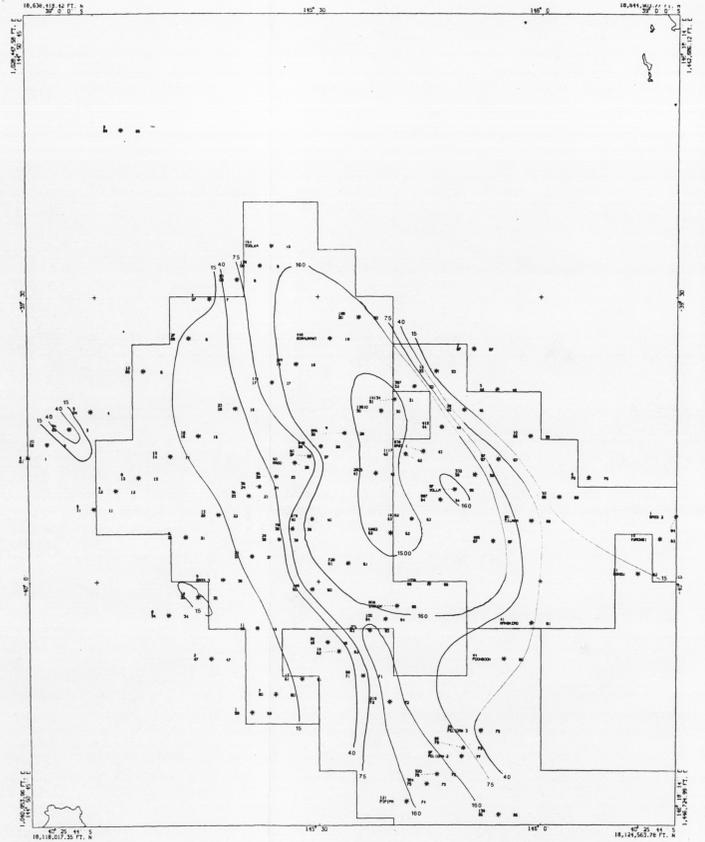
02219



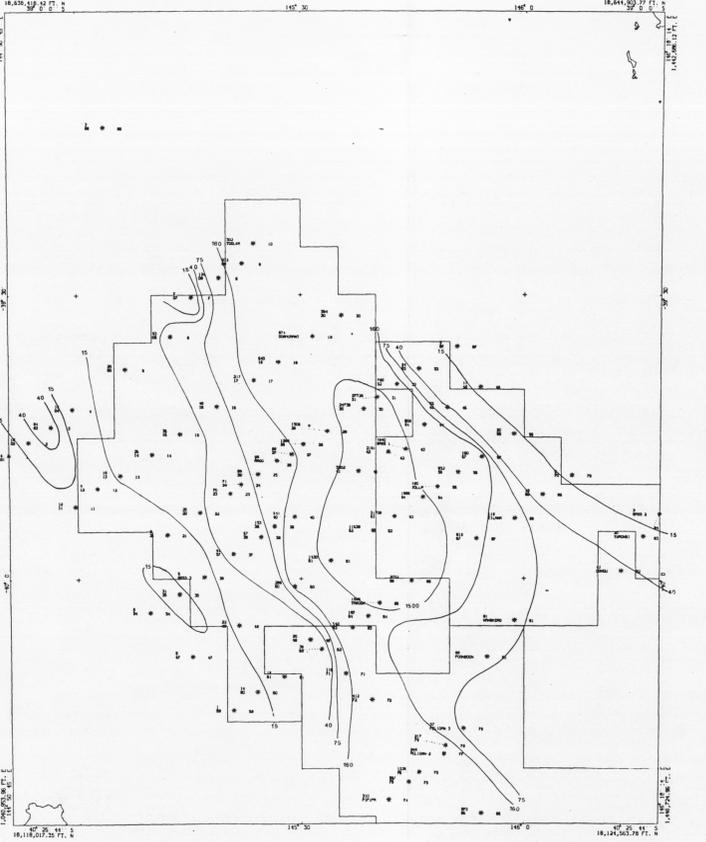
AMOCO PRODUCTION COMPANY
M. DIVERSUS
TTI VALUES
PRESENT DRY
STRATPARM - 0600000 - TTI
CONTOUR METHOD - AMOCO1
SCALE 1 TO 400,000 MAY 5, 1987



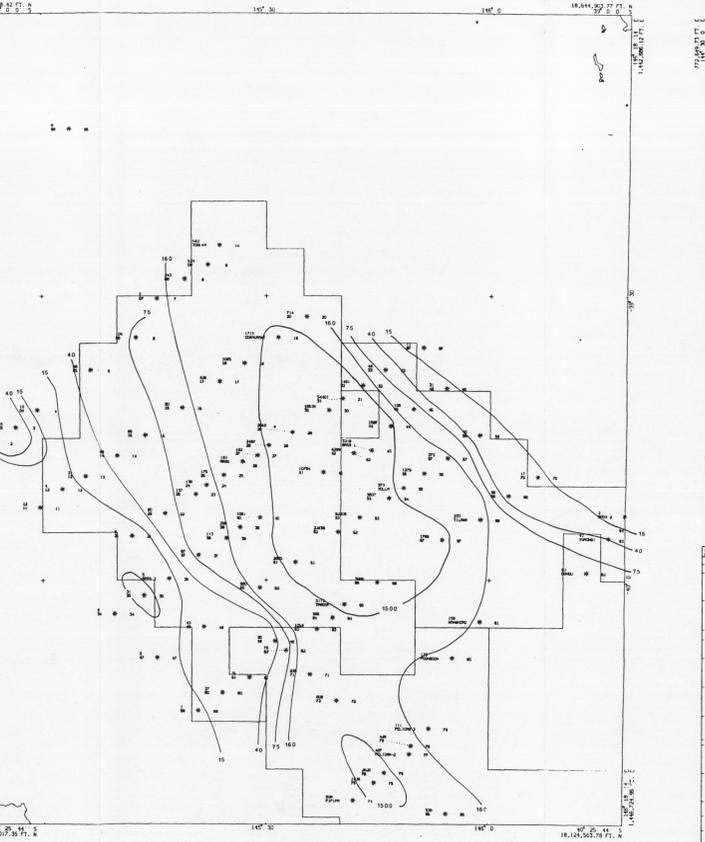
AMOCO PRODUCTION COMPANY
TOP OF L. BALMEI
PRESENT DRY
TTI VALUES
STRATPARM - 0800000 - TTI
CONTOUR METHOD - AMOCO1
SCALE 1 TO 400,000 MAY 5, 1987



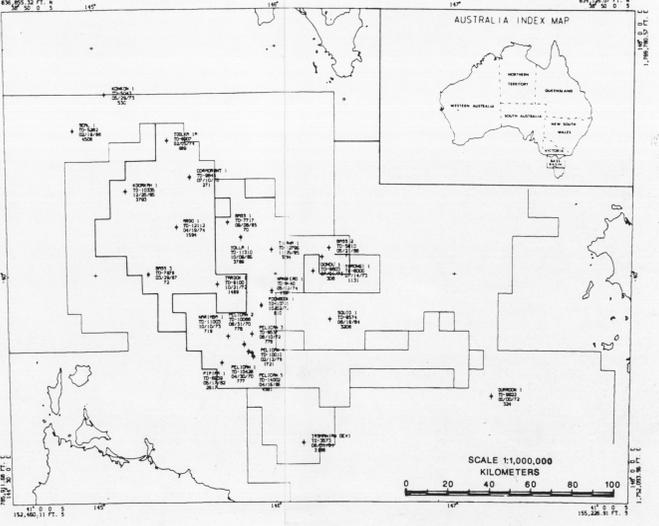
AMOCO PRODUCTION COMPANY
TOP OF T. LONGUS
PRESENT DRY
TTI VALUES
STRATPARM - 0900000 - TTI
CONTOUR METHOD - AMOCO1
SCALE 1 TO 400,000 MAY 5, 1987



AMOCO PRODUCTION COMPANY
TOP OF T. LILLIE1
PRESENT DRY
TTI VALUES
STRATPARM - 1000000 - TTI
CONTOUR METHOD - AMOCO1
SCALE 1 TO 400,000 MAY 5, 1987



AMOCO PRODUCTION COMPANY
BASE OF T. LILLIE1
PRESENT DRY
TTI VALUES
STRATPARM - 1100000 - TTI
CONTOUR METHOD - AMOCO1
SCALE 1 TO 400,000 MAY 6, 1987



| | | |
|---------------|-------------------|--------------|
| SPRUE | UPPER PERMIAN | BASE PERMIAN |
| KLAROCK | DEKANS BLUFF | |
| | UPPER N. ASPENIC | |
| EXXIDE | MIDDLE N. ASPENIC | |
| | LOWER N. ASPENIC | |
| | F. ASPENICOLIC | |
| | UPPER N. LONGUS | |
| | MIDDLE N. LONGUS | |
| | LOWER N. LONGUS | |
| | UPPER L. BALMEI | |
| PALEODE | LOWER L. BALMEI | |
| | L. LONGUS | |
| | T. LILLIE | |
| LATE | N. PACIFICUS | |
| | T. PACIFICUS | |
| ORFEDOS | C. TRILLI | |
| | A. DICTYONALIC | |
| | P. PAROSUS | |
| | C. PAROSUS | |
| EARLY ORFEDOS | C. TRILLI | |
| | C. PAROSUS | |
| | L. LONGUS | |
| | P. PAROSUS | |

TTI VALUES:
 [Symbol] 15-40, B. OIL
 [Symbol] 40-75, E. P. OIL
 [Symbol] 75-160, P. OIL
 [Symbol] 160-1500, E. OIL



Amoco Australia Petroleum Company

BASS BASIN
MATURATION MAPS
PRESENT DRY

Top of M. Diversus
Top of L. Balmei
Top of T. Longus
Top of T. Lillie1
Base of T. Lillie1

Interpreter(s) M. Donahon Date May 1987
 Scale: 1:400,000 Contour Values: 15, 40, 75, 160, 1500
 Report No. W-07-051 Enclosure Enclosure 8

SW

PELICAN - 3

1972
TD 9837'
KB 32' WD 263'

POONBOON - 1

1972
TD 10715'
KB 32' WD 259'

NANGKERO - 1

1974
TD 9440'
KB 32' WD 261'

DONDU - 1

1973
TD 9603'
KB 32' WD 269'

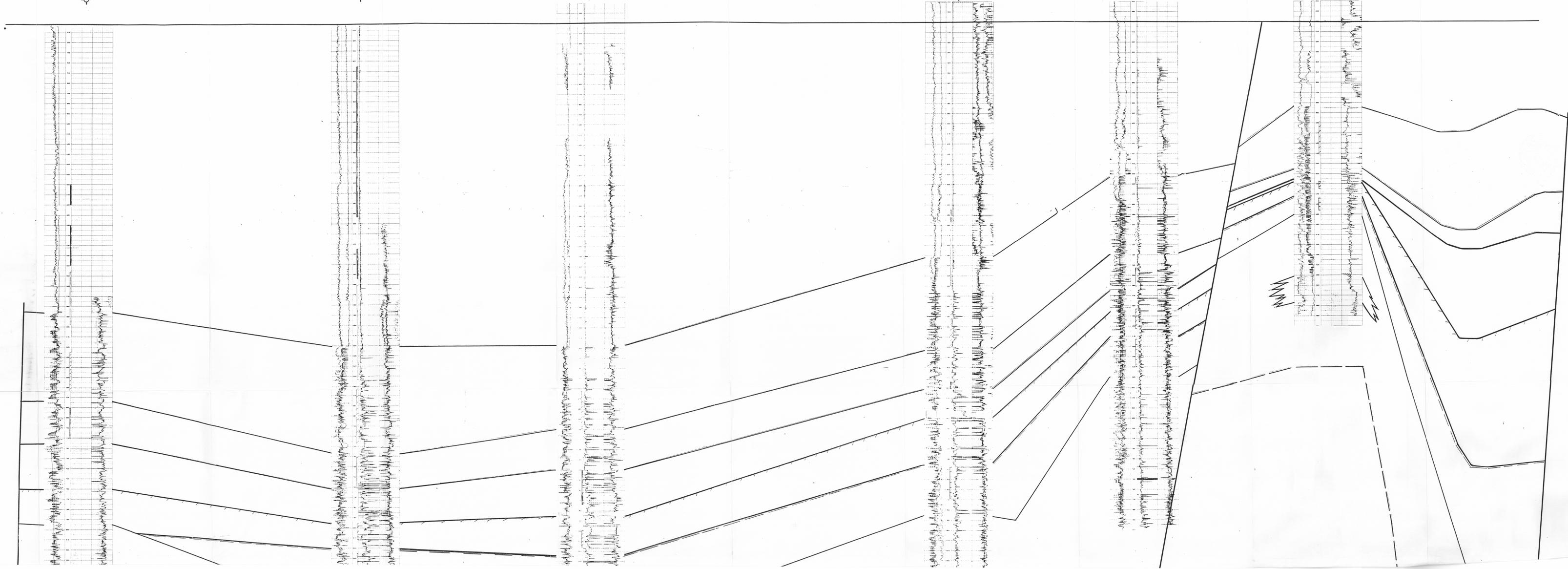
YURONGI - 1

1973
TD 8000'
KB 31' WD 272'

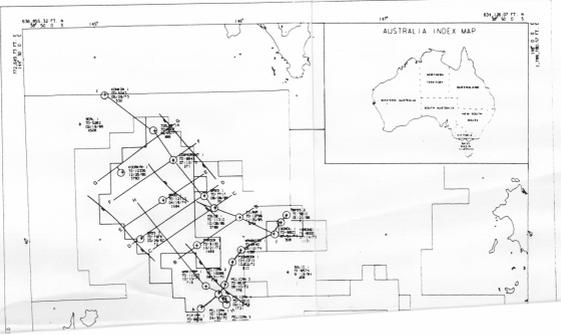
BASS - 2

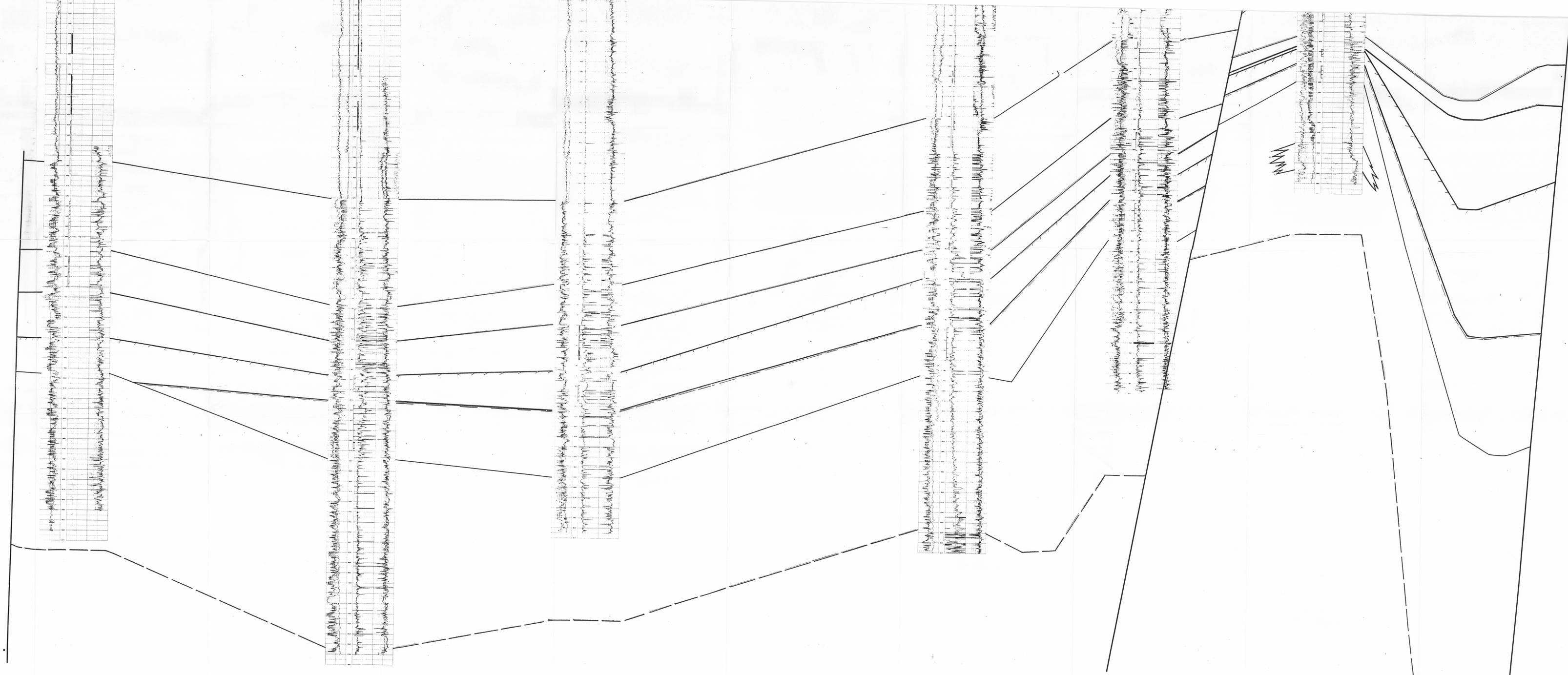
1966
TD 5910'
KB 31' WD 266'

NE

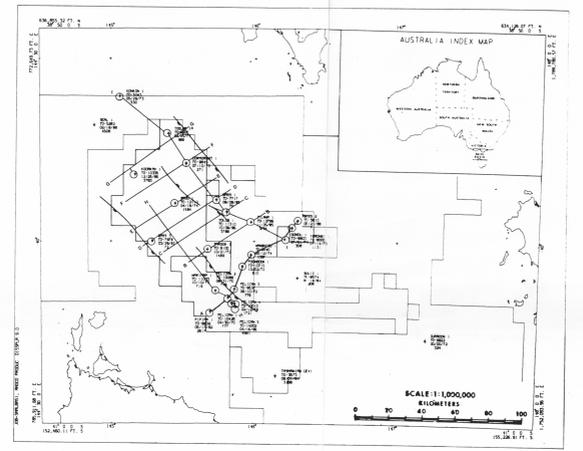


| AGE M.Y. | EPOCH | SPORE POLLEN ASSEMBLAGE ZONES | BASS BASIN STRATIGRAPHY |
|-------------|---------------------|----------------------------------|-------------------------------|
| 24 | OLIGOCENE | | TOROLAY GROUP |
| 25 | | | |
| 30 | EOCENE | UPPER N. ASPERUS | DEMONS BLUFF |
| 35 | | MIDDLE N. ASPERUS | |
| 40 | | LOWER N. ASPERUS | |
| 45 | | P. ASPEROPOLUS | |
| 50 | | UPPER M. DIVERSUS | |
| 55 | | MIDDLE M. DIVERSUS | |
| 60 | PALEOCENE | LOWER L. BALWEI | EASTERN VIEW COAL MEASURES |
| 65 | | | |
| 70 | LATE CRETACEOUS | T. LONGEI | |
| 75 | | T. LILLIEI | |
| 80 | | N. SENECTUS | |
| 85 | EARLY CRETACEOUS | T. PACHYXNAUS | OTWAY |
| 90 | | C. TRIFLEX | |
| 95 | | A. DISTOCARNATUS | |
| 100 | | P. PANNOBUS | |
| 105 | | C. PARADOXUS | |
| 110 | | C. STRIATUS | |
| 115 | | C. HUGHESI | |





| | | |
|------------------|--------------------|----------------------------|
| PALEOCENE | LOWER N. ASPERUS | EASTERN VIEW COAL MEASURES |
| | P. ASPEROPOLUS | |
| | UPPER M. DIVERSUS | |
| | MIDDLE M. DIVERSUS | |
| | LOWER M. DIVERSUS | |
| UPPER L. BALMEI | | |
| LOWER L. BALMEI | | |
| LATE CRETACEOUS | T. LONGES | |
| | T. LILIKI | |
| | N. SENECTUS | |
| | T. PACHYKINUS | |
| EARLY CRETACEOUS | C. TRIPLEX | OTWAY |
| | A. DISTOCARNATUS | |
| | P. PANNOSUS | |
| | C. PARADOXUS | |
| | C. STRIATUS | |
| | C. MICHESI | |



CLASS II
CONFIDENTIAL

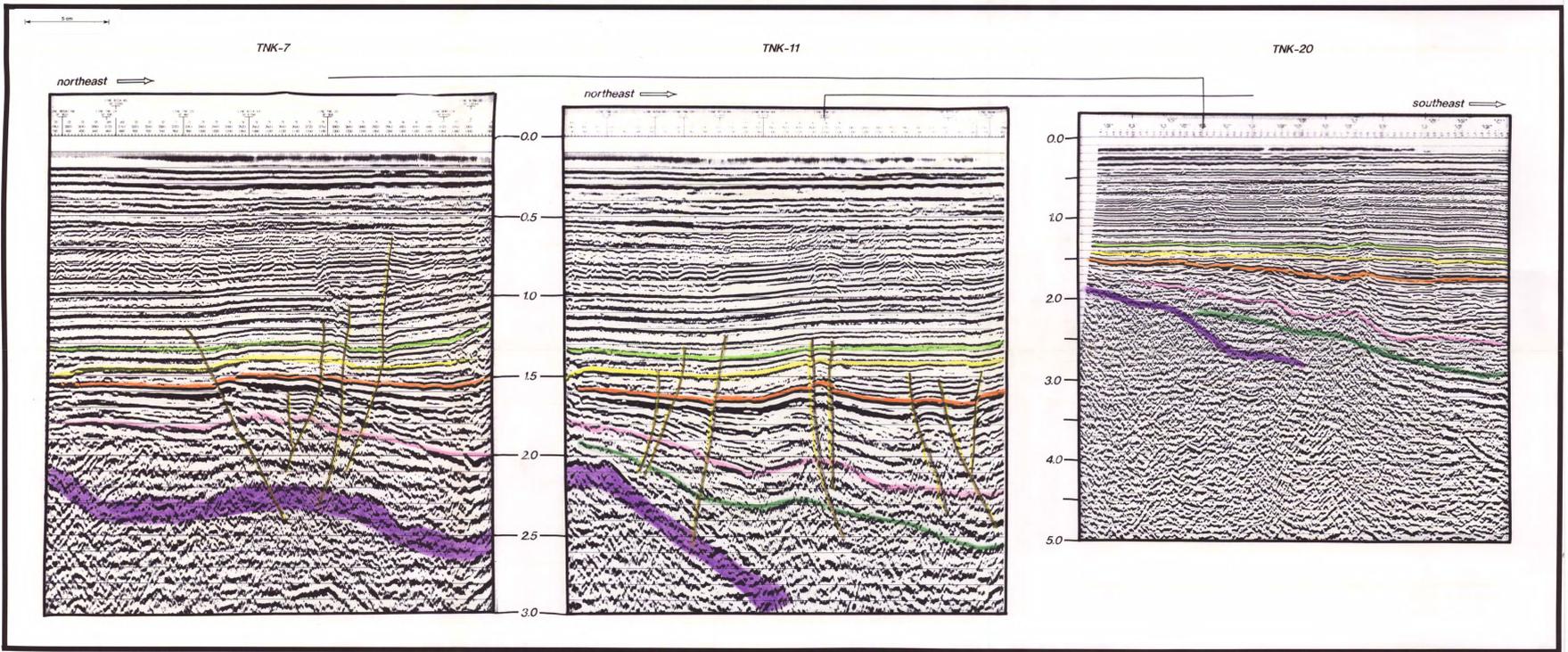
Amoco Australia Petroleum Company
BASS BASIN

CROSS SECTION A-A'
NORTH PORTION

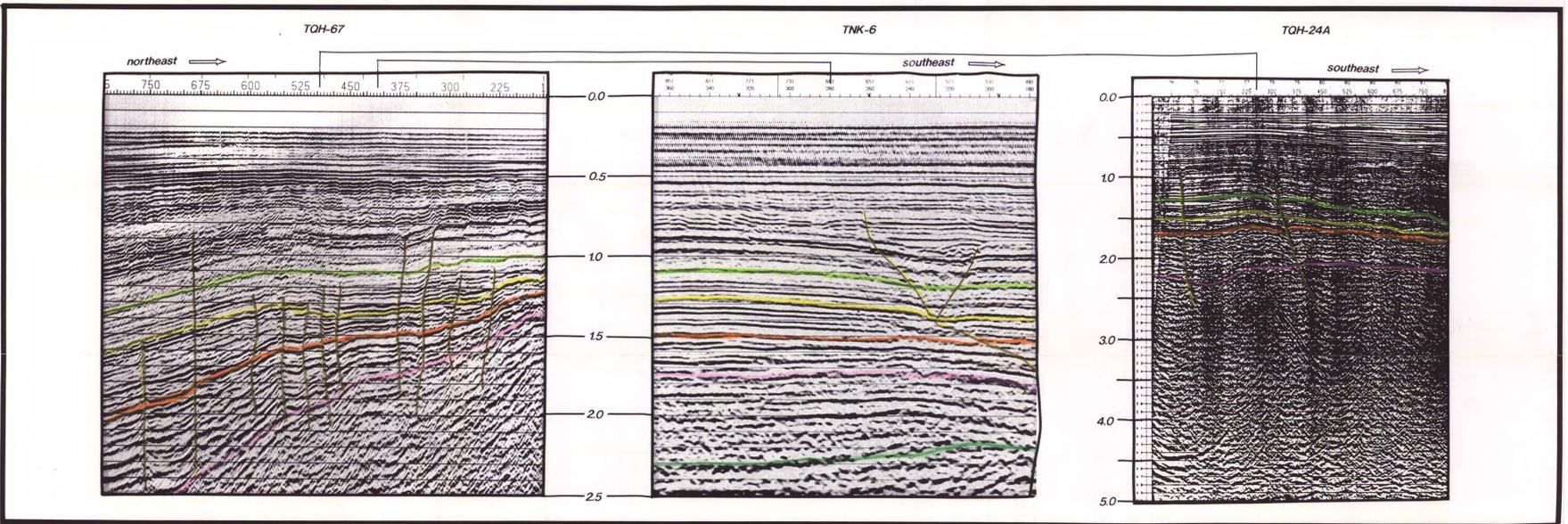
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| Scale: HORIZONTAL APPROX. 1:2500' | Contour Interval: |
| Report No. P-87-051 | Enclosure No. 9 |
| Film File No. | Remarks: |

10-10-78-R

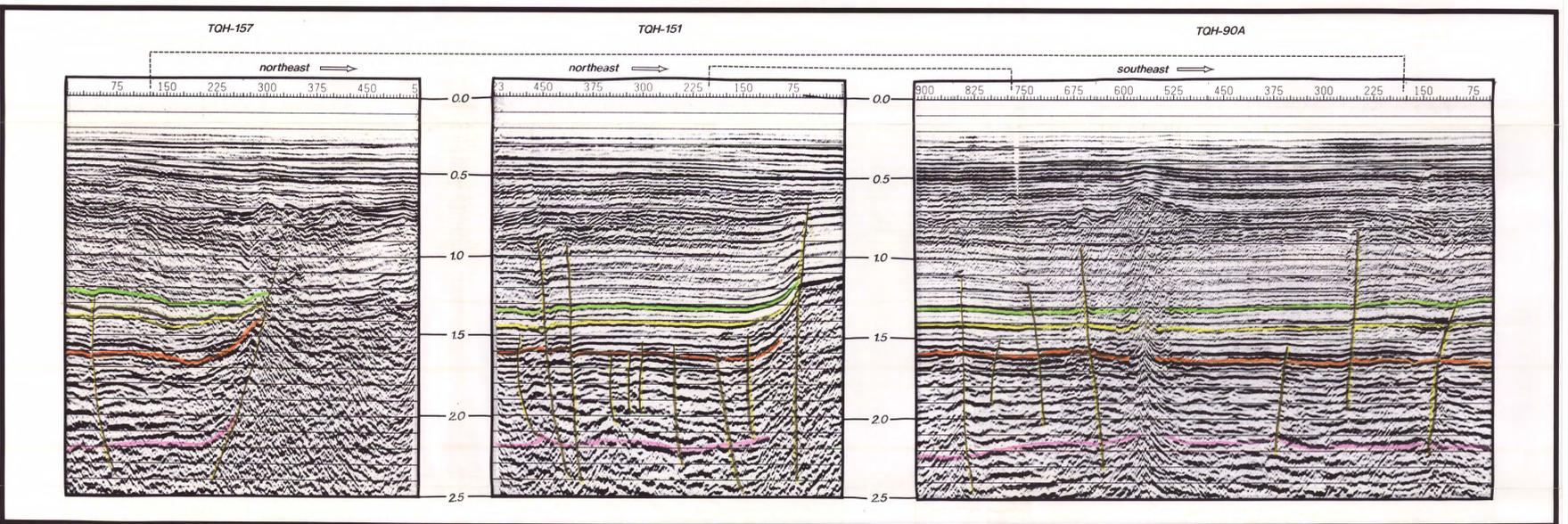
Lead #12



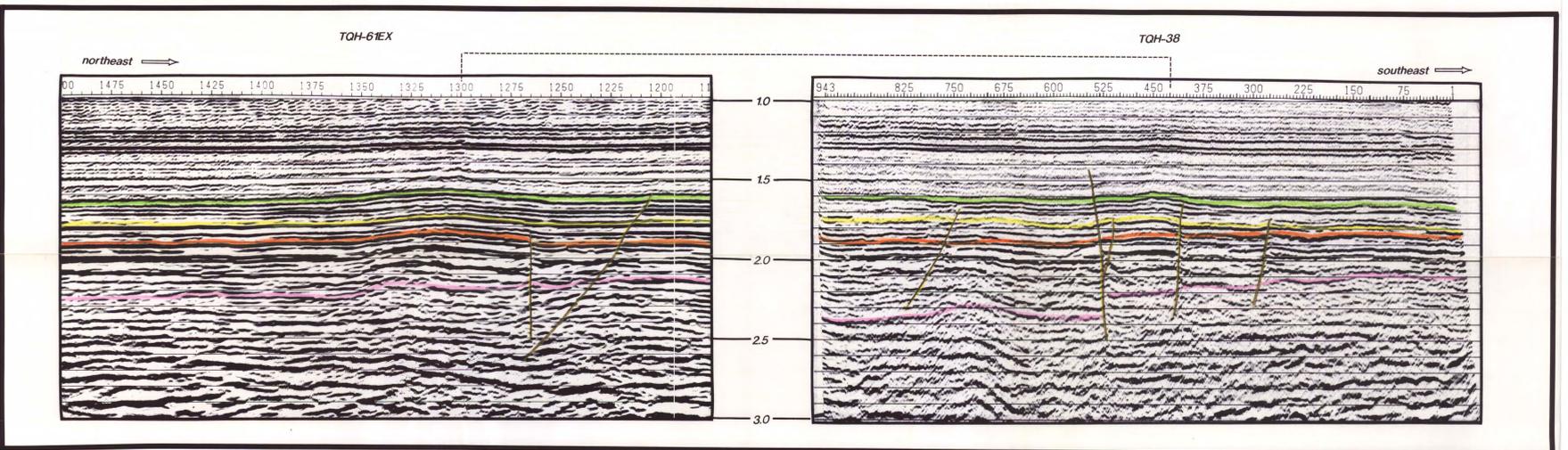
Lead #5



Cormorant Area



Lead #1



Summary of Requirements for Prospective Plays in the Bass Basin

315020



Structural closure with rock volume greater than approx. 150,000 acre feet.

- **Structure must vertically overlie mature fetch area. Lateral migration is very inefficient.**
- **The structures must have formed in areas that were in sand-prone, nearshore marine settings. Fluvial sands are sporatically distributed and relatively immature lithologically (Pelican Analog).**

①
OR-279

OR-279



Technical Concerns

- **The Apex of feature is 20 mill. (approx. 175 feet) high to Bass-3 Well at top EVCN.**
- **Structure does not overlie kitchen area and requires tortuous lateral migration.**
- **Bass-3 has no pay zones, sands present are likely to be of limited extent.**
- **The strat. trap at T. Longus level calls upon a relatively major NW-SE fault to be permeable**



Technical Concerns (Continued)

and a minor synthetic NW-SE fault to be sealing in order to explain the lack of pay at Bass-3.

- **Estimated Reserves: 103 BCF.**



Technical Concerns

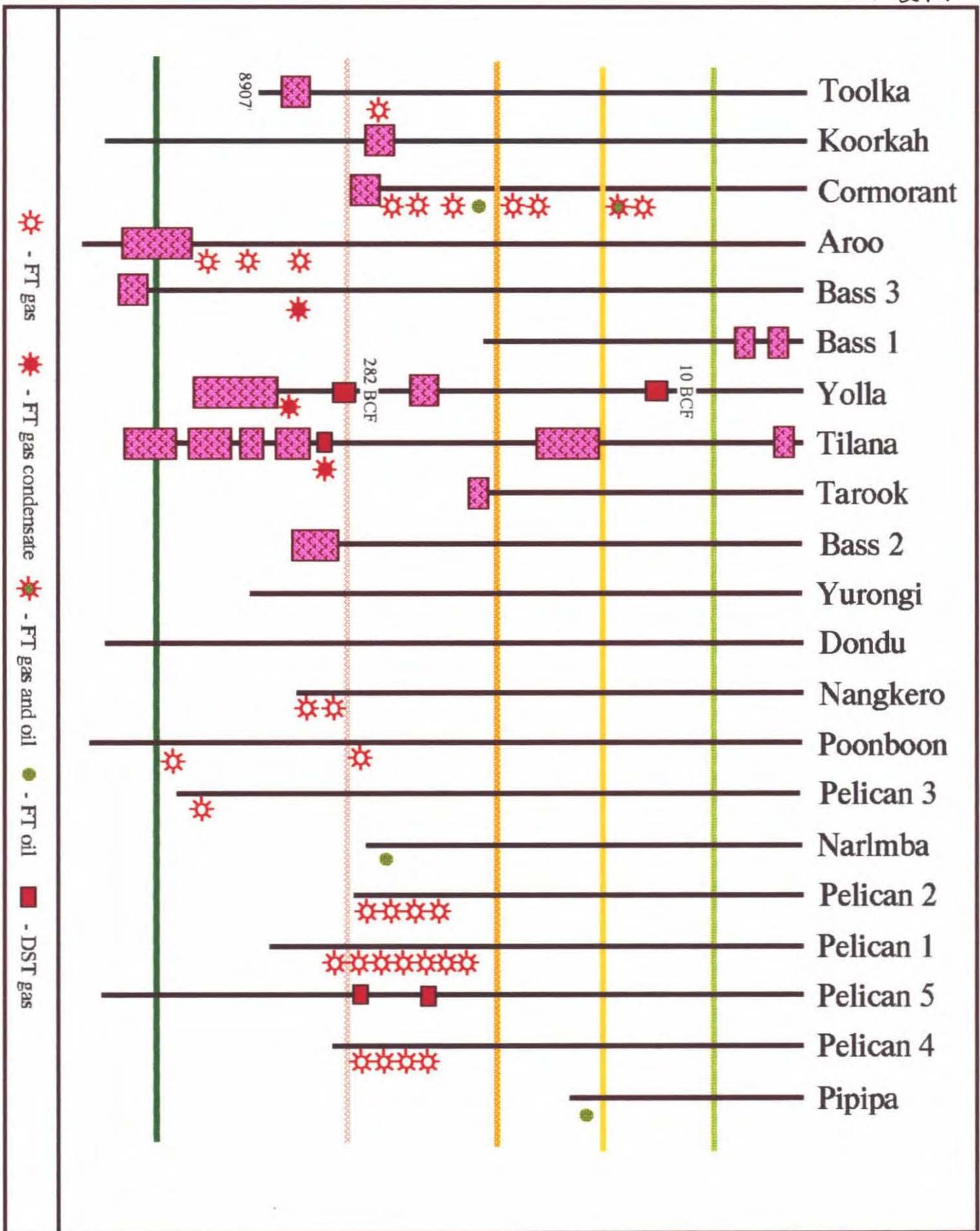
- **Structure is of relatively small magnitude and more complexly faulted at depth (L. Balmei, T. Longus levels).**
- **Charge capability concern: Yolla may not be filled to spill at all levels.**
- **Migration would have to be through valid closures at Dondu, Yurongi and Bass-2 which lacked shows.**

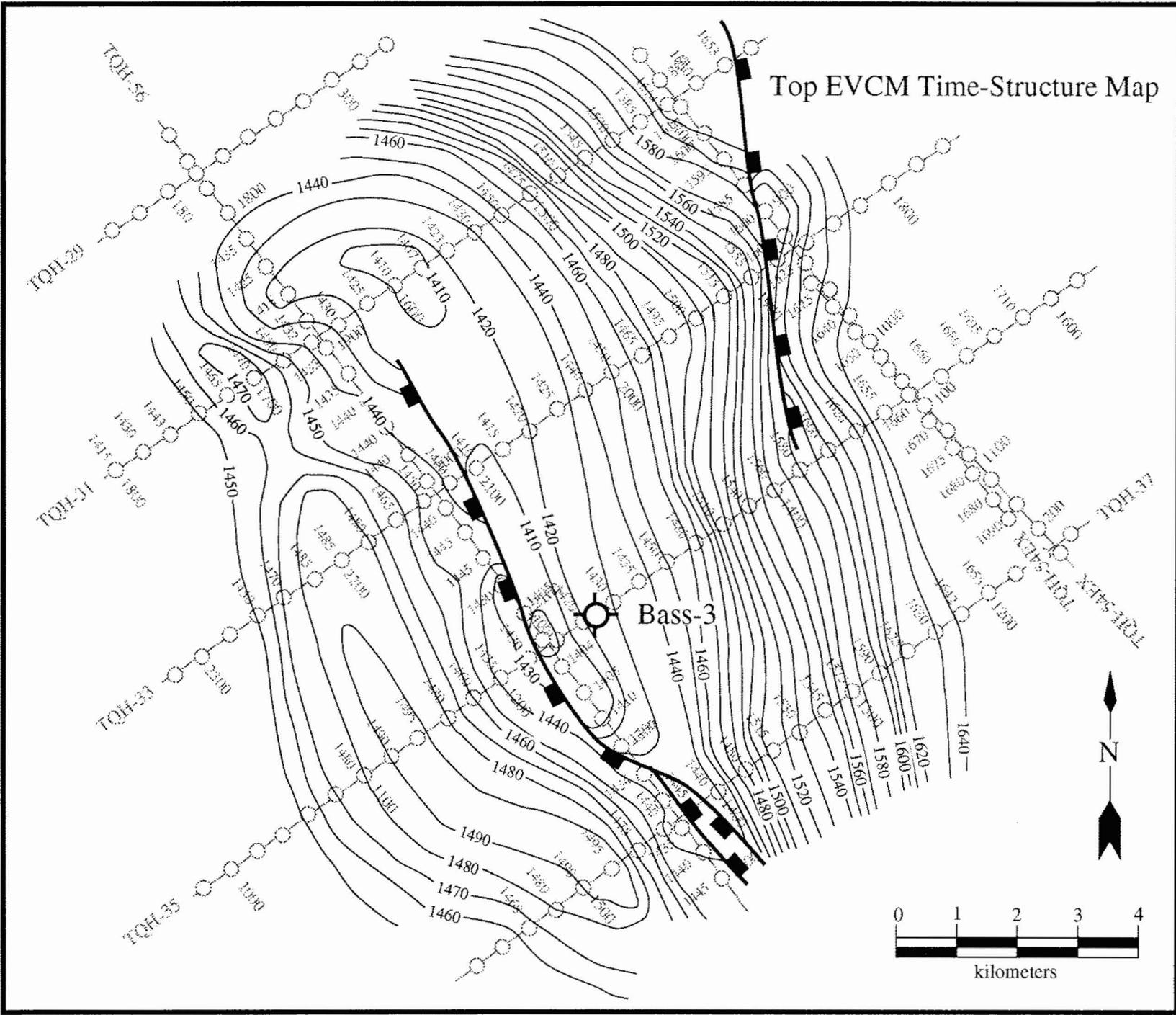
OK-279 ⑤



Technical Concerns (Continued)

- **Long distance migration is necessary because the feature does not overlie mature fetch area. This type of migration is also less efficient due to discontinuity of carrier beds.**
- **Estimated Reserves: 53 BCF.**

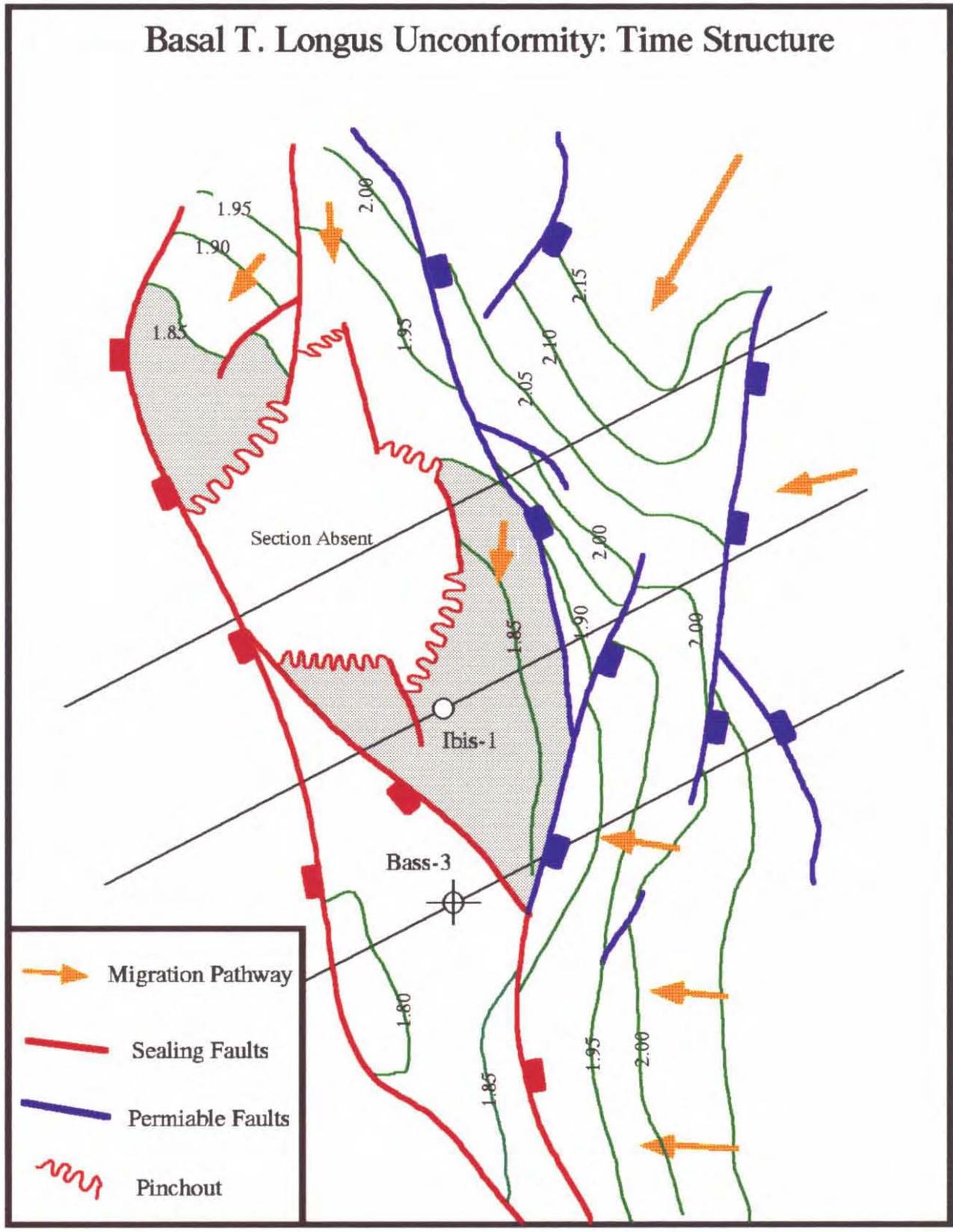




315027

OR-279 ⑥

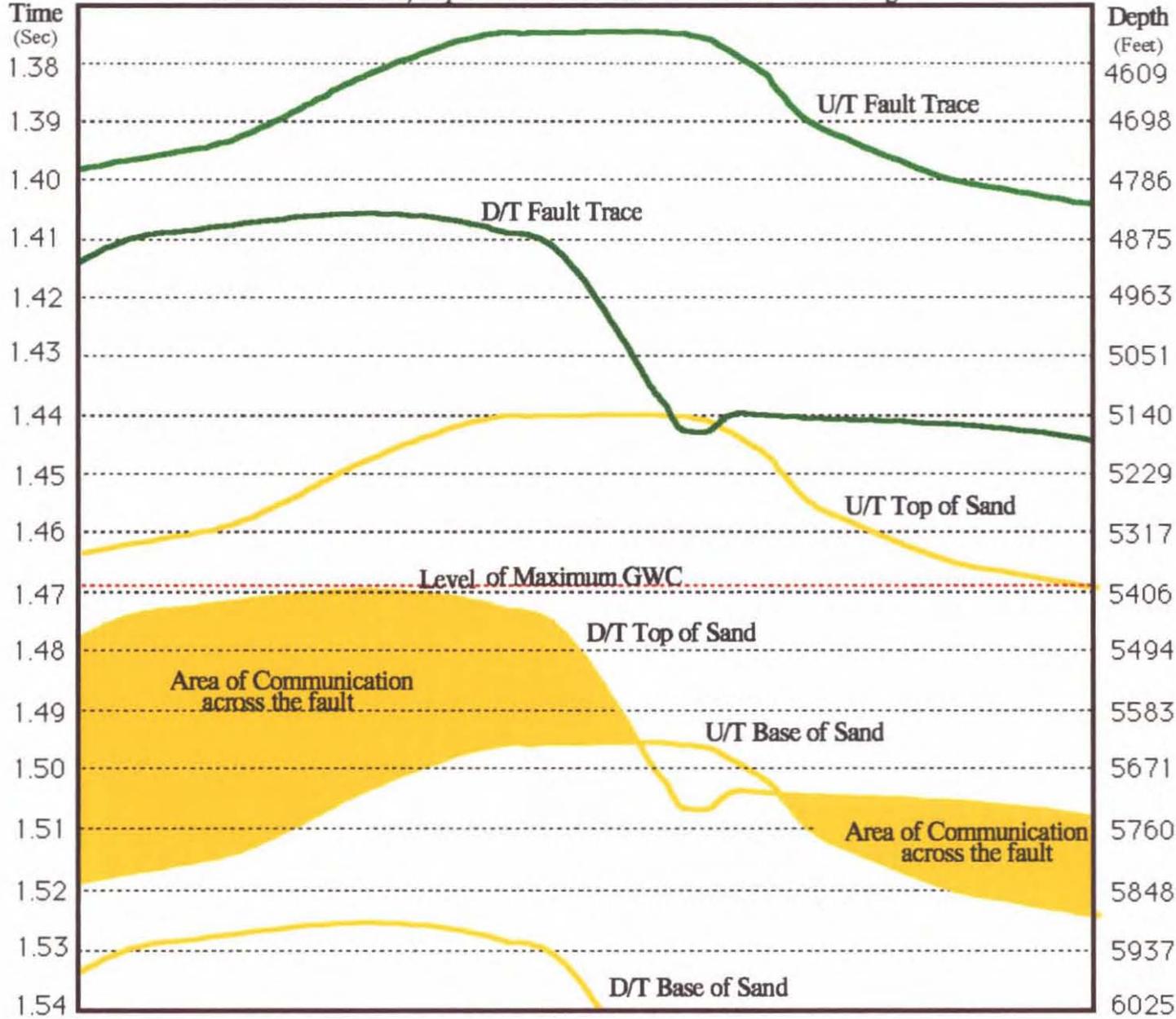
Basal T. Longus Unconformity: Time Structure



315028

OK-279 (8)
 Allan Fault Plane Projection Representation of the Southwestern Bounding Fault
 at the Ibis Structure, Top EVCM Sandstone based on the Bass-3 Log

315029



Yurongi Well:

Drilled: 1973
TD: 8000'
Drilled by: ESSO
Penetrated: L. Balmei
Shows: None
Area: 2480 acres
Maximum closure height: 50 msec of 4-way; 150 msec on 3-way.
Type of structure: Weak fault bounded 4-way on L. Balmei; ramping fault bounded 3-way on other EVCM units.
Primary target horizons: L. Balmei
Play concept: Basin margin fault rollover.
Comments: Data quality makes it difficult to determine whether top Lower EVCM closes. Major bounding fault penetrates well into the Tertiary section.

Dondu Well:

Drilled: 1973
TD: 9580'
Drilled by: ESSO
Penetrated: Lower EVCM
Shows: None
Area: 4092 acres
Maximum closure height: 100 msec
Type of structure: Fault bounded 4-way.
Primary target horizons: Closure throughout EVCM.
Play concept: Fault bounded 4-way near basin margin.
Comments: Closure strongest at L. Balmei level. Well probably located along the migration pathway between the main kitchen area and the Firetail prospect, however, it requires a relatively long distance migration.

Bass-2 Well:

Drilled: 1971
 TD: 5910'
 Drilled by: ESSO
 Penetrated: L. Balmei
 Shows: None
 Area: (see Firetail Prospect)
 Maximum closure height: (see Firetail Prospect)
 Type of structure: Fault bounded 4-way.
 Primary target horizons: L. Balmei.
 Play concept: Fault bounded 4-way basement drape near basin margin.
 Comments: Well drilled on margin of Firetail prospect closure. The upper ECVN units are thin due to the location being on the upthrown side of the a major basin bounding fault. Site is far removed from main kitchen area.

Tilana Well:

Drilled: 1985
 TD: 12,800'
 Drilled by: Amoco
 Penetrated: Top lower EVCN
 Shows: 2 DST's weak blow, some sw at 50%
 Area: 2976 acres
 Maximum closure height: 125 msec
 Type of structure: Broad 4-way.
 Primary target horizons: Top middle N. Asperus, top P. Asperus
 Play concept: Broad 4-way anticline in central portion of basin
 Comments: The regional dip to the west makes closure at the L. Balmei and top lower EVCN weak to non-existent. Gas shows found at L. Balmei level, same as at the Yolla discovery well.

Nangkero Well:

Drilled: 1974
TD: 9450'
Drilled by: Hemitite Petro
Penetrated: L. Balmei
Shows: Gas shows at L. Balmei level
Area: 1984 acres
Maximum closure height: 50 msec
Type of structure: Weak faulted 4-way.
Primary target horizons: Upper M. Diversus,
L. Balmei
Play concept: Weak 4-way structure in
southern portion of T14
Comments: Well was drilled off from the
crest of the closure. Structure is very
weak at the best, and is only defined by
three lines.

Tarook Well:

Drilled: 1972
TD: 9100'
Drilled by: ESSO
Penetrated: Upper M. Diversus
Shows: None
Area: 4836 acres
Maximum closure height: 50 msec or less
Type of structure: Fault bounded 4-way
Primary target horizon: Middle N. Aspersus.
Play concept: Broad fault bounded 4-way in
central portion of the basin.
Comments: Well was drilled off from the
crest of the closure. Although the
structure has a large aerial extent, the
closure is very weak. There is no closure
at the top L. Balmei or the top lower
EVCN levels.

Aroo-1 Well:

Drilled: 1974
 TD: 12112'
 Drilled by: Hemitite Petro
 Penetrated: Top Lower EVCM.
 Shows: FT gas shows in L. Balmei section.
 Area: 9176 acres
 Maximum closure height: 50 msec or less
 Type of structure: Fault bounded 4-way (?)
 Primary target horizons: L. Balmei, Lower EVCM.
 Play concept: Broad closure in deep portion of basin, located above main kitchen area.
 Comments: Major problem with the play is that the closure is only clearly defined on 1 line. There is no closure in the upper EVCM section above the L. Balmei level, and only very weak closure at the L. Balmei level. Play sits directly over the kitchen area.

Bass-3 Well:

Drilled: 1967
 TD: 7980'
 Drilled by: ESSO
 Penetrated: Top Lower EVCM.
 Shows: FT gas condensate at L. Balmei level, gor=1200.
 Area: 20,088 acres
 Maximum closure height: 150 msec
 Type of structure: Drapped basement high 4-way; 3-way ramp into basement high.
 Primary target horizons: Enitre EVCM section is closed, with strongest closure in the upper units.
 Play concept: Drapped basement high 4-way; 3-way ramping pinchout stratagraphic play.
 Comments: Very large structure associated with the faulted basement high. However, the EVCM section is very condensed, especially in the L. Balmei and Lower EVCM levels. 4-way closure is much smaller than the 3-way ramping pinchout structure. Good migration pathway from the main kitchen

Koorkah Well:

Drilled: 1986
 TD: 10,330'
 Drilled by: Amoco
 Penetrated: Top Lower EVCM.
 Shows: None
 Area: 13,268 acres
 Maximum closure height: 100 msec or less
 Type of structure: Fault bounded 4-way.
 Primary target horizons: Upper EVCM section is closed, with strongest closure at the M. Diversus level.
 Play concept: Fault bounded 4-way with closure throughout Upper EVCM and easy migration pathway from the kitchen area.
 Comments: The structure forms a large nose protruding into the center of the basin. The data over the structure is sparse, and the closure on the updip side is somewhat questionable.

Firetail Prospect:

Area: 14,012 acres
 Maximum closure height: 150 msec
 Type of structure: Faulted 4-way.
 Primary target horizons: Lower EVCM
 Play concept: Faulted 4-way basin margin play.
 Comments: Two dry holes flank the 4-way: Yurongi-1 on the down-thrown side of the basin margin fault, and Bass-2 on the northern edge of the closure. Neither hole had shows, however neither penetrated the Lower EVCM section. The Dondu well, located to the southwest, did penetrate the Lower EVCM section and had no shows. It is likely that the Dondu well is in a position that lies on the migration pathway between the main kitchen and the Firetail prospect. Thus, it seems there is a very high probability that the Lower EVCM section within the Firetail closure does not have any significant accumulation of hydrocarbons. See Shell farmout report in vault for more details on this prospect.

Yolla Satellite Prospect:

Area: 1488 acres
Maximum closure height: 60 msec
Type of structure: Faulted 4-way.
Primary target horizons: L. Balmei
Play concept: Faulted 4-way satellite structure south of Yolla discovery well.
Comments: See report by Mark Steele for a detailed map of the structure

Prospect #1:

Area: 2356 acres
Maximum closure height: 75 msec
Type of structure: Broad fault bounded 4-way.
Closed horizons: Strongest closure at Upper M. Diversus level.
Play concept: Broad, relatively unfaulted 4-way with easy migration pathway from kitchen.
Comments: The major downside of the play is that the structural closure at the L. Balmei level appears to be very weak. Mapping at this level is complicated by relatively poor data quality.

Prospect #2:

Area: 4960 acres
Maximum closure height: 50 msec
Type of structure: Broad 4-way.
Closed horizons: Middle N. Aspersus, Lower N. Diversus.
Play concept: Broad 4-way in central portion of basin with easy migration pathway from kitchen.
Comments: This is the structure that the Tarook well was aiming for but missed. Although the vertical relief is low, the aerial extent of the feature is fairly large. The two major downsides to the play are: 1) The closure at the L. Balmei level is very weak, and 2) the Tarook well had no shows in the Middle N. Aspersus and Lower N. Diversus sections.

Prospect #3:

Area: 3472 acres
Maximum closure height: 50 msec or less
Type of structure: Broad and very subtle 4-way.
Closed horizons: L. Balmei.
Play concept: Subtle 4-way directly over kitchen.
Comments: Only 3 lines define the structure, and the data quality at the L. Balmei level is poor. Closure may purely be a product of the poor data quality or velocity perturbations.

Prospect #4:

Area: 1066 acres
Maximum closure height: 50 msec
Type of structure: Faulted 4-way.
Closed horizons: Best closure at the Middle N. Aspersus level.
Play concept: Faulted 4-way on the up-dip trend of the migration pathway from the Yolla discovery well.
Comments: This feature is very subtle, and the regional dip to the west along with the poor data quality make the closure sketchy.

Prospect #5:

Area: 4216 acres
Maximum closure height: 100 msec
Type of structure: Paired faulted 4-ways.
Closed horizons: Upper EVCM units.
Play concept: Two adjacent 4-ways related to a basin margin fault.
Comments: The down-dip structure is the largest of the two anomalies, with good closure throughout the Upper EVCM units. The northern most structure is weakly closed and may not be closed from the top of the L. Balmei level and below.
Associated Lines:

Prospect #6:

Area: 2232 acres

Maximum closure height: 30 msec

Type of structure: Broad fault bounded 4-way(?)

Closed horizons: Not closed above Upper N. Diversus level.

Play concept: Subtle closure in basin center with simple migration pathway.

Comments: With only 30 msec of relief, the feature could easily be an artificial closure due to volcanics which are found extensively through the section. Further, the closure is poorly defined by only 3 lines.

Prospect #7:

Area: 2480 acres

Maximum closure height: 75 msec

Type of structure: Fault bounded 4-way

Closed horizons: Strongest closure at P. Aspersus level.

Play concept: Faulted 4-way directly above the kitchen area.

Comments: The data quality is poor at the L. Balmei level and it is not clear whether there is closure at this level. The structure is located on the down thrown side of the fault which bounds the eastern edge of the structure penetrated by the Aroo-1 well. Gas shows were found in the L. Balmei level in Aroo-1.

Prospect #8:

Area: 3720 acres

Maximum closure height: 40 msec or less

Type of structure: subtle 4-way

Closed horizons: Middle N. Aspersus

Play concept: Subtle 4-way roll up-dip from the kitchen.

Comments: Closure is very weak and subtle. There is no closure at the L. Balmei level and below.

Prospect #9:

Area: 1562 acres
Maximum closure height: 50 msec
Type of structure: 3-way basin margin fault
Closed horizons: Upper EVCM
Play concept: 3-way basin margin fault play with a slight (20 msec) roll into fault.
Comments: The EVCM section is very condensed and/or absent. The structure is similar to the structure drilled by the BASS-3 well, but has a much smaller aerial extent.

Prospect #10:

Area: 3224 acres
Maximum closure height: 50 msec
Type of structure: Broad 4-way anticline
Closed horizons: Strongest closure between Middle N. Aspersus and Upper M. Diversus.
Play concept: 4-way closure up-dip from the kitchen area.
Comments: Above the Upper M. Diversus level, the structure is clearly defined, however, it is not clear whether the L. Balmei level is closed.

Prospect #11:

Area: 4960 acres
Maximum closure height: 50 msec or less
Type of structure: Fault bounded 4-way
Closed horizons: L. Balmei
Play concept: Broad 4-way roll in L. Balmei directly above the kitchen area.
Comments: The structure becomes a fault bounded 3-way above the L. BALmei level.

Prospect #12:

Area: 12,648 acres
Maximum closure height: 100 msec
Type of structure: 3-way pinchout
Closed horizons: Strongest closure at top of Upper M. Diversus.
Play concept: 3-way pinchout strat play sealed on up-dip side by on-lapping units below the Upper M. Diversus level.
Comments: All the units below the Upper M. Diversus level are possible traps.

Toolka Well:

Drilled: 1974
TD: 8907'
Drilled by: ESSO
Penetrated: L. Balmei
Shows: 2 FT gas shows at base of M.
Diversus
Area: 3472 acres
Maximum closure height: 75 msec
Type of structure: Faulted 4-way
Primary target horizons: Upper EVCM
Play concept: 4-way structural closure of
EVCM section.
Comments: Data is sparse over structure and
extensive volcanics in the Tertiary section
make data quality poor in the older
section. Some of the structures in the area
may be Tertiary in age.

Cormorant Well:

Drilled: 1970
TD: 9840'
Drilled by: ESSO
Penetrated: M. Diversus
Shows: Numerous Gas shows throughout
upper EVCM along with some oil
shows.
Area: 8104 acres
Maximum closure height: 100 msec
Type of structure: Faulted 4-way
Primary target horizons: Upper EVCM
Play concept: Fault controlled 4-way.
Comments: Closure on northern end of
structure is suspect. Area of drilled
structure is more likely ≈2000 acres. The
well was charged, but no satisfactory
reservoir section was present.

Bass-1 Well:

Drilled: 1965
TD: 7700'
Drilled by: ESSO
Penetrated: M. Diversus
Shows: None
Area: No closure
Maximum closure height: No closure
Type of structure: Target was Oligocene
volcanic section, which was misidentified
as a carbonate buildup.

Prospect #13:

Area: 2232 acres

Maximum closure height: 40 msec

Type of structure: Fault bounded 4-way

Closed horizons: EVCM section below

Upper M. Diversus is closed

Play concept: Satellite feature of larger structure penetrated by the Koorkah-1 well.

Comments: Fairly weak closure overall. Major liability is that there were no shows in the better looking structure at Koorkah-1.

Cormorant Area:

Area: several ≈2000 acre structures

Type of structure: Fault bounded 3-way closures

Closed horizons: Upper EVCM section.

Play concept: Basin margin fault controlled 3-way closures.

Comments: Several structures in this area appear to have closure along faults. Liabilities are lack of reservoir section in the Cormorant well and some Tertiary tectonics in the area.