

## INTERPRETATIVE

Angler-1  
RFT Analysis  
Report



GL/89/024  
JMQ/sw  
19 September 1989

## TABLE OF CONTENTS

<u>CONTENTS</u>	<u>PAGE</u>
1. Summary and Conclusions.....	1
2. Introduction.....	1
3. Zone 1 (3125-3305m).....	2
4. Zone 2 (3252-3305m).....	2
5. Zone 3 (3453-3868m).....	2
6. Zone 4 (4214-4269m).....	3

## LIST OF TABLES

TABLE 1: Angler-1 RFT data

## LIST OF ENCLOSURES

- ENCLOSURE 1: RFT Plot - Pressure vs depth 3100-4275m (scale 1:1,500) ✓
- ENCLOSURE 2: RFT Plot - Pressure vs depth  
Zone 1 and Zone 2 (3100-3305m) (scale 1:200) ✓
- ENCLOSURE 3: RFT Plot - Pressure vs depth  
Zone 3 (4210-4275m) (scale 1:200) ✓

## 1. SUMMARY AND CONCLUSIONS

45 RFT pressure tests were carried out at Angler-1, covering the interval 3125-4269m. Of these, 34 were successful, including the recovery of a segregated sample at 4226m.

The conclusions from these tests are:

- i) All formation pressures measured in sandstones above 4213m display a water gradient trend, with gradients ranging from 0.455 psi/ft to a low of 0.429 psi/ft (Enclosures 1 & 2)
- ii) A gas gradient of 0.110 psi/ft was measured in the interval 4213m to 4239m, and intersects an underlying water gradient of 0.430 psi/ft at 4239m, indicating a gas water contact at that level (Enclosures 1 & 3)
- iii) The hydrostatic mud gradient is constant at 0.505 psi/ft (1.17 SG; 9.75 lb/gal)
- iv) The hydrostatic overbalance from the mud column ranges from a low of 625 psi to a high of 897 psi (Table 1)
- v) All reservoirs down to 4212m are normally pressured (0.437 psi/ft / 1.009 SG / 8.42 lb/gal)
- vi) The reservoirs below 4242m are very slightly overpressured with a gradient of 0.461 psi/ft (1.06 SG or 8.9 lb/gal)

## 2. INTRODUCTION

A total of 45 RFT pressure measurements were taken at Angler-1 over the interval 3125-4269m. Of these, 2 tests had seal failures; 7 tests were taken in tight formations and did not stabilize to formation pressure, and 1 reading showed supercharging (Table 1 and Enclosure 1). The mud hydrostatic pressure was measured at 0.505 psi/ft or 1.17 SG. A segregated sample was taken at 4226m and recovered 92.4 ft<sup>3</sup> of gas and 600 cc of condensate (Enclosure 3). Pressure sampling was concentrated in four zones, 3125-3252m; 3252-3305m; 3453-3868m and 4214-4629m.

3. ZONE 1 (3125-3252m)

This zone is made up of poorly developed sandstone, interbedded with siltstones and coals, deposited in a coastal plain environment. Good gas shows were recorded when drilling this section, and log analysis results show minor sandstone stringers with  $S_w$  values ranging from 55% to 90%, with most values above 70% (Enclosure 2). The water gradient in this interval is 0.455 psi/ft (Enclosures 1 and 2), indicating a moderately saline formation water.

A single point at 3231m has a pressure which is 21 psi higher than that expected from the established trend (Enclosure 2). This pressure measurement was taken in a thin sandstone bed correlating with a gas peak. This anomalous pressure could be the result of hydrocarbon effect, although the possibility of supercharging cannot be discounted in, what appears from the logs, to be a tight shaley sandstone.

4. ZONE 2 (3252-3305m)

This interval represents the upper part of the Selene Sandstone, and consists of well developed stream mouth bar sandstones, interbedded with minor siltstone and coal stringers. A water gradient of 0.429 psi/ft is measured in this interval, which is slightly lower than that measured in Zone 1, indicating two separate reservoirs.

The gradient of 0.429 psi/ft is fractionally lower than that expected in a fresh water reservoir and is interpreted as indicating the presence of some free gas in the upper section of the Selene Sandstones, a feature confirmed by the low hydrocarbon saturation computed from the log analysis and the gas shows recorded while drilling the top 10m.

5. ZONE 3 (3453-3868m)

No hydrocarbon shows were recorded while drilling this interval and only 12 pressure measurements were taken over this entire section, enough to establish a reliable pressure gradient. Enclosures 1 and 2 show a normal water gradient of 0.434 psi/ft or 1.002 SG over that interval.



6. ZONE 4 (4213-4269m)

This interval covers the Campanian "B" Sandstone (4213m - TD [4330m]) and shows two very clear gradients (Enclosures 1 and 3). The first, a gas gradient of 0.110 psi/ft intersects a water gradient of 0.430 psi/ft at 4239m, indicating a gas water contact at that level. The water gradient below 4239m is slightly less than a fresh water gradient, and like Zone 2, is attributed to the presence of minor free gas in the sandstones. The presence of gas was confirmed both by the log analysis results which show low hydrocarbon saturation, and the good gas shows recorded while drilling down to 4300m. The sample recovered at 4226m contained 92.4 cu ft of gas and 600 cc of condensate. The composition of the recovered gas is: C1 = 88.24%, C2 = 5.0%, C3 = 1.63%, iC4 = 0.11%, nC4 = 0.13%, CO<sub>2</sub> = 3.0%, H<sub>2</sub>S = NIL. Condensate: SG = 0.77 @ 21.8°C, 52° API.

TABLE 1

ANGLER-1 RFT DATA

DEPTH RKB M	DEPTH RKB FT	DEPTH SS M	DEPTH SS FT	FORMATION PRES PSIA	SURF. GRAD PSI/FT	HYDROSTATIC PSI	HYDRO. GRAD PSI/FT	COMMENTS
3125.00	10252.50	3098.00	10163.92	4442.49	0.437	5178.75	0.505	GOOD TEST
3142.00	10308.27	3115.00	10219.69	4466.61	0.437	5207.22	0.505	GOOD TEST
3157.50	10359.13	3130.50	10270.54	4488.92	0.437	5233.11	0.505	GOOD TEST
3171.50	10405.06	3144.50	10316.48	4509.84	0.437	5257.23	0.505	GOOD TEST
3182.00	10439.51	3155.00	10350.92	4529.20	0.438	5275.60	0.505	GOOD TEST
3193.00	10475.59	3166.00	10387.01	4544.59	0.438	5293.20	0.505	GOOD TEST
3197.00	10488.72	3170.00	10400.14	4550.27	0.438	5300.16	0.505	GOOD TEST
3205.50	10516.60	3178.50	10428.02	4564.57	0.438	5315.01	0.505	GOOD TEST
3208.50	10526.45	3181.50	10437.87	4568.54	0.438	5319.95	0.505	GOOD TEST
3222.50	10572.38	3195.50	10483.80	4590.21	0.438	5343.15	0.505	GOOD TEST
3231.00	10600.26	3204.00	10511.68	4619.72	0.439	5357.40	0.505	SUPERCHARGED?
3236.00	10616.67	3209.00	10528.09	4613.55	0.438	5365.95	0.505	GOOD TEST
3248.50	10657.68	3221.50	10569.10	4629.36	0.438	5386.90	0.505	GOOD TEST
3256.00	10682.28	3229.00	10593.70	4639.41	0.438	5399.44	0.505	GOOD TEST
3262.00	10701.97	3235.00	10613.39	4648.05	0.438	5409.72	0.505	GOOD TEST
3278.00	10754.46	3251.00	10665.88	4670.61	0.438	5436.41	0.506	GOOD TEST
3292.00	10800.39	3265.00	10711.81	4689.57	0.438	5458.40	0.505	GOOD TEST
3305.00	10843.04	3278.00	10754.46	4708.38	0.438	5480.22	0.505	GOOD TEST
3453.00	11328.60	3426.00	11240.02	4920.93	0.438	5727.80	0.506	GOOD TEST
3538.00	11607.47	3511.00	11518.89	5040.81	0.438	5866.10	0.505	GOOD TEST
3667.00	12030.69	3640.00	11942.11	5227.20	0.438	6080.90	0.505	GOOD TEST
3756.00	12322.68	3729.00	12234.10	5352.36	0.437	6226.70	0.505	GOOD TEST
3807.00	12490.01	3780.00	12401.42	5424.12	0.437	6308.70	0.505	GOOD TEST
3814.00	12512.97	3787.00	12424.39	5434.95	0.437	6321.70	0.505	GOOD TEST
3825.00	12549.06	3798.00	12460.48					TIGHT
3825.50	12550.70	3798.50	12462.12					TIGHT
3831.00	12568.74	3804.00	12480.16					TIGHT
3836.00	12585.15	3809.00	12496.57					SEAL FAILURE
3845.00	12614.68	3818.00	12526.09	5482.55	0.438	6374.00	0.505	GOOD TEST
3867.00	12686.85	3840.00	12598.27	5513.34	0.438	6410.50	0.505	GOOD TEST
4214.00	13825.29	4187.00	13736.71					TIGHT
4214.50	13826.93	4187.50	13738.35					SEAL FAILURE
4216.00	13831.85	4189.00	13743.27	6347.68	0.462	6972.80	0.504	GOOD TEST
4220.00	13844.98	4193.00	13756.39	6349.77	0.462	6981.20	0.504	GOOD TEST
4222.00	13851.54	4195.00	13762.96	6349.92	0.461	6984.80	0.504	GOOD TEST
4226.00	13864.66	4199.00	13776.08	6350.77	0.461	6995.00	0.505	GOOD TEST
4230.00	13877.78	4203.00	13789.20	6352.64	0.461	7002.19	0.505	GOOD TEST
4234.20	13891.56	4207.20	13802.98					TIGHT
4235.00	13894.19	4208.00	13805.61	6480.00				SUPERCHARGED
4243.00	13920.43	4216.00	13831.85					TIGHT
4246.30	13931.26	4219.30	13842.68	6366.10	0.460	7021.10	0.504	GOOD TEST
4251.00	13946.68	4224.00	13858.10	6373.00	0.460	7041.00	0.505	GOOD TEST
4254.20	13957.18	4227.20	13868.60	6377.60	0.460	7046.60	0.505	GOOD TEST
4257.00	13966.37	4230.00	13877.78					TIGHT
4269.00	14005.74	4242.00	13917.15	6397.90	0.460	7072.00	0.505	GOOD TEST

SEGREGATED FLUID SAMPLES COLLECTED AT 4226m, 2 3/4 GALLON CHAMBER CONTAINED 92.4 CU FT OF GAS AND 600 CC's OF CONDENSATE.

GAS COMPOSITION: C1 88.24%, C2 5.0%, C3=1.63%, iC4=0.11%, nC4=0.13%, CO2=3.0%, H2S=NIL.

CONDENSATE: Sg=0.77 @ 21.8 C, 52 DEGREES API.

ONE GALLON PRESSURE SAMPLE PRESERVED FOR PVT ANALYSIS.