MRC9409016-AJB

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POONBOON 1

LOG INTERPRETATION

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CONTENTS

SUMMARY

Poonboon 1 was spudded on 29 August 1972 and is now located in T/25P, 15km north of Pelican 3 and 40km south of the Yolla gas and condensate field. The well was plugged and abandoned. Poonboon 1 was drilled on the crest of a low relief anticlinal feature. The primary objective of Poonboon 1 was to test the hydrocarbon potential of the Eastern View Coal Measures.

Only low levels of background gas were reported with an exception at 3183.3-3185.2m where the well kicked. The zone is badly washed out (possibly indicating a fracture zone). Testing of the zone by FITs produced low salinity water and small volumes of gas (probably solution gas).

Poonboon 1 established the presence of good quality reservoirs, however the availability of additional seismic since Poonboon 1 was drilled suggests the well was drilled off structure.

A quicklook Terralog analysis was performed using the following logs:

Gamma Ray Log
Spontaneous Potential Log
Sonic Log
Resistivity Logs (SFL-IND-SN-MLL)
Density Log (FDC)
Neutron Log (SNP (only available from 2925m-TD))

Interpretation was performed from 2700m (just below the 9⅝ casing shoe) to TD (3270m) and displayed as an analog plot (see Enclosure 1).

The quicklook confirmed a hydrocarbon anomaly at 3180-3185m but was used primarily to establish log derived porosity and permeability and the potential reservoir character of the Eastern View Coal Measures.

MUD SYSTEM (2670-3267m)

Mud Type		Lignosulphate
Mud Density		12.2 ppg
Mud Resistivity	(Rm)	0.868 Ω/m @ 89°F
Mud Filtrate Resistivity	(Rmf)	0.482 Ω/m @ 72°F
Mud Cake Resistivity	(Rmc)	1.22 Ω/m @ 72°F
Bottom Hole Temperature	(BHT)	218°F

DST/RFT SUMMARY

Eight formation interval tests were performed at Poonboon 1

FIT	DEPTH (m)	RECOVERY	FSIP (Psi)	HP (Psi)	COMMENTS
1	2670.1	0.1 ft^3 gas 400.0 cm^3 water	3680	4480	
2	3180.3	1.4 ft^3 gas 2200.0 cm^3 water	5700	6200	
3	3103.2	1000.0 cm^3 water	-	6200	Lost pad seat
4	2964.8	2200.0 cm^3 water	4500	5800	
5	3191.3				Misrun
6	3048.0	2100.0 cm^3 water	5000	5000	
7	3178.2	1.1 ft^3 gas	5300	5300	
8	3255.3	2100.0 cm^3 water	5950	5950	

CORE SUMMARY

Five cores were cut at Poonboon 1

Core	Interval (m)	Recovery (%)
1	1952.9-1960.5	96
2	2467.6-2474.4	100
3	2682.8-2690.5	100
4	3034.0-3042.5	100
5	3258.6-3265.9	100

INTERPRETATION METHOD

Environmentally corrected log data were evaluated using a quicklook log analysis method.

Parameter		Derivation/Value
*Porosity	(ϕ)	A minimum porosity value (derived from Sonic, Neutron and Density logs and a ***Petra* derived porosity)
Shale Volume	(Vsh)	*Petra* derived shale volume
True Resistivity	(Rt)	ILD-SFL-Rxo Tornado chart
Shale Resistivity	(Rsh)	12 Ω/m
Water Saturation	(Sw)	***Indonesian Equation
Tortuosity	(a)	1.0
Saturation Exponent	(n)	2.0
Cementation Exponent	(m)	2.0

*Porosity: An important feature of this analysis is to determine the reservoir quality of the Eastern View Coal Measures. Minimal core data is available to correlate log with core porosity, therefore log derived porosities were calculated from:

1. Hunt-Raymer Sonic Equation (Shale Corrected)
2. Neutron-Density Crossplot Equation (Shale Corrected)
3. *Petra* derived porosity resolved by solving a set of linear equations

A minimum porosity was created from the existing defined porosities by taking the minimum porosity from all the selected porosity channels.

The porosity used in this analysis represents a pessimistic value.

** *Petra*: The *Petra* algorithms are simple matrix algebra procedures. Log responses are related to the sum of the proportions of the components each multiplied by the appropriate response coefficients in a series of simultaneous equations.

A simple *Petra* example for a Sandstone-Shale-Porosity system using only density and sonic logs is:

Number of components $m = 3$
Number of logs $n = 2$
The n log equation is:

$$2.65 \text{ Vsst} + 2.56 \text{ Vsh} + 1.00 \text{ phi} = \text{density log}$$
$$55.5 \text{ Vsst} + 81.0 \text{ Vsh} + 189.0 \text{ phi} = \text{sonic log}$$

where

Phi = vpor

Because of material balance the proportions of the components must sum to unity. Rewriting the above equation in matrix algebraic terms:

$$CV = L$$

C			V	= L
2.65	2.56	1.0	Vsst	Density log
55.5	81.0	189	Vsh	Sonic log
1.0	1.0	1.0	phi	1.0

This example is a uniquely determined system ie when the numbers of logs is less than the number of components by one, and is the most common matrix method used for the calculation of porosity and component proportions.

*** Sw: Water saturations are calculated using the Indonesian Equation.

$$Sw = \left(\frac{Vsh^{(0.5*(2-Vsh))}}{(Rsh/Rt)^{0.5}} + (Rt/Ro)^{0.5} \right)^{\left(\frac{-2}{n}\right)}$$

where

Ro	=	$\frac{a^* Rw}{\phi^m}$
a	=	Tortuosity (1.0)
ϕ	=	Input porosity (from minimum porosity value)
m	=	Cementation factor (2.0)
Rw	=	Formation water resistivity (temperature corrected)
Vsh	=	Shale volume (from Petra)
Rsh	=	Shale resistivity (from log data)
Rt	=	ILD-SFL-Rxo Tornado chart
n	=	Saturation exponent (2.0)

FORMATION WATER RESISTIVITY

It was assumed that at Poonboon 1 all sands were water saturated though it appears that the Formation Water Resistivity (Rw) varies within the Eastern View Coal Measures. An average Rw value has been used in the Poonboon 1 analysis to establish an Sw that honours the known engineering data.

The Rw was established from

- Ro/Rt : If the calculated Ro (Rt (wet)) curve and Rt curve overlay each other a water sand is present, if Rt is greater than Ro then hydrocarbons are present (see Enclosure 2). These logs were used to establish water zones at Poonboon 1
- Rwa : Apparent water resistivity (0.3 Ω/m @ Formation Temperature (see Enclosure 2)
- SP : Formation water resistivity derived from the spontaneous potential log (see Enclosure 3)
- Pickett Plot : 0.208 Ω/m @ Formation Temperature (Figure 1)
- Offset well data :

Pelican 5
DST 5 (2855-2860.5m)
4000 ppm NaCl equivalent
Rw = 1.39 Ω/m @ 75°F
= 0.42 Ω/m @ Formation Temperature

DST 5A (2869-2883m)
6000 ppm NaCl equivalent
Rw = 0.98 Ω/m @ 75°F
= 0.32 Ω/m @ Formation Temperature

DST 6 (2786-2790)
7500 ppm NaCl equivalent
Rw = 0.8 Ω/m @ 75°F
= 0.27 Ω/m @ Formation Temperature

Given all the data available an average Rw value used for Poonboon 1 was:

Rw = 10000 ppm NaCl equivalent
= 0.58 Ω/m @ 75°F
= 0.2 Ω/m @ Formation Temperature (218°F)

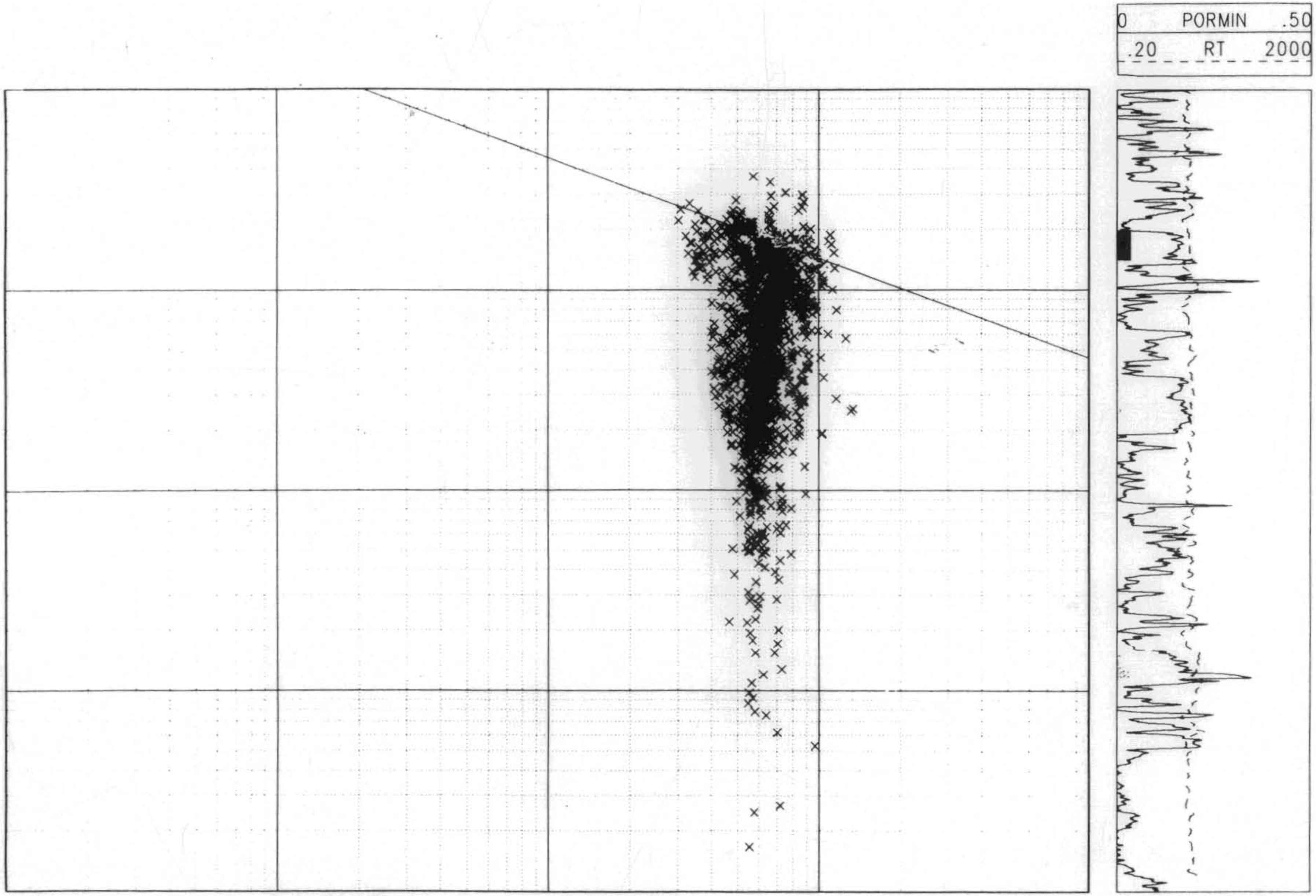

FIGURE 1

PICKETT PLOT 3000 - 3025m

RW = 0.208 ohmm
X AXIS = RESISTIVITY
Y AXIS = POROSITY

5 cm

LOG PERMEABILITY

Limited core data allowed a core permeability versus core porosity crossplot to be constructed see (Figure 2). A line of best fit resulted in the following relationship between permeability and porosity:

$$Y = 13.67 + 3.26 * \log_{10} X$$

where

Y = core porosity (ϕ)
X = core permeability (k)

$$\log_{10} = \frac{Y - 13.6}{3.26}$$

$$X = 10^{\left(\frac{Y - 13.67}{3.26}\right)}$$

After substituting core porosity for log porosity a log permeability curve was derived.

Combining the log derived porosity and permeability allows us to establish potential pay sands within the Eastern View Coal Measures (see Enclosure 1).

NET RESERVOIR ROCK CRITERIA

Two cases were used to establish potential reservoir rock

A *Pessimistic Case*

Log Porosity	(ϕ)	>	15%
Log Permeability	(k)	>	10 md
Shale Volume	(Vsh)	<	40%

B *Optimistic Case* (using cores 1-4 porosity-permeability crossplot data (Figure 3))

Log Porosity	(ϕ)	>	10%
Log Permeability	(k)	>	5 md
Shale Volume	(Vsh)	<	40%

		Case A	Case B
Gross Thickness	(m)	550	550
Net/Gross	(%)	7	10.5
Net Sand	(m)	39	58

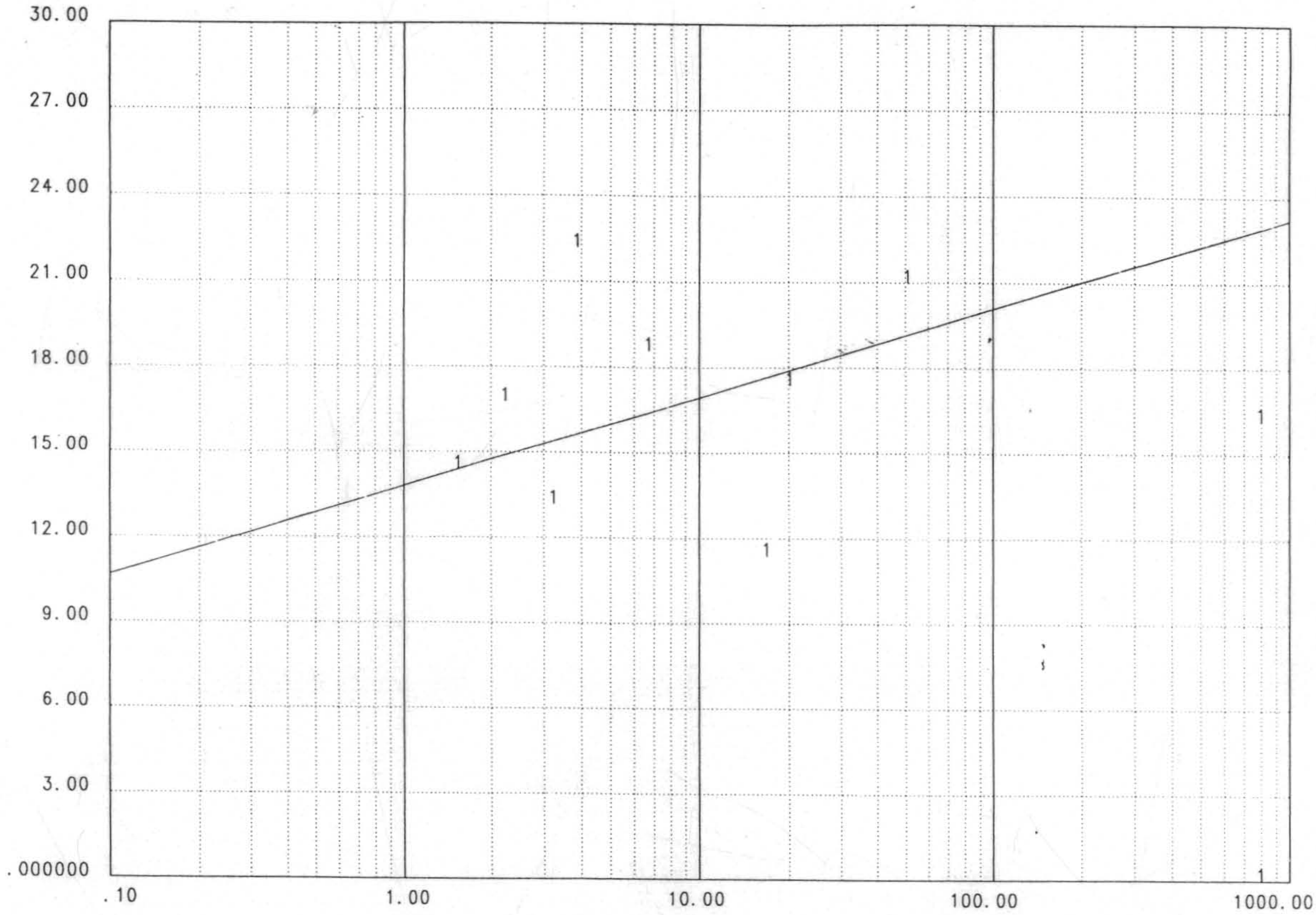

FIGURE 2 CORE #4 3034 - 3042.5m POROSITY - PERMEABILITY CROSSPLOT SHOWING LINE OF BEST FIT

5 cm

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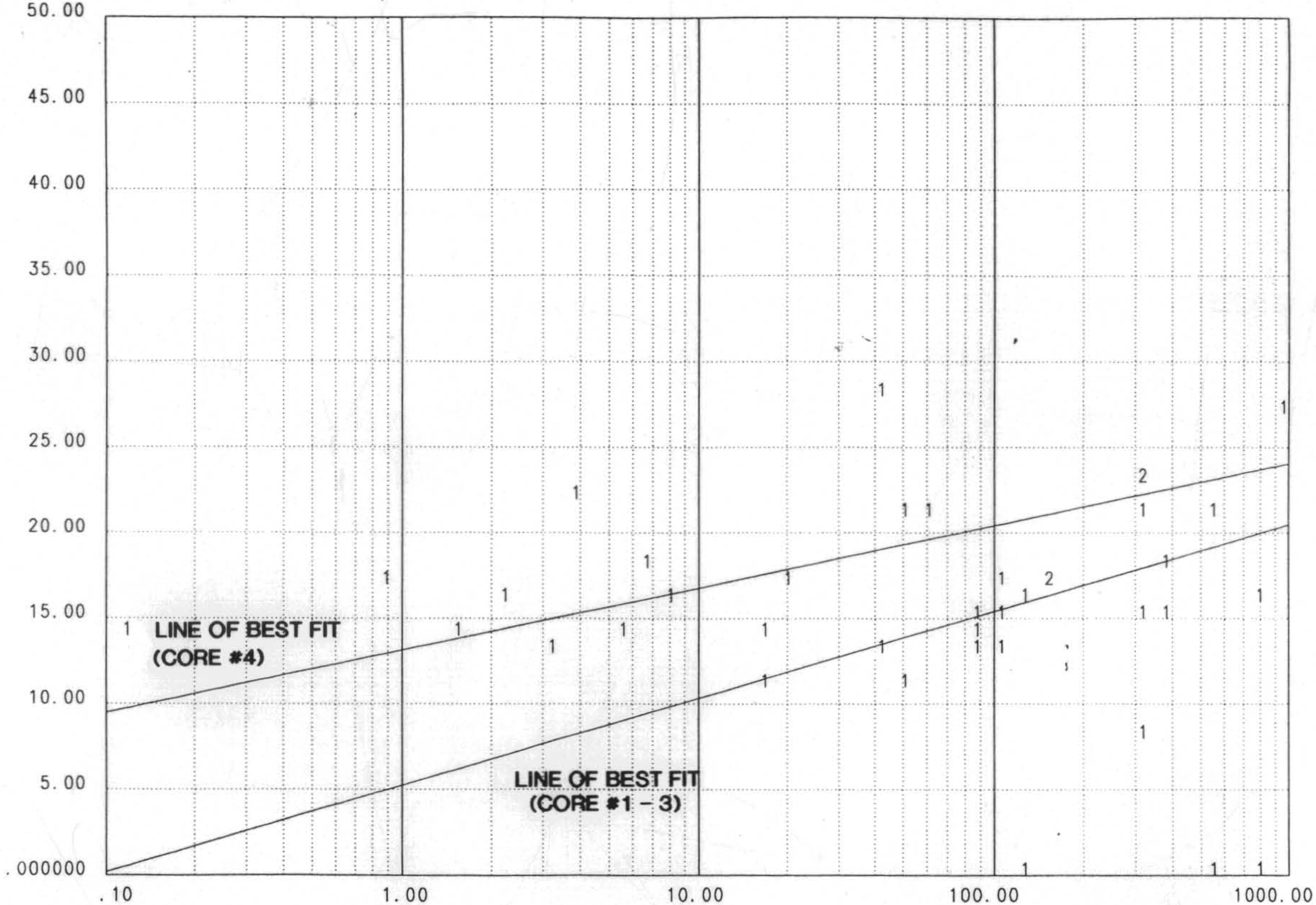

FIGURE 3 **POROSITY - PERMEABILITY CROSSPLOT FOR CORES #1 - 4**

5 cm

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CONCLUSIONS

- Porosity values determined for the Eastern View Coal Measures are the minimum (and therefore most pessimistic) values, note that the log determined porosity values are generally less than the core porosities (Enclosure 1).

- The log derived permeabilities being determined from the porosities, are also indicative of pessimistic values although they do show a better correlation with the core permeability (Enclosure 1).

- Net pay uses two cases (Case A is flagged in the depth tracks of Enclosure 1), in both cases the pessimistically log derived porosity and permeability is used, any improvement in the actual porosity and permeability will obviously improve the potential net pay.

- The reservoir characteristics of the Eastern View Coal Measures at Poonboon 1 are good. The potential therefore exists for multiple stacked sand bodies to exist to depths of 3200m with good porosities and permeabilities.

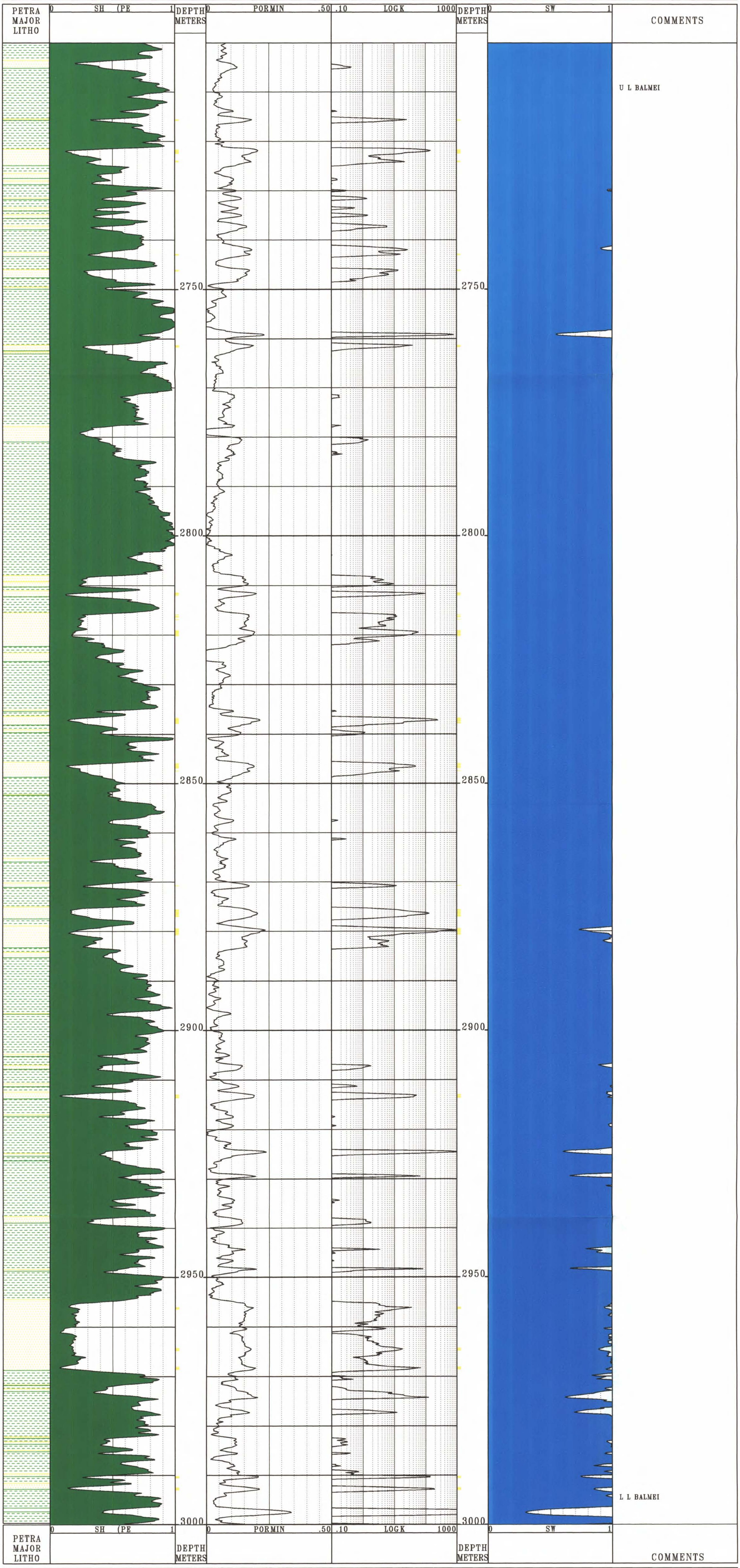
- The formation water resistivity (Rw) is variable throughout the Eastern View Coal Measures as demonstrated by the various techniques used to determine Rw in Poonboon 1. Whilst this was of little consequence at Poonboon 1 where the well was obviously water wet, establishing a correct Rw in the Eastern View Coal Measures reservoirs in gas/oil wells in the Bass Basin is important to establish the correct Sw.

- The hydrocarbon anomaly, originally defined at Poonboon 1 was identified by this quicklook. It is possible that the anomaly is due to fracturing, this fact is highlighted by the large caliper washout.

- Poonboon 1 was effectively evaluated by the operator and plugged and abandoned, after demonstrating the existence of potentially good reservoir rocks.

Poonboon 1

T/25P Spudded 29/08/72



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Poonboon 1

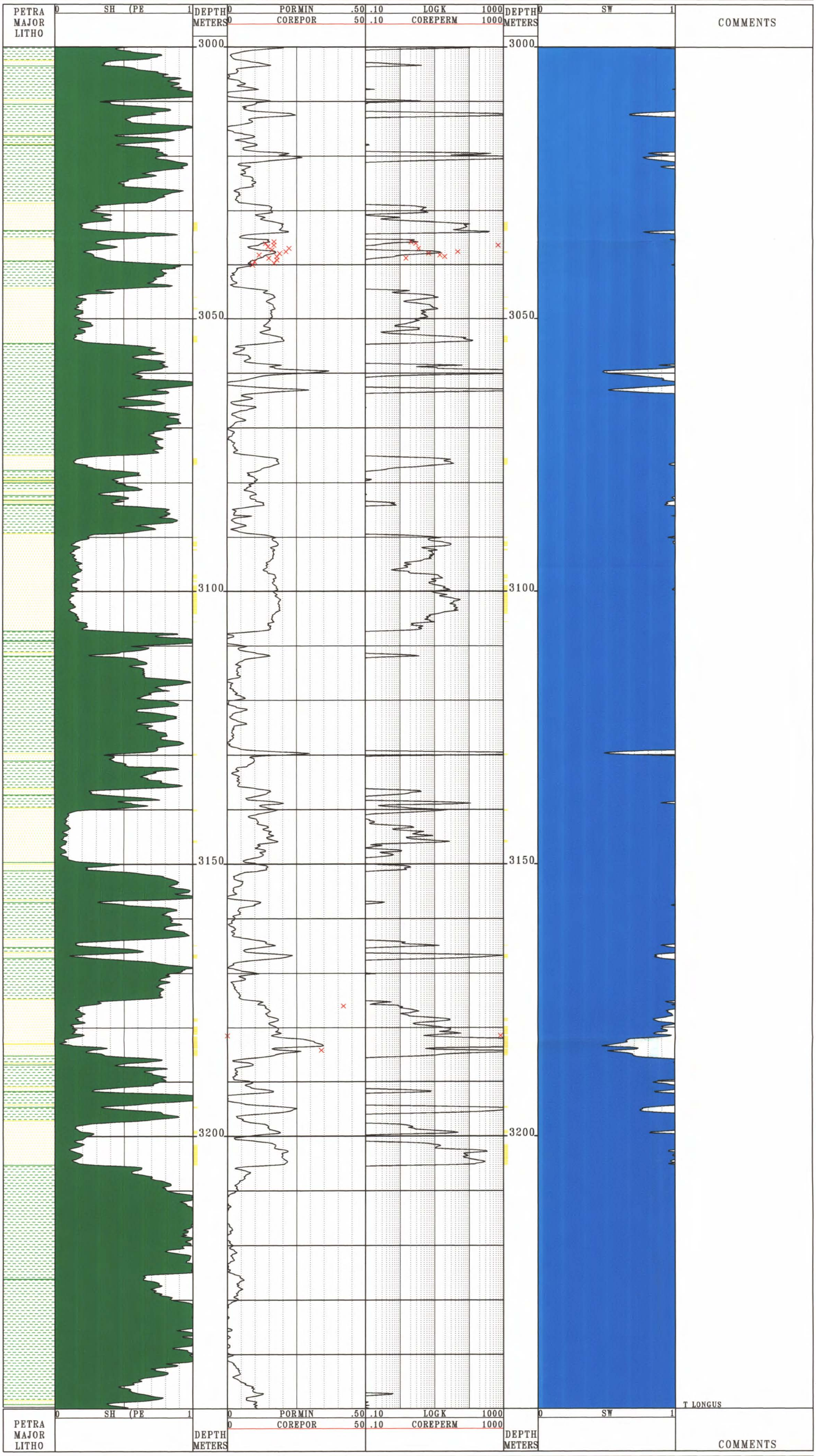
T/25P Spudded 29/08/72

5 cm

ENCLOSURE 1.(i)

Poonboon 1

T/25P Spudded 29/08/72



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Poonboon 1

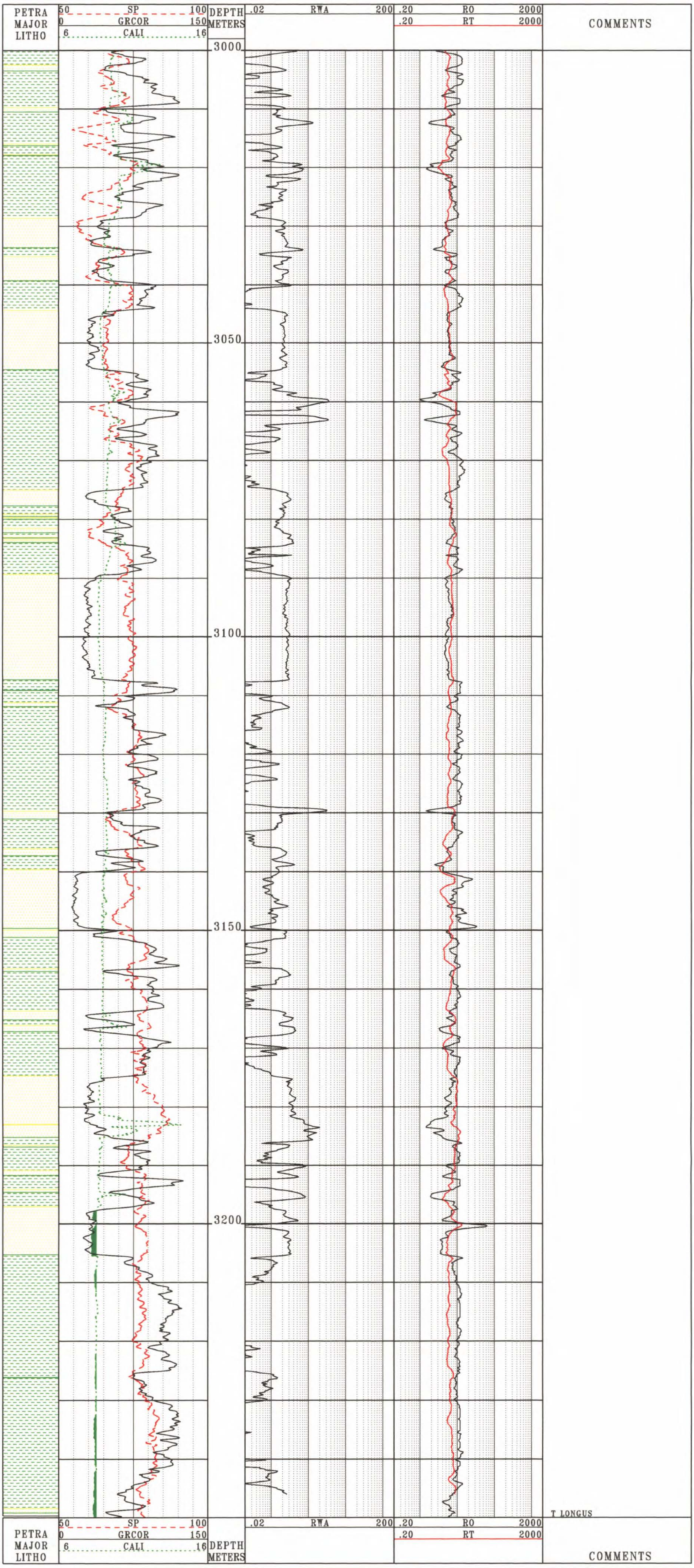
T/25P Spudded 29/08/72

ENCLOSURE 1 (ii)

5 cm

Poonboon 1

T/25P Spudded 29/08/72



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Poonboon 1

T/25P Spudded 29/08/72

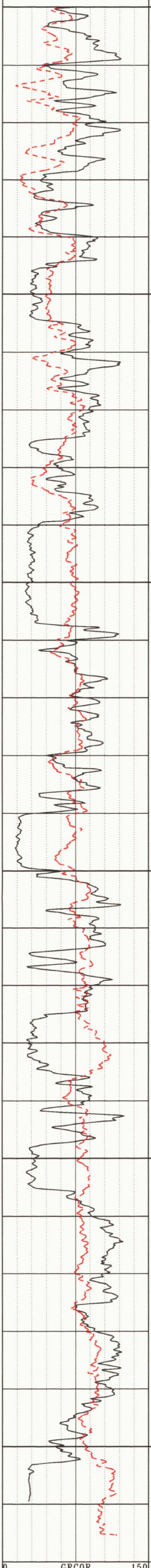
ENCLOSURE 2.

5 cm

Poonboon 1

T/25P Spudded 29/08/72

0 GRCOR 150 / 50 SP 100	DEPTH METERS	COMMENTS
	3000	
	3050	SP DERIVED RW 16000 PPM NACL EQ RW= 0.38 75DEG F RW= 0.13 FT
	3100	SP DERIVED RW 13000 PPM NACL EQ RW= 0.42 75DEG F RW= 0.155 FT
	3150	
		SP DERIVED RW 6500 PPM NACL EQ RW= 0.9 75DEG F RW= 0.3 FT
	3200	
	3250	T LONGUS



0 GRCOR 150 / 50 SP 100	DEPTH METERS	COMMENTS

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494016 Poonboon 1

5 cm

T/25P Spudded 29/08/72

ENCLOSURE 3.