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MRC9205017-ACM

SAGASCO RESOURCES LIMITED

PROPOSAL TO DRILL
KING 1
T/18P, BASS BASIN,
TASMANIA

by AC Migliucci, RJ Suttill & AJ Waldron
June 1992

OR_301

SUMMARY

It is proposed to drill the exploration well King 1 at a location approximately 2km southwest of Cormorant 1 on the intersection of seismic lines HB77A-306 and HB77A-314, in permit T/18P, offshore Bass Basin. Water depth at this location is 75m.

The objective of the well is to evaluate the oil potential of the upper Eastern View Coal Measures (EVCM) at the crest of the Cormorant anticline, updip from Cormorant 1 where encouraging shows were recorded. Penetration of the Eocene *N.asperus* level primary target is predicted at 1458m subsea and the prognosed total depth of the well is 2200m subsea near the base of the upper *M.diversus* zone of the EVCM.

The reserves potential for the King prospect, assuming 15m of pay at the primary target level, is 79 MMSTB oil-in-place updip of Cormorant 1. Reserves for the entire greater Cormorant structure, assuming 40m of net pay, are estimated to be 980 MMSTB oil-in-place. Reservoir quality and hydrocarbon deliverability pose the greatest risks to the commercial success of King 1.

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1 INTRODUCTION

1.1 Geographical Location

The proposed King 1 well is located approximately 2km southwest of Cormorant 1 at the intersection of seismic lines HB77A-306 (SP300) and HB77A-314 (SP691), within permit T/18P of the offshore Bass Basin (Figure 1). The location lies 192km northwest of Devonport (Tasmania) and 85km southwest of Wilson's Promontory (Victoria). The water depth at this location is 75m. The anticipated spud date is August 1992 and the Ocean Epoch semi-submersible rig will be used for drilling the well. A summary of the prospect is displayed in Table 1.

1.2 Permit Details

The prognosed King 1 well is located in petroleum exploration licence T/18P which was granted on 24/7/80. The permit is in its final year of the first renewal period (Table 2). The participating company interests are:

SAGASCO Resources Limited	55% (Operator)
Gas and Fuel Exploration NL	20%
Cultus Petroleum (Australia) NL	15%
Petroz NL	10%

1.3 Well Data

Six petroleum exploration wells have been drilled in T/18P (Figure 1). Four of these wells encountered hydrocarbon shows but no commercial discoveries have been made to date (Table 3). The most significant well is Cormorant 1 which is located two kilometres downdip on the same structure as the proposed King 1 well. This well, and other nearby wells such as Koorkah 1 (the most recent well drilled in T/18P) and Yolla 1 (an oil and gas discovery in T/RL1) provide stratigraphic control.

1.4 Seismic Data

A listing of all seismic surveys undertaken in the T/18P area is given in Table 4. The first data were acquired by Esso in 1963 and the most recent data by Shell in 1990. Most of the regional seismic data were shot by AMOCO, in conjunction with gravity and magnetic data, during the 1984-1985 surveys.

The data used for the mapping of the King prospect predominantly comprised the 1977 data acquired by Hematite Petroleum Limited (reprocessed by SAGASCO Resources Limited in 1991) and the 1990 data acquired by Shell.

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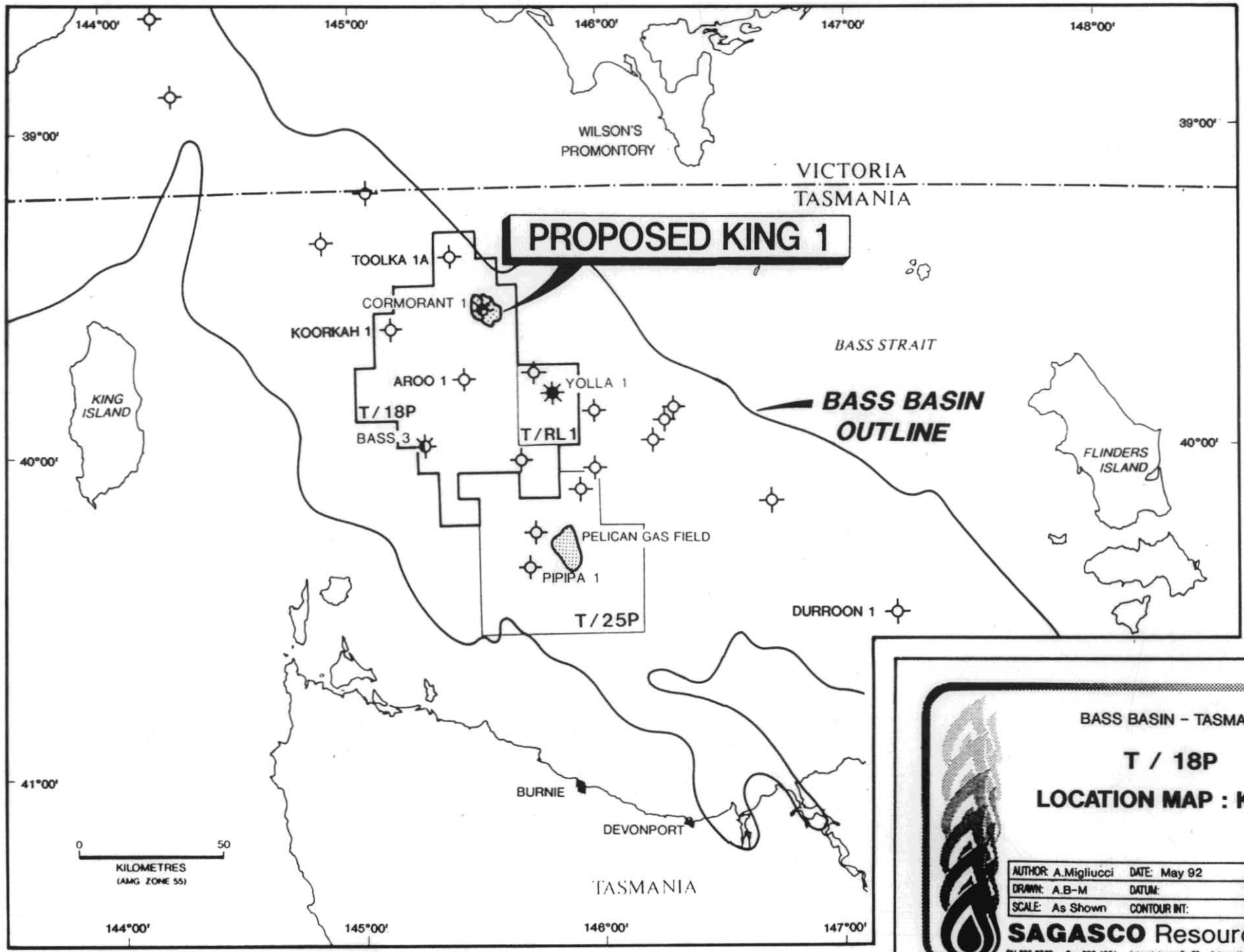

BASS BASIN – TASMANIA

T / 18P

LOCATION MAP : KING 1

AUTHOR: A.Migliucci	DATE: May 92	PLAN No: KG000.8549
DRAWN: A.B-M	DATUM:	CHECKED:
SCALE: As Shown	CONTOUR INT:	FIG: 1

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TABLE 1

PROSPECT SUMMARY: KING 1

WELL NAME	King 1	
LOCATION	Latitude : 39° 35' 24.37"S Longitude : 145° 31' 08.80"E Seismic : HB77A-306 (SP300) Approximately 2km southwest of Cormorant 1 and 192km northwest of Devonport (Tasmania)	
PERMIT	T/18P BASS BASIN	
INTEREST HOLDERS	SAGASCO Resources Limited Gas and Fuel Exploration NL Cultus Petroleum (Australia) NL Petroz NL	55% (Operator) 20% 15% 10%
TYPE OF WELL	Exploration	
ANTICIPATED SPUD	August 1992	
ELEVATION	Water Depth 75 metres Kelly Bushing To be determined	
PROPOSED TD	2200 metres subsea	
PRIMARY OBJECTIVE	Upper EVCM (Top EVCM to basal *N.asperus* zone)	
SECONDARY OBJECTIVE	Upper EVCM (basal *N.asperus* to near base upper M.diversus)	

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TABLE 2

WORK PROGRAM COMMITMENTS: PERMIT T/18P

YEAR	ENDING	COMMITMENT	PROGRAM	ACTUAL	PROGRAM
1	24/08/88	Geology @	$250,000	Geology @	$296,000
2	24/08/89	Seismic Interp @	$200,000	Seismic Interp @	$183,000
3	24/08/90	200km Seismic @	$300,000	Geochem Survey @	$423,500
4	24/08/91	Data Review @	$250,000	200km Seismic @	$317,000
5	24/08/92	1 Well @	$5,000,000		

TABLE 3

WELLS DRILLED; PERMIT T/18P

YEAR	WELL NAME	OPERATOR	TARGET	TOTAL DEPTH (M)	RESULT	SHOWS
1967	Bass 3	Esso	EVCM	2432	P&A	Gas Shows
1970	Cormorant 1	Esso	Mid EVCM	3001	P&A	FIT Oil Recovery
1972	Tarook 1	Esso	Top EVCM	2774	P&A	-
1974	Toolka 1A	Esso	EVCM	2715	P&A	Gas & Condensate Shows
1974	Aroo 1	Hematite	Mid EVCM	3692	P&A	Gas & Condensate Shows
1985	Koorkah 1	AMOCO	Basal EVCM	3147	P&A	-

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TABLE 4

SEISMIC ACQUIRED: PERMIT T/18P

YEAR	SURVEY NAME	OPERATOR	KILOMETRES	QUALITY
1963	B	Esso	146.3	Poor
	B63	Esso	263.8	Poor
1965	EB	Esso	62.0	Poor
	EK	Esso	80.2	Poor
1966	ES	Esso	29.5	Poor
1969	B69B	Esso	100.0	Poor
1971	B71A	Esso	230.5	Poor
1972	B72A	Esso	582.5	Poor
1973	HB73A	Hematite	297.3	Poor-Med
1975	HB75A	Hematite	440.5	Med
1977	HB77A	Hematite	318.75	Med-Good
1981	BBS81	Bass Strait Oil & Gas	419.75	Medium
	BCSS81	Bass Strait Oil & Gas	14.75	Medium
1982	82BMR	BMR	178.0	Medium
	BB82A	Bass Strait Oil & Gas	34.5	Medium
1984	TNK4	AMOCO	660.5	Good
1985	TP05	AMOCO	304.25	Good
	TQH5	AMOCO	1135.25	Good
1990	BS90B	SHELL	201.5	V-Good
		TOTAL	5499.85	

2 PROSPECT DESCRIPTION

2.1 Regional Setting

The Bass Basin is one of a series of basins along the southern margin of Australia that were formed as a result of Cretaceous rifting between Australia and Antarctica, and subsequently modified by Late Tertiary compression.

The Pelican and Cormorant Troughs are the two major depocentres of the Bass Basin (Figure 2). The proposed King 1 well lies on the large Cormorant anticline which was formed by structural inversion near the centre of the Cormorant Trough during the Late Tertiary.

2.2 Stratigraphy

The stratigraphic succession in the Bass Basin includes sediments which range in age from the Early Cretaceous to Recent (Figure 3). The Early Cretaceous Otway Group rests unconformably on pre-rift Mesozoic and Palaeozoic rocks but has not been penetrated by any wells in T/18P. The nearest control is provided by Durroon 1, located approximately 175km to the southeast, which penetrated an Early Cretaceous sequence of clastic and volcanoclastic fluvial and deltaic sediments comprising sandstone, siltstone, shale and coal. The Otway Group is considered to be less prospective than the overlying Eastern View Coal Measures on the basis of reservoir and source potential.

The Late Cretaceous to Late Eocene Eastern View Coal Measures (EVCM) unconformably overly the Otway Group and comprise a thick sequence of sandstone, siltstone, shale and coal deposited in fluvial, deltaic and lacustrine environments occasionally subjected to marine inundation. The EVCM are thickest in the centre of the major troughs where seismic data suggest a total thickness greater than 5000m. The thickest sequence drilled is at Pelican 5 (T/25P) where 2507m was penetrated. The EVCM thins markedly towards the basin margins and exhibits both onlap onto basement and erosional truncation following uplift.

A three fold stratigraphic subdivision of the EVCM is recognised based on palynological and microfossil assemblages and unconformities recognised on seismic (SAGASCO Report: *Structural Interpretation of the Cormorant Anticline, 1992*). The intra-formational unconformities are most apparent over basement highs and near to the basin margins, but are less obvious in the centres of the major troughs where continuous deposition occurred. Each of the unconformities corresponds to a period of structural movement accompanied by volcanic activity.

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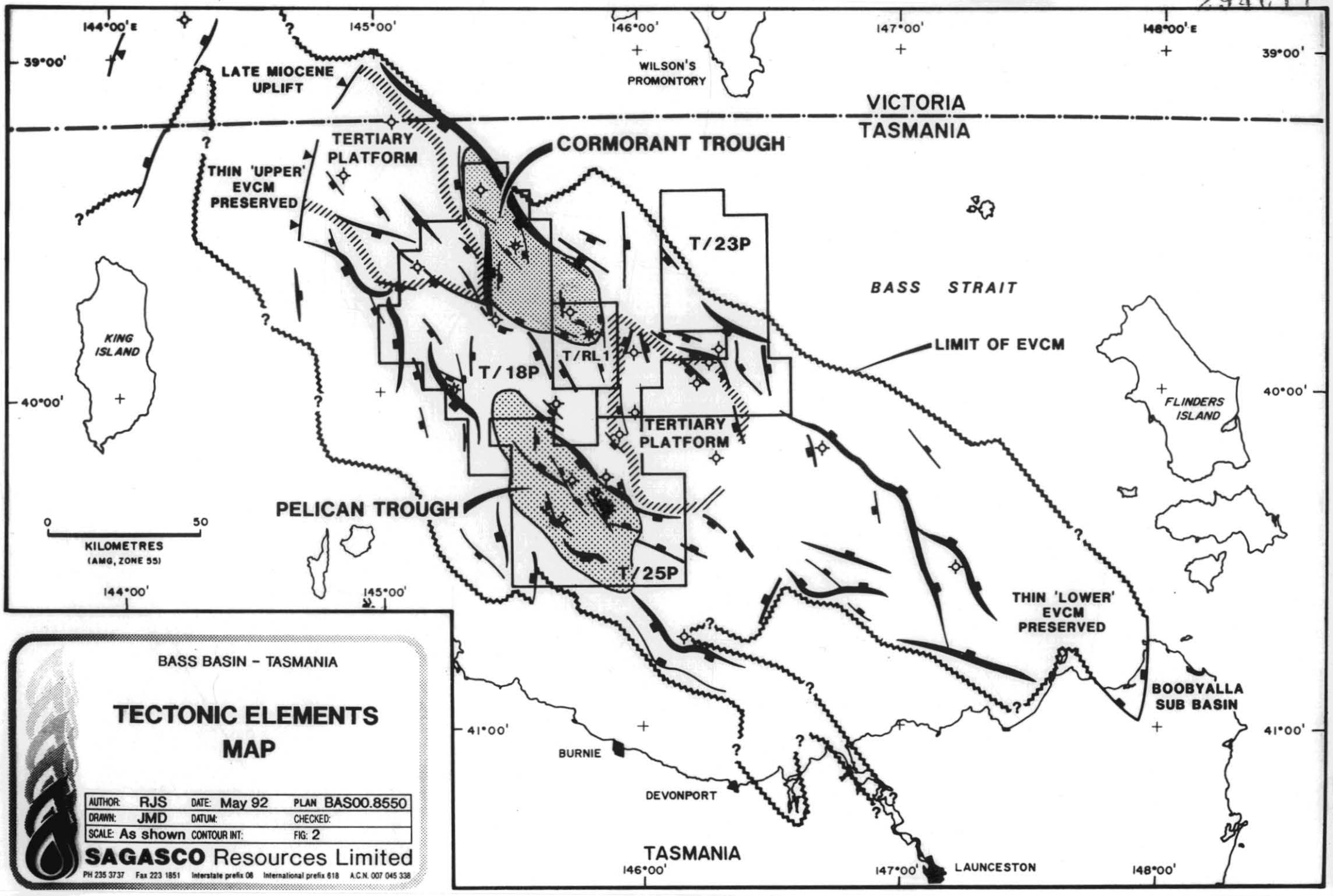

BASS BASIN - TASMANIA

TECTONIC ELEMENTS MAP

AUTHOR: RJS	DATE: May 92	PLAN BAS00.8550	
DRAWN: JMD	DATUM:	CHECKED:	
SCALE: As shown	CONTOUR INT:	FIG: 2	

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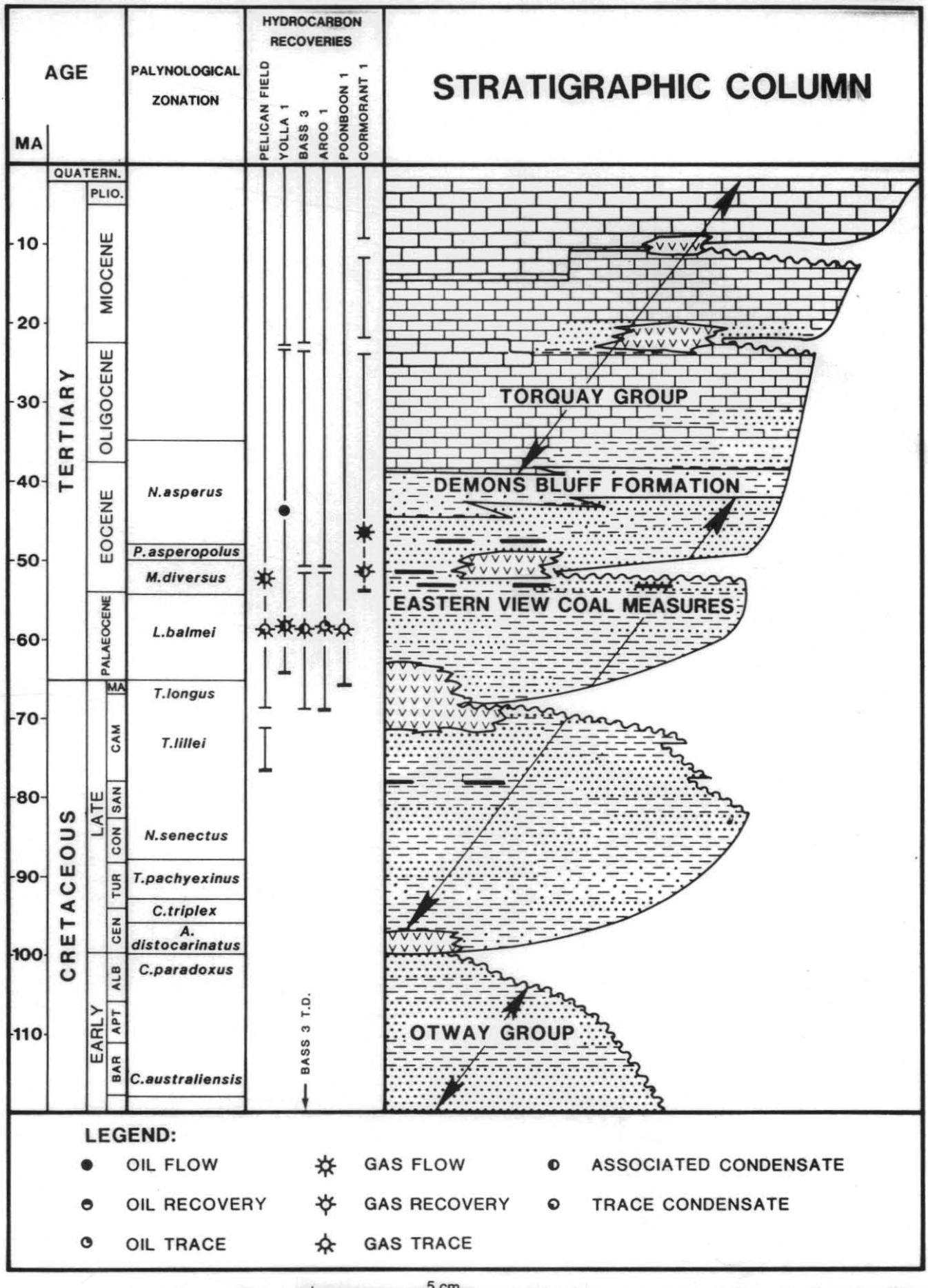

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BASS BASIN - TASMANIA

BASS BASIN STRATIGRAPHY

AUTHOR: R.Suttill DRAWN: J.Dutkiewicz DATE: May 92 SCALE: As shown No.: BAS00.8551 FIG: 3

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The lowermost sequence of EVCM sediments is largely unexplored because of its depth of burial. It extends between the major unconformity at the base of the EVCM (usually top Otway Group) to the basal *T.longus* unconformity. The basal *T.longus* unconformity (Late Cretaceous) is associated with a period of major tectonic movement including extensional tilted block faulting and subsequent erosion. No well in T/18P has penetrated this sequence; the nearest control is at Pelican 5 in T/25P.

The middle sequence of EVCM sediments is bounded by the basal *T.longus* unconformity at its base and an unconformity at the base of the upper *M.diversus* zone (Early Eocene). Deposition during the *T.longus* and *L.balmei* zones appears to have been controlled by tectonic subsidence. King 1 will not penetrate this middle sequence due to poor sand content encountered at this level in Cormorant 1, but elsewhere in the basin it is a prospective target for gas and condensate (eg the Yolla and Pelican Fields).

The uppermost sequence of EVCM sediments lies between the base of the upper *M.diversus* unconformity and the top of the formation. Basin sag induced by sediment compaction was the dominant control on deposition. This sequence contains the target reservoirs for the King 1 well. An oil and gas accumulation was discovered at the top of the zone at the Yolla Field in T/RL1 and significant oil and gas shows were recorded in Cormorant 1.

Conformably overlying the EVCM is the Late Eocene Demon's Bluff Formation. Lithologically this unit consists of a sequence of fine grained shale and siltstone deposited in a marine environment. The unit has an average thickness over the basin of approximately 120m but thins towards the basin margins. The Demon's Bluff Formation provides a regional top seal to hydrocarbons reservoired in the uppermost sandstone of the EVCM as demonstrated by the accumulation at Yolla 1.

The Demon's Bluff Formation is overlain by the Oligocene to Pliocene age Torquay Group which consists of a basal sequence of marl and calcareous shale grading upwards into a sequence of bioclastic limestone. The Torquay Group ranges in thickness from approximately 450m around the basin margins to about 1000m in the Cormorant area. In addition to extrusive igneous rocks associated with the basal and intra-EVCM unconformities, intrusive and extrusive igneous rocks of Oligocene to Miocene age have been intersected in a number of wells drilled within the Bass Basin. Seismic data allow the mapping of the extrusives with a high level of confidence whereas the intrusives are difficult to image and identify.

2.3 Cormorant 1 Results

The Cormorant structure has been previously tested by the exploration well Cormorant 1, drilled in 1970 by Esso to a total depth of 3000 metres. The entire EVCM section penetrated by Cormorant 1 (approximately 1700 metres) contained hydrocarbon shows which were partly tested by a FIT program (Figures 4 and 5). However, there is reason to believe that a commercial hydrocarbon accumulation may have been missed at the time of the drilling of Cormorant 1.

The interval 1400-1550m is of primary interest due to the abundance of mud gas and fluorescence shows and the hydrocarbons recovered from FIT's 6, 11 and 13 (Figure 5). The best result was achieved by FIT 6 at 1500m (4922') which recovered 21.5 litres of dark-brown oil (22° API) and 3.2 cubic feet of gas. Chemical analysis of the oil revealed that it was partially biodegraded.

A limited logging suite and an inadequate testing program at Cormorant 1 do not allow this well to be fully evaluated. However, existing logs indicate low invasion and suggest a minimum of 2m oil pay at 1500m, 2m probable gas condensate pay at 1826m (5591') and 3m probable gas condensate pay at 2007m (6585'). The use of more optimistic, yet realistic, values for the petrophysical parameters *m*, *n* and *a*, indicate a potential hydrocarbon column of up to 30m (SAGASCO Report: *Cormorant 1 Upper EVCM Petrophysical Review, 1992*).

2.4 Reservoir

The primary reservoir targets in King 1 are the shoreface and fluvial sandstone beds within the upper EVCM of the lower base *N.asperus* zone.

Sand development and reservoir quality are significant risks in the Bass Basin as shown in Figure 6. The results of these wells have been used to map regional sand trends and predict the likely reservoir quality for the King prospect. Similar sandstone development to Cormorant 1 is anticipated at King 1.

Upper EVCM sandstone beds occur in two packages each approximately 100m thick. The upper package, present in all wells, shows a gradual increase in sand content from the Cormorant Trough towards the southeast and northwest indicating sediment sourcing from both directions. A marked improvement in the reservoir quality occurs towards the southeast where Yolla 1 flowed oil at 300 BOPD and gas at 15 MMCFD with 892 BCPD.

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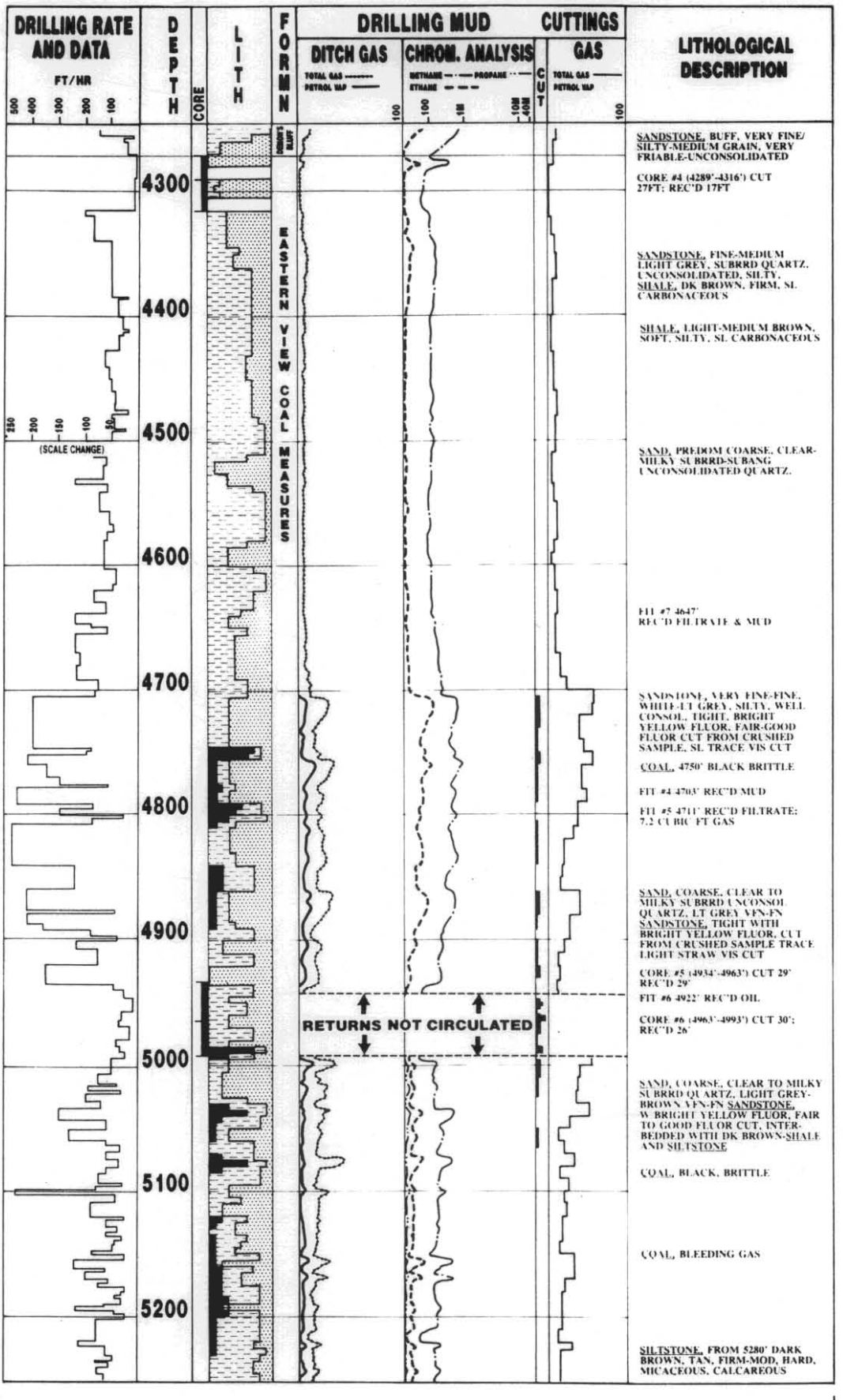

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BASS BASIN - TASMANIA

T/18P

CORMORANT 1 MUD LOG

AUTHOR: A.Buffin DRAWN: P.Oldham DATE: May 92 SCALE: As shown No.: COR008553 FIG: 4

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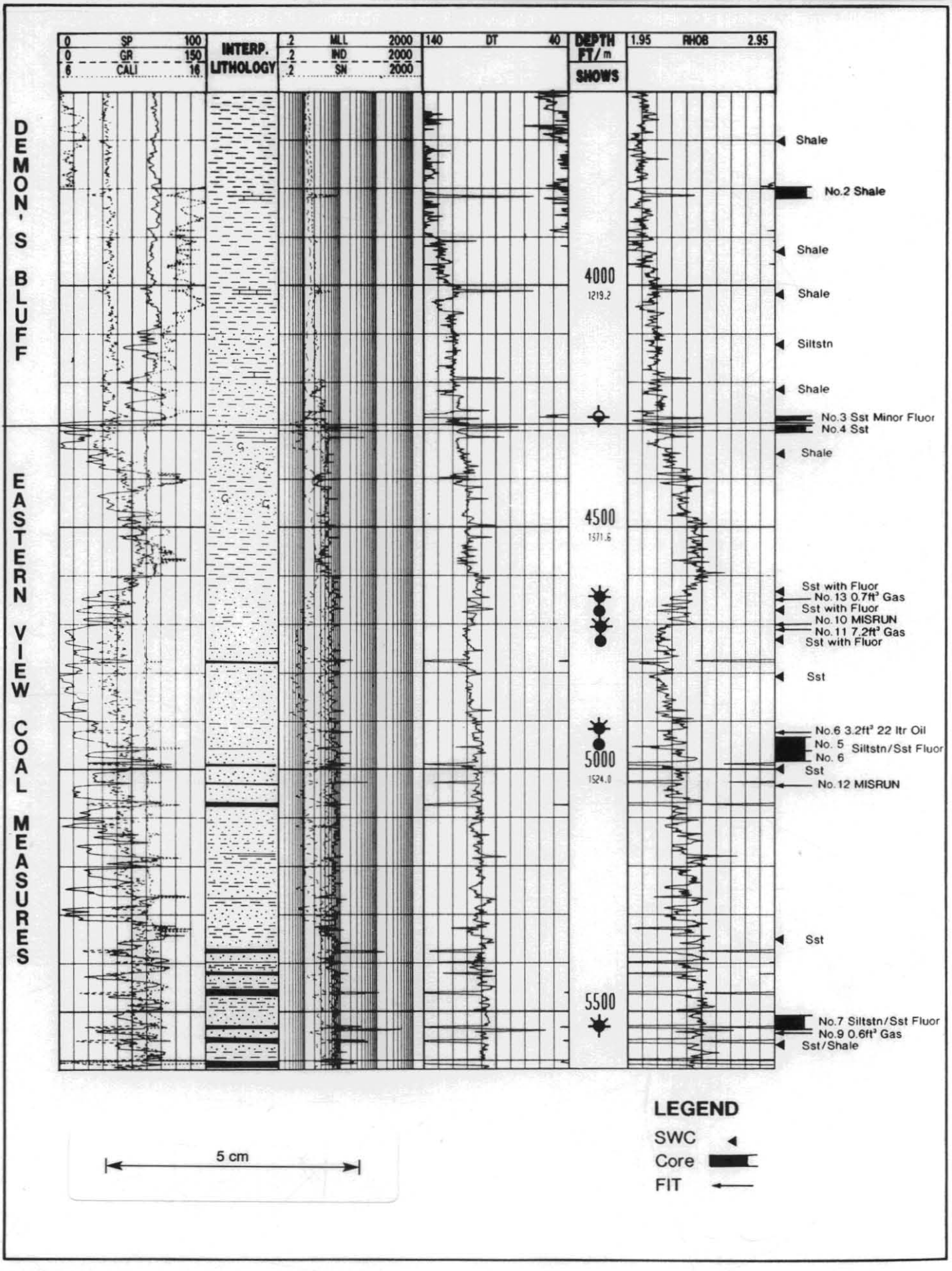

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BASS BASIN - TASMANIA

T/18P

CORMORANT 1 COMPOSITE LOG

AUTHOR: A.Buffin DRAWN: P.Oldham DATE: May 92 SCALE: As shown No.: COR008554 FIG: 5

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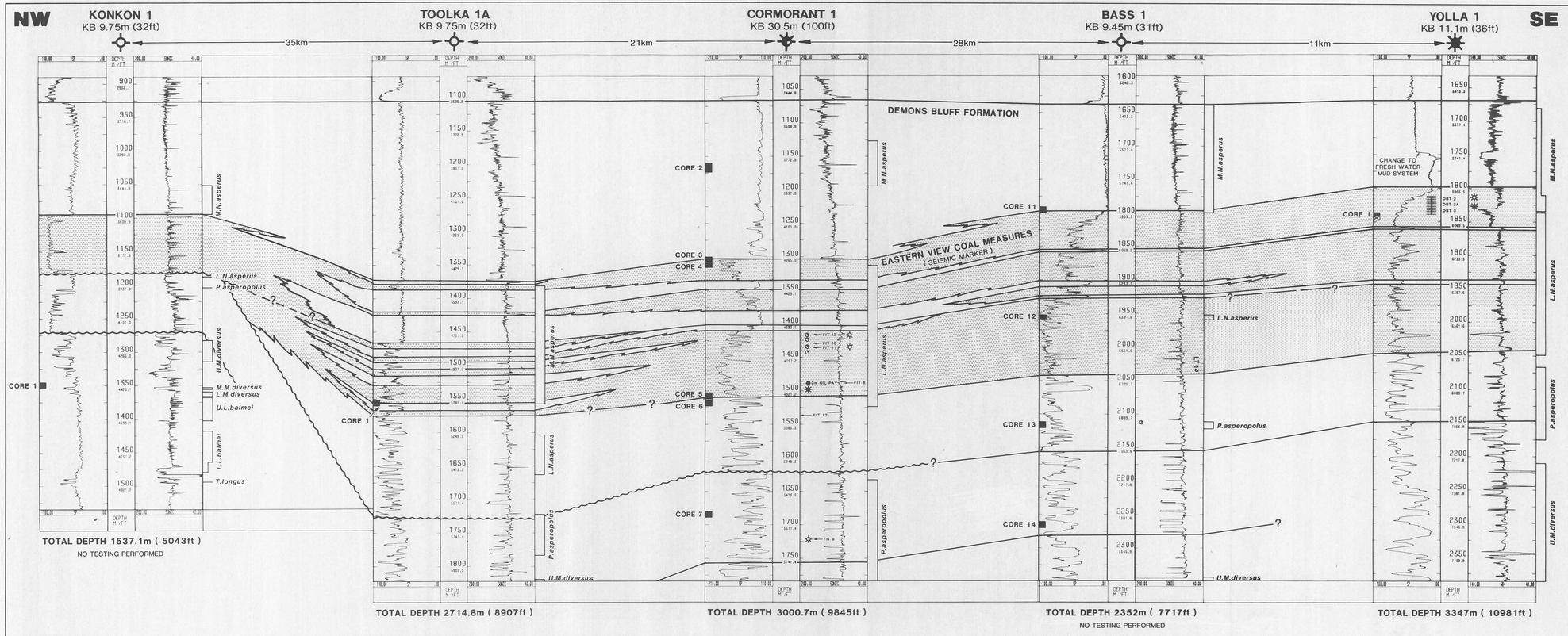

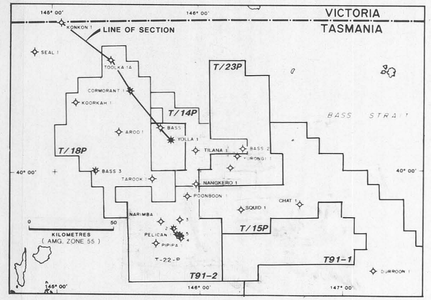

LEGEND

- OIL FLOW
- OIL RECOVERY
- OIL SHOW
- GAS FLOW
- GAS RECOVERY
- GAS SHOW
- ASSOCIATED CONDENSATE
- CONDENSATE SHOW
- DRY WELL
- FORMATION INTERVAL TEST (FIT)
- PERFORATED INTERVAL

5 cm

BASS BASIN – SOUTH AUSTRALIA

Reservoir Distribution : UPPER EVCM CORRELATION

AUTHOR: R.Suttill	DATE: May'92	PLAN No: BA500.8427	
DRAWN: P.Oldham	DATUM:	CHECKED:	
SCALE: As shown	CONTOUR INT:	FIG 6	

SAGASCO Resources Limited

The lower package is absent in Konkon 1 but is present in all other wells. This package shows a similar increase in sand content and reservoir quality towards the southeast. This interval has not been production tested although gas condensate and oil shows with 2m of proven oil pay occur within this section at Cormorant 1.

A report prepared by SAGASCO Resources Limited (*Cormorant 1 Upper EVCM-Petrophysical Review)* documents the petrophysical properties of the upper EVCM. Log analysis indicates that these sandstones have an average porosity of 20%. Furthermore, good permeability is inferred by:

- mudcake build-up (from caliper log)
- log separation and invasion profile (from resistivity logs)
- cutting descriptions, SWC data (from mudlog)
- significant recovery at Cormorant 1 (FIT 6)

2.5 Source and Hydrocarbon Type

The Cormorant Trough is considered to be the main hydrocarbon generative centre in T/18P with the deepest section lying between Cormorant 1 and Yolla 1. The best EVCM source potential occurs within the lower and middle *M.diversus* and *L.balmei* zones, which is thought to source the hydrocarbons encountered in Cormorant 1 and Yolla 1. This is further evidenced, by significant shows at Bass 3 (a FIT in the EVCM *L.balmei* interval recovered 29 cubic feet of gas and 800cc of condensate) and in Aroo 1, where the encouraging hydrocarbon indications in the interval *M.diversus* to *N.asperus* correlate to the Cormorant 1 gas and condensate bearing sands.

Organic-rich mudstone and coal from the EVCM typically have high total organic carbon content (average 7-10% TOC) and good yields (1-14mg/g S_1+S_2) as illustrated by Appendix Figures 1 and 2). The source potential is in general, good to excellent for coal, moderate to good for coaly shale, and marginal to moderate for shale (Amoco Report: *Hydrocarbon Source Rock Evaluation, Bass Basin, 1987*).

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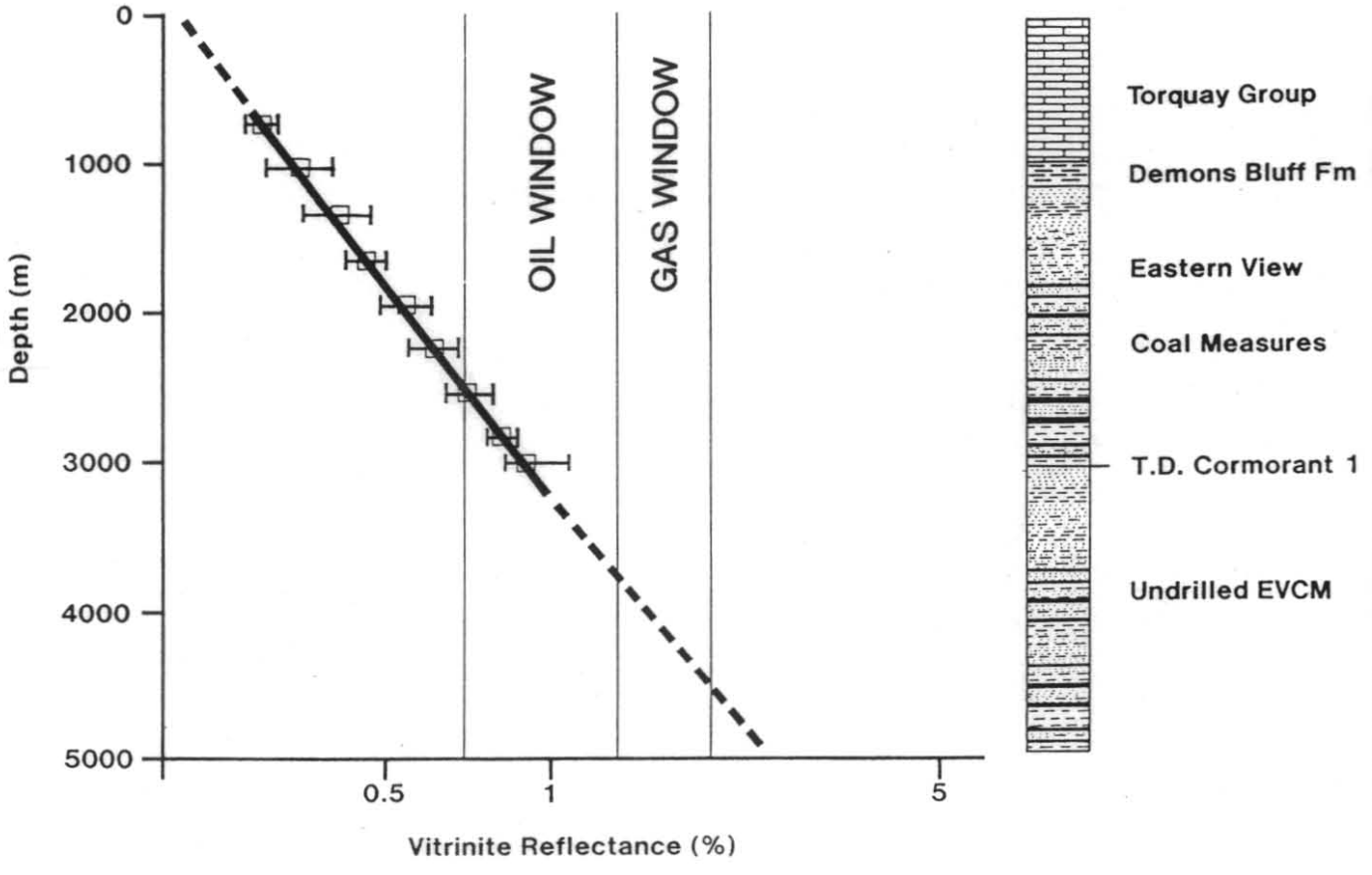

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BASS BASIN - TASMANIA

T/18P

MATURITY PLOT: CORMORANT 1

AUTHOR: A.Migliucci | DRAWN: C.P.K., P.O. | DATE: 05/92 | SCALE: AS SHOWN | No.: COR008560 | FIG: 7

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Maturity studies of wells within both the Pelican and Cormorant Troughs indicate that the lowermost EVCM (pre-middle *M.diversus*) is currently mature for hydrocarbon generation as shown by the vitrinite reflectance profile (Figure 7).

To illustrate the distribution of mature sediments, maturity maps have been constructed at three major stratigraphic levels (Appendix: Figures 3-5):

* Top Eastern View Coal Measures
* Near base *P.asperopolus*
* Approximate top Palaeocene

The section above approximately 1500 metres is usually immature to marginally mature, whereas the deeper sequence is progressively moderately mature to mature. The top EVCM maturity map shows relatively low vitrinite reflectance values of 0.4 - 0.6% with a general increase towards the eastern part of the permit. At the near base *P.asperopolus* level this trend continues with slightly higher maturity values of 0.5 to 0.7% + (Appendix: Figure 4).

At approximate top Palaeocene level, the vitrinite reflectance values show the whole eastern portion of T/18P to be mature for hydrocarbon generation (0.7 - 1.0% +). At Cormorant 1, vitrinite reflectance values exceed 1.0% at this level and therefore sediments between the near base *P.asperopolus* and top Palaeocene are considered to be mature for hydrocarbon generation in this area.

The hydrocarbon recoveries obtained in Cormorant 1 and Yolla 1 confirm that the deeper part of the EVCM in the Cormorant Trough has generated significant volumes of oil and gas which have migrated vertically to top EVCM closures presumably utilising fault conduits. The same mechanism should apply for the King 1 location.

2.6 Trap

The King Prospect is a low relief fault independent closure mapped at the base *N.asperus* level. The crest is 20 msecs (approximately 33 metres) updip from the Cormorant 1 well (Figures 8 and 11). Structural closure is also mapped at top EVCM, near base *P.asperopolus*, and near base upper *M.diversus* levels which are also levels prospective for hydrocarbons (Enclosures 1-5).

Faulting associated with the development of the Cormorant Trough is extensional in style and is characterised by growth faults throughout the Early-Middle Eocene and crestal graben collapse features of post-Early Miocene age. The Cormorant anticline was formed by structural inversion during the Late Tertiary. The interpreted structural development of the Cormorant anticline and its mechanism of inversion is discussed in detail in the SAGASCO report: *Structural Interpretation of the Cormorant Anticline, T/18P, Bass Basin, 1992.* Updip of Cormorant 1, the King 1 prospect at base *N.asperus* level has an

areal closure of 9km^2 (2288 acres). The larger Cormorant structure has an areal closure of 62km^2 (15365 acres).

Competent seal development is anticipated at King 1. The Demon's Bluff Formation which is composed of shale and siltstone acts as a regional top seal to the Eastern View Coal Measures. Furthermore, the intraformational shale and siltstone of the upper EVCM are also likely to be effective seals.

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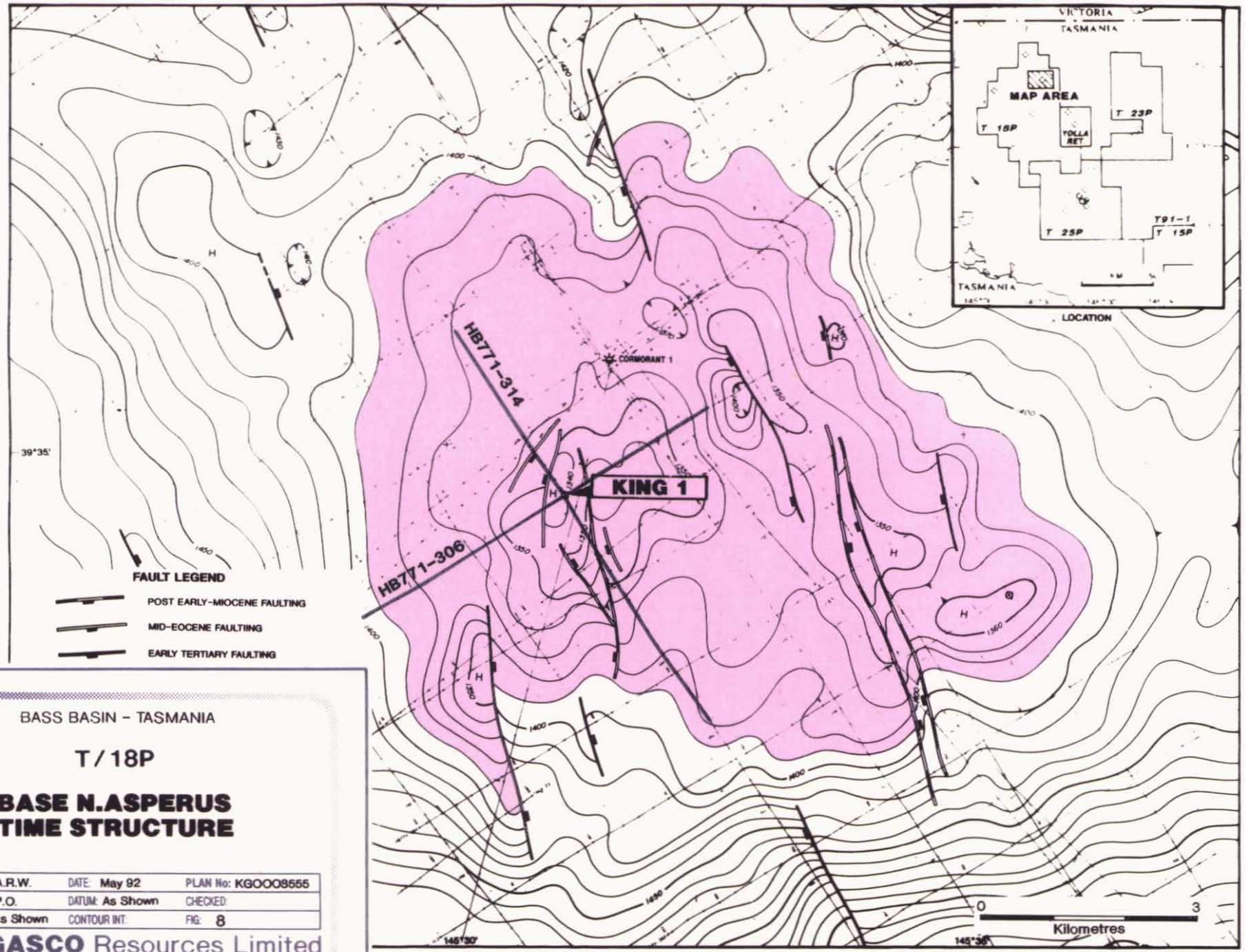

BASS BASIN - TASMANIA

T/18P

BASE N.ASPERUS TIME STRUCTURE

AUTHOR: A.R.W.	DATE: May 92	PLAN No: KGOOO8555	
DRAWN: P.O.	DATUM: As Shown	CHECKED:	
SCALE: As Shown	CONTOUR INT:	FIG: 8	

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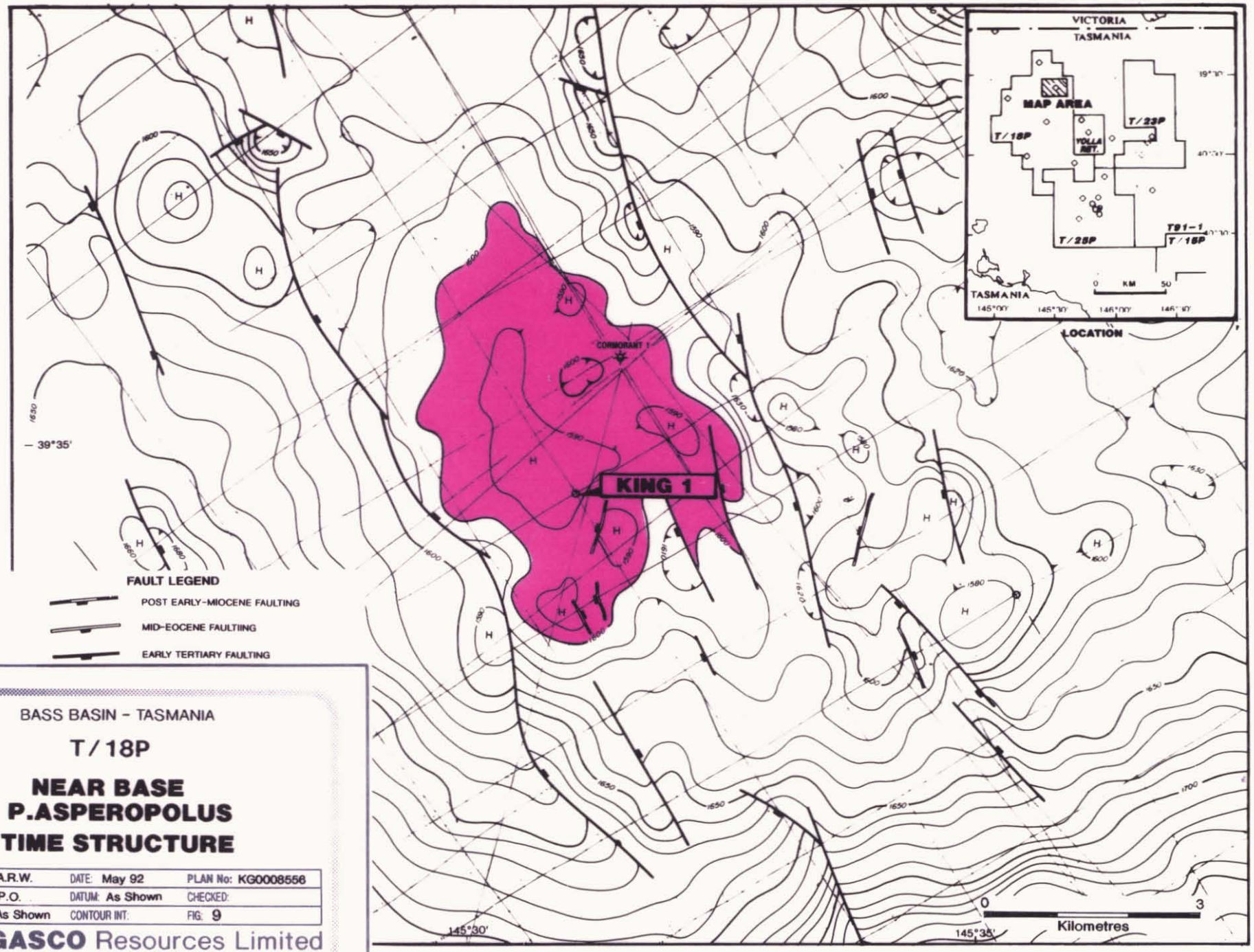

BASS BASIN - TASMANIA

T/18P

NEAR BASE P.ASPEROPOLUS TIME STRUCTURE

AUTHOR: A.R.W.	DATE: May 92	PLAN No: KG0008556
DRAWN: P.O.	DATUM: As Shown	CHECKED:
SCALE: As Shown	CONTOUR INT:	FIG: 9

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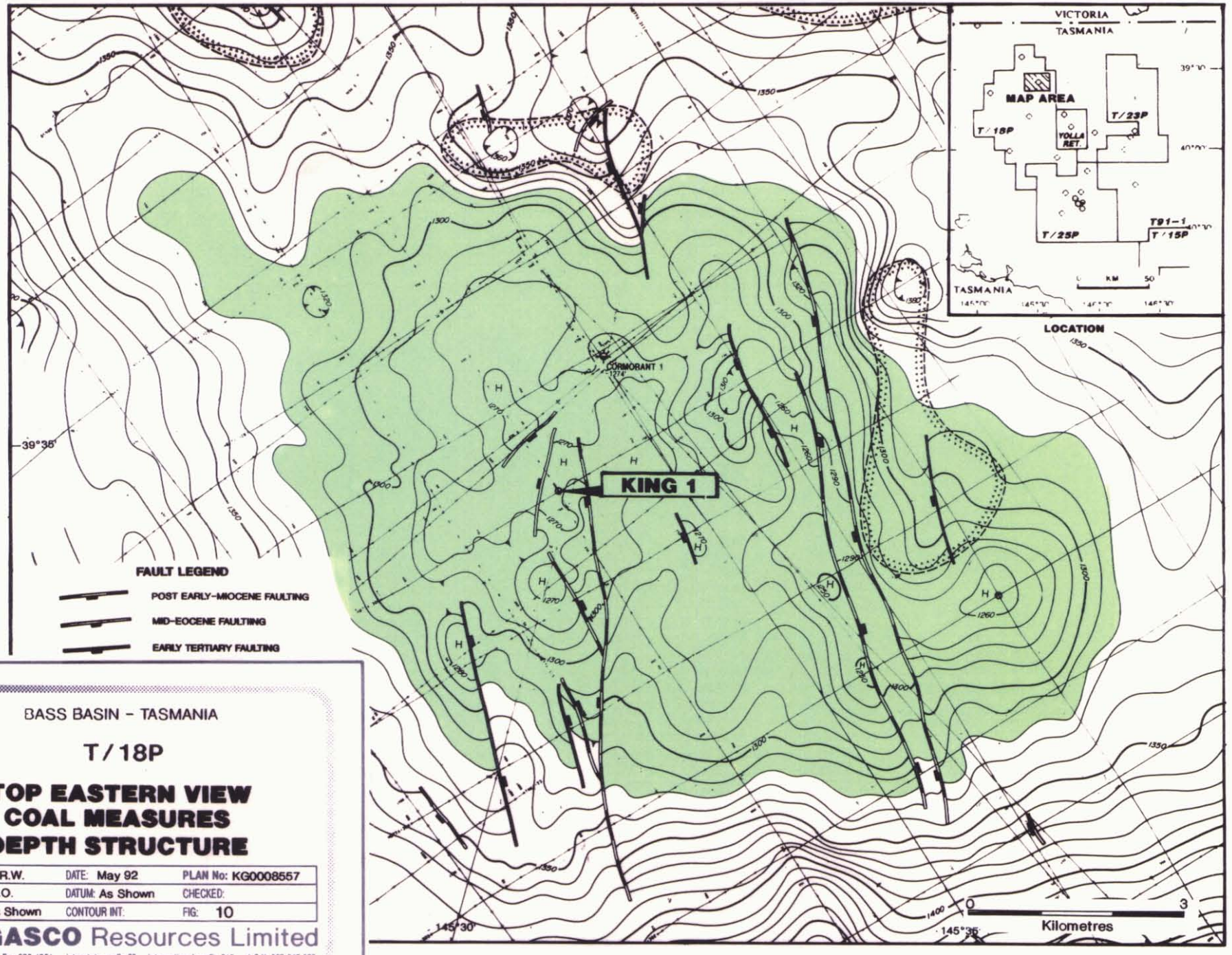
5 cm



BASS BASIN - TASMANIA

T/18P

TOP EASTERN VIEW COAL MEASURES DEPTH STRUCTURE

AUTHOR: A.R.W.	DATE: May 92	PLAN No: KG0008557
DRAWN: P.O.	DATUM: As Shown	CHECKED:
SCALE: As Shown	CONTOUR INT:	FIG: 10

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3 SEISMIC

3.1 Seismic Data Base

The King 1 location is based on seismic mapping using the HB77A data reprocessed by SAGASCO Resources Limited in 1991 and data acquired by Shell in 1990. Average grid spacing over the prospect is about 1.5km. The data were interpreted using the Geoquest 2D interpretation system, on a SUN Sparc II Workstation.

3.2 Structural Mapping

The geophysical and structural interpretation of the Cormorant structure has been fully documented in a SAGASCO Resources Limited Report entitled "*Structural Interpretation of the Cormorant Anticline*" 1992.

Nine seismic events were chosen for detailed correlation. These are shown in Table 5, and were selected for the following reasons:

- they are important in the definition of structural history, particularly in defining the timing and mechanism of inversion.
- to map structural closure at all levels prospective for hydrocarbons and to aid in the siting of a well.
- to map unique velocity packages to allow accurate layer-cake depth conversion of key horizons.
- to map events with greater continuity of character and amplitude facilitating correlation particularly across faults.

Time structure contour maps have been prepared at a scale of 1:25,000 at the following levels:

Top Eastern View Coal Measures	(Enclosure 1)
Base *N.asperus*	(Enclosure 2/Figure 8)
Near base *P.asperopolus*	(Enclosure 3/Figure 9)
Near base Upper *M.diversus*	(Enclosure 4)

3.3 Depth Conversion

A depth structure map has been constructed for the top Eastern View Coal Measures (Enclosure 5/Figure 10). The depth conversion was made using a simple layer-cake technique and single interval velocity values calculated for each interval using the Cormorant 1 well data, as follows.

Marker	Interval Velocity (m/sec)
Sea level	
	1977
Intra-Torquay	
	1851
Early Miocene	
	2600-2300*
Late Oligocene	
	2412
Top Demon's Bluff	
	2324
Top EVCM	

* A contour map of velocity for the Late Oligocene - Early Miocene interval was produced to account for the sporadic presence of high velocity basalts in this section (measured at 2600m/sec in Bass 1). Over most of the area the interval has a velocity of 2300 m/sec; but rises to 2450 m/sec for the smaller extrusive piles that comprise up to half of the mapped interval, and up to 2600 m/sec for the larger piles along the bounding fault that comprise the total thickness of the interval. This varying velocity was than used as input to the depth conversion calculations.

294027

TABLE 5

SEISMIC EVENTS: PERMIT T/18P

EVENT NAME	CORMORANT-1 DEPTH (metres KB)	MAPPING	DESCRIPTION
1 Intra-Torquay	451	-	Start of last phase carbonate deposition. Structural growth due to inversion finished by this time. End of post-Early Miocene faults.
2 Early Miocene	687	-	Top of interval containing volcanic extrusives. Start of second major faulting episode.
3 Late Oligocene	833	-	Base of interval containing volcanic extrusives. Start of inversion.
4 Top Demon's Bluff Fm	1067	-	Top of marine shale with uniform thickness and distribution over area. Quiet period tectonically.
5 Top Eastern View Coal Measures	1304	Depth, Time	Start of shallow marine - deltaic deposition. Relatively quiet period tectonically.
6 Base *N. asperus*	1521	Time	Near base of sand that recovered 21.5 litres of oil in Cormorant-1. End of period of growth faults that dominate the deeper EVCM.
7 Near Base *P. asperopolus*	1846	Time	Period of active growth faults.
8 Near Base Upper *M.diversus*	2124	Time	Period of active growth faults. Predominantly shale and coal deposition - poor sand development.
9 Near Top Lower *M.diversus*	2713	-	Early Eocene marker. Lies 190 metres below the igneous intrusives intersected in Cormorant-1.

294028

TABLE 6

DEPTH PROGNOSIS AND GEOPHYSICAL FORECAST

MARKER	INTERVAL VELOCITY m/sec	TWT msecs	INTERVAL THICKNESS (m)	TOP (m subsea)
Sea-Level		0		0
	1977		404.3	
Intra Torquay		409		404
	1851		254.5	
Early Miocene		684		659
	2299		143.7	
Late Oligocene		809		803
	2412		232.8	
Top Demon's Bluff		1002		1035
	2324		233.6	
Top EVCM		1203		1269
	2782		189.2	
Base *N.asperus*		1339		1458
	2790		343.2	
Near base *P.asperopolus*		1585		1801
	3141		287.4	
Near base *U.M. diversus*		1768		2089
	3184		573.1	
Near top *L.M. diversus*		2128		2662

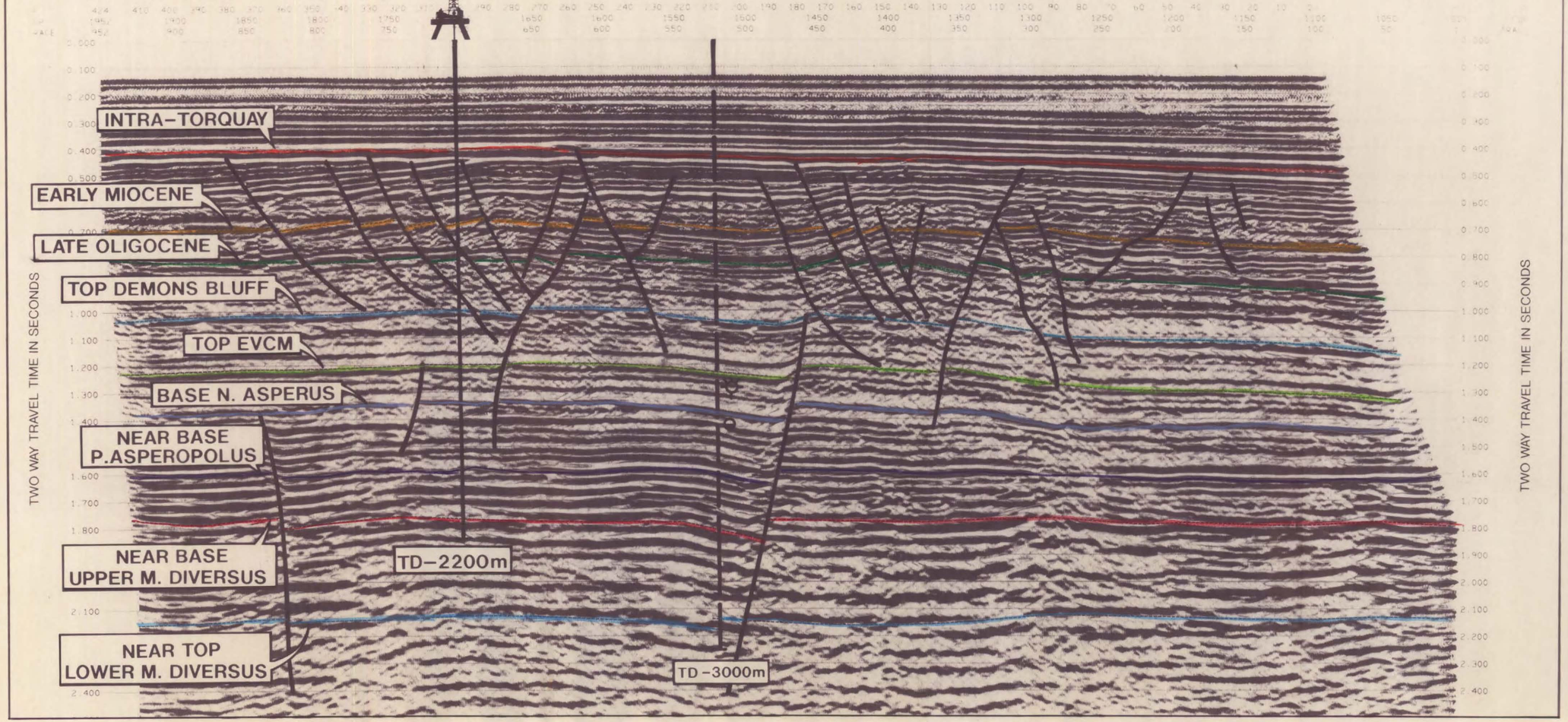
LINE HB77A–306

KING 1

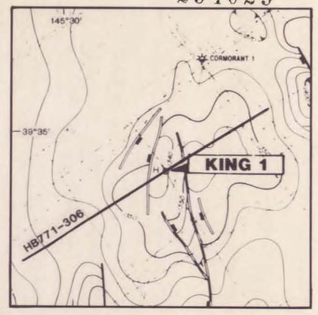
CORMORANT 1
(Projected)

SW

NE



294029



LOCATION MAP 0 1km

5 cm

BASS BASIN - TASMANIA

T/18P

LINE HB77A–306

AUTHOR A.R.W.,A.C.M.	DATE May 92	PLAN No: KG0008558	
DRAWN A.B-M.	DATUM	CHECKED	
SCALE As Shown	CONTOUR INT	FIG. 11	

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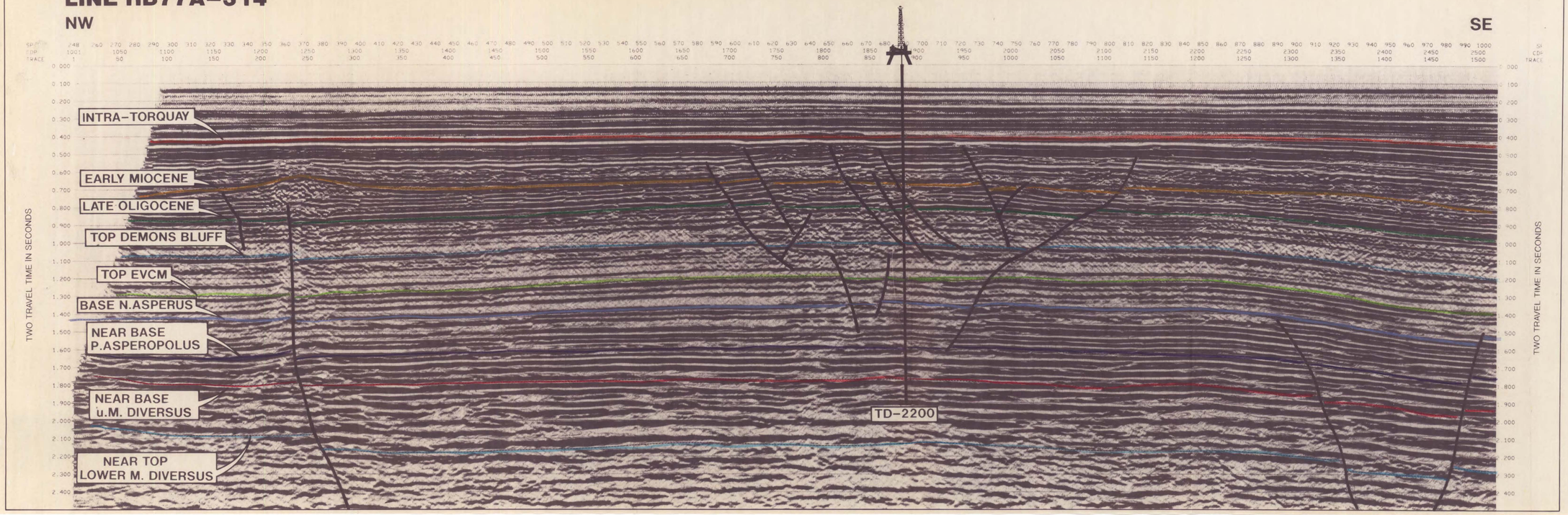
LINE HB77A–314

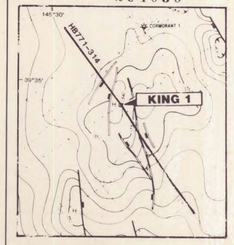
NW

KING 1

SE



294630



5 cm

BASS BASIN – TASMANIA

T/18P

LINE HB77A–314

SAGASCO Resources Limited

4 WELL LOCATION AND FORECAST

4.1 Choice of Location

Points in favour of drilling King 1 at the proposed location are as follows:

- proximity to Cormorant 1 where the presence of hydrocarbons has already been established.
- crestal location at the top EVCM and base *N.asperus* level. Importantly the location is 20 msecs (approximately 33 metres) structurally updip from the Cormorant 1 well at base *N.asperus* level where a full chamber of oil was recovered in FIT 6 in Cormorant 1.
- good seismic control due to location at the intersection of two lines.

Success at King 1 would give encouragement to drill the location originally proposed as King A as a follow-up well (SAGASCO Report: *Structural Interpretation of the Cormorant Anticline T/18P, Bass Basin, 1992*). This location is situated on the eastern fault bounded margin of the greater Cormorant anticline but updip of Cormorant 1 structurally lower than the proposed King 1 location.

4.2 Objectives

The primary objective is fluvial sandstone of the basal *N.asperus* zone in the upper Eastern View Coal Measures (Figure 13). The sandstone sequence in the upper Eastern View Coal Measures between the basal *N.asperus* and near base upper *M.diversus* zone is a secondary objective.

4.3 Prognosed Stratigraphic Sequence

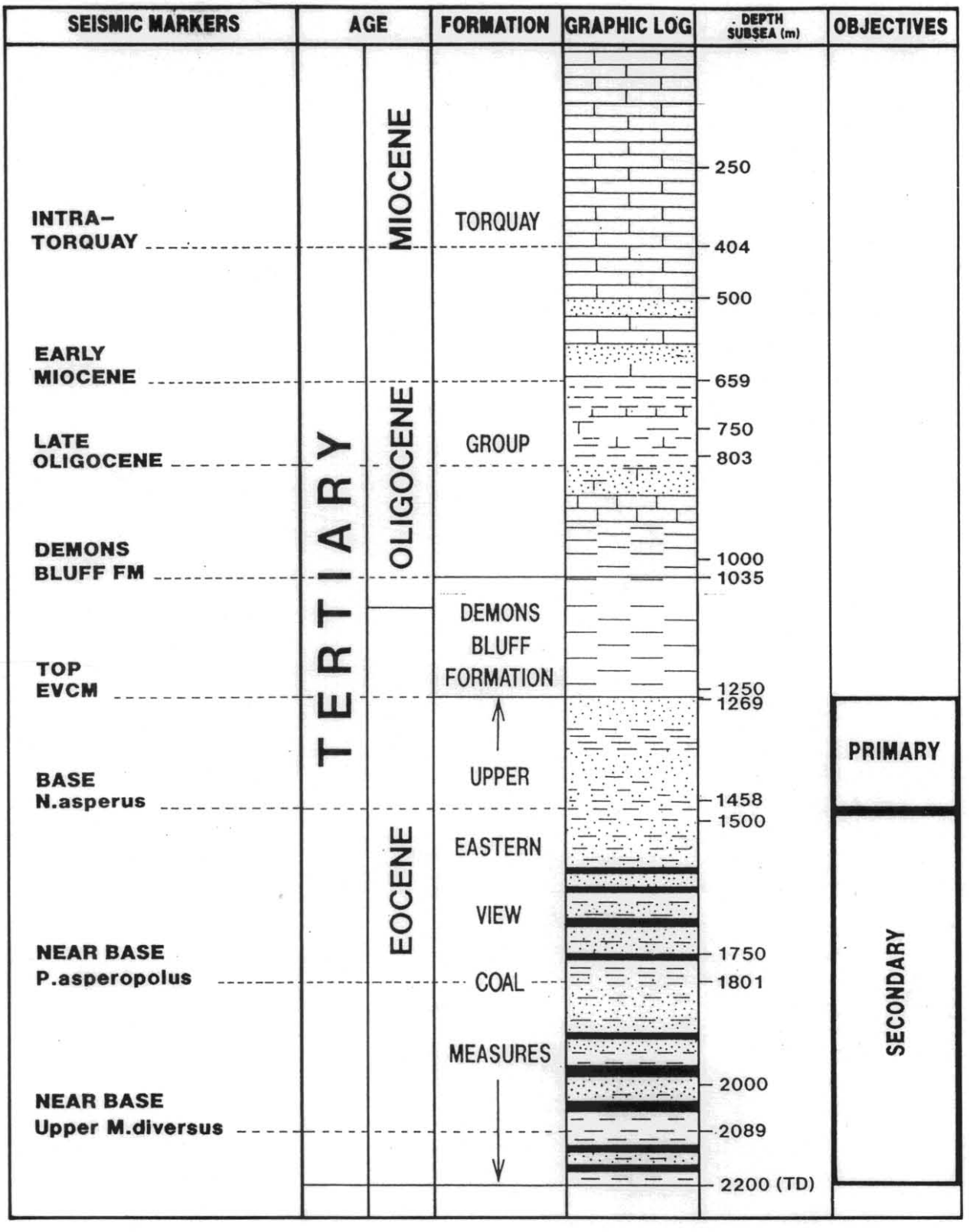
The prognosed stratigraphic sequence in King 1 is tabulated in Table 6 and illustrated by Figure 13.

A generalised lithological description of the sequence anticipated at King 1 follows:

Torquay Group (75-1035m subsea)

The Torquay Group consists predominantly of bioclastic limestone. The upper section of the Torquay Group is characterised by calcarenite which is white to light grey with fossiliferous fragments (bryozoa, foraminifera, echinoids) and occasional coarse quartz grains. The lower section grades into a calcilutite which shows a decrease in grain size and increase in clay content with depth. This section consists predominantly of fossiliferous marl (light grey-green with occasional glauconite) interbedded with mudstone, minor sandstone and rare dolomite.

294032



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BASS BASIN - TASMANIA

T/18P

PROGNOSED SEQUENCE : KING 1

AUTHOR : A.Migliucci DRAWN : C.P.K., P.O. DATE : 05/92 SCALE : AS SHOWN No. : KG0008552 FIG : 13

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Demon's Bluff Formation (1035-1269m subsea)

The Demon's Bluff Formation consists of a monotonous sequence of argillaceous siltstone and shale. The siltstone and shale are dark brown, soft, pyritic, slightly carbonaceous and occasionally calcareous.

Eastern View Coal Measures (1269m - TD)

The upper part of the Eastern View Coal Measures drilled at Cormorant 1 consists of interbedded sandstone, siltstone, shale and coal. The sandstone varies from very fine grained to coarse grained, with clear to milky subrounded quartz grains.

Cores 3 and 4 at the top EVCM in Cormorant 1 (1300-1315m) show fine sand lenses with discrete pulses of thin conglomerate in an upward coarsening sequence. The interval is interpreted as a succession of progradational events up to 50m thick deposited in a lower to middle shoreface setting.

Cores 5 and 6 (1402-1504m) are more deltaic in character consisting of numerous small-scale upward coarsening cycles which are interpreted as crevasse splays (below the resolution of conventional wireline logs) from a nearby distributary channel. Coal seams within the sequence are often interbedded with carbonaceous shale and represent the accumulation of organic rich detritus in a lacustrine/interdistributary bay type environment.

RESERVES

The structure updip of Cormorant 1 at the base *N.asperus* level, assuming 15m of pay, has potential oil-in-place of 79 MMSTB or 72 BCF gas-in-place. The greater Cormorant structure, assuming 40m of pay, has the potential for oil-in-place of 980 MMSTB or 1.1 TCF gas-in-place (Table 7).

Effective porosities and net pay thicknesses were estimated by petrophysical examination of the wireline logs from Cormorant 1 (SAGASCO Report: *Cormorant 1 upper EVCM - Petrophysical Review, 1992*). In this report three cases were presented for the calculation of Sw, and hence net pay, using variable *a*, *m*, and *n* values.

Reserve estimates for all three cases are detailed in the SAGASCO Report entitled *Cormorant/King Reserve Calculations, T/18P Bass Basin, 1992.* However, given the friable condition of sandstone recovered in cuttings, cores and SWC's the use of *a*, *m*, and *n* values for a soft unconsolidated sandstone is justified, and the resultant low Sw's are most realistic. Reserve calculations were performed with geometric corrections to account for the thinning effect at the trap edge (based on models by Gehman *et al* (1975)).

TABLE 7

POTENTIAL RESERVES

KING 1 PROSPECT			OIL CASE ONLY		GAS CASE ONLY	
	AREAL CLOSURE SQ KM	PAY (M)	OIP	REC	GIP	REC
			(MMBBLS)		(BCF)	
Base *N.asperus* updip of Cormorant 1 (@ 1521m)	9	15	79	20	72	50
Base *N.asperus* down to LCC	62	40	980	245	1165	816

6 CONCLUSION

It is proposed to drill King 1 approximately 2km southwest of Cormorant 1 at the intersection of seismic lines HB77A-306 and HB77A-314, in permit T/18P, offshore Bass Basin. Water depth at this location is 75m.

The objective of the well is to evaluate the oil potential of the upper Eastern View Coal Measures (EVCM) at the crest of the Cormorant anticline, updip from Cormorant 1 where encouraging shows were recorded. Penetration of the Eocene *N.asperus* level primary target is predicted at 1458m subsea and the prognosed total depth of the well is 2200m subsea near the base of the upper *M.diversus* zone of the EVCM.

The reserves potential for the King prospect, assuming 15m of pay at the primary target level, is 79 MMSTB oil-in-place updip of Cormorant 1. Reserves for the entire greater Cormorant structure, assuming 40m of net pay, are estimated to be 980 MMSTB oil-in-place. Reservoir quality and hydrocarbon deliverability pose the greatest risks to the commercial success of King 1.

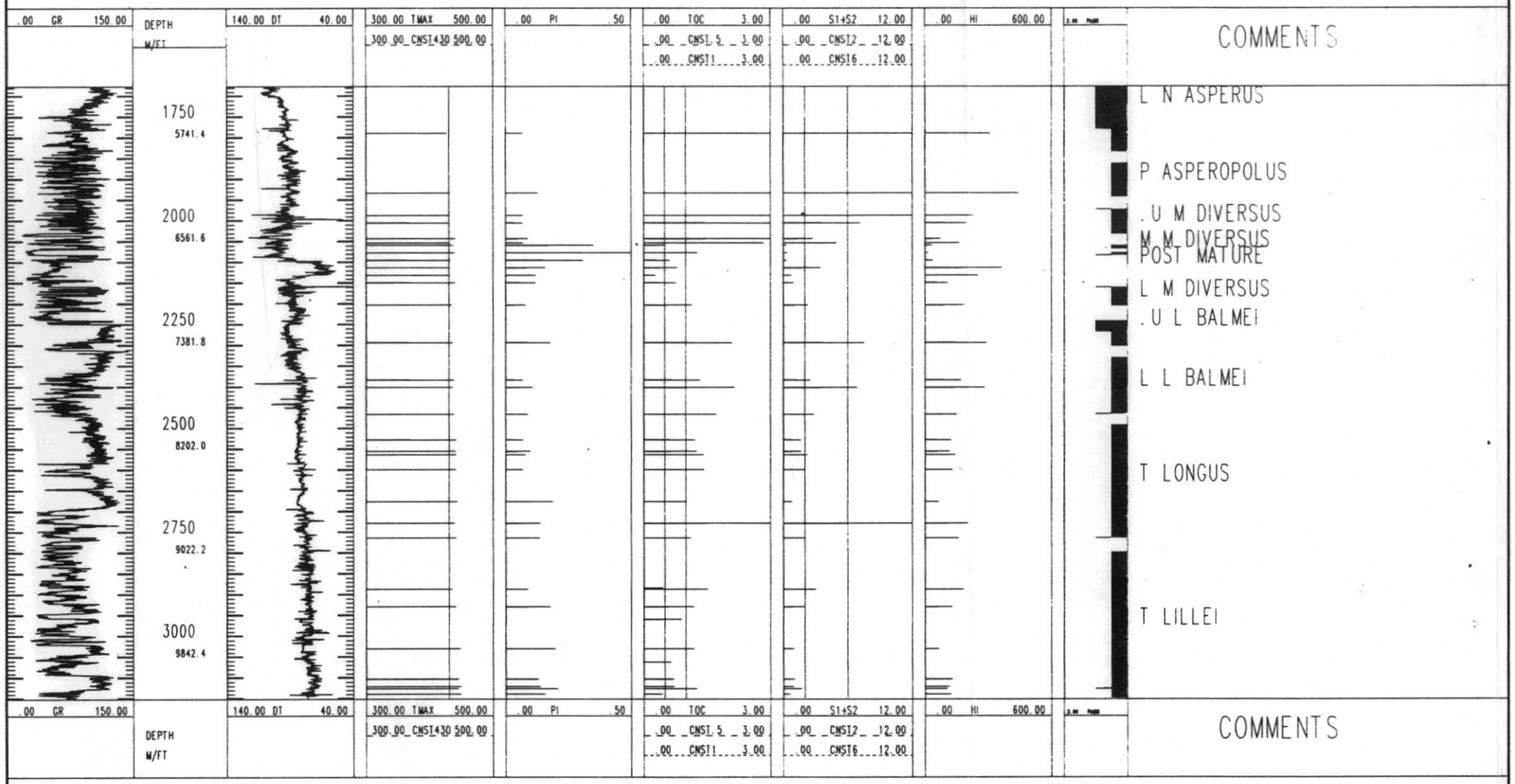
7 REFERENCES

ANALABS	1987	Hydrocarbon Source Rock Evaluation Bass Basin. Report for AMOCO Australia Petroleum Company
Buffin, AJ	1992	Cormorant 1 - Upper Eastern View Coal Measures: Petrophysical Review. SAGASCO Resources Limited.
ESSO Australia Ltd	1970	Cormorant 1 Well Completion Report.
Migliucci, AC	1992	Cormorant/King Reserve Calculations. T/18P Bass Basin. SAGASCO Resources Limited.
Suttill, RJ and and Smit R	1987	Exploration Permits - T/14P, T/18P, T/22P Data Package, Bass Basin, Australia. SAGASCO Resources Limited.
Waldron, AR	1992	Structural Interpretation of the Cormorant Anticline T/18P Bass Basin. SAGASCO Resources Limited.

APPENDIX

294038

KOORKAH 1



KOORKAH 1

5 cm

TASMANIA

T/18P – BASS BASIN

KOORKAH 1

SOURCE ROCK DATA

AUTHOR: R.Suttill	DATE: May 92	PLAN No: KK 001 8544	
DRAWN: C.Kay	DATUM:	CHECKED:	
SCALE: As shown	CONTOUR INT:	FIG: A1	

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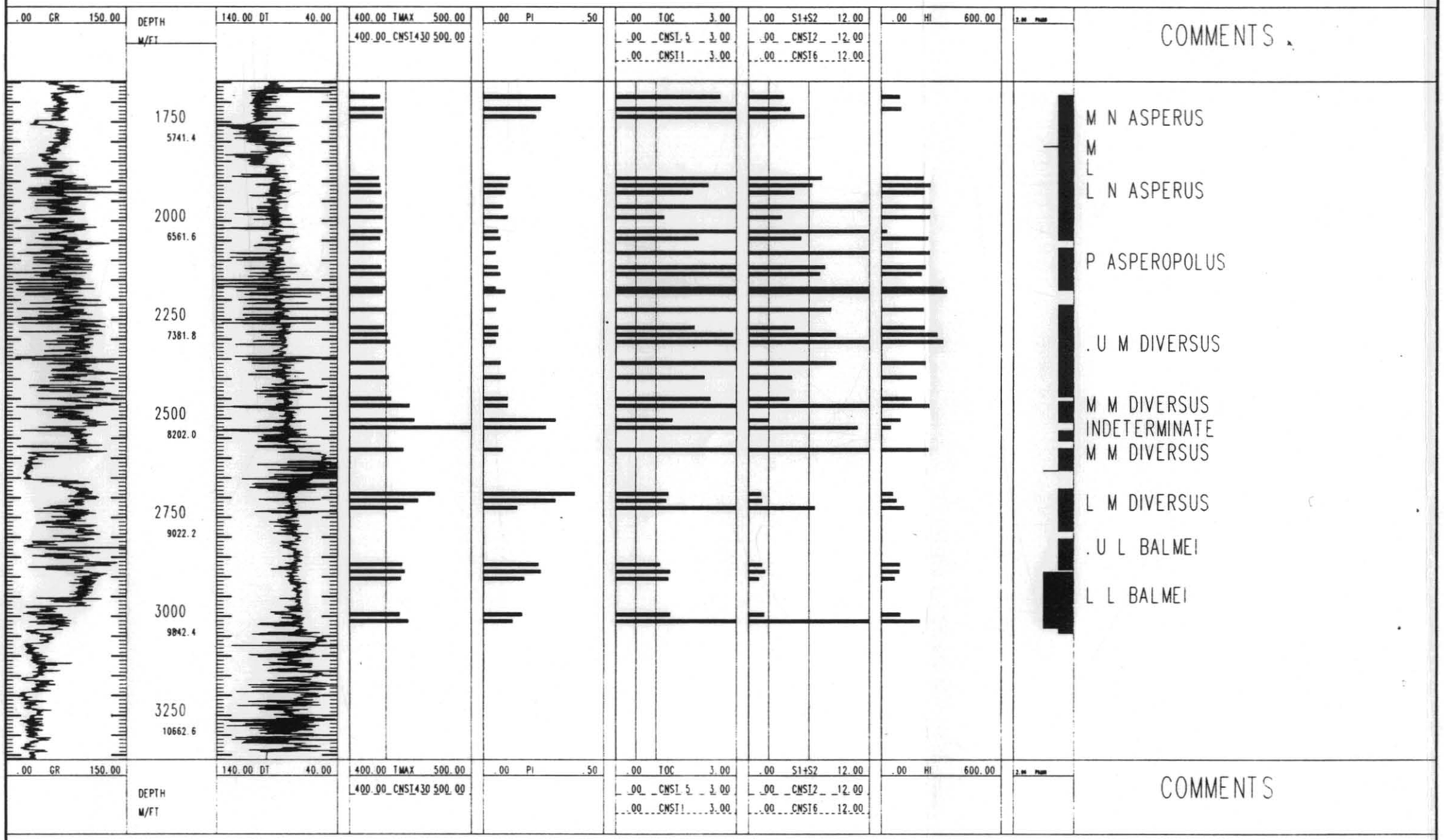
294039

YOLLA 1



YOLLA 1

5 cm

TASMANIA

T/RL1 - BASS BASIN

YOLLA 1
SOURCE ROCK DATA

AUTHOR: R.Suttill	DATE: May 92	PLAN No: YX 001 8546	
DRAWN: C.Kay	DATUM:	CHECKED:	
SCALE: As shown	CONTOUR INT.:	FIG: A2	

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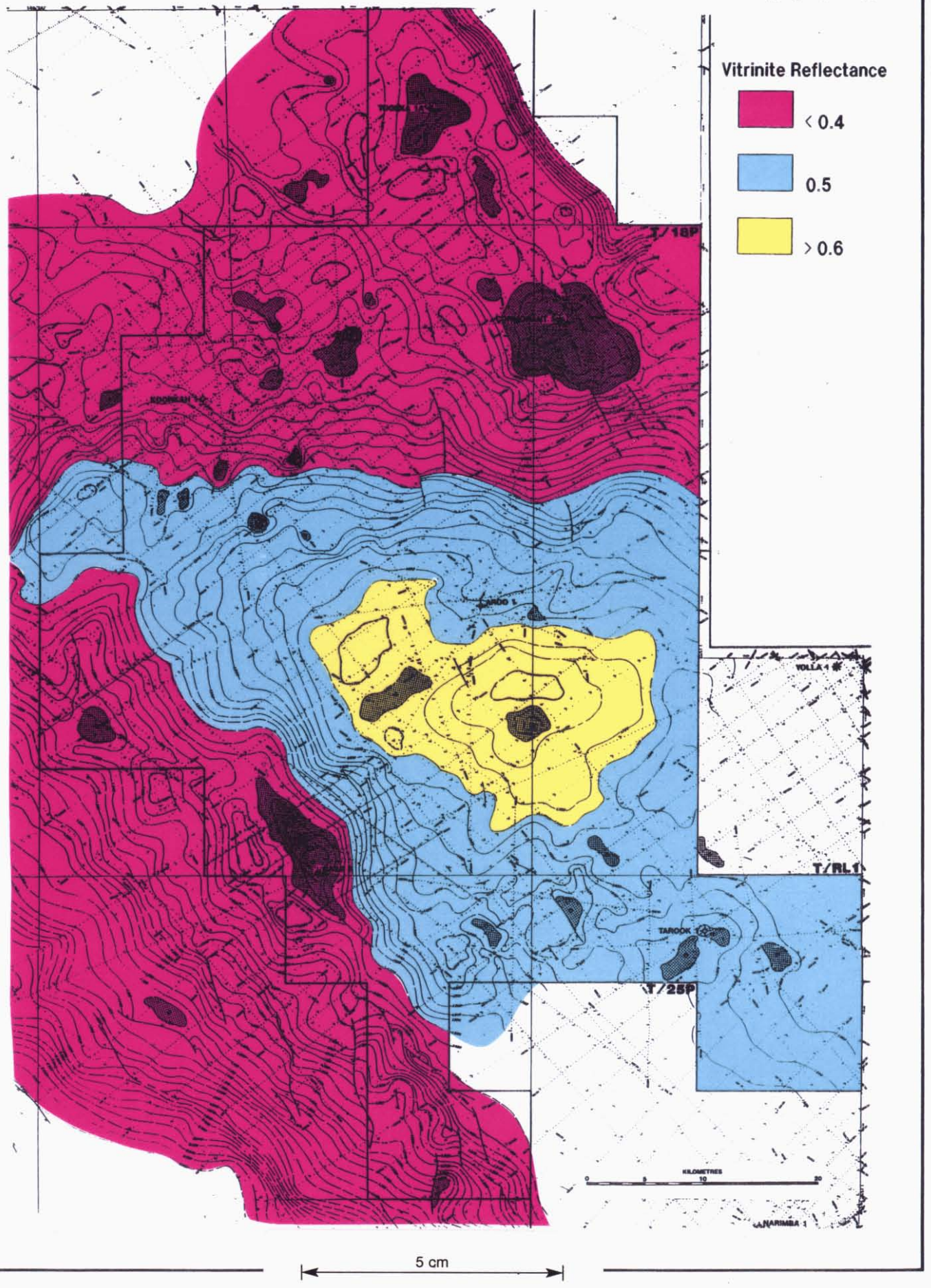
294640



5 cm

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BASS BASIN – TASMANIA

T/18P

Top EVCM Maturity Map

AUTHOR : A.MIGLIUCCI DRAWN : C.Kay DATE : May 92 SCALE : As Shown No. : KG000.8561 FIG : A3

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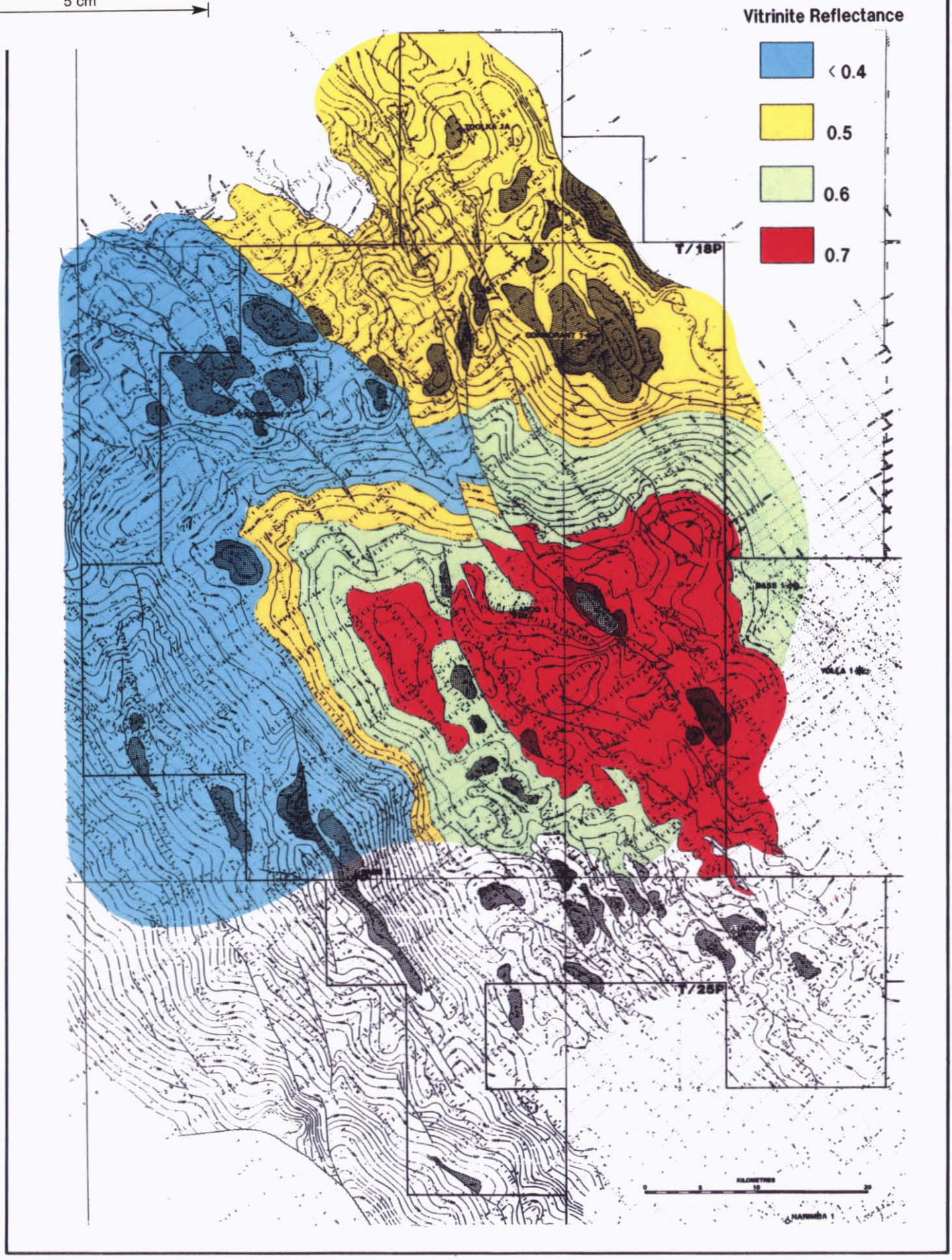
294041

5 cm



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BASS BASIN - TASMANIA

T/18P

Near Base P.asperopolus Maturity Map

AUTHOR : A.MIGLIUCCI DRAWN : C.Kay DATE : May 92 SCALE : As Shown No. : KG000.8562 FIG : A4

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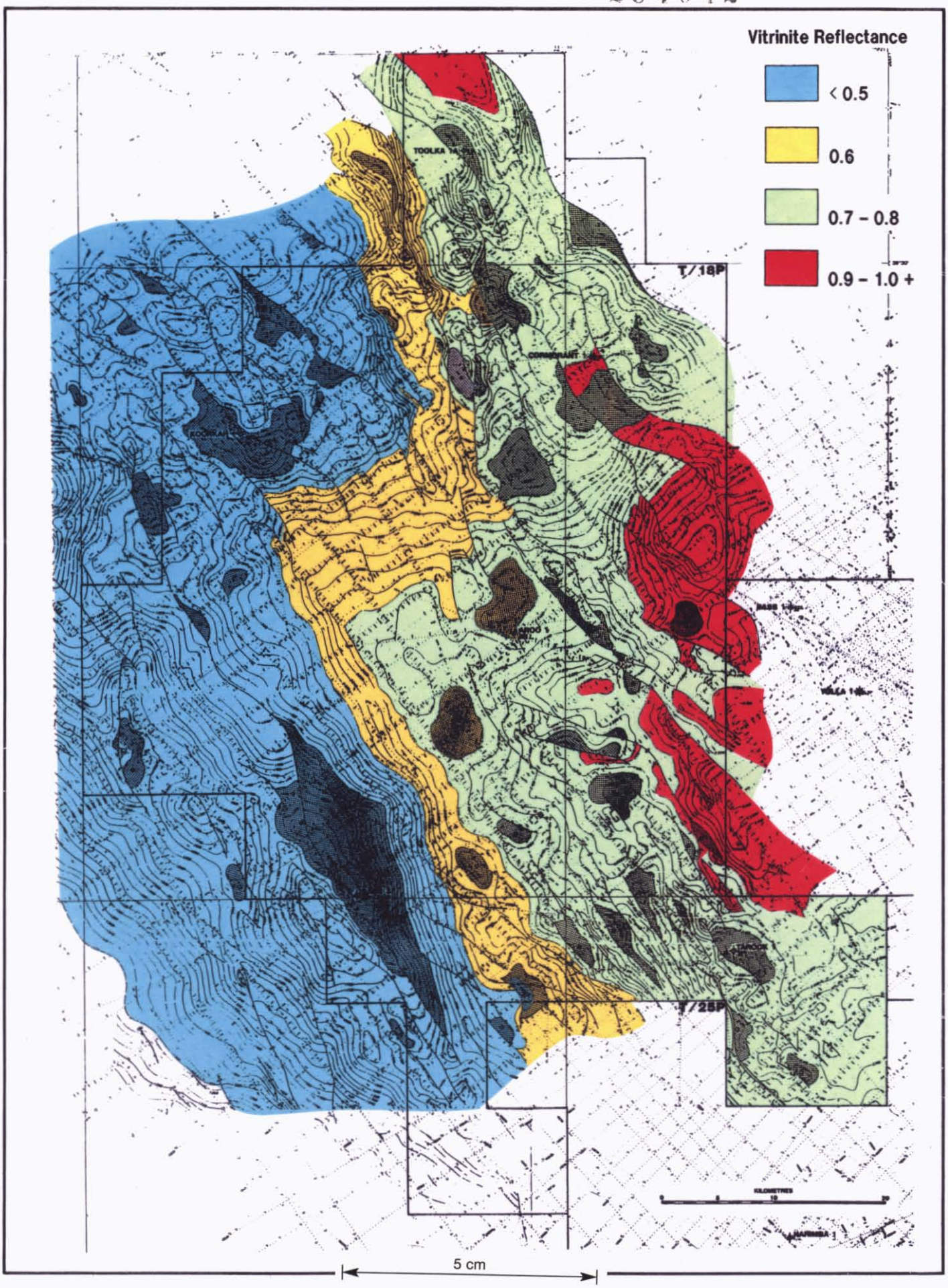
294042



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BASS BASIN – TASMANIA

T/18P

Approx Top Palaeocene Maturity Map

AUTHOR: A.MIGLIUCCI DRAWN: C.Kay DATE: May 92 SCALE: As Shown No.: KG000.8563 FIG: A5

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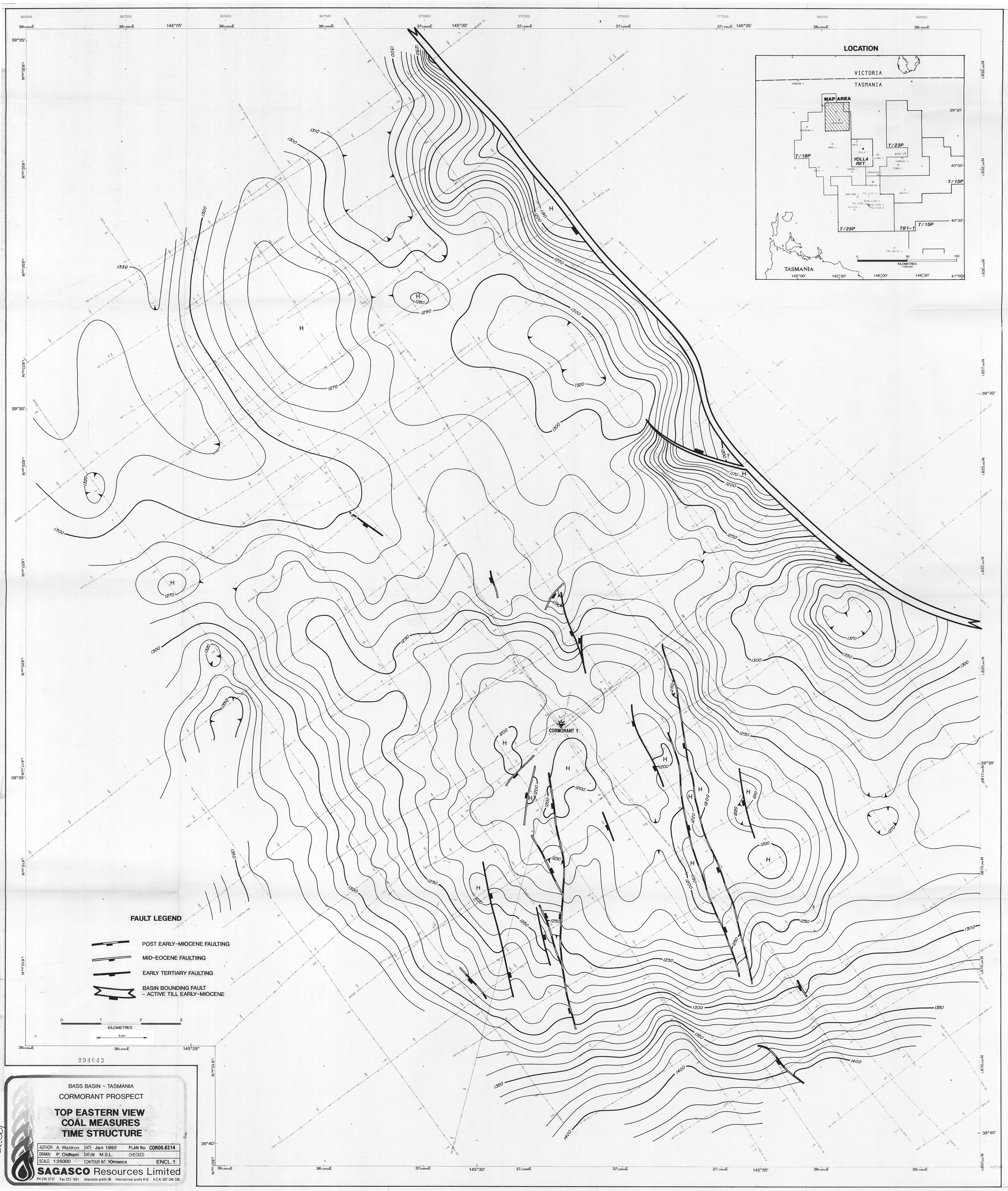
LOCATION
VICTORIA
TASMANIA
MAP AREA
KONKON 1
NIDDRAH 1
ARDD 1
BASS 1
YOLLA 1
TILANA 1
BASS 2
YURONGI 1
ZONDU 1
BASS 3
TARDOK 1
NANGKERO 1
DONBODN 1
NARIMBA 1
PELICAN 3
SQUID 1
PELICAN 2
PELICAN 1
PELICAN 5
PELICAN 4
PIPIPA 1
TAS DEVIL 1
T/18P
T/23P
YOLLA RET.
T/15P
T/25P
T91-1
T/15P
0
50
100
KILOMETRES
1:1000,000
TASMANIA
145°00'
145°30'
146°00'
146°30'
41°00'
39°30'
40°00'
40°30'
1300
1250
1310
1330
1270
1290
1280
1320
1190
1200
1170
1230
1370
1350
1400
H
CORMORANT 1
FAULT LEGEND
POST EARLY-MIOCENE FAULTING
MID-EOCENE FAULTIING
EARLY TERTIARY FAULTING
BASIN BOUNDING FAULT
– ACTIVE TILL EARLY-MIOCENE
0
1
2
3
KILOMETRES
5 cm
360000E
362500E
365000E
367500E
370000E
372500E
375000E
377500E
380000E
382500E
145°25'
145°30'
145°35'
145°25"
39°25'
39°30'
39°35'
39°40'
5635,000N
5632,000N
5630,000N
5627,000N
5625,000N
5622,000N
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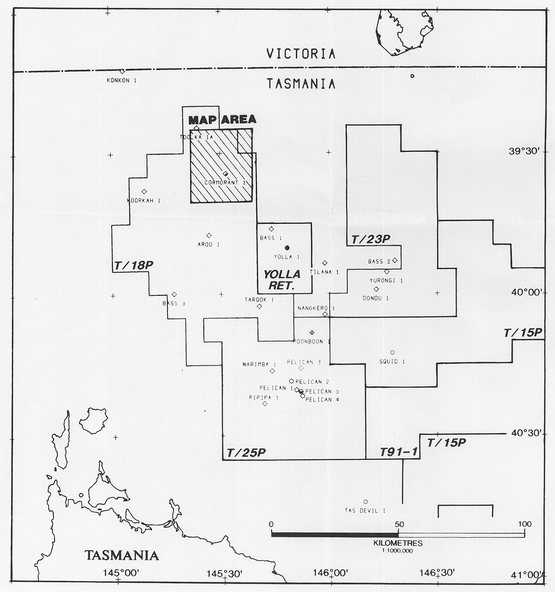
5615,000N
5612,000N
5610,000N
5607,000N
294643
BASS BASIN - TASMANIA
CORMORANT PROSPECT
TOP EASTERN VIEW
COAL MEASURES
TIME STRUCTURE
AUTHOR: A. Waldron
DATE: Jan 1992
PLAN No: COR00.8314
DRAWN: P. Oldham
DATUM: M.S.L.
CHECKED:
SCALE: 1:25000
CONTOUR INT: 10msecs
ENCL. 1
SAGASCO Resources Limited
PH 235 3737 Fax 223 1851 Interstate prefix 08 International prefix 618 A.C.N. 007 045 338



FAULT LEGEND

- POST EARLY-MIOCENE FAULTING
- MID-EOCENE FAULTIING
- EARLY TERTIARY FAULTING
- BASIN BOUNDING FAULT – ACTIVE TILL EARLY-MIOCENE

5 cm

0 1 2 3
KILOMETRES

294644

BASS BASIN - TASMANIA

CORMORANT PROSPECT

BASE N.ASPERUS TIME STRUCTURE

AUTHOR: A. Waldron	DATE: Jan 1992	PLAN No: COR00.8315	
DRAWN: P. Oldham	DATUM: M.S.L.	CHECKED:	
SCALE: 1:25000	CONTOUR INT: 10msecs	ENCL.2	

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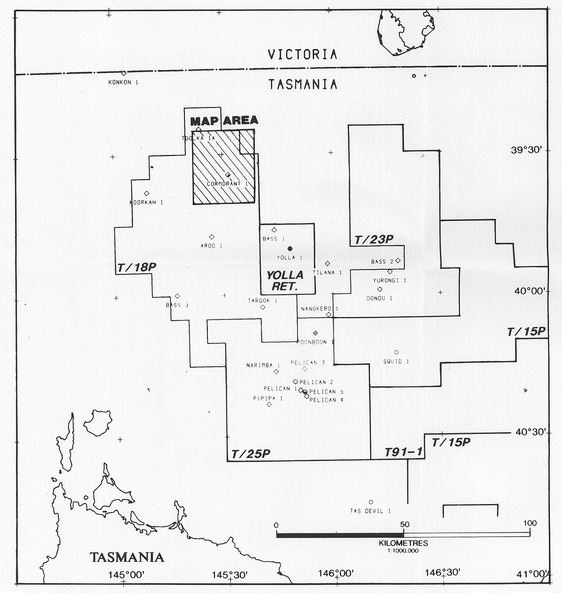

CORMORANT 1

FAULT LEGEND

- POST EARLY-MIOCENE FAULTING
- MID-EOCENE FAULTIING
- EARLY TERTIARY FAULTING
- BASIN BOUNDING FAULT – ACTIVE TILL EARLY-MIOCENE

0 1 2 3
KILOMETRES
5 cm

294645

BASS BASIN - TASMANIA

CORMORANT PROSPECT

NEAR BASE P.ASPEROPOLUS TIME STRUCTURE

AUTHOR: A. Waldron	DATE: Jan 1992	PLAN No: COR00.8316	
DRAWN: P. Oldham	DATUM: M.S.L.	CHECKED:	
SCALE: 1:25000	CONTOUR INT: 10msecs	ENCL.3	

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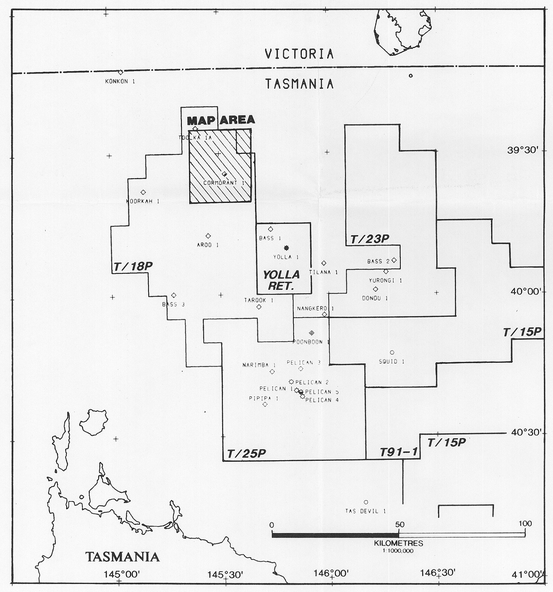
102-30



294646

BASS BASIN – TASMANIA

CORMORANT PROSPECT

NEAR BASE UPPER M.DIVERSUS TIME STRUCTURE

AUTHOR:	A. Waldron	DATE:	Jan 1992	PLAN No:	COR00.8317
DRAWN:	P. Oldham	DATUM:	M.S.L.	CHECKED:	
SCALE:	1:25000	CONTOUR INT:	10msecs		ENCL.4

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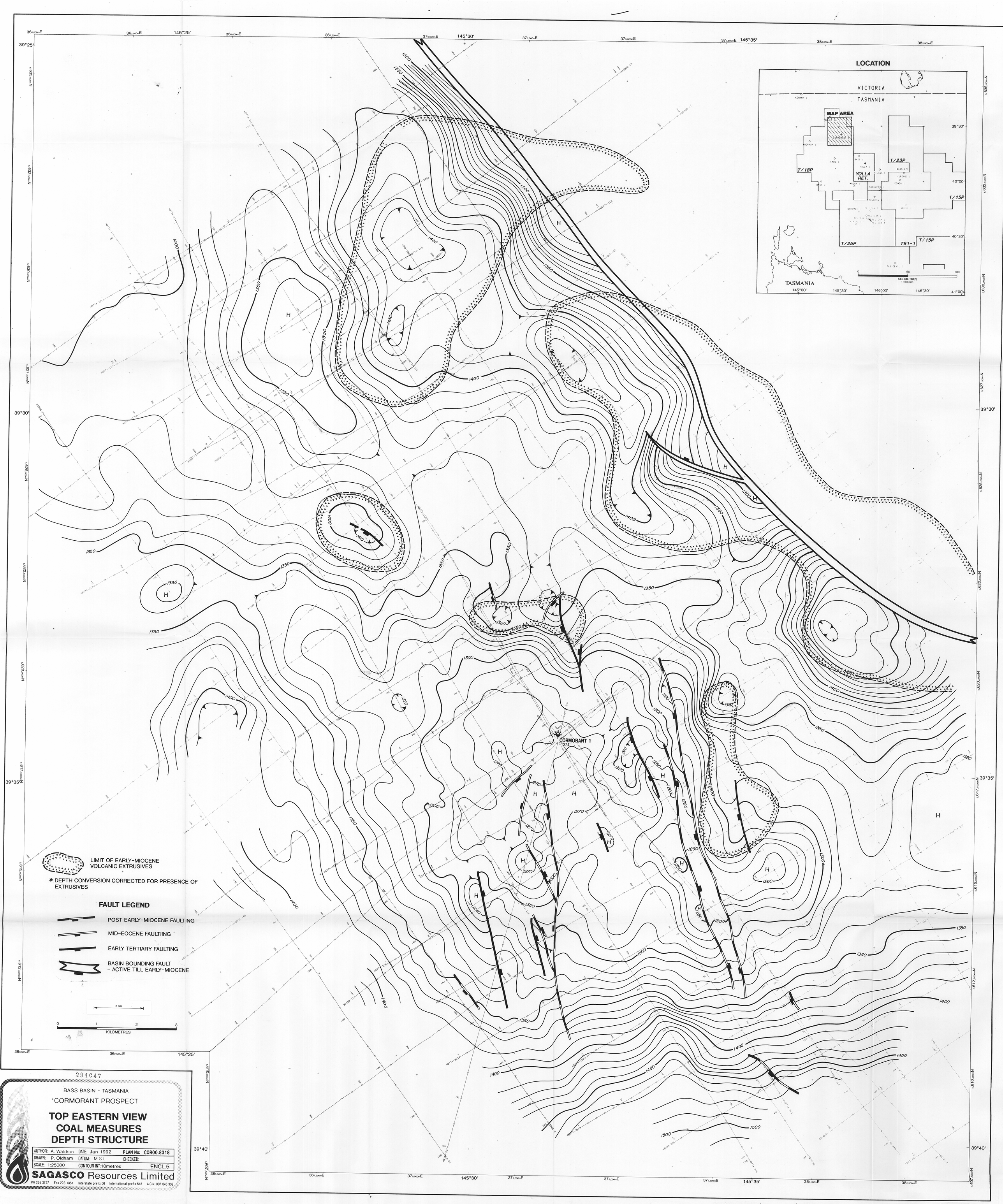


294647

BASS BASIN - TASMANIA

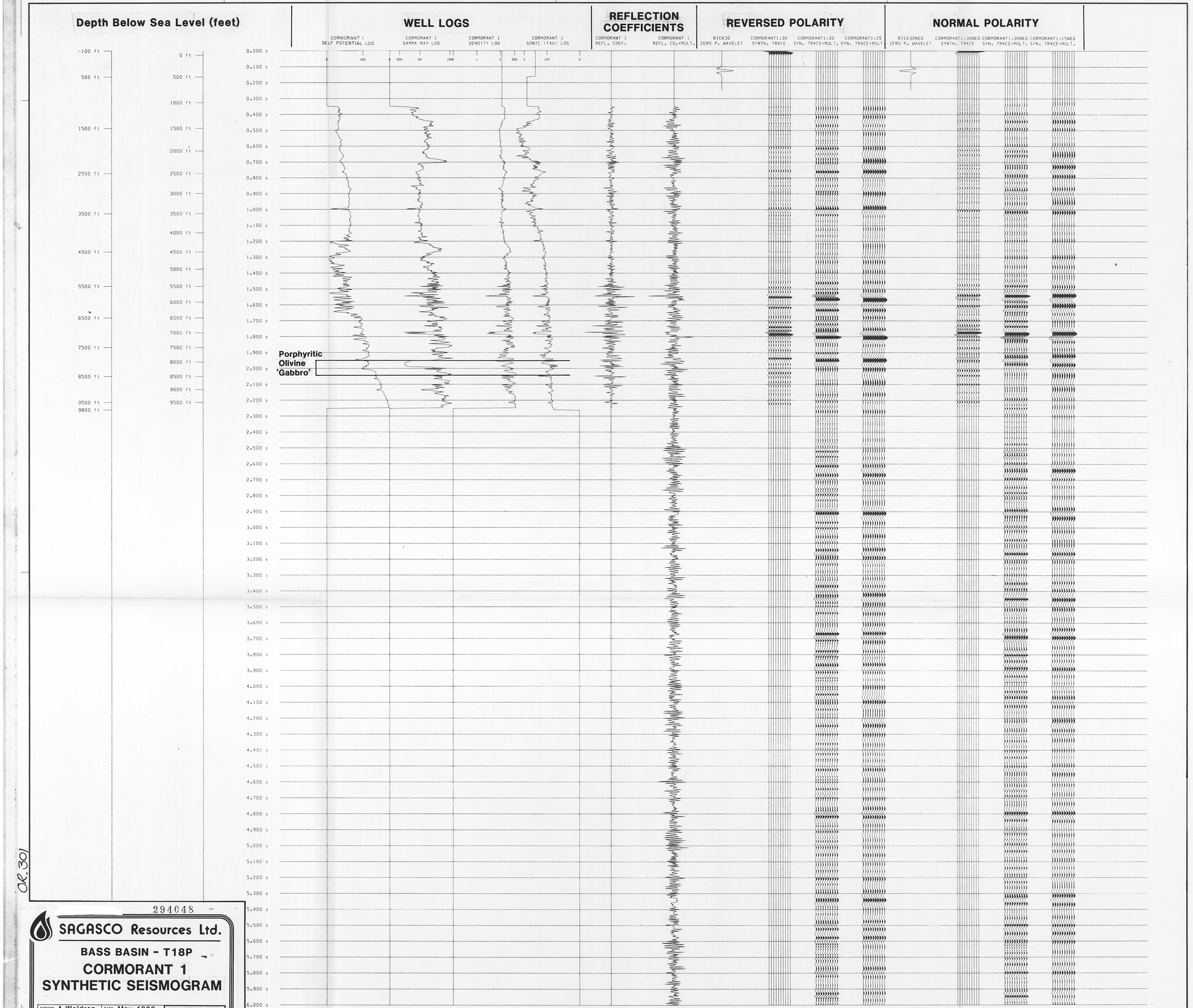
*CORMORANT PROSPECT

TOP EASTERN VIEW COAL MEASURES DEPTH STRUCTURE

AUTHOR: A. Waldron	DATE: Jan 1992	PLAN No:	COR00.8318
DRAWN: P. Oldham	DATUM: M.S.L.	CHECKED:	
SCALE: 1:25000	CONTOUR INT.:10metres		ENCL.5

SAGASCO Resources Limited

PH 235 3737 Fax 223 1851 Interstate prefix 08 International prefix 618 A.C.N. 007 045 338



OR.301

294048

SAGASCO Resources Ltd.

BASS BASIN - T18P

CORMORANT 1
SYNTHETIC SEISMOGRAM

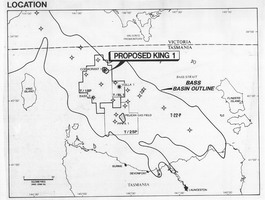
AUTHOR: A.Waldron	DATE: May 1990	COR00.7628
DRAWN: B.D.W.	DATUM: As Shown	
SCALE: As Shown	CONTOUR INTERVAL: N/A	CHECKED: ENCL.6

5 cm

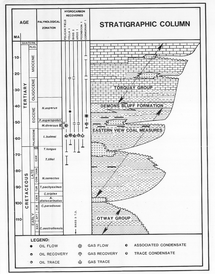
SAGASCO Resources Ltd.

KING 1 PROSPECT MONTAGE

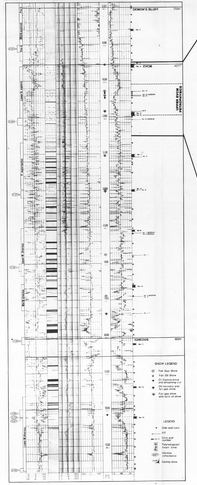
LOCATION



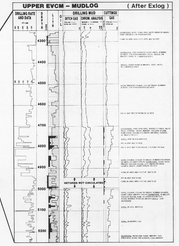
BASS BASIN STRATIGRAPHY



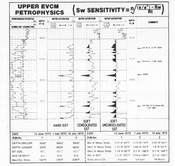
CORMORANT 1 COMPOSITE LOG



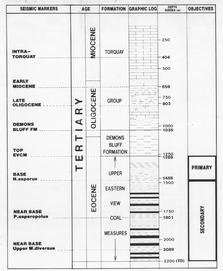
CORMORANT 1 MUDLOG



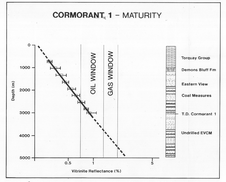
UPPER EVCM PETROPHYSICS



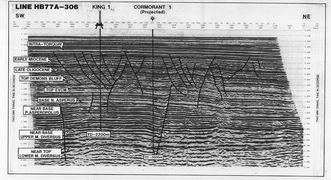
KING 1 DEPTH PROGNOSIS



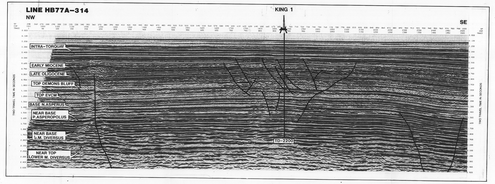
MATURITY PLOT



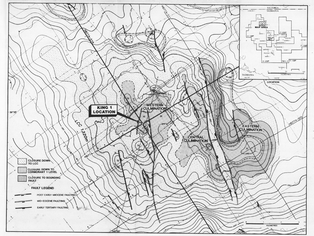
SEISMIC LINE HB77A–306



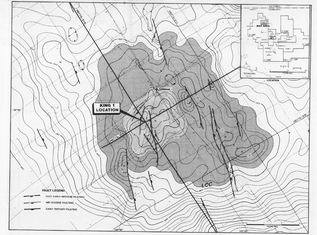
SEISMIC LINE HB77A – 314



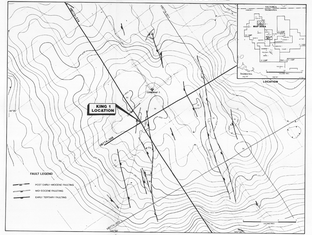
TOP EASTERN VIEW COAL MEASURES DEPTH STRUCTURE



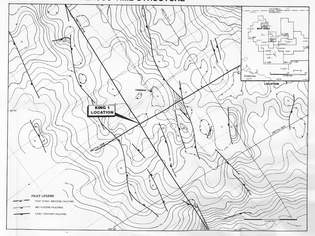
BASE N. ASPERUS TIME STRUCTURE



TOP EASTERN VIEW COAL MEASURES TIME STRUCTURE



BASE UPPER M.DIVERSUS TIME STRUCTURE



PROSPECT ATTRIBUTES

LOCATION: Lat. 38°28'36"S
Long. 147°55'58"E

Intersection of line HB77A-306 (SP 3016)(of HB77A-314)

T1/P Base Basin – 2km southwest of Cormorant 1

DISTANCE TO SHORE: 19Km northwest of Devonport (Tasmania)
27km northwest of Yolla

WATER DEPTH: 75 metres

PLANNED TD: 2300 metres (Sub-Sea)

TRAP: The proposed King 1 well lies within the largest closure of the Cormorant anticline (Base N.asperus Time Structure). The crest of this structure is located 2km southeast of Cormorant 1. The Cormorant structure was formed by structural inversion during the Late Eocene).

RESERVOIR:

Primary: Upper Eastern View Coal Measures sequence in the basal N.asperus zone.

Secondary: Sands between the base N.asperus and near base upper M.diversus.

SEAL: Demons Bluff Formation and EVCM intra-formational shales.

SOURCE: Lower EVCM marine (to oil and gas generation with empty vertical migration in the structure).

The upper EVCM sequence penetrated by Cormorant 1 produced encouraging hydrocarbon shows and FIT recoveries which demonstrate that vertical migration of hydrocarbons into the upper EVCM has occurred from deeper mature source rocks.

PRINCIPAL RISKS:

Seal:
Low risk due to thick Demons Bluff Formation and abundant intra-formational shales.

Reservoir Development/Quality:
There is little risk of the reservoir sequence varying in thickness or quality from the Cormorant 1 location.

Source:
The generative hydrocarbon potential of the source rocks in the investment EVCM is not a major risk, however vertical migration into the upper EVCM target at King 1 has moderate risk.

Structure:
Low risk, structural closure is mapped at all levels prospective for hydrocarbons. Closure is fault independent.

POTENTIAL RESERVES

1. Updip of Cormorant 1 (Base N.asperus level)

		GAS ONLY CASE		GAS ONLY CASE	
AREAL CLOSURE (SQ KM)	PAY (METRES)	GIP (MMSCF)	REC (BCF)	GIP (MMSCF)	REC (BCF)
9.3	15	79.4	19.9	71.6	30.1

2. Base N.asperus/ deeps to LCC

		OIL ONLY CASE		GAS ONLY CASE	
AREAL CLOSURE (SQ KM)	PAY (METRES)	OIP (MMBBL)	REC (MMBBL)	GIP (BCF)	REC (BCF)
62.2	40	700	245	1184.3	803.1

SAGASCO Resources Ltd.
T 1/P BASS BASIN
KING 1 PROSPECT MONTAGE