WELL COMPLETION REPORT

HORIZON OPERATING CO./BENNETT PETROLEUM

ETINGIMBRA - 1

(E.P.-1, Northern Territory)

prepared by

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&

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(a wholly owned subsidiary of
Adelaide Petroleum N.L.)

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CONTENTS

1. SUMMARY

The petroleum exploration well Etingimbra-1 was drilled to a total depth of 1006m (-883m) in January 1990 to test a very large, well defined structural closure located on the northeast -plunging McDills Anticlinal Trend, 14km south southwest of McDills-1 drilled in 1965. As at McDills-1, the section at Etingimbra-1 was expected to include stacked sequences of three sedimentary basins;-the Eromanga (Jurassic Cretaceous), Pedirka (Late Carboniferous-Permian) and Amadeus (Adelaidean-Devonian) Basins.

The primary reservoir objective of the well was the massive porous sandstone of the Devonian Langra Formation, with secondary objectives provided by the Jurassic - Early Cretaceous Algebuckina Sandstone and sandstones of the Late Carboniferous-Permian Crown Point Formation.

No hydrocarbon indications were recorded during drilling. Log analysis confirmed all porous zones to be 100% water-wet and the well was plugged and abandoned. The stratigraphic sequence encountered was close to prognosis with the main exception being the absence of the Devonian Horseshoe Bend Shale, the anticipated top seal for the underlying Langra Formation reservoir. Explanations for the absence of any oil or gas shows in the well, particularly beneath the base of the massive, Early Cretaceous regional shale seal, include either a lack of sufficiently mature hydrocarbon generative source rocks in the adjacent Eringa Trough or that the major thrust fault bounding the westward flank of the Etingimbra structure forms a barrier to hydrocarbon migration from the trough. In the latter case, structures located within the Eringa Trough, westward of the McDills Anticlinal Trend, could provide valid, future exploration targets.

2. INTRODUCTION

Etingimbra-1 was located in the western Simpson Desert, approximately 300km southeast of Alice Springs, or some 630km by road via Kulgera, Finke and Mt Dare homestead (Figs 1 and 2), and is only the second oil exploration well to be drilled in the area covered by Permit EP-1, the previous well, McDills-1 having being drilled 25 years earlier. McDills-1 was plugged and abandoned after encountering only minor hydrocarbon indications, but it confirmed the existence of good potential reservoir objectives at a number of stratigraphic levels in the area, plus a potential hydrocarbon source sequence within the Early Permian sediments.

The McDills-1 well was located on a large closure on the major northeastward plunging McDills Anticlinal Trend. The McDills structure was mapped from early reflection seismic data recorded in 1963-64. Seismic data from surveys recorded in 1985 and 1987 by the current joint venture in EP-1, operated by Territory Petroleum Pty. Ltd. (a wholly owned subsidiary of Adelaide Petroleum N.L.), indicated that the McDills structure was partly complicated by crestal keystone faulting, particularly at Permian to uppermost Devonian levels, and the McDills well was located somewhat downflank from the crest (by 60msecs TWT at Top Langra Formation level).

Although significant untested updip potential exists at the McDills structure, the EP-1 joint venture considered a test of the less faulted, similarly large, but shallower Etingimbra structure, some 14km south southwest of McDills-1, would provide a more definitive test of the potential of the McDills Anticlinal Trend.

The Etingimbra structure was first identified during the 1987 seismic survey. Under an agreement reached during 1988-1989 between the EP-1 Joint Venture and Horizon Operating Company (of Bakersfield, California), Horizon committed to fund the drilling of Etingimbra-1 to earn an interest in the Prospect. Subsequently Bennett Petroleum Corporation (of Denver, Colorado) also joined Horizon in the programme.

The main objective at Etingimbra-1 was to be the massive sandstone of the Devonian Langra Formation, which it was anticipated could be sealed by the conformably overlying Horseshoe Bend Shale. In McDills-1 the Langra Formation had good measured porosities and high permeabilities. The Jurassic-Early Cretaceous Algebuckina Sandstone and Late Carboniferous-Permian Crown Point Formation were to provide additional, secondary objectives.

The well location at Station 150 on Seismic Line NT87-15 was selected to intersect both the primary and secondary objectives at a near-crestal position on the structure at each level.

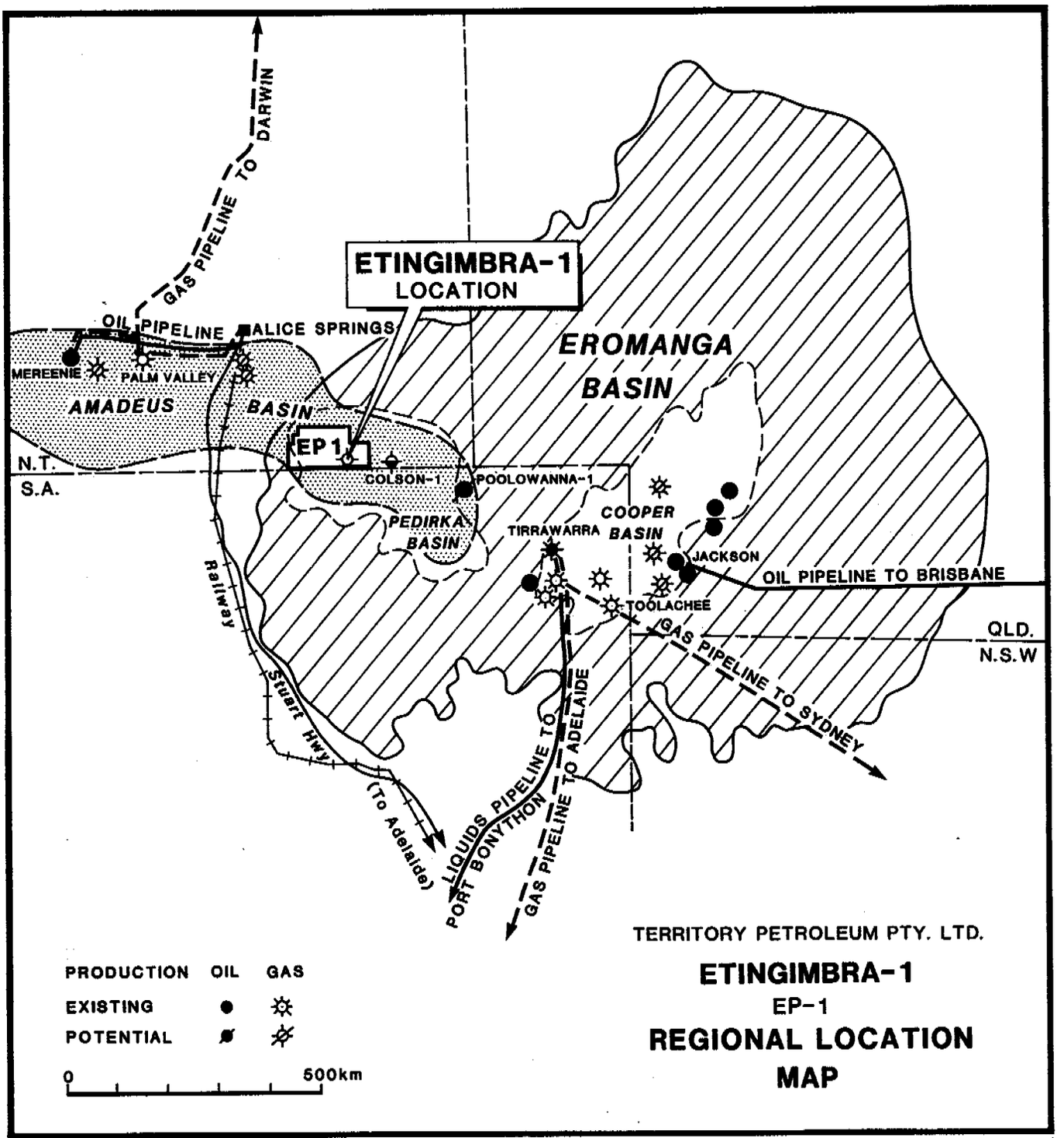

GAS PIPELINE TO DARWIN
ETINGIMBRA-1
LOCATION
OIL PIPELINE
ALICE SPRINGS
EROMANGA
BASIN
MEREENIE
PALM VALLEY
AMADEUS
BASIN
EP 1
N.T.
S.A.
COLSON-1
POOLOWANNA-1
PEDIRKA
BASIN
COOPER
BASIN
TIRRAWARRA
JACKSON
OIL PIPELINE TO BRISBANE
TOOLACHEE
QLD.
N.S.W
GAS PIPELINE TO SYDNEY
Railway
Stuart Hwy
(To Adelaide)
LIQUIDS PIPELINE TO PORT BONYTHON
GAS PIPELINE TO ADELAIDE
PRODUCTION OIL GAS
EXISTING
POTENTIAL
0
500km
TERRITORY PETROLEUM PTY. LTD.
ETINGIMBRA-1
EP-1
REGIONAL LOCATION MAP

FIGURE 1

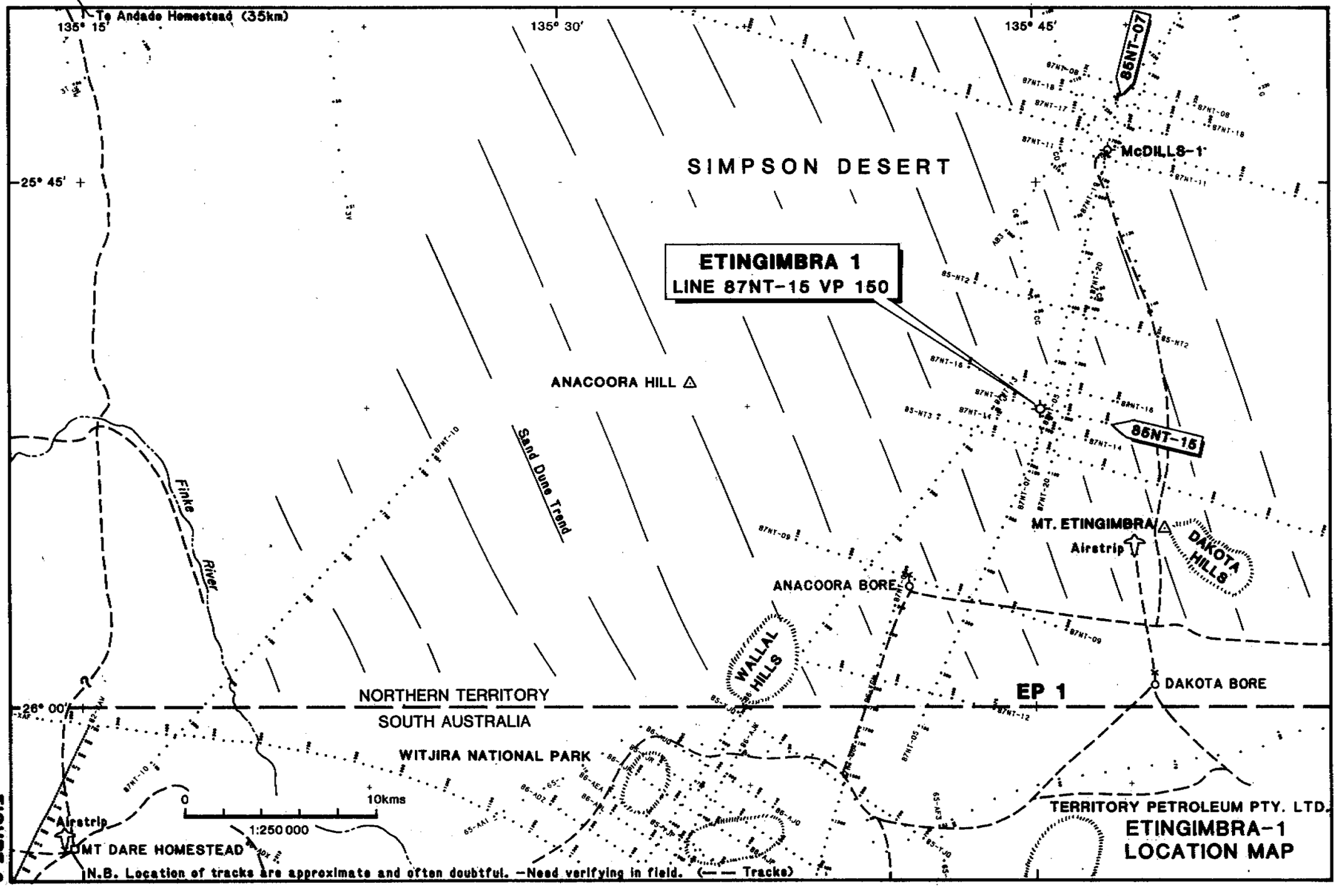

To Andado Homestead (35km)
135° 15'
135° 30'
135° 45'
25° 45'
26° 00'
SIMPSON DESERT
ETINGIMBRA 1
LINE 87NT-15 VP 150
McDILLS-1
86NT-07
86NT-15
ANACOORA HILL
Sand Dune Trend
Finke River
MT. ETINGIMBRA
Airstrip
DAKOTA HILLS
ANACOORA BORE
WALLAL HILLS
DAKOTA BORE
EP 1
NORTHERN TERRITORY
SOUTH AUSTRALIA
WITJIRA NATIONAL PARK
Airstrip
MT DARE HOMESTEAD
0
10kms
1:250 000
N.B. Location of tracks are approximate and often doubtful. —Need verifying in field. (— — Tracks)
TERRITORY PETROLEUM PTY. LTD.
ETINGIMBRA-1
LOCATION MAP

FIGURE 2

3. WELL HISTORY

3.1 General Data

Well Name:	**Etingimbra-1**
Permit:	EP-1, Northern Territory
Permit Operator:	**Territory Petroleum Pty Ltd** (a wholly owned subsidiary of Adelaide Petroleum N.L.), of 1st Floor, Hampden House,174 Hampden Road, Nedlands, Western Australia 6109
Well Operators:	**Horizon Operating Company**, of 200 New Stine Road, Suite 132, Bakersfield, California, USA 933090, and **Bennett Petroleum Corporation**, of 630 Spectrum Bldg, 1580 Lincoln Street, Denver, Colorado, USA 80203
Permit Interests: (excluding Etingimbra structure):	Territory Petroleum Pty Ltd 75% Bridge Oil Limited 20% Allco Petroleum N.L. 2.5% Arabasin Oil N.L. 2.5%
Etingimbra Prospect Interest: (post-well)	Horizon Operating Company and Bennett Petroleum Corporation et al 71.25% Territory Petroleum Pty Ltd 18.75% Bridge Oil Limited 5.0% Allco Petroleum N.L. 2.5% Arabasin Oil N.L. 2.5%
Location (final) geographic:	Latitude: 25° 51' 26.63"S E 575,459.491 Longitude: 135° 45' 09.67"E N 7,139,882.178 (Final location surveyed on 22 January 1990 by Tony Markham Contracting Pty. Ltd. of Alice Springs, using GPS Satellite Navigator Magnavox 4400, Serial No. 213).
seismic:	Station : 150 on Line NT 87-15
Elevation :	KB: +123 M GL: +120 M (from surveyor's records, 1987 seismic survey).
Total Depth:	Driller: 1004.8m Logger: 1006.3m
Status:	Plugged and Abandoned
Drilling Commenced:	12 January 1990
Drilling Completed:	18 January 1990
Rig Release:	20 January 1990
Drilling Rig:	Drillcorp Ltd., Rig 24
Wireline logging:	Gearhart Pty Ltd
Mudlogging:	Gearhart Pty Ltd (Geodata Services)

3.2 Drilling Summary

The well was spudded in with a 12-1/4 inch bit at 1300 hours, 12 January 1990. The 12-1/4 inch hole was drilled without any problems to 110m where a wiper trip was conducted prior to running 9-5/8 casing. Nine joints of 9-5/8 inch, J55, 43.5ppf, 8 round STC casing were run to 107.3m, following which 107 sacks of Class A cement at 15.6ppg were mixed and pumped, and then displaced with 25bbls of freshwater. The plug was bumped and after bleeding off pressure the float equipment held. Full returns of cement were received at surface during pumping and displacement. After waiting on cement for 6-1/2 hours and when surface samples had hardened, the casing was slacked off and the 9-5/8 inch braden-head and BOP's were installed. The BOP's were tested with a plug type tester to 1000 psi.

An 8- 1/2 inch J22 bit and slick assembly were made up and run in the hole. Cement was tagged at 102m. Drilling out of the float equipment and cement took 2 hours due to hard cement. A formation integrity test was performed at 114m to an equivalent mud weight of 13.5 ppg.

Drilling of the 8-1/2 inch hole continued without any problems to 627m where it was decided to change the bottomhole assembly as the hole angle had built to 3^{o}. A pendulum assembly was made up and run in the hole. A trip was conducted at 754m to locate a suspected washout in the drill string. Drilling then proceeded without incident, with hole angle decreasing to 2^{o} at the total depth of 1005m (driller).

Electric logging was then conducted by Gearhart. Following an evaluation of the logs the decision was made to plug and abandon the well. Three plugs were run across the intervals 660-600m, 140-80m and 45m($\pm$) to surface with the deeper plugs being tagged at 601m and 78m respectively.

Prior to running the surface plug, all pipe and collars were laid out, the BOP's were nippled down and the mud tanks were cleaned.

The rig was released at 1200 hours on 20 January 1990.

3.3 Drilling Data

a) Name and Address of Drilling Contractor

Drillcorp Ltd.
41 Buckingham Drive
WANGARA WA 6065

b) Details of Rig, Plant and Equipment

Drilling Plant:

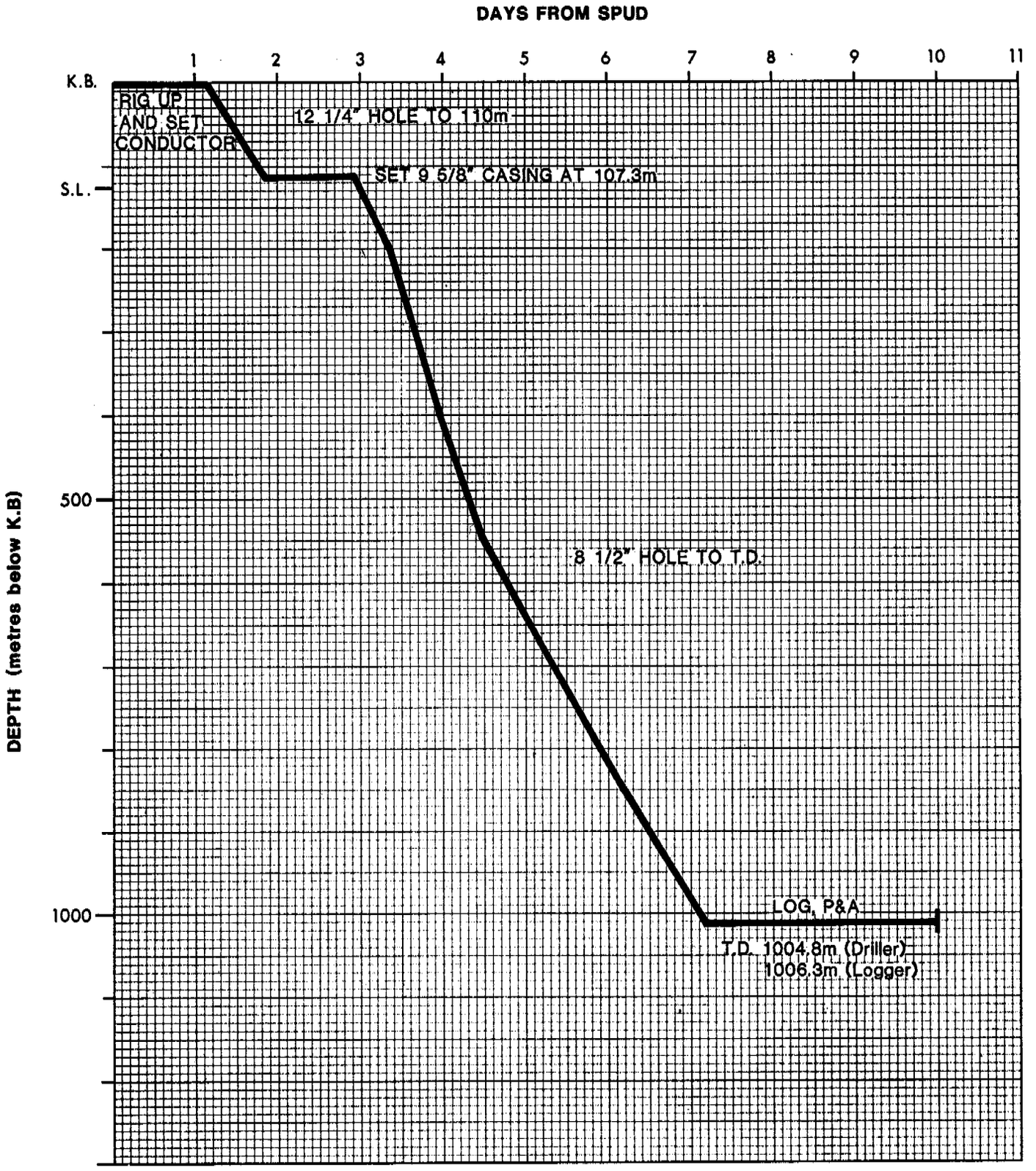
Type: Franks Cabot Explorer, Carrier-Mounted
Capacity: 1600m
Draw-works: Cabot Split draw-works, drilling/tripping drums, Model 1D58/150-2, 2 Detroit Diesel GM6V-71N motors.

Mast/Derrick:

Make/Type: Cabot, 29-45.7m, 4 leg, telescoping
Capacity: 96-150,000lb capacity.

Mud Pumps:

Make: Ideco MM450 Duplex 7-1/4 inch x 12 inch powered by two 6-71GM motors.



ETINGIMBRA #1

DRILLING TIME VERSUS DEPTH CHART

FIGURE 3

Blow-out Preventer Equipment:

Make: Shaffer Type 'E' Double gate, 10 inch x 3000 psi.
(1) Annular Shaffer 10 inch x 3000psi.
(2) Annular Regan 9 inch x 3000 psi.

c) Hole Size, Casing and Cementing

Refer to Section 3.2.

d) Bit Runs

Bit data is recorded on the Mudlog (Encl. 2).

e) Drilling Fluids

Water based gel polymer.
Average mud properties during drilling:

Mud weight	9.0-9.2ppg
Viscosily	40
PV/YP	12/16
Water Loss	8
PH	9.5
Chlorides	14

f) Water Supply

The drilling and drinking water for the operation was hauled from Dakota Bore, approximately 15km to the south.

g) Plugging

In plugging the well three abandonment plugs were set as follows:

Plug 1 - 70 sacks of Class "A" cement plus 2% $CaCl_2$ at 15.6 ppg over the zone 660-600m. After waiting 5 hours for cement to set the plug was tagged at 601m with 7000lbs W.O.B.

Plug 2 - 70 sacks of Class "A" cement plus 2% $CaCl_2$ at 15.6ppg over the zone 140-80m. After waiting on the cement to set, the plug was tagged at 78m with 7000lbs W.O.B.

Plug 3 - A surface plug was set using 20 sacks of Class "A" cement to cover the interval from approximately 45m to surface. A collar cap and marker plate were installed on the wellhead.

3.4 Logging and Testing

a) Mudlogging

Mudlogging services were provided by Gearhart Pty Ltd (Geodata Services). Due to high drill rates throughout much of the section, sampling was mainly at 9 metre intervals, reduced to 3 metre intervals over zones of slower drilling. Samples were washed, checked for fluorescence, described, allowed to air dry and split into 3 sets and forwarded for storage to the Northern Territory Department of Mines and Energy, at the Power Street Core Library, Alice Springs, N.T. 5070. An additional set of bulk (0.5kg) washed samples plus 1 set of 50 metre interval composite samples (for possible future palynological studies) were also forwarded to the Core Library for temporary storage.

Ditch gas was continuously monitored from near-surface to total depth using a hot-wire total gas detector and flame ionisation chromatagraph. In addition pump strokes, pit levels, depth and rate of penetration were also monitored. Mudlogging data from the well is summarised on the Mudlog (Enclosure 2).

b) Testing

No testing was carried out.

c) Coring

No cores were cut.

d) Wireline Logging

One suite of logs was run upon reaching total depth. Log coverage was as follows:

Log	Interval
DDL-MSFL-GR	1005.7-106.6m
BCS-GR	1003-106.6m (GR TO 16.1m)
CDL-CNS-GR	880-633m & 350-292m

e) Geothermal Gradient

An extrapolated bottom hole temperature of 66^{o}C (151^{o}F) was calculated for the logging runs at total depth. This indicates an overall temperature gradient of 3.9^{o}C/100m (2.15^{o}F/100ft; - see Appendix 1).

f) Deviation Surveys

Borehole deviation data as recorded from Totco surveys are provided on the Mudlog and Composite Well Log (Encls. 1 & 2). Maximum hole deviation recorded was 3^{o} at 615m. Survey's at 740m and 765m were 'misruns'.

g) Velocity Survey

No velocity survey was conducted.

4. GEOLOGY

4.1 Regional Setting

Etingimbra-1 is located in Northern Territory Permit EP-1 which in part contains stacked sequences of four sedimentary basins, the Eromanga (Jurassic-Cretaceous), Simpson Desert (Triassic), Pedirka (Late Carboniferous-Permian) and Amadeus (Adelaidean-Devonian) Basins, all of which include potential reservoir objectives.

The dominant tectonic element is the major NNE-SSW trending McDills Anticline which is upthrust adjacent to the Eringa Trough to the west. The eastern flank of the anticline dips regionally into the Madigan Trough.

Potential objectives in the region include the following:

Jurassic-Cretaceous:	Algebuckina Sandstone and Poolowanna Fm.
Triassic:	Peera Peera Fm.
Late Carboniferous - Permian:	Crown Point Fm.
Ordovican-Devonian:	Langra Fm., Mereenie Sandstone, (?) Stairway Sandstone

All reservoirs show good porosity. Pronounced diagenetic reduction of porosity as occurs in the central Pedirka Basin region is not apparent in EP-1 The Triassic Peera Peera Formation and Jurassic Poolowanna Formation are absent along the McDills Anticlinal Trend.

Potential Permian source rocks present in McDills-1 may lie within the oil-generative window in the adjacent Eringa Trough, with potential to provide hydrocarbon charge to closures along the upthrust trend. In other basins where the Permian has remained within the oil window it has been proven to generate significant volumes of liquids, as in the Patchawarra Trough of the Cooper Basin (Tirrawarra, Fly Lake, Moorari Fields, etc.) and in the southern Surat Basin (Moonie Oilfield).

The Poolowanna Formation (Jurassic) and Peera Peera Formation (Triassic) have generated oil in the vicinity of Colson-1 and are predicted to be oil mature east of the McDills Trend.

Deeper source rocks such as the Ordovician Horn Valley Siltstone (the likely source for the Mereenie Oilfield with an estimated 240 million barrels of oil-in-place) and Lower Cambrian deep water carbonates could provide additional mature sources within the Eringa Trough.

4.2 Summary of Previous Work.

The Etingimbra structure was first identified as a likely major structural closure during a seismic survey, conducted by the EP-1 Joint Venture in 1987 under the operatorship of Territory Petroleum Pty Ltd (a wholly owned subsidiary of Adelaide Petroleum N.L.). Substantial dip reversal was recognised at Pre-Permian levels during in-field processing of regional strike line 87NT-07, which was located along the approximate crest of the McDills Trend as defined by earlier, 1985 reconnaissance dip lines 85NT-03 and 85NT-02. Subsequent detailing of the strong lead during the same survey with 3 dip lines on a 1km spacing, plus an additional strike line, was sufficient to mature Etingimbra to drillable prospect status.

Prior to drilling, the nearest well control for Etingimbra-1 was McDills-1 drilled in 1965, and located 14km north northeast of the proposed Etingimbra-1 location. McDills-1 reached a total depth of 3205m (-3079m) in carbonates of Lower Cambrian age and encountered only a minor gas show at the top of the Lower Cretaceous Cadna-Owie Formation. Modern seismic indicated the well was located somewhat downdip of the structural crest and evidence of crestal faulting suggested that the McDills structure may not be effectively sealed (see Section 2).

Oil shows have previously been encountered in the Jurassic-Triassic section at Colson-1, 90km east of Etingimbra-1 and at Poolowanna-1, 250km east southeast (Fig. 1). The Dingo-1 gas discovery within the Amadeus Basin section, is located 150km to the northwest.

4.3 Stratigraphic Table (TABLE 1)

Age and Formation	Depth m		Penetrated Thickness m
	KB	Subsea	
TERTIARY-RECENT			
Surficial deposits	3 (surface)	+120	7
	(10)	(+113)	
EARLY CRETACEOUS			
Wallumbilla Formation	10	+113	293
Cadna-Owie Formation	303	-180	22
JURASSIC - EARLY CRETACEOUS			
Algebuckina Sandstone	325	-202	289
(Base Jurassic Unconformity)	(614)	(-491)	
LATE CARBONIFEROUS - EARLY PERMIAN			
Purni Formation	614	-491	23
Crown Point Formation	637	-514	110
(Base Permian - Carb. Unconformity)	(747)	(-624)	
DEVONIAN - Finke Group			
Idracowra Sandstone Equivalent	747	-624	41
(? Disconformity)	(788)	(-665)	
Langra Formation	788	-665	218 (+)
TOTAL DEPTH (Logger)	(1006)	(-883)	

4.4 Stratigraphy

The following summarises the stratigraphy of lithologic units encountered in Etingimbra-1 . A more detailed description of lithologies as described during drilling is presented on the Mudlog (Encl. 2). An interpretation of the sequence from both the Mudlog information and wireline logs is presented on the Composite Well Log (Encl. 1).

As indicated on Table 2, the top of the Cadna-Owie Formation and the Base Permian-Carboniferous Unconformity were encountered within 3 - 6 metres of the depths prognosed from seismic data. Other prognosed formation tops and boundaries within the sequence were based primarily on extrapolation of unit thicknesses from McDills-1 and the variations of actual depths by up to 59m from prognosis are not surprising given the lateral variations in unit thicknessess and stratigraphy to be expected above and below the two main unconformities in the region. As prognosed, and as at McDills-1, the Lower Jurassic Poolowanna Formation (at the base of Eromanga Basin sequence) and the underlying Triassic Simpson Desert Basin sequence are absent along the McDills Anticlinal Trend including Etingimbra-1.

TABLE 2 - PREDICTED VERSUS ACTUAL FORMATION TOPS

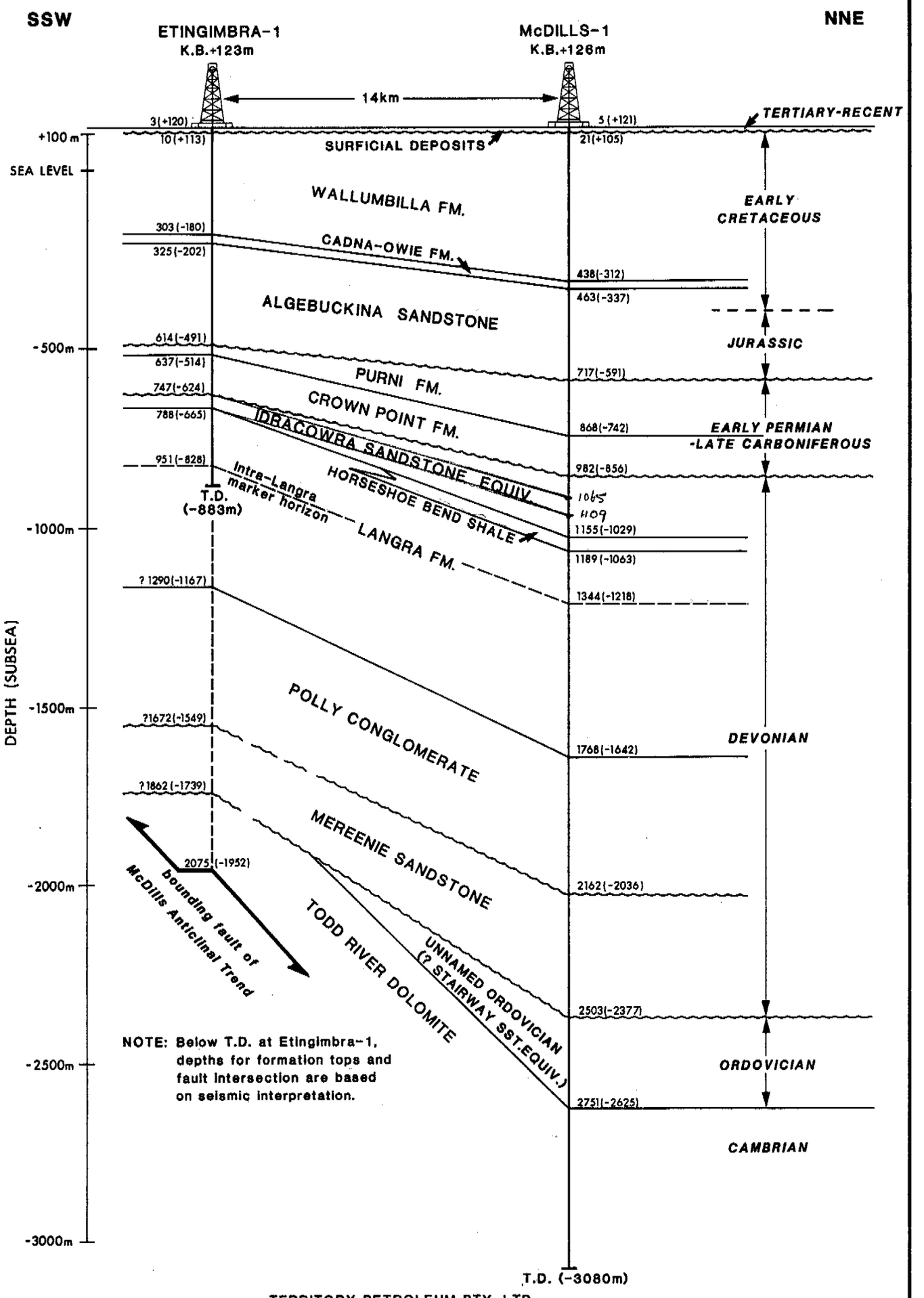
	Subsea Depth m		Difference to Prognosis (m)
	Predicted	Actual	
Top Cadna-Owie Formation	-183	-180	-3
Top Algebuckina Sandstone	-196	-202	+6
Base Jurassic Unconformity/ Top Purni Formation	-460	-491	+31
Top Crown Point Formation	-535	-514	-21
Base Permian-Carb. Unconformity/ Top Idracowra Sandstone Equivalent	-618	-624	+6
Top Horseshoe Bend Shale	-639	absent	---
Top Langra Formation	-724	-665	-59

A correlation of stratigraphic units between Etingimbra-1 and McDills-1 is shown on Figure 4.

TERTIARY-RECENT

Surficial Deposits — Surface to 10m (+120m to + 113m)
Thickness: 7m

Surface to 10m: SAND, clear, fine-medium, friable to loose, subangular to subrounded, moderately sorted, trace yellow, argillaceous matrix, trace silica cement.



TERRITORY PETROLEUM PTY. LTD.

STRATIGRAPHIC CORRELATION, ETINGIMBRA-1 TO McDILLS-1, ALONG McDILLS ANTICLINAL TREND

FIGURE 4

EARLY CRETACEOUS

Wallumbilla Formation ("Rumbalara Shale" of Amerada, 1965)
10-303m (+113m to -180m)
Thickness: 292m

10 - 25m: Weathered CLAYSTONE, light yellow brown, soft when wet.

25 - 155m: Claystone grading to Siltstone, with occasional thin interbeds of Limestone. CLAYSTONE, mainly grey to dark grey, part light grey, silty in part, trace carbonaceous laminae, firm, blocky. SILTSTONE, mainly grey to dark grey, part light grey, argillaceous, trace very fine carbonaceous specks, firm, blocky. LIMESTONE, grey to light brown micritic, silty, trace carbonaceous specks, hard.

155- 303m: SILTSTONE, as above, often with abundant very dark green glauconite, grades to CLAYSTONE, with bulk of sampls washing into suspension. Traces of pyrite and pyritised fossil debris (mainly (?) Inoceramus) Occasional thin interbeds of LIMESTONE, as above.

Cadna-Owie Formation 303-325m (-180m to -202m)
Thickness: 22m

303 - 325m: SANDSTONE, mainly white to light grey, fine grained, occasionally medium to coarse, subangular to subrounded, moderately to well sorted, calcite-cemented in uppermost 4 metres (303-307m), hard, no visual porosity. Below 307m partly silica-cemented, but partly loose in cuttings, wireline logs suggest presence also of argillaceous matrix probably washing out of cuttings. Also minor thin stringers and interbeds of DOLOMITE, tan, cryptocrystalline, hard, tight.

JURASSIC-EARLY CRETACEOUS

Algebuckina Sandstone 325-614m (-202m to -491m)
Thickness: 289m

325 - 614m: Massive Sandstone, with very minor, thin Claystone interbeds or laminae. SANDSTONE, light grey, quartzose, grains mainly clear to translucent, mainly medium to coarse, ranging fine to very coarse in part, poorly to mainly moderately to well sorted, subangular to subrounded, clean, as loose grains in samples. Interpreted very good porosity, trace silica cement in uppermost 39m (325 - 364m) but high drill rate suggests high permeability, trace pyrite. Minor CLAYSTONE, grey to dark grey, silty, moderately hard, blocky. Minor COAL at approximately 595m, black, subvitreous to vitreous, bituminous, hard, angular to subconchoidal fracture.

The Base Jurassic Unconformity is picked at 614m (-419m) at the base of the massive Alegebuckina Sandstone.

LATE CARBONIFEROUS-EARLY PERMIAN

At the time of this report, no age dating has been completed on samples from the well but on seismic data the 133m thick interval encountered between 614m and 747m corresponds to a zone which is clearly bracketed by the Base Jurassic Unconformity and the Base Permian - Carboniferous Unconformity. The lower unconformity was penetrated close to the depth prognosed from the pre-drill seismic interpretation and is well defined on log character and by the presence of a basal conglomerate in the Crown Point Formation.

Purni Formation 614-637m (-491m to-514m)
Thickness: 23m

The recognition of the lowermost section of the Purni Formation in Etingimbra-1 is based on lithology, log character, and correlation with McDills-1. The base of the unit is picked at the top of an underlying sandstone unit which is here considered to be part of the underlying Crown Point Formation. The top of a probable equivalent sandstone in McDills-1, which is picked at 868m (-742m) in that well, was previously placed by Youngs, 1975, in the lower part of the Purni Formation as the sandstone appears fluviatile rather than glacigene in character. However, more recent well control to the south suggests that despite glacial influences, deposition of the Crown Point Formation occurred in fluvial and lacustrine environments.

Based on log character, the pick for the base of the Purni Formation in Etingimbra-1 appears appropriate, but formal revision of the definition of the Late Carboniferous-Permian stratigraphic units awaits further review of well correlations within the Pedirka Basin region, combined with new palynological studies. The upper coal-bearing member of the Purni Formation as encountered in McDills-1 is absent in
Etingimbra-1 due to erosional truncation at the Base Jurassic Unconformity across the Etingimbra structure.

The (?) Purni Formation section encountered is as follows:

614-637m:	Mainly Shale/Claystone with interbeds of Sandstone up to 3 metres thick. Minor Siltstone. SHALE/CLAYSTONE, mainly light to medium grey, partly light to medium greenish-grey, soft to firm, occasionally blocky, non-calcareous, (poor sample returns, due to clay dispersing in mud system). SANDSTONE, light grey, fine-medium, part loose in samples, probably with clay matrix in part (washing out), part silica and calcite-cemented.

Crown Point Formation 637-747m (-514m to -624m)
Thickness: 110m

637-648m:	Massive SANDSTONE, light grey, medium, upper 4 metres hard and silica/calcite-cemented, remainder loose, clean, subrounded to rounded, mainly well sorted, grains frosted in part, clear to occasionally milky quartz, minor pyrite cement.
648 - 720m:	Interbedded and intergrading Claystone, Siltstone and Sandstone. Possibly including glacial tills (interpretive). CLAYSTONE/SILTSTONE, mainly light grey, medium to dark grey and trace carbonaceous below 71m, mainly soft and sticky (washing out of samples, poor returns), occasionally firm to hard and moderately to very calcareous. SANDSTONE, mainly very fine to fine, loose in cuttings and passing through shale shaker screens, probably kaolin matrix dispersing in mud system, part fine to medium (665 - 671m), subrounded to rounded, moderately to well sorted, partly with silica and calcite cements and kaolin matrix, trace pyrite, inferred moderate to good porosity in part.

720 - 747m: Sandstone with minor Claystone and Siltstone. Conglomeratic SANDSTONE, light grey, very fine to fine, part pebbly, variable quantity of lithic fragments ranging light greenish and reddish, quartzite, granitic and occasionally volcanic pebbles, mainly hard and tightly silica and calcite-cemented, occasionally friable to loose with good porosity, common pyrite. CLAYSTONE/SILTSTONE as above (poor returns).

The basal, conglomeratic sandstone unit at 720-747m is interpreted as correlating to a similar unit at 956 - 982m in McDills-1 and is consistent with initial deposition across a significant regional, angular unconformity. The base of the unit in McDills-1 was also tentatively interpreted by Youngs, 1975, as corresponding to the Base Permian - Carboniferous Unconformity.

The lithology of the basal unit at Etingimbra-1 also has strong similarities in part to Unit "C" of the Crown Point Formation as encountered at Dalmatia-1 (interval 663-945m) and Mt. Hammersley-1 (interval 1245-1592m), respectively 45km and 90km to the southwest in South Australia. Palynology indicates a Late Carboniferous age for the unit in those wells (Santos, 1988 a,b).

DEVONIAN

Idracowra Sandstone Equivalent 747-788m (-624 to -665m)
Thickness: 41m

Based on lithology and its position below the Base Permian-Carboniferous Unconformity and above the Langra Formation, the interval 747-778m is interpreted as a partial equivalent of the Idracowra Sandstone. The interval may correlate to the interval 1065-1109m in McDills-1. This suggests:

a) the upper, 83m thickness of Idracowra between 982 and 1065m in McDills-1 has been removed by erosion at the Base Permian-Carboniferous Unconformity, and;

b) the lower 167m thickness of Idracowra, between 1109m and 1155m in McDills-1 is absent at Etingimbra-1 possibly due to stratigraphic wedge-out and onlap over the Langra Formation (and Horseshoe Bend Shale, elsewhere). The latter implies a disconformable relationship between the Idracowra and the underlying unit/s which agrees with the outcrop interpretation (Youngs, 1975).

The lithological units within the Idracowra Sandstone Equivalent at Etingimbra-1 are as follows:

747-757m: CLAYSTONE, light grey to light grey brown, soft, dispersive.

757-776m: SANDSTONE, light grey; - Upper 12 metres light grey, medium-coarse, subrounded to rounded moderately sorted, loose in sample, part pyritic, inferred good porosity; - Lower 7 metres light grey to light grey green, very fine, subrounded, well sorted, silica and calcite-cemented, pyritic, hard, tight.

776-788m: CLAYSTONE as above, soft, dispersive, with very poor sample returns, mainly (?) light grey, with SILTSTONE, dark grey, argillaceous, firm, blocky to subfissile.

Langra Formation 788-1006m (T.D.) (-665m to -883m)
Thickness: 218m(+)

At Etingimbra-1 the Langra Formation is directly overlain by the Idracowra Sandstone Equivalent. The distinctive red and green shale and siltstone of the Horseshoe Bend Shale, which overlies the Langra Formation in McDills-1 (interval 1155-1189m), are absent in Etingimbra-1, possibly due to non-deposition or local erosion preceding deposition of the Idracowra equivalent in the Etingimbra area. The 218m section of Langra Formation penetrated in Etingimbra-1 correlates approximately to the interval 1189-1400m in McDills-1. Two broad, coarsening-upward cycles are apparent from wireline logs, with the top of the lower cycle occurring at 951m in Etingimbra-1 and 1344m in McDills-1. In the Etingimbra-1 area this boundary represents a local, intra-Langra Formation seismic reflector.

The lithologies in Etingimbra-1 are as follows:

788-951m: Massive Sandstone with minor Claystone.
SANDSTONE, light grey with scattered orange to red brown grains, mainly medium grained, ranging to coarse in part, well sorted, rounded, mainly as loose gains, often calcite-cemented in part but friable, traces of argillaceous matrix, trace pyrite, inferred good porosity. This lithology quite closely resembles the description of the cross-bedded sandstone in Core-11 (interval 1265-1270m) in McDills-1 which may be stratigraphically equivalent to a depth of around 865-870m in Etingimbra-1. As there is no evidence of lithic clasts, the partly shaley gamma-ray response of this unit suggests the presence of some clay matrix (? kaolin) mainly washing out of samples, but consistent with the mainly white appearance of the core in McDills-1.

Minor CLAYSTONE occurs below 825m, grey, grey green, red brown to slightly purplish, soft to firm, partly dispersive, variably calcareous to slightly dolomitic. The "Claystone" may be in the form of pebble-sized clasts contained within the sandstone rather than as discrete interbeds or laminae (c.f. McDills-1 Core-14, interval 1555-1560m).

951-1006m (T.D.): Massive Sandstone, similar to above. SANDSTONE, light grey, scattered orange-yellow grains, clear to translucent quartz, fine to mainly medium, rounded, well sorted, traces of white clay matrix, mainly as loose grains in samples, slightly to moderately calcareous in part and friable to moderately hard in part, mainly good inferred porosity.

4.5 Structure

Mapping of the Etingimbra structure was based on interpretation of 1985 (24-fold) and 1987 (30-fold) seismic data which is of very good quality, though some loss of coherency of deeper events is apparent in some areas probably due to multiple energy from the strong Permian coal reflectors interfering with reflections from the deeper part of the section.

Seismic strike line 87NT-07 provided a direct tie from McDills-1 well to the Etingimbra Prospect. Attempts at tying the deeper events to wells in the south in South Australia were unsuccessful mainly due to difficulties in correlating across large fault throws and due to poorer data quality beneath the Permian section.

Structural closure was mapped at several potential objective levels including Top Cadna-Owie Formation (near-top Algebuckina Sandstone, Fig.6), Top Crown Point Formation, and Top Langra Formation (Fig. 5). Closure at Top Langra level was the best developed, with vertical relief of 170 milliseconds TWT (250m$\pm$) and 23 sq km of areal closure.

The probable disconformity at the top of the Langra Sandstone does not provide a continuous coherent reflection along the McDills Trend and its identification across Etingimbra was further complicated by interference from diffractive energy produced from the Base Permian-Carboniferous Unconformity across the crest of the structure (Figs 7 & 8). However, a deeper intra-Langra event, encountered at 951m (-828m) in Etingimbra-1, provided a good reflector across the structure which was mapped locally and confirmed the validity of the structural form mapped at Top Langra level (Fig 5).

No dipmeter was run in the well, but the seismic interpretation suggests the well was located close to the structural crest at both the Top Cadna-Owie and Top Langra levels (Figs 5 and 6).

Seismic data provides good evidence that the Etingimbra structure was already developed as a structural high by the Late Devonian - Early Carboniferous, during the Alice Springs Orogeny, at which time the McDills Anticlinal Trend began forming as a structural inversion. Substantial westward thickening of the deeper part of the Devonian sequence lying beneath the total depth of Etingimbra-1 is evident on Figure 7 (seismic line 87NT-15, part). The subsequent inversion resulted in the truncation of part of the shallower Devonian sequence (i.e. much of Idracowra Sandstone Equivalent) at the Base Permian - Late Carboniferous Unconformity across the crest of the newly developing Etingimbra high (see Figs 7 & 8). Further growth of the structure occurred during the Late Permian - Early Jurassic (corresponding to the Base Jurassic Unconformity) and during the Tertiary.

4.6 Relevance to Occurrence of Hydrocarbons

No hydrocarbon shows were encountered during the drilling of Etingimbra-1 and wireline log analysis confirmed all porous zones to be 100% water-saturated.

As anticipated, potential hydrocarbon source rocks present in the coal-bearing upper section of the Permian Purni Formation in McDills-1 were absent in Etingimbra-1 due to erosional truncation beneath the Base Jurassic Unconformity. However, the coal bearing sequence should be preserved in the adjacent Eringa Trough which would have begun developing contemporaneously with the structural inversion and uplift along the McDills Trend during the Alice Springs Orogeny in the Late Devonian - Early Carboniferous.

The overall formation temperature gradient down to total depth in Etingimbra-1 of $3.9^{o}C/100m$ ($2.15^{o}F/100ft$; based on extrapolated bottom hole temperature; Appendix 1) implies that at present day, adequate temperatures for oil generation from suitable source material could be reached at a depth of around 2000m($\pm$) in the Eringa Trough. The Early Permian Purni Formation is a lateral equivalent of the lower Patchawarra Formation of the Cooper Basin and thus may lie beneath a much thicker, younger Permian sequence (upper Patchawarra to Daralingie Formation equivalents) preserved within the Eringa Trough. If such is the case the potential source beds of the Purni Formation would be sufficiently buried for hydrocarbon generation.

The lack of any hydrocarbon indications in the well, particularly within the uppermost Algebuckina Sandstone or overlying Cadna-Owie Fm, despite the presence of a good regional seal and closure at that level, suggests that either;

a) no hydrocarbon generation has occurred in the trough, or,

b) the major thrust fault separating the McDills Anticlinal Trend from the Eringa Trough has acted as a barrier to migration.

Hydrocarbon entrapment within the pre-Jurassic sequence encountered at Etingimbra-1 was also precluded by the lack of any adequate seals within that sequence, the maximum individual "clean" shale bed thickness being only 12m, immediately overlying the Langra Formation. Absence of the Horseshoe Bend Shale (34m thick in McDills-1) in particular downgrades the potential of the Devonian play in this region.

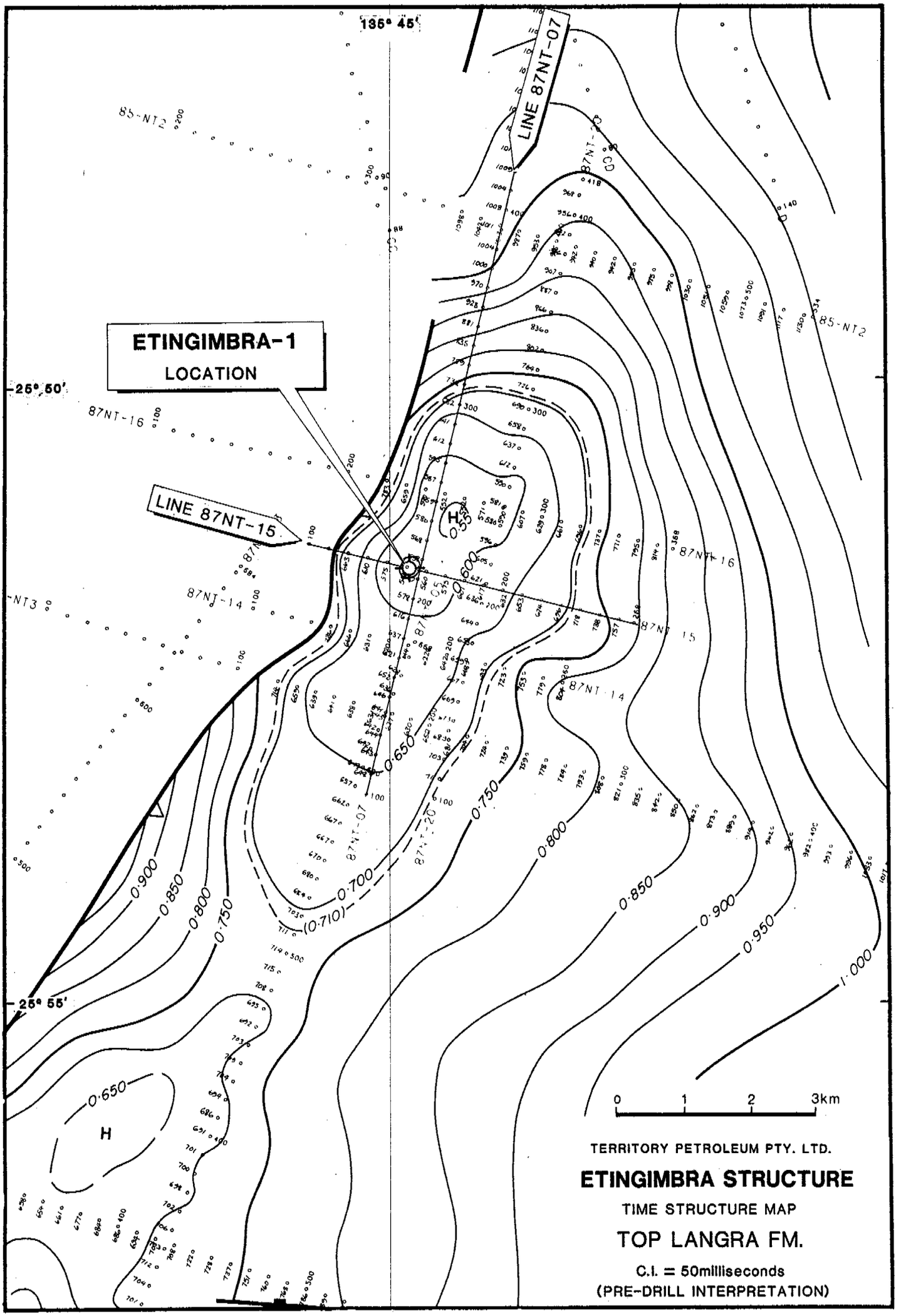

135° 45'
25° 50'
25° 55'
ETINGIMBRA-1
LOCATION
LINE 87NT-07
LINE 87NT-15
87NT-16
87NT-14
87NT-15
87NT-07
87NT-20
85-NT2
0·600
0·650
0·700
(0·710)
0·750
0·800
0·850
0·900
0·950
1·000
H
0 1 2 3km
TERRITORY PETROLEUM PTY. LTD.
ETINGIMBRA STRUCTURE
TIME STRUCTURE MAP
TOP LANGRA FM.
C.I. = 50milliseconds
(PRE-DRILL INTERPRETATION)

FIGURE 5

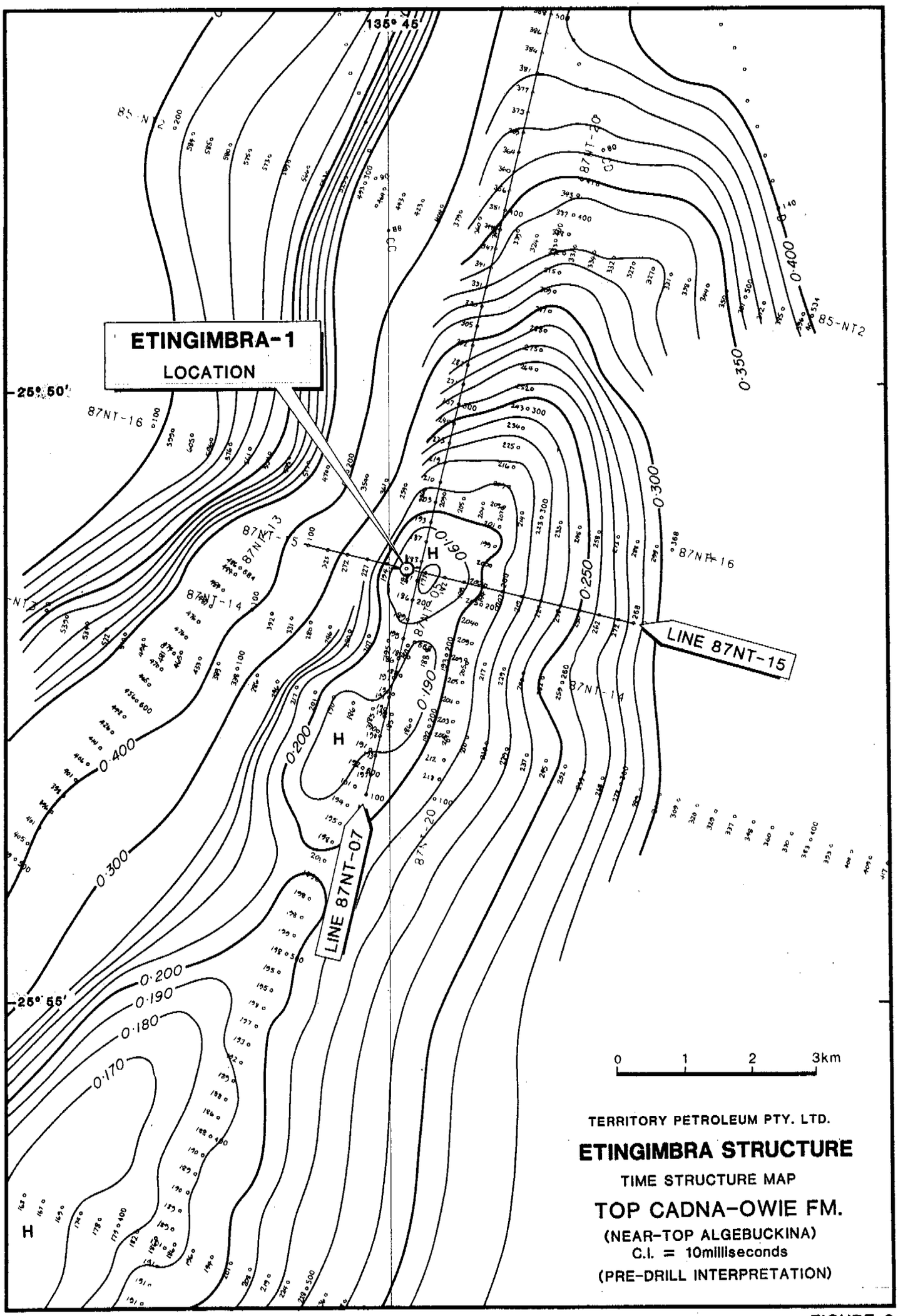

135° 45'
ETINGIMBRA-1
LOCATION
25° 50'
25° 55'
LINE 87NT-15
LINE 87NT-07
87NT-16
87NT-13
87NT-14
87NT-20
87NT-18
85-NT2
0·400
0·350
0·300
0·250
0·200
0·190
0·180
0·170
H
0
1
2
3km
TERRITORY PETROLEUM PTY. LTD.
ETINGIMBRA STRUCTURE
TIME STRUCTURE MAP
TOP CADNA-OWIE FM.
(NEAR-TOP ALGEBUCKINA)
C.I. = 10milliseconds
(PRE-DRILL INTERPRETATION)

FIGURE 6

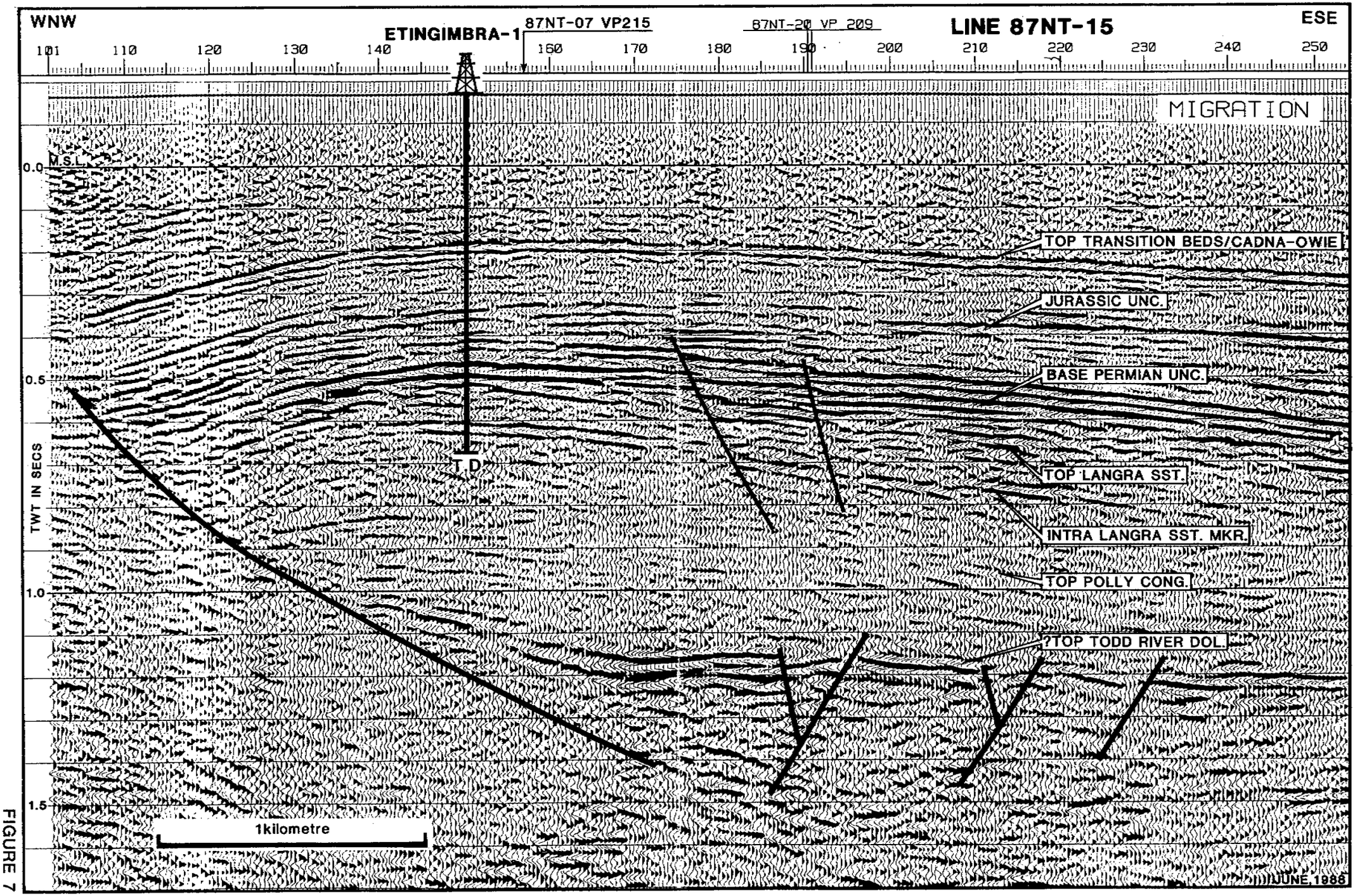

WNW
ETINGIMBRA-1
87NT-07 VP215
87NT-20 VP 209
LINE 87NT-15
ESE
101
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
MIGRATION
M.S.L.
0.0
0.5
1.0
1.5
TWT IN SECS
T.D.
TOP TRANSITION BEDS/CADNA-OWIE
JURASSIC UNC.
BASE PERMIAN UNC.
TOP LANGRA SST.
INTRA LANGRA SST. MKR.
TOP POLLY CONG.
?TOP TODD RIVER DOL.
1kilometre
JUNE, 1988

FIGURE 7

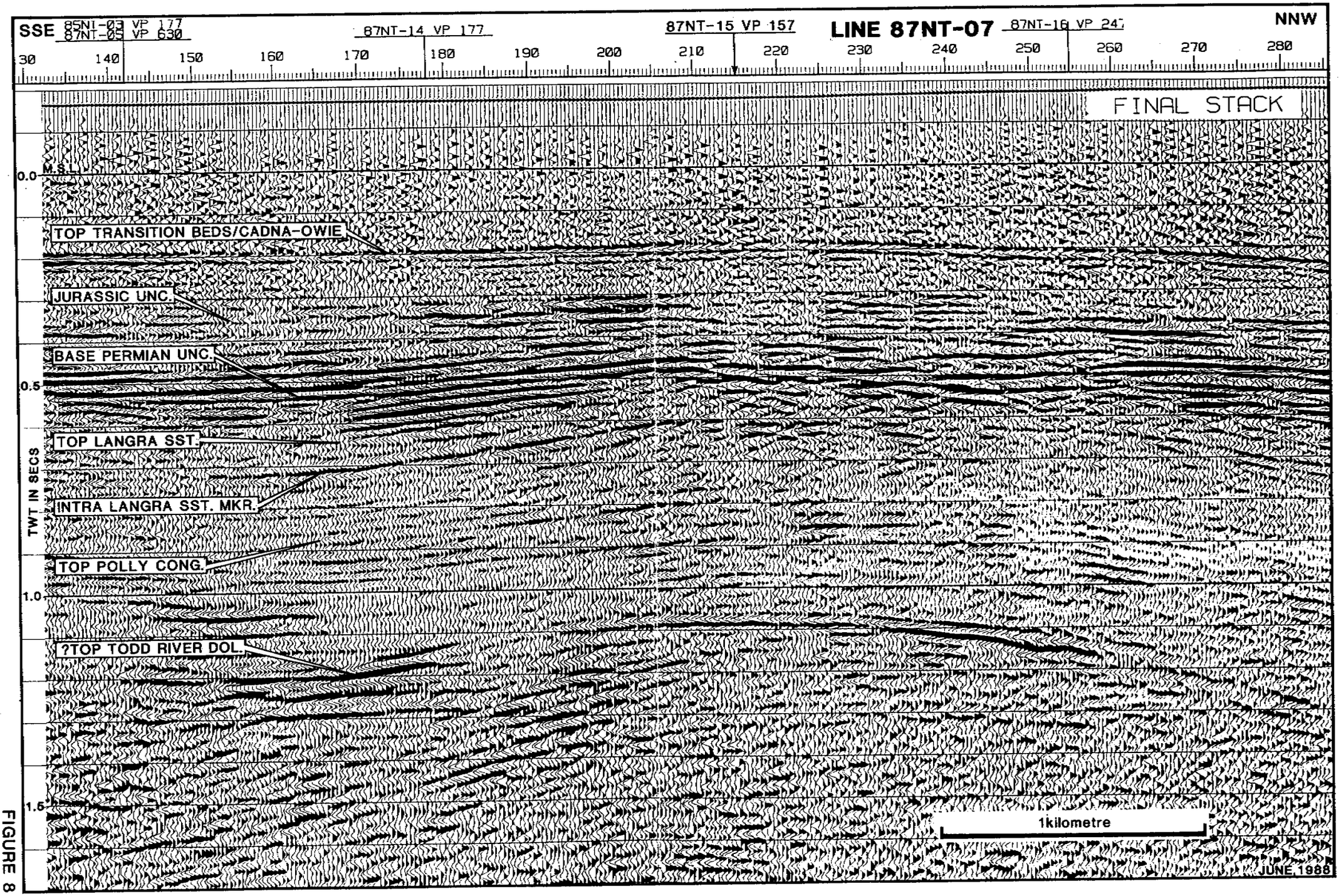

SSE
85NT-03 VP 177
87NT-05 VP 630
87NT-14 VP 177
87NT-15 VP 157
LINE 87NT-07
87NT-16 VP 247
NNW
30
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
FINAL STACK
M.S.L.
0.0
0.5
1.0
1.5
TWT IN SECS
TOP TRANSITION BEDS/CADNA-OWIE
JURASSIC UNC.
BASE PERMIAN UNC.
TOP LANGRA SST.
INTRA LANGRA SST. MKR.
TOP POLLY CONG.
?TOP TODD RIVER DOL.
1kilometre
JUNE 1988

FIGURE 8

4.7 Porosity, Permeability and Formation Water Salinities

All objective sequences within the well proved to contain sandstones with good potential reservoir quality. For the cleanest, least cemented sandstones, log-derived porosities are as follows:

Unit	Porosity
Algebuckina Sandstone - uppermost 40m	29-32%
Purni Formation - thin sands only	31 - 32% (max)
Crown Point Formation	28 - 30% (max)
Idracowra Sandstone Equivalent -upper 10m of middle sandstone unit	25 - 28%
Langra Formation	25 - 27%

The fine grained sandstones of the Cadna-Owie Formation overlying the Algebuckina Sandstone are interpreted as having very low effective porosity.

Based on Bureau of Mineral Resources core analysis data from McDills-1, the more porous sandstones encountered in Etingimbra-1 are also likely to have fair to excellent permeability; e.g. Cores from the lower member of the Purni Formation in McDills-1 gave porosities of 19-22% and permeabilities of 135-187md (Cores 2 and 3); the Idracowra Sandstone gave core porosities of 22-23% with permeabilities ranging 31-650md (Cores 7 & 8); and for the section of Langra Formation in McDills-1 equivalent to that penetrated in Etingimbra-1, core porosities range 20-24% with permeabilities of 54-1250md (Cores 11 & 12).

Porosities in the Permian-Carboniferous and Devonian sandstones in Etingimbra-1 appear on average to be approximately 3-5 porosity units greater than in the equivalent sandstones in McDills-1. This reflects the significantly shallower depth of burial of these sediments at Etingimbra-1 (see Fig. 4).

Log-calculated water salinities confirm fresh formation waters (1700-3000 ppm NaCl equivalent) throughout the Algebuckina Sandstone, the major artesian aquifer in the region. Within the underlying Carboniferous section, salinities remain relatively fresh, rising from 3300 ppm NaCl equivalent in the Purni Formation to around 5000 ppm in the uppermost sandstone of the Crown Point Formation. Salinity increases to around 8500-9000 ppm in the basal sandstone of the Crown Point Formation and remains similar in the underlying Devonian sequence.

4.8 Conclusions

i) Etingimbra-1 is considered to have been a valid test of the hydrocarbon potential of a large, well defined anticlinal structure located on the major McDills Anticlinal Trend. Lack of any hydrocarbon indications in the well suggests either a lack of significant hydrocarbon generation in the adjacent Eringa Trough, or, assuming generation has occurred in the Trough, the major thrust fault separating the McDills Anticlinal Trend from the Eringa Trough has acted as a barrier to hydrocarbon migration from the trough into the Etingimbra structure.

ii) As anticipated, sandstones with good potential reservoir quality were encountered throughout much of the drilled sequence. However, the only potential top seal of regional significance appears to be the massive claystone of the Early Cretaceous Wallumbilla Formation. Shales/claystones deeper within the sequence are relatively thin (maximum 12 metres) and are unlikely to provide adequate seals. The distinctive Horseshoe Bend Shale was not developed at Etingimbra-1, with the result that the massive sandstones of the Devonian Langra Formation, the main objective in the well, lacks an adequate seal. This downgrades the potential of the Devonian play in the region.

iii) Future exploration in the region could be directed towards identifying prospects within the Eringa Trough where potential source beds within the Early Permian Purni Formation (as identified in McDills-1) may be sufficiently buried for hydrocarbon generation with sandstones within the Permian or shallower sequences providing potential reservoirs.

iv) The 174m of section preserved in Etingimbra-1 between the Top Langra Formation (Devonian) and the base of the Algebuckina Sandstone (Base Jurassic Unconformity) compares to a substantially thicker equivalent section in McDills-1 of 472m. i.e. a relative loss of almost 300m of section has occurred at Etingimbra-1. This apparent thinning is largely due to erosional truncation at the two major unconformities, with 128m of Purni Formation being removed at the Base Permian - Late Carboniferous Unconformity. Seismic data indicate these losses are mainly localised over the Etingimbra Structure and reflect its early development during the Late Devonian - Early Carboniferous (Alice Springs Orogeny) and during the Late Permian - Early Jurassic.

The stratigraphic interpretation of the Top Langra to Base Algebuckina sequence at Etingimbra-1 presented in this report is well supported by the available 1985 and 1987 seismic data. However, future palynological study of this part of the sequence is also recommended in combination with a review of regional stratigraphic correlations within the Pedirka Basin.

5. REFERENCES

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Beer, B., 1985	1985 Etingimbra Seismic Survey - Final Field Operations Report (for Adelaide Petroleum N.L.)
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Santos Ltd, 1988 (b)	Mt. Hammersley-1 Well Completion Report. Report. Dalhousie Block, South Australia.
Youngs, B.C., 1975	The Geology and Hydrocarbon Potential of the Pedirka Basin. Geol. Surv. of S.A., Report of Investigations 44.

BOTTOM HOLE TEMPERATURE EXTRAPOLATION
DATA SHEET

WELL IDENTIFICATION

COMPANY: HORIZON OPERATING CO. – BENNETT PETROLEUM

WELL: EATNGIMBRA-1

FIELD: WILDCAT

BASIN: EROMANGA – PEDIRKA – AMADEUS

STATE: N.T.

LOCATION: PERMIT EP-1 ; LAT. 25°51'26.16"S LONG. 135°45'09.06"E
(Survey, Section, Twp., Rge.)

ELEVATION OF REFERENCE DATUM: K.B. 123m

DEPTH INFORMATION

TOTAL DEPTH: 1006m (LOGGER)

FORMATION AT TOTAL DEPTH: LANGRA FM. (DEVONIAN)

LITHOLOGY AT TOTAL DEPTH: Massive sandstone

TEMPERATURE DISTURBANCE DATA

A. TIME BIT REACHED TOTAL DEPTH (Hr., Date): 1615 hrs 18-1-90

B TIME CIRCULATION STOPPED (Hr., Date): 0444 hrs 19-1-90

CIRCULATING TIME (T): 12 hrs 29 mins

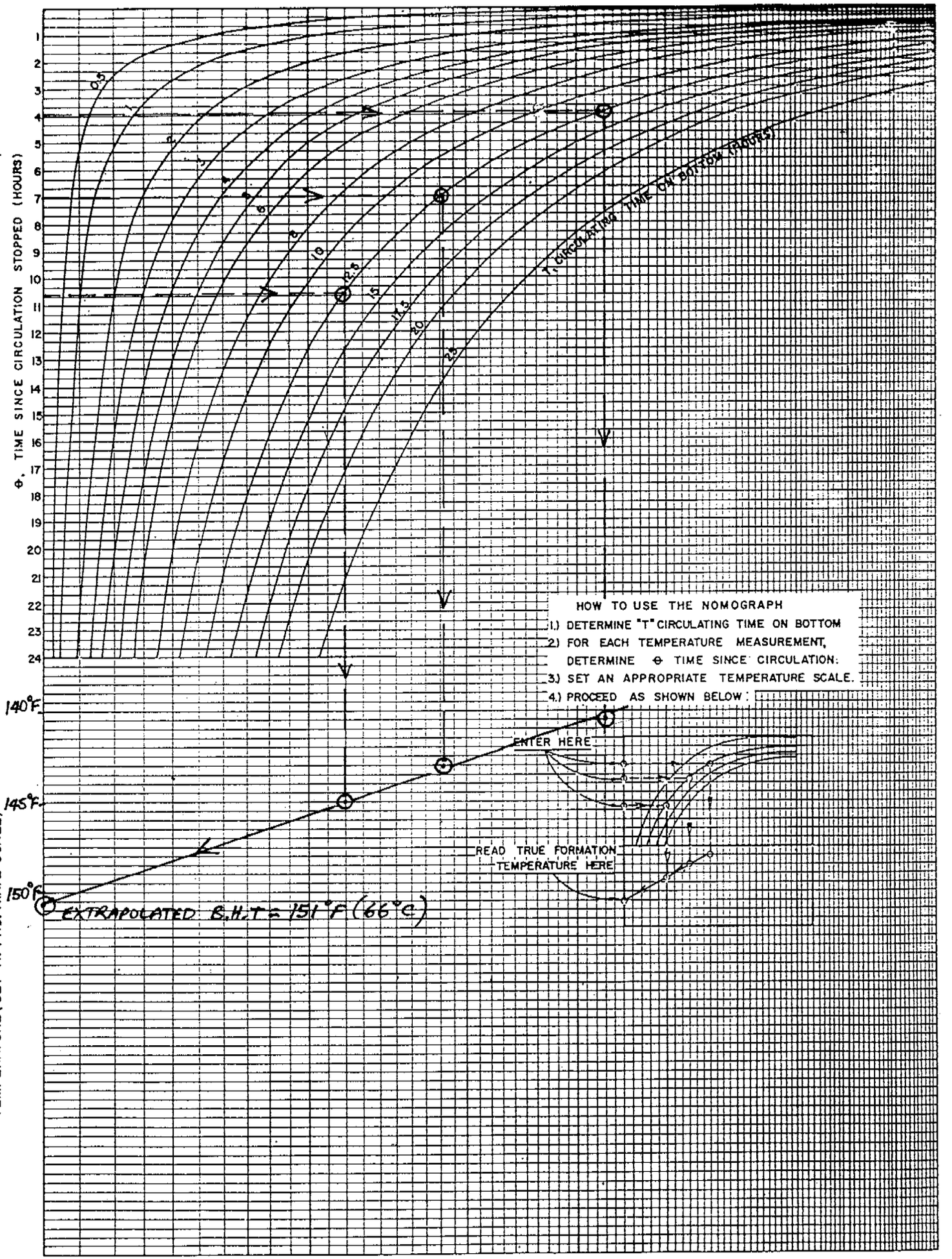
TEMPERATURE RECOVERY DATE

LOG SUITE N°: 1

	1	2	3	4	5
Log Type (IES, Sonic, CDM, etc)	DLL-MSFL-GR	BCS-GR	CDL-CNS-GR		
Time Sonde Off Bottom (Hour Date)	0838 hrs 19-1-90	1143 hrs 19-1-90	1520 hrs 19-1-90		
Maximum Temperature Recorded (°C)	60.5°C (141°F)	61.6°C (143°F)	62.8°C (145°F)		
Time Since Circulation Stopped θ	3hr 54mins	6hr 59mins	10hr 36mins		

REMARKS

From attached graphical solution;
EXTRAPOLATED BHT @ 1006m (T.D.) = 66°C / 151°F
Assuming an ambient temp. of 27°C / 80°F
TEMPERATURE GRADIENT = 3.9°C/100m (2.15°F/100ft)
D.G. Osborne (Territory Petroleum Pty Ltd)



BOTTOM HOLE TEMPERATURE EXTRAPOLATION NOMOGRAPH