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GIPPSLAND BASIN.

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ATTACHMENT TO WCR ESTIMATE OF HYDROCARBONS IN PLACE (REPORT) WHITING-1 (W807)

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W807

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OIL AND GAS DIVISION

EXPLORATION BRANCH

ESTIMATES OF HYDROCARBONS IN PLACE
WHITING FIELD - GIPPSLAND BASIN

BY

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C O N T E N T S

TABLES

FIGURES

SUMMARY

Whiting-1 well drilled on a small anticlinal feature, WSW of well Snapper-3 discovered oil and gas in the intra-Latrobe section. Although a number of oil and gas zones were identified on the logs, one oil and one gas zone were tested by wireline tools. The oil zone was later production tested and flowed 5323 b/d of 58° API oil with GOR of 225 cft/bbl on one inch choke. The gas zone had a good test at 2418 mkB. Gas with 53° API condensate was recovered in the 6 gal.RFT chamber. The well has been suspended for a possible future subsea completion.

Estimate of initial hydrocarbons in place for the oil and gas zones has been made. The oil zone contains 1.8 GL (11.6 million barrels) of oil in place and the gas zone, 11.9 billion m^3 (422.6 Bcf) of gas in place.

1. INTRODUCTION

The Whiting structure is a small anticlinal feature, 8 km SE of Wirrah-1 and 10 km WSW of Snapper-3 wells (FIG-1). Whiting-1 well is located at 38° 14' 11.77" S Latitude and 147°53' 0.93" E longitude in VIC L/2 licence area in 53 m of water. The semi-submersible drilling rig "Southern Cross" was used by ESSO-BHP to drill the well. It was spudded on 6 March and the rig moved off location on 28 April, 1983.

The object of the well was to define and evaluate potential of intra Latrobe sediments in a separate anticlinal closure between Barracouta and Snapper fields.

A number of potential oil and gas bearing zones were seen on the logs of the well. One promising oil zone in the 1481-96 mkB interval was tested by RFT and later by a cased hole production test. The potential gas zone from 2403 to 2477 mkB depth was tested by RFT only. The oil zone is in P-asperopolus and gas zone in lower L-balmei.

The well has been suspended with the possibility of a future subsea completion.

An assessment of hydrocarbons in place for these two zones of Whiting structure has been made in this report. The test data points to the possibility of development of this field along with Wirrah and other small accumulations in the general area.

2. Structure

Whiting structure is a NE-SW trending anticline with no closure at top Latrobe level. A small structural closure in seen at the base of Lower N-asperus level, increasing to 3 x 2 km closure at the top of P-asperopolus and 9 x 3.5 km at the upper M-diversus level.
No structure map is available for zones deeper than upper M-diversus.

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The predicted and actual formation tops and gross thickness of the stratigraphic units are given in table 1.

Figures 2 and 3 are the structure maps on the top of P asperopolus and upper M-diversus seismic marker. Figures 4 and 5 are gross thickness maps of the 1481-96 m oil zone and 2403-2477 mkB gas zones, respectively.

3. FORMATION TESTS

A total of 6 repeat formation tests were done, two for pressure data and four for flow and sample collection. Pressures were also measured in RFT no. 5. The tests are listed in table 2.

The well was production tested in the interval 1483-86 mkB. Due to variation in the rate of flow, the interval was reperforated.
The results of production test are given in table 3.

4. Oil and Gas Analysis

Very limited data on the analysis of oil and gas is available. Gravity of the oil produced from the oil zone was 58° API. Gravity of condensate produced with gas from the lower zone was 53° API at 16°C. The gas condensate ratio works out to be 8176 m^3/KL.

5. Occurrence of Hydrocarbons and Log Interpretation

A number of oil and gas zones have been identified after log interpretation. The best oil zone is in the interval 1481-1496 mkB and the best gas zone from 2403 - 2477 mkB with gas water contact at 2477 mkB.
Both these zones were tested by RFT (RFT numbers 3 and 5).

Table 4 gives the hydrocarbon bearing intervals, net-sand thickness, porosity and water saturation data. The oil water, gas water and oil gas contacts have also been indicated in the table. Figures 6 and 7 are the pressure data plots for these zones. There is good agreement between log and pressure data derived gas water contact. For the oil zone, pressure data shows oil water contact 2.5 m higher than from log interpretation. For calculation of reserves, OWC has been taken at 1496 mkB.

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6. Initial Reservoir Pressure and Temperature

The pressure data was recorded during RFT runs 1, 2 and 5. Initial reservoir pressures at mid point of the two zones, 1488.5 mkB and 2440 mkB, have been read off figures 6 and 7 as 2111.2 and 3533.8 psia respectively.

For reservoir temperature data, the temperature recorded during the FIT sample collection in a number of Gippsland wells was plotted against depth. The points fall on a fairly smooth curve. The initial reservoir temperature at the mid point of the two hydrocarbon zones has been read as 170.5° and 223.5°F respectively.

7. FORMATION VOLUME FACTORS

For the oil zone,oil formation volume factor at bubble point pressure was determined from Standing correlation, using initial reservoir pressure, temperature and production test data. Oil FVF at initial reservoir pressure was then determined as 1.093 reservoir volume per unit stock tank volume.

For the gas zone, gas formation volume factor was calculated for initial reservoir temperature, pressure and assumed gas gravity of 0.8 (w.r.to air) using correlation charts. The gas volume factor value is 211.2 volumes at STP per unit volume of gas at initial reservoir pressure and temperature.

8. RESERVES

The rock volume for the oil and gas zones was calculated using gross isopay maps (figures 4 and 5) respectively. Net to gross ratio from log interpretation was used to convert gross rock volumes to net hydrocarbon bearing rock volume. The porosity and water saturation values were taken from log interpretation data, table 4.

Initial oil and gas in place and other parameters are given in table 6.

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9. DISCUSSIONS

Although a number of oil and gas bearing zones were identified on the logs of Whiting-1 well, the present report deals with the two zones considered most significant. Since it is a small accumulation, close to existing production facilities, there is possibility of the oil zone only being produced as a subsea completion. The possibility of production from the other zones is less likely.

The basic information such as structure maps, log interpretation etc has been taken from ESSO. The structure map at the top of Upper M-diversus is the source of structural control for the gas sand. There is a possibility of change in the structure of the gas zone which will have an immediate impact on the gas in place reserves for this zone.

The oil of the 1481-96 mkB zone is very light (58°API) and appears to be highly under-saturated. The reserves of solution gas for this zone or condensate reserves for the 2403-77 mkB zone have not been determined.

TABLE-1

DEPTH OF FORMATION TOPS AND GROSS THICKNESS

FORMATION	PREDICTED DEPTH, MSS m	ACTUAL DEPTH, MSS m	GROSS THICKNESS, m
GIPPSLAND LIMESTONE	53	80	
LAKES ENTRANCE FORMATION	950	899	819
TOP LATROBE (GURNARD)	1248	1261	362
TOP LATROBE COARSE CLASTICS	1268	1266	5
NEAR BASE LOWER N-asperus	1338		
TOP P-asperopolus	1440	1454	188
UPPER M-diversus seismic marker	1609	1619	165
UPPER L-balmei seismic marker	1790	1804	185

WHITING-1 RFT DATA

TABLE 2

RFT No	Depth mkB	Chamber Size, Gals	Gas, cft	Oil, c c	Water/Mud Filtrate, cc	Surface Pressure, psi	Titrated cl, ppm	No_3, ppm	REMARKS
3	1482	6	15.3	16,850	650	320	8,000	66	
4	28015	6	0.66		19500	0	15,000	22	
		2.3/4	0.38		900	0	15,500	30	
5	2418	6	124 .1	430 (condensate)	1300	1800	3,500	8	Condensate 53° API @ 16°C
		1	P R E S E R V E D						
6	1401	6	0.85		21,300 fm water	590	6,000	Tr	Rw - 0.493 ohm.m @ 21°C
		2.3/4	0.37		10,000	200	4,300	0	Rw - 0.718 ohm.m @ 21°C

TABLE 3

PRODUCTION TEST RESULTS

	CHOKE, INCH	OIL, b/d	GAS, Mcf/d	GOR, ft/bbl	Oil Gravity, °API	REMARKS
INITIAL PERFORATION 1483 - 1486 mkB						
	78/64	3513				INITIAL FLOW
	48/64	2200	.484	220	58	FINAL FLOW FTHP-217 psig CO_2 - 1.1% H_2S - 7 - 8 ppm
REPERFORATION 1483 - 1486 mkB						
	64/64	5323	1.198	225	58	FINAL FLOW FTHP - 389 -psi CO_2 - 1.3% H_2S - 25 ppm max.

TABLE 4

WHITING-1 LOG INTERPRETATION DATA

ZONE, mkB	NET SAND, M	FLUID TYPE	POROSITY, %	WATER SATURATION, %	REMARKS
1481-1496	10	oil	27	20	OWC - 1496 m
1535-1537	2	oil	27	40	OWC - 1537 m
1659-1662	3	Gas	30	25	
1717-1723	6	Gas	23	25	
1735-1739	3.5	Oil	22	50	OWC - 1739 m
1758-1763	5	Gas	25	25	GWC - 1763 m
1805-1813	7.5	Gas	25	-	
1854-1855	1	Gas	20	30	
1879-1908	14.5	Gas	22-23	15-20	GOC - 1908 m
1908-1913	5	Oil	20	45	OWC - 1913 m
1941-1946	5	Gas	21	25	
1946-1947	0.5	Oil	20	?	
2114-2125	7	Gas	16	25	
2146-2151	45	Gas	15	40	
2190-2205	4	Gas	15-18	25	
2298-2301	3	Gas	21	15	
2342-2356	7	Gas	16	20	
2403-2477	32	Gas	15-18	10-20	GWC - 2477 m
2685-2702	3.5	Gas?	15	?	poor reservoir
2775-2804	6.5	Gas?	12	?	poor reservoir
2861-2870	2.5	Gas	12	?	poor reservoir

TABLE 5

GIPPSLAND RESERVOIR TEMPERATURE DATA

WELL	DEPTH, m SUBSEA	TEMP., °F	GRAVITY OF GAS SAMPLE Air = 1
EMPEROR-1	1533.5	173	
BARRACOUTA A-3	1382.6	166	
BARRACOUTA A-4	1375.9	165	
BREAM - 2	1925.1	195	
BREAM - 4A	1923.5	181	
COBIA-1	2397.0	220	
COBIA-2	2387.5	220	
SNAPPER A.1	1349.1	165	
SNAPPER-1	1334.7	169	
SUNFISH-1	2233.9	212	
SUNFISH-1	2054.6	215	0.7816
SUNFISH-1	2045.5	210	0.7555
SUNFISH-1	2015.0	200	0.7720
MARLIN A-24	2187	208	
MARLIN A-24	2406.2	224	
MARLIN A-24	2439-1	226	
MARLIN - 4	2378.6	220	0.8664
MARLIN - 4	2264.0	210	0.8286
MARLIN A-1	1438.7	167	0.746

TABLE 6

INITIAL HYDROCARBONS IN PLACE

ZONE	GROSS ROCK VOLUME, 10^6 M^3	NETT/GROSS RATIO	AVERAGE		F V F		INITIAL OIL IN PLACE, GL(10^6 bbl)	INITIAL GAS IN PLACE 10^6m^3(BcF)
			POROSITY ø, %	WATER SATN Sw,%	OIL, bbl/STB	GAS SCF/STB		
OIL ZONE 1481-1496 mkB	13.92	0.67	27	20	1.093		1.843 (11.59)	
GAS ZONE 2403-2477 mkB	94.08	0.43	16.5	15		211.2	-	11,972.7 (422.6)

FIG 1: LOCALITY MAP

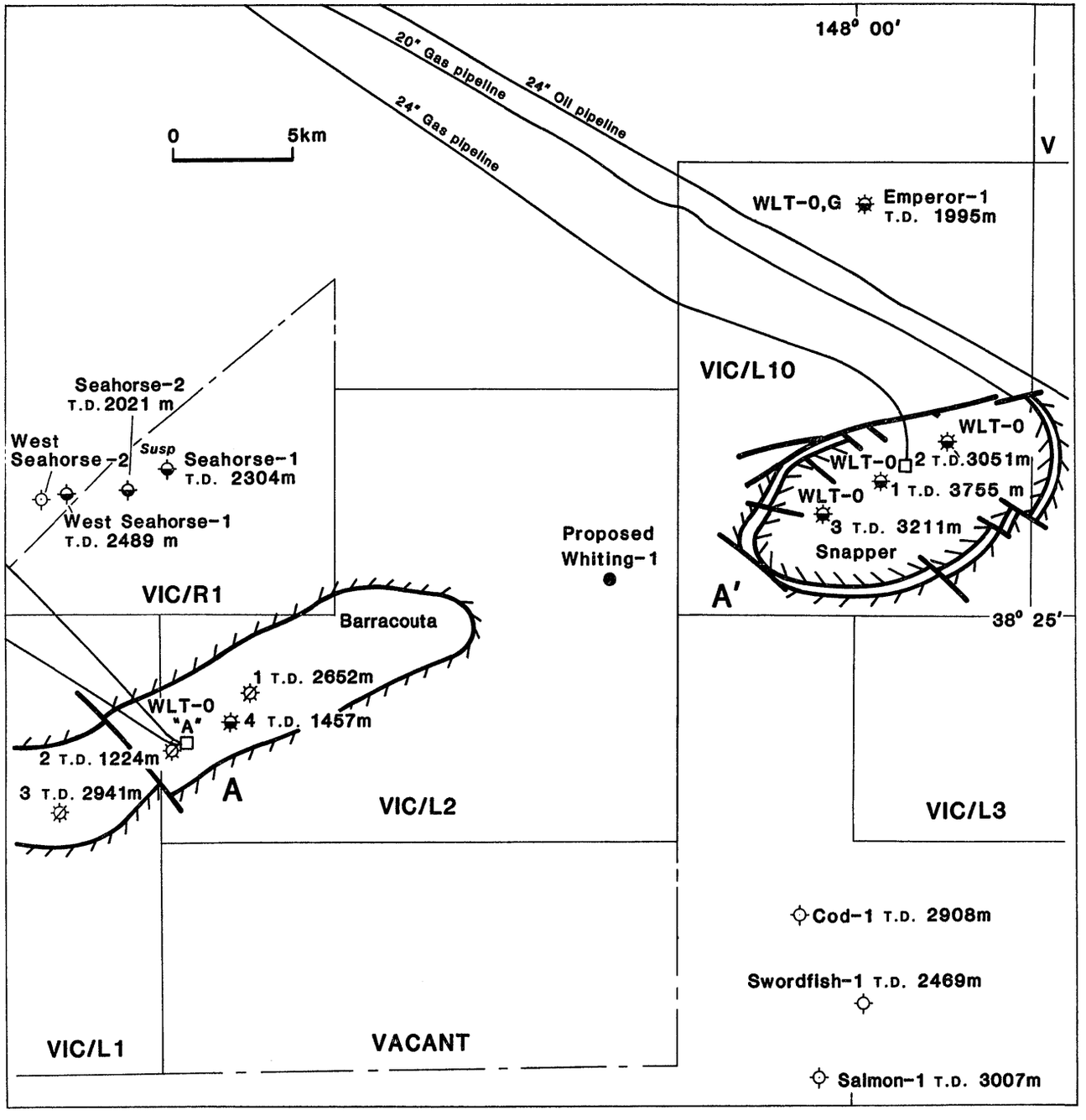
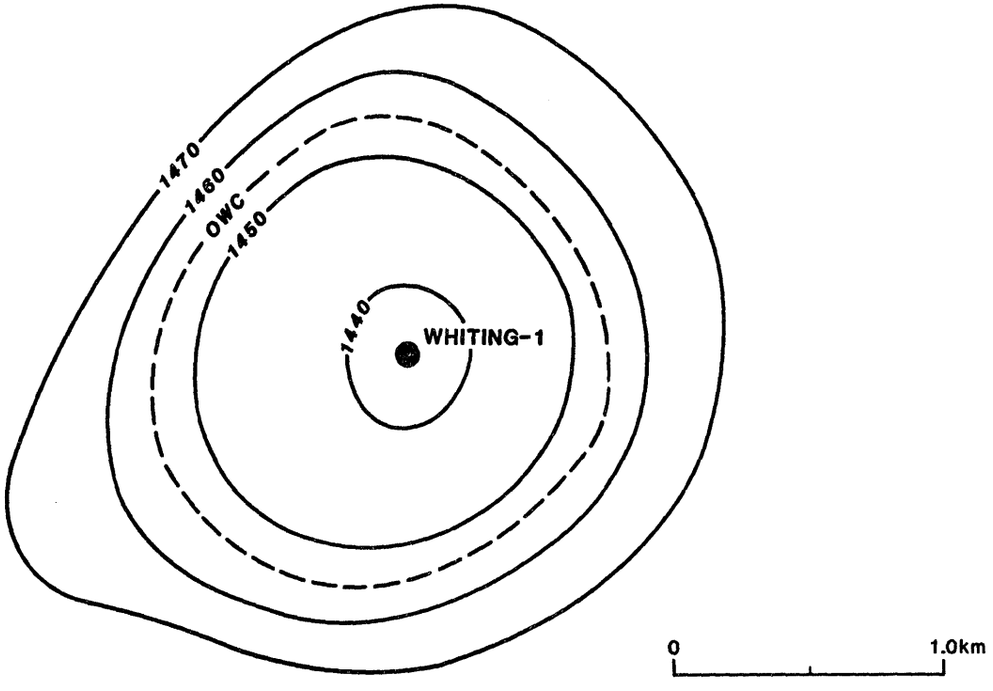
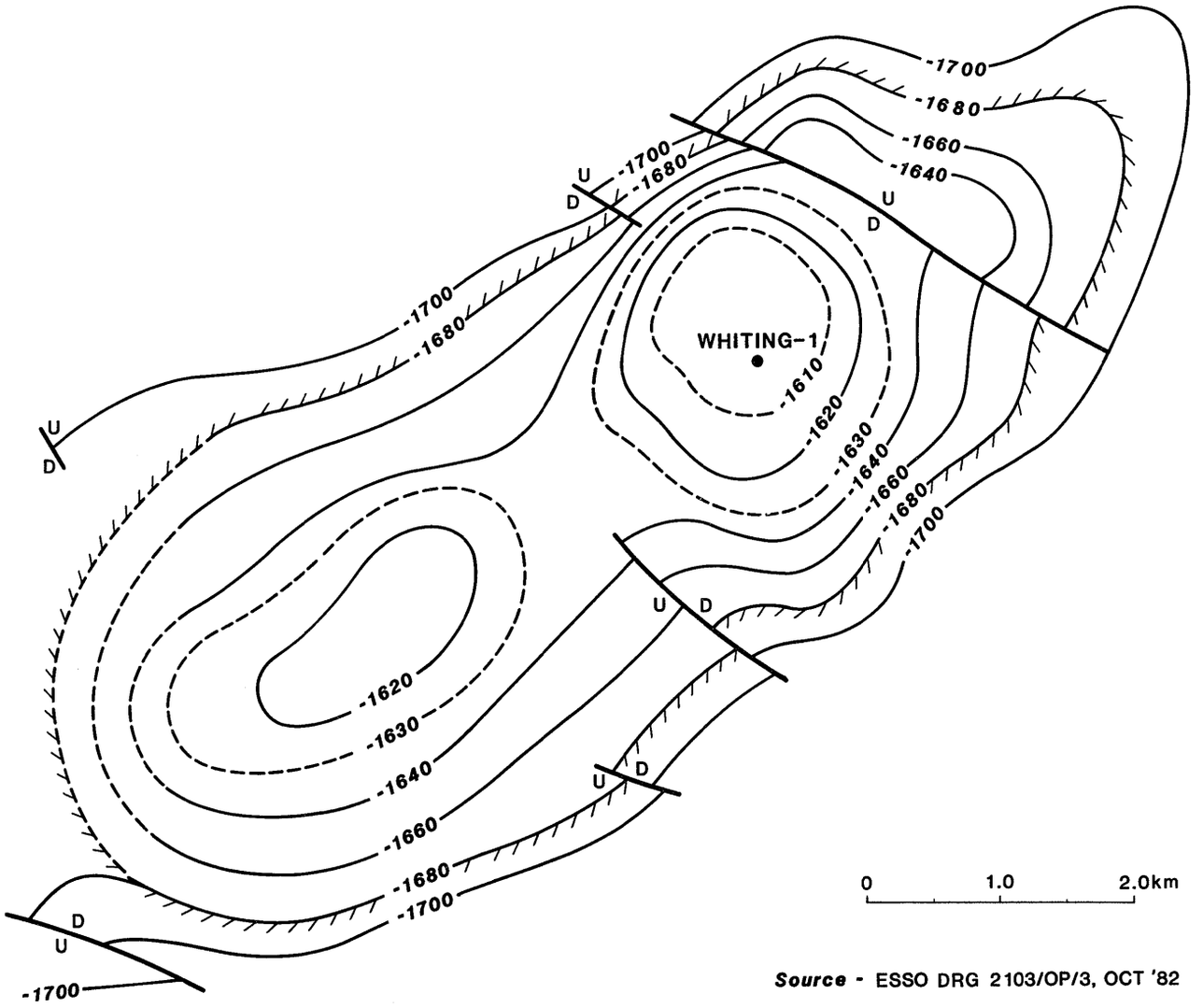


FIG 2: WHITING FIELD – GIPPSLAND BASIN
STRUCTURE MAP – TOP OF P. ASPEROPOLUS



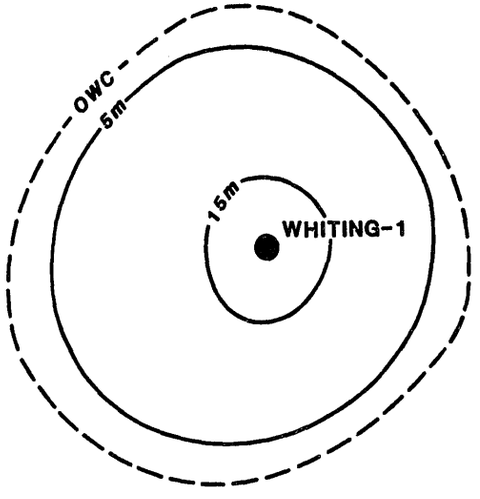
Source - ESSO DRG 2103/OP/4, OCT'82

FIG 3: WHITING FIELD - GIPPSLAND BASIN
STRUCTURE MAP - UPPER M-DIVERSUS SEISMIC MARKER



Source - ESSO DRG 2103/OP/3, OCT '82

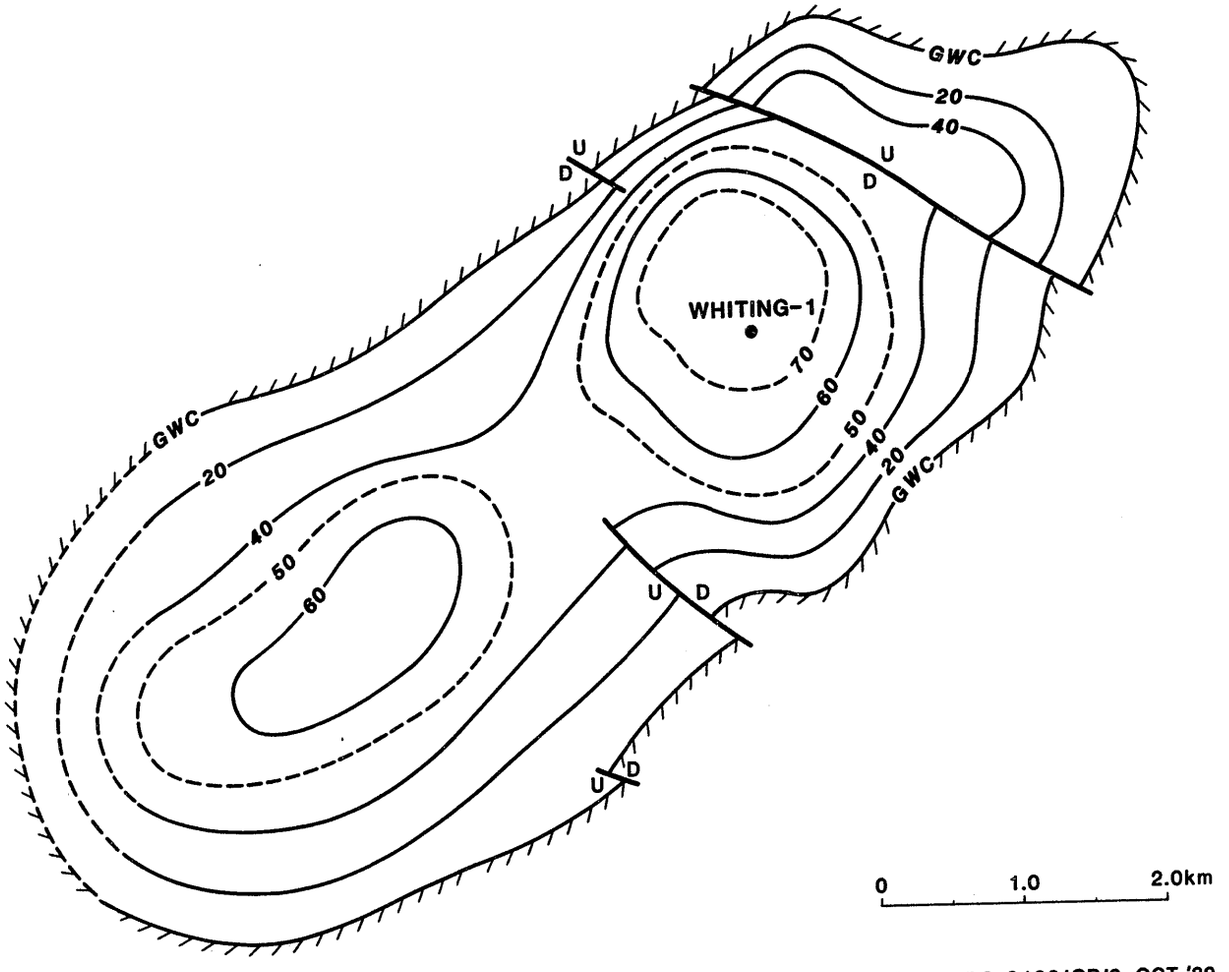
FIG 4: WHITING FIELD - GIPPSLAND BASIN
GROSS OIL ISOPAY
(1481-1496mKB ZONE)



0 1.0km

Source - ESSO DRG 2103/OP/4, OCT'82

FIG 5: WHITING FIELD - GIPPSLAND BASIN
GROSS GAS ISOPAY
(2403-2477mKB ZONE)



Source - ESSO DRG 2103/OP/3, OCT '82

FIG 6: WHITING-1 RFT PRESSURES
(1481-1496mKB ZONE)

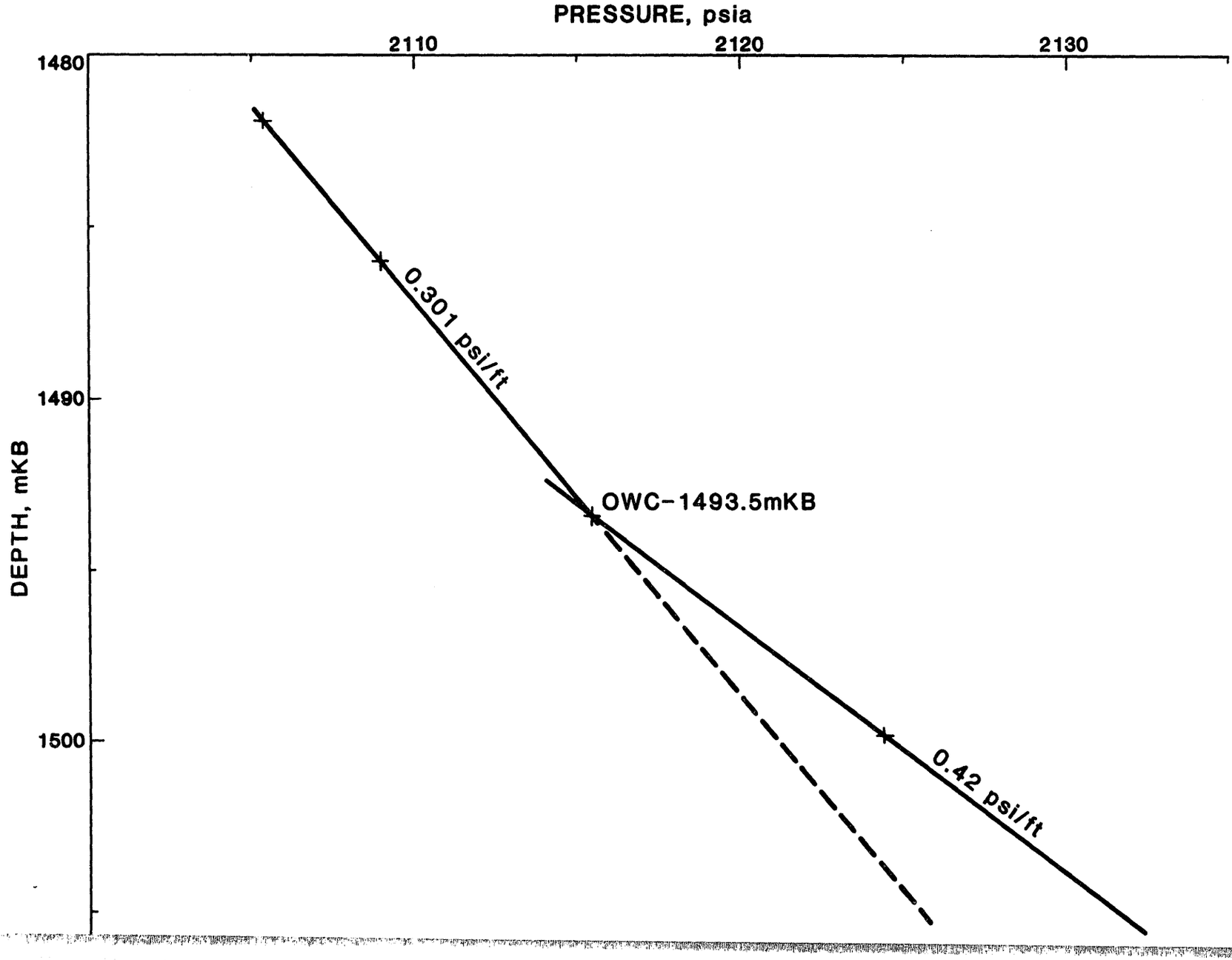


FIG 7: WHITING-1 RFT PRESSURE DATA
(2403-2477mKB ZONE)

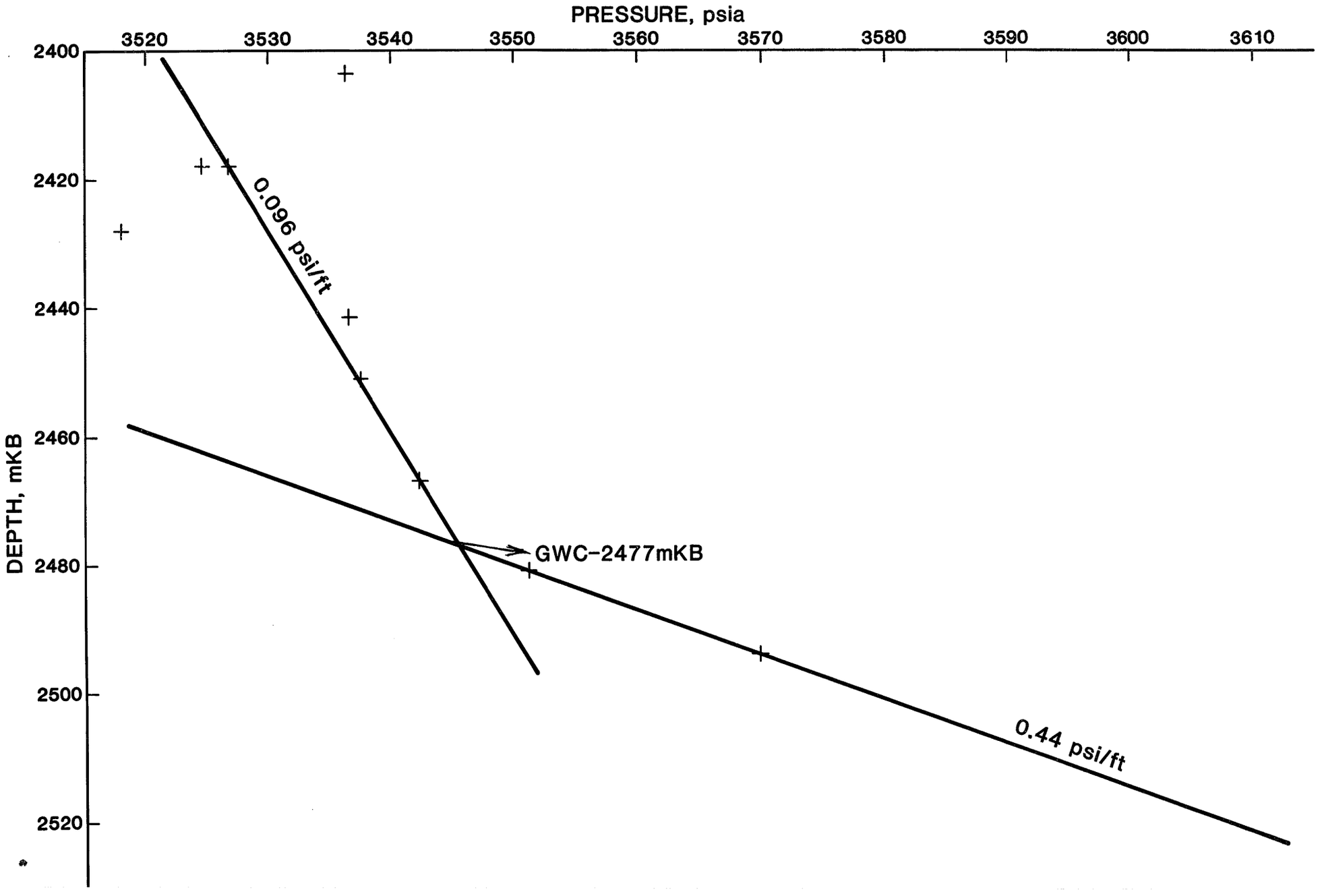


FIG 8: GIPPSLAND TEMPERATURE VS DEPTH FROM RFT/FIT DATA