WCR (VOL. 2)
BLACKBACK - 1
(W994)

ESSO EXPLORATION AND PRODUCTION
AUSTRALIA INC.

W994

WELL COMPLETION REPORT

BLACKBACK-1
BLACKBACK-1 SIDETRACK-1
BLACKBACK-1 SIDETRACK-2
VOLUME 2
INTERPRETED DATA

GIPPSLAND BASIN
VICTORIA

ESSO AUSTRALIA RESOURCES LIMITED

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APRIL 1990

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GEOLOGICAL AND GEOPHYSICAL ANALYSIS

1. SUMMARY OF WELL RESULTS

Formation/Horizon	Pre-drill Depth (mSS TVD)	Post Drill Depth (mSS TVD)
Gippsland Limestone (seafloor)	398	418
Lakes Entrance Formation	2485	2549
Top of Latrobe Group	2758	2802
70.5 MY Sequence Boundary*	2806	Not Seen
Base of Channel	-	2883
Top of Lower T. longus Sands	3387	3420
Lower T. longus Seismic Marker	3473	3522
TD	3750	4022

* Now referred to as the 68 MY Sequence Boundary

2. INTRODUCTION

The twin objectives of the Blackback-1 exploration well were:

1. to test a sequence of lower T. longus sands sealed by thick coastal plain shales and coals in a simple faulted anticlinal trap, and

2. To test a marginal marine sand developed on the 70.5 MY sequence boundary (now known as the 68.0 MY sequence boundary), in a location updip from Hapuku 1.

The well intersected a 31m gross oil column reservoired in N. asperus aged channel fill sediments as the top of Latrobe Group. This zone subsequently tested at 1508 BPD of 51^{o} API gravity oil with 1.9 MMSCF of gas. The 68.0 MY sequence was absent at this location.

A further 10 reservoir systems were defined within the lower T. longus coastal plain sediments which were more sandy than anticipated. The lower T. longus target sands were water bearing, however a thin oil accumulation was intersected below the coal of the Lower T. longus seismic marker. The well was deepened to a total depth of 4022mSS TVD, intersecting two additional thin hydrocarbon zones before being plugged and abandoned as a successful exploration well.

3. PREVIOUS HISTORY

The area of the Blackback prospect was part of the original VIC/P1 permit. One exploration well, Hapuku-1 was drilled on an interpreted anticlinal trend in 1975. This well intersected an interpreted 46m of gross oil column below the Top of Latrobe Group in poor quality reservoir. An N. asperus aged shale overlies a sequence of lower shoreface sands to offshore shales of upper L. balmei age. The well was plugged and abandoned as a non commercial discovery. The area was relinquished in 1979. Subsequently the area was acquired by BHPP (Victoria) as VIC/P24 in 1986. The Blackback well represents the Year 2 commitment well for the permit.

4. STRUCTURE

The Blackback structure is a closure mapped on a northeasterly plunging anticline. New seismic data, re-mapping and the dipmeter from Hapuku-1 showed that Hapuku-1 was located on the northern flank of the anticline and that there was potential to encounter upper-shoreface sands developed on the 68 million year sequence boundary, (previously 70.5 MY SB) penetrated in Hapuku-1 in a situation 90m updip from Hapuku-1.

Deeper in the section the height of closure increases, at the level of the lower T. longus seismic marker the crest of the anticline was predicted to occur 140m updip from Hapuku, which was dry at this level.

The Blackback well was expected to penetrate this horizon 108m updip from Hapuku. Truncation of the youngest Latrobe Group by the top of Latrobe Group unconformity along the southern flank of the anticline causes the structural crest of the top of Latrobe Group target to be displaced northwest of the main anticlinal axis. The top of Latrobe Group was encountered at 2802mSS TVD, 44m low to prediction. Late

Latrobe Group channel fill sediments were encountered immediately below the Top of Latrobe. Below the base of the channel at 2883m correlation with Hapuku 1 indicates that Blackback 1 ST2 is 60m updip at the Lower T. longus seismic marker, 48m deep to prediction. This confirms the original structural interpretation though the error in predicting the Top of Latrobe Group is reflected in each of the predicted tops. Adjusting the mapping for the deeper top of Latrobe, (Enclosures 2 and 3) suggests that Blackback 1 ST2 was close to the anticlinal axis at the total depth of 4022mSS TVD.

5. STATIGRAPHY

The Blackback well was expected to encounter Lower T. longus sediments below the top of Latrobe and perhaps T. lilliei aged section close to T.D. 38m of upper shoreface sands deposited on the 68 MY sequence boundary were expected to overlie 160m of estuarine/marginal marine sediments. Below this a thick sequence of coastal plain coals, shales and minor sandstones were expected to overlie a basal lower T. longus marginal marine sandstones.

81m of Upper N. asperus to Lower N. asperus sandstones were encountered below the top of Latrobe Group at 2802mSS TVD. These sandstones are rich in glauconite, pyrite, siderite and micas and are interpreted to represent a marine channel fill unit.

The section from the base of the channel at 2883mSS TVD to 3866mSS TVD is dated as Lower T. longus. No positive dating was possible in the basal 156m of the hole. This section from 2883mSS can be divided into 3 broad units and is essentially as predicted. The interval from 2883mSS TVD to 3098mSS TVD consists of interbedded sandstones, siltstones and minor shales. The presence of the dinoflagellate M. druggii, (2891m to 2919 mSS TVD), confirms the marine influence and dates the upper part of the section to the upper part of the Lower T. longus.

Coastal plain coals, shales and sandstones from the second unit from 3098mSS TVD to 3420mSS TVD. Below 3420mSS TVD to TD the section consists primarily of sandstone with minor siltstone and shale. The occurrence of rare dinoflagellates and the lack of coals indicate a return to marginal marine conditions.

6. HYDROCARBONS

Blackback-1 and Blackback-1 ST1 encountered a 31m gross oil column below the top of Latrobe Group. An oil water contact was identified at 2833mSS TVD. Two cores were cut through the oil zone, both recovered sandstone that was very rich in glauconite and also contained significant amounts of siderite and clay. Common micas and minor feldspars were also present. This unusual mineralogical assemblage is responsible for the abnormal electric log responses observed. The resistivity logs are suppressed in the oil zone and the gamma ray/neutron/density combination suggest that the section is more shaley than it actually is (Figure 2). Calibration to core analysis results have been difficult due to the presence of the abnormal mineral assemblage and the difficulties in generating reliable data from the core plugs. Results of the petrophysical studies are summarised in Appendix 3 and Appendix 7.

The oil recovered on test from the top of Latrobe Group is a light volatile crude. The API gravity is 51° with a gas oil ratio of 1260 SCF/BBL. Although similar to the oil recovered from Hapuku-1, it differs significantly from other nearby top of Latrobe accumulations such as Mackerel. The most likely explanation of this is a variation in source areas and migration pathways.

Intra Latrobe hydrocarbons occur below 3265mSS TVD. Eight thin hydrocarbon bearing zones are recognised in the basal portion of the Lower T. longus coastal plain unit, (Figure 3). This section contains both gas and oil zones. Individual zones attain a maximum thickness of 6m true vertical thickness, (T240). Each has a base seal and RFT data suggest fairly short columns of between 1m and 5m below the base of the sand (Appendix 5).

RFT samples recovered gas from 1 zone and oil from 1 zone. The sample from the T250 is not definitive. The oil recovered was extremely volatile. Fluid contents of the other zones in this interval have been interpreted from log responses and from geochemical extracts from sidewall cores.

Within the lower T. longus marginal marine section 3 further hydrocarbon zones have been identified, (Figures 4 and 5). An oil zone, the T450, occurs below the coal of the Lower T. longus seismic marker (at -3521.5mSS). An oil water contact occurs at 3524mSS TVD. The oil is of a similar character to the other intra Latrobe oils at 53° API gravity and being extremely volatile and gas saturated.

A gas zone the T600 is developed below 3778mSS TVD, 7m TVT gross of gas occurs and RFT pressures suggest a 3m column downdip from low proved gas.

An oil zone is interpreted below 3805mSS TVD and an oil water contact is evident at 3809mSS TVD. This is supported by the RFT pressure interpretation.

At the level of the T200, the top of the sand is calculated to be 33m downdip from the crest of the structure. This decreases to 15m at the level of the T650, due to the deviation of the well bore.

7. GEOPHYSICAL DISCUSSION

Seismic data over the prospect has a spacing of 1km or less. Vintages vary from 1980 to 1988. All the data were processed or reprocessed by GSI in 1988. Well ties to the data were provided by Hapuku-1 and Volador 1. The Sierra RAYMAP depth conversion/raytracing program was used to compensate for the water bottom distortions of the data.

Post-drill the top of Latrobe Group structure map (Enclosure 2) was generated by creating an average velocity map from the original depth and time maps. This average velocity map was adjusted to tie the average velocity determined from the well results. The new average velocity map was then multiplied by the original two way time map to produce a new top of Latrobe Group map.

The post-drill Lower T. longus seismic marker map (Enclosure 3), was created using a constant interval velocity derived from the Blackback well to isopach down from the top of Latrobe Group.

The error in depth prediction at the top of Latrobe Group was 1.6%. Pre-drill there was no indication of the N. asperus filled channel.

8. DISCUSSION

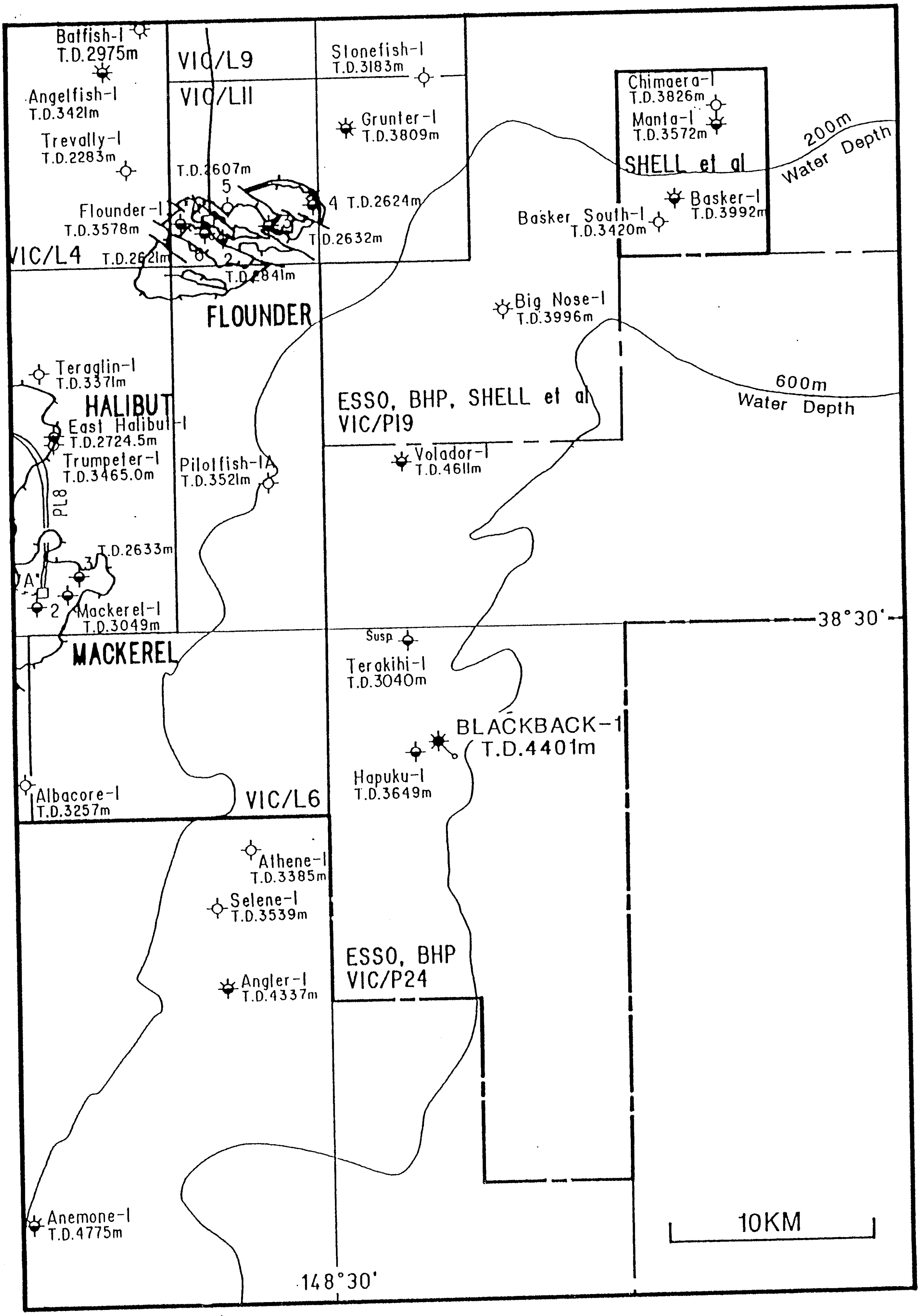
The pre-drill internal Latrobe structural configuration was demonstrated to be essentially correct. The error in velocities used in depth conversion was reflected in all predicted tops. This together with the N. asperus channel fill which was not predicted to occur acted to reduce the scale of success.

The observed oil water contact at -2833mSS is 3m above the calculated contact in Hapuku-1, though the contact in Hapuku-1 is not well defined, it is likely that the two wells have a common contact.

The failure of the Lower T. longus target to host a larger pool is most likely due to a lack of seal. The overlying coastal plain section being more sandy than predicted. The occurrence of the hydrocarbon bearing zones within this unit prognosed to seal is evidence that hydrocarbons have migrated through this section.

FIGURES

BLACKBACK-1
LOCALITY MAP



2452/C

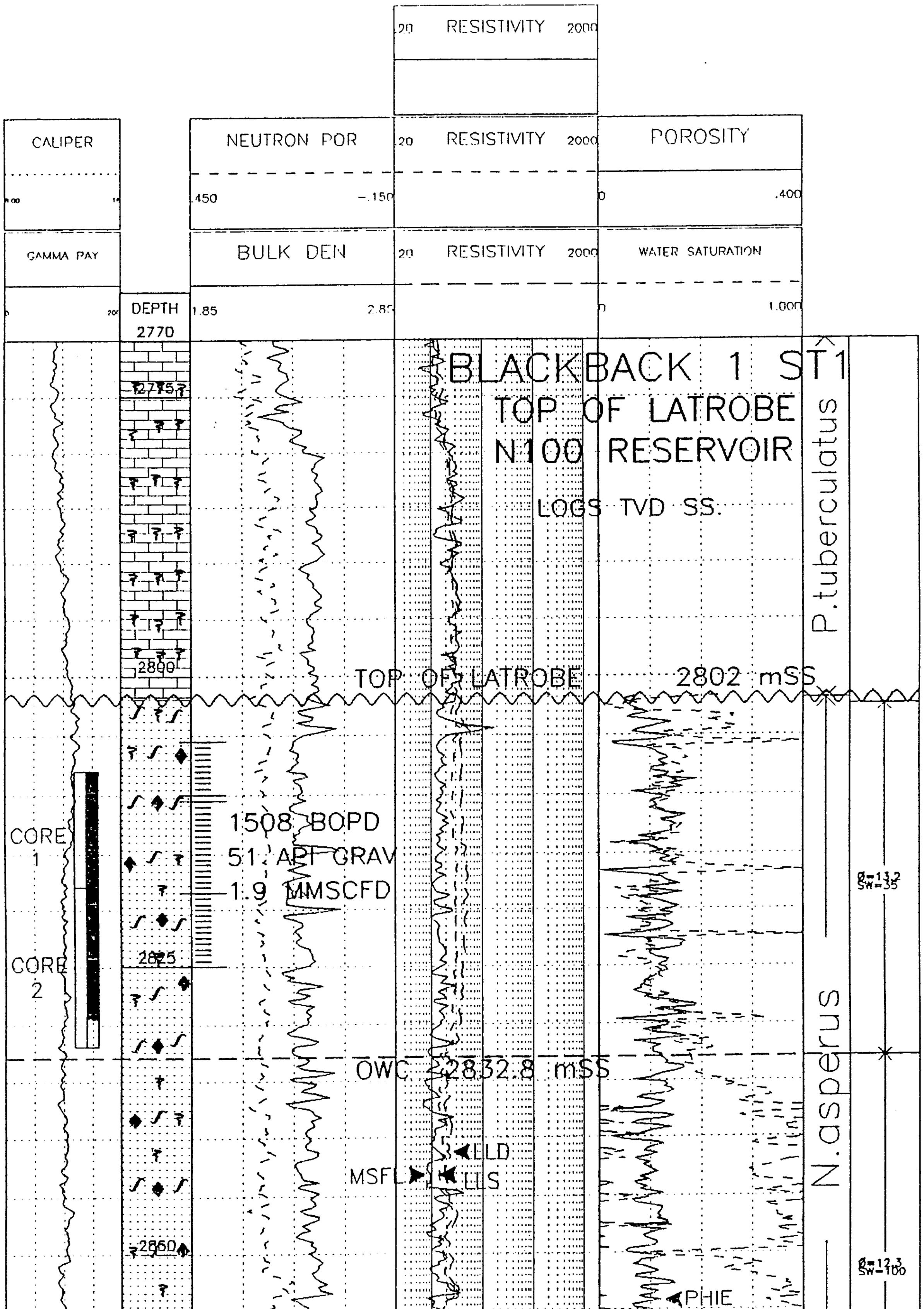

RESISTIVITY
RESISTIVITY
RESISTIVITY
CALIPER
GAMMA RAY
DEPTH
NEUTRON POR
BULK DEN
POROSITY
WATER SATURATION
BLACKBACK 1 ST1
TOP OF LATROBE
N100 RESERVOIR
LOGS TVD SS.
TOP OF LATROBE 2802 mSS
1508 BOPD
51. API GRAV
1.9 MMSCFD
CORE 1
CORE 2
OWC 2832.8 mSS
LLD
MSFL
LLS
PHIE
CALI
GR
NPHI
RHOB
SWE
P.tuberculatus
N.asperus

FIGURE 2

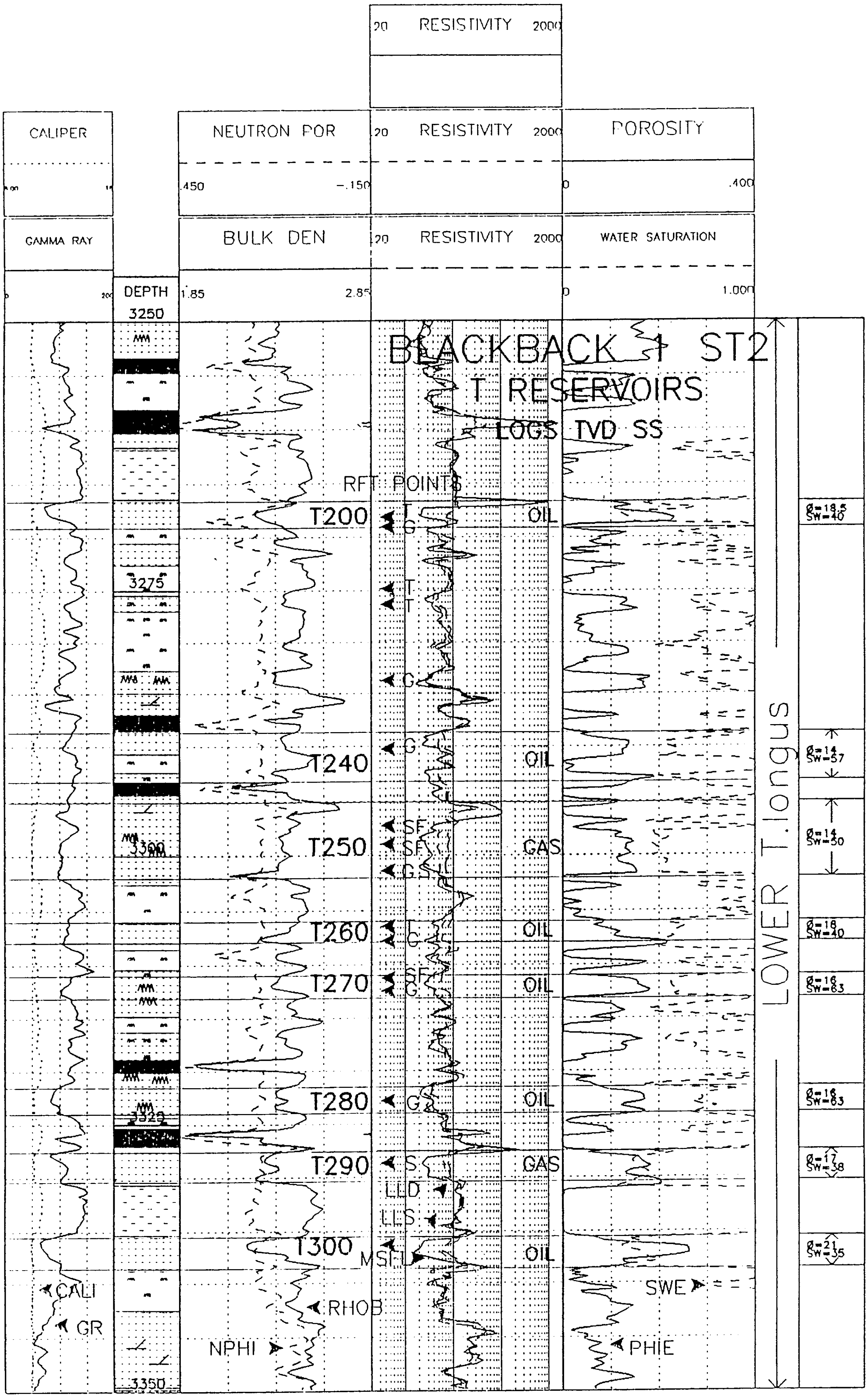
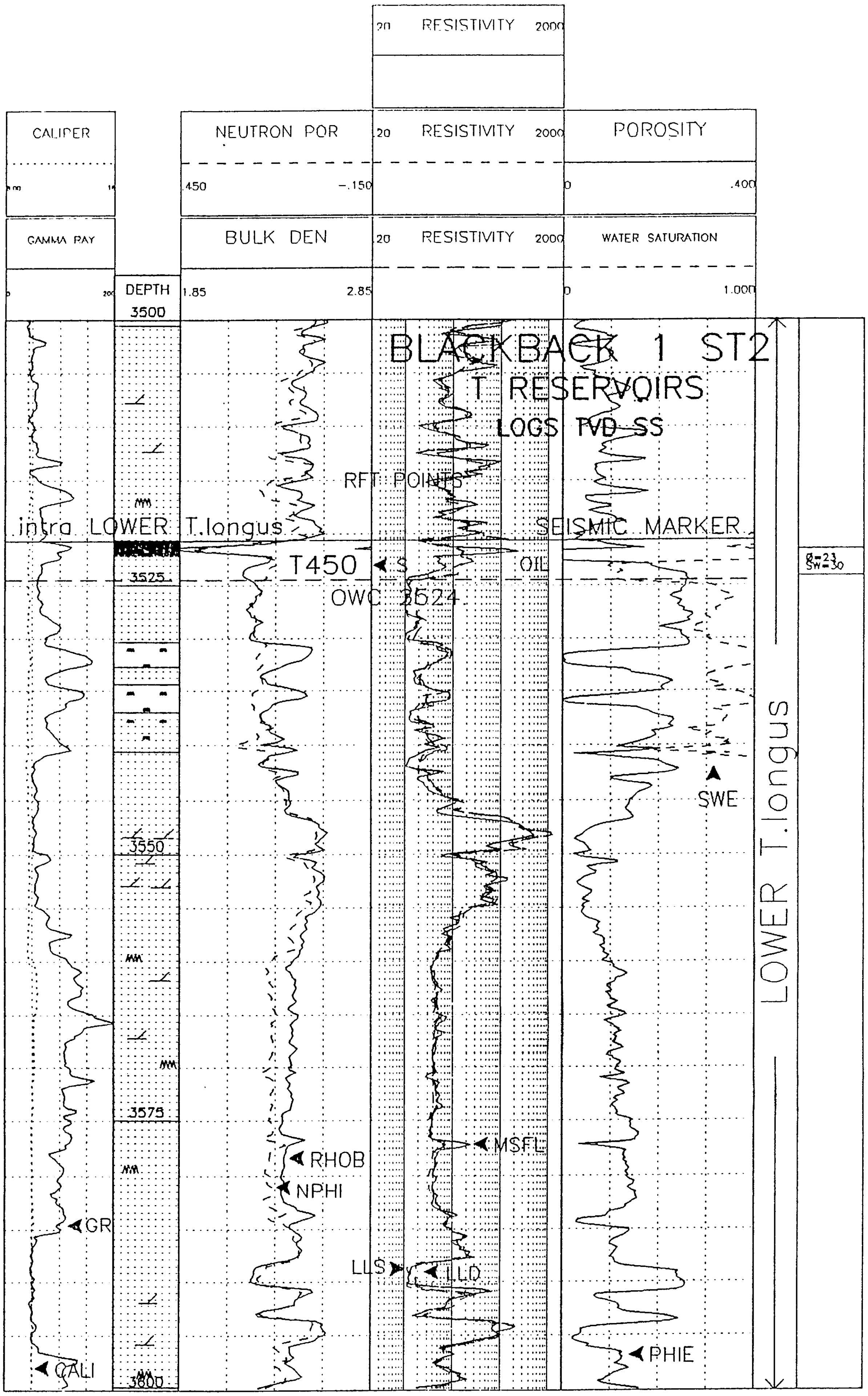
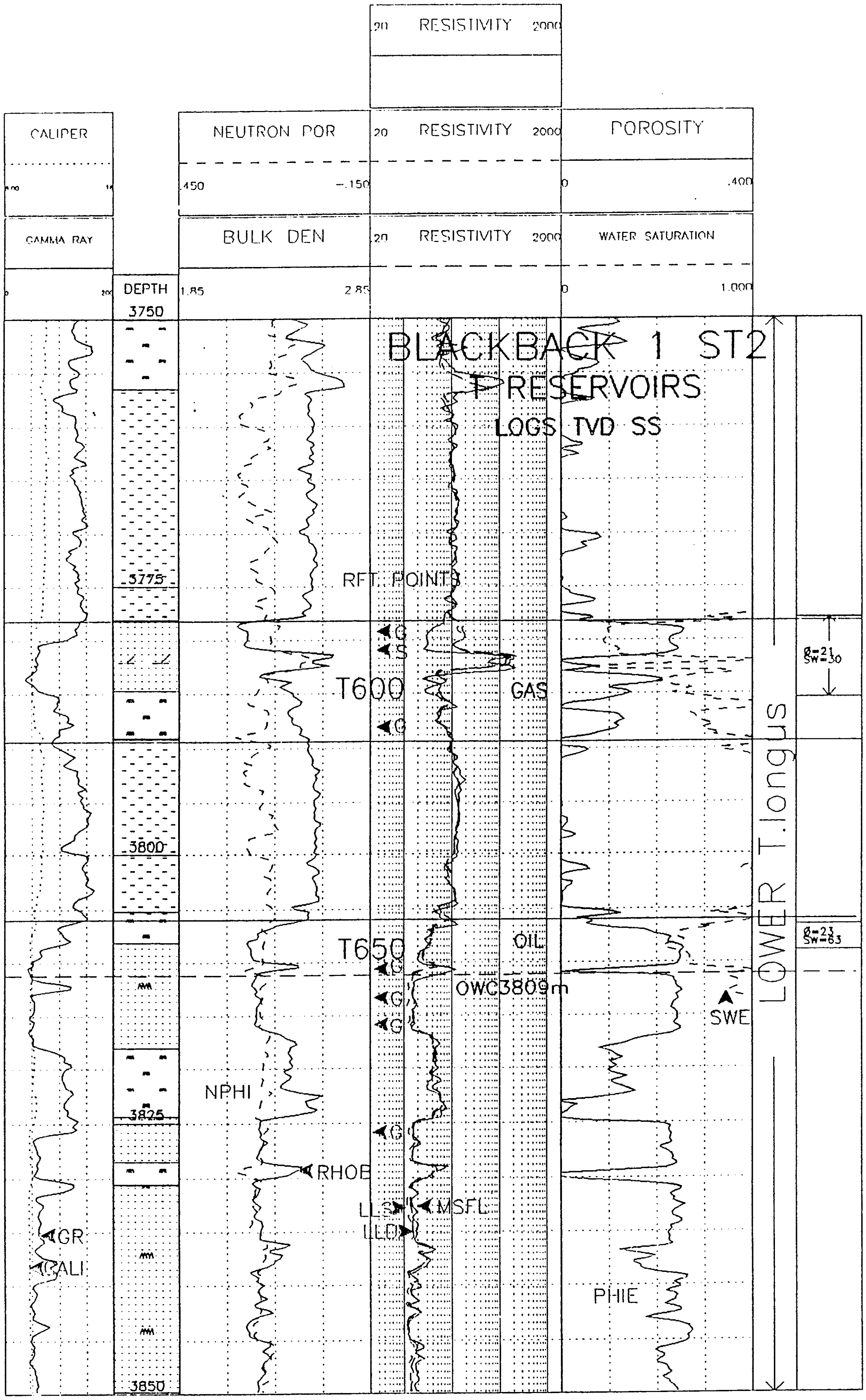

BLACKBACK 1 ST2
T RESERVOIRS
LOGS TVD SS
CALIPER
GAMMA RAY
DEPTH
NEUTRON POR
BULK DEN
RESISTIVITY
POROSITY
WATER SATURATION
RFT POINTS
T200
T240
T250
T260
T270
T280
T290
T300
OIL
GAS
LOWER T.longus
CALI
GR
NPHI
RHOB
LLD
LLS
MSFL
SWE
PHIE
3250
3275
3300
3325
3350

FIGURE 3



RESISTIVITY
CALIPER
NEUTRON POR
RESISTIVITY
POROSITY
GAMMA RAY
BULK DEN
RESISTIVITY
WATER SATURATION
DEPTH
1.85
2.85
.450
-.150
20
2000
0
.400
1.000
3500
3525
3550
3575
3600
BLACKBACK 1 ST2
T RESERVOIRS
LOGS TVD SS
RFT POINTS
intra LOWER T.longus
SEISMIC MARKER
T450
OIL
OWC 3524
SWE
LOWER T.longus
RHOB
NPHI
MSFL
GR
LLS
LLD
PHIE
CALI

FIGURE 4



RESISTIVITY
NEUTRON POR
RESISTIVITY
POROSITY
CALIPER
GAMMA RAY
BULK DEN
RESISTIVITY
WATER SATURATION
DEPTH
BLACKBACK 1 ST2
T RESERVOIRS
LOGS TVD SS
RFT. POINTS
T600
GAS
T650
OIL
OWC3809m
SWE
LOWER T.longus
NPHI
RHOB
LLS
MSFL
LLD
GR
CALI
PHIE

FIGURE 5

APPENDIX 1

APPENDIX 1

APPENDIX-1

FORAMINIFERAL ANALYSIS OF ESSO/BHP BLACKBACK-1 SIDETRACK-1, GIPPSLAND BASIN.

by

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Palaeontology Report 1990/8

February, 1990.

INTRODUCTION

The foraminiferal data summarised on the attached data sheets are a result of the rapid scans of the top seven samples in Blackback-1 ST-1. In each sample only the key indicator species were recorded, these are listed in Table-1.

M.J. HANNAH.

TABLE-1: FORAMINIFERAL DATA, BLACKBACK-1 SIDETRACK-1.

SWC NO.	DEPTH (METRES)	ZONE	AGE	KEY SPECIES
30	2828	G	Early Miocene	*Globigerinoides trilobus, Globigerina woodi, Globoquadrina dehiscens.*
29	2838	G	Early Miocene	*Globigerinoides trilobus, Globoquadrina dehiscens*
28	2841	G	Indeterminate	
27	2851.5	G	Early Miocene	*Globigerinoides trilobus, Globoquadrina dehiscens*
26	2850.0	G	Early Miocene	*Globigerinoides trilobus, Globoquadrina dehiscens, Globigerina woodi connecta.*
25	2862		Indeterminate	
24	2870	J	Early Oligocene	*Subbotina angiporoides*

(MH95)

MICROPALEONTOLOGICAL DATA SHEET

BASIN: GIPPSLAND
ELEVATION: KB: +21.0m GL: -418.0m

WELL NAME: BLACKBACK-1 SIDETRACK-1
TOTAL DEPTH: 3047.0m

AGE		FORAM. ZONULES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
PLEISTOCENE		A_1										
		A_2										
PLIOCENE		A_3										
		A_4										
		B_1										
MIOCENE	LATE	B_2										
		C										
	MIDDLE	D_1										
		D_2										
		E_1										
		E_2										
	EARLY	F										
		G	2827.9	1				2856	1			
		H_1										
OLIGOCENE	LATE	H_2										
		I_1										
		I_2										
	EARLY	J_1						2870	1			
		J_2										
EOCENE		K										
		Pre-K										

COMMENTS: All depths in metres.
Foraminiferal data based on the shallowest seven sidewall cores recovered from Blackback-1 Sidetrack-1.

CONFIDENCE RATING:
- O: SWC or Core - Complete assemblage (very high confidence).
- 1: SWC or Core - Almost complete assemblage (high confidence).
- 2: SWC or Core - Close to zonule change but able to interpret (low confidence)
- 3: Cuttings - Complete assemblage (low confidence).
- 4: Cuttings - Incomplete assemblage, next to uninterpretable or SWC with depth suspicion (very low confidence).

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: M. Hannah DATE: February, 16, 1990.

DATA REVISED BY: DATE:

MICROPALEONTOLOGICAL DATA SHEET

BASIN: *GIPPSLAND* ELEVATION: KB: *+21.0m* GL: *-418.0m*

WELL NAME: *BLACKBACK-1* TOTAL DEPTH: *4022m T.V.D.*

AGE		FORAM. ZONULES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
PLEISTOCENE		A_1										
		A_2										
PLIOCENE		A_3										
		A_4										
		B_1										
MIOCENE	LATE	B_2										
		C										
	MIDDLE	D_1										
		D_2										
		E_1										
		E_2										
	EARLY	F										
		G	*2757*	*1*				*2779*	*1*			
		H_1										
OLIGOCENE	LATE	H_2										
		I_1										
		I_2										
	EARLY	J_1						*2790*	*1*			
		J_2										
EOCENE		K										
		Pre-K										

COMMENTS: *All depths have been converted to True Vertical Depth (TVD) Foraminiferal analysis was only undertaken on shallowest seven sidewall cores recovered from Blackback-1 Sidetrack-1.*

CONFIDENCE RATING:
- O: SWC or Core - Complete assemblage (very high confidence).
- 1: SWC or Core - Almost complete assemblage (high confidence).
- 2: SWC or Core - Close to zonule change but able to interpret (low confidence).
- 3: Cuttings - Complete assemblage (low confidence).
- 4: Cuttings - Incomplete assemblage, next to uninterpretable or SWC with depth suspicion (very low confidence).

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: *M. Hannah* DATE: *February 16, 1990.*

DATA REVISED BY: DATE:

APPENDIX
2

APPENDIX-2

PALYNOLOGICAL ANALYSIS OF BLACKBACK-1 AND ITS SIDETRACKS 1 AND 2 IN PERMIT VIC/P24, GIPPSLAND BASIN.

by

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AND

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Palaeontology Report 1990/4

March, 1990

INTERPRETED DATA

INTRODUCTION

A total of sixty-eight samples, comprising forty-eight sidewall cores, eight conventional core samples and twelve cuttings samples were processed from Blackback-1 and its two sidetracks and examined for spores, pollen and microplankton.

In Blackback-1 four conventional core samples and four cutting samples were examined from the Middle to Late Eocene channel fill section. Oxidised organic residue yields were mostly low resulting in mostly low to moderate palynomorph concentration and diversity.

In Blackback-1 Sidetrack-1 sixteen sidewall cores and four conventional cores were examined. Two of the sidewall cores examined were the basal Lakes Entrance Formation while the remaining samples were from the Middle to Late Eocene channel fill section. As in the original hole oxidised organic residue yields and palynomorph yields were mostly low, however recorded species diversity for both spores-pollen and microplankton were significantly higher resulting in zone assignments of higher confidence.

In Blackback-1 Sidetrack-2 thirty-two sidewall cores and eight cutting samples were examined. All samples are from the undifferentiated part of the Latrobe Group (often referred to as Latrobe coarse clastics). Oxidised residue yields were mostly moderate to high, but palynomorph and diversity was variable from very low to high.

Lithological units and palynological zones from base of Lakes Entrance Formation to T.D. are given in the following summary. Interpretative data with indentification of zones and their confidence ratings are recorded in Tables-1 to 3, while basic data on residue yields, preservation and diversity are recorded in Tables-4 to 6. All species which can be identified with binomial names are tabulated on the accompanying separate range charts for the original Blackback-1 and the Sidetrack-1 and Sidetrack-2 holes.

All depths given in this report are measured depths in the respective boreholes except on the Palynological Data Sheet where the data from the three boreholes has been merged and reported as TVDSS (True Vertical Depth Subsea).

PALYNOLOGICAL SUMMARY OF BLACKBACK-1 AND SIDETRACKS 1 AND 2.

ALL DEPTHS ON SUMMARY ARE MEASURED DEPTHS IN RESPECTIVE BOREHOLES.

AGE	UNIT/FACIES	BLACKBACK-1		SIDETRACK-1		SIDETRACK-2	
		SPORE-POLLEN ZONES (DINOFLAGELLATE ZONES)	DEPTHS (mKB)	SPORE-POLLEN ZONES (DINOFLAGELLATE ZONES)	DEPTHS (mKB)	SPORE-POLLEN ZONES (DINOFLAGELLATE ZONES)	DEPTHS (mKB)
Oligocene	Lakes Entrance Formation	NOT SAMPLED		*P. tuberculatus*	2877.0	NOT SAMPLED	
Oligocene?				Upper *N. asperus*	2884.0		
			2897m		2887m		
Late Eocene	LATROBE GROUP: "*N. asperus* Channel-fill"			Upper *N. asperus*	2887.4		
Late Eocene		Middle *N. asperus*	2903.0-2911.4	Middle *N. asperus* (*T. spinosus*)*	2897.0-2912.8 (2908.6)	NOT SAMPLED	
Middle Eocene		Lower *N. asperus*	2915.0	Lower *N. asperus* (*T. inaequalis*)*	2917.6-2991.0 (2940.0-2980.0)		
UNCONFORMITY			3003m		2996m		2996m
Maastrichtian	LATROBE GROUP: Undifferentiated or "coarse clastics" facies	NOT SAMPLED		NOT SAMPLED		Upper *T. longus* (*M. druggii*)	3008.0-3142.0 (3008.0-3045.0)
Maastrichtian						Lower *T. longus*	3260.0-4221.5
			T.D. 3400m		T.D. 3047m		T.D. 4401m

* Informal Microplankton Zones.

GEOLOGICAL COMMENTS

1) The Maastrichtian Upper and Lower *T. longus* Zones are recorded over a measured interval of over 2,000 metres in the deviated Sidetrack-2. Assuming the zone extends to T.D. a minimum true vertical thickness of 1,100 metres was drilled. The minimum average depositional rate is 157 metres/million years. Similar thicknesses for the zones were drilled in other nearby deep wells, *viz*: Flounder-1 (1070+ metres), Flounder-A1 (1140+ metres) Hermes-1 (1430 metres) and Volador-1 (1,200 metres).

2) Review and re-examination of palynomorph assemblages recorded from the adjacent Hapuku-1 well indicate that it was also still within the Lower *T. longus* Zone at T.D. A significant section in Hapuku-1 was originally assigned to the underlying *T. lilliei* Zone on the **negative evidence** of the absence of key *T. longus* Zone index species such as *Forcipites longus*, *Quadraplanus brossus* and *Tetracolporites verrucosus*. It is now considered that insufficient samples were analysed from this well and insufficient time spent searching for the rarer zone species. The combined thickness of the Upper and Lower *T. longus* Zones intersected in Hapuku-1 is about 750 metres.

3) The spore-pollen assemblages recorded in sidewall core samples from the *T. longus* Zones in both Blackback-1 and Hapuku-1 are typically of low to moderate diversity and this is considered to be an affect of the higher than average depositional rates during these zones. In the thicker sections of most of the Late Cretaceous to Paleocene zones in the Gippsland Basin, it is empirically observed that key spore-pollen index species are often rare. This rarity is interpreted to reflect dilution or masking of the more regional index species by more abundant long ranging species. Most of the latter species are known to originate from parent plants which would have been most abundant on the coastal plain and therefore produce spore-pollen of more local origin.

4) At least two marine incursions are recognised in the Late Cretaceous in Blackback-1 Sidetrack-2. The younger incursion is part of the widespread *M. druggii* Zone identified at the top of the section between 3008-3045m. It is suggested the whole of the Upper *T. longus* Zone may be marine on the presence of glauconite in the sidewall cores and absence of coals through the section.

   The older incursion is represented by rare but diagnostic early Maastrichtian dinoflagellates between 4095-4112m. It is suggested that the shales between 4074-4152m, which represent the thickest shale package in the lower part of the well, may correlate to one of the Maastrichtian condensed sections (see Haq *et al.* 1987, 1988; Loutit *et al.* 1988).

The rarity of dinoflagellate specimens in both incursions is considered to be due to dilution by "local" terrestrial spore-pollen.

5) A major erosive unconformity separates the Maastrichtian *T. longus* Zones from the overlying Middle to Late Eocene *N. asperus* Zones. At this unconformity the condensed sequence of dinoflagellate rich Paleocene to Early Eocene sediments in the adjacent Hapuku-1 between 9227-9400 feet (2812.4-2865.1m) have all been eroded. The presence of marine sediments above and below the unconformity and the location of Blackback-1 with respect to the known palaeogeography of the basin suggests the unconformity was most likely formed by a submarine channel or canyon.

6) The "*N. asperus* Channel Fill" in Blackback-1 is predominantly a poorly sorted, glauconitic sandstone. The unit varies from siltstone through fine to medium grained sandstone. Overall the unit is much coarser grained than either of the age equivalent Turrum or Gurnard Formations, and the reservoired hydrocarbons indicate it has better porosities than either of the latter formations. The presence of the acritarch *Tritonites inequalis* in microplankton assemblages from the "*N. asperus* Channel Fill" and absence of the older species *T. tricornus* and *T. pandus* indicate an age younger than the oldest Turrum Formation (see Marshall & Partridge, 1988). It is therefore difficult to source the coarser sands in Blackback from down the Marlin Channel.

7) The common occurrence in the "*N. asperus* Channel Fill" of microplankton species interpreted as reworked suggest instead a provenance for the unit to the south-west. Although the palynological data on the wells Athene-1, Selene-1 and Helios-1 in that direction is somewhat patchy the following observations are made:

   a) In Athene-1 the sidewall core assemblage at 2838.5m contains a Lower *N. asperus* Zone assemblage with frequent *Areosphaeridium* sp. cf *A. arcuatum* associated with *Homotyblium tasmaniense* a species association characteristic of this zone in Blackback-1. The immediately underlying sidewall core at 2879.5m contains an Upper *T. longus* Zone assemblage.

b) In Helios-1 the sidewall core at 2630m contains a *P. asperopolus* Zone assemblage in which *Homotyblium tasmaniense* comprises 14% of the assemblage and also has the only previous record the acritarch *Tritonites bilobus* in the Gippsland Basin (R. Morgan, pers comm.). This latter species is significant as it is recorded as reworked in Blackback. At the time of description of the *Tritonites* species *T. bilobus* had not been found in the Gippsland Basin even though plenty of suitable aged samples had been examined to the north of the Blackback location (Marshall & Partridge, 1988). Overlying the *P. asperopolus* Zone in Helios-1 is a poorly documented *N. asperus* Zone section between 2596-2680m. Unfortunately the recorded assemblages are too limited to make a clear comparison to assemblages of the same age in Blackback.

c) Rare reworked Paleocene dinoflagellates in the "*N. asperus* Channel Fill" suggest local reworking from a condensed marine Paleocene section similar to that documented in Hapuku-1 (Partridge, 1975).

8) Comparing the microplankton assemblages in Blackback with those recorded from Hapuku-1 including the distribution of reworking it is suggested that the base of the "*N. asperus* Channel Fill" in Hapuku-1 lies between the sidewall cores at 9221 ft and 9227 ft (2810.6-2812.4m).

BIOSTRATIGRAPHY

Zone and age determinations have been made using criteria proposed by Stover & Partridge (1973), Helby *et al.* (1987) and unpublished observations made on Gippsland Basin wells drilled by Esso Australia Ltd.

Author citations for most spore-pollen species can be sourced from Stover & Partridge (1973, 1982), Helby *et al.* (1987) and Dettmann & Jarzen (1988) or other references cited herein. Species names followed by "ms" are unpublished manuscript names. Zone names have not been altered to conform with recent nomenclatural changes to nominate species such as *Forcipites* (al.*Tricolpites*) *longus* (Stover & Evans) Dettmann & Jarzen 1988. Author citations for dinoflagellates can be found in Lentin & Williams (1985, 1989).

Lower *Tricolpites longus* Zone Maastrichtian.

The Lower *T. longus* Zone is recorded from Sidetrack-2 between 3260-4221.5m but probably extends the extra 180 metres to T.D. Although moderate to high organic residue yields were obtained from most samples, palynomorph concentrations were often low, and the mostly moderate species diversity of the individual samples reflect this. Overall the total species diversity in the zone is high with 68 spore-pollen species recorded on the range chart. It is notable however that key zone species were recorded in less than half of samples examined (i.e. 9 out of 23 sidewall cores). The species used to identify the base of the zone are *Forcipites longus* (identified in 5 sidewall cores), *Tetracolporites verrucosus* (identified in 3 sidewall cores at 3802.5m, 3949m and 4095m), and *Quadraplanus brossus* (from sidewall cores at 3448m and 3478.5m). These species were also recorded from cuttings samples. About a third of the sidewall cores, although clearly containing Late Cretaceous assemblages could only be confidently assigned to the broader time interval of *T. lilliei* to *T. longus* Zones.

In the lower half of the zone very rare microplankton are recorded in the samples. Usually only a single specimen or fragment was recorded in any one palynological slide. Most of the fragmented specimens are peridinacean dinoflagellates and have been recorded on the range chart as *Isabelidinium* spp. The four significant species recorded are all only represented by single specimens. These are *Isabelidinium pellucidum*, from cuttings at 4110m; *Odontochitina spinosa* from SWC 70 at 4112m; *Nelsoniella tuberculata* from SWC 11 at 4112m, *Isabelidinium cretaceum* at 4095m. The first two species are consistent with an early Maastrichtian age (Helby *et* *al*. 1987, fig. 40; Wilson, 1984) while *N. tuberculata* and *I. cretaceum* are not normally recorded in sediments younger than Campanian.

Upper *Tricolpites longus* Zone **Maastrichtian.**

This zone is recorded from five sidewall cores from Sidetrack-2 between 3008-3142m. The base of the zone is recognised by the increase in abundance of *Gambierina* spp. principally *G. rudata*. The deepest three samples containing this characteristic abundance are only give a confidence rating of 2. The higher confidence rating of 1 is reserved for the shallower samples containing either *Stereisporites (Tripunctisporis)* spp. (at 3008.0m) or the indicator species for the *M. druggii* Zone. These are several specimens of *Manumiella conoratum* at 3008m and 3045m , while *Manumiella druggii* was only recorded from the shallower sample.

Lower *Nothofagidites asperus* Zone **Middle Eocene.**

The Lower *N. asperus* Zone was recorded in the original Blackback-1 from a single conventional core sample at 2915m and from both conventional core and sidewall core samples in the Sidetrack-1 between 2917-2991m.

The zone is identified on the common to abundant presence of *Nothofagidites* spp. including the First Appearance Datum (FAD) for *Nothofagidites falcatus* at 2991m in Sidetrack-1.

The microplankton assemblages in the samples also indicate a Middle Eocene age and suggest a correlation with the upper part of the Lower *N. asperus* Zone. Key microplankton identified in the Sidetrack-1 samples are dinoflagellates *Wilsonidium lineidentatum* (at 2965.1m and 2991m); *Rhombodinium glabrum* (at 2940m and 2967.5m); *Achilleodinium* sp. cf. *A. biformoides* (at 2951.9m) and the acritarch *Tritonites inaequalis*. The ranges of these species according to Marshall & Partridge (1988, fig. 4) would suggest a correlation with the *D. heterophlycta* Zone of Partridge (1976). Unfortunately *Deflandrea heterophlycta* was not positively identified, although possible endocysts with the characteristic verrucate ornament of the species were recorded in the sidewall core at 2991m.

Two pollen species recorded do suggest a younger Middle *N. asperus* Zone age for the sequence in Sidetrack-1. These are single specimens of *Triorites magnificus* recorded at 2980m and *Proteacidites tuberculatus* recorded at 2946.2m. It is considered preferable to regard these records as anomalously low first appearances for these species, and favour the age dating indicated by the more abundant microplankton.

The gross composition of the microplankton assemblages can be characterised by the unusual association of *Areosphaeridium* sp. cf *A. arcuatum* and *Homotryblium tasmaniense*.

Areosphaeridium australicum ms (= *Areosphaeidium* sp. cf. *A. diktyoplokus* in Marshall & Partridge 1988) is typical the dominent species in many samples from the Lower *N. asperus* Zone in the Gippsland Basin. In this well it is only positively recorded from the deepest core sample in Blackback-1. The remainder of the samples from the zone contain rare to common specimens of the closely related species *Areosphaeridium* sp. cf. *A. arcuatum*. Although previously recorded from the Gippsland Basin the total range, geographic distribution and likely acme of this species is poorly understood.

The frequent to common *Homotryblium tasmaniense* specimens found in most samples are all interpreted to be reworked. *Homotryblium tasmaniense* is not found in other well sampled Middle to Late Eocene marine sequences referred to the *N. asperus* Zone elsewhere in the Gippsland Basin. For example, *H. tasmaniense* is not found in the Turrum Formation in the Marlin Channel in wells such as Turrum-1 and Remora-1 (Partridge, 1987). Nor is *H. tasmaniense* found in the Gurnard Formation. For example see well sampled Gurnard Formation in Swordfish-1 (Partridge, 1977). The only exception is the record of *H. tasmaniense* in the Upper *N. asperus* Zone from the adjacent Hapuku-1 well. The range of *H. tasmaniense* in other wells in the Gippsland Basin suggests that the reworking is from Early Eocene Upper *M. diversus* to *P. asperopolus* Zones. Another reworked fossil suggesting a similar age is a specimen of *Tritonites bilobus* recorded at 2951.5m in Sidetrack-1 (see Marshall & Partridge, 1988, fig.4).

In addition to the dominant Early Eocene reworking there are a few rare specimens of key Paleocene dinoflagellates which are also interpreted as reworked. The most notable are *Palaeoperidinium pyrophorum* at 2991m and *Eisenackia crassitabulata* at 2923.97m both from Sidetrack-1.

Middle *Nothofagidites asperus* Zone Late Eocene.

The Middle *N. asperus* Zone is recorded from the conventional core-1 in Blackback-1 between 2903-2911.41m and in the Sidetrack-1 between 2987-2912.8m from conventional core-1 and a shallower sidewall core.

Nearly all the samples gave low to very low yields, and although the assemblages are clearly assigned to the broader *N. asperus* Zone interval, key indicator species for the Middle subdivision are rare.

In the original Blackback-1 hole key spore-pollen species were not recorded and the zone assignment is based on the associated microplankton. Key species of which, in order of importance, are: *Schematophora speciosus* (2911.41m); *Alisocysta ornata* (2905.56m); A. sp. cf. *A. ornata* (2903m); and *Areosphaeridium capricornum* (2911.41m).

In the Sidetrack-1 hole the key spore-pollen recorded are *Triorites magnificus* (2912.8m) and *Proteacidites rectomarginis* (2908.6m). The microplankton support the zone assignment and the key species recorded are: *Tritonites spinosus* (2912.8m); *Areosphaeridium capricornum* (2987m); *Deflandrea leptodermata* (2987m) and *Corrudinium corrugatum* ms (2908.6m and 2912.8m).

Upper *Nothofagidites asperus* Zone **Late Eocene-Oligocene.**

Two sidewall cores at 2884m and 2887.4m from Sidetrack-1 are assigned to the Upper *N. asperus* Zone.

The deeper sample at 2887.4m gave only a very low yield and the palynomorph assemblage was dominated by spore-pollen. The sample is assigned to the Upper subdivision on presence of *Proteacidites stipplatus*.

The shallower sample at 2884m gave a high yield and a high concentration of palynomorphs, again dominated by spore-pollen, and is assigned to the Upper subdivision based on the frequent occurrence of both *P. stipplatus* and *P. rectomarginis*.

The few microplankton recorded in both samples were not diagnostic.

***Proteacidites tuberculatus* Zone** **Oligocene.**

The sidewall at 2877m in Sidetrack-1 was assigned to the *P. tuberculatus* Zone on the presence of the key spore *Cyatheacidites annulatus*. The diverse spore-pollen assemblage also contained frequent *Proteacidites rectomarginis* and rare *P. stipplatus*, while the microplankton were dominated by *Operculodinium centrocarpum*.

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TABLE-1: INTERPRETATIVE PALYNOLOGICAL DATA BLACKBACK-1, GIPPSLAND BASIN.

SAMPLE TYPE	DEPTH (METRES)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENTS
Core-1	2903.0	Middle *N. asperus*		2	
Core-1	2905.56	Middle *N. asperus*	(*A. ornata*)	1	
Core-1	2911.41	Middle *N. asperus*	(*S. speciosus*)	0	*Rhombodinium glabrum* present.
Core-1	2915.0	Lower *N. asperus*		2	*Areosphaeridium australicum* ms present.
Cuttings	2935	Indeterminate			Abundant *P. tuberculatus* Zone cavings.
Cuttings	2950	Indeterminate			
Cuttings	2970	Indeterminate			
Cuttings	2995	Indeterminate			*Areosphaeridium* sp. cf. *A. arcuatum* present.

TABLE-2: INTERPRETATIVE PALYNOLOGICAL DATA BLACKBACK-1, SIDETRACK-1, GIPPSLAND BASIN.

SAMPLE TYPE	DEPTH (METRES)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENTS
SWC 23	2877.0	*P. tuberculatus*		1	*Cyatheacidites annulatus* present.
SWC 22	2884.0	Upper *N. asperus*		1	Frequent *Proteacidites stipplatus*.
SWC 21	2887.4	Upper *N. asperus*		2	
SWC 18	2897.0	Middle *N. asperus*		2	Age based on dinoflagellates.
Core-1	2908.6	Middle *N. asperus*	(*T. spinosus*)	2	
Core-1	2912.8	Middle *N. asperus*		0	*Triorites magnificus* present.
Core-1	2917.6	Lower *N. asperus*		2	*Areosphaeridium* sp. cf. *A. arcuatum* common.
Core-1	2923.97	Lower *N. asperus*		1	*A.* sp. cf. *A. arcuatum* frequent.
SWC 15	2936.0	Lower *N. asperus*		2	
SWC 14	2940.0	Lower *N. asperus*	(*T. inaequalis*)	1	
SWC 13	2946.2	Lower *N. asperus*	(*T. inaequalis*)	1	*Proteacidites pachypolus* frequent!
SWC 12	2951.9	Lower *N. asperus*		2	Reworked *Tritonites bilobus*!
SWC 11	2959.5	Lower *N. asperus*	(*T. inaequalis*)	1	
SWC 10	2965.1	Lower *N. asperus*	(*T. inaequalis*)	1	*Wilsonidinium lineidentatum* present.
SWC 9	2967.5	Lower *N. asperus*		2	*Rhombodinium glabrum* present.
SWC 6	2980.0	Lower *N. asperus*	(*T. inaequalis*)	1	Anomalously low record of *Triorites magnificus*.
SWC 5	2984.5	Indeterminate		-	
SWC 4	2987.2	Indeterminate		-	Most dinoflagellates caved.
SWC 3	2991.0	Lower *N. asperus*		1	*W. lineidentatum*, *N. falcatus* present.
SWC 1	2995.0	Indeterminate		-	

TABLE-3: INTERPRETATIVE PALYNOLOGICAL DATA BLACKBACK-1 SIDETRACK-2, GIPPSLAND BASIN

Sheet 1 of 2

SAMPLE TYPE	DEPTH (METRES)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENT
SWC 90	3008.0	Upper *T. longus*	*M. druggii*	1	
SWC 89	3045.0	Upper *T. longus*	*M. druggii*	1	
SWC 57	3082.0	Upper *T. longus*		2	
SWC 56	3095.0	Upper *T. longus*		2	
SWC 54	3142.0	Upper *T. longus*		2	*Gambierina* common.
SWC 53	3180.0	Indeterminate			
SWC 52	3236.0	Indeterminate			
SWC 88	3260.0	Lower *T. longus*		1	*Proteacidites reticuloconcavus* ms present.
SWC 87	3280.5	*T. lilliei/T. longus*			
SWC 49	3332.5	*T. lilliei/T. longus*			
SWC 48	3357.5	Indeterminate			Limited assemblage from coal.
SWC 86	3377.5	*T. lilliei/T. longus*			
SWC 46	3400.5	*T. lilliei/T. longus*			
SWC 45	3427.0	*T. lilliei/T. longus*			
SWC 44	3448.0	Lower *T. longus*		1	*Quadraplanus brossus* present.
SWC 42	3478.5	Lower *T. longus*		1	*Quadraplanus brossus* present
SWC 84	3479.5	Lower *T. longus*		1	*Forcipites longus* present.
SWC 36	3535.0	Lower *T. longus*		2	*Proteacidites reticuloconcavus* ms present.
SWC 80	3603.5	*T. lilliei/T. longus*			
SWC 26	3643.0	*T. lilliei/T. longus*			
SWC 25	3660.5	Lower *T. longus*		1	*F. longus* present.
SWC 79	3728.0	Lower *T. longus*		1	*F. longus*, *Micrhystridium* sp. present.
SWC 78	3776.5	Indeterminate			Poorly processed.
SWC 20	3802.5	Lower *T. longus*		1	*Tetracolporites verrucosus* present.
Cuttings	3930	*T. lilliei/T. longus*			
SWC 73	3949.0	Lower *T. longus*		1	Rare species *Reticulosporis albertonensis*.
Cuttings	3995	*T. lilliei/T. longus*			
SWC 12	4095.0	Lower *T. longus*		1	*F. longus*, *T. verrucosus* both present.
Cuttings	4110	Lower *T. longus*	*(I. pellucidum)*	3	
SWC 70	4112.0	*T. lilliei/T. longus*			*Odontochitina spinosa* present.

TABLE-3: INTERPRETATIVE PALYNOLOGICAL DATA BLACKBACK-1 SIDETRACK-2, GIPPSLAND BASIN

Sheet 2 of 2

SAMPLE TYPE	DEPTH (METRES)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENT
SWC 11*	4112.0	*T. lilliei/T. longus*			*Nelsoniella tuberculata* present.
Cuttings	4115	Lower *T. longus*		3	*F. longus* present
Cuttings	4120	Lower *T. longus*		3	*F. longus* present
SWC 69	4143.0	*T. lilliei/T. longus*			
Cuttings	4155	Lower *T. longus*		3	*T. verrucosus* present
SWC 66	4221.5	Lower *T. longus*		1	Sample over oxidised. FAD *F. longus*
SWC 65	4223.0	*T. lilliei/T. longus*			
Cuttings	4225	Indeterminate			
Cuttings	4230	Indeterminate			
SWC 63	4271.0	*T. lilliei/T. longus*			

* Given as 4112.1m on range chart.

LAD = Last appearance datum.
FAD = First appearance datum.

PALYNOLOGY DATA SHEET

BASIN: *GIPPSLAND* ELEVATION: KB: *+21m* GL: *-418.0m*

WELL NAME: *BLACKBACK-1* TOTAL DEPTH: *4022m TVD Subsea*

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
NEOGENE	*T. pleistocenicus*										
	M. lipsis										
	C. bifurcatus										
	T. bellus										
	P. tuberculatus						2794	1			
PALEOGENE	Upper *N. asperus*	2800	1				2803	2			
	Mid *N. asperus*	2809	2				2821	0			
	Lower *N. asperus*	2825	2	2830	1		2879	1			
	P. asperopolus										
	Upper *M. diversus*										
	Mid *M. diversus*										
	Lower *M. diversus*										
	Upper *L. balmei*										
	Lower *L. balmei*										
LATE CRETACEOUS	Upper *T. longus*	2891	1				2993	2	2919	1	
	Lower *T. longus*	3086	1				3866	1			
	T. lilliei										
	N. senectus										
	T. apoxyexinus										
	P. mawsonii										
	A. distocarinatus										
EARLY CRET.	*P. pannosus*										
	C. paradoxa										
	C. striatus										
	C. hughesi										
	F. wonthaggiensis										
	C. australiensis										

COMMENTS: *Data sheet is a composite of original hole and later 2 sidetracks. All depths converted to True Vertical Depth (TVD) measured from mean sea level. Microplankton zones or associations are: T. spinosus 2818m; T. inaequalis 2841-2871m; M. druggii 2891-2919m.*

CONFIDENCE RATING:

- O: SWC or Core, Excellent Confidence, assemblage with zone species of spores, pollen and microplankton.
- 1: SWC or Core, Good Confidence, assemblage with zone species of spores and pollen or microplankton.
- 2: SWC or Core, Poor Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.
- 3: Cuttings, Fair Confidence, assemblage with zone species of either spores and pollen or microplankton, or both.
- 4: Cuttings, No Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: *A.D. Partridge* DATE: *February, 20, 1990.*

DATA REVISED BY: ____________ DATE: ____________

BASIC DATA

TABLE-4: BASIC PALYNOLOGICAL DATA BLACKBACK-1, GIPPSLAND BASIN.

SAMPLE TYPE	DEPTH (METRES)	LAB. NO.	LITHOLOGY	RESIDUE YIELD	PALYNOMORPH CONCENTRATION	PRESERVATION	NUMBER OF S-P SPECIES*	MICROPLANKTON ABUNDANCE	MICROPLANKTON NO. SPECIES*
Core-1	2903.0	78232A	Glauconitic sandstone	Low	Moderate	Poor-Fair	14+	Low	4+
Core-1	2905.56	78232C	Glauconitic sandstone	Low	Moderate	Good	14+	Low	7+
Core-1	2911.41	78232F	Glauconitic sandstone	Moderate	Moderate	Good	20+	Low	9+
Core-1	2915.0	78232H	Glauconitic sandstone	Low	Moderate	Fair-Good	30+	Moderate	7+
Cuttings	2935	78232J		Low	Low	Fair-Good	6+	Moderate	7+
Cuttings	2950	78232K		Moderate	Low	Fair-Good	9+	Moderate	6+
Cuttings	2970	78232L		Low	Very Low	Fair-Good	3+	Moderate	6+
Cuttings	2995	78232M		Very Low	Low	Fair	5+	Low	5+

* Diversity:

Very Low	=	1-5 species
Low	=	6-10 species
Moderate	=	11-25 species
High	=	26-74 species
Very High	=	75+ species

TABLE-5: BASIC PALYNOLOGICAL DATA BLACKBACK-1, SIDETRACK-1, GIPPSLAND BASIN.

SAMPLE TYPE	DEPTH (METRES)	LAB. NO.	LITHOLOGY	RESIDUE YIELD	PALYNOMORPH CONCENTRATION	PRESERVATION	NUMBER OF S-P SPECIES*	MICROPLANKTON ABUNDANCE	MICROPLANKTON NO. SPECIES*
SWC 23	2877.0	78249R	Brown claystone	Moderate	High	Poor-Fair	25+	Low	4+
SWC 22	2884.0	78249Q	Brown claystone	High	High	Fair	35+	Low	2
SWC 21	2887.4	78249P	Glauconitic sandstone	Very Low	Moderate	Fair-Good	26+	Low	2
SWC 18	2897.0	78249O	Glauconitic siltstone	Very Low	Moderate	Fair	17+	Low	7+
Core-1	2908.6	78248A	Glauconitic sltst/sst	Low	Moderate	Fair	20+	Low	5+
Core-1	2912.8	78248B	Glauconitic sltst/sst	Low	Moderate	Poor-Good	18+	Low	5+
Core-1	2917.6	78248C	Glauconitic sltst/sst	Low	Low	Poor	13+	Low	7+
Core-1	2923.97	78248D	Glauconitic sltst/sst	Low	Low	Fair-Good	24+	Moderate	16+
SWC 15	2936.0	78249M	Glauconitic sandstone	Low	Moderate	Fair	15+	Low	5+
SWC 14	2940.0	78249L	Glauconitic sandstone	Low	Moderate	Fair	29+	Moderate	10+
SWC 13	2946.2	78249K	Glauconitic sandstone	High	Moderate	Poor-Good	20+	High	11+
SWC 12	2951.9	78249J	Glauconitic sandstone	Low	Moderate	Fair	19+	Moderate	9+
SWC 11	2959.5	78249I	Glauconitic sandstone	Moderate	Low	Fair	7+	Moderate	7+
SWC 10	2965.1	78249H	Glauconitic sandstone	Moderate	Low	Fair	22+	Moderate	11+
SWC 9	2967.5	78249G	Glauconitic sandstone	Low	Low	Poor-Fair	14+	Moderate	10+
SWC 6	2980.0	78249F	Glauconitic sandstone	Low	Low	Fair-Good	20+	Low	10+
SWC 5	2984.5	78249E	Glauconitic sandstone	Very Low	Very Low	Poor	2+	Very Low	2
SWC 4	2987.2	78249D	Glauconitic sandstone	Very Low	Very Low	Poor	1+	Very Low	1
SWC 3	2991.0	78249C	Glauconitic sandstone	Very Low	Very Low	Poor	14+	Moderate	12+
SWC 1	2995.0	78249A	Glauconitic sandstone	Very Low	Very Low	Poor	1+	Very Low	3

* Diversity (See Table-4)

TABLE-6: BASIC PALYNOLOGIC DATA BLACKBACK-1, SIDETRACK-2, GIPPSLAND BASIN.

Sheet 1 of 2

SAMPLE TYPE	DEPTH (METRES)	LAB NO.	LITHOLOGY	RESIDUE YIELD	PALYNOMORPH CONCENTRATION	PRESERVATION	NUMBER OF S-P SPECIES*	MICROPLANKTON ABUNDANCE	MICROPLANKTON NO. SPECIES*
SWC 90	3008.0	78256M	Sandstone	Moderate	Low	Fair-good	16+	Low	2
SWC 89	3045.0	78256L	Glauconitic sandstone	Moderate	Very low	Fair	5+	Very low	1+
SWC 57	3082.0	78255I	Glauconitic siltstone	Moderate	High	Good	15+		
SWC 56	3095.0	78255H	Argillaceous siltstone	Moderate	Moderate	Fair	14+		
SWC 54	3142.0	78255F	Sst. (trace glauconite)	High	High	Good	22+		
SWC 53	3180.0	78255E	Argillaceous siltstone	Low	Low	Fair-good	3+		
SWC 52	3236.0	78255D	Sandstone	Moderate	Low	Fair-good	8+		
SWC 88	3260.0	78256K	Siltstone	Moderate	High	Fair-good	17+		
SWC 87	3280.5	78256J	Sandstone	Moderate	Low	Fair-good	15+		
SWC 49	3332.5	78255C	Laminated sandstone	High	Moderate	Poor-fair	15+		
SWC 48	3357.5	78255B	Coal	High	High	Poor	7+		
SWC 86	3377.5	78256I	Sandstone	Moderate	Moderate	Fair-poor	17+		
SWC 46	3400.5	78255A	Coally sandstone	High	Moderate	Good	17+		
SWC 45	3427.0	78254Z	Carbonaceous siltstone	Moderate	High	Fair-good	18+		
SWC 44	3448.0	78254Y	Sandstone	Moderate	Low	Fair	18+		
SWC 42	3478.5	78254X	Carbonaceous siltstone	High	Moderate	Fair	18+		
SWC 84	3479.5	78256G	Siltstone	High	High	Fair-good	22+		
SWC 36	3535.0	78254T	Carbonaceous siltstone	High	Low	Poor-fair	20+		
SWC 80	3603.5	78256C	Siltstone/sandstone	High	Low	Poor	20+		
SWC 26	3643.0	78254M	Sandstone	Moderate	Low	Poor	13+		
SWC 25	3660.5	78254L	Carbonaceous siltstone	Moderate	Moderate	Poor	21+		
SWC 79	3728.0	78256B	Siltstone	Moderate	Low	Fair-good	22+	Very low	1
SWC 78	3776.5	78256A	Siltstone	Low	Very low	Poor-fair	4+		
SWC 20	3802.5	78254J	Arenaceous siltstone	High	Low	Poor	17+	Very low	1
Cuttings	3930	78248P		Moderate	Moderate	Fair	8+		
SWC 73	3949.0	78255V	Siltstone/sandstone	Moderate	Low	Poor-fair	22+		
Cuttings	3995	78248Q		Moderate	Moderate	Fair	12+		
SWC 12	4095.0	78254F	Argillaceous siltstone	High	High	Fair-good	25+	Very low	1+
Cuttings	4110	782490		High	High	Fair	31+	Very low	2+

TABLE-6: BASIC PALYNOLOGIC DATA BLACKBACK-1, SIDETRACK-2, GIPPSLAND BASIN.

Sheet 2 of 2

SAMPLE TYPE SPECIES*	DEPTH (METRES)	LAB NO.	LITHOLOGY	RESIDUE YIELD	PALYNOMORPH CONCENTRATION	PRESERVATION	NUMBER OF S-P SPECIES*	MICROPLANKTON ABUNDANCE	MICROPLANKTON NO.
SWC 70	4112.0	78255T	Carbonaceous siltstone	Moderate	Low	Poor-fair	15+	Very low	2
SWC 11**	4112.0	78254E	Carbonaceous siltstone	High	Low	Poor	15+	Very low	2+
Cuttings	4115	78248R		High	Low	Poor	12+		
Cuttings	4120	78248N		High	Moderate	Fair	20+		
SWC 69	4143.0	78255S	Carbonaceous siltstone	Moderate	Low	Poor-fair	15+		
Cuttings	4155	78248M		High	Moderate	Poor-good	14+		
SWC 66	4221.5	78255P	Carbonaceous siltstone	High	High	Poor	20+		
SWC 65	4223.0	782550	Carbonaceous siltstone	High	Low	Fair	26+		
Cuttings	4225	78248S		Moderate	Barren				
Cuttings	4230	78248L		Moderate	Low	Fair	3+		
SWC 63	4271.0	78255M	Siltstone	Moderate	Low	Fair	8+	Very low	1

** Given as 4112.1m on range chart.

* Diversity (See Table-4)

PE900774

This is an enclosure indicator page.
The enclosure PE900774 is enclosed within the container PE902143 at this location in this document.

The enclosure PE900774 has the following characteristics:

ITEM_BARCODE = PE900774
CONTAINER_BARCODE = PE902143
NAME = Palynological Range Chart
BASIN = GIPPSLAND
PERMIT = VIC/P24
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Blackback 1 Palynological Range Chart Sidetrack-2. Enclosure from appendix 2 of WCR volume 2.
REMARKS =
DATE_CREATED =
DATE_RECEIVED = 25/06/90
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR =
CLIENT_OP_CO = Esso Australia Resources LTD.

(Inserted by DNRE - Vic Govt Mines Dept)

PE900775

This is an enclosure indicator page.
The enclosure PE900775 is enclosed within the container PE902143 at this location in this document.

The enclosure PE900775 has the following characteristics:

ITEM_BARCODE = PE900775
CONTAINER_BARCODE = PE902143
NAME = Palynological Range Chart
BASIN = GIPPSLAND
PERMIT = VIC/P24
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Blackback 1 Palynological Range Chart Sidetrack-1. Enclosure from appendix 2 of WCR volume 2.
REMARKS =
DATE_CREATED =
DATE_RECEIVED = 25/06/90
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR =
CLIENT_OP_CO = Esso Australia Resources LTD.

(Inserted by DNRE - Vic Govt Mines Dept)

PE900776

This is an enclosure indicator page.
The enclosure PE900776 is enclosed within the container PE902143 at this location in this document.

The enclosure PE900776 has the following characteristics:

ITEM_BARCODE = PE900776
CONTAINER_BARCODE = PE902143
NAME = Palynological Range Chart
BASIN = GIPPSLAND
PERMIT = VIC/P24
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Blackback 1 Palynological Range Chart. Enclosure from appendix 2 of WCR volume 2.
REMARKS =
DATE_CREATED =
DATE_RECEIVED = 25/06/90
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR =
CLIENT_OP_CO = Esso Australia Resources LTD.

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX
3

APPENDIX 3

APPENDIX 3

BLACKBACK 1.
BLACKBACK 1 Sidetrack 1
BLACKBACK 1 Sidetrack 2

QUANTITATIVE LOG ANALYSES

Interval: 2885 - 4400 mMDKB
Analyst : T. M. Frankham.
Date : May/June, 1990

BLACKBACK 1.
BLACKBACK 1 Sidetrack 1
BLACKBACK 1 Sidetrack 2

Wireline log data from the Blackback 1 exploration well and its sidetracks have been quantitatively analysed over the interval for effective porosity and effective water saturation. Results are presented in the form of the accompanying depth plots (MD and TVD) and listing, and are summarised and discussed below.

WELL HISTORY

An oil bearing N. Asperus channel fill was intersected at 2898 mMDKB (Top of Latrobe) in the original Blackback 1 hole. After cutting a core from 2903 - 2921 mMDKB, the hole was drilled ahead to 3283 mMDKB, where Schlumberger logs were run. The hole was then drilled ahead to 3400 mMDKB (intersecting the top of "Coarse Clastics" at 3002 mMDKB). At this point Drill pipe became stuck in the hole whilst running in for a wiper trip (in order to run RFTs). Attempts to free the pipe were unsuccessful, and pipe was subseqently backed off at 2870 mMDKB, leaving a fish in the hole. Data (logs and cores) obtained to this point are referred to in this report as "Blackback 1" data.

Sidetrack 1 was kicked off at 2448 mMDKB and intersected the oil bearing N. Asperus channel fill at 2885 mMDKB. A core was cut from 2909 - 2927 mMDKB (later shifted down 2.5m to match log data). The sidetrack was then drilled to 3047 mMDKB, at which point Schlumberger logs were run. After logging, a junk sub was run to mill SWC bullets. The BHA became stuck with the bit at 3034 mMDKB. The pipe was backed off at 3019 mMDKB, again leaving a fish in the hole. Data (logs and cores) obtained between the sidetrack 1 kickoff point and this point are referred to in this report as "Blackback 1 Sidetrack 1" (or "Blackback 1 St 1") data.

Sidetrack 2 was kicked off at 2952 mMDKB (within the N. Asperous channel fill). Sidetrack 2 intersected the top of "Coarse Clastics" at 2994 mMDKB (approx.) and was then drilled to 3904 mMDKB, where logs were run. After logging, the well was drilled on to a TD of 4401 mMDKB, where final logs were run. Data obtained between the sidetrack 2 kickoff point and TD are referred to in this report as "Blackback 1 Sidetrack 2" (or "Blackback 1 St 2" / "Sidetrack 2") data.

ANALYSIS METHODOLOGY

Two distinctly different reservoir types were encountered in this well and its sidetracks; the glauconitic, sideritic, N. Asperus channel fill, and the more usual sand/shale section intersected below the "Top of Coarse Clastics. Two different analysis methods were therefore employed and are described seperately.

ANALYSIS of N. ASPERUS CHANNEL FILL

(Blackback 1 and Blackback 1 Sidetrack 1)

The N. Asperus Channel Fill sections were analysed for mineralogy volumes and porosity using the EPRCo developed LASER analysis program. LASER is a least squares inversion analysis technique which operates on principles similar to those used in Schlumberger's GLOBAL program. (See: Dahlberg, K.E.,"LASER", EPRCo Reservoir Description Section Research Reports, April 1986-April 1987.) Water saturation was then calculated on the basis of the Dual Water saturation model.

The use of a program such as LASER enables the analyst to model a lithology consisting of a complex suite of minerals, so long as the component mineralogy is known, and the logging tool responses to those minerals is known. Core description by both Amdel and EPRCo suggest a mineralogy consisting essentially of quartz, glauconite, minor mica, mixed clays, and siderite cement. A Quartz-Glauconite- Sideride-Chlorite-Water LASER model was therefore derived, with "Chlorite" representing a composite of the clays and "Water" representing porosity. (NOTE: The LASER derived Water fraction was similar to a straight density-neutron crossplot porosity, and is hence understood to represent total porosity.)

LOGS USED:

- LLD (laterolog deep)
- RHOB (bulk density)
- PEF (photoelectric X section)
- NPHI (neutron porosity)
- DT (sonic transit time)

A Sonic log was not recorded in the sidetrack 1 wellbore. Since LASER requires at least as many input logs as there are unknowns (mineral volumes), it was necessary to generate a a pseudo sonic transit time from the density log, using a density-sonic transform derived from the original hole data. While it is recognised the this is probably less than satisfactory, the sidetrack hole results seem reasonable when compared with the original hole data.

CORE POROSITY:

Cores were cut in part of the N. Asperus hydrocarbon bearing interval in both the original wellbore and sidetrack 1 (the sidetrack 1 core data was depth shifted down 2.5m to align with the log data). Conventional core analysis was carried out at net overburden pressure on plugs cut from both cores. Capilliary pressure measurements were made on a subset of the core plugs. The measured helium injection porosities seem anomolous in that they are lower than the LASER porosity (as they should be if LASER calculates total porosity, helium injection measures effective porosity, and the formation is shaly.), but somewhat higher than the estimated effective porosity. As a check on the core analysis, thin sections were cut from ten of the plugs and point counted for mineralogy and pore volume. These point-count pore volumes were then compared to their respective plug helium injection porosities and found to be dramatically lower (commonly by a factor of 0.5 - see figure 1.). While one might expect the point count to be conservative, the difference is too great to be merely a function of technique. It is therefore suspected that the clays in the core plugs had been damaged, allowing the helium injection porosity to "see" some of what in-situ would have been clay "bound" porosity. The point count pore volume was thus taken as the most likely indicator of "effective" porosity. In view of the likely damage to the plugs, the capilliary pressure measurements were not considered reliable and have not been further considered.

"EFFECTIVE" POROSITY:

As stated above, the porosity (or water fraction) derived from LASER appear is understood to be the total porosity. It is not apparent from logs what appropiate "shale" parameters should be used to determine effective porosity. An attempt to assign laboratory derived microporosity values to the recognised minerals, and to subtract this on a pro-rated volume basis from total porosity gave results that did not match either helium injection or point count core porosities.

A purely empirical approach was therefore taken, using the point count pore and "clay" (clay + glauconite + mica) fractions, and the LASER total porosity fractions at the point-counted plug depths. An apparent bound porosity was calculated for each plug depth by taking the difference between the LASER total porosity and the point-count "effective" porosity. This was in turn used to generate an apparent "shale porosity" by dividing this "effective" porosity by the point-counted clay fraction. The average value of these ten apparent "shale porosities" was then used in the derivation of an effective porosity curve from the LASER generated total porosity, and glauconite and chlorite fraction curves:

Phi{effective} = Phi{total} - ((Glauconite+Chlorite) * Phi{shale})

WATER SATURATION

Water Saturation was calculated using the Dual Water saturation relationship. Water salinity was derived from the underlying clean water bearing "Coarse Clastic" sand. Since no true "shale" occurs in the N.Asperus section, shale parameters were difficult to derive. Shale porosity was derived as detailed above, while shale resistivity was obtained from a "trial and error" process. This consisted of selecting the shale resistivity that gave the best result (closest to 100% Sw) in the N.Asperus water leg.

COMMENT.

While some significant assumptions have been made in determining effective porosity and water saturation values, and it could be argued that these assumptions, and consequently the derived effective porosity and water saturation values are wrong, the hydrocarbon in place values calculated from these figures [porosity*(1-Sw)] should be reasonable. This is because the "dual water" relationship used to generate Sw is a function of "total" porosity and generates a "total" Sw (Swt), and is thus relatively independent of the abovementioned assumptions. (There is some infuence from the "swb" term, a function of shale volume.) The "effective" values for porosity and Sw are generated from the calculated "total" values (as a function of shale volume), however hydrocarbon volume remains constant.

i.e. Bulk Volume Hydrocarbon = phie*(1-Swe) = phit*(1-Swt).

"DUAL WATER SATURATION" ANALYSIS PARAMETERS (N.Asperus):

	BLACKBACK 1	BLACKBACK 1 SIDETRACK 1
Tortuosity; 'a'.................................. :	1.00	1.00
Cementation factor; 'm'........................ :	2.00	2.00
Saturation exponent; 'n'....................... :	2.00	2.00
Apparent shale porosity........................ :	0.390	0.390
Apparent shale resistivity..................... :	0.30	0.50
Formation water expressed in salinity		
Formation water salinity....................... :	40000	40000
Downhole temperature calculated from BHT		
Temperature measured in degrees Celsius		
Logged TD... :	3275	3005
Logged bottom hole temperature................. :	66	64
Est. sea bed temperature....................... :	10	10
Water depth...................................... :	418	418
KB height... :	21	21
Irreducible water saturation................... :	0.025	0.025
Vsh upper limit for effective porosity.......... :	0.65	0.65
Minimum effective porosity for hydrocarbons..... :	0.03	0.03

"LASER" PARAMETERS (N.Asperus):

```
CURVE TABLE
     INPUT:
     Density Linear            RHOB
     Photoelectric Linear      PEF
     Photoelectric Linear      RHOB
     CNL Piecewise-Linear      TNPH
     Velocity equation         VS (inverse of DT)
     OUTPUT:
         FLUID_1, QRTZ, SDRT, GLAU, CHLR
     ---------------------------------------------------
```

CONSTRAINT TABLE

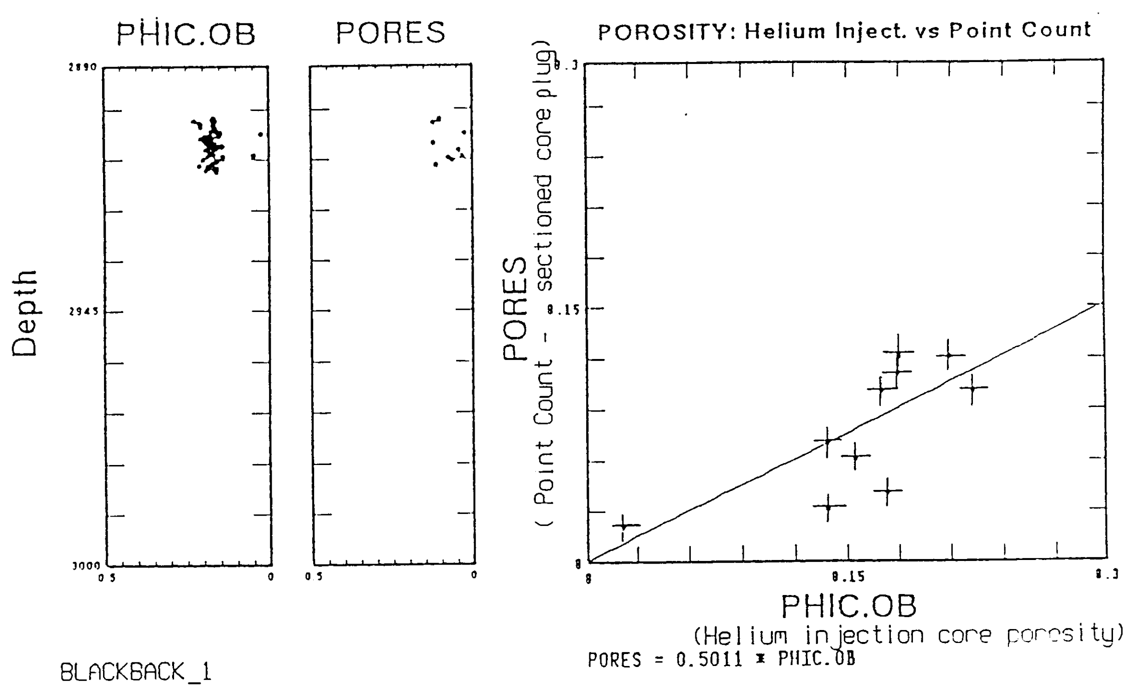
INPUT	CONSTRAINT	ERROR
1.	sum=1	.005
BULK DENSITY	Density Linear	.03
VOL.PHOTO XSECTION	Photoelectric Linear	.5
NEUTRON POROSITY	CNL Piecewise-Linear	.03
SONIC VELOCITY	Velocity equation	.2

VARIABLE TABLE

NAME, INDEX		CODE	MINIMUM	MAXIMUM	INITIAL VALUE
FLUID_1	1	0	0.	1.	0.2000
QRTZ	7	3	0.	1.	0.2000
SDRT	14	3	0.	1.	0.2000
GLAU	16	3	0.	1.	0.2000
CHLR	17	3	0.	1.	0.2000

CONSTRAINT PARAMETER EXCEPTION TABLE

CONSTRAINT	PARAMETER NAME	VALUE
Density Linear	rho SDRT	3.91
Density Linear	rho GLAU	2.83
Density Linear	rho CHLR	3.4
Photoelectric Linear	U GLAU	13.5
Photoelectric Linear	U CHLR	17.4
CNL Piecewise-Linear	CNL 0 FLUID_1	0.0
CNL Piecewise-Linear	CNL 0 SDRT	.136
CNL Piecewise-Linear	CNL 0 GLAU	.152
CNL Piecewise-Linear	CNL 0 CHLR	.532
CNL Piecewise-Linear	CNL 5 FLUID_1	0.0
CNL Piecewise-Linear	CNL 5 QRTZ	.018
CNL Piecewise-Linear	CNL 5 SDRT	.29
CNL Piecewise-Linear	CNL 5 GLAU	.218
CNL Piecewise-Linear	CNL 5 CHLR	.606
CNL Piecewise-Linear	CNL 10 FLUID_1	0.0
CNL Piecewise-Linear	CNL 10 SDRT	.39
CNL Piecewise-Linear	CNL 10 GLAU	.276
CNL Piecewise-Linear	CNL 10 CHLR	.665
CNL Piecewise-Linear	CNL 20 FLUID_1	0.0
CNL Piecewise-Linear	CNL 20 QRTZ	.154
CNL Piecewise-Linear	CNL 20 SDRT	.526
CNL Piecewise-Linear	CNL 20 GLAU	.372
CNL Piecewise-Linear	CNL 20 CHLR	.745
CNL Piecewise-Linear	CNL 40 FLUID_1	0.0
CNL Piecewise-Linear	CNL 40 QRTZ	.355
CNL Piecewise-Linear	CNL 40 SDRT	.687
CNL Piecewise-Linear	CNL 40 GLAU	.526
CNL Piecewise-Linear	CNL 40 CHLR	.827
Velocity equation	coeff FLUID_1	-.7
Velocity equation	coeff QRTZ	5.3
Velocity equation	coeff SDRT	6.7
Velocity equation	coeff GLAU	2.9
Velocity equation	coeff CHLR	2.9



BLACKBACK_1
Monday, May 28, 1990
4:37:24 pm (AEST)

FIGURE: 1

Core Porosities: Point Count vs Helium Injection.

ANALYSIS of "COARSE CLASTICS"

(Blackback 1 and Blackback 1 Sidetrack 2)

The Coarse Clastic sections of the well and sidetracks were analysed using EAL's standard shaly sand algorithms and logic, as follows.

Porosities and water saturations were calculated using an iterative technique which converges into a preselected grain density window by appropriately incrementing or decrementing shale volume. Initial shale volume is derived from the Gamma Ray response. The model incorporates porosity calculation from density-neutron crossplot algorithms, water saturation from the dual water relationship, hydrocarbon corrections to the porosity logs where applicable, and convergence upon the preselected grain density window (calculated from hydrocarbon and shale corrected density and neutron logs) by shale volume adjustment. Algorithms used are shown in appendix 1 .

LOGS USED:

- GR (gamma ray)
- LLD (laterolog deep)
- RHOB (bulk density)
- NPHI (neutron porosity)

When plotted on sandstone compatible scales, the Density and Neutron logs exhibit a very minor amount of crossover through clean water bearing sands. This would give rise to slightly less than 2.65 g/cc calculated grain densities, and suggests that one or other of the logs may need normalising. However, in view of the very small size of potential error and the lack of any core data in the intra-Latrobe interval to normalise to, the logs were left unadjusted.

Otherwise, log quality appears satisfactory. Minor depth matching was undertaken prior to carrying out the analysis.

COMMENT.

Intra-Latrobe hydrocarbon bearing intervals were intersected in the sidetrack 2 hole at 3480-3580 mMDKB, 3803-3806 mMDKB, and 4150-4155 mMDKB. Hydrocarbon type has been identified by either RFT sampling or gas chromatography of sidewall core extracts.

ANALYSIS PARAMETERS. (Coarse Clastics)

VSH and POROSITY from DENSITY-NEUTRON GR used for initial est. of VSH).	BLACKBACK 1	BLACKBACK 1 SIDETRACK 2
Tortuosity; 'a'	: 1.00	1.00
Cementation factor; 'm'	: 2.00	2.00
Saturation exponent; 'n'	: 2.00	2.00
Fluid density	: 1.00	1.05
Gamma Ray value in clean formation (grmin)	: 50	50
Gamma Ray value in shale (grmax)	: 150	150
Apparent shale resistivity	:12.00	12.00
Apparent bulk density of shale	: 2.55	2.55
Apparent neutron porosity of shale	: 0.30	0.28
Lower limit of grain density	: 2.645	2.645
Upper limit of grain density	: 2.675	2.675
Formation Water entered in terms of SALINITY.		
Formation water salinity	: 40000	40000
Measured Rmf	: 0.225	0.164
Temperature at which Rmf measured	: 21.0	16.1 deg.C
Sxo derived from Sw (Sxo = Sw**z).		
Z (where Sxo=SW**Z)	: 0.30	0.30
Logged TD	: 3279	4399
Logged bottom hole temperature	: 66	90 deg.C
Est. sea bed temperature	: 10	10 deg.C
Water depth	: 418	418
KB height	: 21	21
Irreducible water saturation	: 0.025	0.025
Vsh upper limit for effective porosity	: 0.65	0.65
Minimum effective porosity for hydrocarbons	: 0.03	0.03

ANALYSIS SUMMARY.

Net porosity cut-off..........: 0.100 volume per volume
Net water saturation cut-off..: 0.600 volume per volume

Net Porous Interval based on Porosity cut-off only.
Both Porosity and Sw cut-offs invoked when generating Hydrocarbon-Metres.

GROSS INTERVAL (metres) (top) -(base)	Gross Metres	NET POROUS INTERVAL Net Metres	Net to Gross	Mean Vsh	(Std.) (Dev.)	Mean Porosity	(Std.) (Dev.)	Mean Sw	(Std.) (Dev.)	HYDROCARBON METRES
BLACKBACK_1: N.asperus channel fill.										
MDKB 2898.1-2929.7	31.6	19.8								
TVDSS 2805.1-2830.1	25.1	15.7	63 %	0.229	(0.039)	0.132	(0.024)	0.363	(0.067)	1.314 OIL
MDKB 2929.9-2932.2	2.3	2.1								
TVDSS 2830.3-2832.1	1.8	1.7	96 %	0.201	(0.028)	0.147	(0.020)	0.597	(0.027)	0.054 TRANSITION
MDKB 2932.3-3000.0	67.7	19.3								
TVDSS 2832.2-2884.4	52.2	14.9	29 %	0.201	(0.063)	0.132	(0.027)	0.996	(0.035)	0.000 WATER
BLACKBACK_1: Coarse Clastics.										
MDKB 3001.9-3071.9	70.0	65.6								
TVDSS 2885.8-2939.3	53.5	50.2	94 %	0.128	(0.076)	0.201	(0.031)	1.000	(0.000)	0.000
MDKB 3073.6-3171.9	98.3	83.5								
TVDSS 2940.6-3014.9	74.3	63.1	85 %	0.123	(0.088)	0.215	(0.047)	1.000	(0.000)	0.000
MDKB 3176.8-3179.5	2.7	2.4								
TVDSS 3018.7-3020.7	2.0	1.8	91 %	0.065	(0.111)	0.223	(0.057)	1.000	(0.000)	0.000
MDKB 3189.9-3233.9	44.0	29.1								
TVDSS 3028.5-3061.7	33.2	22.0	66 %	0.010	(0.036)	0.197	(0.036)	1.000	(0.000)	0.000
MDKB 3247.5-3254.2	6.7	5.8								
TVDSS 3072.0-3077.1	5.1	4.4	87 %	0.194	(0.085)	0.150	(0.021)	1.000	(0.000)	0.000

BLACKBACK_1 SIDETRACK 1: N.asperus channel fill.

	GROSS INTERVAL (metres) (top) -(base)	Gross Metres	NET POROUS INTERVAL Net Metres	Net to Gross	Mean Vsh	(Std.) (Dev.)	Mean Porosity	(Std.) (Dev.)	Mean Sw	(Std.) (Dev.)	HYDROCARBON METRES
MDKB	2885.0-2928.1	43.1	29.5								
TVDSS	2800.7-2832.5	31.8	21.8	69 %	0.241	(0.031)	0.132	(0.021)	0.356	(0.121)	1.806 OIL
MDKB	2928.3-2992.5	64.3	26.4								
TVDSS	2832.6-2879.8	47.2	19.4	41 %	0.222	(0.049)	0.123	(0.021)	1.000	(0.000)	0.000 WATER

BLACKBACK_1 SIDETRACK 2: Coarse Clastics.

	GROSS INTERVAL (metres) (top) -(base)	Gross Metres	NET POROUS INTERVAL Net Metres	Net to Gross	Mean Vsh	(Std.) (Dev.)	Mean Porosity	(Std.) (Dev.)	Mean Sw	(Std.) (Dev.)	HYDROCARBON METRES
MDKB	2995.9-3003.3	7.4	4.4	60 %	0.194	(0.082)	0.146	(0.016)	1.000	(0.000)	0.000
MDKB	3010.7-3018.6	7.9	7.9	100 %	0.179	(0.108)	0.212	(0.045)	1.000	(0.000)	0.000
MDKB	3020.4-3089.9	69.5	58.9	85 %	0.131	(0.106)	0.204	(0.044)	1.000	(0.000)	0.000
MDKB	3096.1-3099.2	3.1	2.6	85 %	0.254	(0.069)	0.151	(0.021)	1.000	(0.000)	0.000
MDKB	3100.6-3111.8	11.3	11.2	100 %	0.031	(0.051)	0.178	(0.023)	1.000	(0.000)	0.000
MDKB	3114.2-3124.6	10.4	9.5	91 %	0.176	(0.130)	0.205	(0.051)	1.000	(0.000)	0.000
MDKB	3128.3-3133.2	4.9	4.9	100 %	0.061	(0.084)	0.206	(0.025)	1.000	(0.000)	0.000
MDKB	3136.3-3141.4	5.1	4.5	88 %	0.316	(0.135)	0.158	(0.044)	1.000	(0.000)	0.000
MDKB	3144.6-3149.6	4.9	3.9	81 %	0.182	(0.133)	0.181	(0.061)	1.000	(0.000)	0.000
MDKB	3156.7-3164.6	7.9	6.4	81 %	0.242	(0.141)	0.149	(0.033)	1.000	(0.000)	0.000
MDKB	3166.1-3170.1	4.0	3.1	80 %	0.104	(0.071)	0.137	(0.019)	1.000	(0.000)	0.000
MDKB	3185.1-3229.9	44.8	30.0	67 %	0.013	(0.026)	0.229	(0.037)	1.000	(0.000)	0.000
MDKB	3251.3-3257.1	5.9	5.8	99 %	0.164	(0.099)	0.213	(0.036)	1.000	(0.000)	0.000
MDKB	3261.4-3265.1	3.7	3.5	96 %	0.059	(0.066)	0.198	(0.029)	1.000	(0.000)	0.000
MDKB	3283.9-3293.3	9.4	7.4	79 %	0.338	(0.094)	0.153	(0.039)	1.000	(0.000)	0.000
MDKB	3297.1-3302.1	5.0	4.5	90 %	0.330	(0.071)	0.140	(0.021)	1.000	(0.000)	0.000
MDKB	3307.6-3320.7	13.1	12.4	95 %	0.199	(0.112)	0.203	(0.042)	1.000	(0.000)	0.000
MDKB	3321.4-3324.3	2.9	2.8	98 %	0.183	(0.063)	0.194	(0.021)	1.000	(0.000)	0.000
MDKB	3334.4-3337.1	2.6	2.6	100 %	0.275	(0.067)	0.192	(0.028)	1.000	(0.000)	0.000
MDKB	3339.8-3345.4	5.6	5.6	100 %	0.209	(0.083)	0.214	(0.032)	1.000	(0.000)	0.000
MDKB	3347.3-3351.7	4.4	4.0	90 %	0.286	(0.074)	0.178	(0.026)	1.000	(0.000)	0.000
MDKB	3353.8-3370.9	17.1	16.8	98 %	0.226	(0.079)	0.190	(0.029)	1.000	(0.000)	0.000
MDKB	3380.0-3382.9	2.9	2.7	93 %	0.204	(0.113)	0.186	(0.032)	1.000	(0.000)	0.000
MDKB	3387.4-3392.3	4.9	4.7	98 %	0.304	(0.062)	0.165	(0.025)	1.000	(0.000)	0.000
MDKB	3405.2-3409.9	4.7	4.6	99 %	0.264	(0.092)	0.193	(0.050)	1.000	(0.000)	0.000
MDKB	3412.1-3414.4	2.3	2.3	100 %	0.155	(0.093)	0.212	(0.020)	1.000	(0.000)	0.000
MDKB	3416.9-3420.6	3.6	3.0	85 %	0.286	(0.073)	0.169	(0.028)	1.000	(0.000)	0.000
MDKB	3428.1-3435.0	6.9	5.0	72 %	0.333	(0.069)	0.139	(0.015)	1.000	(0.000)	0.000
MDKB	3437.7-3440.6	2.9	2.7	96 %	0.084	(0.073)	0.180	(0.029)	1.000	(0.000)	0.000
MDKB	3448.9-3451.8	2.9	2.8	100 %	0.166	(0.103)	0.197	(0.040)	1.000	(0.000)	0.000
MDKB	3452.6-3456.6	4.0	4.0	100 %	0.143	(0.062)	0.200	(0.019)	1.000	(0.000)	0.000

BLACKBACK_1 SIDETRACK 2: Coarse Clastics. (Continued)

	GROSS INTERVAL (metres) (top) -(base)	Gross Metres	NET POROUS INTERVAL Net Metres	Net to Gross	Mean Vsh	(Std.) (Dev.)	Mean Porosity	(Std.) (Dev.)	Mean Sw	(Std.) (Dev.)	HYDROCARBON METRES
MDKB	3465.0-3471.4	6.4	6.1	96 %	0.286	(0.060)	0.168	(0.025)	1.000	(0.000)	0.000
MDKB	3472.4-3474.4	2.0	1.4	73 %	0.386	(0.030)	0.127	(0.012)	1.000	(0.000)	0.000
MDKB	3475.2-3476.4	1.3	1.1	88 %	0.293	(0.051)	0.143	(0.011)	1.000	(0.000)	0.000
MDKB	3480.1-3481.6	1.5	0.9	58 %	0.219	(0.124)	0.126	(0.011)	0.623	(0.045)	0.011 OIL
MDKB	3486.9-3489.9	3.0	2.4	82 %	0.159	(0.094)	0.166	(0.050)	0.458	(0.130)	0.216 OIL
MDKB	3498.2-3500.4	2.3	1.9	87 %	0.322	(0.081)	0.131	(0.013)	1.000	(0.000)	0.000
MDKB	3503.9-3506.0	2.1	1.4	69 %	0.327	(0.033)	0.128	(0.011)	1.000	(0.000)	0.000
MDKB	3507.6-3510.1	2.5	2.0	84 %	0.228	(0.054)	0.164	(0.017)	1.000	(0.000)	0.000
MDKB	3515.1-3517.9	2.8	2.0	71 %	0.338	(0.027)	0.129	(0.009)	0.572	(0.039)	0.072 OIL
MDKB	3519.4-3521.1	1.7	1.5	91 %	0.275	(0.071)	0.151	(0.028)	0.647	(0.087)	0.042 OIL
MDKB	3522.4-3523.1	0.8	0.5	67 %	0.340	(0.019)	0.113	(0.003)	0.589	(0.018)	0.017 OIL
MDKB	3524.4-3530.9	6.5	5.4	82 %	0.301	(0.051)	0.132	(0.014)	0.511	(0.037)	0.341 OIL
MDKB	3536.0-3539.8	3.8	2.2	60 %	0.270	(0.096)	0.153	(0.044)	0.526	(0.045)	0.168 OIL
MDKB	3540.6-3541.9	1.3	0.9	70 %	0.275	(0.082)	0.150	(0.023)	0.638	(0.036)	0.013 OIL
MDKB	3542.6-3545.0	2.4	2.2	94 %	0.262	(0.065)	0.157	(0.019)	0.587	(0.021)	0.104 OIL
MDKB	3545.8-3548.0	2.3	1.4	64 %	0.353	(0.026)	0.115	(0.009)	0.588	(0.142)	0.057 OIL
MDKB	3549.2-3551.9	2.7	2.1	80 %	0.346	(0.050)	0.135	(0.015)	0.633	(0.065)	0.056 OIL
MDKB	3554.4-3558.9	4.5	3.0	66 %	0.254	(0.062)	0.152	(0.020)	0.742	(0.059)	0.000 OIL?
MDKB	3562.9-3567.4	4.5	3.7	84 %	0.295	(0.071)	0.166	(0.026)	0.374	(0.050)	0.393 GAS
MDKB	3572.8-3576.9	4.1	2.9	70 %	0.168	(0.153)	0.197	(0.059)	0.392	(0.069)	0.350 OIL
MDKB	3597.4-3599.2	1.8	1.4	78 %	0.074	(0.106)	0.195	(0.042)	1.000	(0.000)	0.000
MDKB	3605.4-3608.8	3.4	3.0	88 %	0.352	(0.062)	0.129	(0.014)	1.000	(0.000)	0.000
MDKB	3612.6-3616.4	3.7	2.3	62 %	0.171	(0.126)	0.164	(0.031)	1.000	(0.000)	0.000
MDKB	3623.8-3632.8	9.0	8.1	91 %	0.243	(0.098)	0.174	(0.040)	1.000	(0.000)	0.000
MDKB	3636.4-3639.0	2.6	2.2	85 %	0.107	(0.141)	0.179	(0.045)	1.000	(0.000)	0.000
MDKB	3641.6-3643.8	2.2	2.2	100 %	0.084	(0.107)	0.166	(0.041)	1.000	(0.000)	0.000
MDKB	3645.0-3648.2	3.2	3.1	97 %	0.201	(0.151)	0.177	(0.046)	1.000	(0.000)	0.000
MDKB	3649.1-3651.9	2.8	2.7	98 %	0.141	(0.063)	0.143	(0.020)	1.000	(0.000)	0.000
MDKB	3653.6-3654.9	1.3	1.3	96 %	0.250	(0.088)	0.165	(0.027)	1.000	(0.000)	0.000
MDKB	3661.1-3673.4	12.3	11.9	98 %	0.094	(0.119)	0.218	(0.045)	1.000	(0.000)	0.000
MDKB	3700.9-3704.2	3.3	2.5	77 %	0.246	(0.069)	0.149	(0.015)	1.000	(0.000)	0.000

BLACKBACK_1 SIDETRACK 2: Coarse Clastics. (Continued)

	GROSS INTERVAL (metres) (top) -(base)	Gross Metres	NET POROUS INTERVAL Net Metres	Net to Gross	Mean Vsh	(Std.) (Dev.)	Mean Porosity	(Std.) (Dev.)	Mean Sw	(Std.) (Dev.)	HYDROCARBON METRES	
MDKB	3705.0-3707.0	2.0	1.4	70 %	0.230	(0.023)	0.138	(0.014)	1.000	(0.000)	0.000	
MDKB	3707.8-3763.1	55.4	53.2	96 %	0.036	(0.052)	0.210	(0.045)	1.000	(0.000)	0.000	
MDKB	3803.6-3806.2	2.6	2.5	98 %	0.017	(0.034)	0.230	(0.035)	0.308	(0.068)	0.396	OIL
MDKB	3806.4-3814.0	7.6	7.6	100 %	0.034	(0.040)	0.247	(0.018)	0.980	(0.051)	0.000	
MDKB	3816.0-3819.8	3.8	3.0	81 %	0.162	(0.093)	0.185	(0.036)	1.000	(0.000)	0.000	
MDKB	3820.4-3825.4	5.0	4.9	99 %	0.175	(0.133)	0.188	(0.034)	1.000	(0.000)	0.000	
MDKB	3826.2-3833.6	7.4	7.1	96 %	0.053	(0.052)	0.163	(0.036)	1.000	(0.000)	0.000	
MDKB	3879.9-3891.4	11.6	10.3	89 %	0.016	(0.028)	0.164	(0.059)	1.000	(0.000)	0.000	
MDKB	3905.0-3933.9	28.9	27.8	96 %	0.032	(0.038)	0.179	(0.035)	1.000	(0.000)	0.000	
MDKB	3939.3-3946.8	7.4	7.4	100 %	0.065	(0.074)	0.197	(0.032)	1.000	(0.000)	0.000	
MDKB	3956.4-3998.8	42.3	41.7	99 %	0.082	(0.104)	0.197	(0.038)	1.000	(0.000)	0.000	
MDKB	3999.6-4007.6	8.0	8.0	100 %	0.079	(0.054)	0.223	(0.018)	1.000	(0.000)	0.000	
MDKB	4010.2-4015.6	5.4	5.4	100 %	0.018	(0.044)	0.223	(0.023)	1.000	(0.000)	0.000	
MDKB	4015.9-4051.0	35.1	34.0	97 %	0.092	(0.077)	0.173	(0.031)	1.000	(0.000)	0.000	
MDKB	4062.0-4073.4	11.4	11.1	97 %	0.044	(0.047)	0.202	(0.036)	1.000	(0.000)	0.000	
MDKB	4116.6-4120.6	4.0	3.8	95 %	0.118	(0.067)	0.225	(0.034)	0.254	(0.051)	0.645	GAS
MDKB	4122.4-4125.1	2.8	2.3	85 %	0.237	(0.109)	0.155	(0.037)	0.555	(0.071)	0.146	GAS
MDKB	4126.5-4129.0	2.5	1.9	78 %	0.268	(0.040)	0.120	(0.008)	0.683	(0.033)	0.000	GAS?
MDKB	4150.5-4154.8	4.2	4.2	100 %	0.022	(0.046)	0.233	(0.024)	0.603	(0.047)	0.199	OIL
MDKB	4155.8-4163.5	7.7	7.7	100 %	0.025	(0.063)	0.229	(0.032)	1.000	(0.000)	0.000	
MDKB	4164.1-4169.1	5.0	4.9	98 %	0.314	(0.050)	0.120	(0.015)	1.000	(0.000)	0.000	
MDKB	4172.0-4176.9	4.9	4.9	100 %	0.018	(0.025)	0.227	(0.010)	1.000	(0.000)	0.000	
MDKB	4178.4-4219.6	41.3	41.3	100 %	0.035	(0.054)	0.215	(0.029)	1.000	(0.000)	0.000	
MDKB	4222.8-4248.9	26.1	25.8	99 %	0.065	(0.071)	0.206	(0.031)	1.000	(0.000)	0.000	
MDKB	4249.9-4263.8	13.9	13.8	100 %	0.097	(0.121)	0.189	(0.030)	1.000	(0.000)	0.000	
MDKB	4272.1-4289.4	17.3	17.1	99 %	0.025	(0.048)	0.208	(0.021)	1.000	(0.000)	0.000	
MDKB	4291.2-4313.8	22.5	22.2	99 %	0.046	(0.067)	0.211	(0.023)	1.000	(0.000)	0.000	
MDKB	4314.9-4352.1	37.2	37.2	100 %	0.079	(0.099)	0.192	(0.034)	1.000	(0.000)	0.000	

APPENDIX 1

ALGORITHMS AND LOGIC USED IN THE QUANTITATIVE COARSE CLASTICS ANALYSIS.

Initial shale volume calculated from GR response.

```
vsh1 = (gr-grmin)/(grmax-grmin)          (Linear Index)
vsh2 = (1.7-sqrt(3.38-((vsh1+0.7)**2)))  (Clavier equation)
vsh  = vsh1*vsh1 + (1-vsh1)*vsh2
```

Apparent shale porosity calculated from density-neutron crossplot algorithm using apparent bulk density of shale and apparent neutron porosity (limestone matrix) of shale.

```
h = 2.71 - rhobsh + phinsh*(rhof-2.71)
   if (h <= 0) rhoma = 2.71 - 0.64*h
   else        rhoma = 2.71 - 0.5*h
phish = (rhoma-rhobsh)/(rhoma-rhof)
```

Bound water resistivity (rwb) calculated via Archie, using apparent shale porosity and apparent shale resistivity.

```
rwb = (rsh*(phish**m))/a
```

Initial estimate of total porosity from density-neutron crossplot algorithms, using bulk density and neutron porosity (limestone matrix, decimal p.u.) log values.

```
h = 2.71 - rhob + nphi*(rhof-2.71)
   if (h < 0) rhoma = 2.71 - 0.64*h
   else       rhoma = 2.71 - 0.5*h
phit = (rhoma-rhob)/(rhoma-rhof)
```

Water saturation (total) calculated using dual water relationship:

```
1/rt=(swt**n)*(phit**m)/(a*rw)+swt**(n-1)*(swb*(phit**m)/a)*((1/rwb)-(1/rw))
      This is solved for Sw by Newtons solution
        exsw=0
        sw  =0.9
        aa  =((phiti**m)/(a*rwi))
        bb  =((swb*(phiti**m)/a)*((1/rwb)-(1/rwi)))
            repeat
              fx1=(aa*(sw**n))+(bb*(sw**(n-1)))-(1/res)
              fx2=(n*aa*(sw**(n-1)))+((n-1)*bb*(sw**(n-2)))
                 if((abs(fx2)) < 0.0001)
                   fx2=0.0001
              swp=sw
              sw =swp-(fx1/fx2)
              exsw=exsw+1
            until (exsw > 4 or (abs(sw-swp)) <= 0.01)
        swt=sw
               [ where:swb = bound water saturation            ]
               [       swb = max(0,(min(1,(vsh*phish/phit)))) ]
```

Sxo is estimated by the relationship Sxo = Sw**Z, where Z is an analyst input.

The bulk density and neutron porosity log responses are then corrected for hydrocarbon effects, using the following algorithms, which incorporate calculated Sxo and analyst input hydrocarbon density (rhoh).

```
rhobh=rhob+1.07*phit*(1-sxot)*((1.11-0.1*p)*rhof-1.15*rhoh)
phinh=nphi+(1.3*phit*(1-sxot)*(rhof*(1-p)-1.5*rhoh+0.2))/(rhof*(1-p))
          where:[  p = mud filtrate salinity in parts per unity ]
                [  p = 0.1778*(3/(rmf*(trmf+7)-1))**(1.05)       ]
```

Total porosity is then recalculated from the density-neutron crossplot algorithm, using the hydrocarbon corrected porosity logs, Sw and Sxo recalculated, and replacement hydrocarbon corrections calculated using the latest Sxo. This process is repeated until the latest total porosity calculated is within 0.008pu (0.8% porosity) of the previously calculated value. At this stage, clay corrections are made to the hydrocarbon corrected bulk density and neutron porosity logs, and apparent matrix density calculated from the density-neutron crossplot algorithm.

```
rhobc = (rhobh - vsh*rhobsh)/(1 - vsh)
phinc = (phinh - vsh*phinsh)/(1 - vsh)
h  = 2.71 - rhobc + phinc*(rhof-2.71)
   if (h < 0)  rhogc = 2.71 - 0.64*h
   else        rhogc = 2.71 - 0.5*h
```

The apparent matrix density is compared to the analyst input grain density window. If it falls within this window, effective porosity and water saturation are calculated, and the processing sequence finished. If it falls outside the specified grain density window, shale volume is incremented or decremented, and the whole processing sequence repeated, until the calculated grain density falls within the grain density window.

Effective porosity and water saturation are derived from calculated total porosity and water saturation as follows:

```
phie= max(0.001,(phit-(vsh*phish)))
swe = max(swirr,( 1 - ((phit/phie)*(1-swt))))
sxo =1 - ((phit/phie)*(1-sxot))
sxo = min(sxo,swe,1)
   if (vsh > vshco) {
      swt  = 1
      swe  = 1
      sxo  = 1
      phie = 0
   }
   if (vsh > (vshco-0.2)) {
      phie= phie*((vshco-vsh)/0.2)
      swe = 1-((1-swe)*((vshco-vsh)/0.2))
      sxo = 1-((1-sxo)*((vshco-vsh)/0.2))
   }
                 where: vshco is the maximum shale volume
                        for any effective porosity.
```

PE600993

This is an enclosure indicator page.
The enclosure PE600993 is enclosed within the container PE902143 at this location in this document.

The enclosure PE600993 has the following characteristics:

```
     ITEM_BARCODE = PE600993
CONTAINER_BARCODE = PE902143
             NAME = Quantitative Log
            BASIN = GIPPSLAND
           PERMIT = Vic/P24
             TYPE = WELL
          SUBTYPE = well log
      DESCRIPTION = Quantitative Log
          REMARKS =
     DATE_CREATED = 07/06/1990
    DATE_RECEIVED = 25/06/1990
             W_NO = W994
        WELL_NAME = Blackback-1
       CONTRACTOR = ESSO
     CLIENT_OP_CO = ESSO
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE600992

This is an enclosure indicator page.
The enclosure PE600992 is enclosed within the container PE902143 at this location in this document.

The enclosure PE600992 has the following characteristics:

ITEM_BARCODE = PE600992
CONTAINER_BARCODE = PE902143
NAME = Quantitative Log
BASIN = GIPPSLAND
PERMIT = Vic/P24
TYPE = WELL
SUBTYPE = well log
DESCRIPTION = Quantitative Log
REMARKS =
DATE_CREATED = 08/06/1990
DATE_RECEIVED = 25/06/1990
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600997

This is an enclosure indicator page.
The enclosure PE600997 is enclosed within the container PE902143 at this location in this document.

The enclosure PE600997 has the following characteristics:

ITEM_BARCODE = PE600997
CONTAINER_BARCODE = PE902143
NAME = Litho log
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Litho log
REMARKS =
DATE_CREATED = 07/06/1990
DATE_RECEIVED = 25/06/1990
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX
4

APPENDIX 4

APPENDIX 4

GEOCHEMICAL REPORT

ON

BLACKBACK 1 WELL

GIPPSLAND BASIN

BY

B.J.BURNS

MARCH 1990

LIST OF TABLES AND FIGURES

INTRODUCTION

Blackback 1 was drilled just north-east of Hapuku 1 along the eastern side of the basin and penetrated a relatively thin section of Latrobe Group Eocene channel fill sediments underlain by Upper Cretaceous sands and carbonaceous shales/siltstones. The well was sidetracked twice before reaching Total Depth of 4401m and all of the samples analysed for this report came from the second sidetracked hole, ie Blackback 1 ST-2. The maturity of this section was expected to be relatively low due to the very late burial and loading of the overlying Gippsland Limestone. Potential source rock intervals were identified from their electric log characteristics and thirteen SWCs from the Upper Cretaceous section below a depth of 3000m were selected for routine TOC and Rockeval measurements and eight samples were sent to Keiraville Konsultants for Vitrinite Reflectance determination.

Twenty seven sidewall core samples from 3000 - 4271m were selected for palynological examination and a fraction of the organic concentrate was analysed to determine the Carbon/Hydrogen atomic ratio. Kerogen and fluorescence determinations were carried out by Dr. M.J. Hannah on a suite of ten representative samples.

Oils were recovered from four RFTs at 3530.4m, 3566.8m, 3574.5m and 3805.5m and analysed for their API gravities as well as "Whole Oil" gas chromatography.

RESULTS

The TOC and Rockeval results are presented in Tables 1 and 2 and summarised in Figure 1. All of the samples are from the Upper Cretaceous *T. longus* zone and are medium- to dark-brown or grey-brown carbonaceous siltstones. The Total Organic Carbon (TOC) content is uniformly "good" to "excellent" with all samples except 3260m having TOC's above 2.0% and ranging up to 9.08%

The corresponding Rockeval results (Table 2) are generally dissapointing with only three samples having a "good" source richness rating (based on S2 yields in excess of 6mg/g). The richest samples are from the lower *T. longus* Zone at 3463, 3535 and 3802.5m. Oil would be the interpreted hydrocarbon product (at peak maturity) from these three samples with Hydrogen Indices of approx. 300 or greater (Table 2, Fig 2), while the remaining samples would be expected to yield mainly gas.

The low Tmax values for all samples (<431) indicate that the majority of the section penetrated in the well is immature and this is confirmed by the vitrinite reflectance data (Table 3) which only reach Rv= 0.55% at 4271m. Kerogen Fluorescence data (see below) also supports the low maturity of these samples.

Kerogen organic matter descriptions and fluorescence characteristics are set out in Tables 4 & 5 and Figures 3 & 4. The kerogen types vary considerably but only three samples contain over 60% "oil-prone" material (mainly the Amorphous and Biodegraded Terrestrial categories). The bright yellow fluorescence present in all kerogen types (except Semi-opaque) is indicative of the low maturity of all samples. There is no clear relationship between the amount of fluorescing material and the content or type of "oil-prone" material.

The H/C atomic ratios of the kerogens, as shown in the Van Krevelen Plot (Table 6, Fig. 5), indicate a predominance of Type III terrestrial organic matter for most of the samples. Only four samples show moderately enriched hydrogen compositions with H/C atomic ratios greater than 0.9. This is approaching the composition of intermediate Type II-III kerogen, and hence greater oil source potential, but it is clear from Figure 5 that these samples are still very immature.

DEPOSITIONAL ENVIRONMENT

For the samples studied in this report there is a fair degree of correlation between the various geochemical results and the environments of deposition as determined by A.D.Partridge 1990 (see Tables 2 & 6; Figs 6, 7 & 8). The samples with the best oil-prone characteristics, namely HI greater than 300, atomic H/C ratio greater than 0.9, and strong fluorescence, all occur in the Upper Coastal Plain environment. This is similar to the results from the Sweetlips 1 well but is at slight variance with the data from some of the previous wells such as Conger 1 and Roundhead 1 in which the Lower Coastal Plain facies have contained the better source rocks.

OIL SAMPLES

Four oils were recovered from RFTs at 3530.4m, 3566.8m, 3574.5m and 3805.5m and were analysed for API gravity (Table 7)and "Whole Oil" gas chromatography. All of these oils were from sands well below the main "Top Latrobe" reservoir at 2886-2927m. The 39.6 API oil from 3574.5m (Fig. 12) is a waxy oil with a maximium at C_{23} and only a relatively small amount of lighter gasoline components. It has some resemblance to the oil recovered from the nearby Hapuku 1 well in that both contain appreciable amounts of 'heavy' hydrocarbons in the C_{20-30} range although the Blackback sample is even waxier than Hapuku. However the other three Blackback 1 ST-2 oils, while similar to each other, are different from the 3574.5m oil in that they are lighter oils with API gravities from 45.7-48.7 and chromatograms that indicate a predominance of C_{6-10} gasoline range components with only very minor contributions of components heavier than C_{20} (Figs 10,11 & 13). They are each quite different from the Hapuku oil.

OIL STAINED SIDEWALL CORES

In order to assist the conventional log interpretation of reservoired hydrocarbons, ten sidewall cores from possible hydrocarbon bearing sands over the interval from 3020m to 4153.5m were extracted with low boiling solvent (n-pentane) and the extract analysed by gas chromatography in order to ascertain if the indicated reservoired hydrocarbons were oil or gas (ie. residual condensate).

The results are summarised in Table 8 and Figure 9 and it is clear that at least six of the samples contain oil that matches very closely to the known oil recovered from RFT 3/31 at 3574.5m. (The samples from 3529m and 3565.5m came from intervals that tested gas on RFT's and were selected to represent the extract from known gas sands. The 3565.5m extract does contain a small amount of waxy components but the predominant components are in the C_{12-16} range, and since the interval tested gas with minor liquids it must be considered as representative of a gas/condensate reservoir.)

SUMMARY

1. The Upper Coastal Plain facies of the lower *T. longus* Zone contains the most oil-prone source rocks. All are immature at the well location.

2. The oil at 3574.5m is a 39.6 API crude that is similar to, but waxier than, the oil from Hapuku 1 (2841.4m). The other three oils are lighter and are dominated by the gasoline range components.

3. Extracted hydrocarbons from sidewall cores in selected reservoir sands indicate that at least six other intervals also contain oil.

REFERENCES

PARTRIDGE, A.D., Palynological analysis of Blackback 1, Gippsland Basin. Esso Australia Ltd. Palaeo. Rept. 1990/4, 1-20.

(BJB132)

TABLE 1 **TOTAL ORGANIC CARBON**

WELL: BLACKBACK 1 ST-2

SAMPLE NO.	DEPTH (m)	TYPE	AGE	ZONE	TOC %	CO3 %	DESCRIPTION
78255 H	3095.0	CRSW	Upper Cret	U T. longus	2.57	1.97	M GY-BRN SLTST,DK LAM
78256 K	3260.0	CRSW	"	L T. longus	1.19	1.44	M BRN-BUFF SLTST,TR CARB
78254 Z	3427.0	CRSW	"	"	3.31	3.93	DK BRN SLTST,CARB FLKS
78256 H	3463.0	CRSW	"	"	9.08	0.11	DK BRN CLYST,CARB FLKS
78254 T	3535.0	CRSW	"	"	6.60	3.26	M-DK BRN SLTST,CARB FLKS
78254 O	3570.5	CRSW	"	"	2.12	3.30	M BRN-GY SLTST,TR CARB
78254 J	3802.5	CRSW	"	"	5.45	0.62	BRN-GY BRN SLTST,TR CARB
78254 I	3905.0	CRSW	"	"	2.26	2.76	PL M BRN-M GY BRN SLTST
78254 F	4095.0	CRSW	"	"	2.09	6.69	M-DK BRN-GY SLTST,CARB
78255 T	4112.0	CRSW	"	"	2.94	4.12	DK BRN SLTST
78255 S	4143.0	CRSW	"	"	2.83	0.35	DK BRN SLTST,CARB FLKS
78255 O	4223.0	CRSW	"	"	4.31	1.87	M BRN-GY SLTST,CARB FLKS
78254 C	4271.0	CRSW	"	"	2.13	1.96	M BRN-M GY-BRN SLTST

TABLE 2 ROCKEVAL REPORT

WELL: BLACKBACK 1 ST-2

SAMPLE NO.	DEPTH (m)	TYPE	TOC %	Tmax	S1 mg/g	S2 mg/g	S3 mg/g	HI	OI	HI/OI	ENVIRONMENT
78255 H	3095.0	CRSW	2.57	415	0.43	2.86	0.31	111	12	9	Esturine/Marine
78256 K	3260.0	CRSW	1.19	418	0.32	0.66	0.24	55	20	3	U. Coastal Plain
78254 Z	3427.0	CRSW	3.31	422	0.67	5.42	0.42	164	13	13	"
78256 H	3463.0	CRSW	9.08	405	3.45	34.37	0.70	379	8	49	"
78254 T	3535.0	CRSW	6.60	409	2.80	23.04	0.41	349	6	57	"
78254 O	3570.5	CRSW	2.12	423	0.61	3.12	0.29	147	14	11	"
78254 J	3802.5	CRSW	5.45	417	1.80	15.95	0.47	293	9	34	"
78254 I	3905.0	CRSW	2.26	421	0.44	1.19	0.33	52	15	4	"
78254 F	4095.0	CRSW	2.09	430	0.24	2.62	0.19	125	9	14	L. Coastal Plain
78255 T	4112.0	CRSW	2.94	431	0.36	3.45	0.30	117	10	12	"
78255 S	4143.0	CRSW	2.83	426	0.60	2.42	0.28	86	10	9	"
78255 O	4223.0	CRSW	4.31	422	1.03	5.90	0.39	137	9	15	"
78254 C	4271.0	CRSW	2.13	428	0.32	1.94	0.27	91	13	7	"

TABLE 3 **VITRINITE REFLECTANCE REPORT**

WELL: BLACKBACK 1 ST-2

SAMPLE NO.	DEPTH (m)	TYPE	Rv (max) Avg %	COUNTS	FLUORESCENCE COLOUR	MACERALS
78255 B	3357.5	CRSW	0.39	26	YEL-OR	COAL,V>E>I
78254 X	3478.5	CRSW	0.46	26	OR-DUL OR	DOM ABUNDANT,V>E>I
78254 S	3544.0	CRSW	0.54	27	OR-DUL OR	DOM COMMON,I>V>E
78254 L	3660.5	CRSW	0.55	27	YEL-OR	DOM ABUNDANT,I>V>E
78254 F	4095.0	CRSW	0.57	28	YEL-OR	DOM ABUNDANT,I>V>E
78254 E	4112.0	CRSW	0.57	27	YEL-OR	DOM ABUNDANT,I>V>E
78255 P	4221.5	CRSW	0.52	30	YEL-DUL OR	COAL ABUNDANT,V>I>E
78255 M	4271.0	CRSW	0.55	27	OR-DUL OR	DOM ABUNDANT,I>V>E
78255 L	4315.0	CRSW	-	0		NO VITRINITE

TABLE 4 KEROGEN P.O.M.T.

WELL: BLACKBACK 1 ST-2

SAMPLE NO	DEPTH (M)	KEROGEN TYPES 1.1	1.2	2.1	2.2	3.0	4.0	5.1	5.2	5.3	6.1	6.2	7.0	TAI	% OIL PRONE	FLUOR %
78256 M	3095.0	20				30	10		10	20			10		60	90
78256 K	3260.0	20				25	10		25	15			5		55	90
78254 Z	3472.0	20				25	5		20	20			10		50	95
78254 T	3535.0	30				10	0		35	15			10		40	100
78254 J	3802.5	30				30	5		20	10			5		65	80
78254 F	4095.0	40				15	5		15	20			5		60	30
78255 T	4112.0	20				30	5		15	15	5		10		55	35
78255 S	4143.0	10				30	5		25	20			10		45	80
78255 O	4223.0	10				20	5		30	20	5		10		35	90
78255 M	4271.0	15				5	5		40	25	10				25	40

LEGEND

1 = AMORPHOUS 1.1 – UNDIFFERENTIATED 1.2 – GREY

2 = STRUCTURED AQUEOUS 2.1 – ALGAE 2.2 – DINOFLAGELLATES/ACRITARCHS

3 = BIODEGRADED TERRESTRIAL

4 = SPORES/POLLEN

5 = STRUCTURED TERRESTRIAL 5.1 – LAMINAR 5.2 – CELLULAR 5.3 – SEMI-OPAQUE

6 = INERT 6.1 – OPAQUE 6.2 – META-OPAQUE

7 = INDETERMINATE FINES

TAI = THERMAL ALTERATION INDEX

OIL PRONE = SUM OF 1.1 THRU 4.0

FLUOR = PERCENT FLUORECSCENT MATERIAL

TABLE 5 KEROGEN FLUORESCENCE

WELL: BLACKBACK 1 ST-2

SAMPLE NO	DEPTH (M)	TYPE	COLOUR	%	DESCRIPTOR	COMMENTS
78256 M	3095.0	CRSW	BRIGHT YELLOW	90	ALL TYPES EXCEPT SOME SEMI OPAQUE.	IMMATURE.
			TOTAL	90		
78256 K	3260.0	CRSW	BRIGHT YELLOW	90	ALL TYPES EXCEPT SOME SEMI OPAQUE.	IMMATURE.
			TOTAL	90		
78254 Z	3472.0	CRSW	BRIGHT YELLOW	95	ALL TYPES EXCEPT SOME SEMI OPAQUE.	IMMATURE.
			TOTAL	95		
78254 T	3535.0	CRSW	BRIGHT YELLOW	100	ALL TYPES.	IMMATURE.
			TOTAL	100		
78254 J	3802.5	CRSW	BRIGHT YELLOW	80	ALL TYPES EXCEPT SOME SEMI OPAQUE.	IMMATURE.
			TOTAL	80		
78254 F	4095.0	CRSW	BRIGHT YELLOW	30	CELLULAR, "PIN-PRICK".	IMMATURE. AMORPHOUS MATERIAL CONTAINS "PIN-PRICK" FLUORESCENCE.
			TOTAL	30		
78255 T	4112.0	CRSW	BRIGHT YELLOW	20	CELLULAR.	MARGINALLY MATURE AMORPHOUS MATERIAL CONTAINS "PIN-PRICK" FLOURESCENCE.
			GOLD	15	CELLULAR, "PIN-PRICK".	
			TOTAL	35		
78255 S	4143.0	CRSW	BRIGHT YELLOW	70	ALL TYPES EXCEPT SOME SEMI OPAQUE.	MARGINALLY MATURE.
			GOLD	10	CELLULAR.	
			TOTAL	80		
78255 O	4223.0	CRSW	BRIGHT YELLOW	90	ALL TYPES.	IMMATURE.
			TOTAL	90		
78255 M	4271.0	CRSW	BRIGHT YELLOW	10	CELLULAR.	MARGINALLY MATURE.
			GOLD	30	BIODEG. TERREST., CELLULAR.	
			TOTAL	40		

TABLE 6 KEROGEN ELEMENTAL ANALYSIS

WELL: BLACKBACK 1 ST-2

SAMPLE NO.	DEPTH (m)	TYPE	AGE	ZONE	ATOMIC RATIOS H/C	O/C	N/C	ENVIRONMENT
78256 M	3008.0	CRSW	Maastrichtian	U T. longus	0.70	0.18	0.02	Esturine/Marine
78255 I	3082.0	CRSW	"	"	0.83	0.21	0.02	"
78255 H	3095.0	CRSW	"	"	0.89	0.35	0.02	"
78255 F	3142.0	CRSW	"	"	0.87	0.19	0.02	"
78255 E	3180.0	CRSW	"	T. longus	0.89	0.23	0.02	"
78256 K	3260.0	CRSW	"	L T. longus	0.85	0.32	0.02	U. Coastal Plain
78255 C	3332.5	CRSW	"	"	0.88	0.27	0.01	"
78256 I	3377.5	CRSW	"	"	0.71	0.21	0.02	"
78255 A	3400.5	CRSW	"	"	0.91	0.07	0.02	"
78254 Z	3427.0	CRSW	"	"	0.85	0.24	0.02	"
78254 Y	3448.0	CRSW	"	"	0.76	0.18	0.02	"
78254 X	3478.5	CRSW	"	"	0.92	0.23	0.02	"
78256 G	3479.5	CRSW	"	"	0.72	0.23	0.02	"
78254 T	3535.0	CRSW	"	"	0.96	0.24	0.01	"
78256 C	3603.5	CRSW	"	"	0.81	0.37	0.01	"
78254 M	3643.0	CRSW	"	"	0.87	0.38	0.01	"
78254 L	3660.5	CRSW	"	"	0.81	0.22	0.01	"
78265 B	3728.0	CRSW	"	"	0.80	0.21	0.01	"
78254 J	3802.5	CRSW	"	"	0.86	0.22	0.01	"
78255 V	3949.0	CRSW	"	"	0.72	0.15	0.01	"
78254 F	4095.0	CRSW	"	"	0.83	0.38	0.02	L. Coastal Plain
78254 E	4112.0	CRSW	"	"	0.69	0.17	0.02	"
78255 T	4112.0	CRSW	"	"	0.71	0.13	0.02	"
78255 S	4143.0	CRSW	"	"	0.83	0.25	0.02	"
78255 P	4221.5	CRSW	"	"	0.92	0.25	0.01	"
78255 O	4223.0	CRSW	"	"	0.82	0.20	0.01	"
78255 M	4271.0	CRSW	"	"	0.77	0.36	0.02	"

TABLE 7 API GRAVITY OF OILS

WELL: BLACKBACK 1 ST-2

SAMPLE	DEPTH (m)	API GRAVITY
RFT 8/50	3530.4	45.7
RFT 4/34	3566.8	48.7
RFT 3/31	3574.5	39.6
RFT 2/30	3805.5	46.9

TABLE 8 RESERVOIR SANDS SWC EXTRACT SUMMARY

WELL: BLACKBACK 1 ST-2

Depth (m)	Stain Fluorescence	Colour of Extract	Extract Fluorescence	Gas Chromatogram pattern	Interpretation
3574.5	RFT 3/31	Reference Oil		Waxy, prominant C20-C30, max C23 & C14	
3020.0	V. patchy blue	None	None	Minor peaks around C16, no C20-C30	No oil present
3489.0	V. strong, 100% blue-wh	Yellow	Good bl-wh	Waxy, max C24 & C16	Oil stain
3516.0	Abundant, blue-white	None	Weak	Waxy, max C24 & C16	Oil stain
3529.0	Weak, pale blue	None	None	Max C14, decreasing to C28	Light oil or condensate
3544.0	Bit patchy, 70% blue-wh	V. pale yl	Fair	Waxy, max C24	Oil stain
3556.5	Good, blue-white	None	Weak	Waxy, max C24	Oil stain
3565.5	Good blue	V. pale yl	Weak	Max C14, signif. C20-C26 waxes	Light oil or condensate
3574.5	V. strong, 100% blue-wh	Yellow	Good bl-wh	Waxy, max C24	Oil stain
3814.5	Patchy, blue-white	None	None	Max C13, decreasing to C27	Condensate
4153.5	V. strong, 100% blue-wh	Pale yl	Fair	Waxy, max C24	Oil stain

COMPOSITE GEOCHEMICAL PROFILE

FIGURE 1

BASIN: GIPPSLAND

BLACKBACK 1

KB: 21 M

TOC = TOTAL ORGANIC CARBON
S1 = VOLATILE HYDROCARBONS (HC)
S2 = HC GENERATION POTENTIAL
PI = PRODUCTION INDEX
HI = HYDROGEN INDEX

$PI = \frac{S1}{S1 + S2}$

$HI = \frac{S2 * 100}{TOC}$

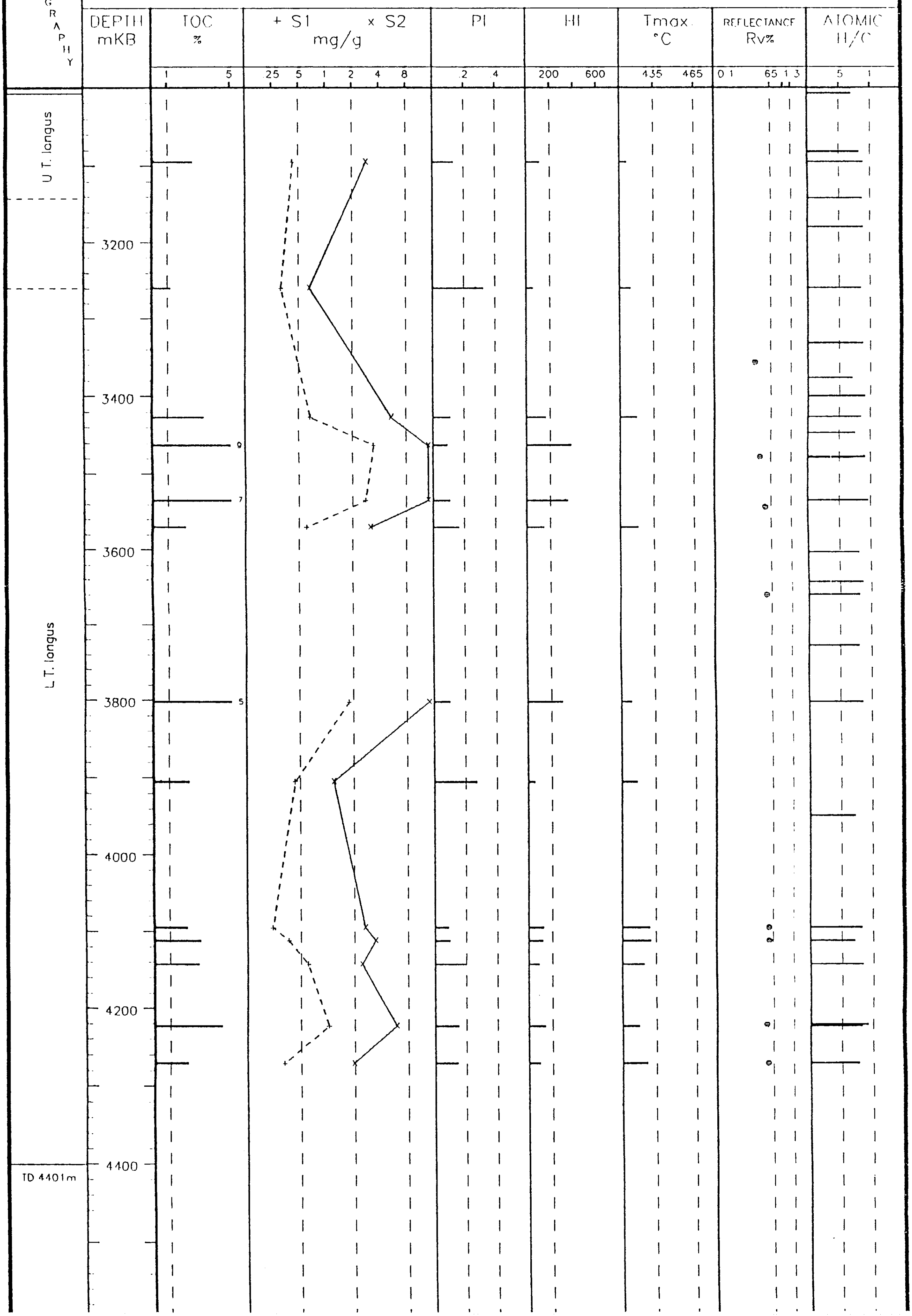


Figure 2

SOURCE MATURITY PLOT

BLACKBACK 1 ST – 2

GIPPSLAND BASIN

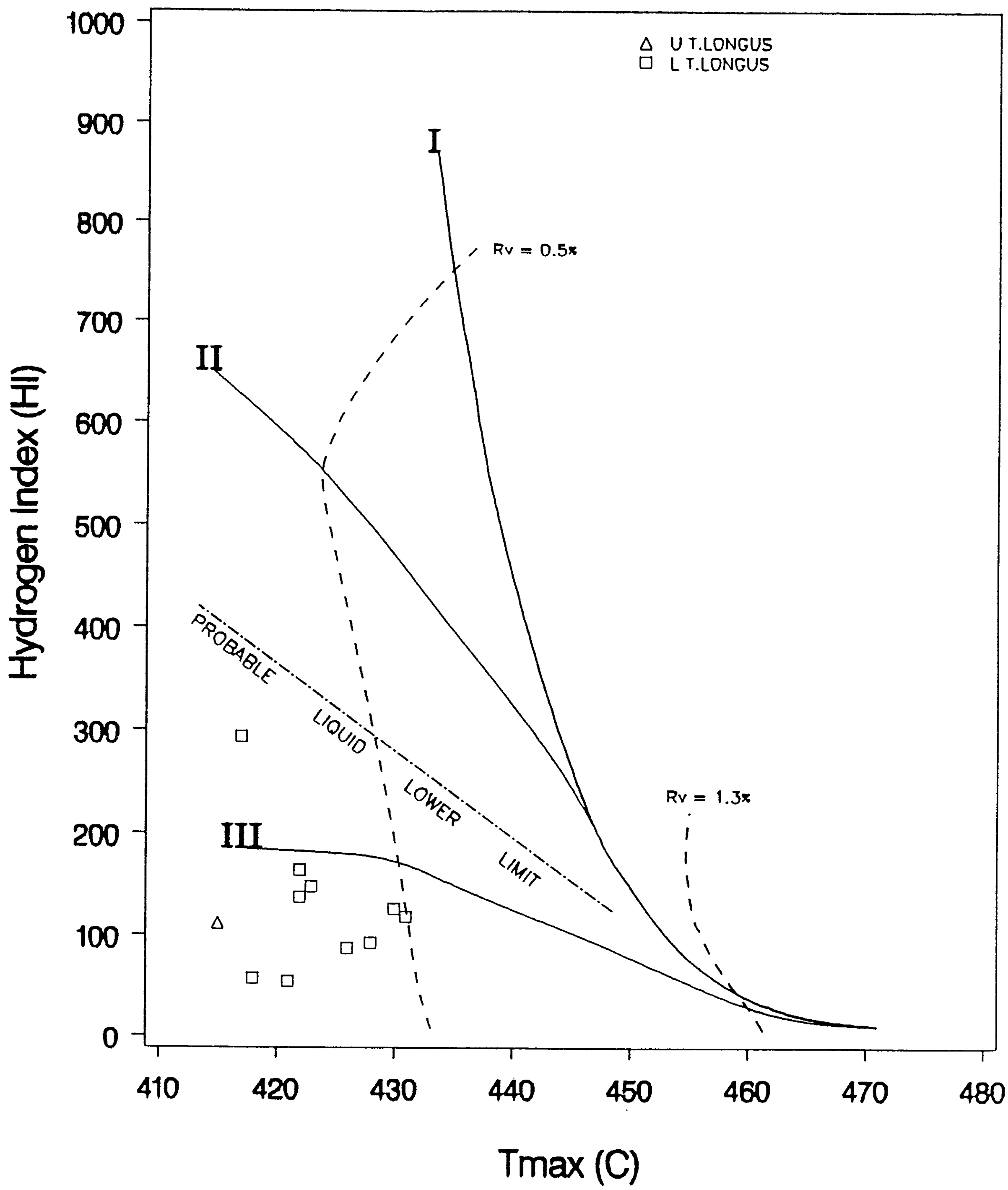
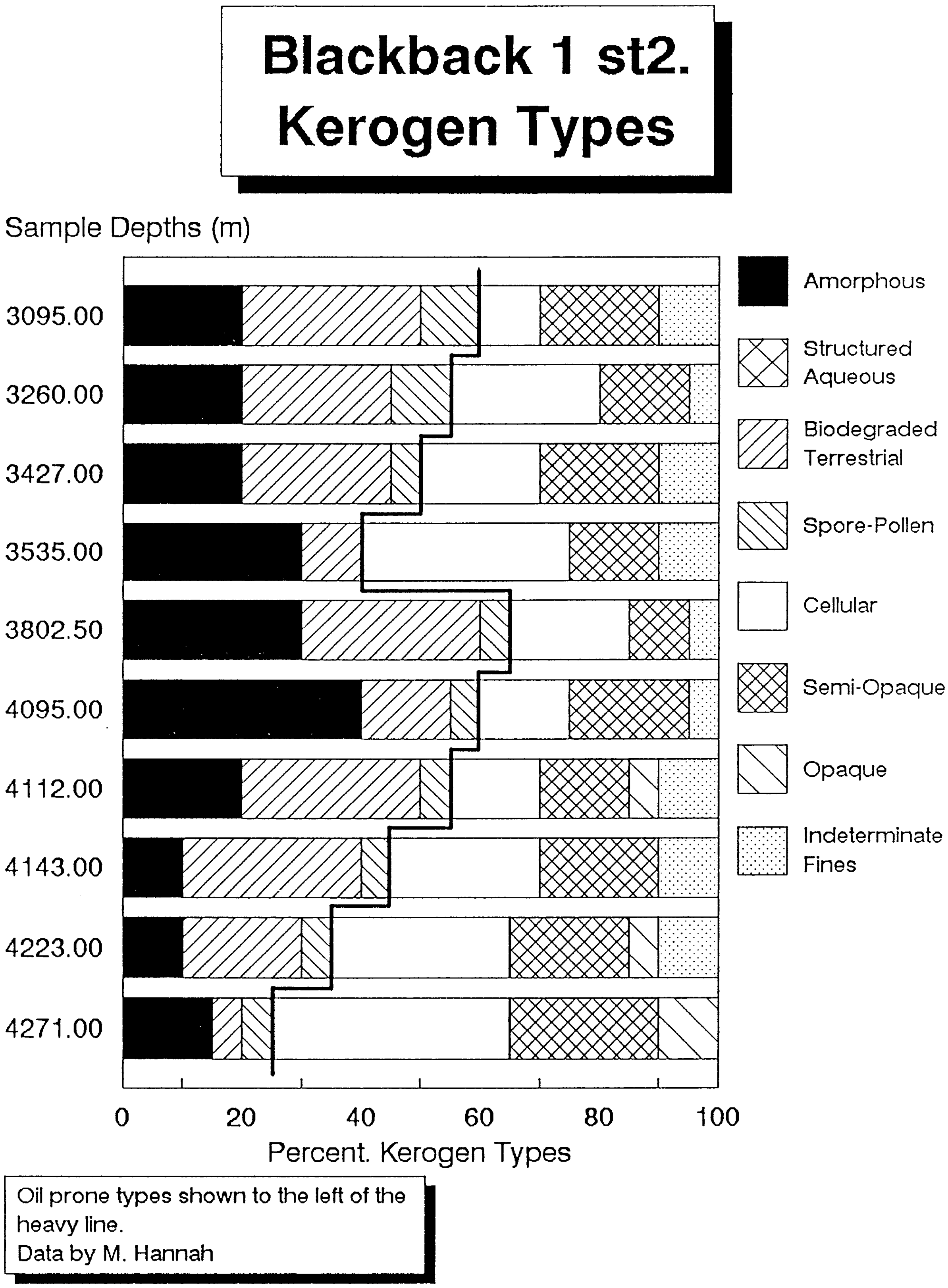
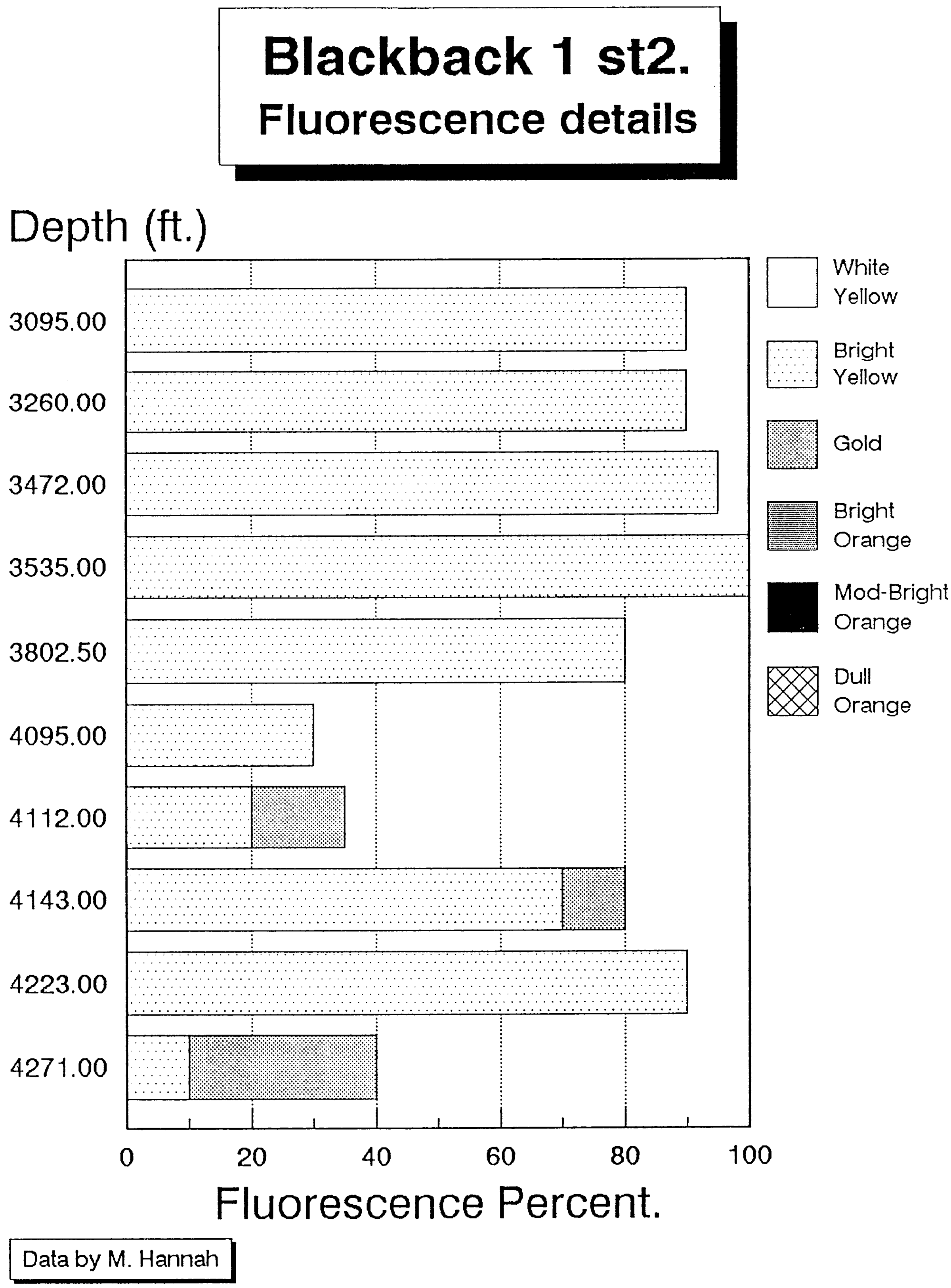


Figure 3



Blackback 1 st2.
Kerogen Types
Sample Depths (m)
3095.00
3260.00
3427.00
3535.00
3802.50
4095.00
4112.00
4143.00
4223.00
4271.00
0
20
40
60
80
100
Percent. Kerogen Types
Amorphous
Structured Aqueous
Biodegraded Terrestrial
Spore-Pollen
Cellular
Semi-Opaque
Opaque
Indeterminate Fines
Oil prone types shown to the left of the heavy line.
Data by M. Hannah

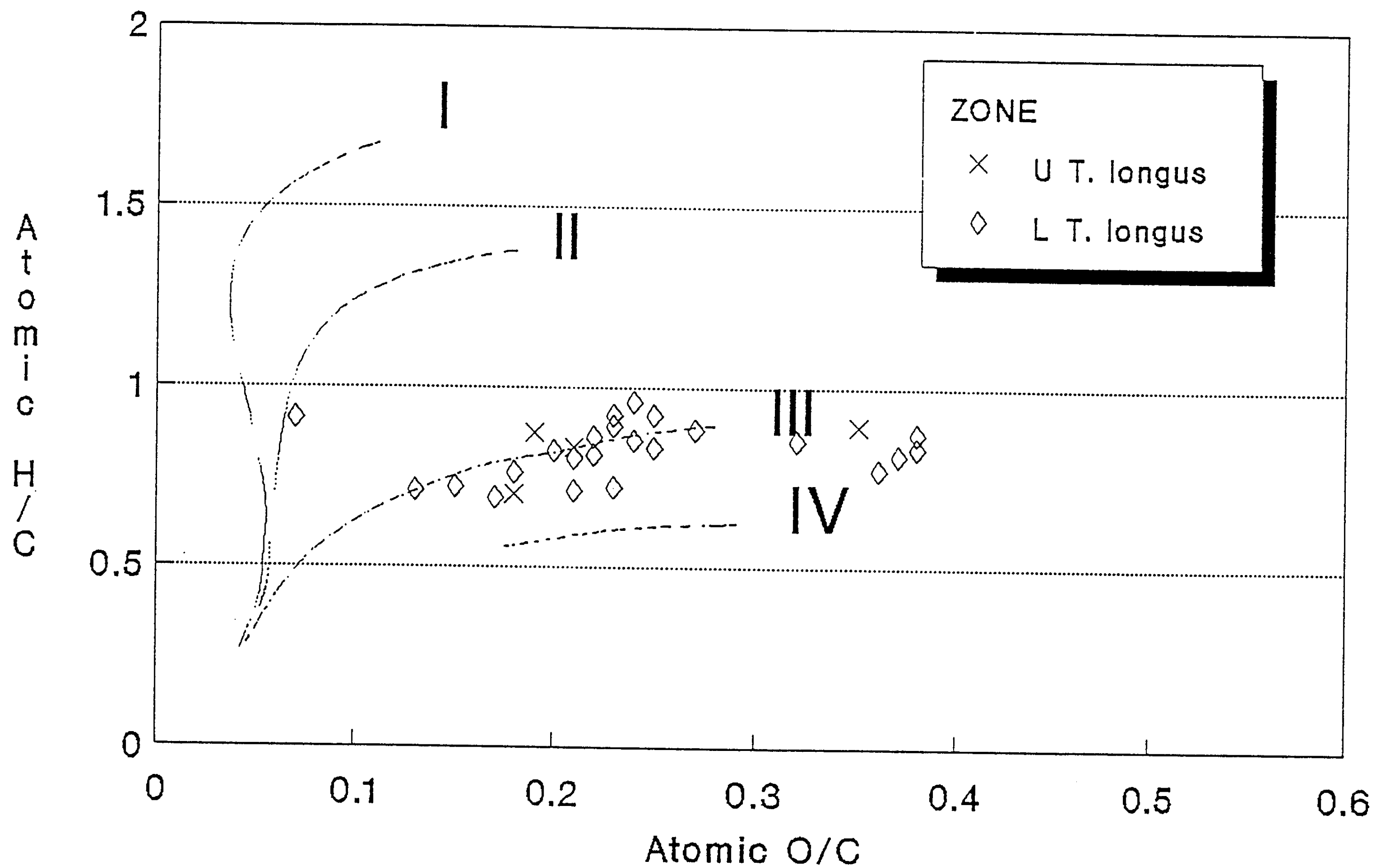
Figure 4



Blackback 1 st2.
Fluorescence details
Depth (ft.)
3095.00
3260.00
3472.00
3535.00
3802.50
4095.00
4112.00
4143.00
4223.00
4271.00
0
20
40
60
80
100
Fluorescence Percent.
White Yellow
Bright Yellow
Gold
Bright Orange
Mod-Bright Orange
Dull Orange
Data by M. Hannah

Figure 5

BLACKBACK 1 ST-2



Van Krevelen Plot for age Zones

Figure 6

Hydrogen Index vs Kerogen H/C
Blackback 1 ST-2

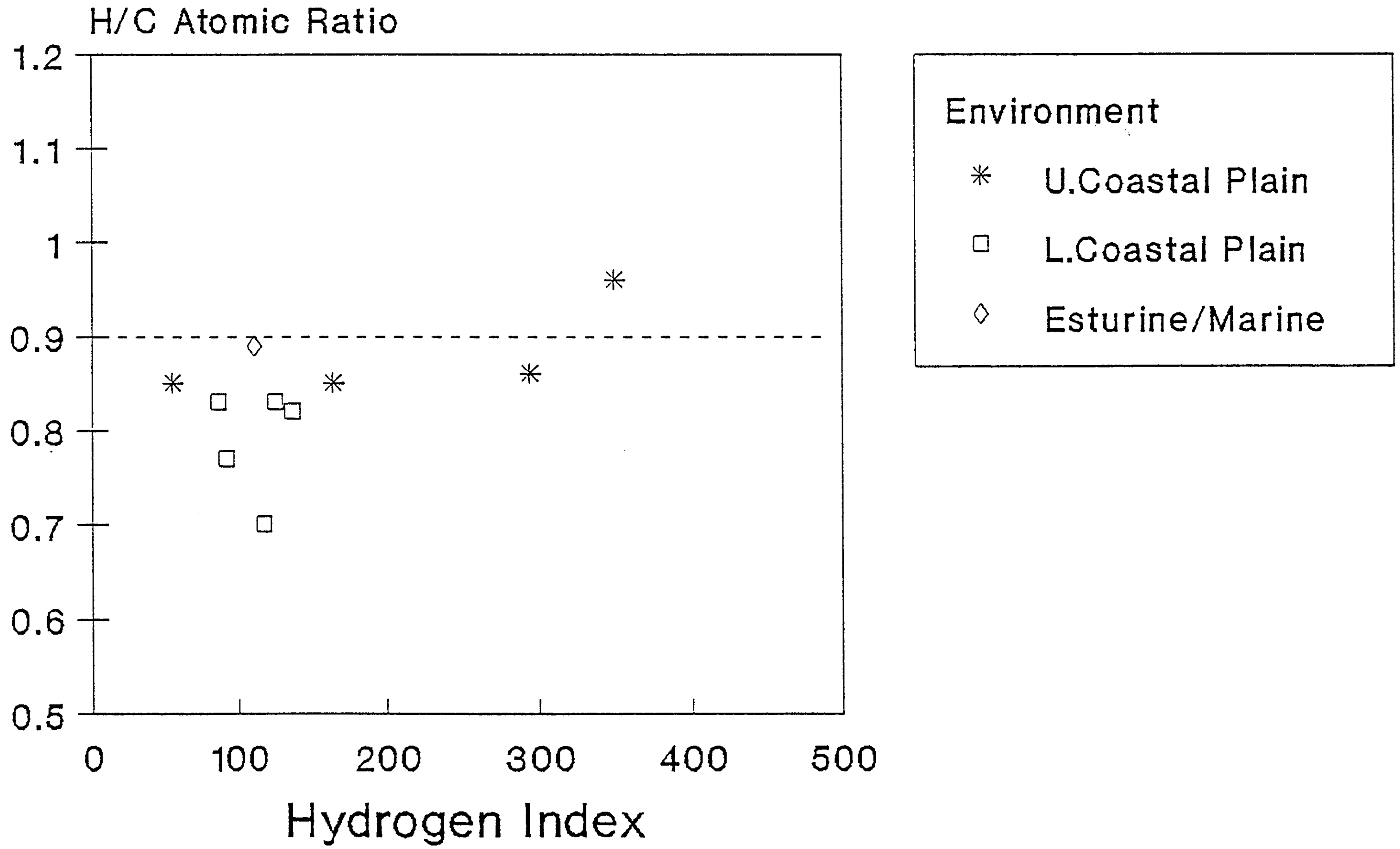
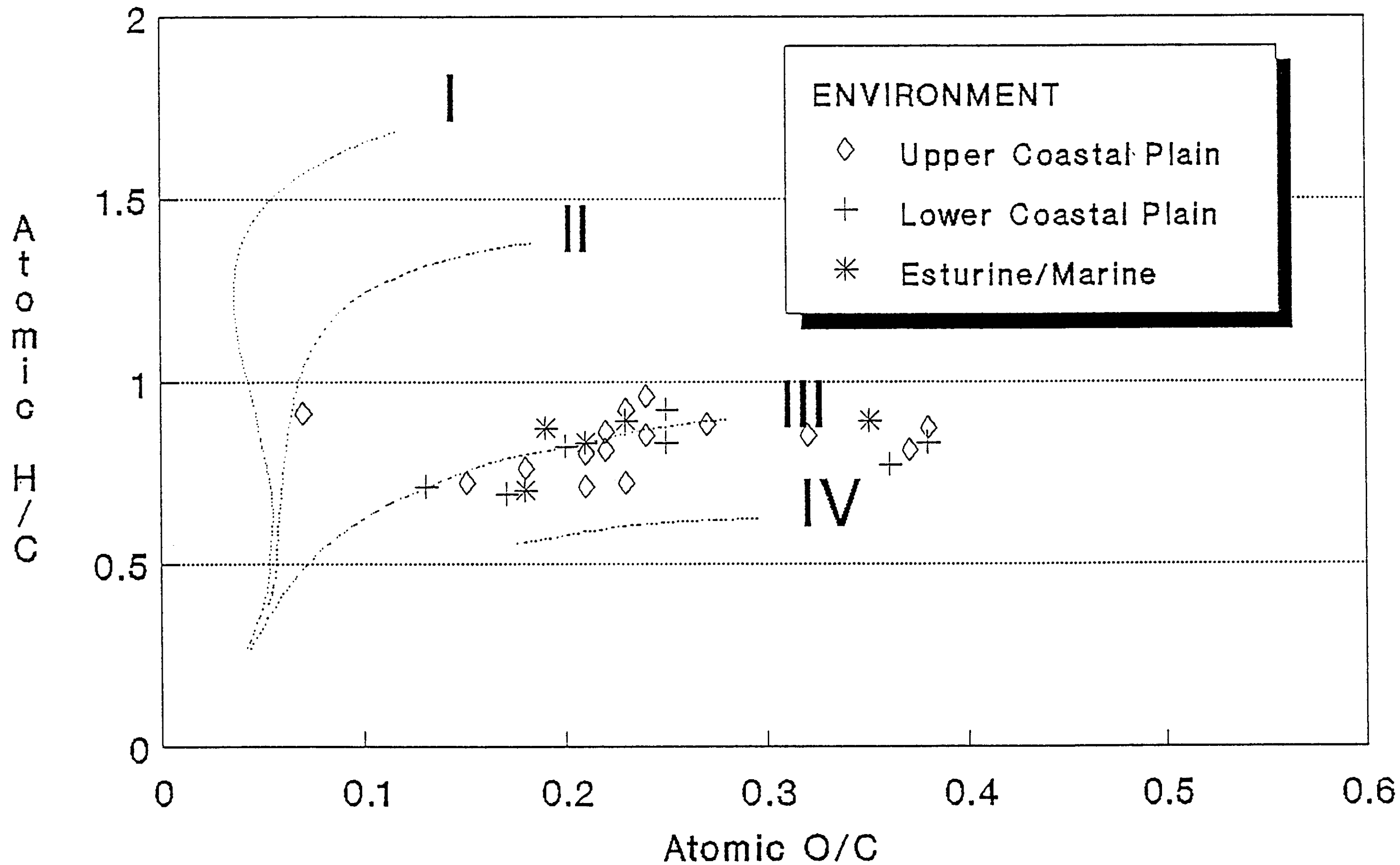


Figure 7

BLACKBACK 1 ST-2



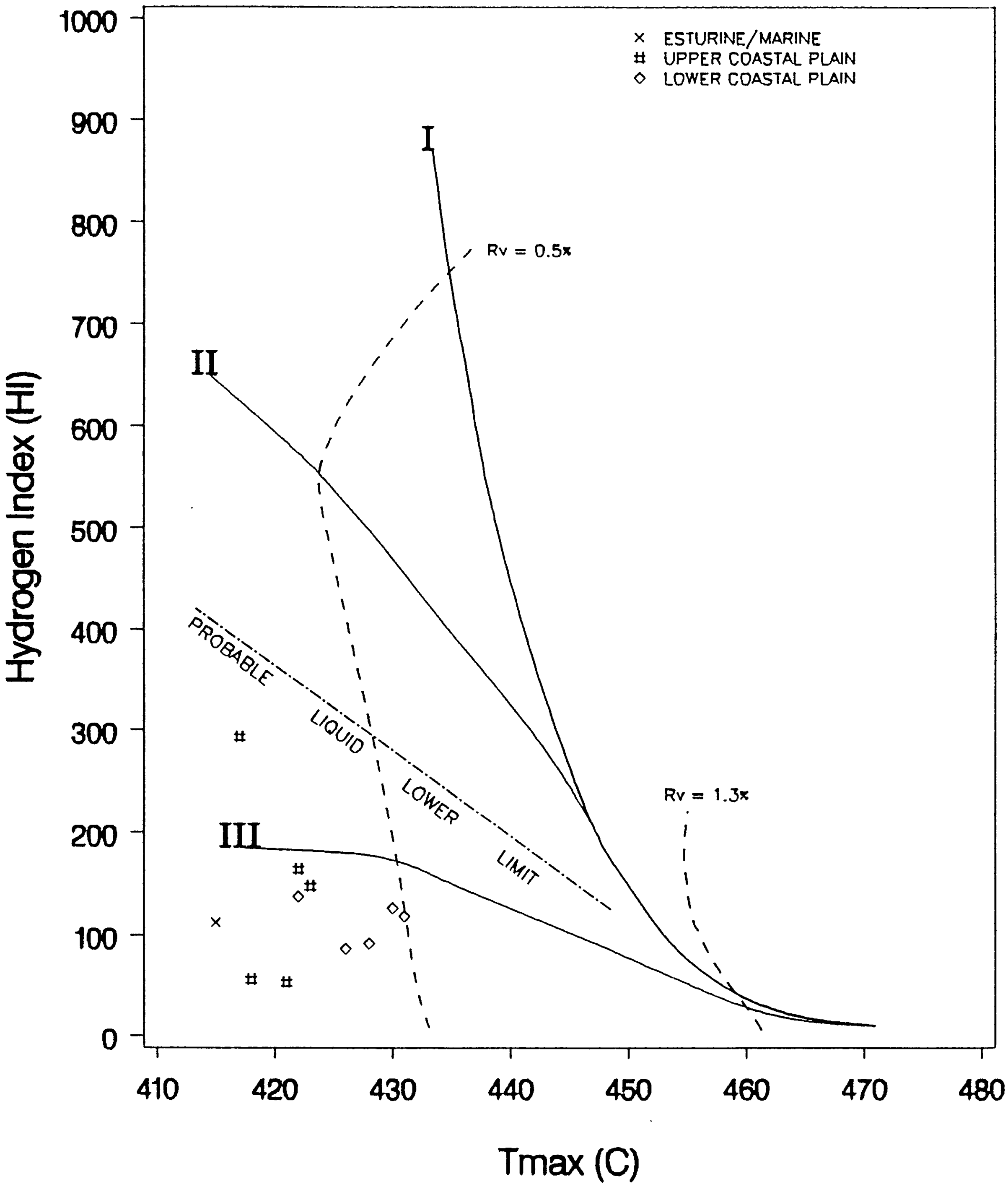
Van Krevelen Plot for Environments

Figure 8

SOURCE MATURITY PLOT

BLACKBACK 1 ST – 2

GIPPSLAND BASIN



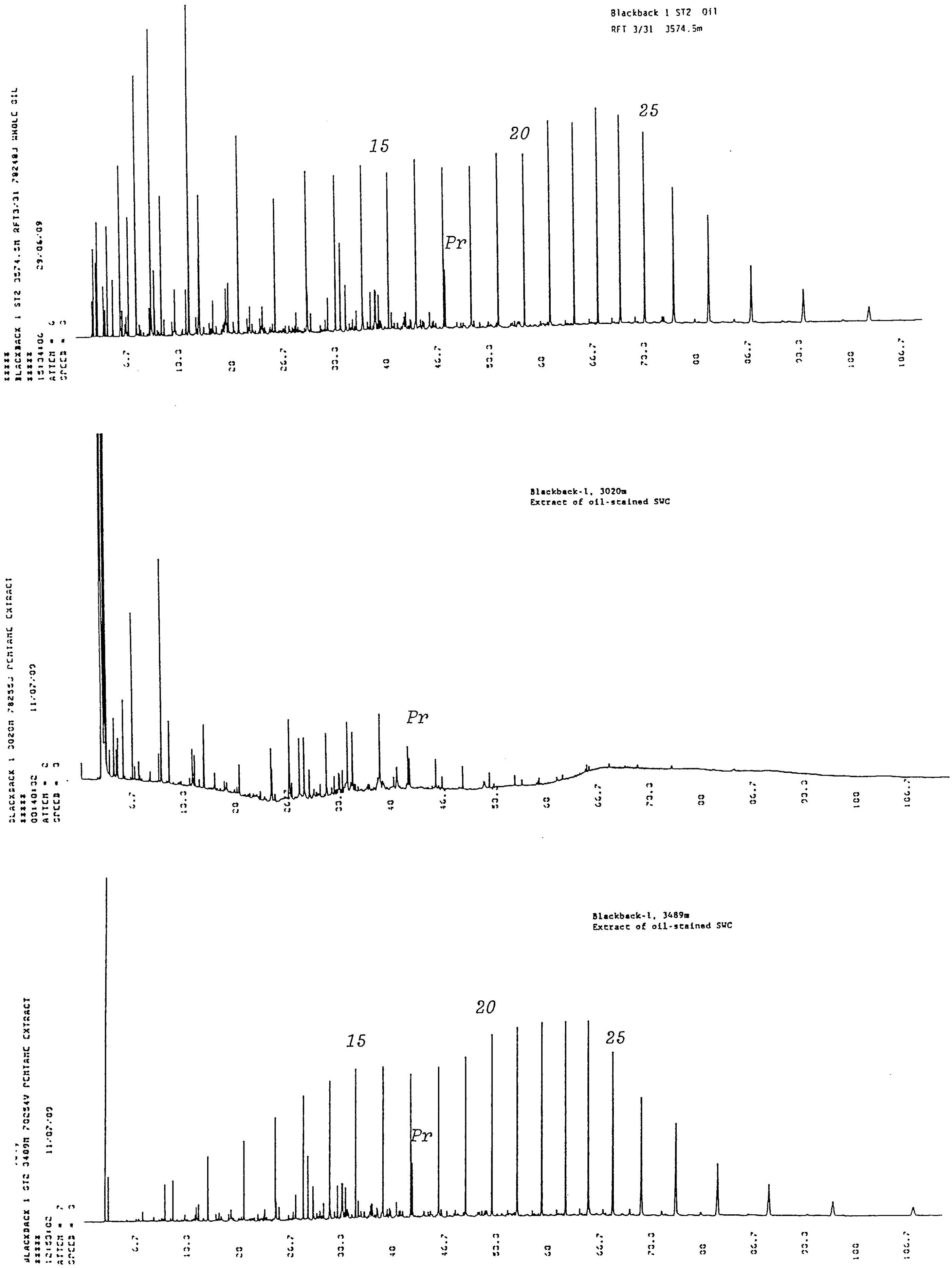


FIGURE 9. Comparison of "Total Extracts" from ten SWCs with oil from RFT 3/31 at 3574.5m

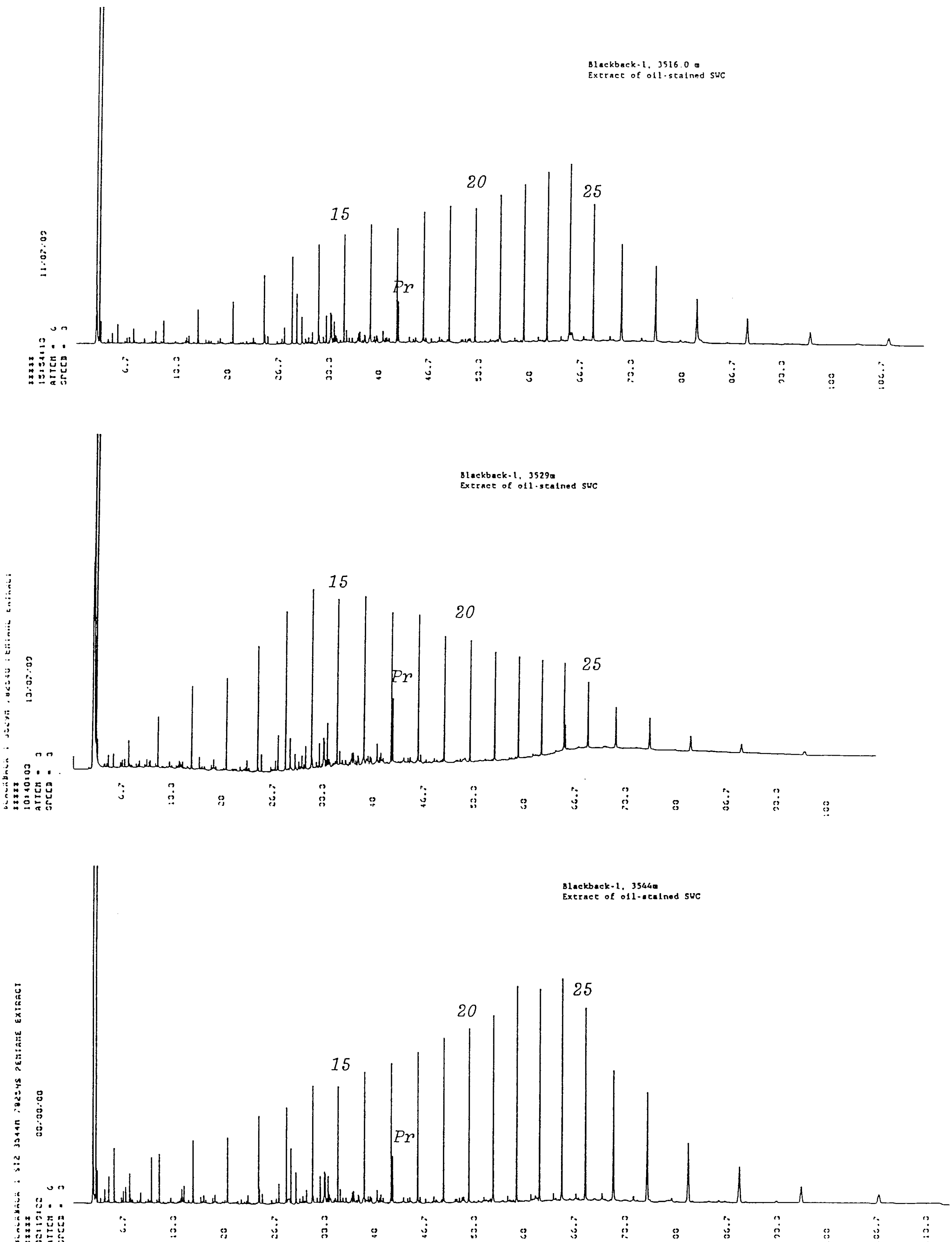


FIGURE 9 (cont) Comparison of "Total Extracts" from ten SWCs with oil from RFT 3/31 at 3574.5m

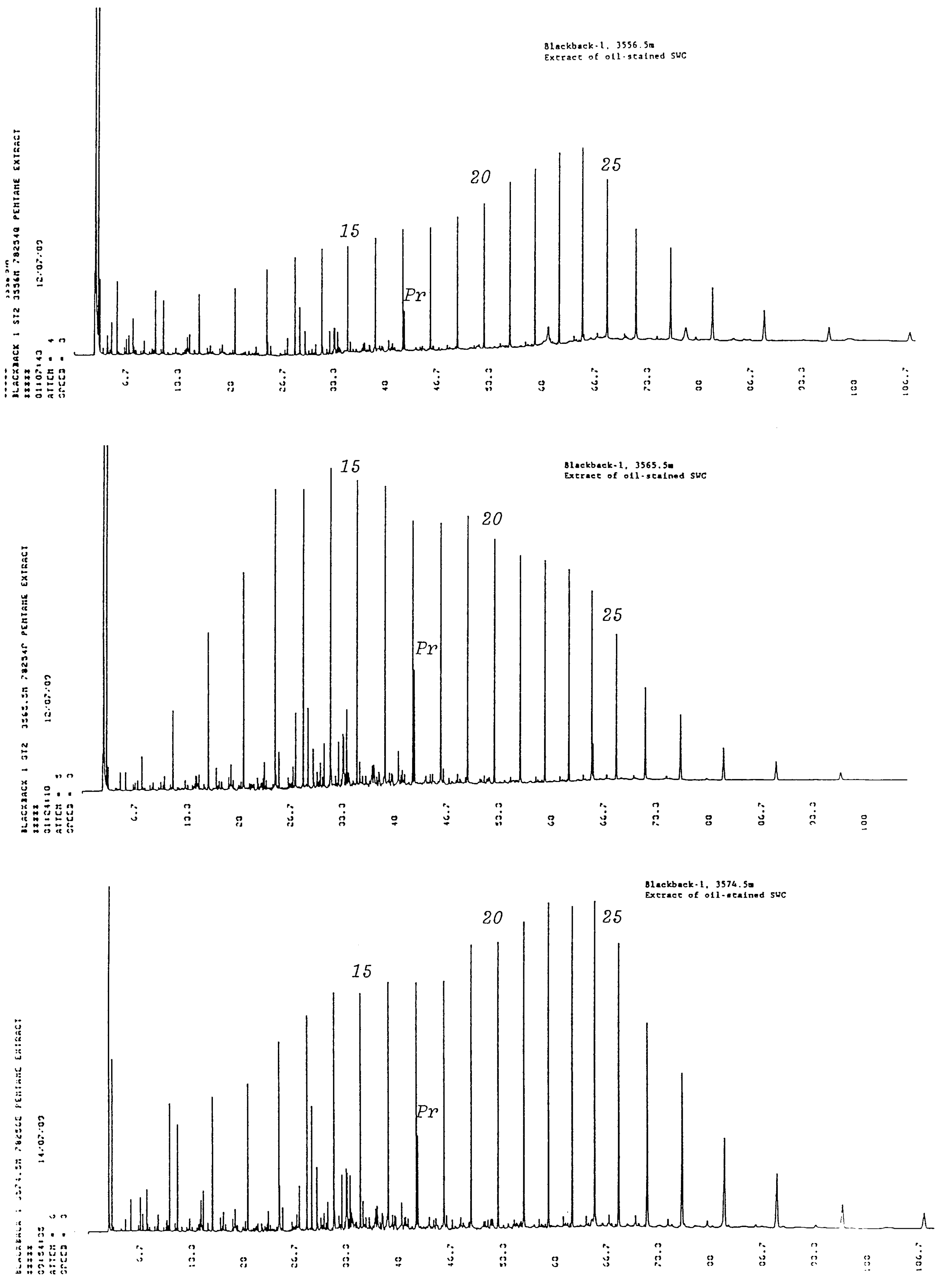
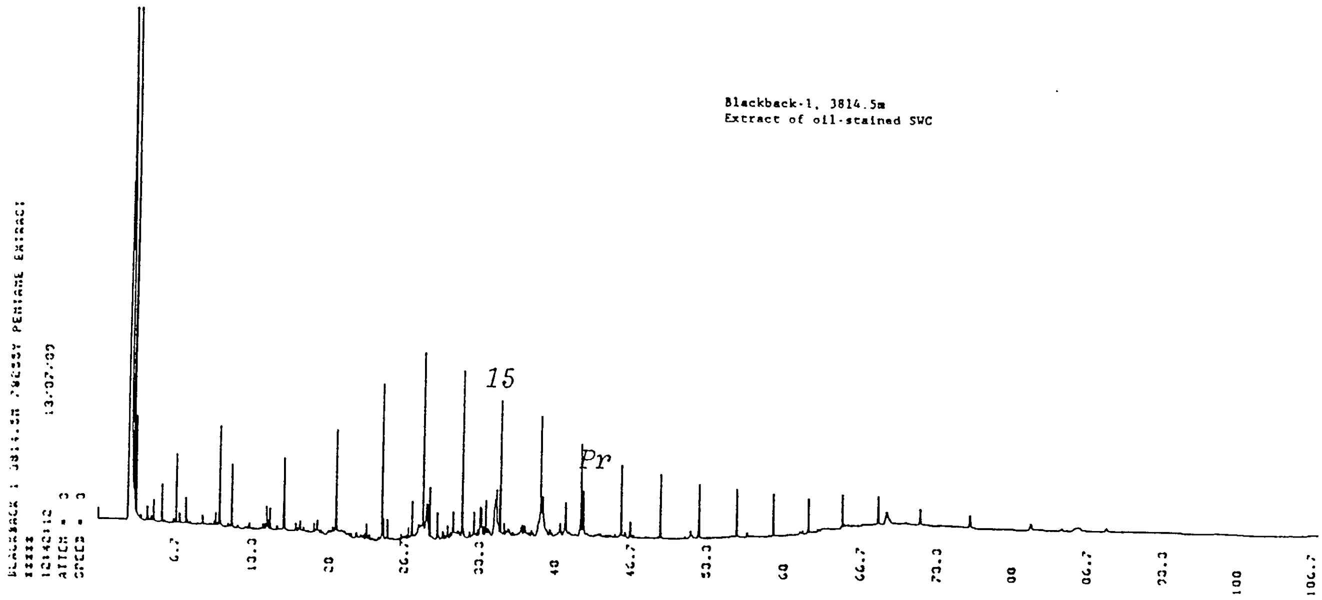


FIGURE 9 (cont) Comparison of "Total Extracts" from ten SWCs with oil from RFT 3/31 at 3574.5m



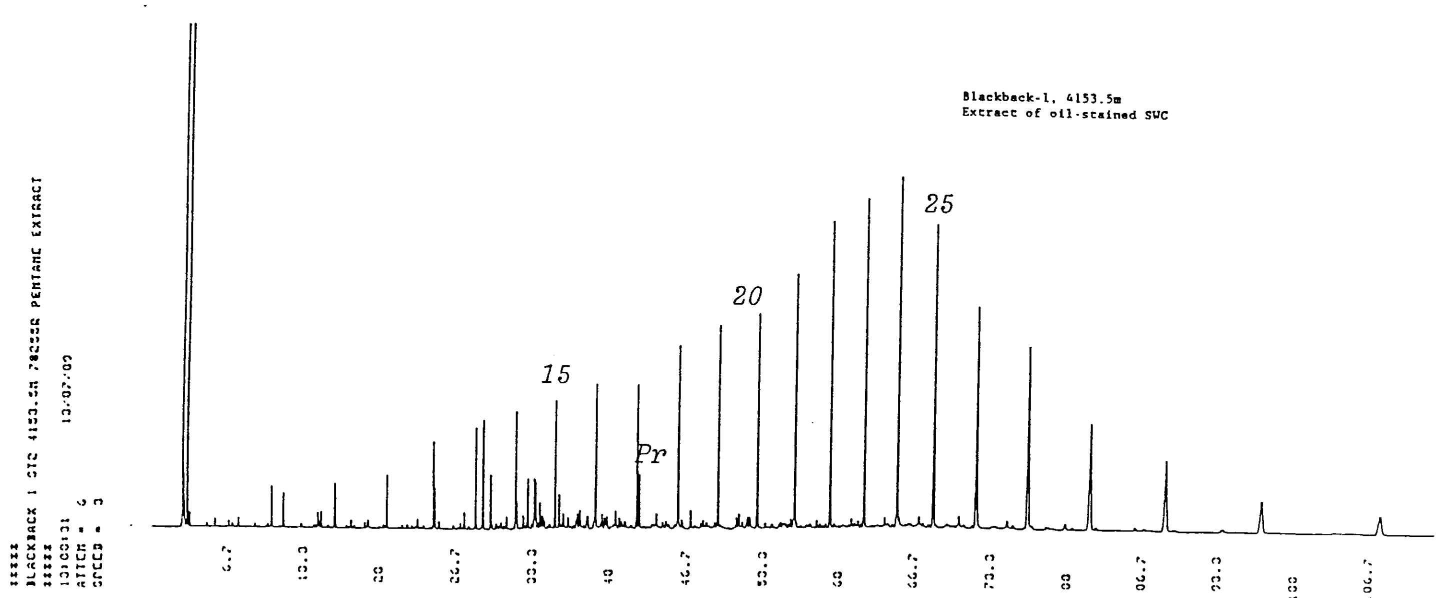


FIGURE 9 (cont) Comparison of "Total Extracts" from ten SWCs with oil from RFT 3/31 at 3574.5m

5412 706007A 077

FIGURE 10. "Whole Oil" Chromatogram

Blackback 1 ST-2

RFT 8/50 , 3530.4m

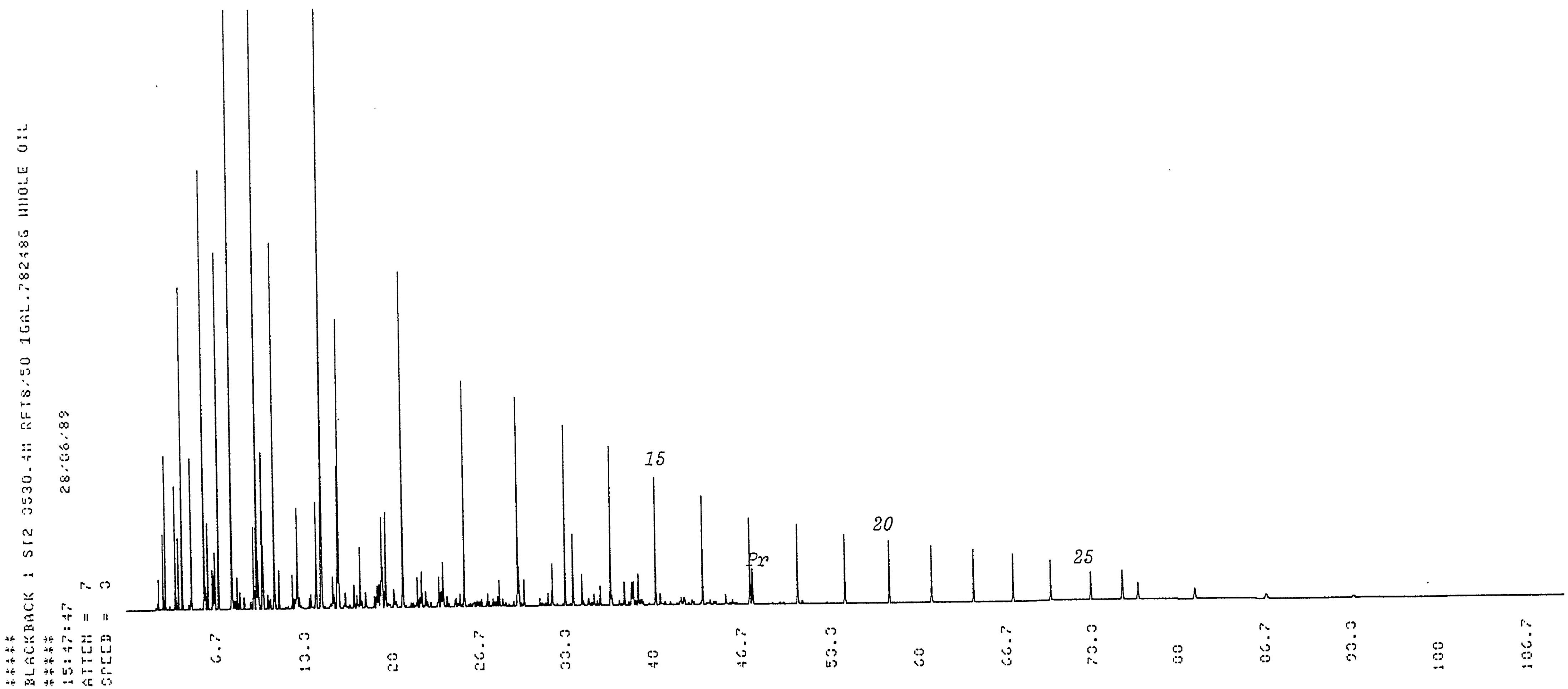
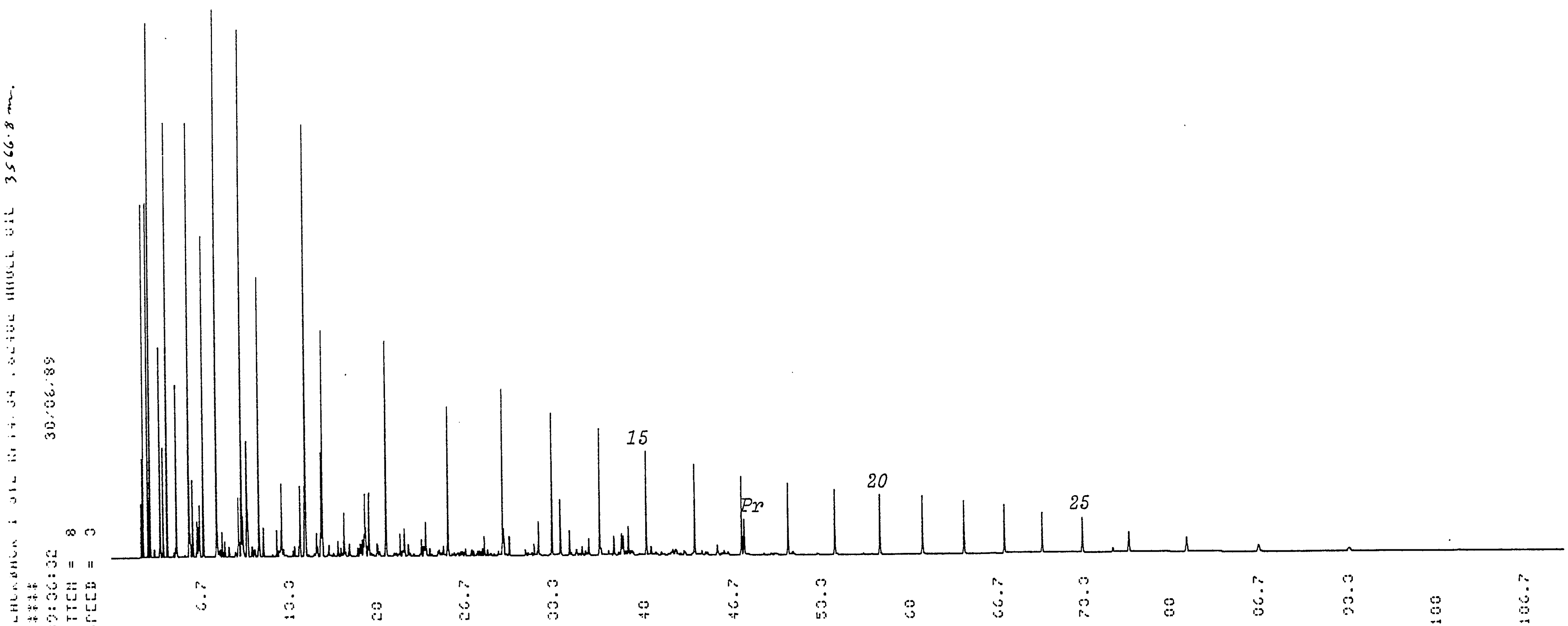


FIGURE 11. "Whole Oil" Chromatogram

Blackback 1 ST-2

RFT 4/34 , 3566.8m



Shimadzu 221-25412 706007A 088

FIGURE 12. *"Whole Oil" Chromatogram*

Blackback 1 ST-2

RFT 3/31 , 3574.5m

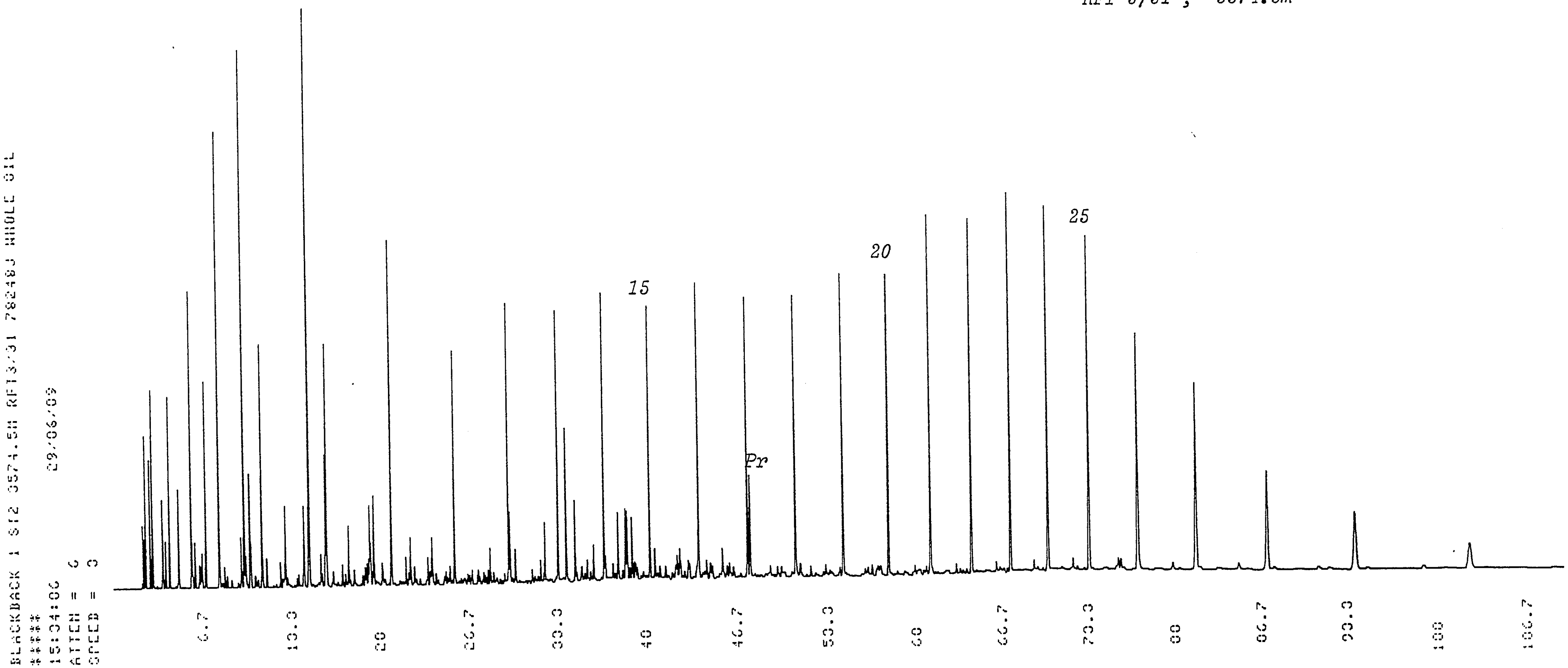
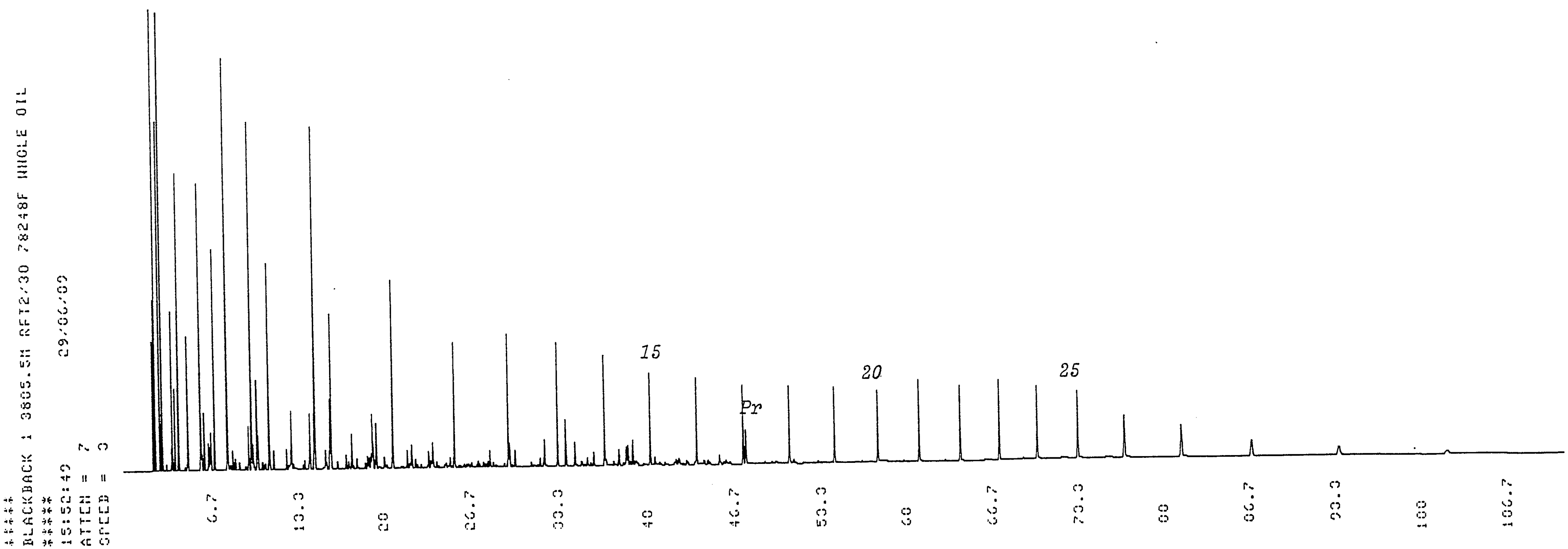


FIGURE 13. *"Whole Oil" Chromatogram*

Blackback 1 ST-2

RFT 2/30 , 3805.5m



APPENDIX 5

APPENDIX 5

WIRELINE TEST REPORT

BLACKBACK-1 ST 1 ST 2

BY

A. B. THOMPSON

DECEMBER 1989

BLACKBACK-1 AND BLACKBACK-1 ST1 AND ST2 RFT REPORT

SUMMARY

The results of RFT pretests and samples taken in the Blackback-1 well and the well's two sidetracks are summarised on Table 1. The RFT program indicated a 28 metre oil column at the Top of Latrobe. A total of 4 oil and gas samples were successfully recovered from a number of thin sands below the intra T.longus seismic marker. A number of other untested hydrocarbon zones were identified by the pretest program.

BLACKBACK-1 (suite 2 logging)

A total of 18 RFT pretest seats were attempted in the Top of Latrobe interval in Blackback-1 on the 30th of April 1989. The Blackback-1 Top Latrobe RFT program consisted of 1 run of pretests. Of the 18 pretests attempted, 9 pretests were successful. Of the 9 unsuccessful pretests, 5 were seal failures, 3 were supercharged and 1 was aborted. The results of the pretest program are summarised on Table 2.

The RFT data indicates an OWC at -2832 m TVDSS which is in very close agreement with the OWC picked off open hole logs at -2833 m TVDSS. Figures 1 and 2 show the RFT interpretation for the Top Latrobe interval. A drawdown of 66 psi from the original Gippsland Basin aquifer gradient was seen in the water directly below the oil. This shows that the Blackback Top of Latrobe oil accumulation is in good communication with the basin wide aquifer system.

BLACKBACK-1 ST1 (Suite 3 logging)

After sidetracking the well due to hole problems, the Top of Latrobe section was relogged in the 23rd of May, 1989. Three RFT samples runs were attempted but all were unsuccessful due to packer failures.

BLACKBACK-1 ST2 (Suite 4 logging)

A total of 29 RFT pretest seats were attempted in the upper Intra T.longus interval from 3440 to 3901 m MDKB on the 16th of June 1989. The Suite 4 RFT program consisted of 1 run of pretests and six sample runs. Of the 29 pretests attempted, 16 pretests were successful. Of the 13 unsuccessful pretests, 7 were seal failures, 5 were tight and 1 was supercharged. The results of the pretest program are summarised on Table 3.

The interpretation is shown on Figures 3, 4 and 5. The pretest program identified 10 hydrocarbon zones between -3260 and -3340 metres TVDSS. Interpretation of the fluid contacts is difficult as there are only a few water points which have had to be projected over the interval. RFT samples in four of these zones has identified the hydrocarbon type, in the other zones the hydrocarbon type is uncertain. Two oil samples, one gas sample and one possible gas sample were recovered, the sample recoveries are summarised on Table 1.

The water gradient used in the interval labelled T300 water on Figure 5 was 1.48 psi/m. This water gradient is higher than that seen in the Top Latrobe water sands. This is consistent with the slight overpressure seen in this interval. The water pretests taken above the T200 zone are 14 psi higher than the original basin gradient and the T300 water pretests were 22 psi higher. This indicates that this zone is slightly overpressured.

BLACKBACK-1 ST2 (Suite 5 logging)

A total of 13 pretests and one sample were taken in the lower T.longus interval from 4020 to 4175 metres MDKB. Of the 13 pretests, 9 were successful. Of the 4 unsuccessful pretests, 2 were seal failures and two were tight. The results of the pretest program are summarised on Table 4.

The interpretation of the pretests is shown on Figure 6. The pretest program identified two hydrocarbon zones. A sample in one these (T550) recovered gas, the other (T600) is a possible oil zone. A fluid contact was observed on open hole logs in the T600 sand. The contact depth was confirmed by the RFT interpretation.

The water pretest taken in the T600 water sand was 31 psi higher than the original basin water gradient. This slight overpressure is similar to but slightly higher than that seen in the suite 4 RFT pretests.

FIGURE 1

BLACKBACK-1 OPEN-HOLE RFT PRESSURE DATA

APRIL 30TH 1989

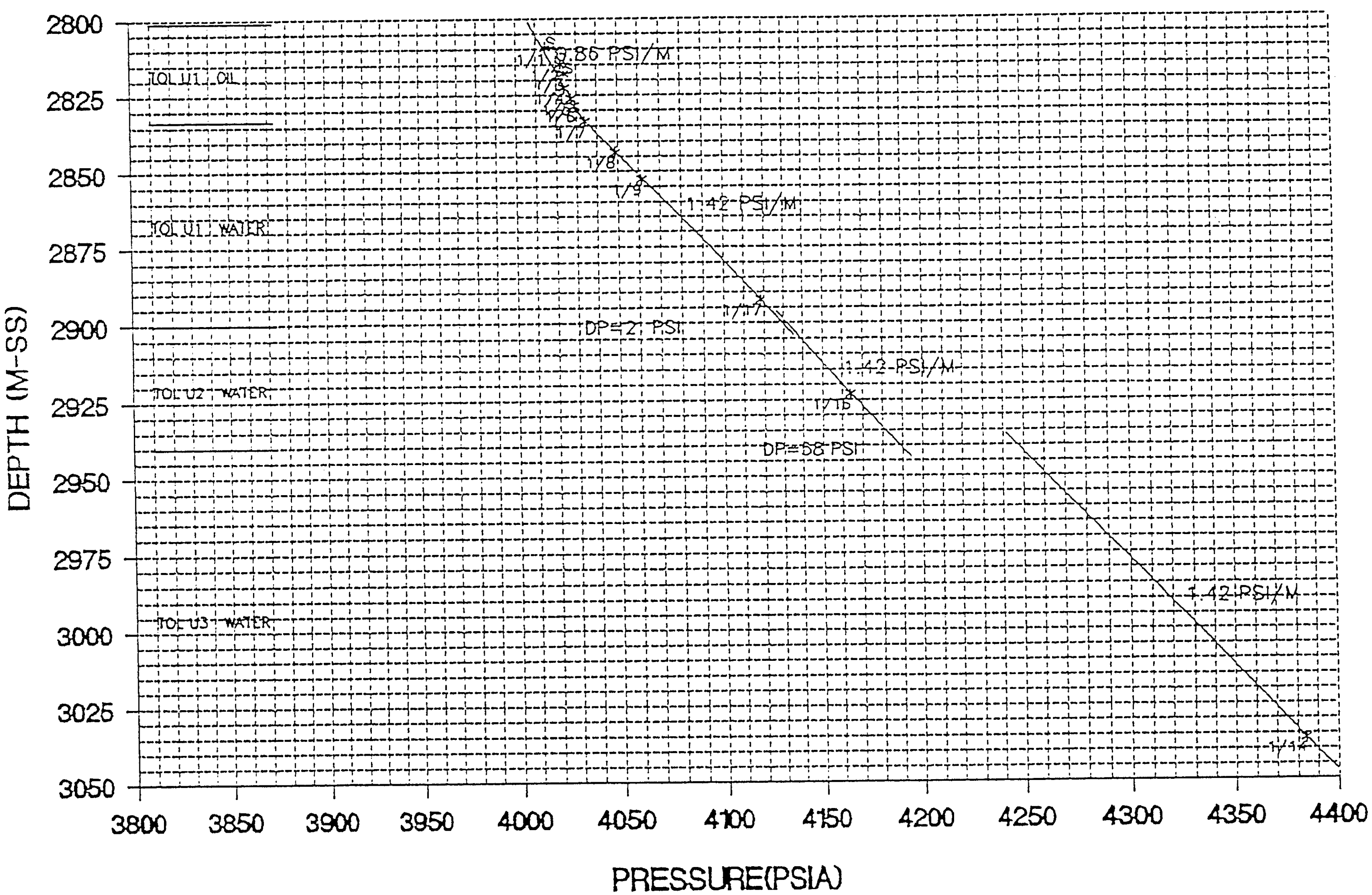


FIGURE 2

BLACKBACK-1 OPEN-HOLE RFT PRESSURE DATA

APRIL 30TH 1989

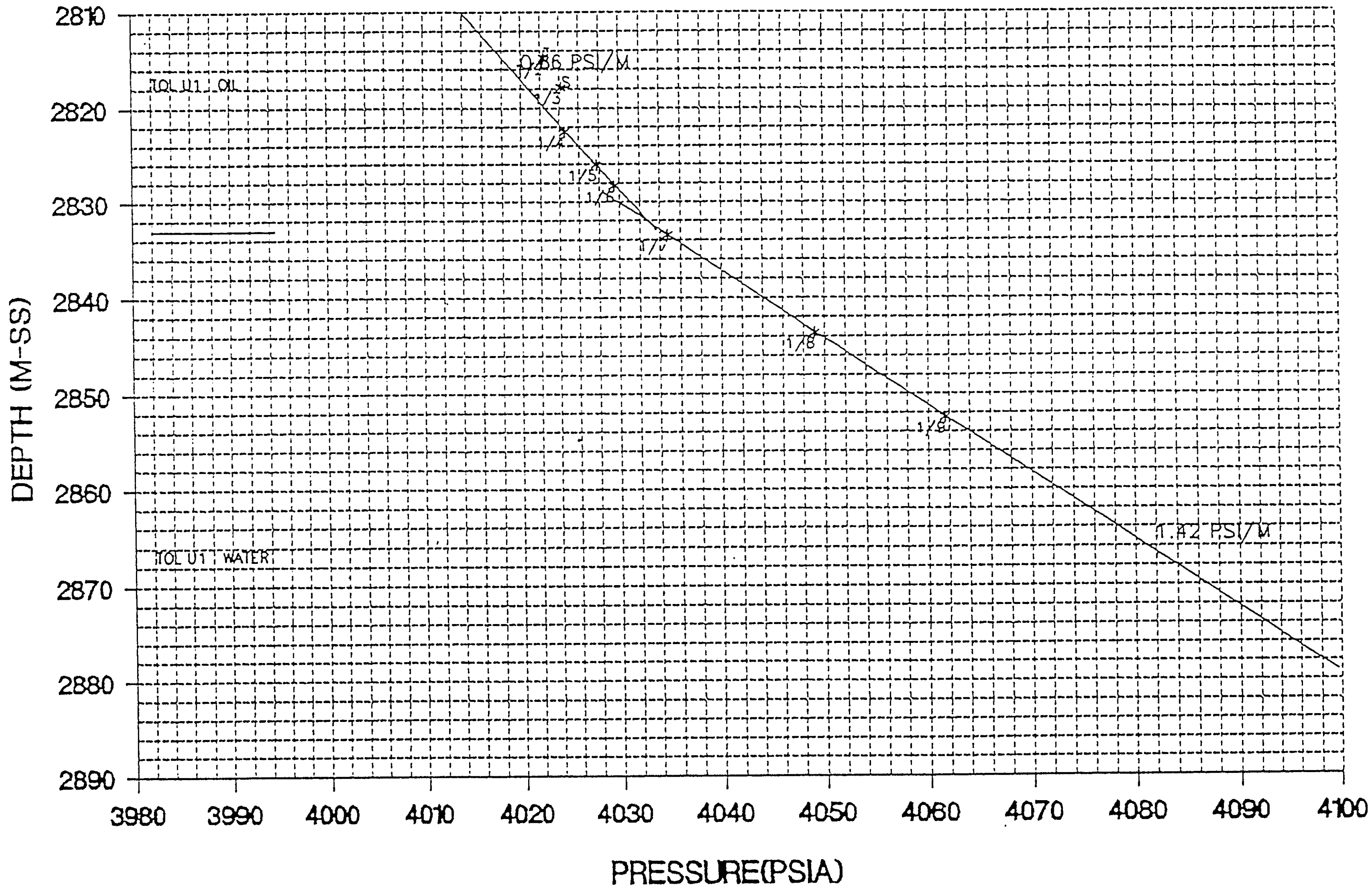


FIGURE 3

BLACKBACK-1 ST2 OPEN-HOLE RFT PRESSURE DATA

JUNE 16TH 1989

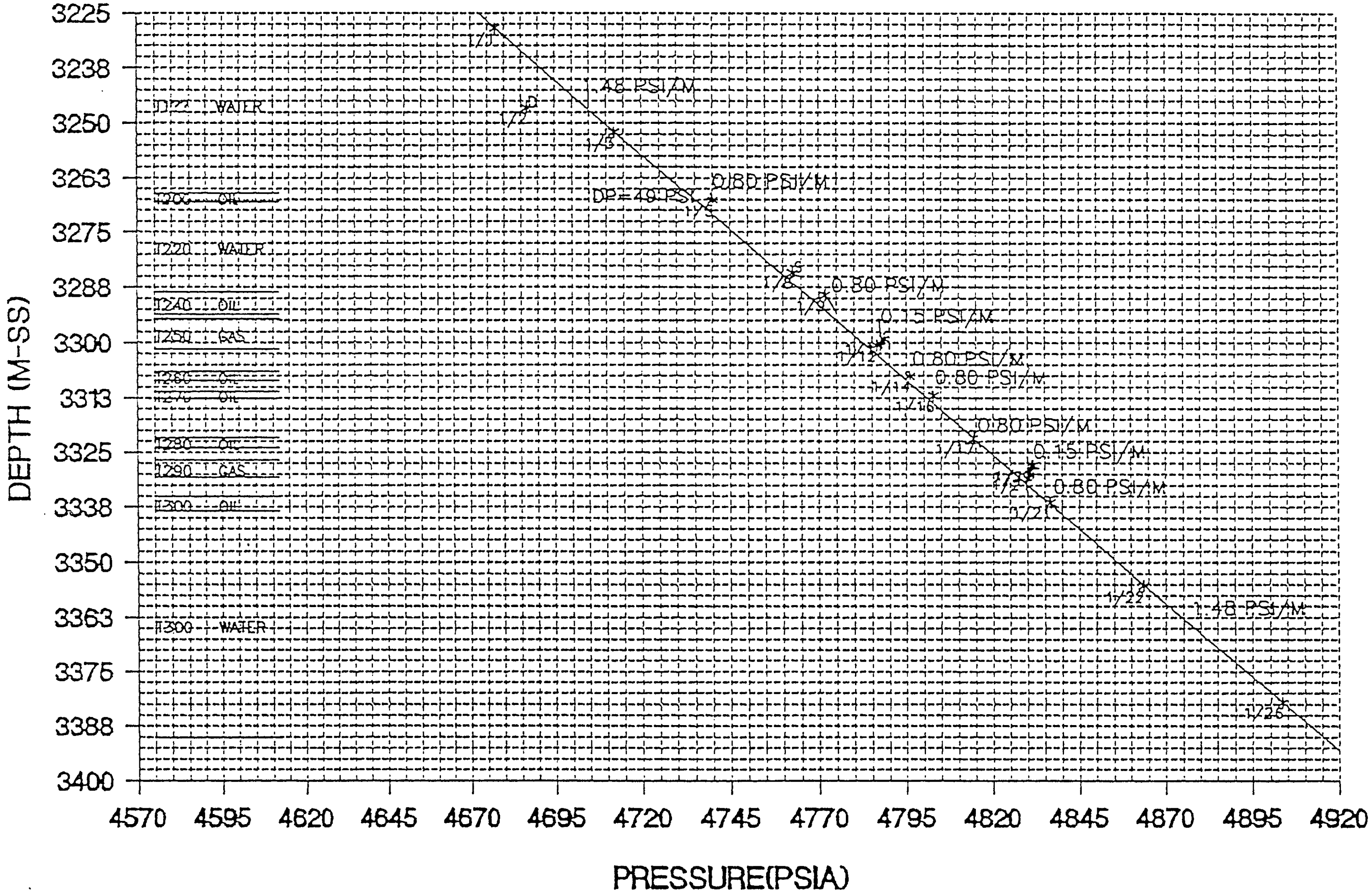


FIGURE 4

BLACKBACK-1 ST2 OPEN-HOLE RFT PRESSURE DATA

JUNE 16TH 1989

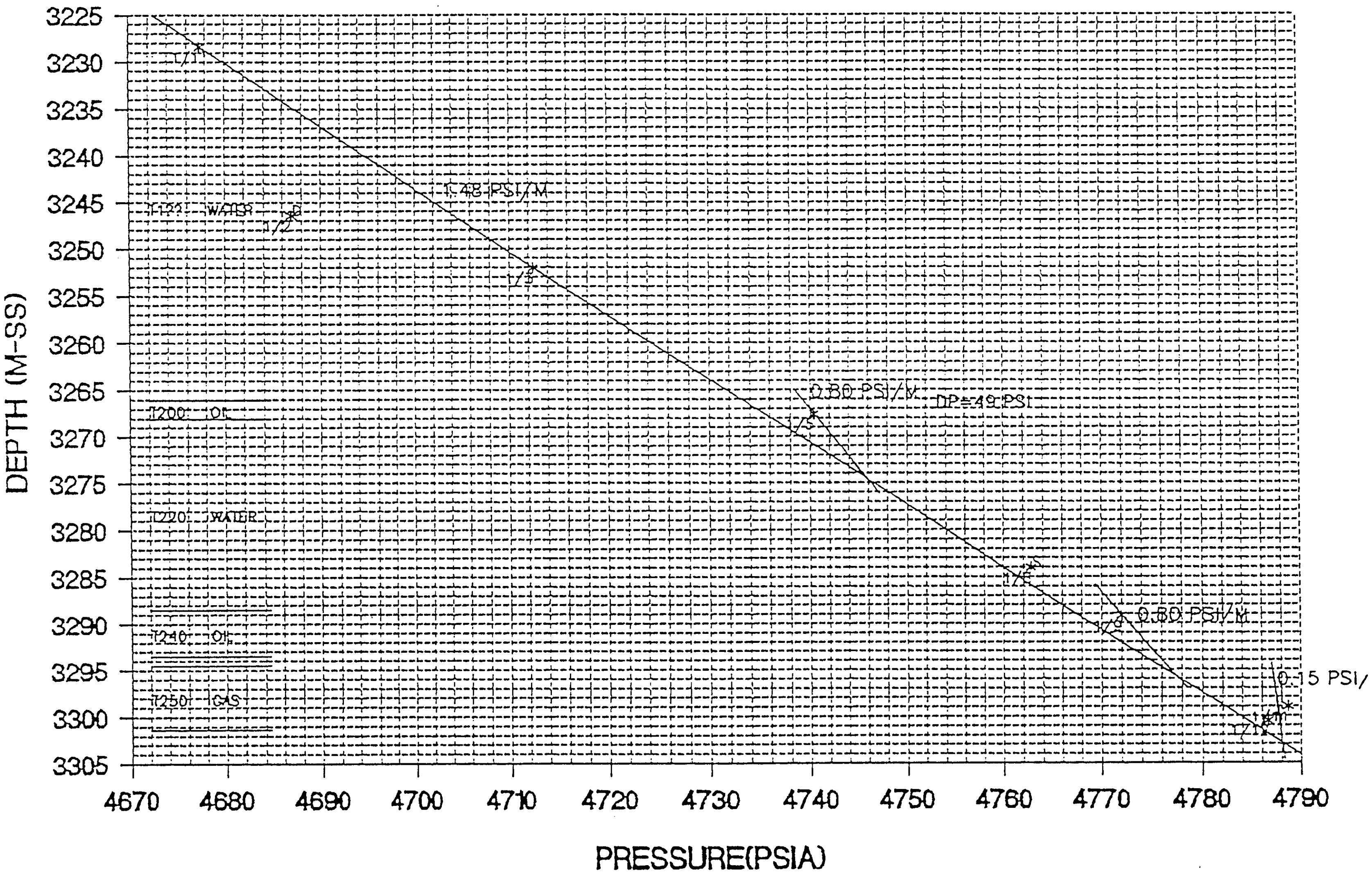


FIGURE 5

BLACKBACK-1 ST2 OPEN-HOLE RFT PRESSURE DATA

JUNE 16TH 1989

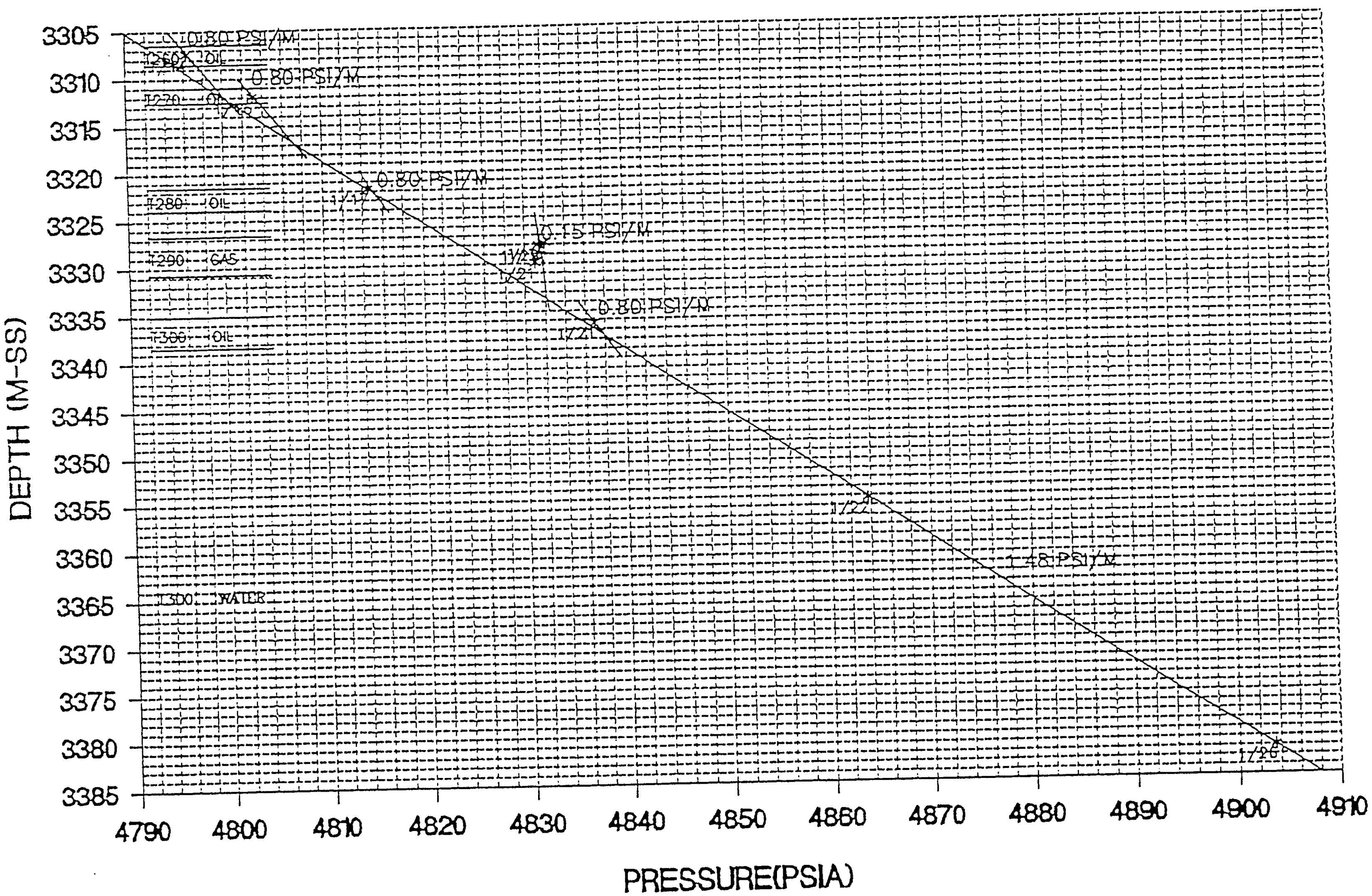


FIGURE 6

BLACKBACK-1 ST2 OPEN-HOLE RFT PRESSURE DATA

JUNE 30TH 1989

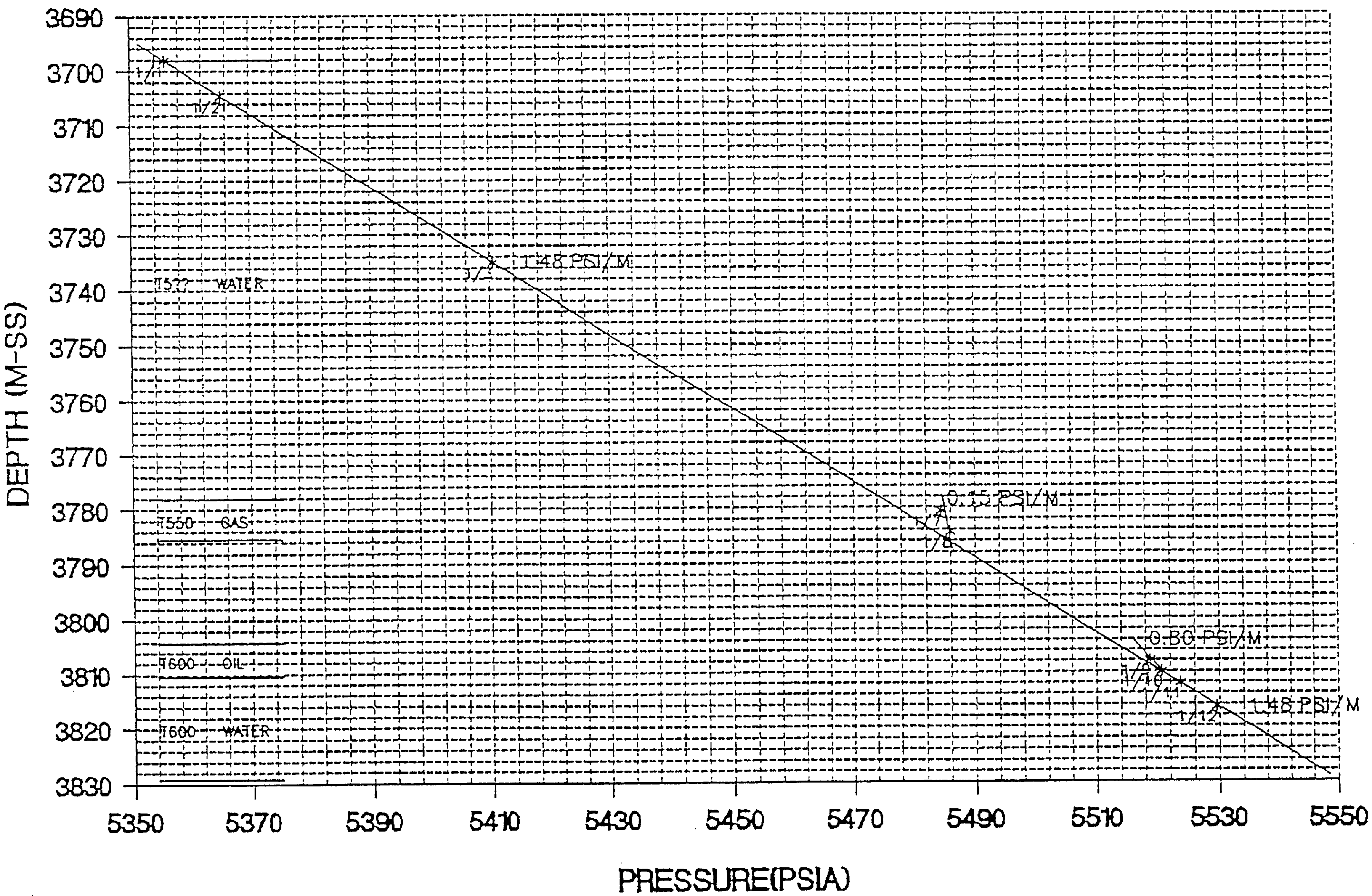


TABLE 1

BLACKBACK-1 RFT INTERPRETATION SUMMARY

UNIT	DEPTH INTERVAL (m MDKB)	DEPTH INTERVAL (m TVDSS)	FLUID TYPE	RFT CONTACT (m TVDSS)	SAMPLE	GAS (cu.ft)	OIL (litres)	WATER (litres)	GOR (SCF/STB)	GLR (STB/kSCF)
Top Latrobe	2887.5-2928.0	2802.6-2833.0	Oil	-2832	No					
T200	3487.0-3490.0	3266.0-3268.4	Oil ?	-3275	No					
T240	3515.0-3521.0	3288.4-3293.4	Oil ?	-3296	No					
T250	3522.5-3531.0	3294.4-3301.3	Gas	-3303	Yes	16.0	0.05	20.1		0.020
T260	3537.5-3540.0	3306.4-3308.5	Oil ?	-3313	No					
T270	3543.0-3545.0	3310.9-3312.5	Oil ?	-3317	No					
T280	3556.0-3559.0	3221.4-3323.8	Oil ?	-3325?	No					
T290	3562.5-3567.5	3326.6-3330.6	Gas	-3334	Yes	87.3	1.2	8.5 *		0.086
T300	3573.0-3577.0	3335.0-3338.3	Oil	-3338	Yes	84.9	14.0	trace *	964	
T350	3634.5-3638.0	3384.7-3387.6	Oil ?	-3387	No					
T450	3803.5-3814.0	3522.0-3530.5	Oil	-3524	Yes	104.6	8.0	0.5 *	2079	
T550	4117.0-4125.5	3778.0-3785.2	Gas	-3788	Yes	177.9	1.2	0.6 *		0.042
T600	4146.0-4155.5	3804.1-3810.3	Oil ?	-3810	No					

NOTES:

1. T280 fluid contact uncertain due to pretest falling below interpolated water line.

2. The T350, T450 and T600 fluid contacts shown are based on contacts observed on open hole logs.

3. RFT recoveries shown are all from the 6 gallon chamber.

4. Samples marked with star (*) had 1 gallon chamber preserved for PVT analysis.

TABLE 2
BLACKBACK-1 OPEN-HOLE RFT PRESSURE DATA
APRIL 30TH 1989

ZONE OR SAND=TOL U1

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/1	2903.5	TOL U1	OIL	2809.4	4015.4	SUPERCHARGED	.	0.855	0.855
1/2	2910.3	TOL U1	OIL	2814.8	4022.5	SUPERCHARGED	1.311	0.855	0.855
1/3	2914.0	TOL U1	OIL	2817.8	4024.3	SUPERCHARGED	0.597	0.855	0.855
1/4	2920.0	TOL U1	OIL	2822.5	4024.6	GOOD	0.072	0.855	0.855
1/5	2924.4	TOL U1	OIL	2826.0	4027.8	GOOD	0.914	0.855	0.855
1/6	2927.3	TOL U1	OIL	2828.3	4029.6	GOOD	0.752	0.855	0.855
1/7	2934.0	TOL U1	WATER	2833.5	4034.8	GOOD	1.012	1.429	1.423
1/8	2947.0	TOL U1	WATER	2843.6	4049.2	GOOD	1.423	1.429	1.423
1/9	2958.6	TOL U1	WATER	2852.5	4061.7	GOOD	1.406	1.429	1.423
1/13	3010.0	TOL U1		2892.1	.	SEAL FAILURE	.	.	.
1/17	3010.4	TOL U1	WATER	2892.4	4118.9	GOOD	1.435	1.429	1.423
1/10	3010.5	TOL U1		2892.4	.	SEAL FAILURE	.	.	.
1/11	3011.0	TOL U1		2892.8	.	SEAL FAILURE	.	.	.
1/12	3011.5	TOL U1		2893.2	.	SEAL FAILURE	.	.	.

ZONE OR SAND=TOL U2

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/16	3050.3	TOL U2	WATER	2922.9	4164.5	GOOD	1.495	.	1.423
1/15	3065.4	TOL U2		2934.4	.	ABORTED	.	.	.
1/18	3065.4	TOL U2		2934.4	.	SEAL FAILURE	.	.	.

ZONE OR SAND=TOL U3

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/14	3200.4	TOL U3	WATER	3036.5	4384.5	GOOD	1.936	.	1.423

TABLE 3
BLACKBACK-1 ST2 OPEN-HOLE RFT PRESSURE DATA
JUNE 16TH 1989

ZONE OR SAND=T1??

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/1	3440.0	T1??	WATER	3228.4	4677.5	GOOD	.	1.487	1.480
1/2	3450.0	T1??	WATER	3246.4	4687.0	DRAWNDOWN	0.528	1.487	1.480
1/3	3469.5	T1??	WATER	3252.0	4712.6	GOOD	4.571	1.487	1.480

ZONE OR SAND=T200

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/4	3488.5	T200		3267.2	.	TIGHT	.	.	.
1/5	3489.0	T200	OIL	3267.6	4740.5	GOOD	1.788	.	0.800

ZONE OR SAND=T220

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/6	3499.5	T220		3276.0	.	TIGHT	.	.	.
1/7	3499.7	T220		3276.2	.	TIGHT	.	.	.
1/8	3509.5	T220	WATER	3284.0	4762.9	SUPERCHARGED	1.366	.	.

ZONE OR SAND=T240

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/9	3516.0	T240	OIL	3289.2	4772.1	GOOD	1.769	.	0.800

ZONE OR SAND=T250

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/10	3527.0	T250		3298.1	.	SEAL FAILURE	.	.	.
1/11	3528.2	T250	GAS	3299.0	4786.8	GOOD	1.704	-1.4	0.150
1/12	3530.5	T250	GAS	3300.5	4786.7	GOOD	-1.4	-1.4	0.150

TABLE 3 (CONT'D)
BLACKBACK-1 ST2 OPEN-HOLE RFT PRESSURE DATA
JUNE 16TH 1989

ZONE OR SAND=T260

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/13	3538.5	T260		3307.3	.	SEAL FAILURE	.	.	.
1/14	3538.7	T260	OIL	3307.4	4796.4	GOOD	1.406	.	0.800

ZONE OR SAND=T270

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/15	3544.0	T270		3311.7	.	TIGHT	.	.	.
1/16	3544.3	T270	OIL	3311.9	4803.1	GOOD	1.489	.	0.800

ZONE OR SAND=T280

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/17	3556.5	T280	OIL	3321.7	4814.7	GOOD	1.184	.	0.800

ZONE OR SAND=T290

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/18	3564.0	T290	GAS	3327.8	4832.2	GOOD	2.869	-.398	0.150
1/29	3564.2	T290	GAS	3328.0	4831.5	GOOD	-3.5	-.398	0.150
1/21	3566.6	T290	GAS	3329.9	4831.1	GOOD	-.211	-.398	0.150
1/19	3567.0	T290		3330.2	.	SEAL FAILURE	.	.	.

ZONE OR SAND=T300

RUN \SEAT	DEPTH MEASURED (M MDRT)	ZONE OR SAND	ASSUMED FORMATION FLUID	DEPTH TVD (M SS)	FORMATION PRESSURE (PSIA)	SEAT VALIDITY	CALC. PT. TO PT. GRADIENT	LEAST SQRS FIT GRAD. FOR ZONE	ASSUMED HYDRAULIC GRADIENT
1/21	3574.5	T300	OIL	3336.3	4837.0	GOOD	0.922	.	0.800
1/22	3598.0	T300	WATER	3355.2	4863.8	GOOD	1.418	1.491	1.480
1/25	3614.5	T300		3368.6	.	SEAL FAILURE	.	.	.
1/23	3614.7	T300		3368.7	.	SEAL FAILURE	.	.	.
1/24	3614.8	T300		3368.8	.	SEAL FAILURE	.	.	.
1/27	3614.9	T300		3368.9	.	SEAL FAILURE	.	.	.
1/26	3631.0	T300	WATER	3381.9	4903.6	GOOD	.	1.491	1.480

APPENDIX 6

APPENDIX 6

BLACKBACK - 1 (ST 2)

PRODUCTION TEST REPORT

A. B. THOMSON

P. K. REICHARDT

MARCH 1990.

ABT01901.

BLACKBACK - 1 (ST 2)

PRODUCTION TEST REPORT

1. Summary of results

2. Production Test 1, 2899.5-2908.0 m MDKB
   - Background and objectives
   - Test description and results
   - Analysis and Conclusions

3. Production Test 1A, 2891.0-2897.0, 2899.5-2908.0 & 2908.8-2916.8 m MDKB
   - Background and objectives
   - Test description and results
   - Analysis and Conclusions

4. Tables

5. Figures

SUMMARY OF RESULTS

Two production tests were made in the Blackback-1 exploration well over the period from July 5 to July 16, 1989. The objectives of the test program were to determine the hydrocarbon content, productivity, reservoir properties and fluid properties of the moderate quality Top of Latrobe hydrocarbon accumulation.

Production Test 1, over the interval 2899.5 to 2908.0 metres MDKB flowed high gravity waxy oil at a final rate of 827 STB/D and 1.3 MSCF/D with no water. Production Test 1A, over the intervals 2891.0 to 2897.0, 2899.5 to 2908.0 and 2908.8 to 2916.8 metres MDKB flowed oil at a final rate of 1508 STB/D, 1.9 MSCF/D and no water.

The results of the tests are summarised on Tables 1 and 2 and showed that;

1. Rates in excess of 1500 STB/D were achievable.

2. The average permeability is between 33 and 50 md.

3. The productivity index is between 0.6 and 1.1 STB/D/psi.

4. The 1400 to 1500 psi of drawdown is approximately 500 psi below the bubble point.

5. Very high skin factors between 50 and 80 were observed, which are partially due to relative permeability effects from producing below the bubble point and to partial penetration.

6. The oil zone showed differing GOR's between tests 1 and 1A. The variation is probably due to gas depletion in the near well bore area, caused by production below the bubble point during test 1.

7. The initial reservoir pressure at the datum (-2816 m TVDSS, the mid point of the combined perf interval) was 4014.6 psia. The initial pressure is based on RFT pretest pressures.

8. The tests were successful despite the mechanical failures associated with the downhole shut in equipment.

.../2

PRODUCTION TEST 1, 2899.5 - 2908.0 m MDKB

Background and Objectives

The Blackback-1 (ST 2) well penetrated a Top of Latrobe hydrocarbon section from 2887 to 2928 metres MDKB (2801 to 2833 metres TVDSS). Open hole RFT's did not recover any formation fluids, although the pretests showed the hydrocarbon column to have a gradient of 0.855 psi/metre indicating oil. The reservoir quality over the pay interval was moderate to poor with porosity averaging 15 to 20 % and core permeability ranging from 1 to 100 md. The production test was designed to verify the hydrocarbon content of the zone, establish the zone's productivity and to determine reservoir and fluid characteristics.

Test Description and Results (Figure 1)

After displacing the the tubing with 69 barrels of diesel, the well was perforated at 20 shots per metre using a 2 1/8th inch Enerjet gun over the interval 2891.0 to 2899.5 metres MDKB with the well open to the gauge tank. The well was flowed to the gauge tank for 10 minutes, with no flow observed, and then shut in and wellhead pressures observed. No increase in well head pressure was observed. The perforating gun was then POOH but became stuck in the MUST (Multiple Shut in Tool) valve assembly. After attempting to free the gun the Schlumberger wireline was pulled out at the rope socket. Otis wireline was rigged up and the perforating gun pushed to TD. Schlumberger was rigged up and the well was perforated at 20 shots per metre using a 2 1/8th inch Enerjet gun over the interval 2899.5 to 2908.0 metres MDKB with the well open to the gauge tank.

The well was flowed for 10 minutes at a rate of 299 STB/D with a flowing well head pressure of 13 psi. The well was shut-in for 70 minutes while the perforating gun was POOH. The well head pressure rose to 580 psi. The well was opened for the initial flow period at 0440 hours 6 July, 1989 on a 16/64th variable choke. The well flowed diesel for 1 hour with a final rate of 264 STB/D. The well was shut-in at the choke manifold for a two hour initial build up. The well head pressure reached 720 psi during initial build up and the downhole Haliburton GRC gauge (the gauge depth was 2869.5 metres) recorded a initial shut-in BHP of 4015.6 psia at datum.

The Schlumberger MUST tool actuator and HP pressure gauge were RIH to 2860 metres. The HP gauge run depth was 2853.6 metres. The initial BHP recorded was 4002.5 psia at datum, which is approximately 13 psi lower than the initial BHP measured by the RFT. The lower initial pressure is probably due to brine/mud from below the packer being displaced into the tubing during the initial flow. The well was opened for the major flow period at 0940, using 16/64th adjustable choke. The choke was opened up to 24/64th at 1045 and then 32/64th at 1115. Formation fluids surfaced at 1135. The choke was taken back to 24/64th at 1215.

.../3

The well was diverted to the separator at 1445 and the choke changed to 24/64th positive. Two separator oil and gas samples were taken at 2030. After eleven unsuccessful attempts were made to shut the well in down hole with the MUST tool, the well was finally shut in at the choke manifold at 2303. The well produced a total of 440 STB with the final flow rate prior to shut-in being 827 STB/D of 51 degrees API oil and 1.435 MSCF/D of gas. The final flowing BHP was 2574.5 psia at datum and the final producing GOR was 1626 SCF/STB.

The well was shut-in to observe build up for 17.5 hours. The final BHP at 1650 hours 7 July, 1989 was 4015.0 psia at datum.

Due to the inability of the MUST tool actuator to release, the test string had to be pulled at the conclusion of test 1.

Analysis and Conclusions (Figures 2 and 3)

The downhole Haliburton pressure gauges, which were recovered at the end of test 1, confirmed that the first perforating run over the interval 2891.0 to 2899.5 metres MDKB did not fire and that only the 8.5 metres from 2899.5 to 2908.0 metres MDKB was actually perforated in test 1.

The failure of the MUST downhole shut-in tool resulted in severe afterflow. Afterflow calculation showed that the start of the MTR (taken at 1% afterflow) did not start until at least 50 minutes after SI. Despite the strong afterflow, the build up data shows a good MTR allowing a Horner analysis to be performed. The extrapolated reservoir pressure P* was 4019.5 psia at datum. Based on a MTR slope of 19.2 psi/cycle the average permeability was 33 md, the skin factor was 79 and the productivity index was 0.6 STB/D/psi.

The final shut in pressure of 4015.0 psia compares very favourably with the initial reservoir pressure of 4014.6 psia measured by RFT. The closeness of the two pressure measurements indicates that no reservoir depletion occurred during the test.

The very high skin factor is made up of a true formation damage skin, a partial penetration skin and a skin due to turbulent flow and the relative permeability effects of two phase flow in the reservoir caused by producing below the bubble point. The calculated partial penetration skin is 15, and the calculated skin due to formation damage was 17.

The average permeability to oil of 33 md is based on a thickness of 31 metres TVT, which is the thickness from the Top of Latrobe down to the OWC. This permeability is consistent with the core analysis from Blackback-1, which over the perforated interval had an average air permeability of 23 md.

The PI of 0.6 STB/D/psi indicates poor productivity and also reflects the high skin factor.

.../4

PRODUCTION TEST 1A, 2891.0 - 2897.0, 2899.5 - 2908.0 & 2908.8 - 2916.8 m MDKB

Background and Objectives

The final flow rate of production test 1 was 827 STB/D and came from the poorer upper part of the reservoir. The lower part of the reservoir has higher permeability and to determine the total flow capacity an extra add on zone from 2908.8 to 2916.8 metres MDKB was selected.

Because perforation of the interval 2891.0 to 2899.5 metres MDKB was unsuccessful in test 1, test 1A in fact consisted of two add on perf intervals. The objective of test 1A was to determine the productivity of the larger perforated interval and to test whether there were any vertical variations in the GOR, indicating a possible gas cap.

Test Description and Results (Figures 4,5 and 6)

After test 1 the test string was POOH, the MUST tool actuator and HP gauge recovered, the MUST tool repaired and the the test string was RIH. The string was displaced with 69 barrels of diesel and the well perforated over the interval 2908.8 to 2916.8 metres MDKB with the wellhead choke cracked to bleed the WHP to 130 psig. The well was SI and the perforating gun pulled up above the MUST assembly and the well flowed to the gauge tank for 5 minutes. The well flowed diesel at a rate of 685 STB/D with a flowing well head pressure of 16 psi. The well was SI and the perforating gun was POOH. A second perforating gun was RIH to perforate the interval 2891.0 to 2899.5 metres MDKB, however, the gun became stuck in the MUST assembly whilst RIH. The well was flowed at variable chokes between 8/64th and fully open in attempts to free the gun. These attempts were unsuccessful and at 0710 on 10 July, 1989 Schlumberger pulled out of the rope socket. The weather worsened and while reverse circulating to kill the well, the unfired perforating gun came free and became trapped in the surface test tree.

The Southern Cross pulled off location at 2130 on the 10th of July and waited on weather. The rig returned to location on 12th July. The perforating gun was recovered. After relatching the test string was displaced with diesel and at 1105 on 14th July the well was perforated over the interval 2891.0 to 2897.0 metres MDKB, with the well head choke cracked to bleed WHP to 18 psig. The well was SI, the gun was pulled above the MUST assembly and the well flowed for 5 minutes at rate of 149 STB/D and a flowing WHP of 50 psi. The well was SI and the gun POOH. The well was opened for a one hour initial flow period. The well flowed at 299 STB/D with a final flowing WHP of 33 psi. The well was SI and the the Schlumberger MUST actuator and HP gauge were RIH.

.../5

At 1748 on 14 July, 1989 the well was opened for the major flow period. The flow was diverted to the separator at 2330 with the well on a 32/64th adjustable choke. At 0123 on 15 July the choke was changed to 42/64th positive. On the 42/64th choke the flow rate increased from 1349 STB/D to 1508 STB/D. The final flowing well head pressure was 918 psi and the final flowing bottom hole pressure was 2636.5 psia. The final oil rate of 1508 STB/D and 1.9 MSCF/D of gas gave a GOR of 1260 SCF/STB.

At 0719 on 15 July, 1989 the well was shut in for 18.5 hours to observe build up. As with the first test the MUST tool failed to operate and the well had to be shut-in at the choke manifold. The final pressure at 0200 16 July, 1989 was 4011.0 psia at datum.

Analysis and Conclusions (Figures 7 and 8)

The failure of the MUST tool prevented downhole shut-in, resulting in severe afterflow. Afterflow calculations show that 1% afterflow was reached at least 50 minutes after shut-in. The relatively low permeabilities seen in Blackback-1 mean that despite the high afterflow, a valid MTR was developed. The MTR has a concave downwards shape, indicating either an improvement in permeability or thickness as the radius of investigation increases or the presence of a gas cap. For the purposes of the Horner analysis an average slope over the entire MTR was selected so that average reservoir properties were calculated.

The final shut in pressure of 4011.0 psia at datum is 3.6 psia lower than the initial reservoir pressure. This difference is not considered significant and is not taken to indicate that any pressure depletion of the reservoir has occurred.

Based on the MTR slope of 27.9 psi/cycle the average permeability was 41 md, the skin factor was 49 and the PI was 1.1 STB/D/psi.

The high skin factor in test 1A, is high for the same reasons outlined in the analysis of test 1. The total skin has been substantially reduced and this is due to reducing the partial penetration skin. The larger perforated interval probably also reduced near well bore turbulence.

The average permeability of 41 md compares favourably with the 33 md measured in test 1. The higher permeability indicated by a decrease in slope after a dimensionless Horner time of 3 has been calculated to be 51 md. This change in slope is interpreted to be due to an increase in the kh product away from the wellbore.

The PI of 1.1 STB/D/psi is considerably better than the PI measured in test 1, but it is still represents low productivity. The various skins in the well, have lowered the near wellbore productivity considerably.

.../6

Test 1A, had a final producing GOR of 1260 SCF/STB, whereas test 1 had a final producing GOR of 1600 SCF/STB. The lower GOR in test 1A is most probably due to gas depletion in the near wellbore region from test 1. Fluid analysis of the separator samples taken during test 1 showed a bubble point of 2910 psia. The flowing bottom hole pressure during test 1 was 2534 psia, so the reservoir was being produced at nearly 400 psia below the bubble point. This has the effect of generating free gas in the near wellbore area and increasing the producing GOR. This probably resulted in a slight depletion in gas in the near well bore area which showed as a lower producing GOR during test 1A.

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TABLE 1

SUMMARY OF BLACKBACK-1 PRODUCTION TEST 1

Date	July 3-7, 1989
Perforation interval	2899.5 - 2908.0 m MDKB
Reservoir datum	2904 m MDKB (-2816 m TVDSS)
Produced Fluid	Oil
Major Flow period	11.4 hours
Cummulative oil production	450 STB
Final oil rate	827 STB/D
Final gas rate	1.34 MSCF/D
Choke size	24/64 inch
Oil gravity	51 degrees API
Gas gravity	0.8
Gas/oil ratio	1626 SCF/STB
Pour point	18 degrees C
CO_2	2 %
H_2S	0 ppm
Final flowing WHP	900 psig
Initial reservoir pressure	4014.6 psia at datum (from RFT)
Final flowing BHP	2574.5 psia at datum
Maximum BHT	80 degrees C
Productivity Index	0.57 STB/D/psi
Permeability thickness	3360 md - ft
Permeability	33 md
Diffusivity	10500 ft2/hour
Total skin factor	79
Partial penetration skin	15
Delta P skin	1310 psi
Damage ratio	11
Radius of investigation	211 metres
Samples taken	2 x 655 ml separator oil, 2 x 20.0 l separator gas

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TABLE 2

SUMMARY OF BLACKBACK-1 PRODUCTION TEST 1A

Date	July 9-16, 1989
Perforation intervals	2891.0 - 2897.0, 2899.5 - 2908.0 & 2908.8 - 2916.8 metres MDKB
Reservoir datum	2904 m MDKB (-2816 m TVDSS)
Produced Fluid	Oil
Major Flow period	11.4 hours
Cummulative oil production	800 STB
Final oil rate	1508 STB/D
Final gas rate	1.89 MSCF/D
Choke size	42/64 inch
Oil gravity	51 degrees API
Gas gravity	0.8
Gas/oil ratio	1260 SCF/STB
Pour point	18 degrees C
CO_2	2 %
H_2S	0 ppm
Final flowing WHP	900 psig
Initial reservoir pressure	4014.6 psia at datum (from RFT)
Final flowing BHP	2636.5 psia at datum
Maximum BHT	80 degrees C
Productivity Index	1.09 STB/D/psi
Permeability thickness	4220 md - ft
Permeability	41 md
Diffusivity	13200 ft2/hour
Total skin factor	49
Partial penetration skin	5
Delta P skin	1180 psi
Damage ratio	6.9
Radius of investigation	236 metres
Samples taken	2 x 655 ml separator oil, 2 x 20.0 l separator gas

BLACKBACK-1 PRODUCTION TEST 1 07/7/89
HORNER ANALYSIS

FLUID AND RESERVOIR PROPERTIES:
Viscosity = 0.240 CP
Fluid volume factor = 2.000 RB/STB
Compressibility = 2.30E-5 1/PSI

Net sand thickness = 102 FT
Perforated thickness = 28.0 FT
Porosity = 15 %
Bottom-hole temperature = 170 F

TEST DATA:
Flow rate = 825.0 STB/D
Horner time = 11.4 HRS
Drawdown = 1427.7 PSI
Initial pressure, Pi = 3977.00 PSIA
Final flowing pressure = 2549.33 PSIA

Gas-oil ratio = 1620 SCF/STB
Wellbore radius = 0.15 FT
Wellbore storage = 0.00159 BBL/PSI
End of afterflow = 44.2 MIN

TEST RESULTS:
MTR slope, m = 19.2 PSIA
Extrapolated pressure,P* = 3994.15 PSIA
Permeability-thickness = 3360 MD-FT
Permeability = 32.9 MD
Average permeability = 3.21 MD
Diffusiviy = 10500 FT2/HR
Delta P skin = 1310 PSIA
Effective wellbore radius = 1.1E-35 FT

Skin = 79
Flow efficiency = 0.093
Damage ratio = 11
Productivity index = 0.571 B/D/PSI
Partial penetration skin = 15
Damage skin = 17

ANALYSIS CHECKS:
Ri at beginning of MTR = 318 FT
Ri at Horner time = 691 FT
(Pi - P*)/m = -0.8940

BLACKBACK-1 PRODUCTION TEST 1A 15/7/89 TABLE 4

HORNER ANALYSIS

FLUID AND RESERVOIR PROPERTIES:

Viscosity = 0.240 CP
Fluid volume factor = 2.000 RB/STB
Compressibility = 2.30E-5 1/PSI
Net sand thickness = 102 FT
Perforated thickness = 54.4 FT
Porosity = 15 %
Bottom-hole temperature = 170 F

TEST DATA:

Flow rate = 1508 STB/D
Horner time = 11.3 HRS
Drawdown = 1365.7 PSI
Initial pressure, Pi = 3977.00 PSIA
Final flowing pressure = 2611.30 PSIA
Gas-oil ratio = 1260 SCF/STB
Wellbore radius = 0.15 FT
Wellbore storage = 0.00159 BBL/PSI
End of afterflow = 24.9 MIN

TEST RESULTS:

MTR slope, m = 27.9 PSIA
Extrapolated pressure,P* = 3991.17 PSIA
Permeability-thickness = 4220 MD-FT
Permeability = 41.4 MD
Average permeability = 6.23 MD
Diffusiviy = 13200 FT2/HR
Delta P skin = 1180 PSIA
Effective wellbore radius = 1.1E-22 FT
Skin = 49
Flow efficiency = 0.14
Damage ratio = 6.9
Productivity index = 1.09 B/D/PSI
Partial penetration skin = 5.0
Damage skin = 23

ANALYSIS CHECKS:

Ri at beginning of MTR = 316 FT
Ri at Horner time = 773 FT
(Pi - P*)/m = -0.5081

FIGURE 1

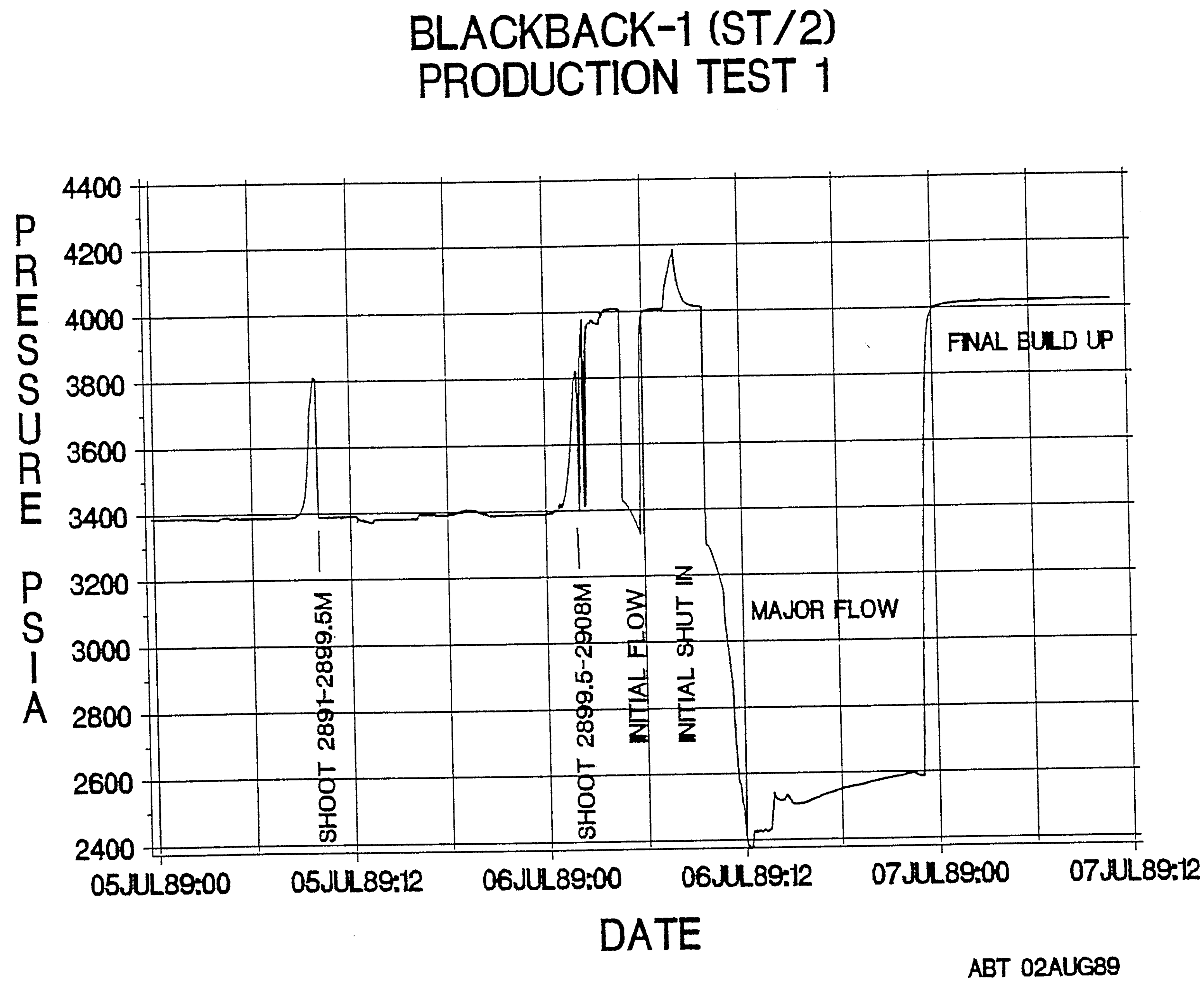

BLACKBACK-1 (ST/2)
PRODUCTION TEST 1
PRESSURE PSIA
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
SHOOT 2891-2899.5M
SHOOT 2899.5-2908M
INITIAL FLOW
INITIAL SHUT IN
MAJOR FLOW
FINAL BUILD UP
05JUL89:00
05JUL89:12
06JUL89:00
06JUL89:12
07JUL89:00
07JUL89:12
DATE
ABT 02AUG89

FIGURE 2

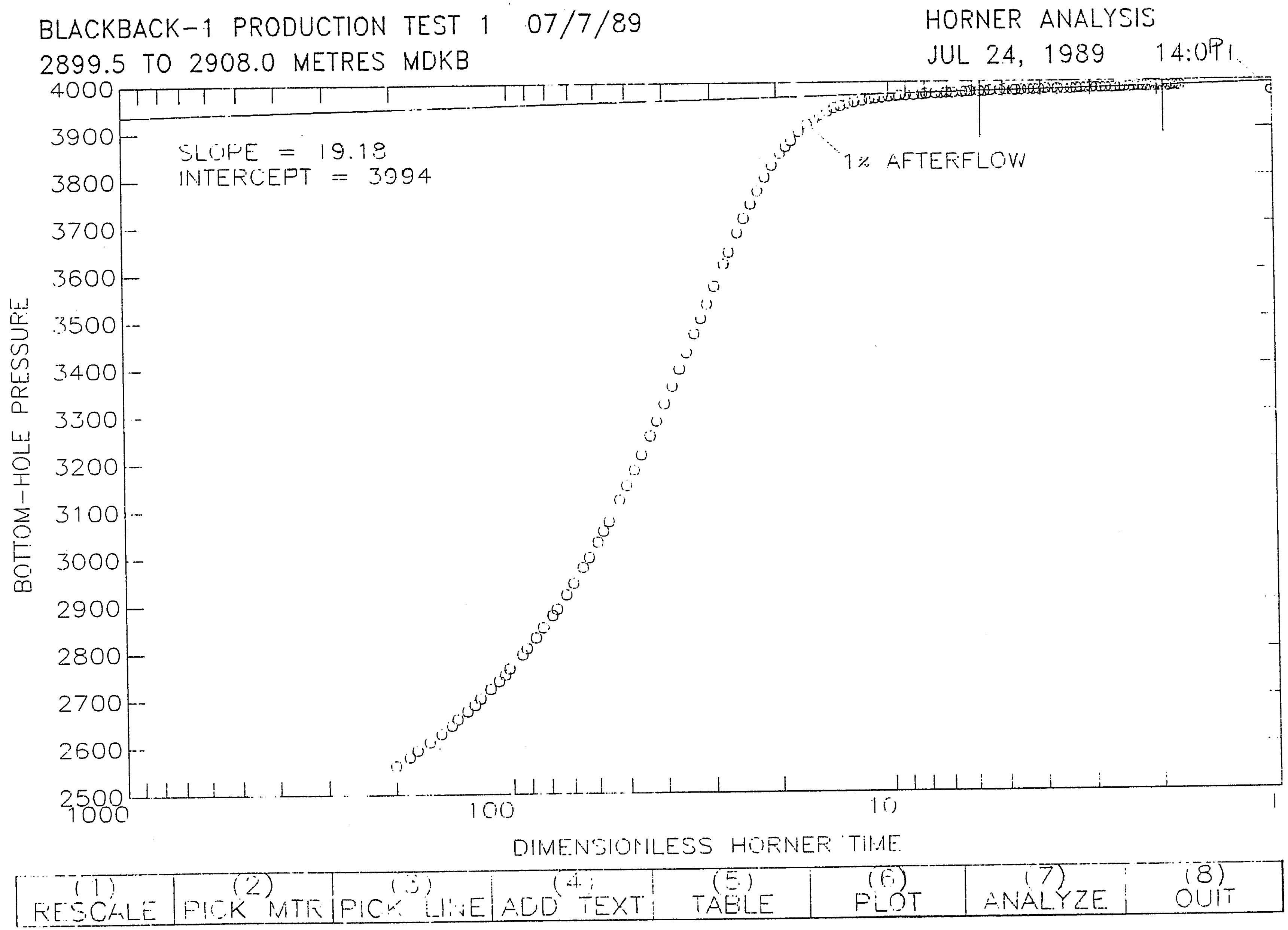
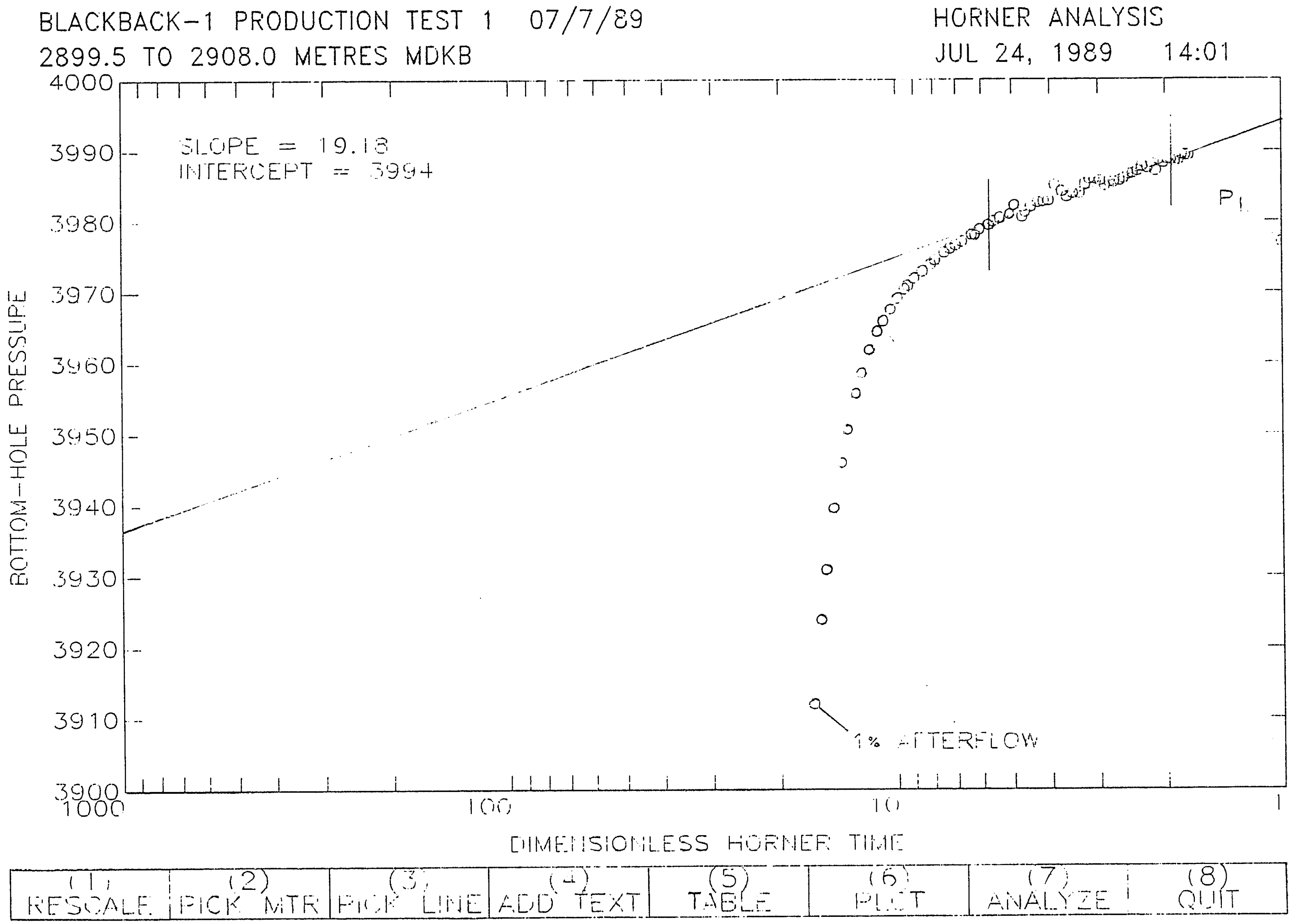

BLACKBACK-1 PRODUCTION TEST 1 07/7/89
2899.5 TO 2908.0 METRES MDKB
HORNER ANALYSIS
JUL 24, 1989 14:07
SLOPE = 19.18
INTERCEPT = 3994
1% AFTERFLOW
BOTTOM-HOLE PRESSURE
4000
3900
3800
3700
3600
3500
3400
3300
3200
3100
3000
2900
2800
2700
2600
2500
1000
100
10
1
DIMENSIONLESS HORNER TIME
(1) RESCALE
(2) PICK MTR
(3) PICK LINE
(4) ADD TEXT
(5) TABLE
(6) PLOT
(7) ANALYZE
(8) QUIT

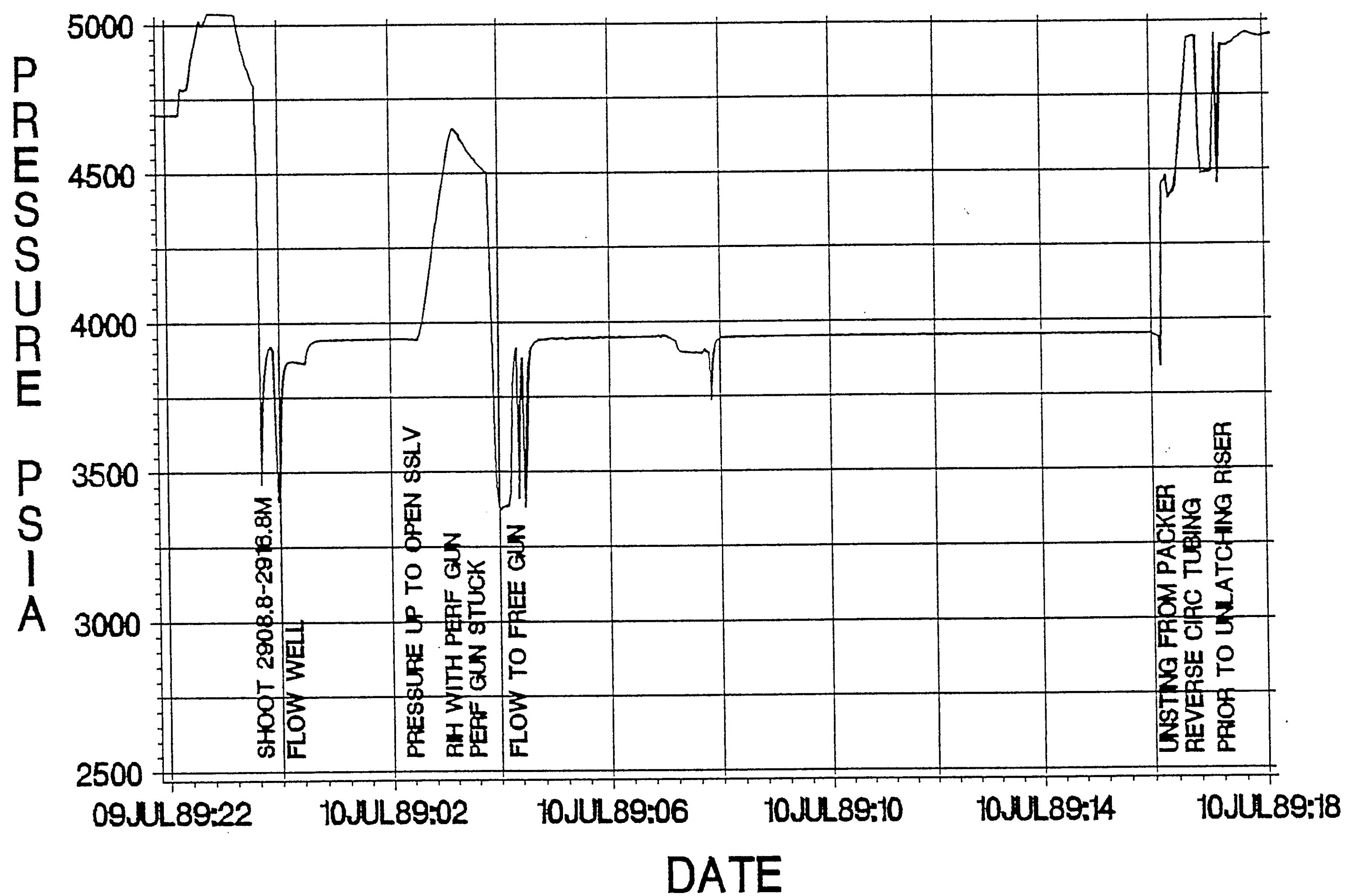
FIGURE 3



BLACKBACK-1 PRODUCTION TEST 1 07/7/89
2899.5 TO 2908.0 METRES MDKB
HORNER ANALYSIS
JUL 24, 1989 14:01
SLOPE = 19.18
INTERCEPT = 3994
BOTTOM-HOLE PRESSURE
4000
3990
3980
3970
3960
3950
3940
3930
3920
3910
3900
1000
100
10
1
DIMENSIONLESS HORNER TIME
1% AFTERFLOW
(1) RESCALE
(2) PICK MTR
(3) PICK LINE
(4) ADD TEXT
(5) TABLE
(6) PLOT
(7) ANALYZE
(8) QUIT

FIGURE 4

BLACKBACK-1 (ST/2)
PRODUCTION TEST 1A



ABT 02AUG89

FIGURE 5

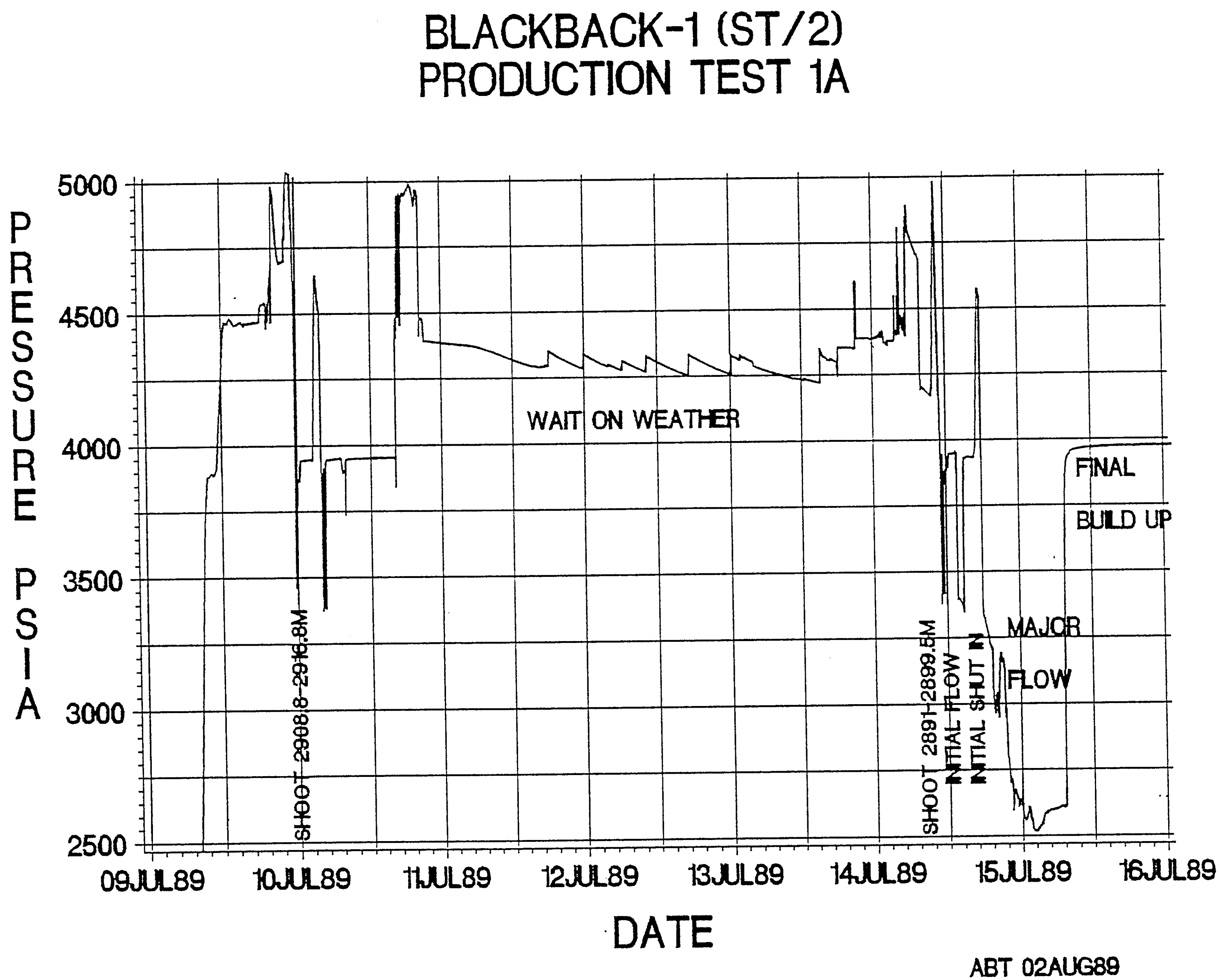

BLACKBACK-1 (ST/2)
PRODUCTION TEST 1A
PRESSURE PSIA
5000
4500
4000
3500
3000
2500
WAIT ON WEATHER
SHOOT 2908.8-2916.8M
SHOOT 2891-2899.5M
INITIAL FLOW
INITIAL SHUT IN
MAJOR FLOW
FINAL BUILD UP
09JUL89
10JUL89
11JUL89
12JUL89
13JUL89
14JUL89
15JUL89
16JUL89
DATE
ABT 02AUG89

FIGURE 6

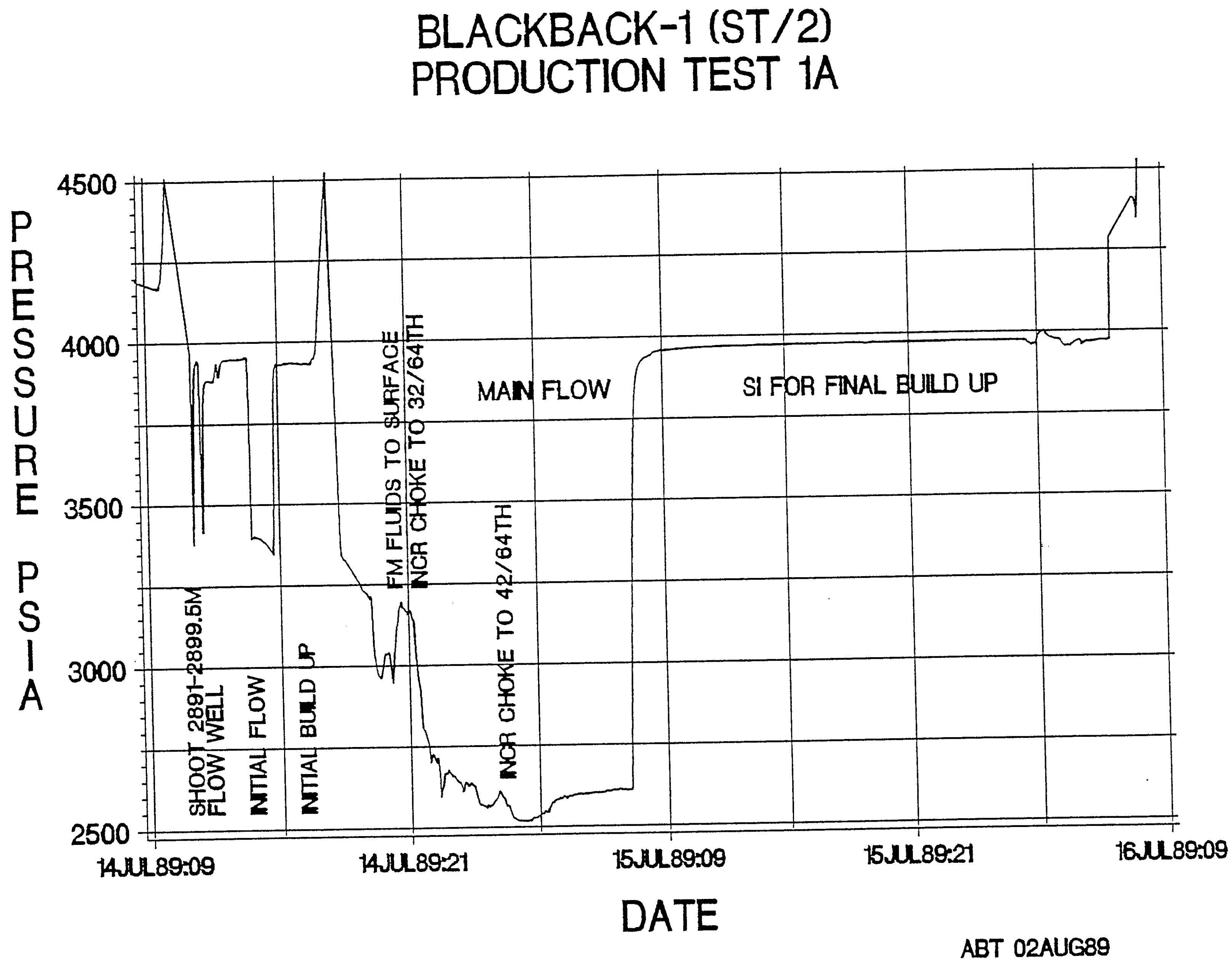
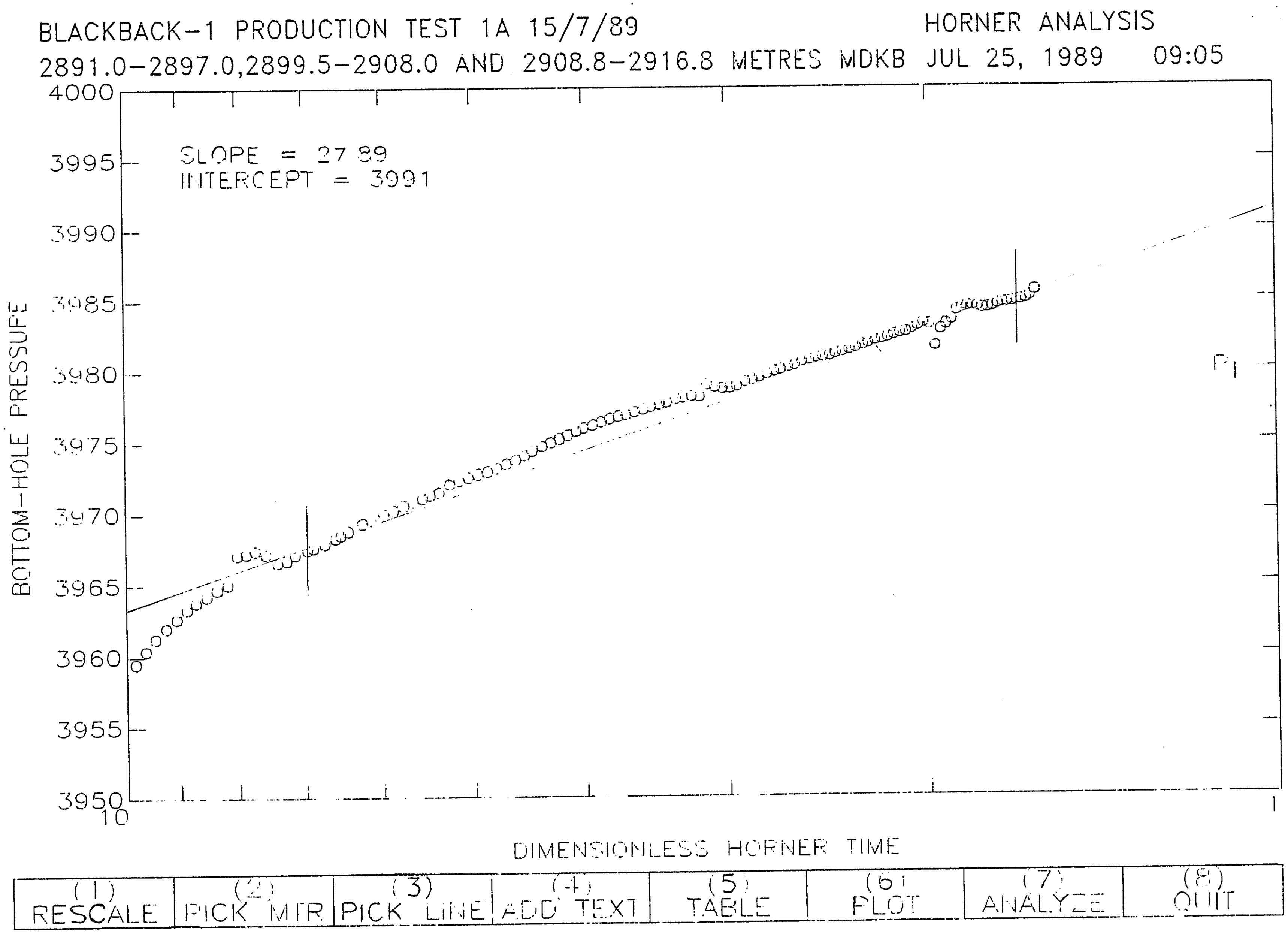

BLACKBACK-1 (ST/2)
PRODUCTION TEST 1A
PRESSURE PSIA
4500
4000
3500
3000
2500
SHOOT 2891-2899.5M
FLOW WELL
INITIAL FLOW
INITIAL BUILD UP
FM FLUIDS TO SURFACE
INCR CHOKE TO 32/64TH
INCR CHOKE TO 42/64TH
MAIN FLOW
SI FOR FINAL BUILD UP
14JUL89:09
14JUL89:21
15JUL89:09
15JUL89:21
16JUL89:09
DATE
ABT 02AUG89

FIGURE 7


BLACKBACK-1 PRODUCTION TEST 1A 15/7/89
HORNER ANALYSIS
2891.0-2897.0,2899.5-2908.0 AND 2908.8-2916.8 METRES MDKB
JUL 25, 1989 09:05
SLOPE = 27.89
INTERCEPT = 3991
BOTTOM-HOLE PRESSURE
4000
3995
3990
3985
3980
3975
3970
3965
3960
3955
3950
10
DIMENSIONLESS HORNER TIME
(1) RESCALE
(2) PICK MTR
(3) PICK LINE
(4) ADD TEXT
(5) TABLE
(6) PLOT
(7) ANALYZE
(8) QUIT

APPENDIX
7

APPENDIX 7

APPENDIX 7

CORE ANALYSIS

Listing of Reports received (distributed separately)

Blackback 1		Core Analysis Report	F5204/89	AMDEL
Blackback 1		Core Analysis Report	F5232/89	AMDEL
Blackback 1		Petrography Report	F7584	AMDEL
Blackback 1	ST1	Core Analysis Report	F5225/89	AMDEL
Blackback 1	ST1	Core Plug Analysis Report	000/008	AMDEL
Blackback 1	ST1	Core Plug Analysis Report	008/008A	AMDEL

ENCLOSURES

ENCLOSURES

PE902144

This is an enclosure indicator page.
The enclosure PE902144 is enclosed within the container PE902143 at this location in this document.

The enclosure PE902144 has the following characteristics:

ITEM_BARCODE = PE902144
CONTAINER_BARCODE = PE902143
NAME = Structural Cross Section
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = CROSS_SECTION
DESCRIPTION = Structural Cross Section
REMARKS =
DATE_CREATED = 31/05/1990
DATE_RECEIVED = 25/06/1990
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902145

This is an enclosure indicator page.
The enclosure PE902145 is enclosed within the container PE902143 at this location in this document.

The enclosure PE902145 has the following characteristics:

ITEM_BARCODE = PE902145
CONTAINER_BARCODE = PE902143
NAME = Structure map - Top Latrobe Group
BASIN = GIPPSLAND
PERMIT =
TYPE = SEISMIC
SUBTYPE = HRZN_CONTR_MAP
DESCRIPTION = Structure map - Top Latrobe Group
REMARKS =
DATE_CREATED = 30/04/1990
DATE_RECEIVED = 25/06/1990
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902146

This is an enclosure indicator page.
The enclosure PE902146 is enclosed within the container PE902143 at this location in this document.

The enclosure PE902146 has the following characteristics:

ITEM_BARCODE =	PE902146
CONTAINER_BARCODE =	PE902143
NAME =	Structure map - Lower T longus Seismic Marker
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	SEISMIC
SUBTYPE =	HRZN_CONTR_MAP
DESCRIPTION =	Structure map - Lower T longus Seismic Marker
REMARKS =	
DATE_CREATED =	30/04/1990
DATE_RECEIVED =	25/06/1990
W_NO =	W994
WELL_NAME =	Blackback-1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600998

This is an enclosure indicator page.
The enclosure PE600998 is enclosed within the container PE902143 at this location in this document.

The enclosure PE600998 has the following characteristics:

ITEM_BARCODE = PE600998
CONTAINER_BARCODE = PE902143
NAME = Formation evaluation log
BASIN = GIPPSLAND
PERMIT = Vic/P24
TYPE = WELL
SUBTYPE = well log
DESCRIPTION = Formation evaluation log
REMARKS =
DATE_CREATED = 22/05/1989
DATE_RECEIVED = 25/06/1990
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600999

This is an enclosure indicator page.
The enclosure PE600999 is enclosed within the container PE902143 at this location in this document.

The enclosure PE600999 has the following characteristics:

ITEM_BARCODE = PE600999
CONTAINER_BARCODE = PE902143
NAME = Formation evaluation log
BASIN = GIPPSLAND
PERMIT = Vic/P24
TYPE = WELL
SUBTYPE = well log
DESCRIPTION = Formation evaluation log
REMARKS =
DATE_CREATED = 05/05/1989
DATE_RECEIVED = 25/06/1990
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE601000

This is an enclosure indicator page.
The enclosure PE601000 is enclosed within the container PE902143 at this location in this document.

The enclosure PE601000 has the following characteristics:

ITEM_BARCODE = PE601000
CONTAINER_BARCODE = PE902143
NAME = Formation evaluation log
BASIN = GIPPSLAND
PERMIT = Vic/P24
TYPE = WELL
SUBTYPE = well log
DESCRIPTION = Formation evaluation log
REMARKS =
DATE_CREATED = 28/06/1989
DATE_RECEIVED = 25/06/1990
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600994

This is an enclosure indicator page.
The enclosure PE600994 is enclosed within the container PE902143 at this location in this document.

The enclosure PE600994 has the following characteristics:

ITEM_BARCODE = PE600994
CONTAINER_BARCODE = PE902143
NAME = Well Completion Log
BASIN = GIPPSLAND
PERMIT = Vic/P24
TYPE = WELL
SUBTYPE = well log
DESCRIPTION = Well Completion Log
REMARKS =
DATE_CREATED = 23/07/1989
DATE_RECEIVED = 25/06/1990
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600995

This is an enclosure indicator page.
The enclosure PE600995 is enclosed within the container PE902143 at this location in this document.

The enclosure PE600995 has the following characteristics:

ITEM_BARCODE = PE600995
CONTAINER_BARCODE = PE902143
NAME = Well Completion Log
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = COMPOSITE_LOG
DESCRIPTION = Well Completion Log
REMARKS =
DATE_CREATED = 23/07/1989
DATE_RECEIVED = 25/06/1990
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600996

This is an enclosure indicator page.
The enclosure PE600996 is enclosed within the container PE902143 at this location in this document.

The enclosure PE600996 has the following characteristics:

ITEM_BARCODE = PE600996
CONTAINER_BARCODE = PE902143
NAME = Well Completion Log
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = COMPOSITE_LOG
DESCRIPTION = Well Completion Log
REMARKS =
DATE_CREATED = 23/07/1989
DATE_RECEIVED = 25/06/1990
W_NO = W994
WELL_NAME = Blackback-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902147

This is an enclosure indicator page.
The enclosure PE902147 is enclosed within the container PE902143 at this location in this document.

The enclosure PE902147 has the following characteristics:

ITEM_BARCODE =	PE902147
CONTAINER_BARCODE =	PE902143
NAME =	Synthetic Seismogram
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	SYNTH_SEISMOGRAPH
DESCRIPTION =	Synthetic Seismogram
REMARKS =	
DATE_CREATED =	22/06/1990
DATE_RECEIVED =	25/06/1990
W_NO =	W994
WELL_NAME =	Blackback-1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)