W1069

WCR VOL 2

TURRUM-4

W1069

Esso Australia Ltd.

WELL COMPLETION REPORT

TURRUM-4

VOLUME 2
INTERPRETED DATA

GIPPSLAND BASIN
VICTORIA

ESSO AUSTRALIA RESOURCES LIMITED

Compiled by - Rod Feldtmann
March 1993

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ENCLOSURES

1. Summary of Well Results

Formation/Horizon	Forecast Depth m TVDSS	Actual Depth m TVDSS	Frcst-Act Depth m
KB	-23	-23	-
Gippsland Limestone (water bottom)	62	62	on prognosis
Lakes Entrance Formation	1365	1505.0	-140
Top of Latrobe Group	1900	1896.0	4
Base Flounder Formation	-	1955.5	-
Top L100 Reservoir	2271	2275.5	-5
54.5Ma Sequence Boundary	2295	2304.0	-9
Top L200 Reservoir	2393	2457.7	-65
Top L300 Reservoir	2475	2529.5	-55
Top L350 Reservoir	2503	2567.3	-64
Top L360 Reservoir	2538	2587.5	-50
Top L400 Reservoir	2578	2636.5	-59
Top L500 Reservoir	2650	2699.8	-50
67.0 Ma Sequence Boundary	2768	(not intersected)	-
TOTAL DEPTH	3050	2755	-

RF:lt:0393rep4

2. Introduction

The Turrum discovery lies beneath the southeastern flank of the Marlin gas field. The Turrum field trapping geometry consists of a series of north-west trending normal faults intersecting a NNE trending anticlinal axis.

The Turrum field consists of a series of multiple stacked hydrocarbon systems within the L. balmei section of the intra-Latrobe Group. Most hydrocarbon systems intersected to date consist of gas reservoirs, with no contacts established. Oil has been penetrated in three zones, (L100, L450, L500).

The objective of Turrum-4 was to test the southeastern flank of the Turrum discovery for possible down dip oil legs in the L200-L400 reservoirs. Predrill pressure data interpretation from Turrum-3 suggested substantial hydrocarbon columns are present with excellent potential to discover down dip oil legs on gas zones penetrated in a crestal position.

The well intersected the Top of the Latrobe Group (TOL), the Top L100 reservoir and the 54.5Ma unconformity 4m high, 5m low and 9m low to prognosis respectively. The deeper horizons, L200 to L500 reservoir markers inclusive, were intersected 50-65m lower than prognosed. This resulted in deepening of the mapped structure on the SE flank of Turrum, thereby decreasing the potential for the field to extend laterally. No hydrocarbons were encountered in Turrum-4, and the well was plugged and abandoned as a dry hole.

3. Structure

At the level of the Turrum "L" reservoirs, the Latrobe Group is extensively faulted by a series of NW-SE trending, normal faults. These faults form a series of titled faulted blocks with the strata generally dipping to the NE in each fault block. Superimposed over this is a gentle mid-Eocene flexuring with a fold axis trending in a NNE direction. The closure is provided to the NE and SW by sealing faults and by dip closure to the SE and NW (Enclosures 3, 4, & 5).

Turrum-4 was drilled on the SE flank of the field. The target reservoirs (L200-L400) were intersected approximately 60m low to prediction. This indicates the southeastern flanks of the Turrum feature to be steeper than anticipated predrill.

4. Stratigraphy

The Top of the Latrobe Group is interpreted at 1896 mSS, with the interval 1896-1955.5mSS assigned to the Flounder Formation. The interval 1900.0-1947.0mSS is of Early Eocene age (P. asperopolus) and consists predominantly of a silty claystone, overlying a 15m massive sandstone. Partridge (1993; Appendix 1) suggests that the Flounder Formation, was deposited in a short time interval essentially representing one depositional event. The environment of deposition is interpreted to be coastal plain/tidal complex, however the rarity of dinoflagellates and a high proportion of terrestrial kerrogen indicate the section has been subject to a significant terrestrial input.

The Late Paleocene interval (Upper L. balmei) 1959.5-2164.0mSS consists predominantly of siltstone and shales with thin coals (<1.7m thick) and minor thin sands (<4.0m thick). The depositional environment was probably a coastal plain/tidal complex.

The Lower L. balmei section, 2267.0-2690mSS consist of siltstones, shales, sandstones and coal. The sandstones and coals are thicker and more abundant than in the Upper L. balmei section and the greater abundance of dinoflagellates suggests there is a greater marine influence in the Lower L. balmei zone (Partridge 1993; Appendix 1).

5. Hydrocarbons

No hydrocarbons were encountered in Turrum-4.

6. Geophysical Discussion

Turrum-4 drilled the Top of the Latrobe Group (TOL) and the 54.5Ma unconformity 4 m high (0.2%) and 9 m low (0.3%), respectively, from prognosis but underestimated the depths of all deeper horizons by 50-65 m (2.6%) (Summary of Well Results; page 1).

The depth difference is due to actual velocities being faster than those forecast. For example, the TOL-Intra-Lower L. Balmei (ILLB) interval velocity that was assumed pre-drill was 3253 m/s; the Vint for this interval from the well is 10% faster at 3527 m/s.

The Turrum-4 well tie to seismic data was achieved by a synthetic seismogram and Seismic Calibration Log (check-shot corrected sonic log; Enclosure 7 & 8). The synthetic was derived using a 90° phase rotated, reverse polarity wavelet with a 25 Hz centre frequency.

Post Drill Re-map

Post drill interpretation was conducted on a Charisma S workstation loaded with the G82C 3D seismic survey. Inline data spacing was 75 m, fold was 48 and group interval 25 m. Depth maps were generated using the sequential isopach method, with isopachs hung from TOL. Five key time horizons were remapped following the completion of Turrum-4. These included TOL, Base Coal (near base P. Tuberculatus), 54.5Ma, ILLB and L500. Isopachs were made by first contouring well interval velocity data for each interval (Turrum 1 to 4, Marlin 1 to 4 and Morwong-1; Marlin A6 and A24 had no sonics, and were not employed) and then taking the product of each interval's Vint and isochore. Phantom depth maps were made from these horizons to the top of key reservoir zones. Post-drill Depth Structure Maps for TOL, top of L100 reservoir, ILLB and top of L500 reservoir are included as Enclosures 1, 2, 3 and 4 respectively.

Post Turrum-4 re-mapping was undertaken in order to gain an understanding of how the well results would impact on the 'hydrocarbon trap geometry' for the field. The results of this work steepened the flanks of the field, focusing hydrocarbons into a smaller area. This focusing is partly due to structure and partly due to velocity. Higher velocity resulting from the stacked-interval velocity approach has pulled in the structure's north-western and southeastern flanks, with the Turrum-4 well providing maximum limits to the lateral extent of hydrocarbons on the south-eastern flank of the structure.

7. Geological Summary

Turrum-4 is located 2km south-east of the Turrum-3 well and some 6km south-east of the Marlin A platform (Figure 1). The Turrum field comprises Lower L. balmei aged reservoirs situated 500m below the Top of Latrobe Group Marlin Gas Field. Prior to Turrum-4, well intersections through the Turrum reservoirs had identified multiple hydrocarbon (predominantly gas) zones. Few of these zones displayed hydrocarbon-water contacts. The objective of the Turrum-4 well was to establish the existence, or otherwise of oil legs to the Lower L. balmei gas reservoirs. Consequently, Turrum-4 was located on the southeastern flank of the Turrum field, within the predrill postulated (from RFT data) oil legs for these reservoirs.

The Top of Latrobe Group and 54.5 million year sequence boundary were intersected close to prognosis (4m high and 9m low respectively). However, the L200 to L500 markers, inclusive, were intersected considerably low to prognosis (50 to 65m low). This indicates the southeastern flanks of the Turrum feature to be steeper than anticipated predrill (at these levels). Whilst the L100 and L500 reservoirs were expected to be intersected below established oil/water contacts (the only two reservoirs with known contacts), the significantly deeper intersection of the remaining objective reservoirs (L200 to L400) lead to a lack of hydrocarbons being encountered. Consequently, all objectives of the well were water saturated. This result, however, does not preclude the existence of flank oil rims to the Turrum gas sands, but it does restrict the aerial occurrence if present updip of Turrum-4. The structural impact of the Turrum-4 result degrades the volumes of potential flank oil associated with Turrum gas.

The structural variance to prognosis seen at Turrum-4 is a result of the intersection of stratigraphy with faster velocities than were predicted predrill. This resulted in predicted depth to targets in excess of actual target intersections below the 54.5 million year sequence boundary.

The Lower L. balmei section penetrated at the Turrum-4 location also highlights the stratigraphic variability of the Turrum reservoirs. Reservoir packages, bounded above and below by coals, and recognised across the Turrum field and whilst these gross packages are recognised in Turrum-4, reservoir development within these intervals is variable compared with other well penetrations. This variability is commonly anticipated when considering fluvial depositional systems and makes confident correlation of reservoirs difficult. Notable variance from anticipated stratigraphy was observed within the L200 package where no reservoir was encountered, and the L300 package, where significantly thinner sand was developed.

The RFT pressure survey conducted in Turrum-4 revealed important information concerning pressure support for the Turrum reservoirs. Whilst pressure points obtained in the L100 (wet) and L500 (wet) sands at Turrum-4 indicate pressure draw down in line with regional gradient data and the Turrum-3 RFT results, the L200 to L400 sands at Turrum-4 (all wet) show little draw down from the original basin aquifer gradient. This suggests that these reservoirs may be in poor communication with the regional aquifer system.

As a result of all potential reservoir sections within Turrum-4 being water saturated, the well was plugged and abandoned as a dry hole.

FIGURES

FIGURES

TURRUM-4
LOCALITY MAP

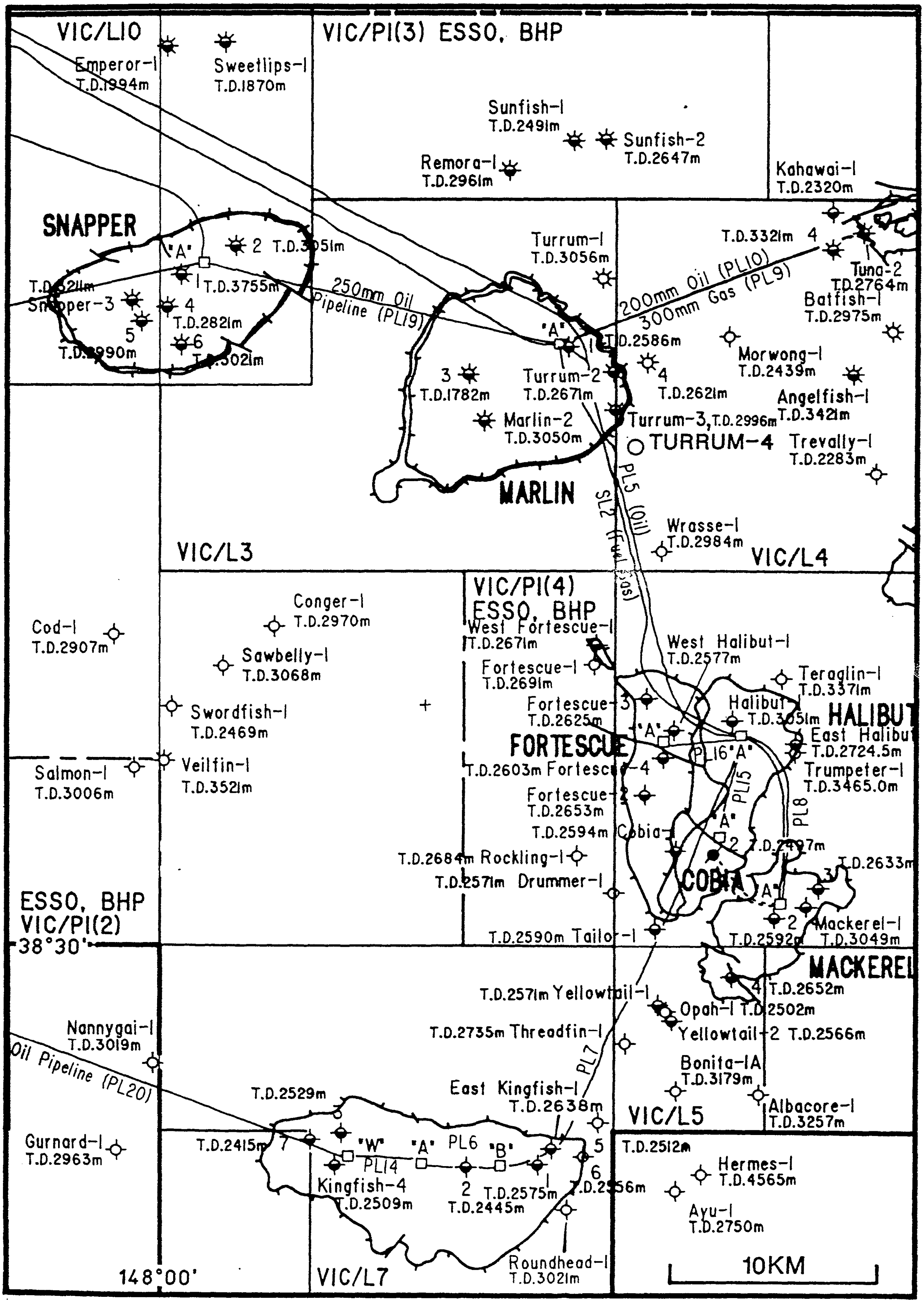

FIGURE 1

Dwg.2281/OP/30

TURRUM 4 SONIC VELOCITY VS DEPTH

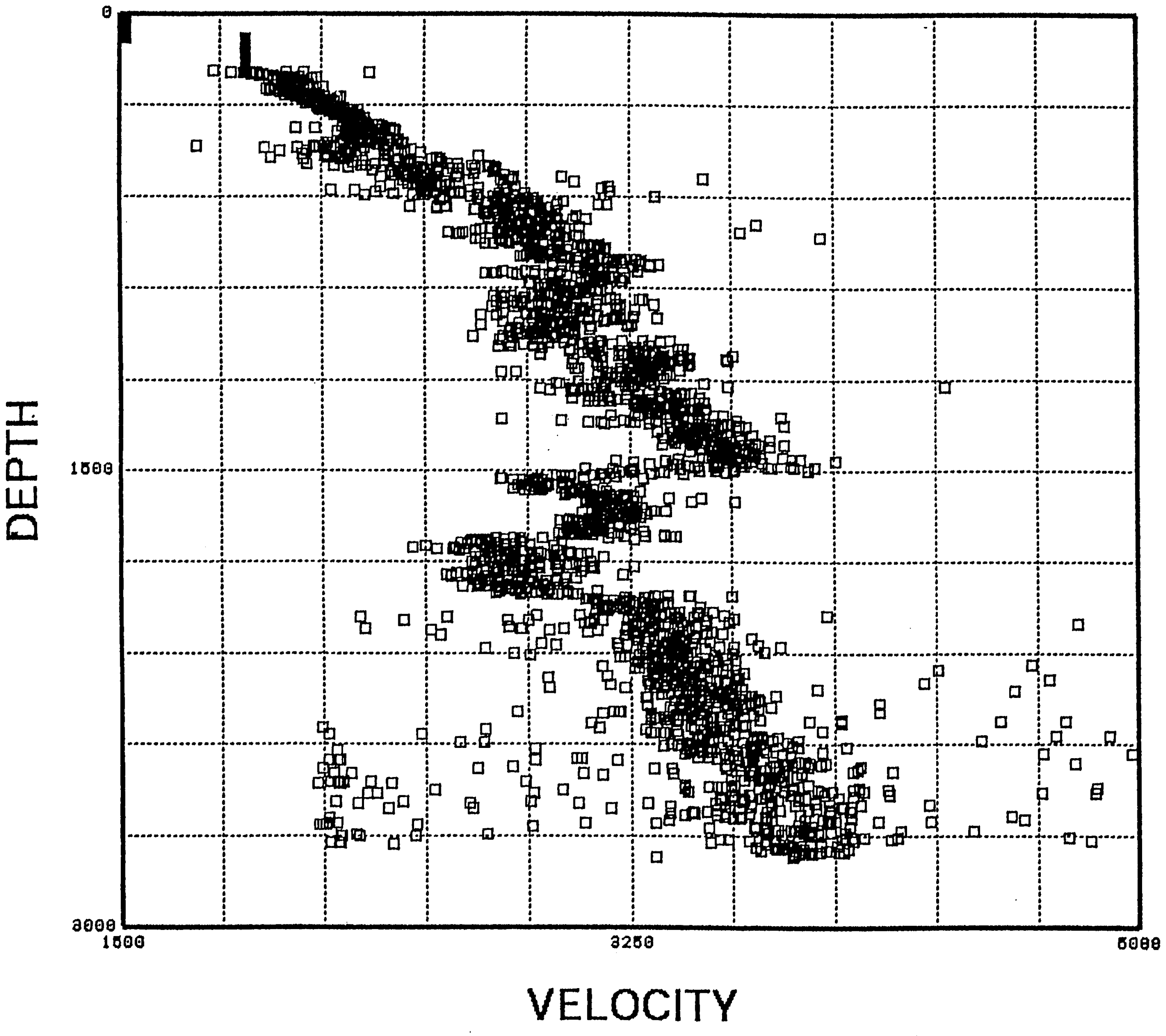

Figure 2 Turrum-4 sonic velocity (check-shot-corrected) versus depth plot. Note key slow zones at 2400-2700m in Turrum-4 and at 1500-1800m and 2100-2600m in Turrum-3 which correlate with coaly intervals (check-shot-corrected).

APPENDIX 1

APPENDIX 1

PALYNOLOGICAL ANALYSIS OF TURRUM-4
GIPPSLAND BASIN

by

ALAN D. PARTRIDGE
BIOSTRATA PTY LTD
A.C.N. 053 800 945

(Submitted 22 January 1993)

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INTERPRETED DATA

INTRODUCTION

Thirty-six samples comprising 32 sidewall cores and 4 cuttings samples were analysed in Turrum-4. Although 60 sidewall cores were shot and 52 recovered, at 18 locations duplicate samples were taken reducing the sample coverage in the well. The author examined all the sidewall cores, and after choosing the most suitable of the duplicate samples and rejecting unsuitable lithologies 32 samples (including 5 coal samples) were selected, cleaned, split and forwarded to Laola Pty Ltd in Perth for processing to prepare the palynological slides. The four cuttings were selected and sent directly to Laola Pty Ltd by personnel at Esso's core store.

An average of 16 grams of cuttings, 9 grams of the clastic sidewall cores and 3 grams of the coals were processed for palynological analysis. Residue yields overall were high in the Latrobe Group and low in the Seaspray Group. Palynomorph concentration on the slides was mostly moderate to high above 2400m but mostly low below this depth. Preservation of palynomorphs was generally poor to fair but deteriorated below about 2500m. Spore-pollen diversity is moderate, averaging 25+ species per sample in the clastic lithologies but low, averaging 10+ species in the coals samples. Microplankton diversity is very low (1-5 species) in the Latrobe Group but moderate (average 12 species) in the overlying Seaspray Group.

Lithological units and palynological zones from the base of the Seaspray Group to Total Depth are given in the following summary. The interpretative data with zone identification and Old and New Confidence Ratings are recorded in Table-1 and basic data on residue yields, preservation and diversity are recorded on Tables-2 and 3. Twenty-three of the samples were counted, and percentage data for these counts are recorded in Tables-4 and 5. All species which have been identified with binomial names are tabulated on palynomorph range charts which present the species on separate charts in order of highest and lowest appearances. Relinquishment list for palynological slides and residues from samples analysed in Turrum-4 are provided at the end of the report.

PALYNOLOGICAL SUMMARY OF TURRUM-4

AGE	UNIT/FACIES		SPORE-POLLEN ZONES (DINOFLAGELLATE ZONES)	DEPTHS (mKB)
MIOCENE TO LATE OLIGOCENE	SEASPRAY GROUP		*P. tuberculatus*	1902.0-1913.0
EARLY EOCENE	LATROBE GROUP	Flounder Formation	*P. asperopolus*	1923.0-1970.0
PALEOCENE	LATROBE GROUP	Undifferentiated coastal plain facies of shale, coals and sands.	Upper *L. balmei* *(A. homomorphum)* Lower *L. balmei* *(E. crassitabulata)*	1982.5-2187.0 *(1982.5-2109.5)* 2290.0-2716.0 *(2390.0)*

GEOLOGICAL COMMENTS

1. The presence of *Foveotriletes lacunosus* diagnostic of the Middle subdivision of the *P. tuberculatus* Zone from both samples near the base of the Seaspray Group suggest the basal Oligocene part of the Lakes Entrance Formation is missing in Turrum-4.

2. The unconformity at 1919m separating the Seaspray Group from the underlying Flounder Formation represents a time break of approximately 20 million years. The interval not represented by sediment is considered to extend from the 30 Ma sequence boundary to the 49.5 Ma sequence boundary as represented on the cycle charts of Haq *et al.* (1987, 1988).

3. There is no evidence in Turrum-4 to indicate that either the Turrum Formation or Gurnard Formation were ever present at this location in the Gippsland Basin. They may never have been deposited at this location due to sediment starvation on the eastern flank of the Marlin Channel.

4. The Flounder Formation consists of a shale/claystone unit between 1919-1963m, which is well defined by the gamma log, underlain by a 15.5 metre thick sand between 1963-1978.5m. Cuttings at 1970m near

the top of this sand gave a *P. asperopolus* Zone age which confirms it is depositionally related to the overlying shale/claystone. The sand can also be distinguished from all sands in the underlying Upper *L. balmei* Zone by being thicker and cleaner according to the gamma log. No equivalent sand was penetrated until below 2300m, and these lie in the Lower *L. balmei* Zone.

5. The palynomorph assemblages from the three sidewall cores and four cuttings analysed from the Flounder Formation are all fairly homogeneous containing assemblages dominated by spore-pollen with dinoflagellates rare to very rare. The deepest sidewall core (at 1962m) and two deepest cuttings (1965m & 1970m) differ slightly in containing a high proportion (est. 20%-50% by volume) of large pieces of structured terrestrial kerogen.

   The three cuttings samples were analysed in an attempt to find the index dinoflagellates *Kisselovia edwardsii* and *K. thompsonae* ms which are used to subdivide the *P. asperopolus* Zone. It was anticipated that the broader sampling interval, with the possibility of some cavings, in the cuttings sample would give a more diverse sampling of the Flounder Formation than obtained from the sidewall cores. The index species were not found, and in fact no clear differences were observed in any of the assemblages. Further, negligible caved palynomorphs were observed from the overlying *P. tuberculatus* Zone and no reworked palynomorphs were recorded from the underlying eroded Upper *L. balmei* Zone.

   The extreme rarity of dinoflagellate in all the samples is unusual for the Flounder Formation. Because of this, and the overall homogeneity of the assemblages, it is suggested the Flounder Formation in Turrum-4 was deposited over only a short time interval, essentially representing one depositional event. Dinoflagellates are rare because they have been diluted by an influx of terrestrial kerogen. This feature has been observed in other sections in the Latrobe Group where depositional rates are high.

6. The unconformity at 1978.5m separating the Flounder Formation from the eroded undifferentiated Latrobe Group represents a time break of at least 3 million years. The erosive event within the Tuna-Flounder Channel system which effected the Turrum-4 site was either the 50.5 Ma or slightly younger 50 Ma sequence boundary, whilst the underlying Upper *L. balmei* Zone is no younger than the 53.5 Ma downlap surface on the cycle charts of Haq *et al.* (1987, 1988).

7. The undifferentiated portion of the Latrobe Group can be subdivided into two on the abundance and thickness of the coals and sands. A third unit of predominantly sand may be present below 2728.5m but as

no suitable samples were available for palynological analysis from this unit it will not be discussed further. The boundary between the two upper units is placed at 2298.5m which is close to the boundary between the Upper and Lower *L. balmei* Zones.

The upper unit from 1978.5-2298.5m is 320 metres thick and is comprised of 83% shale to siltstone, 15% sand and 3% coal. The sands are on average 2 metres thick, but range between 0.6-4.0 metres. The coals are on average 0.5 metres thick but range between 0.3-1.7 metres.

The lower unit from 2298.5-2728.5m is 430 metres thick and is composed of 63% shale to siltstone, 25% sands and 12% coal. The sands are on average 4.2 metres thick but range between 0.4-15.0 metres thick. The coals are on average 1.7 metres thick and range between 0.3 to 8.0 metres thick.

8. The observed dinoflagellate occurrences and their abundance suggest there is more marine influence through the lower unit or in the Lower *L. balmei* Zone than in the upper unit and Upper *L. balmei* Zone.

Examining the sidewall core lithologies there is no obvious characteristic to distinguish those samples containing significant occurrences of dinoflagellates. An equivalent inspection of the gamma, bulk density and neutron porosity electric logs reveal no characteristic that can distinguish between those samples containing dinoflagellates in abundance or of high diversity from samples lacking dinoflagellates.

The lack of any apparent correlation of dinoflagellate bearing palynological assemblage to the lithologies determined from the electric logs highlights an ongoing problem. To apply dinoflagellates successfully to the recognition of further subdivision of the *L. balmei* Zone requires increased sampling density.

9. The five coal samples analysed overall gave poor results principally because it was difficult to concentrate the spore-pollen sufficiently for routine microscope searching. Three samples were indeterminate, one was assigned to the *L. balmei* Zone whist the best sample at 2528m gave a moderate diversity assemblage which was confidently assigned to the Lower *L. balmei* Zone. Because of the uncertainty of obtaining good assemblages from the coals they are not recommended as targets for sidewall cores for palynological analysis.

BIOSTRATIGRAPHY

Zone and age determinations are based on the spore-pollen zonation scheme proposed by Stover & Partridge (1973), partially modified by Stover & Partridge (1982) and Helby, Morgan & Partridge (1987), and a dinoflagellate zonation scheme which has only been published in outline by Partridge (1975, 1976). Other modifications and embellishments to both zonation schemes can be found in the many palynological reports on the Gippsland Basin wells drilled by Esso Australia Ltd. Unfortunately this work is not collated or summarised in a single report.

Author citations for most spore-pollen species can be sourced from Stover & Partridge (1973, 1982), Helby, Morgan & Partridge (1987) or other references cited herein. Author citations for dinoflagellates can be found in the indexes of Lentin & Williams (1985, 1989) in the paper by Wilson (1988), or other references cited herein. Species names followed by "ms" are unpublished manuscript names.

Proteacidites tuberculatus Zone: **1902.0-1913.0 metres**
Late Oligocene-Early Miocene.

The two sidewall cores analysed from the Seaspray Group gave meagre yields from which were recorded moderate diversity spore-pollen and microplankton assemblages which were well preserved. The samples can be confidently assigned to the Middle subdivision of the *P. tuberculatus* Zone on the frequent presence of the spores *Cyatheacidites annulatus* and *Foveotriletes lacunosus*. The remainder of the spore-pollen assemblage consists of long ranging species except for the rare occurrence of *Foraminisporis ozotus* ms and *Monoporites media* Cookson 1947 which are not known to range below the *P. tuberculatus* Zone.

The microplankton assemblage can be assigned to the informal *Operculodinium* spp. Association of Partridge 1976 on the frequent occurrence of the long ranging *Operculodinium centrocarpum* associated with the Oligocene or young index species *Protoellipsodinium simplex* ms, *Pyxidinopsis pontus* ms and *Tectactodinium scabroellipticus* ms.

Rare reworked Permian spores were recorded from both samples.

Proteacidites asperopolus Zone: **1923.0-1970.0 metres** **Early Eocene.**

Three sidewall cores and four cuttings were analysed from the Flounder Formation. The lithology of the sidewall cores consisted of black-brown claystone with silty laminations. All samples gave high yields of moderately concentrated spore-pollen assemblages of high diversity. Average diversity was 32+ species but composite diversity for the zone was a very high 75+ species.

The samples were confidently assigned to the *P. asperopolus* Zone on consistent presence of *Conbaculites apiculatus* ms, *Proteacidites pachypolus* and *Myrtaceidites tenuis* and the inconsistent presence of *Intratriporopollenites notabilis*, *Proteacidites ornatus*, *Santalumidites cainozoicus* and *Sapotaceoidaepollenites rotundus*. The eponymous species *Proteacidites asperopolus* was only recorded from the cuttings sample at 1965m. This species together with *C. apiculatus* ms and *S. rotundus* indicate an age no older while *M. tenuis, P. ornatus* and *I. notabilis* are key species confirming an age no younger than the *P. asperopolus* Zone. *Proteacidites alveolatus* which is essentially restricted to this zone was also recorded as rare specimens in two of the sidewall cores. This species has only been infrequently reported in the basin since originally described by Stover & Partridge (1973) and may be locally restricted.

The three sidewall cores, which were counted, and the four cuttings all contain very similar assemblages dominated by spore-pollen (71%-86% of total count) and fungal spores and hyphae (14%-29%) with dinoflagellates rare to very rare (<1%). The two deepest cuttings and the sidewall core at 1962m are further characterised by a high proportion (est. 20%-50% by volume) of very large pieces of structured terrestrial kerogen. The cuttings contain negligible caved fossils from the overlying *P. tuberculatus* Zone and no reworked fossils from the underlying *L. balmei* Zone were recorded.

Angiosperm pollen, particularly *Proteacidites* spp. 22-24% and *Haloragacidites harrisii* (= *Casuarina* pollen) at 19-23% dominate the spore-pollen assemblages. Spores at 11-16% and gymnosperm pollen at 6-9% are minor components. Of age significance are the abundances of *Conbaculites apiculatus* ms (6.4% at 1954m); *Malvacipollis* spp. (2%-6%); *Myrtaceidites tenuis* (3.6% at 1962m) and *Proteacidites pachypolus* (0.8%-2.7%). *Casuarina* pollen is always more abundant than *Nothofagidites* spp. (6%-16%) and the *Nothofagidites* spp. to *H. harrisii* ratio, which is 0.3 at 1962m and 0.7 at 1954m and 1923m, is clear evidence that the abundance data favours a *P. asperopolus* Zone age.

The commonest *insitu* dinoflagellates were mostly fragmented specimens of *Deflandrea* spp. a few of which could be identified as *D. flounderensis* and one specimen was identified as *D. dartmooria*. Following the discovery of these species in the sidewall cores, the four cuttings samples were processed in the hope that with their broader sampling interval the *Kisselovia* index species could be found. Unfortunately in the cuttings like the sidewall cores the assemblages were overwhelmed by terrestrially derived palynomorphs and detritus.

Upper *Lygistepollenites balmei* Zone: 1982.5-2187.0 metres
and
Apectodinium homomorphum Zone: 1982.5-2109.5 metres Late Paleocene.

All six samples over this zone interval clearly belong to the broader *L. balmei* Zone base on the consistent and frequent to abundant occurrence of *Lygistepollenites balmei*. Associated indicator species which range no young than this zone are *Australopollis obscurus*, *Gambierina rudata*, *Polycolpites langstonii* and *Integricorpus antipodus* ms all of which are less consistent. An age no older than the Upper *L. balmei* Zone is based principally on the occurrence of *Proteacidites annularis* in four of the samples together with *Verrucosisporites kopukuensis* (at 2111.5m and 2187m) and *Anacolosidites acutullus* (at 2187m). Each of these species normally do not range older than the Upper *L. balmei* Zone although poorly preserved specimens compared to *P. annularis* were recorded from the coal samples at 2373.5m and 2524m. Other species in the assemblages which support the zone assignment are the consistent and frequent occurrence of *Haloragacidites harrisii* and *Nothofagidites emarcidus/heterus* and the rare but fairly consistent occurrences of *Malvacipollis subtilis* and *Proteacidites adenanthoides*. These latter species first appear in the Lower *L. balmei* Zone but are generally not consistent until within the Upper *L. balmei* Zone. Overall the assemblages have an average spore-pollen diversity of 34+ species while the composite diversity for the zone is 64+ species.

All 6 samples in this zone were counted with a detailed analysis presented on Tables-4 and 5. In the following discussion average percentages for species discussed are used unless otherwise stated. The spore-pollen assemblages are dominated by spores 38%, with fairly equal amounts of angiosperm pollen 33% and gymnosperm pollen 30%. Spores which exceed 10% in some samples are *Gleicheniidites circinidites* (>15%), *Laevigatosporites* spp. (7.4%), and *Cyathidites* spp. (5.9%). *Proteacidites* spp. (15.4%) is the commonest angiosperm category and *Dilwynites* spp. (9.5%) the commonest gymnosperm. Other species show a high abundance in an occasional sample, such as *L. balmei* (19.5% at 2187m) and *Podocarpidites* spp. (18.6%) and *Australopollis obscurus* (17.3%) both at 2109.5m. *Phyllocladidites mawsonii* (5.3%) is noticeably less abundant than in underlying Lower *L. balmei* Zone, whilst *Nothofagidites* spp. (3.7%) and *H. harrisii* (1.9%) are consistent minor components in counts of the Upper *L. balmei* Zone but are irregular in occurrence in the Lower *L. balmei* Zone.

The only dinoflagellate recorded over the interval was the short spined variety of *Apectodinium homomorphum* whose occurrence confirms presence of the *A. homomorphum* Dinoflagellate Zone. A single specimen was recorded at 2109.5m, a few specimens at 2002m, but the species was abundant at 1982.5m where it comprised nearly 60% of total count.

Lower *Lygistepollenites balmei* Zone: 2290.0-2216.0 metres
and
***Eisenackia crassitabulata* Dinoflagellate Zone: 2390.0 metres**
Early Paleocene.

Twelve of the 21 samples from 2290m to T.D. can be confidently assigned to the Lower *L. balmei* Zone. Most of the remainder contain only the broader *L. balmei* Zone assemblage or are indeterminate. The most important indicator is *Proteacidites angulatus* in eleven samples whilst the occurrence of *Juxtacolpus pieratus* ms at 2327.5m confirms an age no younger than the Lower *L. balmei* Zone for this sample. The total range of *P. angulatus* s.s. is now considered to lie within this zone and it is no longer believed to range into the *T. longus* Zone as stated in Stover & Partridge (1973, p.264). Other features of the assemblages in Turrum-4 considered characteristic of the zone are the consistent occurrence of *L. balmei*, and less consistent but still regular occurrences of the species *Australopollis obscurus, Gambierina rudata* and *Peninsulapollis gillii*. The sporadic occurrence of *Tetracolporites verrucosus* also confirm an age no younger than this zone. Average spore-pollen diversity was 21+ species in samples assigned to Lower subdivision but only 11+ species in samples assigned to broader *L. balmei* Zone or given as indeterminate. Composite recorded diversity of all samples in zone is 60+ species.

Counts of 14 of the 21 samples in the zone are given on Tables-4 and 5. in the following discussion of the spore-pollen abundances the two coal samples (at 2373.5m & 2528m) and the very low count of spore-pollen from 2585m are excluded when calculating average percentages quoted. In the remaining 11 samples which are mostly claystones, gymnosperms dominate (49%) followed by angiosperm pollen (28%) and spores (23%). The dominant gymnosperm is *Phyllocladidites mawsonii* 19% (range 9%-27%) with *Podocarpidites* spp. 11% (3%-30%) and *Dilwynites* spp. 8% (0%-22%) the next most common. The eponymous species *L. balmei* is consistently frequent at 5% with a range of abundances from 1% to 10%. Amongst the angiosperms *Proteacidites* spp. 18% is the only consistently abundant type. The three commonest spore types are *Gleicheniidites* spp. 7%; *Laevigatosporites* spp. 6%, and *Stereisporites* spp. 5%. The counts of the coals are similar to the average abundances in the clastic sediments <u>except</u> that *Dilwynites* spp. is rare <1% and the coals often contain unique abundances of spore species such as *Latrobosporites crassus* 21% at 2373.5m and *Stereisporites* n.sp. at 2726m.

The occurrence of microplankton within the Lower *L. balmei* Zone is best described as sporadic even though a moderate 18+ species diversity is recorded for the whole zone. Of most significance is the total range and abundance of *Glaphyrocysta retiintexta* which occurs in 4 of the 6 sidewall cores of clastic lithology between 2327.5m-2503.5m. Samples in this latter interval contain the highest diversity and the occurrence of *Eisenackia* *crassitabulata* at 2390m confirms the presence of the *E. crassitabulata* Zone. There is little doubt that all the dinoflagellates recorded are displaying only partial ranges reflecting intermittent incursions of marine influence into a predominantly coastal plain environment. Characteristic of these incursions is that most samples containing microplankton are dominated by a single species.

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TABLE-1: INTERPRETATIVE PALYNOLOGICAL DATA FOR TURRUM-4, GIPPSLAND BASIN.

SHEET 1 OF 2

SAMPLE TYPE	DEPTH (m)	SPORE-POLLEN ZONES	*CR OLD	*CR NEW	MICROPLANKTON ZONES (OR ASSOCIATIONS)	*CR OLD	*CR NEW	COMMENTS
SWC 60	1902.0	Middle *P. tuberculatus*	0	B2	(*Operculodinium* spp.)	0	B3	*Monoporites media* present.
SWC 59	1913.0	Middle *P. tuberculatus*	0	B2	(*Operculodinium* spp.)	0	B3	FAD *Foveotriletes lacunosus*.
SWC 58	1923.0	*P. asperopolus*	1	B1				LAD *Myrtaceidites tenuis*.
CUTTINGS	1930	*P. asperopolus*	3	D2				
CUTTINGS	1940	*P. asperopolus*	3	D2				
SWC 56	1954.0	*P. asperopolus*	1	B1				*Conbaculites apiculatus* 6%.
SWC 55	1962.0	*P. asperopolus*	1	B1				FAD *Sapotaceoidaepollenites rotundus*.
CUTTINGS	1965	*P. asperopolus*	3	D1				*Proteacidites asperopolus* present.
CUTTINGS	1970	*P. asperopolus*	3	D1				FAD *Conbaculites apiculatus* ms.
SWC 54	1982.5	Upper *L. balmei*	2	B4	*A. homomorphum*	2	B3	LAD *Lygistepollenites balmei*. Microplankton 59%.
SWC 53	2002.0	Upper *L. balmei*	0	B1	*A. homomorphum*	2	B3	*Proteacidites annularis* present.
SWC 52	2076.0	Upper *L. balmei*	1	B4				Poor *P. annularis* only.
SWC 51	2109.5	*L. balmei*	1	B1	*A. homomorphum*	2	B3	*Australopollis obscurus* 17%.
SWC 50	2111.5	Upper *L. balmei*	4	B4				*Verrucosisporites kopukuensis* present.
SWC 49	2187.0	Upper *L. balmei*	1	B1				FAD *Proteacidites annularis*.
SWC 46	2290.0	Lower *L. balmei*	1	B2				LAD *Proteacidites angulatus*.
SWC 45	2302.5	Lower *L. balmei*	1	B1				LAD *Tetracolporites verrucosus*.
SWC 43	2308.0	Lower *L. balmei*	1	B2				
SWC 40	2323.0	*L. balmei*	2	B3				Sandstone=very low yield.
SWC 38	2327.5	Lower *L. balmei*	2	B3	(*G. retiintexta*)	1	B3	*Juxtacolpus pieratus* present. Microplankton 34%.

TABLE-1: INTERPRETATIVE PALYNOLOGICAL DATA FOR TURRUM-4, GIPPSLAND BASIN.

SHEET 2 OF 2

SAMPLE TYPE	DEPTH (m)	SPORE-POLLEN ZONES	*CR OLD	*CR NEW	MICROPLANKTON ZONES (OR ASSOCIATIONS)	*CR OLD	*CR NEW	COMMENTS
SWC 35	2365.0	*L. balmei*	1	B1				Few diagnostic species
SWC 34	2373.5	*L. balmei*	1	B2				Coal with *Latrobosporites crassus* dominant = 21%.
SWC 33	2390.0	Lower *L. balmei*	0	B2	*E. crassitabulata*	0	B3	Microplankton 15%, with *G. retiintexta* dominant species.
SWC 29	2441.5	Lower *L. balmei*	1	B2	(*G. retiintexta*)	1	B3	Microplankton <3%.
SWC 28	2488.0	*L. balmei*	2	B3				Sandstone = low yield.
SWC 26	2503.5	Lower *L. balmei*	1	B2	(*G. retiintexta*)	1	B3	Microplankton 8%.
SWC 24	2528.0	Lower *L. balmei*	1	B2				Coal with *Juxtacolpus pieratus*.
SWC 23	2541.0	Lower *L. balmei*	1	B2				*Apectodinium* sp. = 30%.
SWC 21	2585.0	*L. balmei*	2	B3				*Vozzhennikovia angulatus* Wilson 74%.
SWC 19	2591.5	Indeterminate						Coal with low diversity. Non-diagnostic assemblage.
SWC 17	2623.0	*L. balmei*	1	B2				Low diversity due to poor preservation.
SWC 13	2657.0	Lower *L. balmei*	1	B2				*Proteacidites angulatus* 5%.
SWC 8	2696.0	Lower *L. balmei*	2	B3				
SWC 7	2703.0	Indeterminate						Coal with low diversity. Non-diagnostic assemblage.
SWC 6	2716.0	Lower *L. balmei*	1	B2				FAD *Proteacidites angulatus*.
SWC 4	2726.0	Indeterminate						Coal with monospecific spore assemblage.

*CR = Confidence Ratings OLD & NEW
FAD = First Appearance Datum
LAD = Last Appearance Datum

CONFIDENCE RATINGS

The concept of Confidence Ratings applied to palaeontological zone picks was originally proposed by Dr. L.E. Stover in 1971 to aid the compilation of micropalaeontological and palynological data and to expedite the revision of the then rapidly evolving zonation concepts in the Gippsland Basin. The original or OLD scheme which mixes confidence in fossil species assemblage with confidence due to sample type has gradually proved to be rather limiting as additional refinements to existing zonations have been made. With the development of the STRATDAT computer database as a replacement for the increasingly unwieldy paper based Palaeontological Data Sheet files a NEW set of Confidence Ratings have been proposed. Both OLD and NEW Confidence Ratings for zone picks are given on Table 1, and their meanings are summarised below:

OLD CONFIDENCE RATINGS

0 SWC or CORE, <u>Excellent Confidence</u>, assemblage with zone species of spore, pollen <u>and</u> microplankton.

1 SWC or CORE, <u>Good Confidence</u>, assemblage with zone species of spores and pollen <u>or</u> microplankton.

2 SWC or CORE, <u>Poor Confidence</u>, assemblage with non-diagnostic spores, pollen and/or microplankton.

3 CUTTINGS, <u>Fair Confidence</u>, assemblage with zone species of either spore and pollen or microplankton, or both.

4 CUTTINGS, <u>No Confidence</u>, assemblage with non-diagnostic spores, pollen and/or microplankton.

NEW CONFIDENCE RATINGS

Alpha codes: Linked to sample type

A Core

B Sidewall core

C Coal cuttings

D Ditch cuttings

E Junk basket

F Miscellaneous/unknown

G Outcrop

Numeric codes: Linked to fossil assemblage

1 **Excellent confidence:** High diversity assemblage recorded with key zone species.

2 **Good confidence:** Moderately diverse assemblage recorded with key zone species.

3 **Fair confidence:** Low diversity assemblage recorded with key zone species.

4 **Poor confidence:** Moderate to high diversity assemblage recorded without key zone species.

5 **Very low confidence:** Low diversity assemblage recorded without key zone species.

BASIC DATA

TABLE 2: BASIC SAMPLE DATA

TABLE 3: BASIC PALYNOMORPH DATA

TABLE 4: PALYNOMORPH PERCENTAGES

TABLE 5: SPORE-POLLEN PERCENTAGES

RELINQUISHMENT LISTS OF PALYNOLOGICAL SLIDES & RESIDUES

PALYNOMORPH RANGE CHARTS

CHART-1: Palynomorph Range Chart for interval 1902-1970m.
Relative Abundance by Highest Appearance

CHART-2: Palynomorph Range Chart for interval 1902-1970m
Relative Abundance by Lowest Appearance

CHART-3: Palynomorph Range Chart for interval 1982.5-2726m
Relative Abundance by Highest Appearance

CHART-4: Palynomorph Range Chart for interval 1982.5-2726m
Relative Abundance by Lowest Appearance

TABLE-2: BASIC SAMPLE DATA FOR TURRUM-4, GIPPSLAND BASIN.

SAMPLE TYPE	DEPTH (m)	LITHOLOGY	SAMPLE WT (g.)	RESIDUE YIELD
SWC 60	1902.0	Calcisiltite, tr. glauc. in burrows	10.7	Low
SWC 59	1913.0	Cal. claystone 5-10% glauconite	9.4	Very low
SWC 58	1923.0	Calc. claystone minor sst. laminations	9.1	High
CUTTINGS	1930		16.8	High
CUTTINGS	1940		15.6	High
SWC 56	1954.0	Claystone with silty laminations	9.4	High
SWC 55	1962.0	Laminated claystone/siltstone	9.8	High
CUTTINGS	1965		15.5	High
CUTTINGS	1970		15.9	High
SWC 54	1982.5	Claystone/conchoidal fracture	8.9	High
SWC 53	2002.0	Claystone with silty laminae	9.3	High
SWC 52	2076.0	Claystone/subconchoidal fracture	9.7	High
SWC 51	2109.5	Claystone with carbonaceous laminae	6.9	High
SWC 50	2111.5	Claystone/massive/subconchoidal fract.	8.4	High
SWC 49	2187.0	Laminated claystone/siltstone	6.5	High
SWC 46	2290.0	Massive claystone/siltstone	10.6	High
SWC 45	2302.5	Massive claystone	8.1	High
SWC 43	2308.0	Claystone with faint laminations	9.5	High
SWC 40	2323.0	Lt. grey sandstone/clayey matrix	6.6	Very low
SWC 38	2327.5	Mottled clayey sandstone	11.1	High
SWC 35	2365.0	Mottled sandstone/minor clay laminae	10.0	Moderate
SWC 34	2373.5	Coal/brittle	2.2	High
SWC 33	2390.0	Dk gry claystone	9.5	High
SWC 29	2441.5	Dk gry claystone/faint laminae	10.3	High
SWC 28	2488.0	Med. gry v.f. sandstone	8.0	Low
SWC 26	2503.5	Laminated claystone/siltstone	9.4	High
SWC 24	2528.0	Coal/brittle	4.7	Moderate
SWC 23	2541.0	Massive dk gry claystone	10.3	High
SWC 21	2585.0	Dk gry firm claystone	10.3	High
SWC 19	2591.5	Coal/brittle	3.9	High
SWC 17	2623.0	Brn gry silty claystone	10.4	Moderate
SWC 13	2657.0	Claystone with siltstone laminae	10.2	High
SWC 8	2696.0	Lt gry sandstone/clay matrix	8.1	High
SWC 7	2703.0	Coal/brittle	2.7	High
SWC 6	2716.0	Claystone/rare sandy laminations	7.4	High
SWC 4	2726.0	Coal/brittle	2.2	High

TABLE-3: **BASIC PALYNOMORPH DATA FOR TURRUM-4, GIPPSLAND BASIN.**

SHEET 1 OF 2

SAMPLE TYPE	DEPTH (m)	PALYNOMORPH CONCENTRATION	PRESERVATION	No. S-P Species*	MICROPLANKTON ABUNDANCE	No. of Species*
SWC 60	1902.0	High	Good	22	Abundant	12
SWC 59	1913.0	Moderate	Good	21	Abundant	12
SWC 58	1923.0	High	Good	49	Very Rare	3
CUTTINGS	1930	Moderate	Fair	19	Very Rare	2
CUTTINGS	1940	Moderate	Fair	19	Very Rare	2
SWC 56	1954.0	High	Good	51	Very Rare	1
SWC 55	1962.0	Moderate	Fair	33	Very Rare	1
CUTTINGS	1965	Moderate	Fair-good	29		
CUTTINGS	1970	High	Fair-good	29	Very Rare	2
SWC 54	1982.5	Low	Poor-fair	24	Abundant	1
SWC 53	2002.0	Moderate	Poor	36	Rare	1
SWC 52	2076.0	High	Good	41		
SWC 51	2109.5	Moderate	Poor-fair	30	Very rare	1
SWC 50	2111.5	High	Fair-good	38		
SWC 49	2187.0	High	Fair	39		
SWC 46	2290.0	Moderate	Poor	18	Rare	1
SWC 45	2302.5	High	Fair	26	Frequent	2
SWC 43	2308.0	High	Fair	22		
SWC 40	2323.0	Low	Poor-fair	7		
SWC 38	2327.5	Low	Poor	22	Abundant	4
SWC 35	2365.0	Moderate	Fair-good	33	Rare	1
SWC 34	2373.5	Moderate	Poor-fair	16		
SWC 33	2390.0	High	Poor-fair	25	Common	5
SWC 29	2441.5	Low	Poor	27	Rare	3
SWC 28	2488.0	Low	Fair	8		
SWC 26	2503.5	Moderate	Poor	25	Frequent	4
SWC 24	2528.0	Moderate	Poor	24		
SWC 23	2541.0	Moderate	Fair	20	Abundant	1
SWC 21	2585.0	Low	Very poor	11	Abundant	3
SWC 19	2591.5	Very low	Poor	6		
SWC 17	2623.0	Low	Poor	14		
SWC 13	2657.0	Low	Poor	16	Rare	1
SWC 8	2696.0	Low	Poor	15		

TABLE-3: BASIC PALYNOMORPH DATA FOR TURRUM-4, GIPPSLAND BASIN.

SHEET 2 OF 2

SAMPLE TYPE	DEPTH (m)	PALYNOMORPH CONCENTRATION	PRESERVATION	No. S-P Species*	MICROPLANKTON ABUNDANCE	No. of Species*
SWC 7	2703.0	Low	Poor-fair	5		
SWC 6	2716.0	Moderate	Poor	20		
SWC 4	2726.0	Very low	Fair	2		

*DIVERSITY:
Very low = 1- 5 species
Low = 6-10 species
Moderate = 11-25 species
High = 26-74 species
Very high = 75+ species

TABLE-4: PALYNOMORPHS PERCENTAGES FOR TURRUM-4 PAGE 1 OF 4						
	1923.0	1954.0	1962.0	1982.5	2002.0	2076.0
	SWC-58	SWC-56	SWC-55	SWC-54	SWC 53	SWC 52
MAJOR CATEGORIES %						
Spores %	10.3%	11.4%	9.2%	16.8%	23.1%	43.9%
Gymnosperm Pollen %	6.5%	4.6%	7.6%	7.2%	11.2%	21.2%
Angiosperm Pollen %	67.7%	55.4%	70.2%	13.2%	34.9%	31.2%
TOTAL SPORE-POLLEN %	84.5%	71.4%	87.0%	37.1%	69.2%	96.3%
Fungal Spores and Hyphae %	14.8%	28.6%	22.9%	3.0%	30.8%	3.7%
Dinoflagellate %	0.6%		0.8%	59.9%		
DINOFLAGELLATES						
Dinoflagellates Undiff.	100.0%		100.0%			
Apectodinium homomorphum				100.0%		
Apectodinium spp.						
Cyclopsiella sp.						
Deflandrea spp.						
Eisenackia crassitabulata						
Glaphrocysta retiintexta						
Glaphrocysta spp.						
Paralecaniella indentata						
Spinidinium spp.						
Vozzhennikovia angulata						
DINOFLAGELLATE COUNT	1		1	100		
TOTAL COUNT	155	175	145	167	169	189

TABLE-4: PALYNOMORPHS PERCENTAGES FOR TURRUM-4 PAGE 2 OF 4						
	2109.5	2111.5	2187.0	2302.5	2308.0	2327.5
	SWC 51	SWC 50	SWC 49	SWC 45	SWC 43	SWC 38
MAJOR CATEGORIES %						
Spores %	23.6%	50.0%	19.6%	32.5%	15.3%	8.0%
Gymnosperm Pollen %	31.3%	23.8%	56.6%	41.3%	53.1%	26.3%
Angiosperm Pollen %	30.8%	17.8%	20.9%	20.9%	22.6%	25.7%
TOTAL SPORE-POLLEN %	85.7%	91.6%	97.0%	94.7%	91.0%	60.0%
Fungal Spores and Hyphae %	13.7%	7.9%	3.8%	5.3%	9.0%	6.3%
Dinoflagellate %	0.5%	0.5%				33.7%
DINOFLAGELLATES						
Dinoflagellates Undiff.		100.0%				5.1%
Apectodinium homomorphum	100.0%					
Apectodinium spp.						
Cyclopsiella sp.						
Deflandrea spp.						
Eisenackia crassitabulata						
Glaphrocysta retiintexta						52.5%
Glaphrocysta spp.						
Paralecaniella indentata						42.4%
Spinidinium spp.						
Vozzhennikovia angulata						
DINOFLAGELLATE COUNT	1	1				59
TOTAL COUNT	182	214	237	206	177	175

TABLE-4: PALYNOMORPHS PERCENTAGES FOR TURRUM-4			PAGE 3 OF 4			
	2365.0	2373.5	2390.0	2441.5	2503.5	2528.0
	SWC 35	SWC 34	SWC 33	SWC 29	SWC 26	SWC 24
		COAL				COAL
MAJOR CATEGORIES %						
Spores %	13.3%	33.9%	19.7%	22.6%	12.1%	25.0%
Gymnosperm Pollen %	57.0%	36.5%	42.9%	45.2%	47.1%	42.2%
Angiosperm Pollen %	16.4%	19.1%	14.3%	19.1%	17.1%	31.0%
TOTAL SPORE-POLLEN %	86.7%	89.6%	76.9%	87.0%	76.4%	98.3%
Fungal Spores and Hyphae %	9.4%	10.4%	9.5%	10.4%	15.7%	1.7%
Dinoflagellate %	3.9%		13.6%	2.6%	7.9%	
DINOFLAGELLATES						
Dinoflagellates Undiff.	20.0%		10.0%	33.3%	54.5%	
Apectodinium homomorphum						
Apectodinium spp.						
Cyclopsiella sp.	80.0%					
Deflandrea spp.						
Eisenackia crassitabulata			5.0%			
Glaphrocysta retiintexta			85.0%	66.7%	45.5%	
Glaphrocysta spp.						
Paralecaniella indentata						
Spinidinium spp.						
Vozzhennikovia angulata						
DINOFLAGELLATE COUNT	5		20	3	11	
TOTAL COUNT	128	115	147	115	140	116

TABLE-4: PALYNOMORPHS PERCENTAGES FOR TURRUM-4				PAGE 4 OF 4		
	2541.0	2585.0	2623.0	2657.0	2761.0	
	SWC 23	SWC 21	SWC 17	SWC 13	SWC 6	
MAJOR CATEGORIES %						
Spores %	21.2%	5.9%	10.2%	13.9%	30.6%	
Gymnosperm Pollen %	16.2%	4.4%	49.1%	29.9%	29.4%	
Angiosperm Pollen %	17.2%	1.5%	35.2%	27.8%	29.4%	
TOTAL SPORE-POLLEN %	54.5%	11.8%	94.4%	71.5%	89.4%	
Fungal Spores and Hyphae %	15.7%	2.9%	5.6%	27.8%	10.6%	
Dinoflagellate %	29.8%	85.3%		0.7%		
DINOFLAGELLATES						
Dinoflagellates Undiff.		1.7%				
Apectodinium homomorphum						
Apectodinium spp.	100.0%					
Cyclopsiella sp.						
Deflandrea spp.		1.7%				
Eisenackia crassitabulata						
Glaphrocysta retiintexta						
Glaphrocysta spp.						
Paralecaniella indentata						
Spinidinium spp.		10.3%		100.0%		
Vozzhennikovia angulata		86.2%				
DINOFLAGELLATE COUNT	59	58		1		
TOTAL COUNT	198	68	108	144	85	

TABLE-5: SPORE-POLLEN PERCENTAGES FOR TURRUM-4 PAGE 1 OF 4						
	1923.0	1954.0	1962.0	1982.5	2002.0	2076.0
	SWC-58	SWC-56	SWC-55	SWC-54	SWC 53	SWC 52
TRILETE SPORES undiff.	3.1%	1.6%	4.5%		1.7%	1.6%
Baculatisporites spp.				1.6%	1.7%	1.1%
Conbaculites apiculatus ms		6.4%				
Cyathidites spp.	3.8%	2.4%	2.7%		5.1%	3.3%
Gleicheniidites/Clavifera spp.	0.8%	4.8%	1.8%	33.9%	16.2%	16.5%
Herkosporites elliottii						
Latrobosporites crassus						
Stereisporites spp.	2.3%			6.5%	4.3%	5.5%
Trilites tuberculiformis						
MONOLETE SPORES undiff.					0.9%	
Laevigatosporites spp.	2.3%	0.8%	1.8%	3.2%	2.6%	16.5%
Peromonolites spp.					0.9%	1.1%
TOTAL SPORES	12.2%	16.0%	10.7%	45.2%	33.3%	45.6%
GYMNOSPERM POLLEN						
Araucariacites australis			0.9%			0.5%
Dilwynites spp.		2.4%	1.8%	11.3%	2.6%	4.4%
Lygistepollenites balmei				1.6%	4.3%	3.8%
Lygistepollenites florinii	3.1%	1.6%	4.5%	1.6%		2.2%
Microcachryidites antarticus					0.9%	
Phyllocladidites mawsonii	3.1%	2.4%			4.3%	6.0%
Phyllocladidites ovalis	0.8%					
Podocarpidites spp.	0.8%		1.8%	3.2%	3.4%	2.7%
Podosporites microsaccatus				1.6%	0.9%	2.2%
TOTAL GYMNOSPERM POLLEN	7.6%	6.4%	8.9%	19.4%	16.2%	22.0%
ANGIOSPERM POLLEN undiff.	1.5%	1.6%	0.9%		0.9%	1.1%
Australopollis obscurus					2.6%	
Casuarina (H. harrisii)	22.1%	19.2%	23.2%	1.6%	1.7%	2.2%
Cupanieidites orthoteichus	0.8%	1.6%	0.9%			
Dicotetradites clavatus	3.8%		1.8%			
Gambierina rudata						
Ilexpollenites sp.	1.5%	0.8%				
Malvacipollis spp.	2.3%	3.2%	6.3%	1.6%	0.9%	
Myrtaceidites spp.		1.6%				
Myrtaceidites tenuis		0.8%	3.6%			
Nothofagidites "brassi" types A/B	11.5%	6.4%	3.6%	3.2%	4.3%	1.1%
Nothofagidites "brassi" type C		4.8%				
Nothofagidites "fusca" type A/B	3.8%	2.4%	2.7%		0.9%	0.5%
Peninsulapollis gillii						
Periporopollenites spp.		0.8%				1.1%
Proteacidites angulatus						
Proteacidites annularis			0.9%			0.5%
Proteacidites pachypolus	0.8%	1.6%	2.7%			
Proteacidites spp.	21.4%	20.0%	20.5%	17.7%	29.1%	19.2%
Tetracolporites spp.						2.7%
Tricolp(or)ates undiff.	10.7%	12.8%	15.2%	8.1%	5.1%	3.3%
Triporopollenites spp. (small)				3.2%	5.1%	0.5%
TOTAL ANGIOSPERM POLLEN	80.2%	77.6%	82.1%	35.5%	50.4%	32.4%
TOTAL SPORES-POLLEN COUNT	131	125	112	62	117	182

TABLE-5: SPORE-POLLEN PERCENTAGES FOR TURRUM-4 PAGE 2 OF 4						
	2109.5	2111.5	2187.0	2302.5	2308.0	2327.5
	SWC 51	SWC 50	SWC 49	SWC 45	SWC 43	SWC 38
TRILETE SPORES undiff.		1.5%	3.1%			
Baculatisporites spp.	0.6%	2.6%	0.9%	0.5%	1.2%	
Conbaculites apiculatus ms						
Cyathidites spp.	5.1%	19.9%	1.8%	0.5%	1.2%	1.0%
Gleicheniidites/Clavifera spp.	7.7%	11.7%	7.1%	14.4%	3.1%	3.8%
Herkosporites elliottii		0.5%		0.5%	0.6%	1.0%
Latrobosporites crassus						
Stereisporites spp.	3.2%	1.5%	0.9%	6.2%	2.5%	2.9%
Trilites tuberculiformis	1.9%	6.1%	1.3%			
MONOLETE SPORES undiff.			0.4%			
Laevigatosporites spp.	7.7%	10.2%	4.9%	11.3%	7.5%	4.8%
Peromonolites spp.	1.3%	0.5%		1.0%	0.6%	
TOTAL SPORES	27.6%	54.6%	20.4%	34.4%	16.8%	13.3%
GYMNOSPERM POLLEN						
Araucariacites australis		1.0%	0.9%	1.0%	1.2%	1.0%
Dilwynites spp.	5.8%	10.7%	22.1%	7.2%	22.4%	7.6%
Lygistepollenites balmei	0.6%	2.0%	19.5%	2.6%	5.0%	9.5%
Lygistepollenites florinii	3.2%	3.6%	2.2%		1.2%	
Microcachryidites antarticus			0.4%			
Phyllocladidites mawsonii	6.4%	5.1%	10.2%	25.6%	17.4%	15.2%
Phyllocladidites ovalis						1.0%
Podocarpidites spp.	18.6%	3.6%	2.7%	6.2%	6.8%	3.8%
Podosporites microsaccatus	1.9%		0.9%	1.0%	4.3%	5.7%
TOTAL GYMNOSPERM POLLEN	36.5%	26.0%	58.8%	43.6%	58.4%	43.8%
ANGIOSPERM POLLEN undiff.	0.6%		0.4%			
Australopollis obscurus	17.3%	3.6%				4.8%
Casuarina (H. harrisii)	3.8%	1.0%	1.3%	0.5%		
Cupanieidites orthoteichus						
Dicotetradites clavatus	0.6%					
Gambierina rudata					0.6%	
Ilexpollenites sp.						
Malvacipollis spp.		0.5%	0.4%			
Myrtaceidites spp.						
Myrtaceidites tenuis						
Nothofagidites "brassi" types A/B	1.9%	2.6%	2.2%	4.6%	6.8%	7.6%
Nothofagidites "brassi" type C						
Nothofagidites "fusca" type A/B	1.9%	0.5%	3.1%			1.9%
Peninsulapollis gillii						
Periporopollenites spp.						
Proteacidites angulatus				0.5%	0.6%	
Proteacidites annularis			0.4%			
Proteacidites pachypolus						
Proteacidites spp.	7.7%	7.7%	10.2%	14.4%	13.0%	21.0%
Tetracolporites spp.	0.6%		0.4%	1.5%	3.1%	1.0%
Tricolp(or)ates undiff.		1.0%	2.7%		0.6%	6.7%
Triporopollenites spp. (small)	1.3%	2.6%	0.4%	0.5%		
TOTAL ANGIOSPERM POLLEN	35.9%	19.4%	21.7%	22.1%	24.8%	42.9%
TOTAL SPORES-POLLEN COUNT	156	196	228	195	161	105

TABLE-5: SPORE-POLLEN PERCENTAGES FOR TURRUM-4 PAGE 3 OF 4						
	2365.0	2373.5	2390.0	2441.5	2503.5	2528.0
	SWC 35	SWC 34	SWC 33	SWC 29	SWC 26	SWC 24
		COAL				COAL
TRILETE SPORES undiff.				2.0%	0.9%	3.5%
Baculatisporites spp.	0.9%			1.0%	0.9%	
Conbaculites apiculatus ms						
Cyathidites spp.	0.9%	1.0%			0.9%	7.9%
Gleicheniidites/Clavifera spp.	5.4%	9.7%	9.7%	6.0%	7.5%	5.3%
Herkosporites elliottii	0.9%					
Latrobosporites crassus		21.4%				
Stereisporites spp.	1.8%	1.9%	8.0%	6.0%	0.9%	3.5%
Trilites tuberculiformis					1.9%	
MONOLETE SPORES undiff.				1.0%		
Laevigatosporites spp.	3.6%	3.9%	7.1%	9.0%	2.8%	2.6%
Peromonolites spp.	1.8%		0.9%	1.0%		2.6%
TOTAL SPORES	15.3%	37.9%	25.7%	26.0%	15.9%	25.4%
GYMNOSPERM POLLEN	0.9%					
Araucariacites australis			0.9%	1.0%	1.9%	
Dilwynites spp.	14.4%	1.0%	11.5%	12.0%	5.6%	0.9%
Lygistepollenites balmei	9.0%	7.8%	0.9%	8.0%	10.3%	6.1%
Lygistepollenites florinii	1.8%	3.9%	1.8%		1.9%	3.5%
Microcachryidites antarticus	1.8%	1.0%	1.8%	1.0%	1.9%	
Phyllocladidites mawsonii	23.4%	18.4%	18.6%	17.0%	27.1%	20.2%
Phyllocladidites ovalis			0.9%			
Podocarpidites spp.	12.6%	8.7%	17.7%	4.0%	12.1%	7.9%
Podosporites microsaccatus	1.8%		1.8%	9.0%	0.9%	4.4%
TOTAL GYMNOSPERM POLLEN	65.8%	40.8%	55.8%	52.0%	61.7%	43.0%
ANGIOSPERM POLLEN undiff.	0.9%	1.0%				1.8%
Australopollis obscurus	1.8%		2.7%		3.7%	8.8%
Casuarina (H. harrisii)		1.9%			0.9%	
Cupanieidites orthoteichus						
Dicotetradites clavatus						
Gambierina rudata		1.0%			0.9%	
Ilexpollenites sp.						
Malvacipollis spp.						
Myrtaceidites spp.						
Myrtaceidites tenuis						
Nothofagidites "brassi" types A/B	3.6%		0.9%	8.0%	0.9%	
Nothofagidites "brassi" type C						
Nothofagidites "fusca" type A/B	0.9%					0.9%
Peninsulapollis gillii						0.9%
Periporopollenites spp.	0.9%					
Proteacidites angulatus			4.4%	2.0%		0.9%
Proteacidites annularis		4.9%				
Proteacidites pachypolus						
Proteacidites spp.	5.4%	10.7%	8.8%	12.0%	15.0%	14.0%
Tetracolporites spp.	0.9%					1.8%
Tricolp(or)ates undiff.	3.6%	1.0%	1.8%		0.9%	1.8%
Triporopollenites spp. (small)	0.9%	1.0%				0.9%
TOTAL ANGIOSPERM POLLEN	18.9%	21.4%	18.6%	22.0%	22.4%	31.6%
TOTAL SPORES-POLLEN COUNT	111	103	113	100	107	114

TABLE-5: SPORE-POLLEN PERCENTAGES FOR TURRUM-4 PAGE 4 OF 4						
	2541.0	2585.0	2623.0	2657.0	2761.0	
	SWC 23	SWC 21	SWC 17	SWC 13	SWC 6	
TRILETE SPORES undiff.	2.8%			1.0%	3.9%	
Baculatisporites spp.	1.9%					
Conbaculites apiculatus ms						
Cyathidites spp.	1.9%		1.0%		2.6%	
Gleicheniidites/Clavifera spp.	8.3%		3.9%	2.9%	10.5%	
Herkosporites elliottii	0.9%				2.6%	
Latrobosporites crassus						
Stereisporites spp.	12.0%		5.9%	6.8%	10.5%	
Trilites tuberculiformis						
MONOLETE SPORES undiff.						
Laevigatosporites spp.	11.1%			7.8%	3.9%	
Peromonolites spp.				1.0%		
TOTAL SPORES	38.9%		10.8%	19.4%	34.2%	
GYMNOSPERM POLLEN						
Araucariacites australis				2.9%		
Dilwynites spp.	3.7%		2.9%	3.9%		
Lygistepollenites balmei	2.8%		1.0%	3.9%	1.3%	
Lygistepollenites florinii			1.0%			
Microcachryidites antarticus	0.9%		1.0%			
Phyllocladidites mawsonii	9.3%		15.7%	9.7%	26.3%	
Phyllocladidites ovalis	1.9%					
Podocarpidites spp.	9.3%		30.4%	20.4%	2.6%	
Podosporites microsaccatus	1.9%			1.0%	2.6%	
TOTAL GYMNOSPERM POLLEN	29.6%		52.0%	41.7%	32.9%	
ANGIOSPERM POLLEN undiff.					1.3%	
Australopollis obscurus	5.6%		4.9%	1.9%		
Casuarina (H. harrisii)						
Cupanieidites orthoteichus						
Dicotetradites clavatus						
Gambierina rudata	0.9%		1.0%			
Ilexpollenites sp.						
Malvacipollis spp.						
Myrtaceidites spp.						
Myrtaceidites tenuis						
Nothofagidites "brassi" types A/B			1.0%	1.0%		
Nothofagidites "brassi" type C						
Nothofagidites "fusca" type A/B						
Peninsulapollis gillii	0.9%		2.0%	1.9%		
Periporopollenites spp.						
Proteacidites angulatus	3.7%			4.9%		
Proteacidites annularis						
Proteacidites pachypolus						
Proteacidites spp.	18.5%		26.5%	24.3%	25.0%	
Tetracolporites spp.					1.3%	
Tricolp(or)ates undiff.	1.9%		2.0%	2.9%	1.3%	
Triporopollenites spp. (small)				1.9%	3.9%	
TOTAL ANGIOSPERM POLLEN	31.5%		37.3%	38.8%	32.9%	
TOTAL SPORES-POLLEN COUNT	108	8	102	103	76	

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: TURRUM-4

PREPARED BY: A.D. PARTRIDGE

DATE: 14 JANUARY 1993

SHEET 1 OF 3

SAMPLE TYPE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC 60	1902.0	P196342	Kerogen slide sieved/unsieved fractions
SWC 60	1902.0	P196343	Oxidized slide 2
SWC 59	1913.0	P196344	Kerogen slide sieved/unsieved fractions
SWC 59	1913.0	P196345	Oxidized slide 2 (1/2 cover slip)
SWC 58	1923.0	P196346	Kerogen slide sieved/unsieved fractions
SWC 58	1923.0	P196347	Oxidized slide 2
SWC 58	1923.0	P196348	Oxidized slide 3
SWC 58	1923.0	P196349	Oxidized slide 4
CUTTINGS	1930	P196350	Kerogen slide sieved/unsieved fractions
CUTTINGS	1930	P196351	Oxidized slide 2
CUTTINGS	1930	P196352	Oxidized slide 3
CUTTINGS	1930	P196353	Oxidized slide 4
SWC 56	1954.0	P196354	Kerogen slide sieved/unsieved fractions
SWC 56	1954.0	P196355	Oxidized slide 2
SWC 56	1954.0	P196356	Oxidized slide 3
SWC 56	1954.0	P196357	Oxidized slide 4
CUTTINGS	1940	P196358	Kerogen slide sieved/unsieved fractions
CUTTINGS	1940	P196359	Oxidized slide 2
CUTTINGS	1940	P196360	Oxidized slide 3
CUTTINGS	1940	P196361	Oxidized slide 4
SWC 55	1962.0	P196362	Kerogen slide sieved/unsieved fractions
SWC 55	1962.0	P196363	Oxidized slide 2
SWC 55	1962.0	P196364	Oxidized slide 3
SWC 55	1962.0	P196365	Oxidized slide 4
CUTTINGS	1965	P196366	Kerogen slide sieved/unsieved fractions
CUTTINGS	1965	P196367	Oxidized slide 2
CUTTINGS	1965	P196368	Oxidized slide 3
CUTTINGS	1965	P196369	Oxidized slide 4
CUTTINGS	1970	P196370	Kerogen slide sieved/unsieved fractions
CUTTINGS	1970	P196371	Oxidized slide 2
CUTTINGS	1970	P196372	Oxidized slide 3
CUTTINGS	1970	P196373	Oxidized slide 4
SWC 54	1982.5	P196374	Kerogen slide sieved/unsieved fractions
SWC 54	1982.5	P196375	Oxidized slide 2
SWC 54	1982.5	P196376	Oxidized slide 3
SWC 54	1982.5	P196377	Oxidized slide 4 (2nd filter)
SWC 53	2002.0	P196378	Kerogen slide sieved/unsieved fractions
SWC 53	2002.0	P196379	Oxidized slide 2
SWC 53	2002.0	P196380	Oxidized slide 3
SWC 53	2002.0	P196381	Oxidized slide 4 (2nd filter)
SWC 53	2002.0	P196382	Oxidized slide 5 (2nd filter)
SWC 52	2076.0	P196383	Kerogen slide sieved/unsieved fractions
SWC 52	2076.0	P196384	Oxidized slide 2
SWC 52	2076.0	P196385	Oxidized slide 3
SWC 52	2076.0	P196386	Oxidized slide 4

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: TURRUM-4

PREPARED BY: A.D. PARTRIDGE

DATE: 14 JANUARY 1993

SHEET 2 OF 3

SAMPLE TYPE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC 51	2109.5	P196387	Kerogen slide sieved/unsieved fractions
SWC 51	2109.5	P196388	Oxidized slide 2
SWC 51	2109.5	P196389	Oxidized slide 3
SWC 51	2109.5	P196390	Oxidized slide 4
SWC 50	2111.5	P196391	Kerogen slide sieved/unsieved fractions
SWC 50	2111.5	P196392	Oxidized slide 2
SWC 50	2111.5	P196393	Oxidized slide 3
SWC 50	2111.5	P196394	Oxidized slide 4
SWC 49	2187.0	P196395	Kerogen slide sieved/unsieved fractions
SWC 49	2187.0	P196396	Oxidized slide 2
SWC 49	2187.0	P196397	Oxidized slide 3
SWC 49	2187.0	P196398	Oxidized slide 4
SWC 46	2290.0	P196399	Kerogen slide sieved/unsieved fractions
SWC 46	2290.0	P196400	Oxidized slide 2
SWC 46	2290.0	P196401	Oxidized slide 3
SWC 46	2290.0	P196402	Oxidized slide 4 (2nd ox.)
SWC 46	2290.0	P196403	Oxidized slide 5 (2nd ox.)
SWC 45	2302.5	P196404	Kerogen slide sieved/unsieved fractions
SWC 45	2302.5	P196405	Oxidized slide 2
SWC 45	2302.5	P196406	Oxidized slide 3
SWC 45	2302.5	P196407	Oxidized slide 4
SWC 43	2308.0	P196408	Kerogen slide sieved/unsieved fractions
SWC 43	2308.0	P196409	Oxidized slide 2
SWC 43	2308.0	P196410	Oxidized slide 3
SWC 43	2308.0	P196411	Oxidized slide 4
SWC 40	2323.0	P196412	Kerogen slide sieved/unsieved fractions
SWC 38	2327.5	P196413	Kerogen slide sieved/unsieved fractions
SWC 38	2327.5	P196414	Oxidized slide 2
SWC 38	2327.5	P196415	Oxidized slide 3
SWC 38	2327.5	P196416	Oxidized slide 4 (2nd ox.)
SWC 38	2327.5	P196417	Oxidized slide 5 (2nd ox.)
SWC 35	2365.0	P196418	Kerogen slide sieved/unsieved fractions
SWC 35	2365.0	P196419	Oxidized slide 2
SWC 35	2365.0	P196420	Oxidized slide 3
SWC 35	2365.0	P196421	Oxidized slide 4
SWC 34	2373.5	P196422	Oxidized slide 2 Coal 30 min ox.
SWC 34	2373.5	P196423	Oxidized slide 3 Coal 30 min ox.
SWC 34	2373.5	P196424	Oxidized slide 4 Coal 5 min ox.
SWC 33	2390.0	P196425	Kerogen slide sieved/unsieved fractions
SWC 33	2390.0	P196426	Oxidized slide 2
SWC 33	2390.0	P196427	Oxidized slide 3
SWC 33	2390.0	P196428	Oxidized slide 4
SWC 29	2441.5	P196429	Kerogen slide sieved/unsieved fractions
SWC 29	2441.5	P196430	Oxidized slide 2
SWC 29	2441.5	P196431	Oxidized slide 3
SWC 29	2441.5	P196432	Oxidized slide 4 (2nd ox.)
SWC 29	2441.5	P196433	Oxidized slide 5 (2nd ox.)

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: TURRUM-4

PREPARED BY: A.D. PARTRIDGE

DATE: 14 JANUARY 1993

SHEET 3 OF 3

SAMPLE TYPE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC 28	2488.0	P196434	Kerogen slide sieved/unsieved fractions
SWC 28	2488.0	P196435	Oxidized slide 2 (1/2 slip cover)
SWC 26	2503.5	P196436	Kerogen slide sieved/unsieved fractions
SWC 26	2503.5	P196437	Oxidized slide 2
SWC 26	2503.5	P196438	Oxidized slide 3
SWC 26	2503.5	P196439	Oxidized slide 4
SWC 24	2528.0	P196440	Oxidized slide 2 Coal 30 min ox.
SWC 24	2528.0	P196441	Oxidized slide 3 Coal 30 min ox.
SWC 24	2528.0	P196442	Oxidized slide 4 Coal 5 min ox.
SWC 23	2541.0	P196443	Kerogen slide sieved/unsieved fractions
SWC 23	2541.0	P196444	Oxidized slide 2
SWC 23	2541.0	P196445	Oxidized slide 3
SWC 23	2541.0	P196446	Oxidized slide 4
SWC 21	2585.0	P196447	Kerogen slide sieved/unsieved fractions
SWC 21	2585.0	P196448	Oxidized slide 2
SWC 21	2585.0	P196449	Oxidized slide 3
SWC 21	2585.0	P196450	Oxidized slide 4 (2nd ox.)
SWC 21	2585.0	P196451	Oxidized slide 5 (2nd ox.)
SWC 19	2591.5	P196452	Oxidized slide 2 Coal 30 min ox.
SWC 19	2591.5	P196453	Oxidized slide 3 Coal 30 min ox.
SWC 19	2591.5	P196454	Oxidized slide 4 Coal 5 min ox.
SWC 17	2623.0	P196455	Kerogen slide sieved/unsieved fractions
SWC 17	2623.0	P196456	Oxidized slide 2
SWC 17	2623.0	P196457	Oxidized slide 3
SWC 17	2623.0	P196458	Oxidized slide 4
SWC 13	2657.0	P196459	Kerogen slide sieved/unsieved fractions
SWC 13	2657.0	P196460	Oxidized slide 2
SWC 13	2657.0	P196461	Oxidized slide 3
SWC 13	2657.0	P196462	Oxidized slide 4
SWC 8	2696.0	P196463	Kerogen slide sieved/unsieved fractions
SWC 8	2696.0	P196464	Oxidized slide 2
SWC 8	2696.0	P196465	Oxidized slide 3
SWC 8	2696.0	P196466	Oxidized slide 4
SWC 8	2696.0	P196467	Oxidized slide 5
SWC 7	2703.0	P196468	Oxidized slide 2 Coal 30 min ox.
SWC 7	2703.0	P196469	Oxidized slide 3 Coal 30 min ox.
SWC 7	2703.0	P196470	Oxidized slide 4 Coal 5 min ox.
SWC 6	2716.0	P196471	Kerogen slide sieved/unsieved fractions
SWC 6	2716.0	P196472	Oxidized slide 2
SWC 6	2716.0	P196473	Oxidized slide 3
SWC 6	2716.0	P196474	Oxidized slide 4
SWC 4	2726.0	P196475	Oxidized slide 2 Coal 30 min ox.
SWC 4	2726.0	P196476	Oxidized slide 3 Coal 30 min ox.
SWC 4	2726.0	P196477	Oxidized slide 4 Coal 5 min ox.

RELINQUISHMENT LIST - PALYNOLOGY RESIDUES

WELL NAME & NO: TURRUM-4

PREPARED BY: A.D. PARTRIDGE

DATE: 14 JANUARY 1993

SHEET 1 OF 2

SAMPLE TYPE	DEPTH (M)	DESCRIPTION
SWC 58 SWC 58	1923.0 1923.0	Kerogen residue Oxidized residue
CUTTINGS	1940.0	Oxidized residue
CUTTINGS	1930.0	Oxidized residue
SWC 56 SWC 56	1954.0 1954.0	Kerogen residue Oxidized residue
SWC 55 SWC 55	1962.0 1962.0	Kerogen residue Oxidized residue
CUTTINGS	1940.0	Oxidized residue
CUTTINGS	1970.0	Oxidized residue
SWC 54 SWC 54	1982.5 1982.5	Kerogen residue Oxidized residue
SWC 53 SWC 53	2002.0 2002.0	Kerogen residue Oxidized residue
SWC 52 SWC 52	2076.0 2076.0	Kerogen residue Oxidized residue
SWC 51 SWC 51	2109.5 2109.5	Kerogen residue Oxidized residue
SWC 50 SWC 50	2111.5 2111.5	Kerogen residue Oxidized residue
SWC 49	2187.0	Oxidized residue
SWC 46 SWC 46	2290.0 2290.0	Kerogen residue Oxidized residue
SWC 45 SWC 45	2302.5 2302.5	Kerogen residue Oxidized residue
SWC 43 SWC 43	2308.0 2308.0	Kerogen residue Oxidized residue
SWC 38	2327.5	Oxidized residue
SWC 35 SWC 35	2365.0 2365.0	Kerogen residue Oxidized residue
SWC 33 SWC 33	2390.0 2390.0	Kerogen residue Oxidized residue
SWC 29 SWC 29	2441.5 2441.5	Kerogen residue Oxidized residue
SWC 26 SWC 26	2503.5 2503.5	Kerogen residue Oxidized residue
SWC 24	2528.0	Oxidized residue

RELINQUISHMENT LIST - PALYNOLOGY RESIDUES

WELL NAME & NO: TURRUM-4

PREPARED BY: A.D. PARTRIDGE

DATE: 14 JANUARY 1993

SHEET 2 OF 2

SAMPLE TYPE	DEPTH (M)	DESCRIPTION
SWC 23	2541.0	Kerogen residue
SWC 23	2541.0	Oxidized residue
SWC 21	2585.0	Kerogen residue
SWC 21	2585.0	Oxidized residue
SWC 19	2591.5	Oxidized residue
SWC 17	2623.0	Kerogen residue
SWC 17	2623.0	Oxidized residue
SWC 13	2657.0	Kerogen residue
SWC 13	2657.0	Oxidized residue
SWC 8	2696.0	Kerogen residue
SWC 8	2696.0	Oxidized residue
SWC 7	2703.0	Oxidized residue
SWC 6	2716.0	Kerogen residue
SWC 6	2716.0	Oxidized residue
SWC 4	2726.0	Oxidized residue

PE900976

This is an enclosure indicator page.
The enclosure PE900976 is enclosed within the container PE900975 at this location in this document.

The enclosure PE900976 has the following characteristics:

ITEM_BARCODE = PE900976
CONTAINER_BARCODE = PE900975
NAME = Palymorph range chart
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Turrum-4 Palynomorph Range Chart for Interval 1902-1970 m. Microplankton species 1-24, Spore-pollen species 25-113. Chart 1 of 4. (Analysis by Alan D. Partridge) From WCR Volume 2 Appendix 1.
REMARKS =
DATE_CREATED = 1/12/92
DATE_RECEIVED = 16/03/93
W_NO = W1069
WELL_NAME = Turrum-4
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

PE905994

This is an enclosure indicator page.
The enclosure PE905994 is enclosed within the container PE900975 at this location in this document.

The enclosure PE905994 has the following characteristics:

ITEM_BARCODE = PE905994
CONTAINER_BARCODE = PE900975
NAME = Palynomorph Range Chart
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Turrum-4 Palynomorph Range Chart for Interval 1902-1970 m. Microplankton species 1-24, Spore-pollen species 25-113. Chart 2 of 4. (Analysis by Alan D. Partridge) From WCR Volume 2 Appendix 1.
REMARKS = Need to look at Kate's S/S for Chart 1 of 4.
DATE_CREATED = 31/12/1992
DATE_RECEIVED =
W_NO =
WELL_NAME = Turrum-4
CONTRACTOR =
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE905995

This is an enclosure indicator page.
The enclosure PE905995 is enclosed within the container PE900975 at this location in this document.

The enclosure PE905995 has the following characteristics:

ITEM_BARCODE = PE905995
CONTAINER_BARCODE = PE900975
NAME = Palynomorph Range Chart
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Turrum-4 Palynomorph Range Chart for Interval 1982.5-2726 m. Microplankton species 1-18, Spore-pollen species 19-93, Reworked species 94-97. Chart 3 of 4. (Analysis by Alan D. Partridge) From WCR Volume 2 Appendix 1.
REMARKS =
DATE_CREATED = 31/12/1992
DATE_RECEIVED =
W_NO =
WELL_NAME = Turrum-4
CONTRACTOR =
CLIENT_OP_CO =

PE905996

This is an enclosure indicator page.
The enclosure PE905996 is enclosed within the container PE900975 at this location in this document.

The enclosure PE905996 has the following characteristics:

ITEM_BARCODE = PE905996
CONTAINER_BARCODE = PE900975
NAME = Palynomorph Range Chart
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Turrum-4 Palynomorph Range Chart for Interval 1982.5-2726 m. Microplankton species 1-18, Spore-pollen species 19-93, Reworked species 94-97. Chart 4 of 4. (Analysis by Alan D. Partridge) From WCR Volume 2 Appendix 1.
REMARKS =
DATE_CREATED = 31/12/1992
DATE_RECEIVED =
W_NO =
WELL_NAME = Turrum-4
CONTRACTOR =
CLIENT_OP_CO =

APPENDIX 2

APPENDIX 2

TURRUM 4

QUANTITATIVE LOG ANALYSIS

Interval:	1919 - 2775 mMDKB
Analyst:	M. C. Schapper
Date:	November, 1992

CONTENTS

TURRUM 4 QUANTITATIVE LOG ANALYSIS

Wireline log data from the Turrum 4 outpost well have been quantitatively analysed for effective porosity and effective water saturation over the interval 1919 - 2775 mMDKB. The results of this analysis are presented as a depth plot, a tabular listing (Appendix 2) and an interval summary table (Table 2). Also included are the results of the analysis of the FMS data. All depths used in this analysis are in mMDKB as the well was not deviated.

Data Acquisition and Quality:

Logs were recorded by Schlumberger using the Maxis 500 unit. The data used in this analysis were acquired in two runs: one recording the resistivity and gamma ray data and the other recording the neutron and density data.

The caliper log (CALS) shows the borehole to be in generally good condition throughout the Latrobe Group section. Some minor washouts are present, predominantly in coals. The quality of the MSFL log has been adversely affected in these washouts but this has not affected the analysis as the MSFL data was not used and the coals have been zoned out for analysis purposes. The quality of other logs is good throughout the analysis interval. Environmental corrections were not used but minor depth alignment of individual logs was required to correct slight depth misalignments in the data before subjecting them to analysis.

Logs Used:

GR	(gamma ray)
LLD	(deep laterolog)
HNRH	(high resolution bulk density)
HNPO	(high resolution neutron porosity)
CALS	(caliper)

Analysis Methodolgy:

Porosities and water saturations were calculated using an interative technique which converges into a preselected grain density window by appropriately incrementing or decrementing shale volume (Vsh). The initial shale volume, used as the starting point for the iterative process, was calculated 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 porosity logs where applicable and convergence upon the preselected grain density window by shale volume adjustment. The preselected grain density window is calculated from hydrocarbon and shale corrected density and neutron logs. The algorithms used are shown in appendix 1.

Analysis Parameters:

Parameters used in the analysis are shown in Table 1 of this report. Formation water salinity was estimated using the Rwa method.

Summary of Results:

Quantitative log analysis indicates that the entire section in Turrum 4 is water wet.

TABLE 1: TURRUM 4 ANALYSIS PARAMETERS.

Tortuosity (a):	1.000
Cementation factor (m):	2.000
Saturation exponent (n):	2.000
Fluid density:	1.000
Gamma ray value in clean formation (grmin):	45 gapi
Gamma ray value in shale (grmax): (curve)	120 - 135 gapi
Apparent shale resistivity (rsh): (curve)	6 - 22 ohmm
Apparent shale bulk density (rhobsh): (curve)	2.41 - 2.57 g/cm3
Apparent shale neutron porosity (phinsh): (curve)	0.24 - 0.30 frac
Input hydrocarbon density:	0.70 g/cm3
Lower limit of grain density:	2.645 g/cm3
Upper limit of grain density:	2.675 g/cm3
Formation water entered in terms of salinity	
Formation water salinity: (curve)	30000-50000 ppm
Measured Rmf:	0.060 ohmm
Temperature at which Rmf was measured:	94 deg C
Sxo derived from Sw (Sxo = Sw**Z) Z:	0.30
Logged TD	2778 mMDKB
Logged bottom hole temperature:	104 deg C
Estimated sea bed temperature:	10 deg C
Water depth:	62 m
KB height:	23 m
Irreducible water saturation: (lower limit)	0.025 frac
Vsh upper limit for effective porosity:	0.65 frac
Minimum effective porosity for hydrocarbons:	0.03 frac

TABLE 2:

TURRUM 4 ANALYSIS SUMMARY

Net porosity cutoff = 0.120 volume per volume

	GROSS INTERVAL (metres) (top) -(base)	Gross Metres	NET POROUS INTERVAL Net Metres	Net to Gross	Mean Vsh	(Std.) (Dev.)	Mean Porosity	(Std.) (Dev.)	Mode Porosity	Mean Sw	INTEGRATED HYDROCARBON PORE VOLUME
MDKB	1962.8-1978.6	15.8	14.2	90 %	0.11	(0.117)	0.21	(0.026)	0.21	1.00	0.000
MDKB	1988.4-1994.6	6.2	2.8	45 %	0.24	(0.093)	0.20	(0.041)	0.25	1.00	0.000
MDKB	2035.0-2041.4	6.4	2.8	44 %	0.29	(0.082)	0.17	(0.028)	0.18	1.00	0.000
MDKB	2063.0-2066.0	3.0	1.0	33 %	0.29	(0.067)	0.17	(0.024)	0.19	1.00	0.000
MDKB	2067.4-2072.4	5.0	1.0	20 %	0.35	(0.037)	0.14	(0.005)	0.14	1.00	0.000
MDKB	2129.2-2134.0	4.8	2.8	58 %	0.23	(0.110)	0.18	(0.027)	0.21	1.00	0.000
MDKB	2140.8-2146.2	5.4	1.0	19 %	0.37	(0.044)	0.14	(0.012)	0.14	1.00	0.000
MDKB	2158.0-2162.2	4.2	0.4	10 %	0.25	(0.089)	0.13	(0.007)	0.12	1.00	0.000
MDKB	2190.4-2194.2	3.8	1.2	32 %	0.26	(0.038)	0.17	(0.031)	0.12	1.00	0.000
MDKB	2197.8-2203.0	5.2	0.4	8 %	0.27	(0.008)	0.14	(0.007)	0.14	1.00	0.000
MDKB	2272.6-2275.0	2.4	0.8	33 %	0.28	(0.051)	0.14	(0.013)	0.12	1.00	0.000
MDKB	2280.0-2282.4	2.4	0.8	33 %	0.21	(0.054)	0.16	(0.004)	0.16	1.00	0.000
MDKB	2299.6-2304.8	5.2	0.4	8 %	0.22	(0.099)	0.14	(0.007)	0.13	1.00	0.000
MDKB	2309.2-2327.0	17.8	15.0	84 %	0.09	(0.115)	0.21	(0.030)	0.23	1.00	0.000
MDKB	2327.8-2335.6	7.8	3.2	41 %	0.14	(0.109)	0.18	(0.028)	0.20	1.00	0.000
MDKB	2338.6-2341.4	2.8	2.0	71 %	0.14	(0.075)	0.19	(0.027)	0.21	1.00	0.000
MDKB	2357.2-2360.0	2.8	2.0	71 %	0.18	(0.048)	0.16	(0.020)	0.16	1.00	0.000
MDKB	2365.8-2371.0	5.2	4.8	92 %	0.09	(0.104)	0.23	(0.022)	0.24	1.00	0.000
MDKB	2374.2-2376.4	2.2	1.6	73 %	0.18	(0.110)	0.17	(0.032)	0.14	1.00	0.000
MDKB	2394.0-2397.6	3.6	0.8	22 %	0.19	(0.081)	0.17	(0.017)	0.17	1.00	0.000
MDKB	2401.4-2413.0	11.6	7.6	66 %	0.12	(0.089)	0.20	(0.028)	0.20	1.00	0.000
MDKB	2424.2-2427.0	2.8	1.4	50 %	0.10	(0.029)	0.18	(0.011)	0.18	1.00	0.000
MDKB	2430.8-2437.6	6.8	3.6	53 %	0.09	(0.090)	0.20	(0.024)	0.22	1.00	0.000
MDKB	2468.4-2473.0	4.6	0.2	4 %	0.29	(0.000)	0.14	(0.000)	0.14	1.00	0.000
MDKB	2535.0-2538.4	3.4	1.2	35 %	0.22	(0.083)	0.16	(0.020)	0.15	1.00	0.000
MDKB	2544.2-2551.6	7.4	1.4	19 %	0.24	(0.204)	0.17	(0.020)	0.18	1.00	0.000
MDKB	2573.4-2579.8	6.4	0.6	9 %	0.18	(0.055)	0.13	(0.007)	0.12	1.00	0.000
MDKB	2604.8-2610.2	5.4	3.2	59 %	0.23	(0.126)	0.15	(0.022)	0.17	1.00	0.000
MDKB	2614.4-2621.8	7.4	1.0	14 %	0.17	(0.062)	0.15	(0.016)	0.15	1.00	0.000
MDKB	2623.8-2643.8	20.0	12.0	60 %	0.18	(0.172)	0.16	(0.027)	0.14	1.00	0.000
MDKB	2673.6-2693.0	19.4	4.8	25 %	0.14	(0.138)	0.15	(0.029)	0.13	1.00	0.000
MDKB	2729.0-2767.2	38.2	27.2	71 %	0.04	(0.062)	0.17	(0.022)	0.17	1.00	0.000

APPENDIX 1

ALGORITHMS AND LOGIC USED IN THE QUANTITATIVE ANALYSIS.

Initial shale volume calculated from GR response.

vsh = (gr-grmin)/(grmax-grmin)

Apparent total porosity and shale porosity calculated from one of two sources, at the analyst's discretion:

1) Density-Neutron Crossplot Porosity.

   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) rho[matrix] = 2.71 - 0.64*h
   else       rho[matrix] = 2.71 - 0.5*h
phit = (rho[matrix]-rhob)/(rho[matrix]-rhof)
```

   Similarly, apparent shale porosity is calculated using apparent shale bulk density and shale neutron porosity values as input to the same algorithms

2) Sonic Porosity.

   Calculated using the following relationship derived in zones of good hole conditions by cross-plotting density-neutron crossplot porosity against DT:

   phis = 0.0055 * dt - 0.2925

   Similarly, apparent shale porosity is calculated from shale transit time, using the same relationship.

Effective porosity is derived by shale correcting the apparent total porosity.

```
     phie = phit-(vsh*phish)
or,  phie = phis - (vsh*phish)
```

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)))) ]
```

If appropriate, invaded zone saturation (Sxo) is then calculated using the same algorithms, replacing Rt with Rxo, and Rw with Rmfi (resistivity of mud filtrate at formation temperature), where:

```
  rmfi= rmf*((trmf+6.77)/(ti+6.77))
   where: [ ti = temperature at zone of interest (degrees F)   ]
          [ ti = ((bht-sbt)/(td-wd-kb))*(depth-wd-kb) + sbt    ]
          [ rmf= measured rmf value                            ]
          [trmf= temperature(F) at which rmf was measured      ]
```

Alternatively, if no Rxo log is available, 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))
   }
```

At high shale volumes, the final calculated effective porosity and water saturation are modified as follows:

```
if (vsh > vshco)  phie = 0, swe  = 1
else if (vsh > (vshco-0.2))
   phie = phie*((vshco-vsh)/0.2)
   swe  = 1-((1-swe)*((vshco-vsh)/0.2))
```

where: vshco = analyst defined vsh cut-off value

APPENDIX 2:

TURRUM_4
Well Data Listing (page 1)

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
1919.0	80	4.0	2.496	0.258	0.945	0.000	1.000
1920.0	110	6.1	2.490	0.232	0.865	0.000	1.000
1921.0	116	6.1	2.431	0.261	0.950	0.000	1.000
1922.0	111	5.4	2.459	0.280	0.943	0.000	1.000
1923.0	126	5.6	2.492	0.263	1.000	0.000	1.000
1924.0	113	5.8	2.451	0.275	0.915	0.000	1.000
1925.0	104	5.9	2.460	0.278	0.936	0.000	1.000
1926.0	113	5.9	2.479	0.288	1.000	0.000	1.000
1927.0	114	5.3	2.439	0.310	1.000	0.000	1.000
1928.0	111	5.5	2.437	0.292	0.941	0.000	1.000
1929.0	116	5.6	2.472	0.329	1.000	0.000	1.000
1930.0	117	5.9	2.459	0.351	1.000	0.000	1.000
1931.0	114	5.8	2.428	0.323	1.000	0.000	1.000
1932.0	108	5.7	2.438	0.348	1.000	0.000	1.000
1933.0	111	6.0	2.449	0.314	1.000	0.000	1.000
1934.0	113	4.7	2.445	0.297	0.990	0.000	1.000
1935.0	115	6.0	2.443	0.357	1.000	0.000	1.000
1936.0	110	5.0	2.477	0.306	1.000	0.000	1.000
1937.0	102	6.1	2.464	0.306	1.000	0.000	1.000
1938.0	118	5.9	2.448	0.328	1.000	0.000	1.000
1939.0	115	5.9	2.449	0.297	0.999	0.000	1.000
1940.0	110	6.1	2.493	0.340	1.000	0.000	1.000
1941.0	101	5.6	2.426	0.285	0.881	0.000	1.000
1942.0	106	6.4	2.531	0.243	0.980	0.000	1.000
1943.0	117	6.3	2.440	0.311	1.000	0.000	1.000
1944.0	118	5.8	2.462	0.274	0.973	0.000	1.000
1945.0	116	5.4	2.428	0.286	0.951	0.000	1.000
1946.0	115	6.3	2.499	0.294	1.000	0.000	1.000
1947.0	117	6.1	2.487	0.265	0.959	0.000	1.000
1948.0	110	6.3	2.511	0.250	0.955	0.000	1.000
1949.0	110	5.2	2.497	0.298	1.000	0.000	1.000
1950.0	109	5.9	2.534	0.276	1.000	0.000	1.000
1951.0	119	6.4	2.469	0.309	1.000	0.000	1.000
1952.0	109	2.2	2.457	0.260	0.854	0.003	1.000
1953.0	114	4.6	2.399	0.330	1.000	0.000	1.000
1954.0	124	4.6	2.503	0.304	1.000	0.000	1.000
1955.0	93	1.6	2.293	0.263	0.399	0.156	1.000
1956.0	102	3.1	2.429	0.283	0.883	0.000	1.000
1957.0	115	2.0	2.438	0.223	0.627	0.022	1.000
1958.0	110	5.5	2.476	0.268	0.949	0.000	1.000
1959.0	110	6.7	2.539	0.290	1.000	0.000	1.000
1960.0	104	4.3	2.513	0.268	1.000	0.000	1.000
1961.0	112	3.2	2.469	0.255	0.900	0.000	1.000
1962.0	109	5.5	2.479	0.313	0.974	0.000	1.000
1963.0	78	1.5	2.390	0.259	0.535	0.065	1.000
1964.0	57	1.2	2.217	0.253	0.141	0.245	1.000
1965.0	41	1.0	2.316	0.247	0.270	0.182	1.000
1966.0	57	1.6	2.344	0.244	0.346	0.152	1.000
1967.0	61	1.1	2.295	0.240	0.180	0.188	1.000
1968.0	69	1.2	2.251	0.247	0.210	0.219	1.000
1969.0	56	1.1	2.252	0.212	0.057	0.234	1.000
1970.0	40	1.2	2.316	0.187	0.000	0.212	1.000
1971.0	54	1.2	2.232	0.240	0.095	0.244	1.000
1972.0	38	1.4	2.342	0.167	0.000	0.197	1.000
1973.0	42	1.1	2.264	0.229	0.060	0.236	1.000
1974.0	41	1.0	2.245	0.210	0.000	0.246	1.000
1975.0	40	1.2	2.309	0.179	0.000	0.213	1.000
1976.0	46	1.0	2.322	0.201	0.084	0.199	1.000

TURRUM_4 (page 2 of data listing)

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
1977.0	41	1.0	2.260	0.210	0.000	0.239	1.000
1978.0	51	1.4	2.312	0.206	0.085	0.198	1.000
1979.0	113	5.3	2.515	0.267	0.882	0.000	1.000
1980.0	109	6.4	2.483	0.332	1.000	0.000	1.000
1981.0	79	1.6	2.463	0.265	0.731	0.019	1.000
1982.0	77	2.5	2.501	0.223	0.652	0.013	1.000
1983.0	133	5.0	2.573	0.337	1.000	0.000	1.000
1984.0	110	3.2	2.197	0.371	Coal		
1985.0	94	3.6	2.472	0.231	0.617	0.008	1.000
1986.0	95	4.2	2.418	0.318	Coal		
1987.0	108	6.2	1.799	0.440	Coal		
1988.0	106	10.2	2.034	0.478	Coal		
1989.0	83	2.4	2.330	0.238	0.362	0.155	1.000
1990.0	89	4.0	2.547	0.242	0.856	0.000	1.000
1991.0	118	7.6	2.473	0.309	0.946	0.000	1.000
1992.0	88	2.9	2.455	0.276	0.774	0.018	1.000
1993.0	53	1.4	2.256	0.261	0.182	0.226	1.000
1994.0	64	2.2	2.311	0.209	0.192	0.181	1.000
1995.0	116	8.1	2.506	0.310	1.000	0.000	1.000
1996.0	112	10.0	2.430	0.274	Coal		
1997.0	107	8.4	2.080	0.508	Coal		
1998.0	78	2.5	2.361	0.240	Coal		
1999.0	79	26.5	1.315	0.639	Coal		
2000.0	78	2.9	2.381	0.219	Coal		
2001.0	95	5.8	2.468	0.255	0.723	0.001	1.000
2002.0	126	7.5	2.512	0.295	0.983	0.000	1.000
2003.0	124	7.6	2.539	0.318	1.000	0.000	1.000
2004.0	95	2.4	2.429	0.236	0.516	0.076	1.000
2005.0	85	2.6	2.356	0.244	0.414	0.115	1.000
2006.0	107	4.1	2.498	0.224	0.674	0.000	1.000
2007.0	140	6.4	2.532	0.345	1.000	0.000	1.000
2008.0	109	9.3	1.814	0.502	Coal		
2009.0	95	2.5	2.323	0.223	Coal		
2010.0	129	5.8	2.508	0.267	0.954	0.000	1.000
2011.0	117	6.7	2.561	0.286	1.000	0.003	1.000
2012.0	85	3.8	2.411	0.258	0.578	0.035	1.000
2013.0	116	7.5	2.574	0.341	1.000	0.000	1.000
2014.0	128	6.7	2.514	0.300	1.000	0.000	1.000
2015.0	113	6.0	2.518	0.290	0.981	0.000	1.000
2016.0	133	6.8	2.474	0.327	1.000	0.000	1.000
2017.0	122	6.2	2.509	0.294	0.975	0.000	1.000
2018.0	87	10.7	1.708	0.540	Coal		
2019.0	106	3.8	2.381	0.239	Coal		
2020.0	110	5.4	2.450	0.282	0.786	0.000	1.000
2021.0	98	2.9	2.369	0.252	0.476	0.097	1.000
2022.0	80	3.0	2.377	0.273	0.556	0.055	1.000
2023.0	103	5.8	2.383	0.303	0.730	0.000	1.000
2024.0	101	8.7	2.352	0.353	0.836	0.000	1.000
2025.0	112	8.9	2.337	0.380	0.907	0.000	1.000
2026.0	90	10.1	2.206	0.428	Coal		
2027.0	100	4.6	2.443	0.263	Coal		
2028.0	131	7.6	2.536	0.319	1.000	0.000	1.000
2029.0	143	7.7	2.545	0.336	Coal		
2030.0	95	10.6	2.061	0.478	Coal		
2031.0	90	3.8	2.385	0.264	Coal		
2032.0	122	7.8	2.498	0.332	1.000	0.000	1.000
2033.0	131	8.1	2.434	0.344	Coal		
2034.0	120	9.7	2.234	0.399	Coal		
2035.0	102	10.0	2.456	0.250	0.667	0.000	1.000
2036.0	94	4.5	2.404	0.250	0.552	0.044	1.000
2037.0	91	2.6	2.307	0.244	0.294	0.161	1.000
2038.0	62	1.6	2.341	0.244	0.326	0.175	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2039.0	77	2.5	2.394	0.229	0.405	0.125	1.000
2040.0	69	2.4	2.451	0.224	0.524	0.088	1.000
2041.0	102	3.7	2.442	0.259	0.680	0.030	1.000
2042.0	119	7.3	2.546	0.268	0.965	0.000	1.000
2043.0	126	8.3	2.855	0.294	1.000	0.000	1.000
2044.0	111	8.3	2.536	0.324	1.000	0.000	1.000
2045.0	106	7.1	2.323	0.389	Coal		
2046.0	98	3.4	2.346	0.275	Coal		
2047.0	115	3.5	2.443	0.251	0.648	0.016	1.000
2048.0	122	6.9	2.512	0.287	0.961	0.000	1.000
2049.0	140	7.4	2.525	0.333	1.000	0.000	1.000
2050.0	109	6.4	2.602	0.292	1.000	0.000	1.000
2051.0	108	8.0	2.559	0.315	1.000	0.000	1.000
2052.0	113	6.5	2.521	0.315	1.000	0.000	1.000
2053.0	120	6.8	2.503	0.297	0.980	0.000	1.000
2054.0	128	6.3	2.564	0.310	1.000	0.000	1.000
2055.0	127	6.7	2.553	0.323	1.000	0.000	1.000
2056.0	114	7.8	2.572	0.245	0.940	0.000	1.000
2057.0	120	7.1	2.524	0.255	0.861	0.000	1.000
2058.0	118	6.7	2.449	0.339	1.000	0.000	1.000
2059.0	117	6.3	2.528	0.244	0.828	0.000	1.000
2060.0	116	6.5	2.515	0.299	1.000	0.000	1.000
2061.0	141	6.9	2.560	0.344	1.000	0.000	1.000
2062.0	133	5.6	2.467	0.253	0.719	0.000	1.000
2063.0	116	5.6	2.571	0.274	1.000	0.000	1.000
2064.0	54	1.4	2.306	0.234	0.199	0.189	1.000
2065.0	97	57.3	2.821	0.102	0.967	0.000	1.000
2066.0	130	4.7	2.460	0.256	0.713	0.000	1.000
2067.0	117	8.1	2.457	0.324	Coal		
2068.0	94	3.4	2.411	0.224	0.468	0.093	1.000
2069.0	83	3.1	2.406	0.234	0.470	0.106	1.000
2070.0	104	3.0	2.459	0.250	0.668	0.009	1.000
2071.0	104	3.5	2.479	0.233	0.637	0.011	1.000
2072.0	106	3.4	2.439	0.233	0.571	0.025	1.000
2073.0	124	6.9	2.448	0.291	0.932	0.000	1.000
2074.0	119	7.2	2.461	0.332	1.000	0.000	1.000
2075.0	123	7.2	2.476	0.328	1.000	0.000	1.000
2076.0	140	7.3	2.479	0.374	Coal		
2077.0	101	5.3	2.190	0.383	Coal		
2078.0	87	2.2	2.346	0.231	0.342	0.136	1.000
2079.0	98	3.4	2.455	0.256	0.681	0.013	1.000
2080.0	104	4.2	2.513	0.248	0.811	0.000	1.000
2081.0	128	8.7	2.529	0.327	1.000	0.000	1.000
2082.0	110	8.1	2.496	0.250	0.777	0.000	1.000
2083.0	124	8.6	2.566	0.305	1.000	0.000	1.000
2084.0	110	6.1	2.517	0.203	0.640	0.020	1.000
2085.0	117	6.4	2.515	0.313	1.000	0.000	1.000
2086.0	119	6.8	2.525	0.285	0.986	0.000	1.000
2087.0	114	6.7	2.505	0.324	1.000	0.000	1.000
2088.0	124	7.2	2.486	0.332	1.000	0.000	1.000
2089.0	101	10.7	2.035	0.453	Coal		
2090.0	125	7.2	2.492	0.339	1.000	0.000	1.000
2091.0	115	5.6	2.478	0.255	0.755	0.000	1.000
2092.0	116	3.5	2.368	0.245	0.448	0.109	1.000
2093.0	127	6.5	2.448	0.299	0.873	0.000	1.000
2094.0	117	8.4	2.513	0.323	1.000	0.000	1.000
2095.0	132	8.3	2.544	0.301	1.000	0.000	1.000
2096.0	120	7.4	2.548	0.258	0.934	0.000	1.000
2097.0	129	7.8	2.591	0.261	1.000	0.000	1.000
2098.0	116	7.2	2.553	0.299	1.000	0.000	1.000
2099.0	119	7.2	2.545	0.292	1.000	0.000	1.000
2100.0	128	7.9	2.545	0.309	1.000	0.000	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2101.0	118	7.3	2.518	0.276	0.939	0.000	1.000
2102.0	122	7.8	2.568	0.266	1.000	0.000	1.000
2103.0	126	7.9	2.528	0.303	1.000	0.000	1.000
2104.0	125	6.8	2.533	0.294	1.000	0.000	1.000
2105.0	120	7.7	2.872	0.306	1.000	0.000	1.000
2106.0	132	7.1	2.486	0.329	Coal		
2107.0	98	10.5	2.333	0.431	Coal		
2108.0	109	6.7	2.493	0.221	0.657	0.000	1.000
2109.0	74	8.0	1.351	0.594	Coal		
2110.0	100	6.2	2.491	0.219	Coal		
2111.0	102	5.4	2.456	0.285	0.825	0.000	1.000
2112.0	133	8.9	2.513	0.303	1.000	0.000	1.000
2113.0	121	8.5	2.507	0.339	1.000	0.000	1.000
2114.0	132	9.5	2.598	0.293	1.000	0.000	1.000
2115.0	120	8.1	2.541	0.321	1.000	0.000	1.000
2116.0	133	8.2	2.518	0.338	1.000	0.000	1.000
2117.0	112	7.3	2.501	0.339	Coal		
2118.0	87	2.9	2.383	0.228	Coal		
2119.0	110	4.1	2.451	0.236	0.616	0.011	1.000
2120.0	114	5.6	2.495	0.252	0.786	0.010	1.000
2121.0	108	5.0	2.558	0.255	0.951	0.000	1.000
2122.0	123	7.3	2.532	0.298	1.000	0.000	1.000
2123.0	122	7.1	2.513	0.292	0.991	0.000	1.000
2124.0	123	7.5	2.501	0.300	0.994	0.000	1.000
2125.0	116	6.9	2.574	0.277	1.000	0.000	1.000
2126.0	128	7.1	2.535	0.234	0.913	0.000	1.000
2127.0	110	6.7	2.563	0.238	0.897	0.000	1.000
2128.0	127	7.4	2.559	0.264	0.994	0.000	1.000
2129.0	132	6.7	2.511	0.271	0.963	0.000	1.000
2130.0	80	1.5	2.284	0.190	0.061	0.203	1.000
2131.0	93	2.1	2.330	0.197	0.167	0.177	1.000
2132.0	100	2.0	2.336	0.234	0.328	0.163	1.000
2133.0	135	3.2	2.411	0.231	0.499	0.085	1.000
2134.0	110	6.2	2.521	0.231	0.742	0.000	1.000
2135.0	116	6.7	2.521	0.268	0.914	0.000	1.000
2136.0	124	7.7	2.867	0.356	1.000	0.000	1.000
2137.0	111	7.0	2.471	0.316	0.986	0.000	1.000
2138.0	118	7.4	2.585	0.243	0.972	0.000	1.000
2139.0	114	5.3	2.401	0.293	0.724	0.000	1.000
2140.0	124	5.3	2.436	0.278	0.750	0.016	1.000
2141.0	134	7.4	2.466	0.323	1.000	0.013	1.000
2142.0	137	2.2	2.332	0.231	0.306	0.157	1.000
2143.0	97	4.0	2.493	0.240	0.717	0.004	1.000
2144.0	87	2.3	2.393	0.225	0.432	0.121	1.000
2145.0	81	6.3	2.562	0.164	0.571	0.022	1.000
2146.0	112	5.5	2.530	0.208	0.696	0.005	1.000
2147.0	118	8.1	2.522	0.289	1.000	0.000	1.000
2148.0	124	6.7	2.519	0.261	0.884	0.000	1.000
2149.0	108	4.7	2.440	0.235	0.585	0.032	1.000
2150.0	131	8.0	2.499	0.312	1.000	0.000	1.000
2151.0	121	6.4	2.515	0.276	0.935	0.000	1.000
2152.0	120	7.5	2.539	0.301	1.000	0.000	1.000
2153.0	134	7.7	2.548	0.285	1.000	0.000	1.000
2154.0	107	6.6	2.488	0.282	0.893	0.000	1.000
2155.0	123	7.7	2.542	0.304	1.000	0.000	1.000
2156.0	124	8.1	2.545	0.306	1.000	0.000	1.000
2157.0	124	7.6	2.562	0.286	1.000	0.000	1.000
2158.0	122	6.9	2.513	0.333	1.000	0.000	1.000
2159.0	88	3.2	2.456	0.199	0.484	0.081	1.000
2160.0	70	6.3	2.379	0.156	0.158	0.108	1.000
2161.0	79	3.7	2.615	0.202	0.881	0.009	1.000
2162.0	113	3.9	2.513	0.245	0.830	0.020	1.000

TURRUM_4 (page 5 of data listing)

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2163.0	105	6.8	2.497	0.289	0.945	0.000	1.000
2164.0	120	8.0	2.552	0.292	1.000	0.000	1.000
2165.0	117	7.1	2.508	0.298	1.000	0.000	1.000
2166.0	133	8.2	2.586	0.267	1.000	0.000	1.000
2167.0	133	7.3	2.547	0.296	1.000	0.000	1.000
2168.0	115	6.2	2.501	0.310	1.000	0.000	1.000
2169.0	112	7.3	2.510	0.257	0.849	0.000	1.000
2170.0	105	3.7	2.449	0.210	0.511	0.051	1.000
2171.0	112	5.5	2.494	0.259	0.815	0.000	1.000
2172.0	119	8.1	2.514	0.311	1.000	0.000	1.000
2173.0	115	5.9	2.493	0.296	0.966	0.000	1.000
2174.0	122	7.4	2.544	0.293	1.000	0.000	1.000
2175.0	123	6.7	2.525	0.299	1.000	0.000	1.000
2176.0	126	8.1	2.497	0.340	1.000	0.000	1.000
2177.0	102	3.8	2.438	0.224	0.540	0.028	1.000
2178.0	100	4.3	2.484	0.243	0.726	0.012	1.000
2179.0	127	8.9	2.533	0.320	1.000	0.000	1.000
2180.0	129	7.9	2.511	0.276	0.945	0.000	1.000
2181.0	127	8.2	2.517	0.292	1.000	0.000	1.000
2182.0	119	7.1	2.485	0.285	0.900	0.000	1.000
2183.0	106	7.2	2.464	0.269	Coal		
2184.0	94	3.3	2.358	0.210	Coal		
2185.0	95	3.6	2.457	0.243	0.637	0.003	1.000
2186.0	110	4.9	2.514	0.261	0.875	0.000	1.000
2187.0	136	8.0	2.510	0.295	1.000	0.000	1.000
2188.0	127	8.6	2.512	0.293	1.000	0.000	1.000
2189.0	120	8.3	2.443	0.295	0.838	0.000	1.000
2190.0	111	5.0	2.492	0.230	0.698	0.000	1.000
2191.0	79	1.7	2.297	0.223	0.225	0.184	1.000
2192.0	88	4.9	2.568	0.202	0.740	0.000	1.000
2193.0	73	19.7	2.550	0.108	0.327	0.044	1.000
2194.0	98	2.8	2.457	0.215	0.549	0.059	1.000
2195.0	127	7.9	2.512	0.301	1.000	0.000	1.000
2196.0	122	7.0	2.529	0.245	0.864	0.000	1.000
2197.0	128	7.6	2.506	0.296	0.996	0.000	1.000
2198.0	132	6.4	2.473	0.286	0.877	0.019	1.000
2199.0	70	2.4	2.427	0.215	0.440	0.108	1.000
2200.0	107	4.0	2.421	0.237	0.553	0.046	1.000
2201.0	109	5.4	2.489	0.217	0.638	0.008	1.000
2202.0	62	8.6	2.704	0.103	0.673	0.016	1.000
2203.0	99	4.4	2.486	0.234	0.687	0.005	1.000
2204.0	118	7.5	2.533	0.308	1.000	0.000	1.000
2205.0	132	8.2	2.496	0.344	1.000	0.000	1.000
2206.0	126	8.6	2.566	0.326	1.000	0.000	1.000
2207.0	125	7.3	2.528	0.316	1.000	0.000	1.000
2208.0	113	7.4	2.529	0.271	0.956	0.000	1.000
2209.0	123	8.2	2.551	0.274	1.000	0.000	1.000
2210.0	111	6.5	2.491	0.250	0.777	0.000	1.000
2211.0	118	8.0	2.564	0.276	1.000	0.000	1.000
2212.0	117	9.0	2.511	0.296	1.000	0.000	1.000
2213.0	131	8.8	2.478	0.292	0.915	0.000	1.000
2214.0	121	8.0	2.531	0.252	0.883	0.000	1.000
2215.0	130	8.4	2.542	0.302	1.000	0.000	1.000
2216.0	117	7.5	2.519	0.272	0.933	0.000	1.000
2217.0	121	8.9	2.505	0.285	0.955	0.000	1.000
2218.0	125	8.4	2.617	0.308	1.000	0.000	1.000
2219.0	133	8.4	2.530	0.349	1.000	0.000	1.000
2220.0	126	11.2	1.885	0.439	Coal		
2221.0	97	3.0	2.419	0.196	0.382	0.104	1.000
2222.0	110	6.5	2.600	0.220	0.926	0.006	1.000
2223.0	103	4.2	2.480	0.214	0.606	0.032	1.000
2224.0	106	6.2	2.490	0.251	0.779	0.003	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2225.0	112	7.9	2.537	0.242	0.859	0.000	1.000
2226.0	121	7.2	2.474	0.274	0.875	0.000	1.000
2227.0	121	6.1	2.495	0.260	0.829	0.000	1.000
2228.0	127	6.6	2.529	0.243	0.906	0.000	1.000
2229.0	92	2.5	2.412	0.218	0.453	0.110	1.000
2230.0	88	8.6	2.560	0.140	0.502	0.020	1.000
2231.0	95	3.3	2.417	0.240	0.556	0.035	1.000
2232.0	125	6.6	2.558	0.265	1.000	0.000	1.000
2233.0	117	7.6	2.529	0.250	0.872	0.000	1.000
2234.0	118	7.3	2.517	0.251	0.854	0.000	1.000
2235.0	117	8.3	2.617	0.258	1.000	0.000	1.000
2236.0	117	8.2	2.538	0.296	1.000	0.000	1.000
2237.0	128	8.5	2.509	0.267	0.894	0.000	1.000
2238.0	106	6.4	2.532	0.222	0.780	0.000	1.000
2239.0	129	9.1	2.534	0.244	0.861	0.000	1.000
2240.0	113	8.3	2.554	0.306	1.000	0.000	1.000
2241.0	115	7.7	2.537	0.255	0.914	0.000	1.000
2242.0	118	6.7	2.500	0.291	0.972	0.000	1.000
2243.0	118	7.4	2.543	0.229	0.822	0.000	1.000
2244.0	84	5.8	2.615	0.186	0.825	0.000	1.000
2245.0	117	8.2	2.576	0.264	1.000	0.000	1.000
2246.0	102	5.1	2.503	0.222	0.670	0.000	1.000
2247.0	119	7.0	2.531	0.286	1.000	0.000	1.000
2248.0	111	2.0	2.426	0.263	0.663	0.061	1.000
2249.0	94	4.1	2.463	0.213	0.546	0.030	1.000
2250.0	128	9.0	2.583	0.261	1.000	0.000	1.000
2251.0	126	9.0	2.518	0.284	0.987	0.000	1.000
2252.0	116	7.8	2.504	0.229	0.727	0.000	1.000
2253.0	119	7.4	2.573	0.271	1.000	0.000	1.000
2254.0	94	4.0	2.471	0.187	0.469	0.062	1.000
2255.0	85	2.9	2.447	0.198	0.407	0.080	1.000
2256.0	73	3.5	2.457	0.207	0.466	0.059	1.000
2257.0	118	7.2	2.588	0.250	1.000	0.000	1.000
2258.0	122	7.8	2.544	0.265	0.973	0.000	1.000
2259.0	126	9.1	2.532	0.260	0.923	0.000	1.000
2260.0	128	8.5	2.479	0.293	0.946	0.000	1.000
2261.0	120	7.7	2.569	0.282	1.000	0.000	1.000
2262.0	99	5.1	2.529	0.203	0.663	0.004	1.000
2263.0	105	6.1	2.454	0.224	0.585	0.020	1.000
2264.0	124	9.1	2.530	0.236	0.864	0.000	1.000
2265.0	107	5.9	2.556	0.196	0.691	0.001	1.000
2266.0	115	6.6	2.556	0.267	1.000	0.000	1.000
2267.0	75	2.6	2.403	0.201	0.359	0.096	1.000
2268.0	97	3.9	2.483	0.229	0.648	0.004	1.000
2269.0	75	4.4	2.503	0.182	0.480	0.033	1.000
2270.0	130	6.8	2.524	0.361	1.000	0.000	1.000
2271.0	124	8.7	2.594	0.256	1.000	0.000	1.000
2272.0	120	5.9	2.538	0.252	0.904	0.000	1.000
2273.0	96	2.5	2.436	0.217	0.490	0.069	1.000
2274.0	76	1.9	2.349	0.197	0.221	0.154	1.000
2275.0	102	4.5	2.480	0.227	0.663	0.014	1.000
2276.0	111	4.7	2.527	0.234	0.807	0.000	1.000
2277.0	115	8.2	2.533	0.314	1.000	0.000	1.000
2278.0	120	8.2	2.554	0.248	0.931	0.000	1.000
2279.0	132	8.4	2.570	0.297	1.000	0.000	1.000
2280.0	125	7.7	2.501	0.280	0.934	0.000	1.000
2281.0	97	2.2	2.446	0.189	0.422	0.104	1.000
2282.0	85	2.9	2.370	0.187	0.225	0.137	1.000
2283.0	115	7.8	2.587	0.245	0.999	0.000	1.000
2284.0	122	9.2	2.548	0.266	0.990	0.000	1.000
2285.0	133	9.0	2.553	0.296	1.000	0.000	1.000
2286.0	124	5.4	2.535	0.198	0.679	0.020	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2287.0	112	4.6	2.538	0.219	0.819	0.000	1.000
2288.0	112	5.6	2.497	0.236	0.723	0.000	1.000
2289.0	128	9.6	2.538	0.272	0.991	0.000	1.000
2290.0	131	8.6	2.523	0.292	1.000	0.000	1.000
2291.0	107	4.8	2.458	0.259	0.747	0.000	1.000
2292.0	118	9.1	2.571	0.287	1.000	0.000	1.000
2293.0	128	9.8	2.521	0.247	0.870	0.000	1.000
2294.0	120	9.5	2.540	0.255	0.925	0.000	1.000
2295.0	132	9.2	2.526	0.323	1.000	0.000	1.000
2296.0	126	9.7	2.529	0.316	1.000	0.000	1.000
2297.0	122	8.2	2.528	0.266	0.942	0.000	1.000
2298.0	130	8.5	2.565	0.278	1.000	0.000	1.000
2299.0	62	28.9	1.323	0.701	Coal		
2300.0	86	3.0	2.399	0.193	Coal		
2301.0	117	4.7	2.451	0.193	0.454	0.072	1.000
2302.0	119	4.7	2.455	0.217	0.562	0.032	1.000
2303.0	117	3.2	2.427	0.205	0.442	0.078	1.000
2304.0	74	3.7	2.422	0.200	0.370	0.107	1.000
2305.0	102	5.3	2.295	0.316	Coal		
2306.0	84	2.7	2.417	0.226	0.476	0.095	1.000
2307.0	115	4.8	2.459	0.215	0.563	0.025	1.000
2308.0	129	10.6	2.512	0.306	1.000	0.000	1.000
2309.0	110	7.2	2.460	0.235	0.646	0.011	1.000
2310.0	77	1.9	2.330	0.166	0.085	0.177	1.000
2311.0	135	5.8	2.574	0.273	1.000	0.008	1.000
2312.0	61	1.1	2.257	0.177	0.000	0.227	1.000
2313.0	53	1.2	2.318	0.170	0.046	0.201	1.000
2314.0	59	1.3	2.294	0.200	0.118	0.207	1.000
2315.0	52	1.2	2.222	0.177	0.000	0.240	1.000
2316.0	42	1.4	2.338	0.155	0.000	0.192	1.000
2317.0	48	1.4	2.321	0.152	0.000	0.201	1.000
2318.0	49	1.2	2.305	0.183	0.053	0.207	1.000
2319.0	55	1.1	2.251	0.199	0.010	0.236	1.000
2320.0	52	1.0	2.255	0.198	0.032	0.237	1.000
2321.0	68	1.8	2.367	0.191	0.255	0.158	1.000
2322.0	78	1.5	2.411	0.207	0.362	0.151	1.000
2323.0	84	1.4	2.328	0.223	0.272	0.174	1.000
2324.0	59	4.0	2.844	0.085	0.987	0.003	1.000
2325.0	53	1.1	2.279	0.169	0.000	0.218	1.000
2326.0	62	1.0	2.211	0.225	0.036	0.249	1.000
2327.0	113	7.0	2.664	0.219	1.000	0.000	1.000
2328.0	106	6.3	2.578	0.212	0.847	0.016	1.000
2329.0	54	3.9	2.497	0.147	0.307	0.077	1.000
2330.0	36	97.3	2.728	0.063	0.540	0.001	1.000
2331.0	38	36.8	2.686	0.030	0.270	0.020	1.000
2332.0	55	1.3	2.340	0.202	0.175	0.189	1.000
2333.0	53	1.7	2.567	0.180	0.654	0.035	1.000
2334.0	73	5.7	2.464	0.111	0.149	0.103	1.000
2335.0	65	1.7	2.332	0.218	0.286	0.166	1.000
2336.0	88	7.3	2.287	0.441	Coal		
2337.0	100	4.2	2.427	0.184	0.358	0.102	1.000
2338.0	118	8.5	2.497	0.215	0.660	0.000	1.000
2339.0	92	2.2	2.499	0.175	0.448	0.068	1.000
2340.0	72	1.7	2.342	0.187	0.184	0.188	1.000
2341.0	84	3.8	2.344	0.186	0.160	0.148	1.000
2342.0	127	11.3	2.562	0.278	1.000	0.000	1.000
2343.0	123	12.2	2.523	0.278	0.988	0.000	1.000
2344.0	124	11.2	2.555	0.288	1.000	0.000	1.000
2345.0	97	7.0	2.512	0.229	0.736	0.016	1.000
2346.0	118	7.3	2.510	0.239	0.833	0.000	1.000
2347.0	102	6.3	2.496	0.245	0.783	0.000	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2348.0	117	7.1	2.542	0.230	0.835	0.000	1.000
2349.0	112	5.4	2.715	0.235	1.000	0.000	1.000
2350.0	111	8.9	2.512	0.270	0.924	0.000	1.000
2351.0	104	4.2	2.431	0.208	0.468	0.055	1.000
2352.0	116	6.6	2.475	0.228	Coal		
2353.0	23	171.8	1.201	0.576	Coal		
2354.0	62	20.5	2.209	0.402	Coal		
2355.0	109	12.3	2.484	0.242	Coal		
2356.0	117	12.6	2.553	0.233	0.877	0.000	1.000
2357.0	125	12.4	2.540	0.228	0.845	0.000	1.000
2358.0	74	1.9	2.342	0.184	0.154	0.170	1.000
2359.0	70	2.6	2.389	0.178	0.267	0.141	1.000
2360.0	76	4.7	2.541	0.203	0.697	0.026	1.000
2361.0	93	12.3	2.588	0.207	0.856	0.000	1.000
2362.0	106	13.1	2.545	0.264	0.986	0.000	1.000
2363.0	116	13.3	2.587	0.263	1.000	0.000	1.000
2364.0	114	9.1	2.603	0.303	1.000	0.000	1.000
2365.0	132	10.2	2.488	0.259	0.878	0.000	1.000
2366.0	107	4.6	2.422	0.271	0.687	0.022	1.000
2367.0	53	1.5	2.247	0.219	0.073	0.239	1.000
2368.0	74	1.8	2.244	0.200	0.011	0.239	1.000
2369.0	81	1.5	2.233	0.211	0.018	0.238	1.000
2370.0	65	1.7	2.234	0.220	0.072	0.236	1.000
2371.0	83	2.5	2.280	0.187	Coal		
2372.0	112	6.7	2.459	0.196	Coal		
2373.0	82	48.1	1.252	0.484	Coal		
2374.0	27	35.6	1.268	0.599	Coal		
2375.0	85	2.0	2.338	0.198	0.193	0.171	1.000
2376.0	86	2.6	2.400	0.180	0.274	0.128	1.000
2377.0	103	144.5	2.693	0.089	0.605	0.000	1.000
2378.0	86	13.2	2.596	0.133	0.547	0.005	1.000
2379.0	101	10.0	2.524	0.225	0.773	0.000	1.000
2380.0	120	12.9	2.571	0.252	1.000	0.000	1.000
2381.0	86	8.0	2.496	0.249	0.799	0.011	1.000
2382.0	110	12.1	2.605	0.259	1.000	0.000	1.000
2383.0	124	11.3	2.569	0.294	1.000	0.000	1.000
2384.0	130	12.0	2.586	0.299	1.000	0.000	1.000
2385.0	128	12.6	2.642	0.295	1.000	0.000	1.000
2386.0	134	13.8	2.625	0.264	1.000	0.000	1.000
2387.0	121	17.8	2.541	0.298	1.000	0.000	1.000
2388.0	112	5.9	2.515	0.200	0.644	0.022	1.000
2389.0	106	6.8	2.533	0.191	0.653	0.006	1.000
2390.0	127	14.5	2.577	0.283	1.000	0.000	1.000
2391.0	126	14.1	2.590	0.246	1.000	0.000	1.000
2392.0	119	16.3	2.578	0.285	1.000	0.000	1.000
2393.0	102	9.1	2.510	0.166	0.494	0.035	1.000
2394.0	104	10.8	2.565	0.210	0.812	0.002	1.000
2395.0	90	4.8	2.491	0.163	0.434	0.081	1.000
2396.0	80	23.3	2.684	0.075	0.479	0.004	1.000
2397.0	64	2.2	2.322	0.204	0.196	0.180	1.000
2398.0	56	43.9	1.295	0.683	Coal		
2399.0	95	6.0	2.348	0.234	Coal		
2400.0	104	8.6	2.498	0.219	0.683	0.017	1.000
2401.0	123	10.0	2.516	0.270	0.942	0.000	1.000
2402.0	90	5.3	2.435	0.176	0.346	0.095	1.000
2403.0	69	1.8	2.377	0.218	0.332	0.124	1.000
2404.0	54	1.5	2.278	0.202	0.078	0.228	1.000
2405.0	55	1.6	2.274	0.191	0.034	0.222	1.000
2406.0	57	1.9	2.287	0.193	0.083	0.209	1.000
2407.0	61	1.9	2.319	0.172	0.053	0.199	1.000
2408.0	67	2.1	2.376	0.180	0.215	0.163	1.000
2409.0	60	2.2	2.374	0.189	0.185	0.163	1.000

TURRUM_4 (page 9 of data listing)

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2410.0	69	2.2	2.299	0.205	0.150	0.194	1.000
2411.0	83	3.9	2.430	0.185	0.374	0.102	1.000
2412.0	83	4.6	2.463	0.167	0.359	0.073	1.000
2413.0	87	6.8	2.621	0.194	0.890	0.001	1.000
2414.0	122	11.8	2.575	0.210	0.842	0.000	1.000
2415.0	109	9.0	2.582	0.198	0.809	0.000	1.000
2416.0	97	5.2	2.473	0.179	0.457	0.082	1.000
2417.0	100	9.5	2.553	0.190	0.703	0.007	1.000
2418.0	100	5.1	2.522	0.182	0.549	0.051	1.000
2419.0	124	11.2	2.610	0.248	1.000	0.000	1.000
2420.0	121	10.6	2.560	0.281	1.000	0.000	1.000
2421.0	121	10.9	2.585	0.316	1.000	0.000	1.000
2422.0	141	10.9	2.603	0.307	Coal		
2423.0	97	51.9	1.277	0.720	Coal		
2424.0	52	29.8	1.706	0.599	Coal		
2425.0	94	2.8	2.464	0.154	0.297	0.102	1.000
2426.0	56	2.2	2.349	0.164	0.103	0.178	1.000
2427.0	100	8.1	2.492	0.236	0.742	0.008	1.000
2428.0	111	11.9	2.605	0.226	0.987	0.000	1.000
2429.0	121	18.2	2.550	0.259	0.984	0.000	1.000
2430.0	128	14.4	2.645	0.265	1.000	0.000	1.000
2431.0	129	15.2	2.575	0.199	0.800	0.004	1.000
2432.0	63	1.7	2.279	0.196	0.055	0.204	1.000
2433.0	47	1.6	2.276	0.192	0.034	0.224	1.000
2434.0	55	1.7	2.297	0.179	0.050	0.199	1.000
2435.0	63	2.6	2.329	0.199	0.202	0.186	1.000
2436.0	52	83.6	2.713	0.036	0.393	0.001	1.000
2437.0	65	4.1	2.432	0.152	0.256	0.102	1.000
2438.0	132	9.6	2.459	0.327	Coal		
2439.0	122	14.6	2.602	0.212	Coal		
2440.0	123	16.0	2.614	0.233	1.000	0.000	1.000
2441.0	114	14.8	2.595	0.258	1.000	0.000	1.000
2442.0	133	14.7	2.619	0.242	1.000	0.000	1.000
2443.0	142	13.3	2.584	0.279	1.000	0.000	1.000
2444.0	88	12.8	2.597	0.204	0.876	0.000	1.000
2445.0	116	15.2	2.588	0.217	0.908	0.000	1.000
2446.0	121	14.8	2.585	0.262	1.000	0.000	1.000
2447.0	122	13.2	2.600	0.288	1.000	0.000	1.000
2448.0	120	12.6	2.641	0.286	1.000	0.000	1.000
2449.0	117	15.7	2.886	0.241	1.000	0.000	1.000
2450.0	119	13.9	2.591	0.257	1.000	0.000	1.000
2451.0	124	13.4	2.586	0.266	1.000	0.000	1.000
2452.0	122	13.4	2.568	0.245	0.973	0.000	1.000
2453.0	109	11.5	2.574	0.205	0.822	0.000	1.000
2454.0	124	7.9	2.079	0.387	Coal		
2455.0	120	17.7	2.390	0.317	Coal		
2456.0	108	104.8	1.368	0.520	Coal		
2457.0	88	19.3	2.314	0.336	Coal		
2458.0	136	21.0	2.473	0.300	Coal		
2459.0	64	304.1	1.304	0.570	Coal		
2460.0	50	159.0	1.389	0.554	Coal		
2461.0	104	9.4	2.482	0.223	Coal		
2462.0	90	5.5	2.463	0.181	0.440	0.081	1.000
2463.0	98	5.0	2.455	0.169	0.372	0.087	1.000
2464.0	80	8.5	2.630	0.175	0.840	0.001	1.000
2465.0	127	13.6	2.584	0.210	0.996	0.000	1.000
2466.0	116	9.6	2.584	0.196	0.811	0.004	1.000
2467.0	112	13.2	2.604	0.197	0.864	0.000	1.000
2468.0	108	11.2	2.522	0.176	0.571	0.012	1.000
2469.0	106	46.4	2.686	0.135	0.812	0.004	1.000
2470.0	90	8.6	2.513	0.164	0.497	0.056	1.000
2471.0	89	6.4	2.489	0.163	0.373	0.062	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2472.0	80	3.6	2.381	0.189	0.293	0.111	1.000
2473.0	94	9.5	2.583	0.168	0.661	0.010	1.000
2474.0	118	14.8	2.514	0.190	0.610	0.005	1.000
2475.0	125	19.9	2.551	0.224	0.923	0.000	1.000
2476.0	122	19.5	2.567	0.265	1.000	0.000	1.000
2477.0	118	16.8	2.741	0.201	1.000	0.000	1.000
2478.0	90	9.7	2.515	0.189	0.606	0.021	1.000
2479.0	122	17.6	2.566	0.245	0.975	0.000	1.000
2480.0	119	18.2	2.547	0.215	0.799	0.000	1.000
2481.0	85	9.5	2.609	0.199	0.890	0.000	1.000
2482.0	120	20.6	1.979	0.439	Coal		
2483.0	118	25.0	2.504	0.298	Coal		
2484.0	50	76.3	2.029	0.484	Coal		
2485.0	144	26.3	2.566	0.335	1.000	0.000	1.000
2486.0	99	61.9	1.412	0.571	Coal		
2487.0	70	8.5	2.507	0.217	Coal		
2488.0	114	6.4	2.460	0.190	0.473	0.074	1.000
2489.0	79	5.1	2.431	0.176	0.358	0.110	1.000
2490.0	86	9.7	2.555	0.186	0.668	0.019	1.000
2491.0	100	7.4	2.475	0.185	0.493	0.056	1.000
2492.0	101	9.7	2.514	0.199	0.619	0.012	1.000
2493.0	93	18.5	2.648	0.155	0.803	0.000	1.000
2494.0	99	10.7	2.526	0.214	0.729	0.000	1.000
2495.0	107	10.7	2.529	0.206	0.719	0.000	1.000
2496.0	100	14.3	2.622	0.194	0.905	0.000	1.000
2497.0	101	9.1	2.565	0.200	0.784	0.007	1.000
2498.0	107	7.3	2.493	0.199	0.594	0.013	1.000
2499.0	118	13.6	1.434	0.345	Coal		
2500.0	48	41.7	1.452	0.602	Coal		
2501.0	24	294.9	1.112	0.606	Coal		
2502.0	123	18.8	2.533	0.239	Coal		
2503.0	123	14.4	2.616	0.227	1.000	0.000	1.000
2504.0	128	10.8	2.543	0.238	Coal		
2505.0	132	12.8	2.540	0.258	Coal		
2506.0	113	14.6	2.558	0.201	0.792	0.001	1.000
2507.0	117	8.7	2.543	0.216	0.795	0.000	1.000
2508.0	119	12.7	2.519	0.214	0.727	0.000	1.000
2509.0	121	14.6	2.551	0.229	0.870	0.000	1.000
2510.0	111	11.8	2.550	0.220	0.831	0.000	1.000
2511.0	107	12.0	2.537	0.220	0.799	0.000	1.000
2512.0	108	12.1	2.533	0.213	0.741	0.000	1.000
2513.0	98	14.4	2.600	0.218	0.951	0.000	1.000
2514.0	104	17.4	2.549	0.251	0.957	0.000	1.000
2515.0	107	14.8	2.554	0.231	0.889	0.000	1.000
2516.0	105	15.8	2.572	0.239	0.967	0.000	1.000
2517.0	105	16.0	2.544	0.223	0.831	0.000	1.000
2518.0	106	16.0	2.562	0.238	0.938	0.000	1.000
2519.0	109	16.1	2.544	0.248	0.933	0.000	1.000
2520.0	116	16.7	2.542	0.241	0.902	0.000	1.000
2521.0	100	15.1	2.537	0.250	0.925	0.000	1.000
2522.0	106	15.0	2.585	0.252	1.000	0.000	1.000
2523.0	106	19.0	2.520	0.259	0.917	0.000	1.000
2524.0	109	20.3	2.537	0.223	0.812	0.000	1.000
2525.0	121	19.7	2.489	0.266	Coal		
2526.0	108	14.1	2.486	0.461	Coal		
2527.0	34	409.3	1.166	0.543	Coal		
2528.0	30	421.5	1.273	0.707	Coal		
2529.0	28	134.6	1.336	0.513	Coal		
2530.0	42	601.5	1.187	0.596	Coal		
2531.0	23	754.5	1.258	0.633	Coal		
2532.0	101	37.7	1.550	0.514	Coal		
2533.0	40	311.8	1.343	0.471	Coal		

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2534.0	70	35.1	2.267	0.353		Coal	
2535.0	122	6.2	2.639	0.247	1.000	0.001	1.000
2536.0	76	2.5	2.342	0.187	0.193	0.147	1.000
2537.0	83	5.4	2.534	0.194	0.668	0.042	1.000
2538.0	65	6.0	2.478	0.207	0.567	0.041	1.000
2539.0	123	12.7	2.797	0.197	1.000	0.000	1.000
2540.0	128	24.8	2.537	0.259	1.000	0.000	1.000
2541.0	127	21.4	2.625	0.308	1.000	0.000	1.000
2542.0	140	28.3	2.976	0.290	1.000	0.000	1.000
2543.0	138	14.0	2.523	0.271	0.991	0.000	1.000
2544.0	109	4.3	2.274	0.387		Coal	
2545.0	93	9.0	2.416	0.197	0.392	0.085	1.000
2546.0	91	3.2	2.467	0.174	0.372	0.115	1.000
2547.0	57	2.9	2.406	0.172	0.193	0.154	1.000
2548.0	74	13.8	2.559	0.094	0.284	0.045	1.000
2549.0	67	84.5	2.720	0.101	0.733	0.000	1.000
2550.0	77	7.2	2.524	0.179	0.555	0.026	1.000
2551.0	89	9.1	2.498	0.183	0.502	0.048	1.000
2552.0	112	23.4	2.621	0.263		Coal	
2553.0	78	98.2	1.510	0.521		Coal	
2554.0	109	27.6	2.595	0.269		Coal	
2555.0	123	18.6	2.577	0.174	0.709	0.000	1.000
2556.0	119	28.0	2.728	0.210	1.000	0.000	1.000
2557.0	106	22.2	2.550	0.212	0.801	0.000	1.000
2558.0	117	19.0	2.551	0.212	0.802	0.000	1.000
2559.0	111	20.0	2.534	0.224	0.811	0.000	1.000
2560.0	126	23.7	2.634	0.229	1.000	0.000	1.000
2561.0	144	19.9	2.626	0.249	1.000	0.000	1.000
2562.0	132	33.8	2.225	0.390		Coal	
2563.0	65	51.0	1.371	0.473		Coal	
2564.0	48	196.0	1.376	0.507		Coal	
2565.0	128	14.3	2.531	0.178		Coal	
2566.0	106	16.2	2.589	0.201	0.958	0.016	1.000
2567.0	93	46.6	2.583	0.141	0.584	0.002	1.000
2568.0	101	25.2	2.608	0.144	0.661	0.000	1.000
2569.0	124	7.3	2.508	0.168	0.508	0.046	1.000
2570.0	99	14.4	2.598	0.186	0.815	0.000	1.000
2571.0	113	30.9	2.602	0.207	0.914	0.000	1.000
2572.0	132	26.6	2.601	0.255	1.000	0.000	1.000
2573.0	131	26.8	2.594	0.245	1.000	0.000	1.000
2574.0	72	5.3	2.398	0.135	0.120	0.135	1.000
2575.0	88	6.6	2.467	0.191	0.496	0.063	1.000
2576.0	108	17.5	2.551	0.190	0.688	0.000	1.000
2577.0	104	17.5	2.510	0.196	0.633	0.015	1.000
2578.0	78	8.7	2.477	0.206	0.553	0.040	1.000
2579.0	94	9.8	2.460	0.214	0.562	0.034	1.000
2580.0	100	19.4	2.578	0.198	0.819	0.000	1.000
2581.0	128	26.1	2.666	0.254	1.000	0.000	1.000
2582.0	134	23.6	2.582	0.253	1.000	0.000	1.000
2583.0	138	23.5	2.639	0.296	1.000	0.000	1.000
2584.0	109	25.7	2.570	0.276	1.000	0.000	1.000
2585.0	129	23.0	2.600	0.266	1.000	0.000	1.000
2586.0	120	23.1	2.582	0.278	1.000	0.000	1.000
2587.0	126	25.2	2.643	0.247	1.000	0.000	1.000
2588.0	132	23.1	2.579	0.244	1.000	0.000	1.000
2589.0	127	20.9	2.618	0.270	1.000	0.000	1.000
2590.0	125	21.4	2.584	0.257		Coal	
2591.0	78	68.9	1.305	0.661		Coal	
2592.0	46	162.6	1.446	0.476		Coal	
2593.0	84	40.6	1.691	0.538		Coal	
2594.0	145	24.9	2.653	0.272	1.000	0.000	1.000
2595.0	123	24.2	2.624	0.223	1.000	0.000	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2596.0	94	164.5	1.694	0.443	Coal		
2597.0	50	36.4	1.228	0.555	Coal		
2598.0	115	57.1	2.006	0.406	Coal		
2599.0	54	40.5	1.874	0.507	Coal		
2600.0	142	21.0	2.543	0.200	0.736	0.000	1.000
2601.0	104	7.3	2.567	0.162	0.587	0.021	1.000
2602.0	128	19.5	2.666	0.172	0.936	0.003	1.000
2603.0	107	14.8	2.569	0.177	0.707	0.000	1.000
2604.0	107	28.3	2.615	0.191	0.886	0.000	1.000
2605.0	119	6.9	2.484	0.214	0.611	0.028	1.000
2606.0	69	3.8	2.329	0.182	0.158	0.162	1.000
2607.0	56	5.0	2.487	0.187	0.500	0.059	1.000
2608.0	55	3.7	2.395	0.176	0.189	0.148	1.000
2609.0	66	3.4	2.451	0.183	0.370	0.125	1.000
2610.0	55	2.6	2.345	0.184	Coal		
2611.0	55	31.5	1.753	0.435	Coal		
2612.0	137	37.6	2.174	0.420	Coal		
2613.0	79	31.1	2.062	0.438	Coal		
2614.0	130	24.6	2.543	0.200	0.737	0.000	1.000
2615.0	104	10.5	2.474	0.164	0.405	0.076	1.000
2616.0	86	8.8	2.516	0.149	0.451	0.070	1.000
2617.0	98	27.5	2.548	0.191	0.712	0.015	1.000
2618.0	118	13.7	2.455	0.194	0.485	0.064	1.000
2619.0	70	3.2	2.465	0.151	0.259	0.112	1.000
2620.0	47	4.6	2.543	0.164	0.526	0.041	1.000
2621.0	68	6.9	2.443	0.144	0.265	0.101	1.000
2622.0	113	20.8	2.553	0.175	0.658	0.003	1.000
2623.0	118	21.8	2.558	0.183	0.706	0.000	1.000
2624.0	105	4.0	2.569	0.184	0.722	0.025	1.000
2625.0	49	3.6	2.349	0.203	0.186	0.176	1.000
2626.0	61	3.2	2.311	0.213	0.135	0.191	1.000
2627.0	48	3.5	2.442	0.205	0.454	0.116	1.000
2628.0	43	3.9	2.408	0.191	0.291	0.134	1.000
2629.0	48	4.7	2.475	0.214	0.606	0.038	1.000
2630.0	49	3.6	2.291	0.181	0.066	0.198	1.000
2631.0	47	3.3	2.315	0.174	0.034	0.190	1.000
2632.0	51	2.3	2.310	0.166	0.000	0.205	1.000
2633.0	42	3.0	2.349	0.164	0.000	0.189	1.000
2634.0	61	5.5	2.469	0.129	0.156	0.112	1.000
2635.0	50	19.8	2.583	0.081	0.233	0.044	1.000
2636.0	43	34.6	2.777	0.053	0.671	0.000	1.000
2637.0	49	4.3	2.376	0.154	0.058	0.160	1.000
2638.0	53	3.5	2.373	0.156	0.019	0.177	1.000
2639.0	46	3.4	2.371	0.162	0.087	0.171	1.000
2640.0	59	5.4	2.424	0.164	0.240	0.125	1.000
2641.0	74	8.6	2.426	0.168	0.262	0.118	1.000
2642.0	61	16.0	2.566	0.166	0.617	0.004	1.000
2643.0	68	4.3	2.382	0.185	0.199	0.136	1.000
2644.0	75	9.9	2.562	0.206	0.814	0.000	1.000
2645.0	77	8.4	2.452	0.328	Coal		
2646.0	30	102.4	1.615	0.428	Coal		
2647.0	121	10.9	2.470	0.199	Coal		
2648.0	80	11.4	2.479	0.195	0.520	0.040	1.000
2649.0	86	24.3	2.555	0.177	0.663	0.001	1.000
2650.0	124	47.8	2.321	0.269	Coal		
2651.0	107	34.6	2.620	0.130	Coal		
2652.0	58	171.4	2.709	0.031	0.375	0.003	1.000
2653.0	56	4.7	2.400	0.174	0.218	0.130	1.000
2654.0	114	14.2	2.557	0.186	0.690	0.001	1.000
2655.0	132	22.6	2.623	0.178	0.854	0.000	1.000
2656.0	138	25.5	2.607	0.227	1.000	0.000	1.000
2657.0	138	24.6	2.569	0.222	1.000	0.000	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2658.0	141	19.1	2.588	0.237	1.000	0.000	1.000
2659.0	149	15.3	2.623	0.232	1.000	0.000	1.000
2660.0	137	31.3	1.956	0.464	Coal		
2661.0	28	264.7	1.214	0.541	Coal		
2662.0	110	100.3	2.357	0.359	Coal		
2663.0	52	1228.2	1.165	0.540	Coal		
2664.0	22	766.0	1.103	0.621	Coal		
2665.0	22	1410.6	1.190	0.511	Coal		
2666.0	17	1071.0	1.243	0.515	Coal		
2667.0	42	693.6	1.265	0.529	Coal		
2668.0	87	51.7	1.539	0.491	Coal		
2669.0	110	10.1	2.538	0.177	Coal		
2670.0	83	6.1	2.440	0.170	0.349	0.090	1.000
2671.0	122	31.8	2.568	0.184	Coal		
2672.0	131	30.2	2.604	0.267	Coal		
2673.0	147	23.8	2.576	0.182	Coal		
2674.0	144	15.0	2.504	0.179	0.551	0.038	1.000
2675.0	72	4.7	2.414	0.143	0.174	0.126	1.000
2676.0	64	3.7	2.386	0.154	0.065	0.163	1.000
2677.0	43	2.5	2.339	0.152	0.000	0.192	1.000
2678.0	52	3.1	2.488	0.150	0.317	0.089	1.000
2679.0	45	5.1	2.477	0.113	0.103	0.110	1.000
2680.0	60	6.3	2.492	0.138	0.284	0.086	1.000
2681.0	64	4.9	2.401	0.140	0.117	0.144	1.000
2682.0	66	6.3	2.539	0.157	0.485	0.043	1.000
2683.0	67	5.2	2.436	0.171	0.296	0.114	1.000
2684.0	69	3.9	2.429	0.186	0.339	0.117	1.000
2685.0	74	7.3	2.517	0.196	0.640	0.006	1.000
2686.0	69	7.9	2.519	0.190	0.615	0.011	1.000
2687.0	78	8.1	2.482	0.181	0.453	0.073	1.000
2688.0	69	13.2	2.612	0.128	0.576	0.001	1.000
2689.0	69	16.7	2.717	0.055	0.502	0.001	1.000
2690.0	49	117.1	2.624	0.111	0.522	0.003	1.000
2691.0	81	9.3	2.563	0.159	0.584	0.013	1.000
2692.0	99	10.2	2.442	0.158	0.342	0.099	1.000
2693.0	91	9.8	2.591	0.172	0.741	0.002	1.000
2694.0	102	12.0	2.597	0.133	0.560	0.000	1.000
2695.0	123	22.6	2.592	0.198	0.863	0.000	1.000
2696.0	130	27.3	2.569	0.223	0.928	0.000	1.000
2697.0	122	22.7	2.589	0.223	0.964	0.000	1.000
2698.0	117	15.4	2.546	0.219	0.838	0.000	1.000
2699.0	115	8.0	2.389	0.303	Coal		
2700.0	68	180.3	1.916	0.492	Coal		
2701.0	122	39.5	2.315	0.376	Coal		
2702.0	39	973.5	1.286	0.555	Coal		
2703.0	29	296.6	1.426	0.523	Coal		
2704.0	74	88.1	1.491	0.520	Coal		
2705.0	59	69.2	1.617	0.525	Coal		
2706.0	147	25.9	2.606	0.228	1.000	0.000	1.000
2707.0	111	23.8	2.624	0.177	0.859	0.000	1.000
2708.0	60	5.0	2.459	0.092	0.048	0.118	1.000
2709.0	71	20.9	2.680	0.129	0.798	0.000	1.000
2710.0	127	35.7	2.554	0.214	0.857	0.000	1.000
2711.0	115	32.0	2.619	0.151	0.705	0.000	1.000
2712.0	62	162.5	2.652	0.035	0.209	0.000	1.000
2713.0	108	27.3	2.593	0.218	0.955	0.000	1.000
2714.0	134	28.4	2.597	0.235	1.000	0.000	1.000
2715.0	118	27.3	2.553	0.217	0.896	0.000	1.000
2716.0	138	27.9	2.514	0.290	1.000	0.000	1.000
2717.0	127	32.5	2.531	0.259	0.971	0.000	1.000
2718.0	129	23.0	2.619	0.256	1.000	0.000	1.000
2719.0	120	21.0	2.556	0.248	0.991	0.000	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2720.0	122	20.2	2.999	0.262	1.000	0.000	1.000
2721.0	93	69.0	2.941	0.161	1.000	0.000	1.000
2722.0	117	20.0	3.033	0.212	1.000	0.000	1.000
2723.0	113	138.2	1.247	0.486	Coal		
2724.0	23	34877.4	1.098	0.568	Coal		
2725.0	21	43208.5	1.105	0.559	Coal		
2726.0	20	42136.6	1.189	0.550	Coal		
2727.0	22	6703.5	1.202	0.553	Coal		
2728.0	22	674.0	1.210	0.574	Coal		
2729.0	23	2.4	2.223	0.343	Coal		
2730.0	44	1.5	2.319	0.146	0.000	0.195	1.000
2731.0	42	1.6	2.317	0.137	0.000	0.192	1.000
2732.0	46	1.5	2.301	0.139	0.000	0.199	1.000
2733.0	44	1.6	2.375	0.150	0.000	0.176	1.000
2734.0	40	1.6	2.371	0.146	0.000	0.177	1.000
2735.0	39	1.7	2.359	0.128	0.000	0.173	1.000
2736.0	42	1.9	2.395	0.121	0.000	0.158	1.000
2737.0	39	1.8	2.440	0.125	0.060	0.134	1.000
2738.0	46	1.6	2.359	0.126	0.000	0.172	1.000
2739.0	52	1.6	2.368	0.128	0.002	0.170	1.000
2740.0	46	1.7	2.346	0.138	0.003	0.181	1.000
2741.0	53	1.5	2.342	0.127	0.000	0.179	1.000
2742.0	57	1.6	2.283	0.147	0.000	0.208	1.000
2743.0	51	1.7	2.373	0.119	0.000	0.164	1.000
2744.0	54	1.9	2.369	0.118	0.000	0.165	1.000
2745.0	64	1.9	2.334	0.136	0.000	0.186	1.000
2746.0	69	1.9	2.340	0.138	0.000	0.184	1.000
2747.0	64	2.1	2.375	0.131	0.024	0.164	1.000
2748.0	73	2.8	2.394	0.125	0.053	0.150	1.000
2749.0	68	2.7	2.401	0.123	0.058	0.146	1.000
2750.0	77	3.1	2.404	0.128	0.115	0.138	1.000
2751.0	85	3.5	2.428	0.126	0.138	0.124	1.000
2752.0	63	2.3	2.459	0.123	0.198	0.105	1.000
2753.0	62	1.9	2.360	0.142	0.034	0.172	1.000
2754.0	64	2.1	2.338	0.133	0.000	0.182	1.000
2755.0	60	3.0	2.371	0.103	0.000	0.158	1.000
2756.0	63	3.9	2.499	0.128	0.244	0.086	1.000
2757.0	62	4.0	2.485	0.129	0.211	0.094	1.000
2758.0	59	5.1	2.474	0.142	0.261	0.097	1.000
2759.0	67	2.8	2.457	0.158	0.258	0.111	1.000
2760.0	59	2.6	2.415	0.154	0.172	0.136	1.000
2761.0	62	2.6	2.411	0.159	0.194	0.135	1.000
2762.0	65	6.9	2.521	0.135	0.353	0.065	1.000
2763.0	59	8.1	2.526	0.135	0.357	0.063	1.000
2764.0	70	6.6	2.522	0.123	0.276	0.070	1.000
2765.0	70	10.4	2.587	0.131	0.516	0.013	1.000
2766.0	70	4.1	2.442	0.124	0.186	0.111	1.000
2767.0	70	8.4	2.555	0.141	0.486	0.032	1.000
2768.0	70	9.4	2.536	0.176	0.606	0.009	1.000
2769.0	70	4.9	2.543	0.177	0.606	0.009	1.000
2770.0	70	2.6	2.537	0.177	0.606	0.009	1.000
2771.0	70	3.2	2.544	0.177	0.606	0.009	1.000
2772.0	70	5.5	2.556	0.177	0.666	0.000	1.000
2773.0	70	5.8	2.696	0.177	1.000	0.000	1.000
2774.0	70	6.2	2.699	0.177	1.000	0.000	1.000
2775.0	70	6.4	2.699	0.177	1.000	0.000	1.000

TURRUM-4 FMS INTERPRETATION REPORT

Introduction

Following Dynamic Processing of the Turrum-4 FMS data, interactive interpretation of the lower L. balmei stratigraphic interval (2300m-2740mKB) was performed using Schlumberger's Fracview interpretation package. Results of this interpretation are listed in the attached Table 1.

Data quality was generally good over the interval of acquisition with few zones of poor pad contact. Although most sands yielded very good detailed resistivity patterns, some sands exhibited an amorphous response precluding meaningful interpretation. Of the eight major hydrocarbon reservoir systems recognised to date in the Turrum field, only five were intersected in the Turrum-4 well. The L100, 350, 360, 400 and 500 sands are investigated in this report. Some 489 surfaces were interactively correlated within the L. balmei zone (Figure 1) yielding both structural and stratigraphic information.

The aim of analysing the FMS data in Turrum-4 was firstly to derive an average structural dip for the interval and establish if the predrill seismic interpretation was accurate and to identify any variations in structural orientation which may have occurred within the L. balmei section. In addition, sedimentological detail extracted from the major sand bodies would be used to aid in the estimation of current flow directions which may enhance the understanding of depositional trends and controls within the major reservoir systems. It should be noted that no cores were cut in Turrum-4 and therefore inferences drawn from FMS interpretation will remain uncorroborated. However, the use of the interactive interpretation package greatly enhanced confidence in identifying small scale features and differentiating these into structural and stratigraphic components.

Structural Analysis

Structural dip was estimated by identifying planar resistivity markers across the borehole (using each of the resistivity pads) from within zones of reasonable shale thickness. Features identified within the thicker shales would more accurately reflect the underlying structural grain in comparison to dips associated with clay drape features more likely in the thinner shale sections. Accordingly, some 155 structural surfaces were correlated (Figure) over discrete shale zones over the entire section between the L100 to L500 reservoirs. The accompanying rose diagram of these surfaces (Figure 1) highlights the general uniformity of dip azimuth and magnitude throughout the lower L. balmei section. This indicates there to have been little significant change in structural orientation during this period. The general southeasterly orientation of these features is consistent with the predrill structural interpretation at the Turrum-4 location. The dip azimuth within the shale sections of the lower L. balmei interval at Turrum-4 ranges from 120° to 175° whilst dip magnitude varies from 1° to 8°. Accordingly, an average structural dip for the lower L. balmei at Turrum-4 is interpreted to be 4° at 139°. This value for structural dip has been rotated out of all subsequent stratigraphic dips presented herein.

Stratigraphic Analysis

The main focus of the stratigraphic analysis of the Turrum-4 FMS data was to establish current flow directions from the recognition of cross bed features within the major sand units intersected in Turrum-4. The Lower L. balmei sequence in the Turrum field is interpreted to have been deposited in a coastal plain setting with fluvial systems feeding into a lacustrine environment situated behind a barrier bar system separating the nearshore marine environment. Minor marine influences are recorded in the Turrum-4 L. balmei section. It is recognised that the FMS data is not calibrated to core from the well and hence some uncertainty to the significance of observed resistivity responses is assumed.

L100 Reservoir (2310-2345mKB)

Dips computed within the L100 sand at Turrum-4, above the 54 million year sequence boundary indicate a bimodel depositional character (Figure 2). The two predominant dip azimuths are approximately mutually orthogonal and may reflect stacked channel sands deposited within different parts of a meander loop with the resistivity surfaces correlated representing lateral accretion surfaces deposited perpendicular to current flow. Dip azimuths of 65° and 320° and dip magnitudes ranging from 4° to 23° are recorded in this interval. The variation in dip azimuth of this unit compared to the more consistent azimuth seen in underlying intervals may reflect the lack of influence of faulting on depositional trends higher in the section. It is interesting to note that below the 54my sequence boundary (2327mKB) dip azimuth is apparently rotated by 180° to 250° and 150° reflecting the different depositional setting in existence below the sequence boundary.

L350 Reservoir (2604-2611mKB)

The L350 reservoir represents a thin channel sand which is variously developed across the Turrum field and generally is found to rest directly upon the L360 coal horizon. It exhibits a blocky to fining upward log signature fieldwide and porosities of 17-18%. A number of resistivity surfaces were correlated over the L350 sand in Turrum-4. The resultant bimodal representation of dip azimuth (Attachment 1 CB2605) indicate a dominant current direction of 280° (northwest) with a minor southwesterly (215°) flow direction also evident.

L360 Reservoir (2628-2654mKB)

The L360 reservoir in the Turrum field represents a thick channel sand or sequence of stacked fining upward sand bodies which are variously developed across the field. In the Turrum-4 well, the L360 sand exhibits a more massive character and lacks the cyclic fining upward log signature exhibited in other wells (Turrum-3, Marlin-4 and Turrum-2) in the field.

A large number of surfaces, mainly consisting of cross bed foresets were correlated within this unit. These surfaces displayed large true dip magnitudes (up to 30°) and a very focused and consistent dip azimuth (ranging from 115° to 175° with an average dip direction of 150°- Figure 3). The apparent consistency of dip azimuth in the southeasterly direction may reflect low sinuosity fluvial deposition with longitudinal bar development in the Turrum-4 location. In addition, the dip azimuth of these bedding features parallels the orientation of the predominant fault system throughout the Turrum field at this stratigraphic level. This indicates that faulting may have influenced depositional trends for the L360 reservoir, possibly concentrating reservoir quality sand on the lowside of faults by focusing channel geometry.

L400 Reservoir (2674-2682mKB)

The L400 sandstone is deposited stratigraphically between the L400 and L450 coal markers. Its thickness varies significantly over the Turrum field and at the Turrum-4 location is above average thickness at some 15m thick.

Dip azimuth plots (Figure 4) indicate two predominant current flow directions. The dominant direction is at 160° and again displays the depositional influence of the syndepositional faulting in Turrum. The subordinate flow direction is between 70° and 95° which is orthogonal to the major current flow direction and may represent depositional differences within the lower and higher flow regimes. The easterly dips are seemingly restricted to the finer grained bases of depositional cycles or the tops of fining upward cycles. Dip magnitudes are observed to vary from 8° to 28°.

L500 Reservoir (2730m-2750mKB)

The L500 sand represents a major reservoir in the Turrum field and consists of a massive blocky sand consistently developed across the Turrum field, immediately below the L500 coal marker. In Turrum-4, some 26 surfaces were correlated on FMS data. These surfaces exhibited little variation in dip azimuth, yielding a constant 130°-140° which is again consistent with the dominant fault strike at Turrum. Dip magnitudes varied from 10° up to 36° and depict very high angle foreset deposition (Figure 5).

Conclusion

The FMS data from the L. balmei section at Turrum-4 yielded good quality dip data and provided images of quite high angle depositional features. Structural dips from the shales indicated little variance in structural attitude throughout the L100 to L500 interval. The dominance of the southeasterly dip azimuth in many of the sand bodies indicated the probable influence of the major faults across the Turrum field on reservoir distribution. Variance to the southeasterly flow direction may be interpreted as deposition within higher sinuosity fluvial channels where lateral accretion surfaces are more prominent

TURRUM-4 FMS INTERPRETATION SUMMARY

Structural Analysis

Interval	Av Dip Magnitude	Dominant Dip Azimuths
Lower L. balmei (2300-2750mKB)	4°	139°

Stratigraphic Analysis

Interval	Av Dip Magnitude	Dominant Dip Azimuths
L100 CB2310 (2310-2345mKB)	Av 10°	065° 320°
L350 CB2605 (2604-2611mKB)	Av 7°	280° 215°
L360 CB 2625 (2628-2654mKB)	Av 16°	150°
L400 CB2675 (2674-2682mKB)	Av 14°	160° 080°
L500 CB 2730 (2730m-2750mKB)	Av 20°	135°

TABLE 1

JP:lt:0193rep3

PE906487

This is an enclosure indicator page.
The enclosure PE906487 is enclosed within the container PE900975 at this location in this document.

The enclosure PE906487 has the following characteristics:

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BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	DIAGRAM
DESCRIPTION =	Structural Dips Data, Figure 1, Turrum-4
REMARKS =	
DATE_CREATED =	30/11/92
DATE_RECEIVED =	16/03/93
W_NO =	W1069
WELL_NAME =	TURRUM-4
CONTRACTOR =	SCHLUMBERGER
CLIENT_OP_CO =	ESSO AUSTRALIA LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)

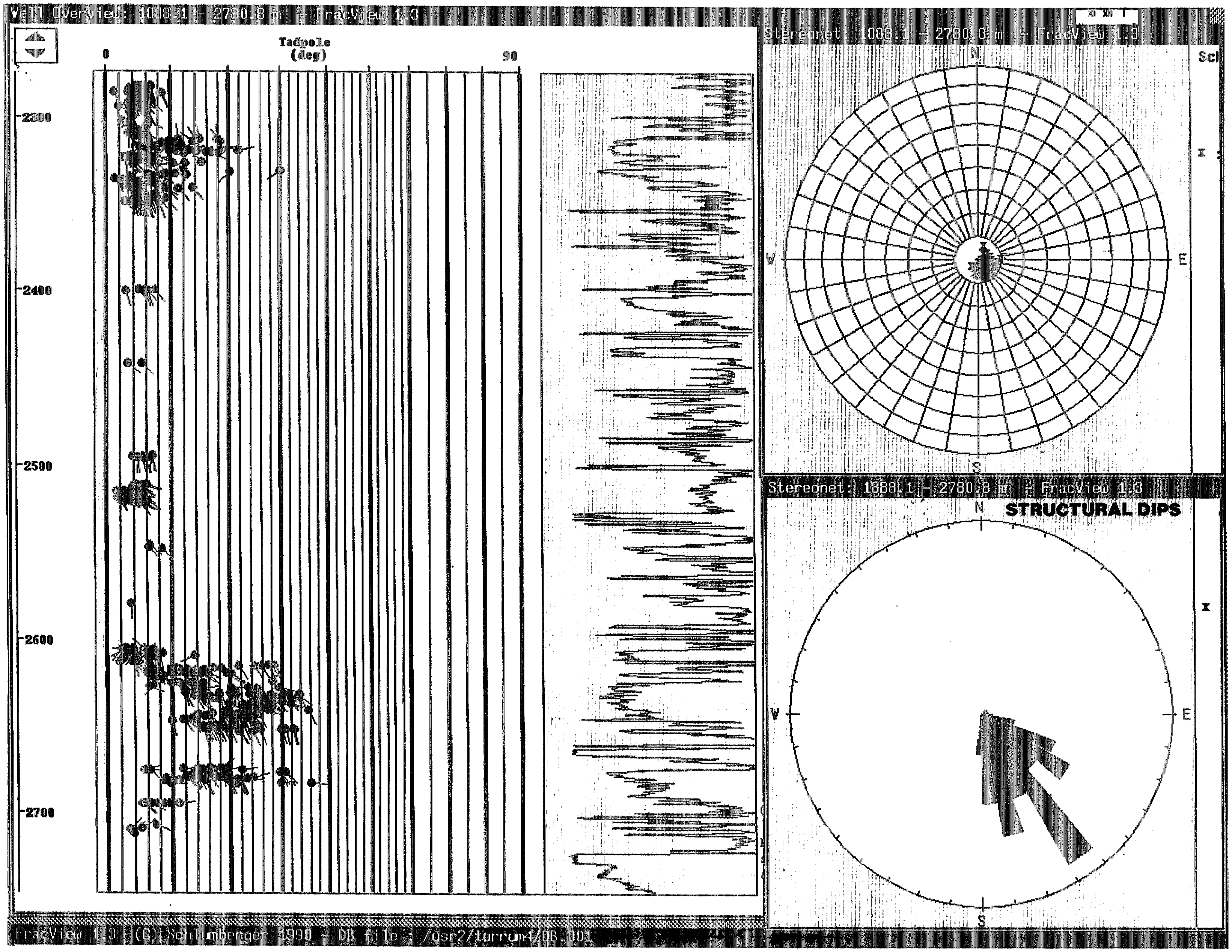
Well Overview: 1888.1 - 2780.8 m - FracView 1.3
Tadpole
(deg)
0
90
2300
2400
2500
2600
2700
Stereonet: 1888.1 - 2780.8 m - FracView 1.3
N
E
S
W
Stereonet: 1888.1 - 2780.8 m - FracView 1.3
STRUCTURAL DIPS
N
E
S
W
FracView 1.3 (C) Schlumberger 1990 - DB file : /usr2/turrum4/DB.001

FIGURE 1

PE906488

This is an enclosure indicator page.
The enclosure PE906488 is enclosed within the container PE900975 at this location in this document.

The enclosure PE906488 has the following characteristics:

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CONTAINER_BARCODE =	PE900975
NAME =	Structural Dips Data, Figure 2
BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	DIAGRAM
DESCRIPTION =	Structural Dips Data, Figure 2, Turrum-4
REMARKS =	
DATE_CREATED =	30/11/92
DATE_RECEIVED =	16/03/93
W_NO =	W1069
WELL_NAME =	TURRUM-4
CONTRACTOR =	SCHLUMBERGER
CLIENT_OP_CO =	ESSO AUSTRALIA LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)

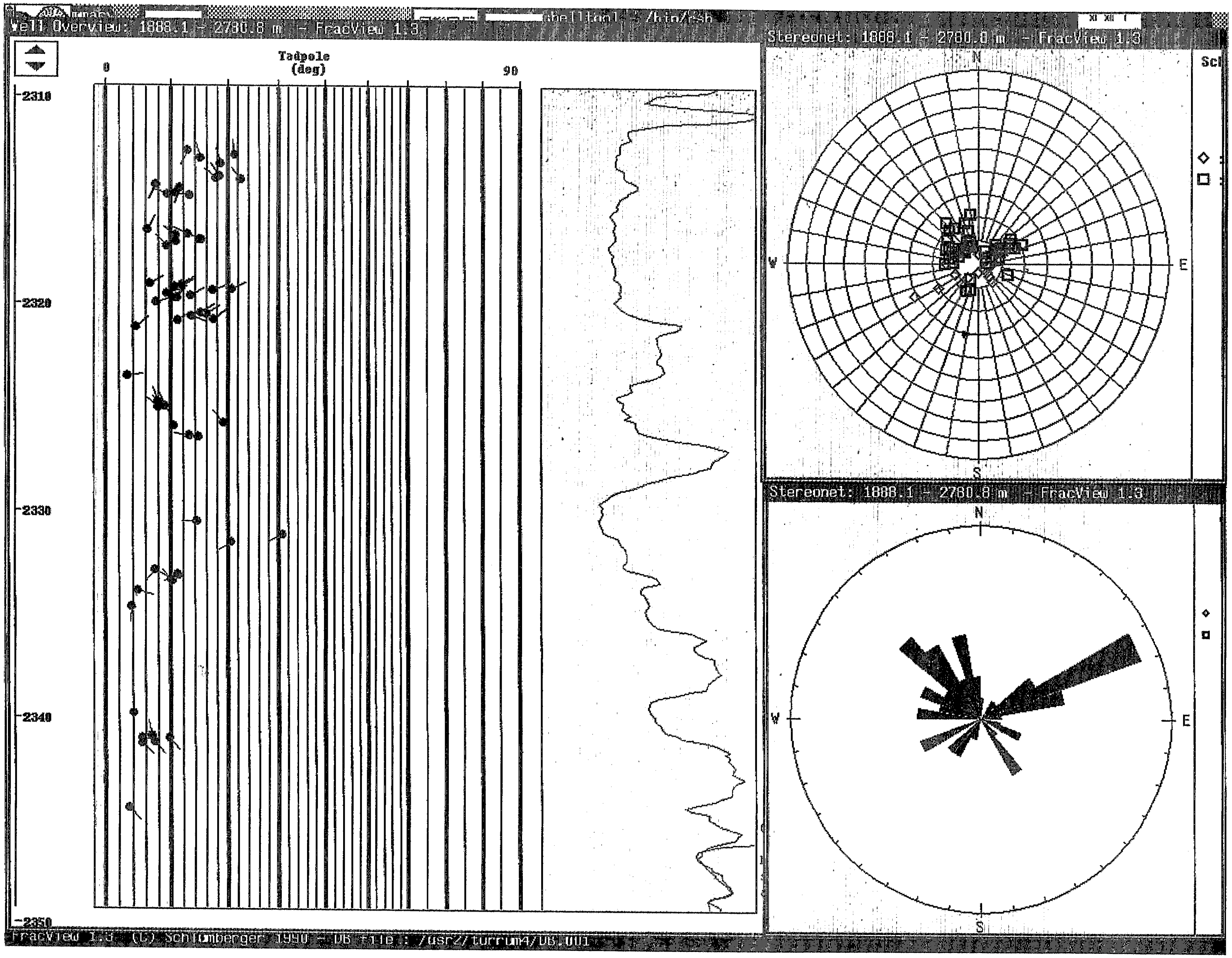
Well Overview: 1888.1 - 2780.8 m - FracView 1.3
Tadpole
(deg)
0
90
2310
2320
2330
2340
2350
Stereonet: 1888.1 - 2780.8 m - FracView 1.3
N
W
E
S
Stereonet: 1888.1 - 2780.8 m - FracView 1.3
N
W
E
S
FracView 1.3 (C) Schlumberger 1990

FIGURE 2

PE906489

This is an enclosure indicator page.
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BASIN = GIPPSLAND
PERMIT = VIC/L4
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Structural Dips Data, Figure 3, Turrum-4
REMARKS =
DATE_CREATED = 30/11/92
DATE_RECEIVED = 16/03/93
W_NO = W1069
WELL_NAME = TURRUM-4
CONTRACTOR = SCHLUMBERGER
CLIENT_OP_CO = ESSO AUSTRALIA LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)

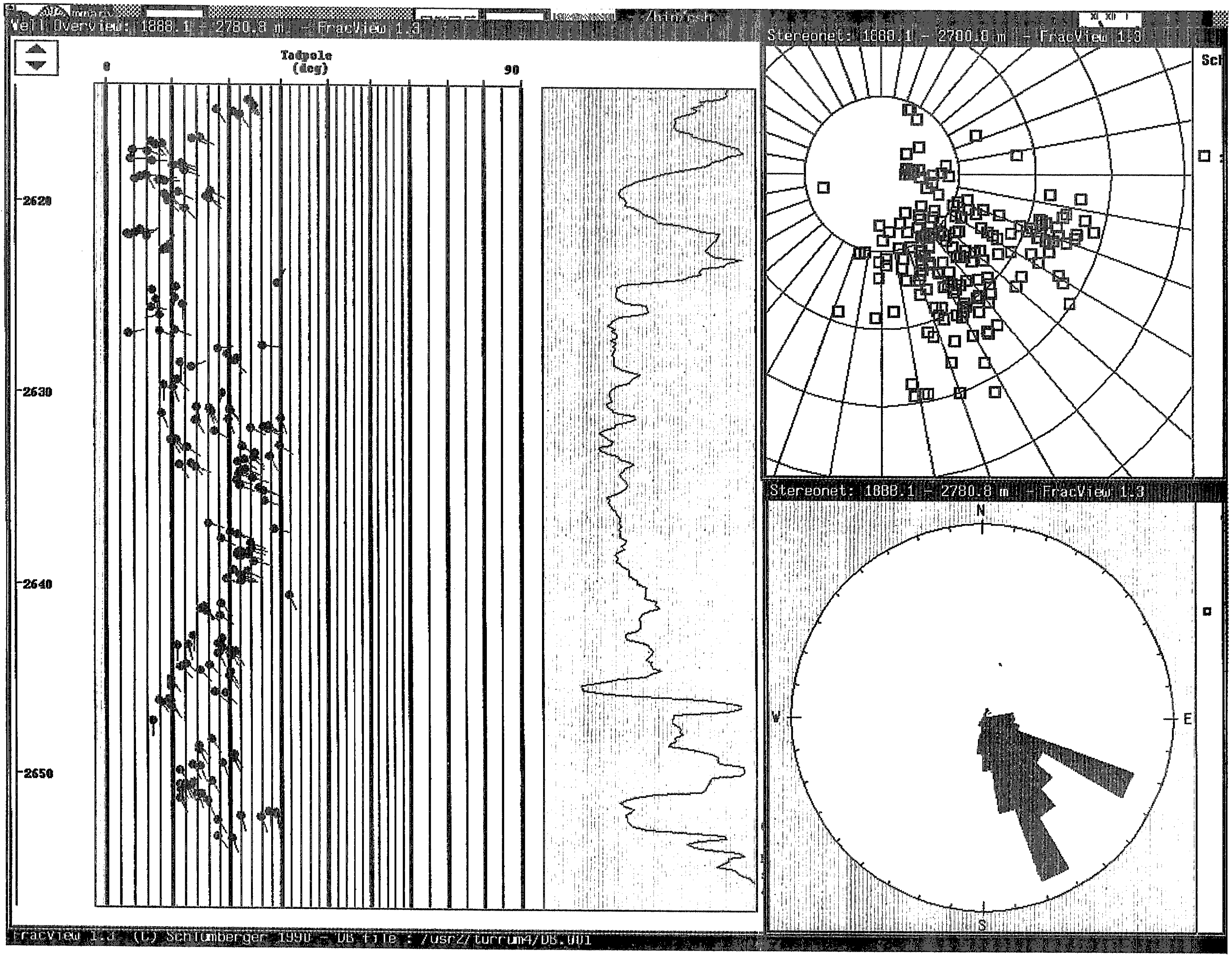
Well Overview: 1888.1 - 2780.8 m - FracView 1.3
Tadpole (deg)
0
90
2620
2630
2640
2650
Stereonet: 1888.1 - 2780.8 m - FracView 1.3
Stereonet: 1888.1 - 2780.8 m - FracView 1.3
N
E
S
W
FracView 1.3 (C) Schlumberger 1990 - DB File : /usr2/turrum4/DB.001

FIGURE 3

PE906490

This is an enclosure indicator page.
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The enclosure PE906490 has the following characteristics:

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CONTAINER_BARCODE = PE900975
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BASIN = GIPPSLAND
PERMIT = VIC/L4
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Structural Dips Data, Figure 4, Turrum-4
REMARKS =
DATE_CREATED = 30/11/92
DATE_RECEIVED = 16/03/93
W_NO = W1069
WELL_NAME = TURRUM-4
CONTRACTOR = SCHLUMBERGER
CLIENT_OP_CO = ESSO AUSTRALIA LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)

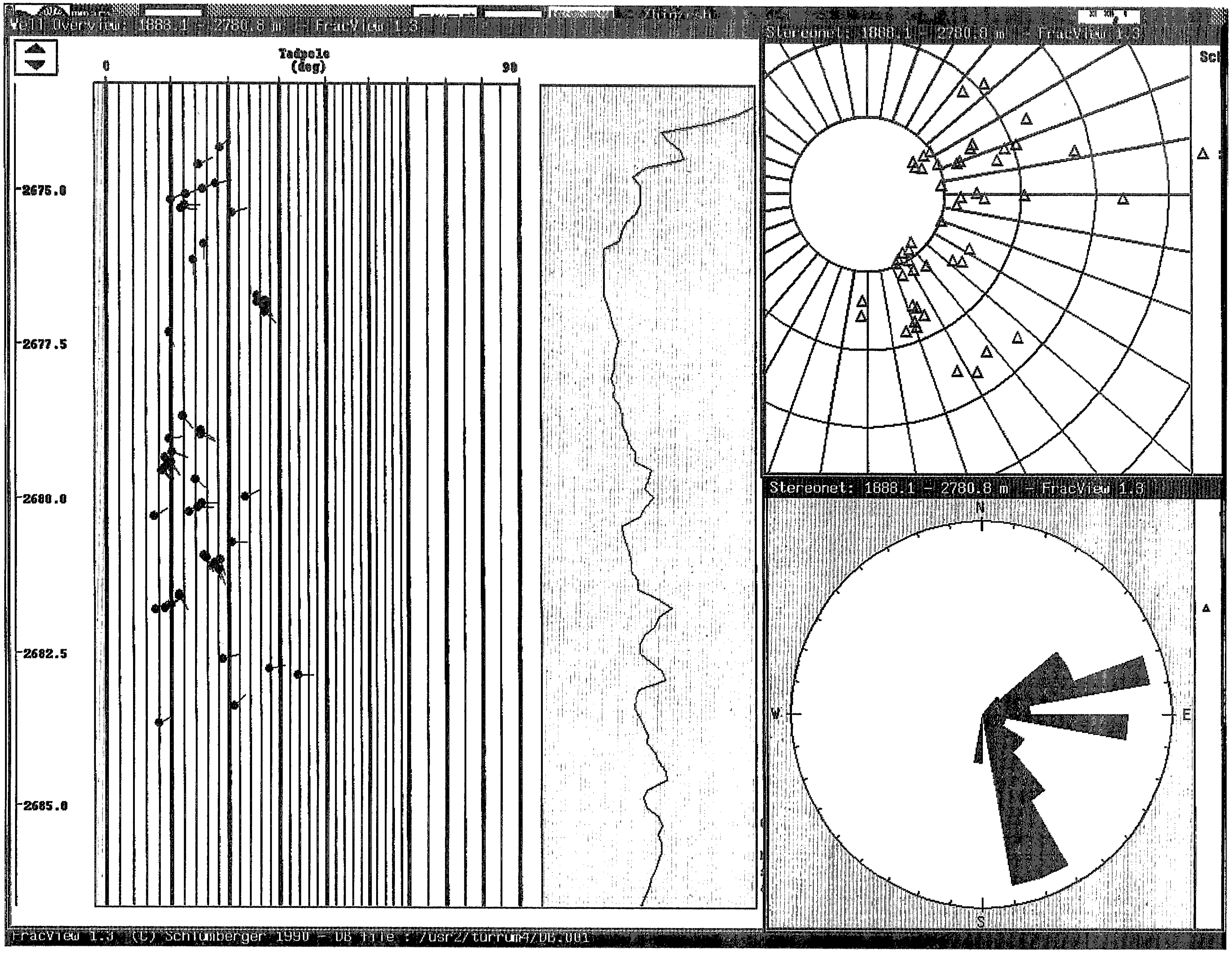
Well Overview: 1888.1 - 2780.8 m - FracView 1.3
Tadpole
(deg)
0
90
2675.0
2677.5
2680.0
2682.5
2685.0
Stereonet: 1888.1 - 2780.8 m - FracView 1.3
Stereonet: 1888.1 - 2780.8 m - FracView 1.3
N
E
S
W
FracView 1.3 (C) Schlumberger 1990 - DB file : /usr2/turrum4/DB.001

FIGURE 4

PE906491

This is an enclosure indicator page.
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The enclosure PE906491 has the following characteristics:

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CONTAINER_BARCODE = PE900975
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            BASIN = GIPPSLAND
           PERMIT = VIC/L4
             TYPE = WELL
          SUBTYPE = DIAGRAM
      DESCRIPTION = Structural Dips Data, Figure 5,
                    Turrum-4
          REMARKS =
     DATE_CREATED = 30/11/92
    DATE_RECEIVED = 16/03/93
             W_NO = W1069
        WELL_NAME = TURRUM-4
       CONTRACTOR = SCHLUMBERGER
     CLIENT_OP_CO = ESSO AUSTRALIA LIMITED
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(Inserted by DNRE - Vic Govt Mines Dept)

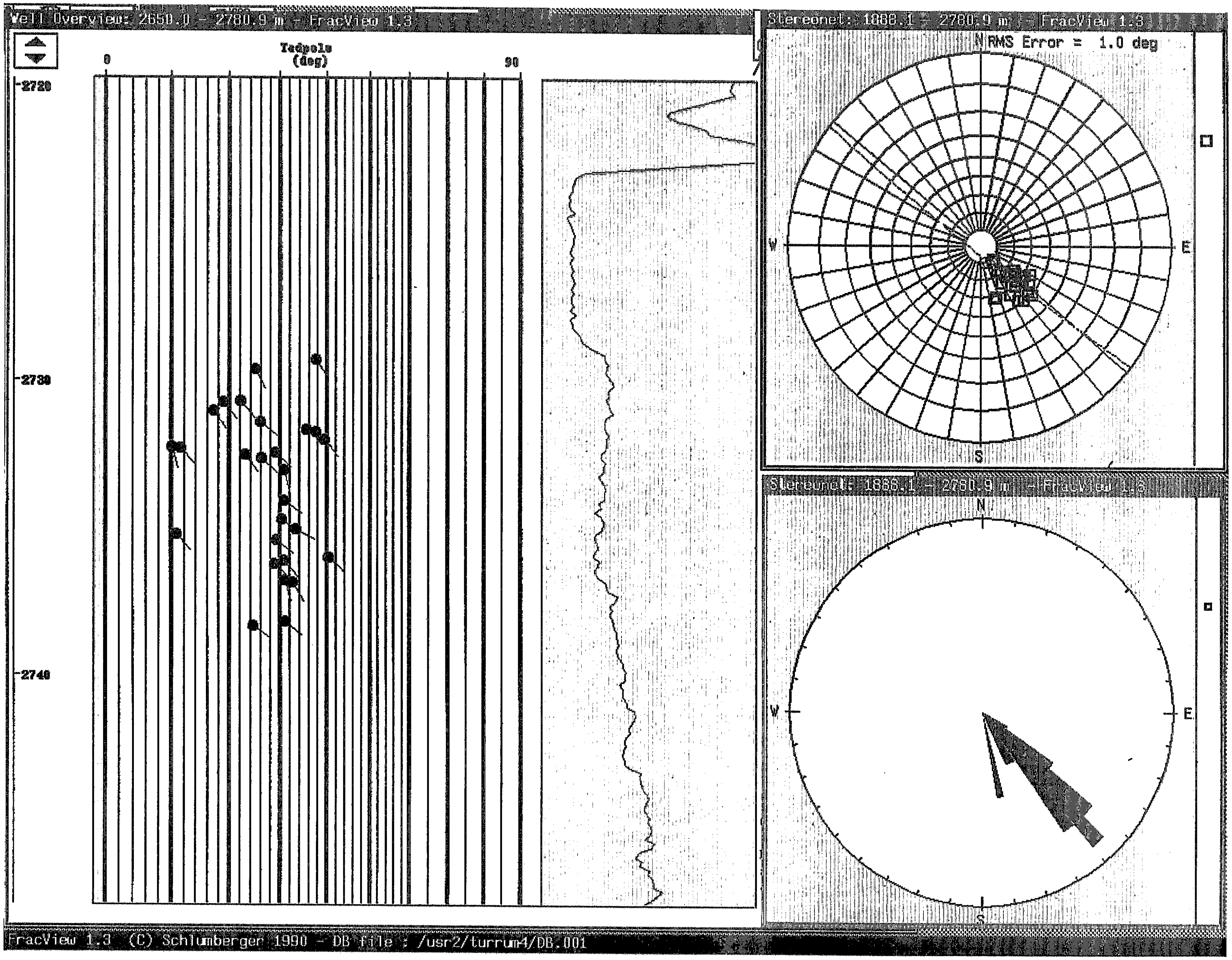
Well Overview: 2650.0 - 2780.9 m - FracView 1.3
Tadpole
(deg)
0
90
2720
2730
2740
Stereonet: 1868.1 - 2780.9 m - FracView 1.3
RMS Error = 1.0 deg
N
W
E
S
Stereonet: 1868.1 - 2780.9 m - FracView 1.3
N
W
E
S
FracView 1.3 (C) Schlumberger 1990 - DB file : /usr2/turrum4/DB.001

FIGURE 5

PE600801

This is an enclosure indicator page.
The enclosure PE600801 is enclosed within the container PE900975 at this location in this document.

The enclosure PE600801 has the following characteristics:

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CONTAINER_BARCODE =	PE900975
NAME =	Quantitative Log
BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	Quantitative Log (enclosure from WCR) for Turrum-4
REMARKS =	
DATE_CREATED =	26/11/92
DATE_RECEIVED =	16/03/93
W_NO =	W1069
WELL_NAME =	Turrum-4
CONTRACTOR =	SOLAR
CLIENT_OP_CO =	ESSO

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PE600802

This is an enclosure indicator page.
The enclosure PE600802 is enclosed within the container PE900975 at this location in this document.

The enclosure PE600802 has the following characteristics:

ITEM_BARCODE =	PE600802
CONTAINER_BARCODE =	PE900975
NAME =	FMS Image Interpretation
BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	FMS Image Interpretation for Turrum-4
REMARKS =	
DATE_CREATED =	12/10/92
DATE_RECEIVED =	16/03/93
W_NO =	W1069
WELL_NAME =	Turrum-4
CONTRACTOR =	SCHLUMBERGER
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 3

APPENDIX 3

TURRUM ORIGINAL CONTACT STUDY

AND TURRUM 4 MDT REPORT

R.A. Youie
February 1993

TURRUM ORIGINAL CONTACT STUDY

AND TURRUM 4 MDT REPORT

CONTENTS

TURRUM ORIGINAL CONTACT STUDY and TURRUM 4 MDT REPORT

OBJECTIVE

A study of the FIT/RFT/MDT data available from the Turrum Field was conducted to assess gas/oil, oil/water and gas/water contact location. This work was undertaken post Turrum 4, drilled in August-September 1992.

The report also serves to document the results of Schlumberger's Modular Formation Dynamics Tester (MDT) run on September 11, 1992 in the Turrum 4 appraisal well.

SUMMARY

TURRUM 4 MDT SUMMARY

The Turrum 4 well intersected the L-100, L-250, L-300, L-350, L-360, L-400 and L-500 sands. Based on log and pressure data, these sands were all water bearing at the well location. The L-200 sand seen in Turrum 3 was absent in Turrum 4.

The L-100 and L-500 pressures had been drawndown approximately 41 psi from the original aquifer gradient. The other sands from L-300 to L-400 were only drawndown about 6-10 psi. This suggests that the L-100 and L-500 are in better communication with the basin aquifer than the L-300 to L-400 sands.

CONTACT LOCATIONS

The following contacts have been assessed as a result of this study:

SAND	GWC	GOC	OWC
L-100		-2133	-2138
L-110	-2190		
L-200	-2392		
L-250	-2417		
L-300	-2437		
L-350	-2483		
L-360	-2581		
L-400	-2590		
L-450		-2543	-2557
L-500		-2583	-2592

Table 1 details contacts assessed post Turrum 3 (March 1985), and the current interpretation. In general, the GWC are around 20m shallower than used in the 1990 assessment. This is due to the current assumption that the L-200 to L-400 sands do not have the same water gradient as the L-100 and L-500.

Table 2 summarises the recommended contact depths to use for the reserves assessment. Table 3 summarises the maximum flank oil potential.

RESULTS AND DISCUSSION

Pressures for the Turrum field were obtained in Turrum 1, 2, 3 and 4, Marlin 4, A-6 and A-24. Data from Turrum 1, 2 Marlin 4, A-6 and A-24 were analysed and reported in 1974 (Appendix 1)

Most of the data in these older wells were assessed as being unreliable due to guage quality.

The results of the Turrum 3 RFT data had also been analysed previously, and formed the basis of the YE 1991 reserves assessment. (Appendix 2, Turrum 3 RFT Report by P.R. Ettema, June 1986).

This 1993 study analysed the more reliable quartz crystal data obtained in Turrum 3 and Turrum 4.

WATER LINES

The Turrum 3 interpretation (Appendix 2) assumed that all sands had a common water gradient. This assumption was reasonable given that water pressures were only obtained in the L-100 and L-500 sands.[1]

The Turrum 3 L-100 and L-500 water pressures points were on a common water line, some 20 psi below the original basin aquifer gradient.

The results of the Turrum 4 MDT survey, however, suggests that the sands between the L-100 and L-500 may not have the same degree of communication with the aquifer. The Turrum 4 L-100 and L-500 pressure points lie on a 1.42 psi/m gradient and are about 41 psi below the original aquifer gradient. The intermediate sands are only 6-10 psi below original in Turrum 4.

---

1 In the Turrum 3 RFT report, the L-100 and L-500 were designated L-1.1.1 and L-1.4.2 respectively

ASSUMPTIONS

The Turrum 3 and Turrum 4 pressure data was re-examined making the following assumptions:

1. The L-100 and L-500 are in good communication with the basin aquifer, and are equally drawndown from the original basin gradient.

2. The L-100 and L-500 are laterally continuous sands, in good communication between Turrum 3 and Turrum 4.

3. The L-200 to L-400 are not as well connected to the aquifer as are the L-100 and L-500.

4. The L-300, L-350, L-360 and L-400 have some continuity between Turrum 3 and Turrum 4. The drawdown in these sands at the time of drilling Turrum 3 is 50% of that seen in Turrum 4. This is based on the L-100 and L-500 drawdown and is key to this study's conclusions.

5. The L-200 sand has a similar water gradient as the L-300 sand.

6. A gas gradient of 0.3 psi/m was used. The Turrum 3 RFT Report used a gas gradient based on the then reservoir data book average gas density of 0.1921 g/cc. This was corrected for P, T, and Z using the 'PYLD' program. This resulted in gas gradients ranging from 0.27 psi/m at the L-100 level, to 0.31 psi/m at the L-500 level.

   The 0.3 psi/m assumption would lead to difference in GWC estimation of up to ~1 metre. This is well within the level of accuracy expected for contact estimation given that the actual water line is unknown, and that different pressure gauges were used in Turrum 3 and Turrum 4.

7. An oil gradient of 0.9 psi/m was used for the L-100 sand. For the L-450 and L-500 sands, gradients of 0.89 and 0.96 psi/m were used respectivly. These gradients are based on the compositional analysis of the Marlin A-24 RFT samples and the PYIELDO program. It is worth noting however, that since the oil columns are short (< 20m) the error in OWC caused by using a common oil gradient of 0.9 psi/m is less than 0.8m.

L-100 (Formerly L-1.1.1)

The three Turrum 4 L-100 pre-tests 1/11, 1/12 and 1/13 lie on a 1.42 psi/m water line which can be extended to the Turrum 4 L-500 pre-tests 1/28, 1/29, and 1/30. This implies that the L-100 and L-500 sands at Turrum 4 are in good hydraulic communication. These sands are drawndown about 41 psi from the original aquifer gradient.

The Turrum 3 L-100 RFT data was interpreted to have an OWC at -2142.5 mSS, however, since only one pre-test was obtained in the gas, oil and water, this interpretation was acknowledged to be dubious. It also stated that based on log data, the OWC would be shallower and lie between -2136.3 mSS and -2139.0 mSS.

Since the L-100 and L-500 appear to be in hydraulic communication at Turrum 4, it may be reasonable to assume that the same applies to Turrum 3. The L-100 OWC could then be estimated by extrapolating the Turrum 3 L-500 water line. Three Turrum 3 L-500 data points, 1/1, 1/2, and 1/3, were obtained over a 15 m interval. A least squares regression on these points produces P (psia)=1.4203*TVDSS+59.675 (r=1.00000).

zUsing this water line and a 0.9 psi/m oil gradient through Turrum 3 1/29 and 7/52, an OWC contact would be interpreted at -2135.4 mSS, slightly above the OWC estimated from log data.

It is recommended that a L-100 OWC at -2137.9 mSS be used, being halfway between LPO at -2136.3 mSS and HKW at -2139.5 mSS.

L-110

This sand was only seen in Marlin A-24. This sand is modelled as a channel sand with the base of the channel being at low proved gas, -2190 mSS. (Unadjusted depth)

L-200 (Formerly L-1.2.1)

The L-200 was not present in Turrum 4. It has been assumed that the L-200 water line is the similar to the L-300 or L-400 water. Making this assumption, the L-200 would have been drawndown about 4 psi at the time of Turrum 3. The estimated GWC would be at -2392 mSS.

The compares with a GWC of -2410 mSS based on a Turrum 3 L-500 water line.

L-250

One Turrum 3 gas (1/18) and one Turrum 4 water (1/18) pre-test pressure were obtained. Assuming a 5 psi drawdown at the time of Turrum 3, the estimated GWC is at -2417 m SS.

L-300 (Formerly L-1.2.3)

Turrum 4 pre-tests 1/19, 1/20 and 1/21 are interpreted to be in the L-300 package. Pretest 1/20 appears to be slightly supercharged, since it falls to the right of the original aquifer gradient.

Using pre-tests 1/19 and 1/21 to define the L-300 water line in Turrum 4, and assuming a drawdown of about 2 psi at the time of Turrum 3, an estimated L-300 GWC of -2437 mSS is obtained. This compares with the previous assessment of -2453 mSS using the Turrum 3 L-500 water line.

The Post Turrum 4 correlation establishes a LKG in the L-300 at 3051 mMD (-2442 mSS adjusted). This is below the estimated GWC and is could be due to the L-300 at Marlin A-24 being in a separate sand to the L-300 at Turrum 3.

L-350

Turrum 4 pre-test 1/21 is in the L-350 sand. Assuming that the L-350 water line had been drawndown approximately 4 psi at the time of Turrum 3, the estimated GWC is at -2483m SS. This compares with a GWC of -2497 mSS estimated using the Turrum 3 L-500 water line. The 1990Turrum assessment[2] assumed the RFT GWC to be at -2506 mSS.

L-360 (Formerly L-1.3)

Pre-tests 1/22, 1/23 and 1/24 were taken in the Turrum 4 L-360 sand. These points lie on a water gradient which is drawndown about 11 psi from the original basin gradient.

Assuming that the L-360 was drawndown half this amount (6 psi) at the time of Turrum 3, the estimated GWC would be at -2581 mSS. This compares with -2594 mSS which was estimated using the Turrum 3 L-500 water line.

L-400

Pre-tests 1/25, 1/26 and 1/27 were taken in the Turrum 4 L-400 sand. 1/27 appears to be supercharged, and lies to the right of the original basin gradient. 1/25 and 1/26 lie on a water gradient, 7 psi below the original basin gradient.

Assuming a 4 psi drawdown at the time of Turrum 3, the L-400 GWC would be at -2590 mSS. This compares with -2605 mSS which was estimated using the Turrum 3 L-500 water line.

L-450

This sand was only penetrated in the Marlin A-24. The GOC of -2543 mSS (3175 m MD) and OWC of -2557 mSS (3192 m MD) is based on adjusted A-24 log data (see L-500 for discussion on adjustment required).

L-500 (Formerly L-1.4.2)

Turrum 3 intersected oil, gas and water. A GOC at -2583 mSS was established in Turrum 2 and is supported by Turrum 3 RFT data. An OWC estimated at -2592 mSS was based this RFT data. Assuming a common OWC, the Marlin A-6 and Marlin A-24 surveys would need to be adjusted to match the OWCs seen in these wells (-2596.57 and -2602.85 mSS respectively) with the OWC established from Turrum 3 RFT data (-2592 mSS). The adjustments are: Marlin A-6 -4.6m, and Marlin A-24, -10.9m.

The problem with above interpretation is that the L-500 oil column would only be 9m. This is inconsistent with the 18m column seen in Marlin A-6, and the 12m column seen in Marlin A-24. However, it honours the pressure data seen in Turrum 3, and the GOC seen in Turrum 2. The reason for this difference could be due to the existance of several isolated L-500 accumulations with different contacts.

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2 Enclosure 5, Turrum Assessment, Volume 1 by D.L.E. Moreton Sept. 1990

An alternative interpretation assumes that the Turrum 2 logs must be adjusted by at least 7 m upwards to match the Top of Latrobe gas water contact. There has been debate as to whether the contact seen in Turrum 2 at the Top of Latrobe is in the same, or separate system as Marlin. Assuming that it is in the same system as Marlin, an adjustment would be required. The Turrum L-500 GOC would be established at -2576 mSS based on Turrum 2 adjusted log data, and an OWC at -2600 mSS based on Turrum 3 RFT data (24 m oil column)

This is consistent with the column lengths seen in A-6 and A-24, but does not honour the pressure data seen in Turrum 3. It requires a +3.5m and -3.85m adjustment for Marlin A-6 and A-24 respectively.

The base case assessment for the L-500 assumes that Turrum 2 does not need adjustment and that the GOC is at -2583 mSS.

The current reserves book assessment assumes an OWC at -2600 mSS and GOC at -2583 mSS. This is inconsistent with the Turrum 3 pressure data since it would require an oil gradient of 1.24 psi/m.

A segregated sample, 8/55 was obtained at -2598.6 mSS from Turrum 3 and recovered filtrate and 100cc of oil in one sample. A repeat run, 9/56 recovered filtrate and a scum of oil from -2598.8 mSS. The Turrum 3 RFT report referred to this sample as 'Accumulation C'. If this sample is a valid oil test, and comes from the L-500 sand, this would suggest LPO at -2598.8 mSS. The pressures obtained from these samples however, are inconsistent with the Turrum 3, L-500 pressures obtained from 1/5, 3/43, and 3/44.

The L-500 at Turrum 4 was wet (pre-tests 1/28, 1/29, and 1/30). This pressure data indicated a drawdown of about 41 psi from the original aquifer gradient at the time of drilling Turrum 4. This compares with a drawdown of 20 psi in the L-500 at Turrum 3.

It is recommended that the P+P case assumes a 9m oil column, and the GPF case assumes a column halfway between 9m, and the maximum column of 24m, ie 17m column. The GPF GOC would be at -2479 mSS and OWC at -2596 mSS.

DOWNDIP OIL POTENTIAL

Based on the pressure data, downdip oil potential exists in some of the Turrum sands. The maximum potential is obtained by attempting to fit an oil gradient (0.9 psi/m) from low known gas (LKG) to the water line, or from spill to the gas line. In some sands, LKG is based on Marlin A-24 and depends on what depth adjustment is considered necessary for this well (see discussion on L-500)

Table 3 lists maximum downdip potential oil columns and contacts assuming that Marlin A-24 requires a -10.9 m adjustment. Figures 10-14 illustrate the downdip potential on the pressure plots.

RECOMMENDATIONS

It is recommended that Marlin A-6 and Marlin A-24 be re-surveyed with a gyro tool. These wells have been surveyed with conventional multishot tools, and have an estimated vertical error of +/- 13m at the L-500 level. A re-survey with a gyro tool will reduce this uncertainty to +/- 4m at TD. This will assist in determining where the L-500 contacts are and will impact the downdip potential.

Table 2 details the recommended contacts to use for reserves determination. The assessment is based on the assumptions listed in the section on Results and Discussion.

TABLE 1

TURRUM CONTACTS

SAND	WELL	LKG	GOC	GWC	HKO	LKO	OWC	HKW	COMMENTS
L-100	TRA-3		2132.5 (PP/LOG)	–		2136.3	2142.5 (PP)	2139.5	
	TRA-4	–	–	–	–	–	2137.9		
L-110	MLA A-24	2190	–		–	–	–		Modelled as channel sand Only seen in MLA A-24
L-200	MLA A-6	2357	–		–	–	–		
	MLA A-24	2354							
	TRA-3		–	2410 (PP)	–	–	–		Uses TRA-3 L-500 water line
	TRA-4	–	–	2392 (PP)	–	–	–	–	Not penetrated, uses L-300 water line
	MLA 2							2410	
L-250	MLA A-24	2419							
	TRA-4			2417 (PP)				2523	
L-300	MLA A-24	2453							
	TRA-3	2422	–	2453 (PP)	–	–	–	–	Uses TRA-3 L-500 water line
	TRA-4	–	–	2437 (PP)	–	–	–	2550.5	GWC busts at MLA 4
L-350	MLA A-24	2485							
	TRA-3	2455	–	2497 (PP)	–	–	–	–	Uses TRA-3 L-500 water line.
	TRA-3			2506 (PP)					From Turrum Assessment. DLM 1990
	TRA-4	–	–	2483 (PP)	–	–	–	–	
L-360	MLA A-24	2508							
	TRA-3	2502	–	2594 (PP)	–	–	–	–	Uses TRA-3 L-500 water line
	TRA-4	–	–	2581 (PP/spill)	–	–	–	2596	
L-400	MLA A-24	2549.71							
	TRA-3	2532	–	2605 (PP)	–	–	–	–	Uses TRA-3 L-500 water line
	TRA-4	–	–	2590 (PP)	–	–	–	2652 (log)	
L-450	MLA A-24		2554.5 (log)	–	2553.25	2568	2566 (res bk) (2m adjust)	2684	Sample @ 2560.75 (HPO) Based on crossover.
L-500	MLA A-6	2571.1		–	2578.7		2596.6		
	MLA A-24			–	2590.6	2600.6	2602.85	2603.5	Sample @ 2600.6 (LPO)
	TRA-2		2582.3 (log)						
	TRA-3	2576 (crossover)	2583 (PP)	–			2594 (PP) 2600 (log)		100cc oil sampled at 2600mSS
	TRA-4	–	–	–	–	–	–		

PP= based on RFT pressure plot
1/2 way = halfway between high and low proved.
Log data based on R.G. Neumann 1988 interpretation

NOTE: MARLIN A-6, A-24 AND TURRUM 2 ARE UNADJUSTED DEPTHS
Honor Turrum 2 GOC in L-500 @ 2583; This implies L-500 OWC at 2592m (from Turrum 3 RFT)
Adjust Marlin A-6 -4.6 m
Adjust Marlin A-24 -10.9m

RAY CONTACTS.WK1 11-Feb-93

TABLE 2

TURRUM PROVED + PROBABLE CASE CONTACTS (mSS)

OIL SANDS

	LKG	GOC	HKO	LKO	OWC	HKW
L-100	-	2133 Turrum 3 crossover	-	2136.3 Turrum 3 sample	2137.9 1/2 way LKO to HKW	2139.5 T-3 log
L-450		2543 Adjusted MLA A-24 log			2557 MLA A-24 adjusted log	
L-500	2576 T-3 log	2583 Turrum 2 logs			2592 Turrum 3 RFT	

GAS SANDS

		LKG	GWC (RFT)
L-110	GAS ON ROCK	-2190 (MLA A-24) *unadjusted	-2190
L-200	GAS ON ROCK	-2352 (MLA A-6)	-2392
L-250	GAS ON ROCK	-2408 (MLA A-24)	-2417
L-300	GAS ON ROCK	-2422 (TRA-3)	-2437
		-2442 (MLA A-24)	
L-350	GAS ON ROCK	-2455 (TRA-3)	-2483
		-2474 (MLA A-24)	
L-360	GAS ON ROCK	-2502 (TRA-3)	-2581
		-2497 (MLA A-24)	
L-400	GAS ON ROCK	-2502 (TRA-3)	-2590
		-2539 (MLA A-24)	

Note: Marlin A-6 and A-24 depths are adjusted -4.6m and -10.85m respectively to match L-500 GOC at 2853 and OWC at 2492mSS

RAY CONTACTS.WK1 [P+P Contacts] 11-Feb-93

TABLE 3

MAXIMUM DOWNDIP OIL POTENTIAL

	GOC	OWC	Max Column m
L-200	-2379	-2410 (at spill)	31
L-250	-2408 (LKG MLA A-24)	-2426	18
L-300	-2422 (LKG TRA-3)	-2455	33
L-350	-2474 (LKG MLA A-24)	-2494	20
L-360	-	-	0 GWC at spill, -2581mSS
L-400	-2582	-2600 (at spill)	18

Note: Oil has not been encountered in the above gas sands. The above contacts are potential contacts if the maximum oil column is present in these sands.

RAY CONTACTS.WK1 [table 3]

MDT PRESSURE DATA

WELL: TURRUM#4 GEOLOGIST-ENGINEER: TONY REEVE

DATE: 11/9/92 RFT NO. RUN-	RFT TYPE	DEPTH m MDKB	m TVD ss KB= 23	INITIAL HYDROSTATIC HP/RFT GAUGE psia	PPg	TIME SET	MINIMUM FLOWING PRESSURE psia (PRETEST)	FORMATION PRESSURE HP/RFT GUAGE psia	PPg	FMS TEMP DEGREES C	TIME RETRACT	FINAL HYDROSTATIC HP/RFT GUAGE psia	PPg	COMMENTS STANDARD MDT PROBE
1-1	PT	1965.50	1942.50	3252.00	9.70	4.23	2722.00	2729.00	8.26	77.50	4.28	3366.40	9.76	EX PERM FINAL HYDROSTATIC DOES NOT REPEAT
1-2	PT	1965.50	1942.50	3256.70	9.73	4.52 4.59	2729.00	2729.20 2729.10	8.26	77.80	4.58 5.05	3261.10	9.74	RESET AFTER PT ONLY OPENED 5cc
1-3	PT	1971.00	1948.00	3269.00	9.74	5.17 5.24	2713.90 2700.00	2737.00 2737.90	8.25		5.21 5.34	3265.00	9.73	GOOD TEST, POOR HYDROSTATIC REPEATABILITY
1-4	PT	1993.00	1970.00	3305.00	9.74	5.58	49.00				6.08			PREPARE TO POOH DUE TO POOR REPEAT-ABILITY TIGHT BUT HYDROSTATIC REPEATED
1-5	PT	1977.50	1954.50	3273.40	9.72	6.12	2714.00	2748.40	8.25		6.15	3272.90	9.72	GOOD TEST HYDROSTATIC REPEATED QUICKLY
1-6	PT	1993.00	1970.00	3298.60	9.72	6.20	2518.00	2798.30	8.34	79.40		3298.40	9.72	GOOD TEST
1-7	PT	2038.00	2015.00	3372.20	9.72		2867.70	2875.80	8.38			3372.70	9.72	GOOD TEST
1-8	PT	2064.00	2041.00	3415.20	9.72	6.46	2840.70	2931.80	8.44	81.50	6.48	3415.20	9.72	GOOD TEST EX PERM
1-9	PT	2130.50	2107.50	3524.00	9.71	6.56	3008.00	3044.10	8.48	82.90	7.20	3525.30	9.72	RETRACT & RESET AFTER SL SEAL FAILURE GOOD TEST
1-10	PT	2248.30	2225.30	3717.60	9.71	7.34	3203.10	3225.80	8.51	86.50	7.44	3717.60	9.71	GOOD TEST GOOD PERM
1-11	PT	2312.50	2289.50	3822.20	9.71	7.49	3287.50	3288.80	8.44	88.20	7.52	3822.80	9.71	GOOD TEST EX PERM
1-12	PT	2320.00	2297.00	3836.00	9.71	8.00	3291.70	3299.40	8.44	88.50	8.05	3835.30	9.71	GOOD TEST EX PERM
1-13	PT	2326.00	2303.00	3845.60	9.71	8.13	3299.00	3308.70	8.44	88.60	8.22	3845.20	9.71	GOOD TEST EX PERM
1-14	PT	2367.00	2344.00	3912.60	9.71	8.38	3374.00	3385.30	8.48	90.10	8.43	3911.60	9.71	GOOD TEST EX PERM
1-15	PT	2403.50	2380.50	3971.70	9.70	8.54	3443.60	3449.50	8.51	91.50	8.59	3970.70	9.70	GOOD TEST EX PERM
1-16	PT	2408.50	2385.50	3979.20	9.70	9.08	3339.40	3456.10	8.51	91.50	9.14	3978.30	9.70	GOOD TEST EX PERM
1-17	PT	2432.50	2409.50	4018.30	9.70	9.23	3481.20	3485.80	8.50	93.00	9.28	4018.70	9.70	GOOD TEST EX PERM

MDT PRESSURE DATA

WELL: TURRUM#4 GEOLOGIST-ENGINEER: TONY REEVE

DATE: 11/9/92 RFT NO. RUN-	RFT TYPE	DEPTH m MDKB	m TVD ss KB= 23	INITIAL HYDROSTATIC HP/RFT GAUGE psia	PPg	TIME SET	MINIMUM FLOWING PRESSURE psia (PRETEST)	FORMATION PRESSURE HP/RFT GUAGE psia	PPg	HMS TEMP DEGREES C	TIME RETRACT	FINAL HYDROSTATIC HP/RFT GUAGE psia	PPg	COMMENTS STANDARD MDT PROBE
1-18	PT	2536.00	2513.00	4186.80	9.70		1826.10	3636.60	8.50	97.00		4186.40	9.70	GOOD TEST EX PERM
1-19	PT	2546.50	2523.50	4203.50	9.70	10.00	3617.00	3657.30	8.51	97.60	10.06	4202.90	9.70	GOOD TEST EX PERM
1-20	PT	2574.00	2551.00	4248.00	9.69	10.13	3637.70	3708.10	8.54	99.00	10.19	4247.40	9.69	GOOD TEST EX PERM
1-21	PT	2608.00	2585.00	4302.80	9.69	10.27	3453.80	3745.80	8.51	101.00	10.33	4302.30	9.69	GOOD TEST EX PERM
1-22	PT	2626.50	2603.50	4332.40	9.69	10.40	3757.30	3764.90	8.49	102.00	10.46	4332.30	9.69	GOOD TEST EX PERM
1-23	PT	2631.00	2608.00	4340.00	9.69	10.52	3585.00	3771.00	8.49	103.00	10.58	4339.60	9.69	GOOD TEST EX PERM
1-24	PT	2639.00	2616.00	4353.40	9.69	11.04	3103.00	3783.20	8.49	103.00	11.13	4352.60	9.69	GOOD TEST EX PERM
1-25	PT	2676.50	2653.50	4413.60	9.68	11.23	3807.20	3840.30	8.50	105.00	11.29	4413.40	9.68	GOOD TEST EX PERM
1-26	PT	2684.00	2660.00	4426.00	9.68		3173.90	3850.80	8.50	106.00	11.44	4425.60	9.68	GOOD TEST EX PERM
1-27	PT	2692.50	2669.50	4439.70	9.68	11.51	2927.00	3873.70	8.52	107.00	12.22	4440.10	9.68	TIGHT POSSIBLY SUPERCHARGED
1-28	PT	2730.00	2707.00	4500.70	9.68	12.27	3844.60	3882.80	8.42	108.00	12.32	4500.80	9.68	GOOD TEST EX PERM
1-29	PT	2735.50	2712.50	4509.50	9.68	12.39	3885.30	3890.40	8.42	109.00	12.45	4510.00	9.68	GOOD TEST EX PERM
1-30	PT	2746.00	2723.00	4527.00	9.68	12.52	3812.80	3904.90	8.42	109.00	12.56	4527.10	9.68	GOOD TEST EX PERM
1-31	PT	2370.00	2347.00	3917.50	9.71	13.13	3382.90	3388.50	8.48	95.00	13.21	3916.20	9.71	GOOD TEST GOOD PERM
1-32	PT	2375.50	2352.50	3925.00	9.70	13.29	1600.10	3400.50	8.49	93.00	13.33	3924.80	9.70	GOOD TEST GOOD PERM
1-33	PT	2472.00	2449.00	4081.70	9.69	13.44	2419.60	3558.40	8.53	95.00	13.51	4081.70	9.69	POSSIBLY SL SUPERCHARGED
1-34	PT	1963.70	1940.70	3252.50	9.73	14.10	2726.00	2729.20	8.26	82.00	14.15	3252.00	9.73	GOOD TEST

MDT PRESSURE DATA

WELL: TURRUM#4 | GEOLOGIST-ENGINEER: TONY REEVE

DATE: 11/9/92 RFT NO. RUN-	RFT TYPE	DEPTH m MDKB	DEPTH m TVD ss KB= 23	INITIAL HYDROSTATIC HP/RFT GAUGE psia	INITIAL HYDROSTATIC PPg	TIME SET	MINIMUM FLOWING PRESSURE psia (PRETEST)	FORMATION PRESSURE HP/RFT GUAGE psia	FORMATION PRESSURE PPg	FMS TEMP DEGREES C	TIME RETRACT	FINAL HYDROSTATIC HP/RFT GUAGE psia	FINAL HYDROSTATIC PPg	COMMENTS STANDARD MDT PROBE
1-35	PT	1971.00	1948.00	3263.70	9.72	14.21	2687.90	2739.10	8.26	81.00	14.27	3263.50	9.72	GOOD TEST
1-36	PT	1974.00	1951.00	3268.10	9.72	14.34	2740.30	2742.90	8.26	80.00	14.39	3268.00	9.72	GOOD TEST EX PERM

PE900977

This is an enclosure indicator page.
The enclosure PE900977 is enclosed within the container PE900975 at this location in this document.

The enclosure PE900977 has the following characteristics:

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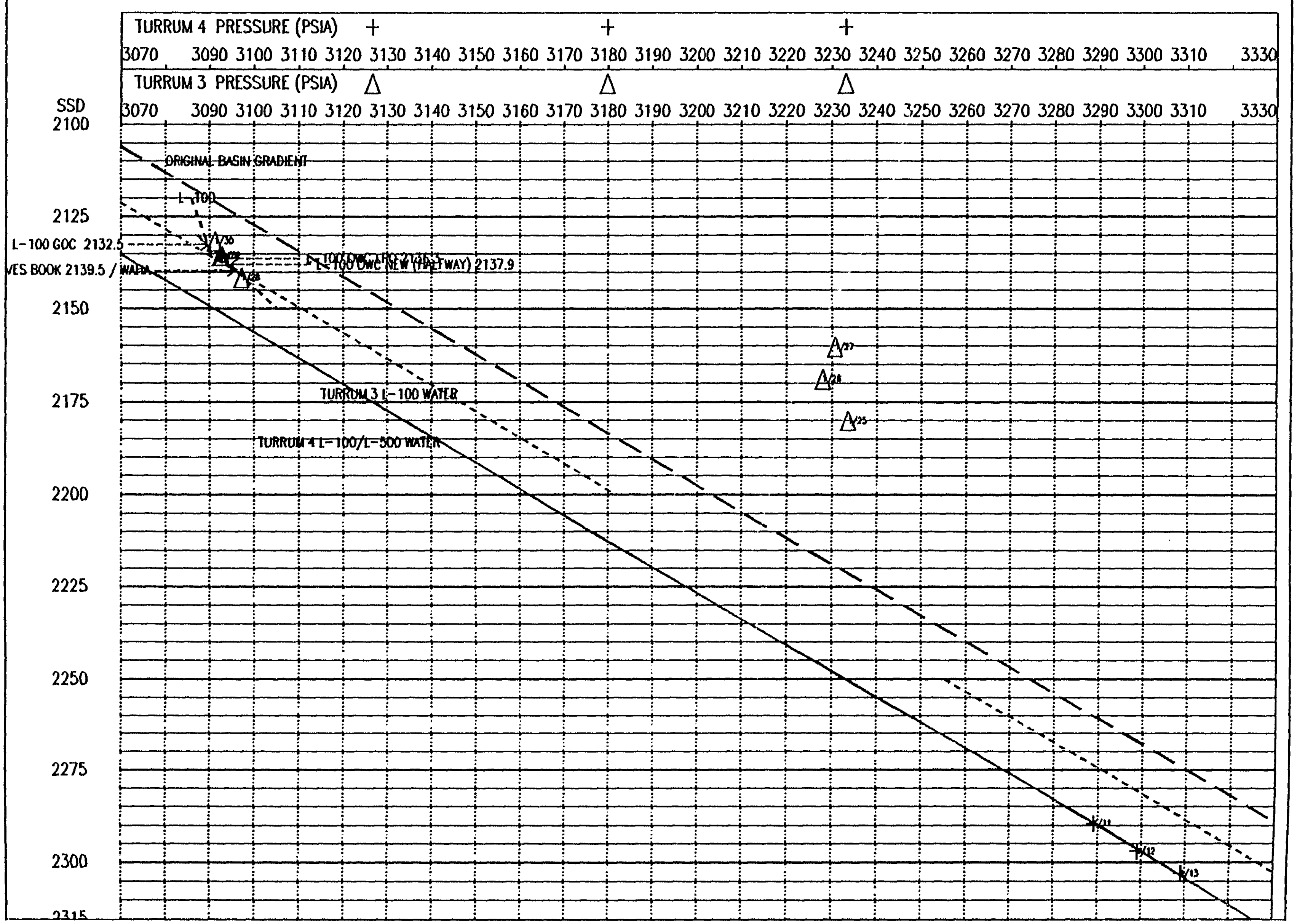
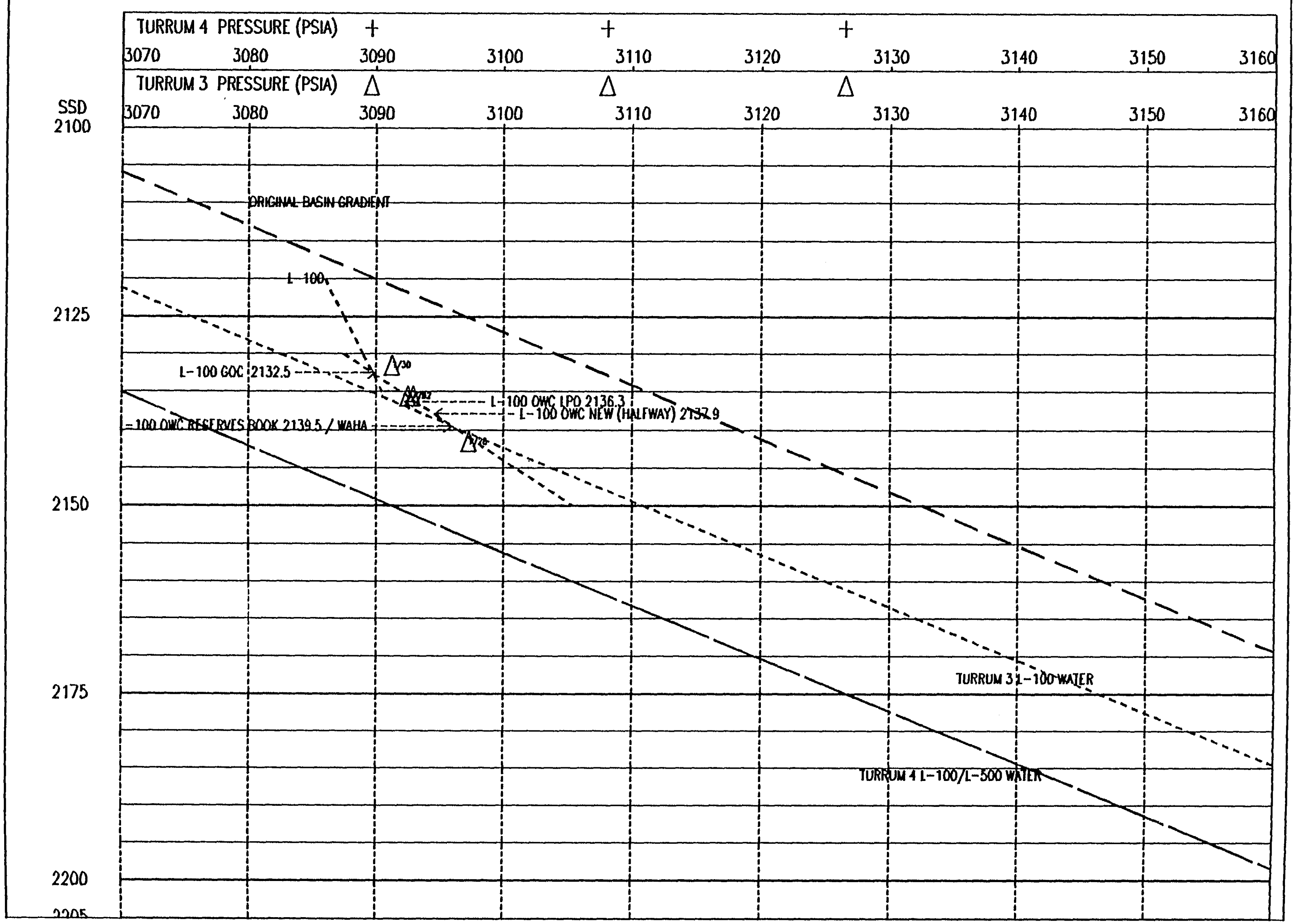
CONTAINER_BARCODE = PE900975
NAME = RFT Survey
BASIN = GIPPSLAND
PERMIT = VIC/L4
TYPE = WELL
SUBTYPE = RFT
DESCRIPTION = RFT Survey Turrum-3 & Turrum-4 (enclosure from WCR vol.2 for Turrum-4)
REMARKS =
DATE_CREATED = 11/03/93
DATE_RECEIVED = 16/03/93
W_NO = W1069
WELL_NAME = Turrum-4
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

TURRUM 3 AND 4 RFT DATA - L-100



TURRUM 3 AND 4 RFT DATA - L-100



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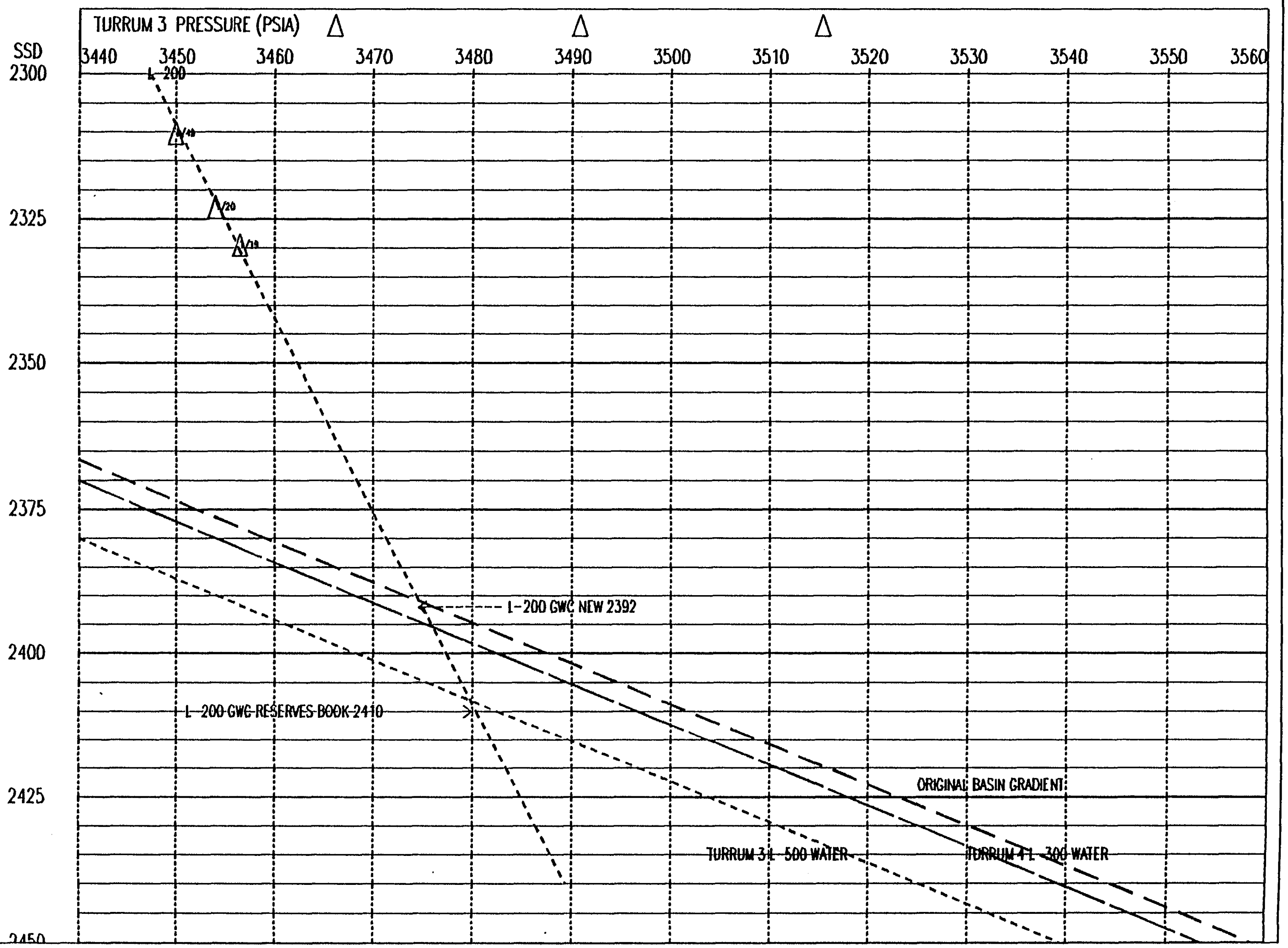

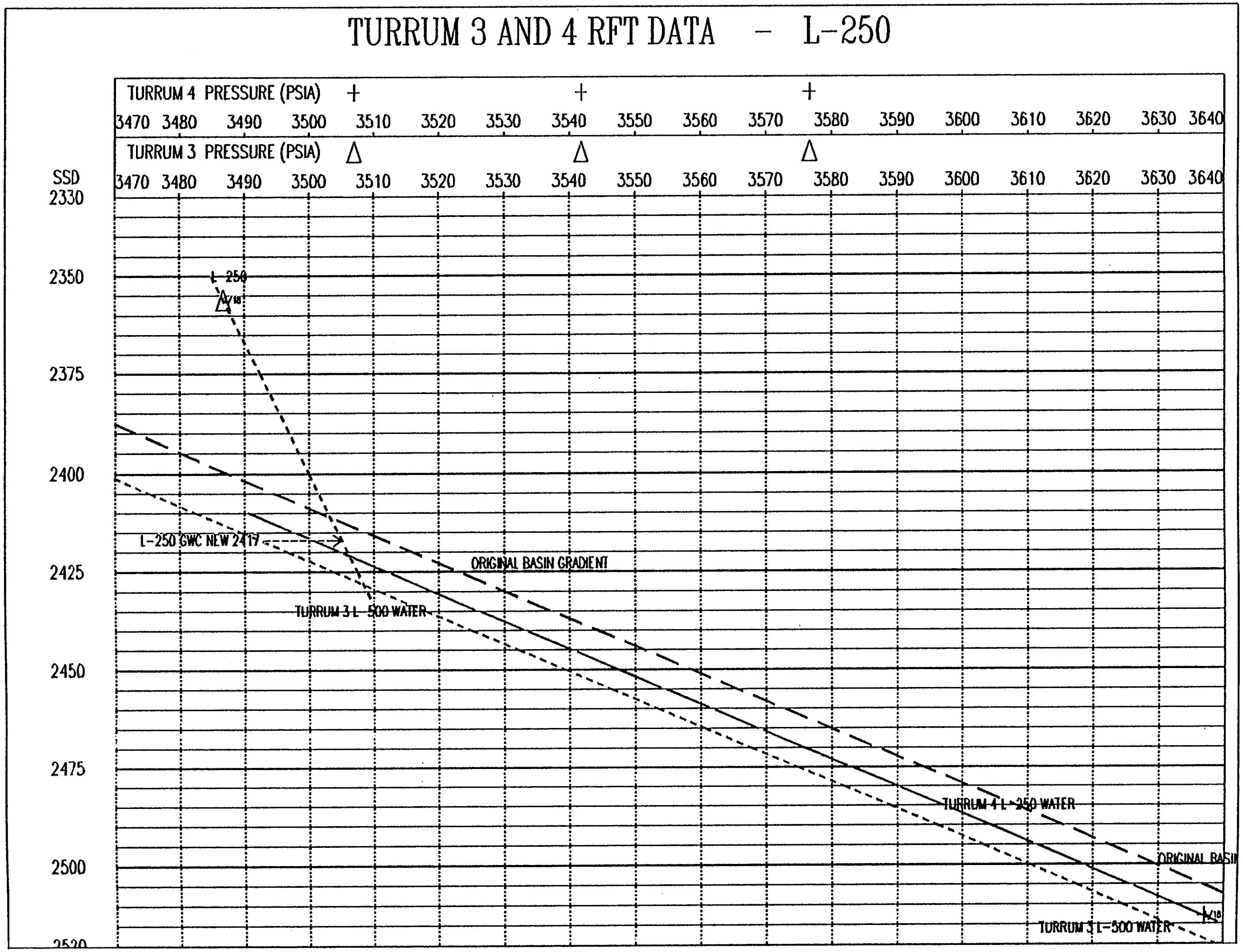
TURRUM 3 AND 4 RFT DATA - L-250
TURRUM 4 PRESSURE (PSIA)
TURRUM 3 PRESSURE (PSIA)
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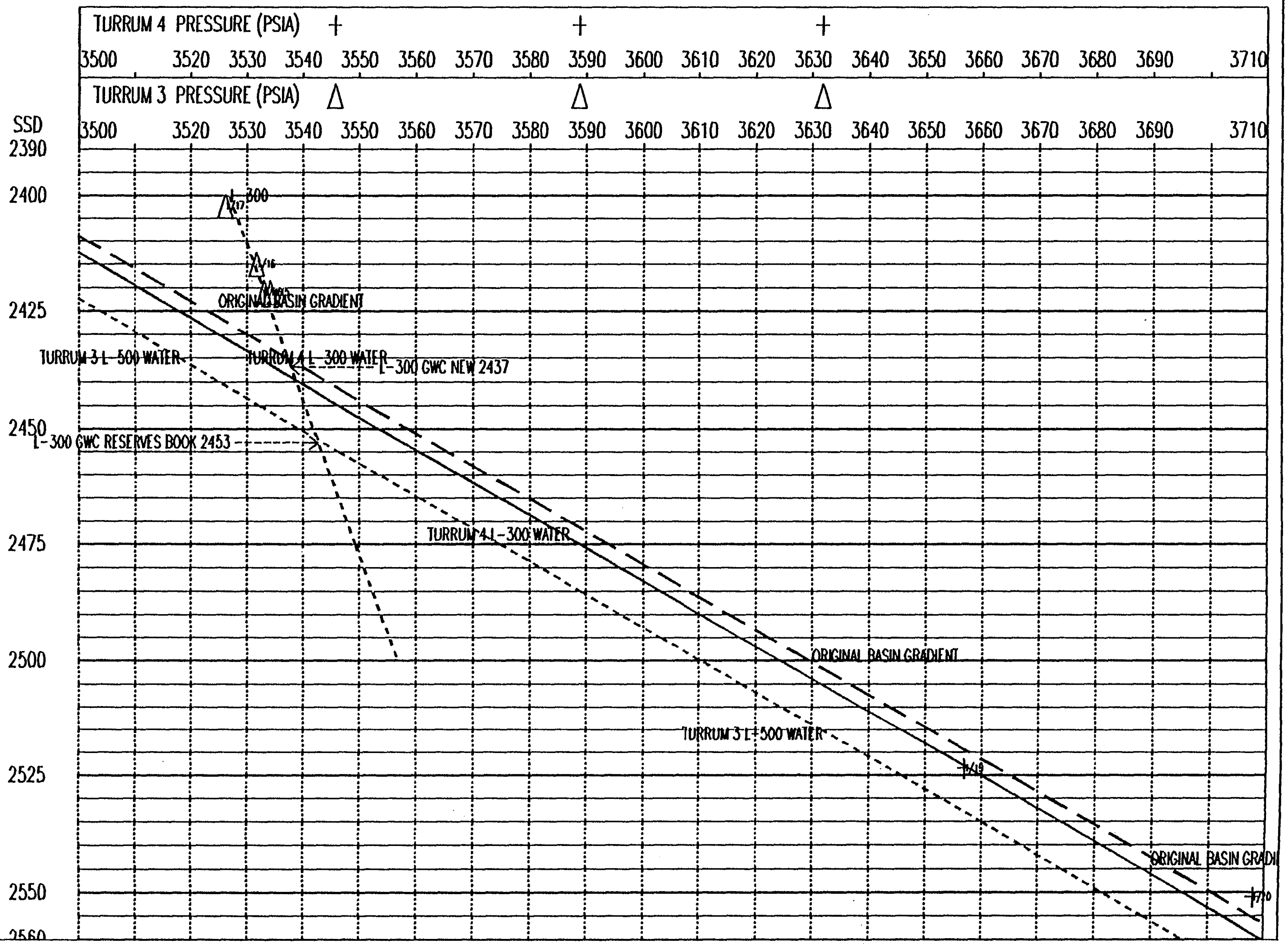
SSD
2330
2350
2375
2400
2425
2450
2475
2500
L-250
L-250 GWC NEW 2417
ORIGINAL BASIN GRADIENT
TURRUM 3 L-500 WATER
TURRUM 4 L-250 WATER

TURRUM 3 AND 4 RFT DATA - L-300



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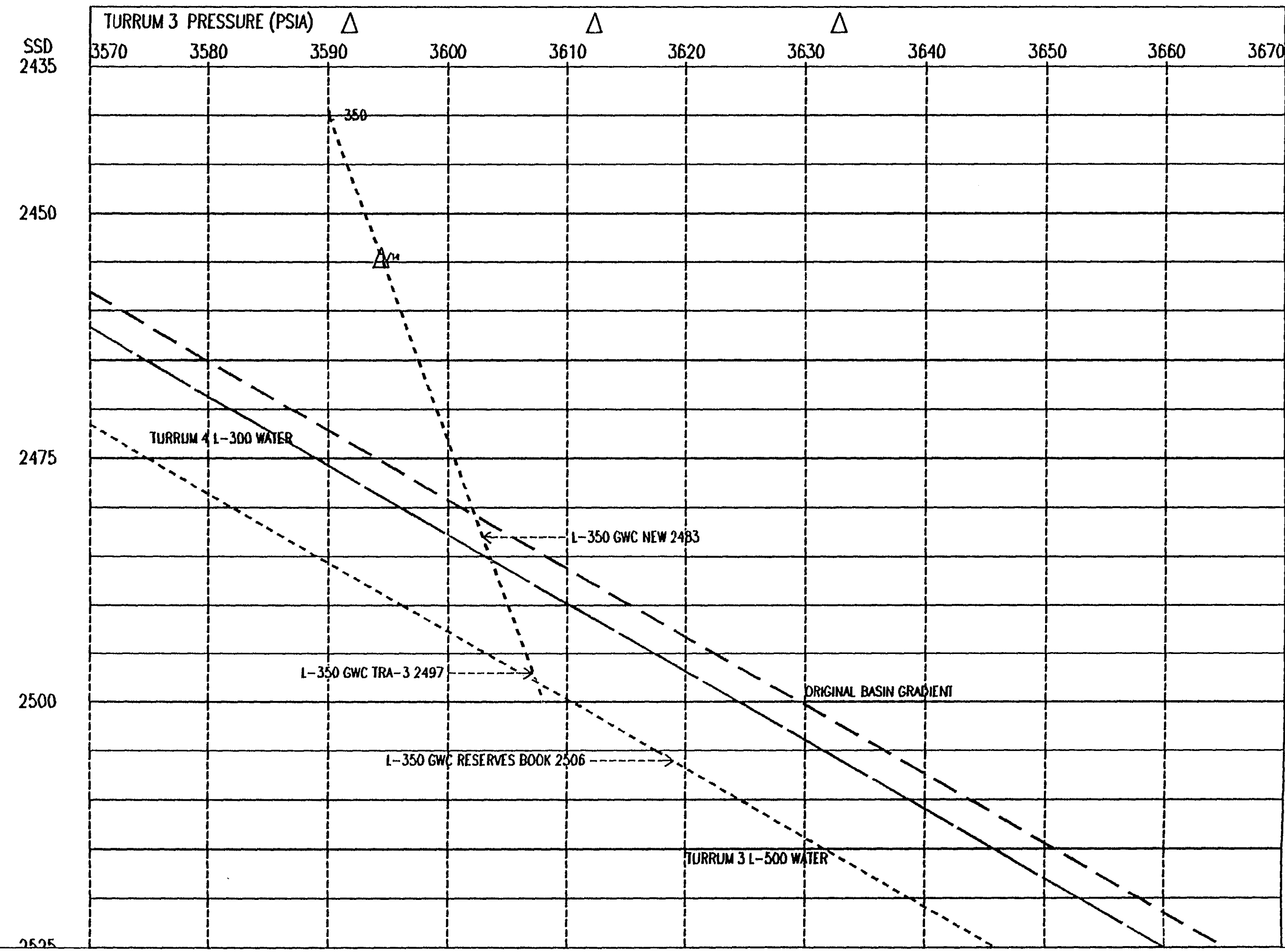

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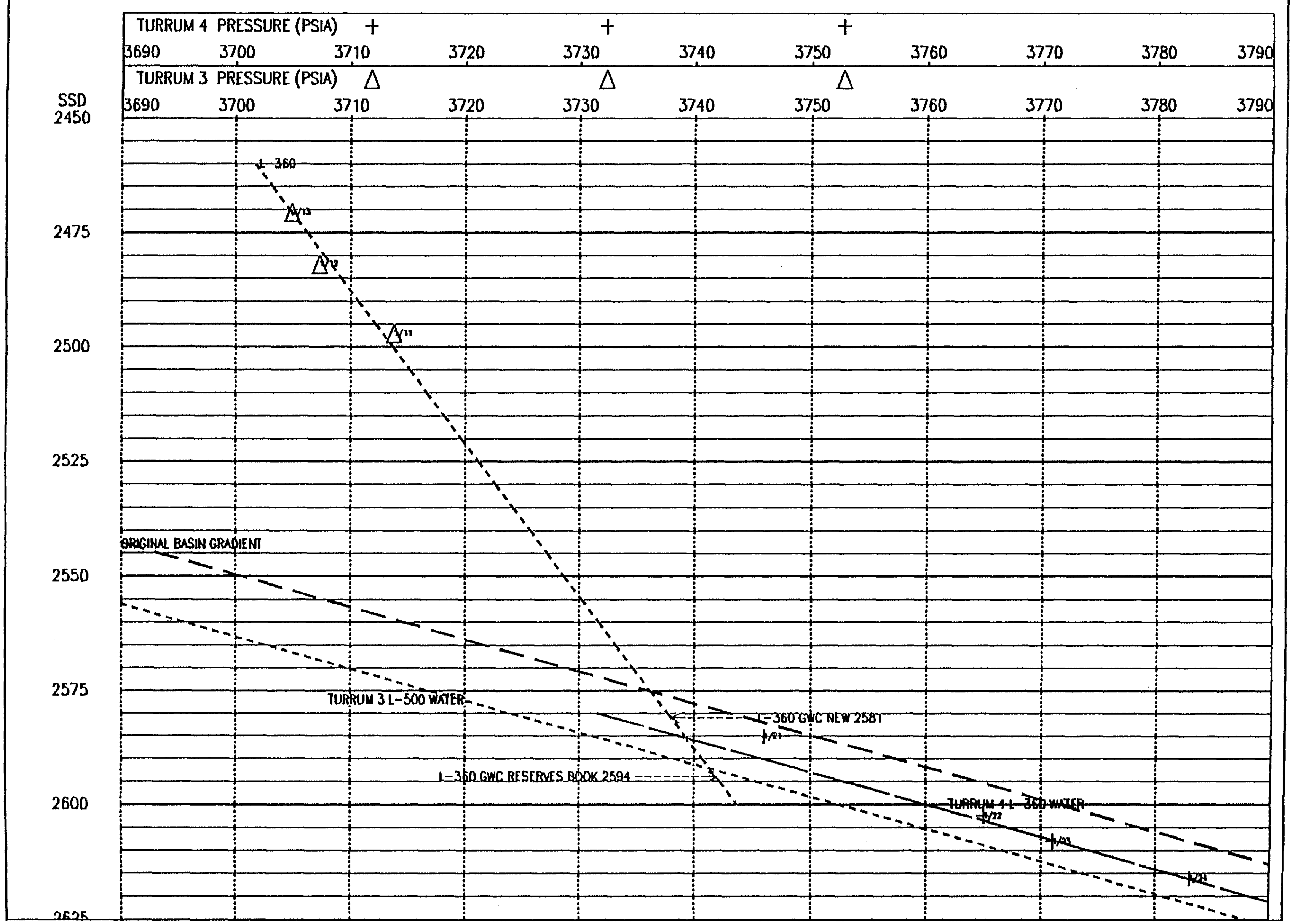

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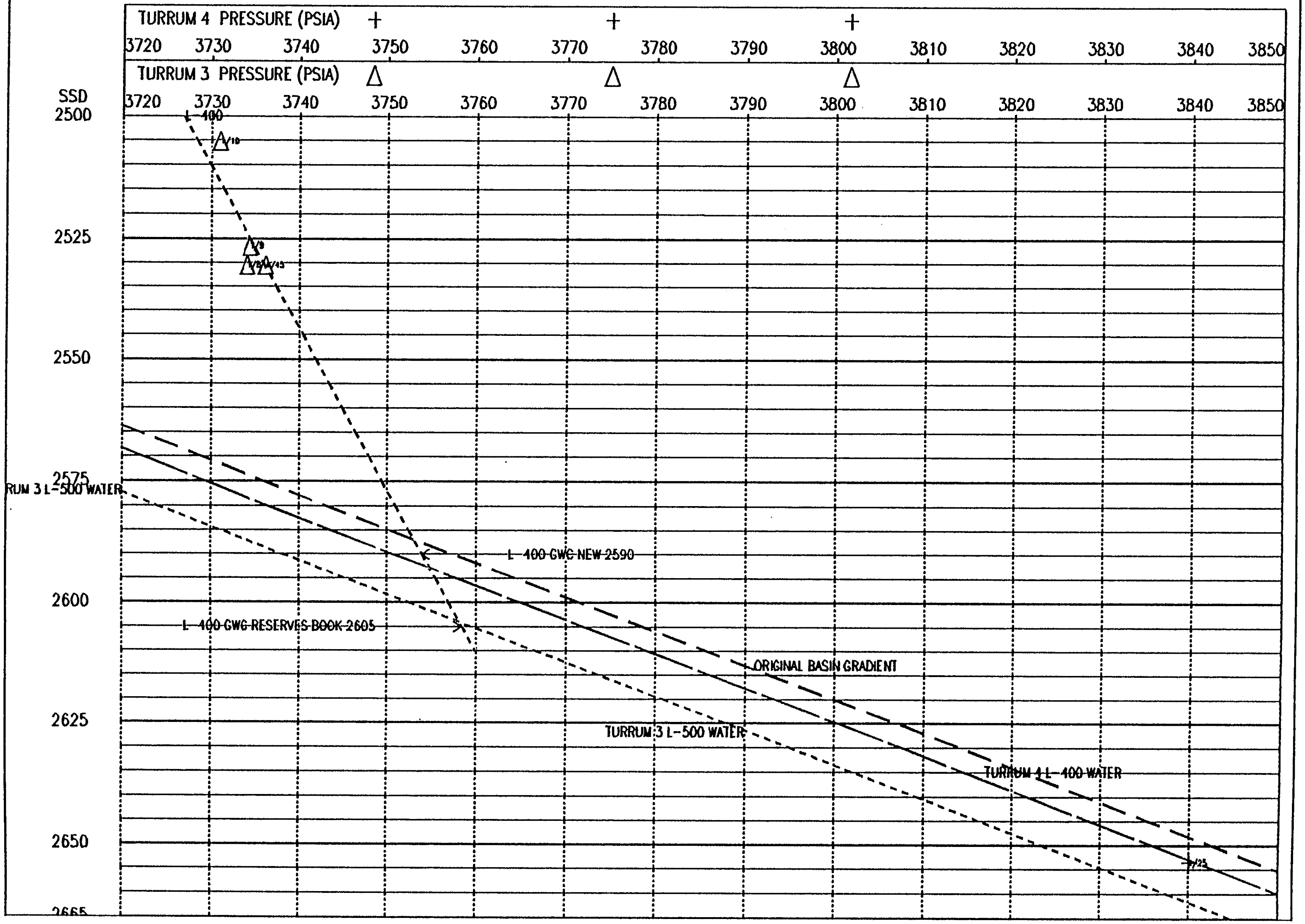

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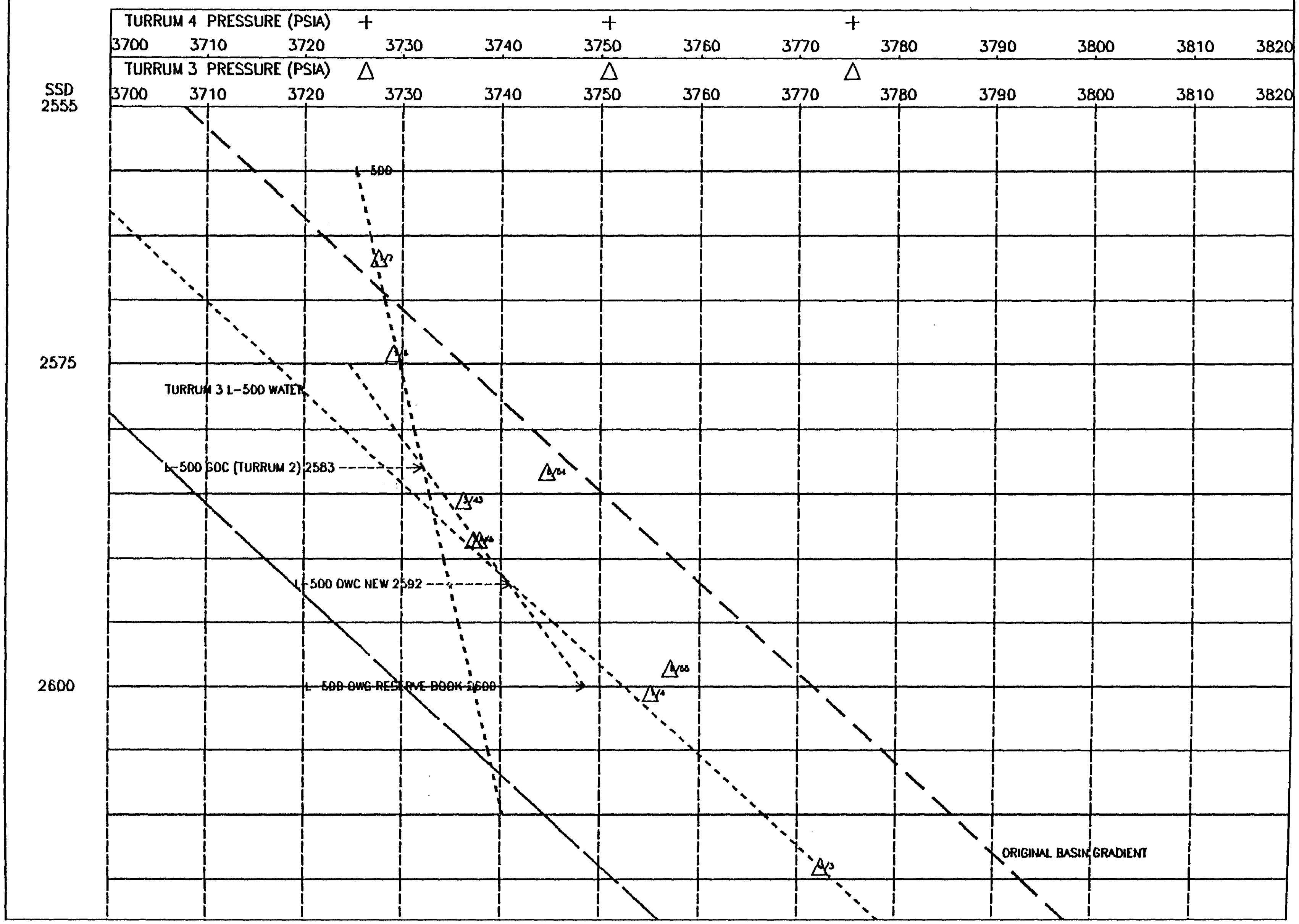
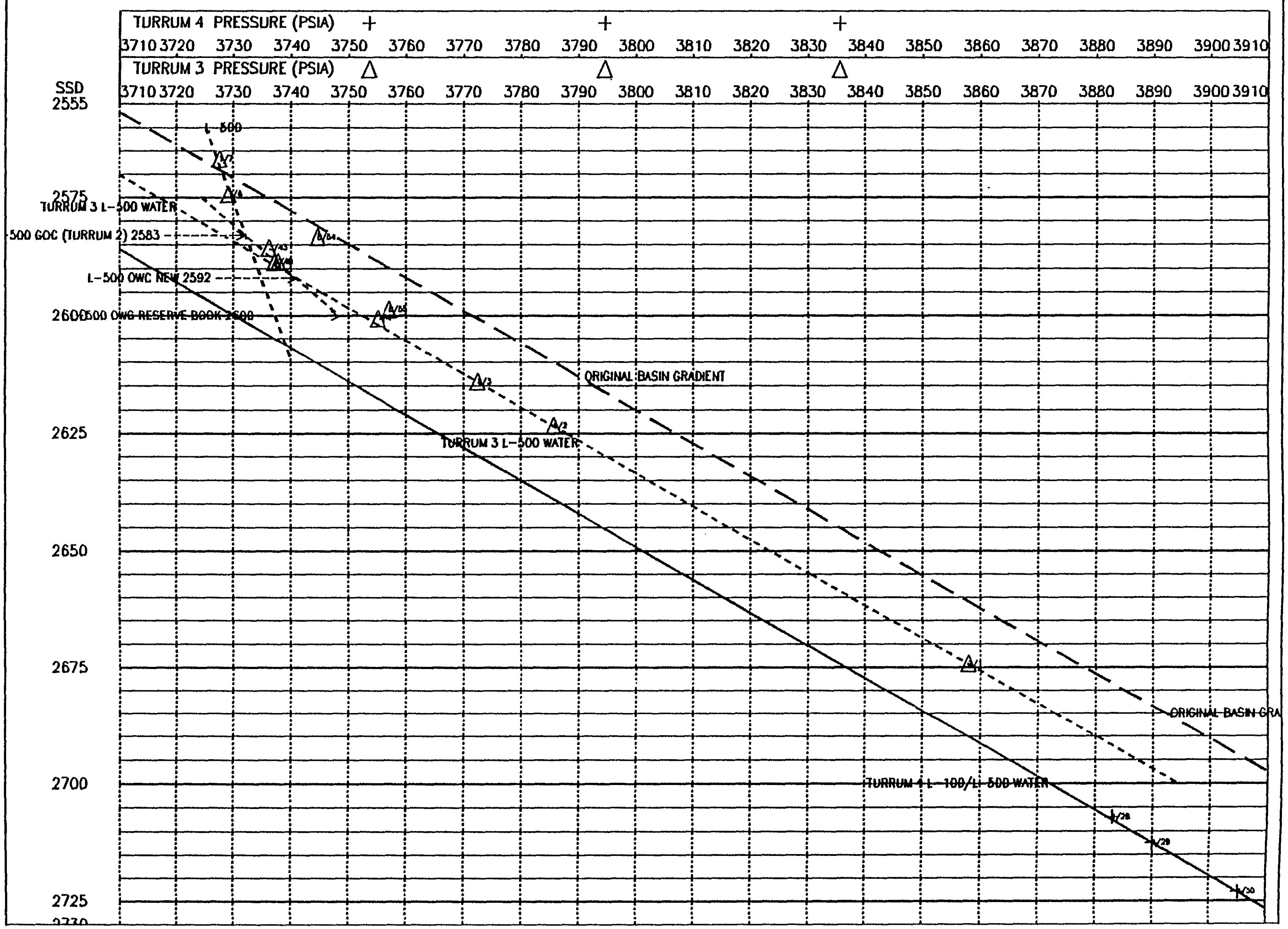
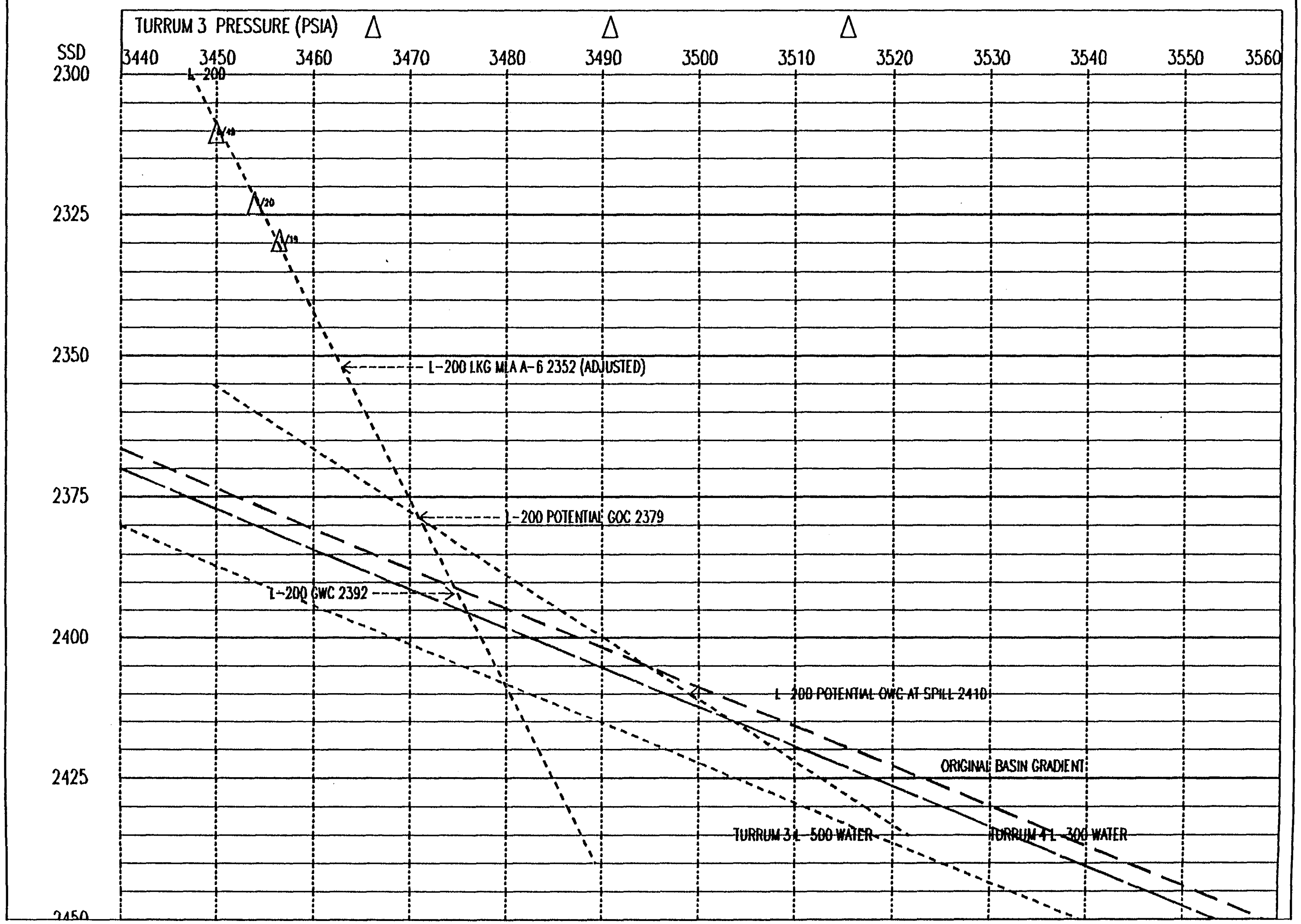


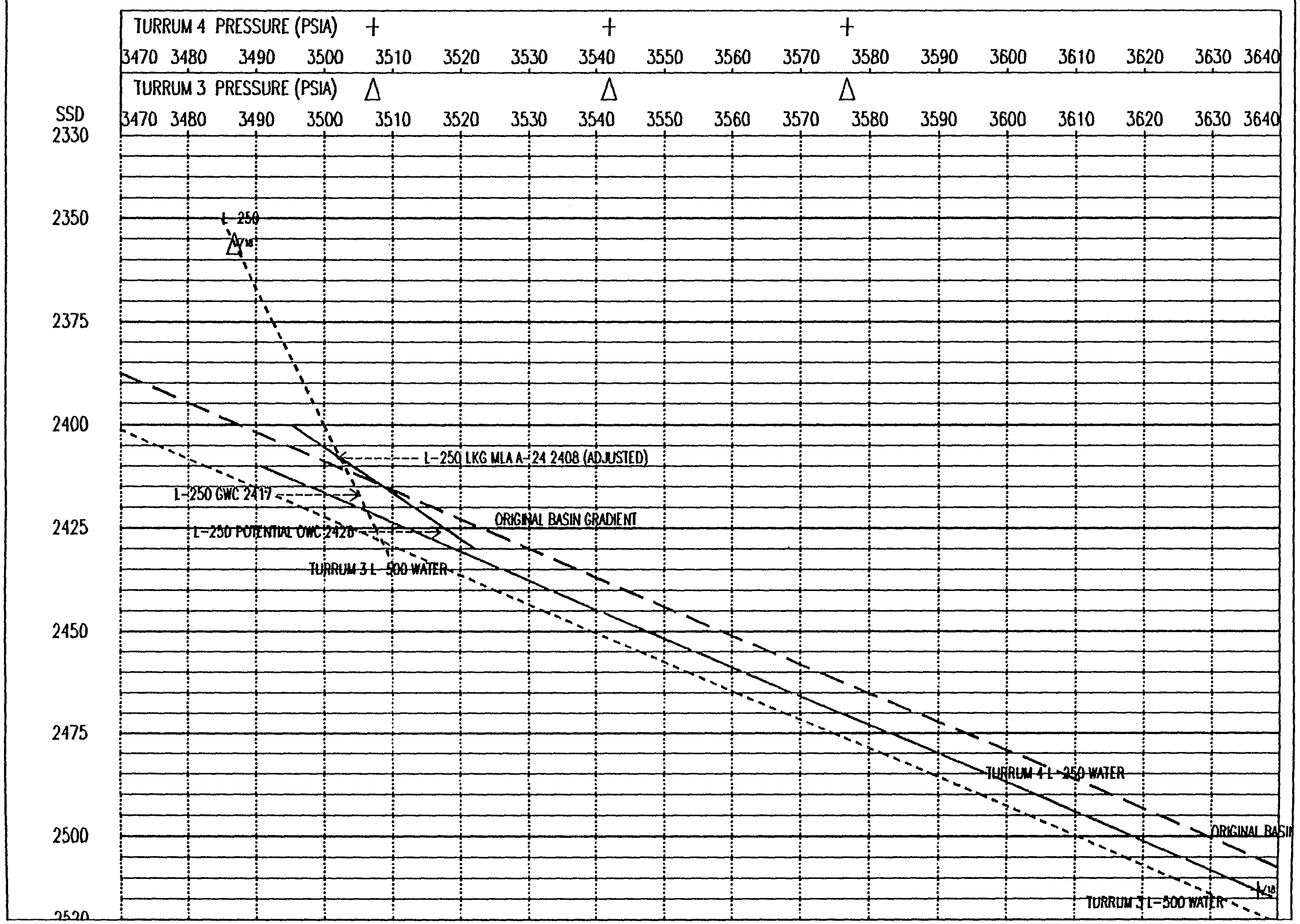
TURRUM 3 AND 4 RFT DATA – L-500



TURRUM MAXIMUM DOWNDIP OIL POTENTIAL - L-200



TURRUM MAXIMUM DOWNDIP OIL POTENTIAL – L-250



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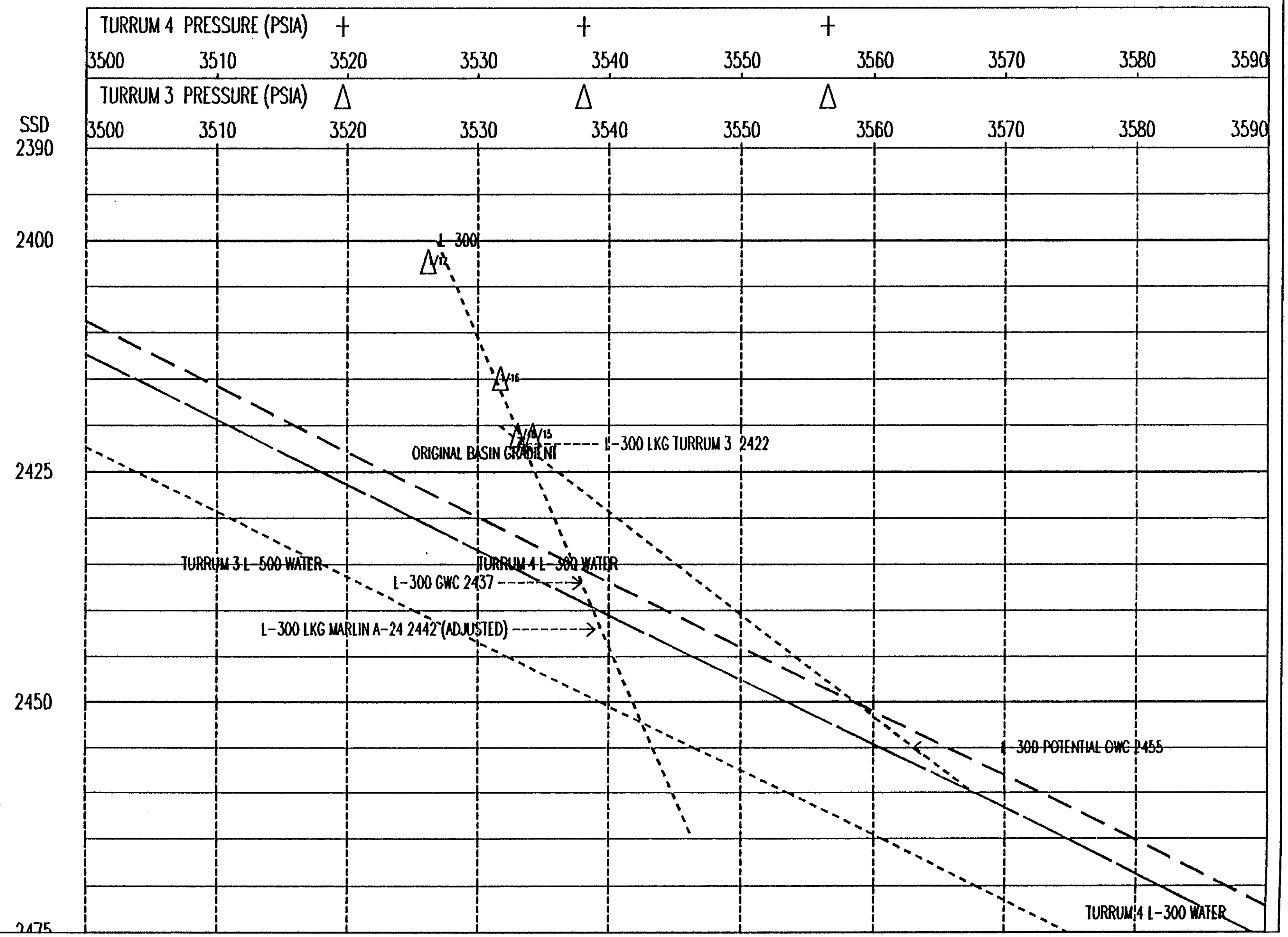
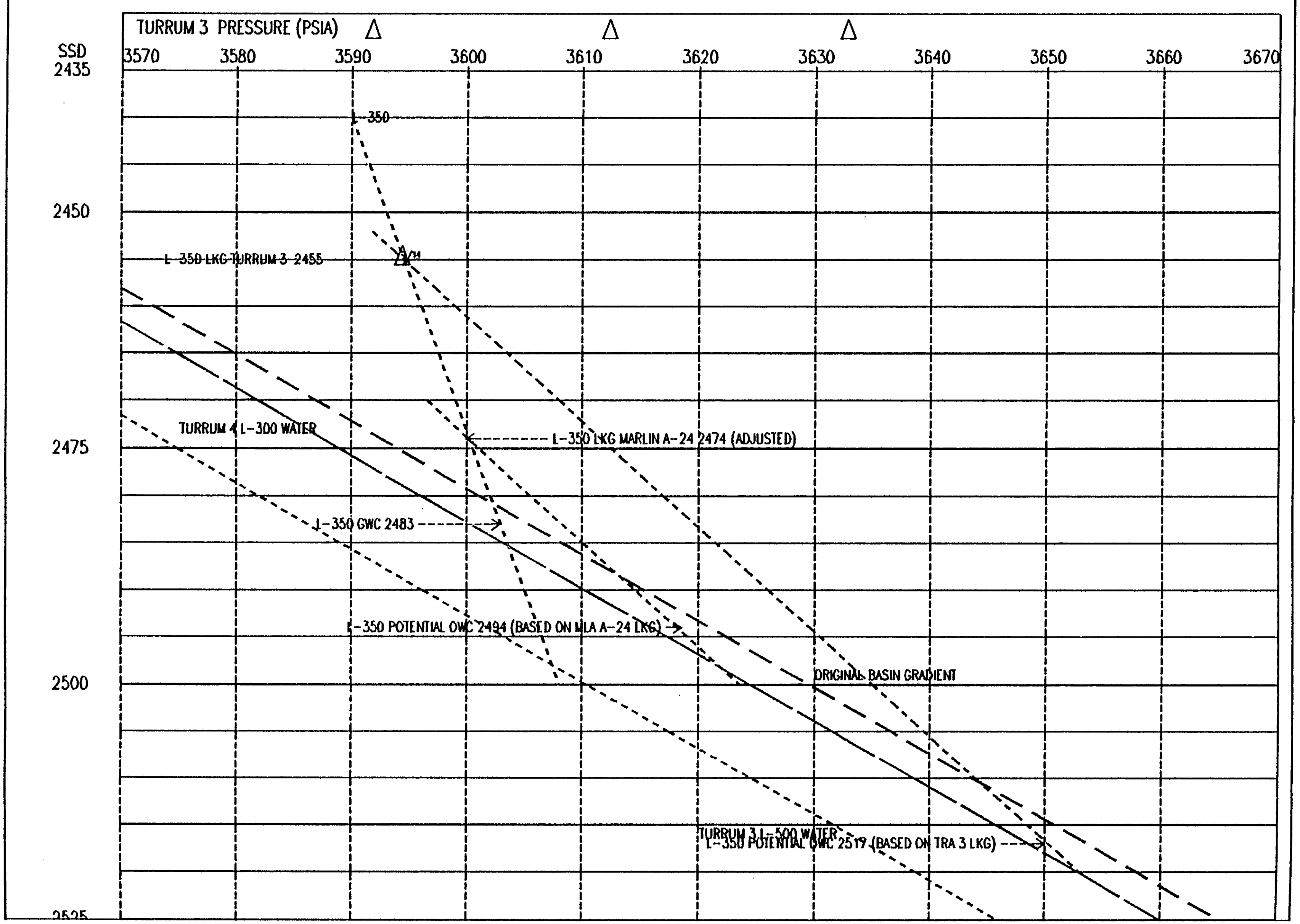
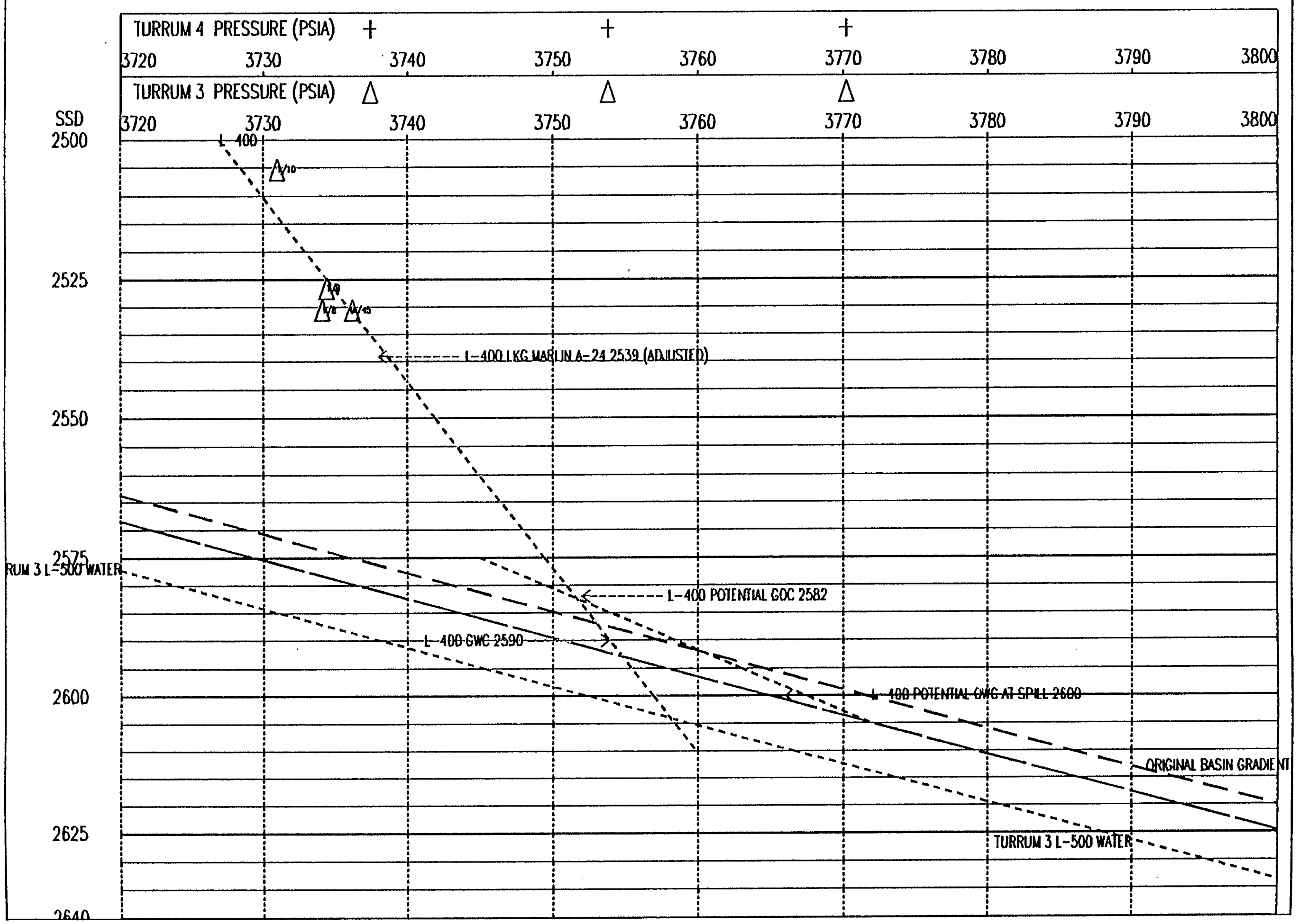


TURRUM MAXIMUM DOWNDIP OIL POTENTIAL – L-350



TURRUM MAXIMUM DOWNDIP OIL POTENTIAL – L-400



APPENDIX 1

MEMORANDUM

SYDNEY October 15, 1974

YOUR REF.

W.W. Fraser

OUR REF: 6650-2/6650-3 DAC:sd

cc: E.B. Stanford (Attn: S. Benedek)

SUBJECT Report on Interpretation of Turrum Gas Sample Analyses and Pressures.

Attached please find a copy of the subject report. You will note that the analysis of FIT pressures is predicated on the basis of each sand being in contact with an underlying water-leg. However the possibility that some, or all of these sands (except in the Marlin-4 fault block) are non-water drive reservoirs cannot be discounted.

Analysis of Amerada pressures in the report shows no evidence of a significant system of gas sands with a common gas/water contact. However in Marlin A-24, the Schlumberger pressures, which are more numerous than the Amerada pressures, indicate the possibility of two such systems, as discussed. Recognizing the inherent inaccuracy of Schlumberger pressures, such an interpretation could only be considered a low probability "maximum" case.

P.C. Hall

P. C. Hall

Attch.

INTERPRETATION OF TURRUM GAS SAMPLE ANALYSES AND PRESSURES

This report documents Turrum gas analyses and formation pressures, and evaluates these data for:

1) evidence of sand continuity and/or communication between fault blocks, and

2) the indicated height of the various gas columns above their respective gas/water contacts.

Based on this evaluation only, the following conclusions can be drawn:

1) On a hydrocarbon basis, the compositions of the Turrum gas samples are similar, and a common source for most of these gases is probable.

2) The CO_2 content of the Turrum gas samples is unusually high compared with the overlying Marlin N-1 gas and the Barracouta N-1 gas, although high CO_2 contents are also seen in the Sunfish and Tuna T-Longus gases at somewhat shallower depths than the Turrum gas sands. This high and variable CO_2 content suggests that its source may be the coals interbedded with the Turrum sands.

3) There is a rough correlation between CO_2 content and depth, with percent CO_2 increasing with depth to a peak value of about 22 percent at a subsea depth of about 7500 feet, and then decreasing below that point.

4) The possibility of communication between the two sands tested by FIT's 1 and 4 in the Marlin-4 well, suggested by very similar CO_2 content and hydrocarbon composition, is not supported by the pressure data. However communication may have existed at the time of CO_2 generation and hydrocarbon migration.

5) The similarity in CO_2 content of the Turrum-1 and Marlin A-24 FIT #10 samples and of the Marlin A-24 FIT #7 and FIT #16 samples is probably coincidental.

6) The variation in CO_2 content of the other samples does not indicate communication within and between the other fault blocks, but does not rule it out.

7) A common gas/water contact for all sands cannot be supported by the pressure data.

8) Gas columns ranging up to 200 feet in height above their respective gas/water contacts can be inferred from the pressure data.

9) The pressure data give no evidence of communication between the different fault blocks.

DISCUSSION

1. Compositional Analyses

Table 1 compares the analyses of the various gas samples from the Turrum field. The most significant feature of these analyses is the unusually high (and variable) CO_2 content seen in all samples, ranging from 6.27 Mol percent in FIT #10 from Marlin A-24 to 21.84 Mol percent in the Marlin-1 Turrum horizon DST. By comparison the Marlin and Barracouta N-1 gases have CO_2 contents ranging up to about 2 percent CO_2, although gas samples from the Sunfish and Tuna T-Longus reservoirs, at somewhat shallower depths than the Turrum gas sands, show CO_2 contents in the 12 percent range. The CO_2 contents of the Turrum samples have been plotted against subsea depth in Figure 1. Although rough, there appears to be a correlation indicating that the CO_2 content generally increases with depth, reaching a peak at a subsea depth of about 7500 feet, and then generally declines as depth increases below that point.

The variations in CO_2 content occur both within and between the various fault blocks. There were only three instances in which similar CO_2 content was observed:

1) Both the CO_2 content and the hydrocarbon composition of the two FIT samples from the Marlin-4 well are almost identical. This suggests either communication between the two sands in the Marlin-4 fault block from which the samples were taken, or common sources or source conditions for both the CO_2 and hydrocarbon components of the gases in these two sands. (As discussed subsequently, the pressures measured with these samples do not indicate communication between these sands at present.)

2) The CO_2 contents of the Turrum-1 FIT #2 and Marlin A-24 FIT #10 samples are almost identical. However, these two wells are widely separated and in non-contiguous fault blocks, and the respective sands are neither stratigraphically equivalent nor at similar depths, suggesting that the similarity in CO_2 content may be coincidental.

3) The CO_2 contents of the Marlin A-24 FIT #7 and FIT #16 samples are very similar. However these samples are from sands over 1000 feet apart, with many intervening sands, shales and coal beds, and this suggests that this similarity is also coincidental.

The variation in CO_2 content of the other samples does not necessarily indicate a difference in hydrocarbon source. In fact the wide variation suggests the possibility that the CO_2 was generated in the coal deposits which are interbedded with the gas bearing sands, with the variation possibly due to differing burial temperature/pressure histories and differing relative volumes of coal and gas in the respective sands and fault blocks. The variation in CO_2 content, while not proving the absence of communication within and between the different fault blocks, does not support it. Even if the CO_2 content was generated below the Turrum horizon, the observed variation would appear to rule out widespread communication at the time of migration.

Table 2 shows the analyses from Table 1 converted to a CO_2/N_2-free basis. It can be seen that the variation in hydrocarbon composition between the samples shown in Table 1 is greatly reduced when the compositions are normalized in this fashion. The most significant variation remaining is in the C_1 and C_6+ contents, and this could well be due to sampling or analysis problems. Variation in C_6+ content due to these problems would be accompanied by offsetting changes in the proportions of the other components, with the great bulk of this change showing up in the C_1 content. It can be concluded that the hydrocarbon portions of these Turrum gas samples are largely similar, and therefore that a common source is probable. (It should also be noted that on a hydrocarbon basis the Turrum gas analyses are similar to the currently accepted analysis of Marlin N-1 gas.) From this review of the Turrum gas analyses it can be concluded that:

1) On a hydrocarbon basis, the compositions of the Turrum gas samples are similar, and a common source for these hydrocarbons is probable.

2) The CO_2 content of the Turrum gas sample is unusually high, and variable, suggesting that the CO_2 source may be the coals interbedded with the Turrum sands.

3) There is a rough correlation between CO_2 content and depth, with percent CO_2 increasing with depth to a peak value of about 22 percent at a subsea depth of about 7500 feet, and then decreasing below that point.

4) The possibility of communication between the two sands tested by FIT's 1 and 4 in the Marlin-4 well, suggested by very similar CO_2 contents and hydrocarbon compositions, is not supported by the pressure data. However communication may have existed at the time of CO_2 generation and hydrocarbon migration.

5) The similarity in CO_2 content between the Turrum-1 and Marlin A-24 FIT #10 samples and of the Marlin A-24 FIT #7 and FIT #16 samples is probably coincidental.

6) The variation in CO_2 content of the other samples does not support communication within and between the other fault blocks, but does not rule it out.

2. Formation Pressures

FIT pressure measurements have been made in all wells in the Turrum field, except Marlin-1. In a gas sand, the amount by which the measured formation pressure exceeds the hydrostatic gradient is a function of the difference between the depths of the point of measurement and the downdip gas/water contact. This is because the pressure gradient in gas is much lower than in water; a typical gas gradient in the Turrum field is 0.09 psi/foot compared with the water gradient of 0.433 psi/foot.

In analysing the Amerada pressure data from these wells the question of accuracy of the measured pressures arises. The quoted accuracy of an Amerada gauge is ±0.25 percent of the maximum range of the instrument. On FIT tests, it is necessary to use an Amerada gauge with a maximum range of about twice the expected formation pressure, in order to withstand the pressures generated by the firing of the various charges during the FIT test. Amerada gauges with a range of 11,800 psig have been commonly used recently, giving an expected accuracy of ±30 psig. Presumably this variation would be distributed such that most measurements would be much closer to the true pressure than ±30 psi.

This is confirmed by a comparison of Amerada and Hewlett-Packard pressures measured concurrently in pulse and build-up tests in Kingfish and Halibut wells this year. The quoted accuracy of the Hewlett-Packard gauge is ±0.025 percent of measured pressure, i.e. less than ±1 psi, making the Hewlett-Packard pressure measurement an acceptable standard for this purpose. The average absolute deviation of the Amerada pressure from that measured by the Hewlett-Packard in 17 tests was 4 psi. In these same tests the maximum deviation of the Amerada pressure from the Hewlett-Packard pressure ranged from -8.8 to +8.4 psi. Amerada gauges with a 5000 psi range were used in these tests giving an expected accuracy of +12 psi. Thus it can be seen that in a small sample of 17 tests, the deviation from the "correct" value did not exceed 75 percent of the quoted accuracy, and most measurements were within 4 psi of the "correct value". On this basis, most measurements with an 11,800 psig range Amerada gauge could be expected to fall within ±10 psi of the correct value. With a Turrum gas gradient of 0.09 psi/foot, this means that most of the indicated gas column heights would be within 110 feet of the correct height, although in the worst case the error could be as much as 300 feet.

The FIT pressures and hydrostatic gradient line are plotted for each well in Figures 2 through 6. Except where noted, the pressures were measured with Amerada gauges. Each well is discussed individually below:

(1) Turrum-1 (Figure 2)

Only two FIT pressure measurements in this well were successful. Neither indicate a significant gas column.

(2) Marlin A-6 (Figure 3)

The FIT pressures from this well must be viewed with caution because no Amerada gauges were run, and the pressures shown are from the Schlumberger gauge which has been found to be inaccurate in the past. The only significant deviation above the hydrostatic gradient is for FIT Nos. 1 and 11, and these pressures are dubious. This is because, in each case, the hydrostatic mud column pressures measured by the Schlumberger gauge, after the FIT tool is collapsed, are several hundred psi above the hydrostatic pressure calculated from the mud weight. Correcting the measured formation pressures by the difference between measured and calculated hydrostatic mud pressure gives values which fall below the gradient line. In any event, these two FIT pressures are from the "A-6 oil sand" rather than from gas sands.

(3) Marlin A-24 (Figure 4)

Points lying below 8540 feet subsea in Figure 4 represent samples from log interpreted water sands. FIT Nos. 1 and 2 in this interval both recovered filtrate. Therefore the above-hydrostatic pressure shown for FIT #2 is probably misleading and not indicative of a hydrocarbon accumulation.

Points plotted in the interval 8380-8540 feet subsea in Figure 4 represent samples in the "A-6 oil sand". FIT #6 is not an Amerada pressure and is considered definitely in error since the Amerada pressure in FIT #14 in the same sand shows a much lower value.

Points plotted above 8380 feet subsea represent samples from the Turrum gas sands. FIT's 8, 12 and 15 are Amerada measured pressures. The FIT #8 pressure lies slightly below the hydrostatic gradient. This would suggest that although no gas was recovered on test, the gas column in this sand, if present, is of negligible extent below this point. The pressure measured in FIT #12 is dubious because the pressure build-up shows an increase in the rate of change in pressure at the end of the build-up, instead of the expected decrease. This suggests some degree of communication with the mud column, a conclusion supported by the recovery of muddy filtrate in this test. Hence this pressure should be ignored. The Amerada pressure obtained from FIT #15, which recovered gas and filtrate, indicates a gas column extending approximately 160 feet below the FIT sample depth to an estimated gas/water contact at a depth of about 7590 feet subsea.

All the other gas sand pressures shown were measured with the Schlumberger gauge and are considered too unreliable to use in predicting gas column height.

(4) Marlin-4 (Figure 5)

All the pressures plotted in Figure 5 were measured with an Amerada gauge. FIT's 3, 5 and 6 fall right on the gradient line, and this, plus the FIT recoveries of more than 20,000 cc of water in each case suggest that these samples were taken in water sands. FIT's 1 and 2 both recovered gas and show pressures which lie on a common gas gradient line, which extrapolates to a common gas/water contact at a depth of about 7890 feet subsea. The height of the indicated gas column is about 140 feet at FIT #2. The pressure from FIT #4 (which recovered gas) also indicates a gas column, in this case extending 200 feet down to a gas/water contact at about 7630 feet subsea. It can be seen that the pressures measured with FIT's 1 and 4 do not lie on a common gradient line and thus do not support communication between the sands in which these two tests were made, as discussed previously.

(5) Turrum-2 (Figure 6)

The pressures plotted in Figure 6 were all measured by Amerada gauge except for FIT #12. Only FIT's 8 and 9 support a significant gas column. FIT #8 which recovered gas indicates a gas column extending 90 feet down to a gas/water contact at a depth of about 7680 feet subsea. FIT #9 which recovered filtrate, indicates a gas column extending 130 feet down to a gas/water contact at a depth of about 7850 feet subsea.

The pressures in these wells have also been reviewed in the light of the latest cross-sectional map of the Turrum field, comparing pressures in sands mapped as being, or likely to be, in communication. In no instance did the pressures indicate communication between fault blocks.

From this review of the FIT pressure data it can be concluded that:

1) Where gas columns are indicated, the heights of the columns above their respective gas/water contacts range up to 200 feet.

2) A common gas/water contact for all sands cannot be supported.

3) There is no evidence of communication between fault blocks.

DAC: 14/10/74

TABLE 1

TURRUM GAS ANALYSES

Well:	MARLIN-1	TURRUM-1	MARLIN A-24					MARLIN-4		TURRUM-2*	
Sample:	Recombined Surface	FIT #2	FIT #7	FIT #9	FIT #10	FIT #11	FIT #16	FIT #1	FIT #4	FIT #12	FIT #8
Depth Ft.SS:	7375 - 7435 7473 - 7574	7059	8217	8096	8002	7894	7175	7804	7428	8622	7624
Laboratory:	APC	EPR	Longford	Longford	EPR	EPR	EPR	EPR	EPR	Longford	Longford
Mol % :											
N_2	0.09	0.16	0.50	1.62	0.39	0.49	0.55	0.28	0.32	0.63	0.29
CO_2	21.84	8.20	10.79	6.27	7.78	12.57	11.15	15.66	15.28	7.06	17.42
C_1	67.24	75.05	78.63	79.76	78.02	74.66	73.92	70.87	70.90	78.68	71.34
C_2	4.49	5.99	5.58	6.41	7.10	6.20	6.25	5.45	5.35	6.17	5.61
C_3	2.56	4.02	2.59	3.32	4.39	3.78	4.06	3.65	3.60	4.13	3.28
iC_4	0.35	0.59	0.36	0.46	0.56	0.58	0.69	0.56	0.67	0.60	0.48
nC_4	0.97	1.34	0.67	0.85	0.89	0.84	1.18	1.09	1.14	1.00	0.80
iC_5	0.36	0.41	0.16	0.22	0.21	0.23	0.36	0.37	0.43	0.26	0.21
nC_5	0.63	0.50	0.16	0.22	0.20	0.21	0.40	0.44	0.46	0.24	0.20
C_6	0.64	0.76	0.56	0.87	0.21	0.20	1.00	0.51	0.94	1.23	0.37
C_7	0.16	0.87	(C_6+)	(C_6+)	0.25	0.24	0.44	1.12	0.91	(C_6+)	(C_6+)
C_8	0.51	0.62			(C_7+)	(C_7+)	(C_7+)	(C_7+)	(C_7+)		
C_9+	0.16	1.49									
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
C_6+	1.47	3.74	0.56	0.87	0.46	0.44	1.84	1.63	1.85	1.23	0.37
Fault Block	V	I	VI	VI	VI	VI	VI	III	III	IV	IV

* The Turrum-2 analyses are approximate only. More definitive analyses are to be made.

DAC: 9/10/74

TABLE 2

TURRUM GAS ANALYSES ON N_2/CO_2-FREE BASIS

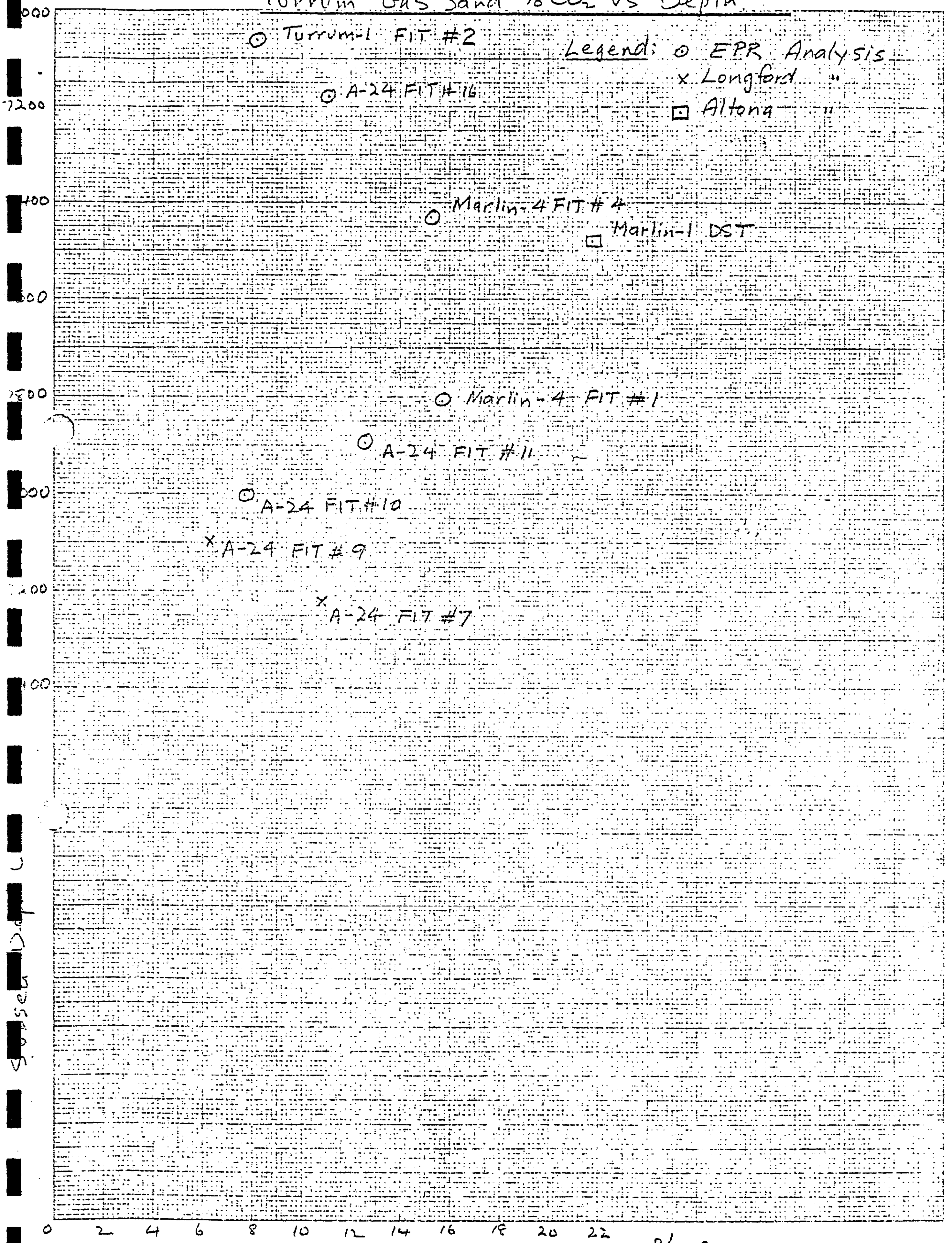
Well:	MARLIN-1	TURRUM-1	MARLIN A-24					MARLIN-4		TURRUM-2*	
Sample:	Recombined Surface	FIT #2	FIT #7	FIT #9	FIT #10	FIT #11	FIT #16	FIT #1	FIT #4	FIT #12	FIT #8
Depth Ft.SS:	7375 - 7435 7473 - 7574	7059	8217	8096	8002	7894	7175	7804	7428	8622	7624
Laboratory:	APC	EPR	Longford	Longford	EPR	EPR	EPR	EPR	EPR	Longford	Longford
Mol % :											
C_1	86.2	82.1	88.6	86.6	85.0	85.9	83.7	84.4	84.1	85.2	86.7
C_2	5.7	6.5	6.3	7.0	7.7	7.1	7.1	6.5	6.3	6.7	6.8
C_3	3.3	4.4	2.9	3.6	4.8	4.3	4.6	4.3	4.3	4.5	4.0
iC_4	0.4	0.6	0.4	0.5	0.6	0.7	0.8	0.7	0.8	0.6	0.6
nC_4	1.2	1.5	0.8	0.9	1.0	1.0	1.3	1.3	1.3	1.1	1.0
iC_5	0.5	0.4	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.3	0.3
nC_5	0.8	0.5	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.3	0.2
C_6	0.8	0.8	0.6	1.0	0.2	0.2	1.1	0.6	1.1	1.3	0.4
C_7	0.2	0.9	(C_6+)	(C_6+)	0.3	0.3	0.5	1.3	1.1	(C_6+)	(C_6+)
C_8	0.7	0.7			(C_7+)	(C_7+)	(C_7+)	(C_7+)	(C_7+)		
C_9+	0.2	1.6									
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
C_6+	1.9	4.0	0.6	1.0	0.5	0.5	1.6	1.9	2.2	1.3	0.4
Fault Block	V	I	VI	VI	VI	VI	VI	III	III	IV	IV

* The Turrum-2 analyses are approximate only. More definitive analyses are to be made.

DAC: 9/10/74

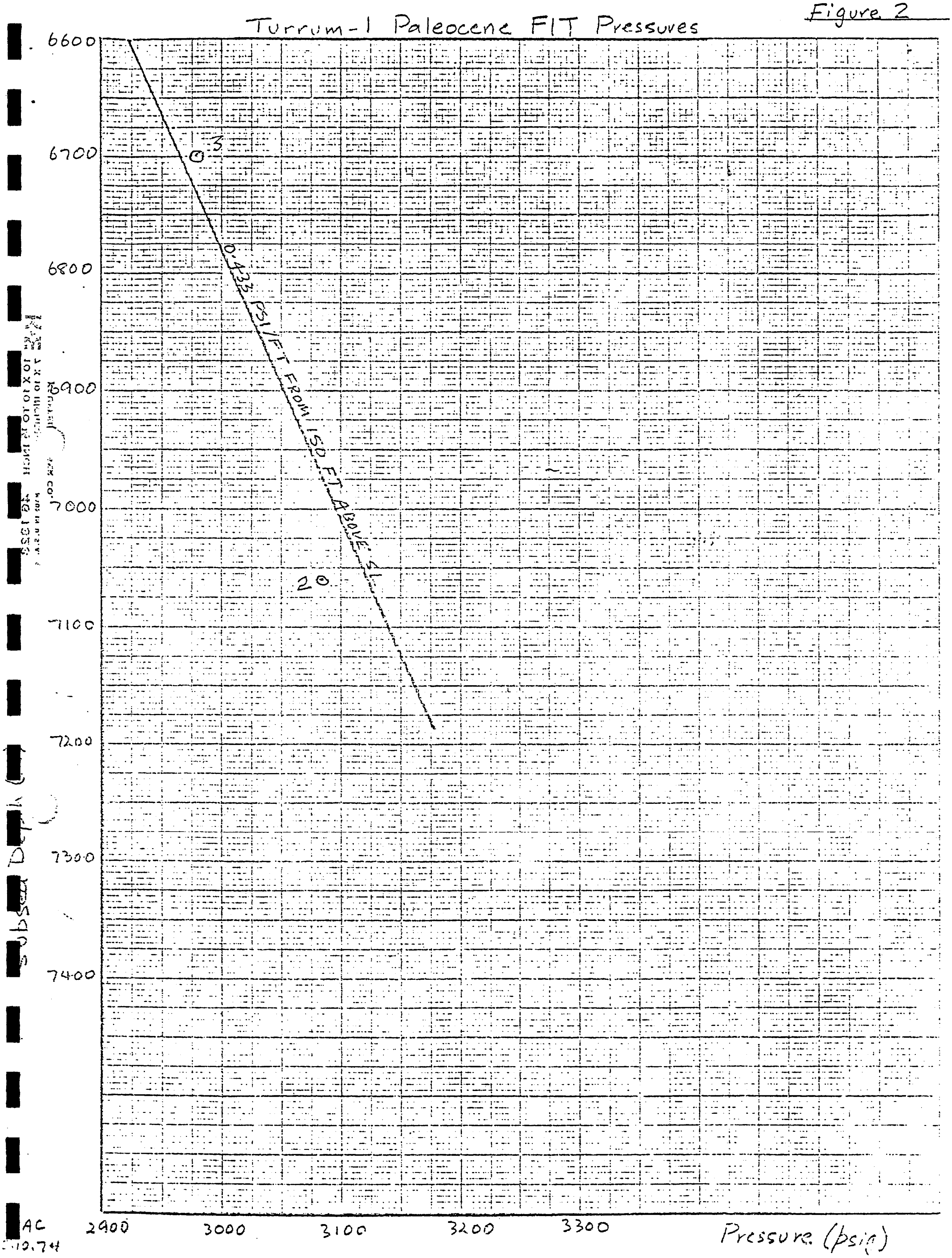
Figure 1.

Turrum Gas Sand $\% CO_2$ vs Depth



SAC
4.0.72

Figure 2



Turrum-1 Paleocene FIT Pressures
6600
6700
6800
6900
7000
7100
7200
7300
7400
Subsea Depth
2900
3000
3100
3200
3300
Pressure (psia)
0.433 PSI/FT FROM 150 FT ABOVE SL
3
2

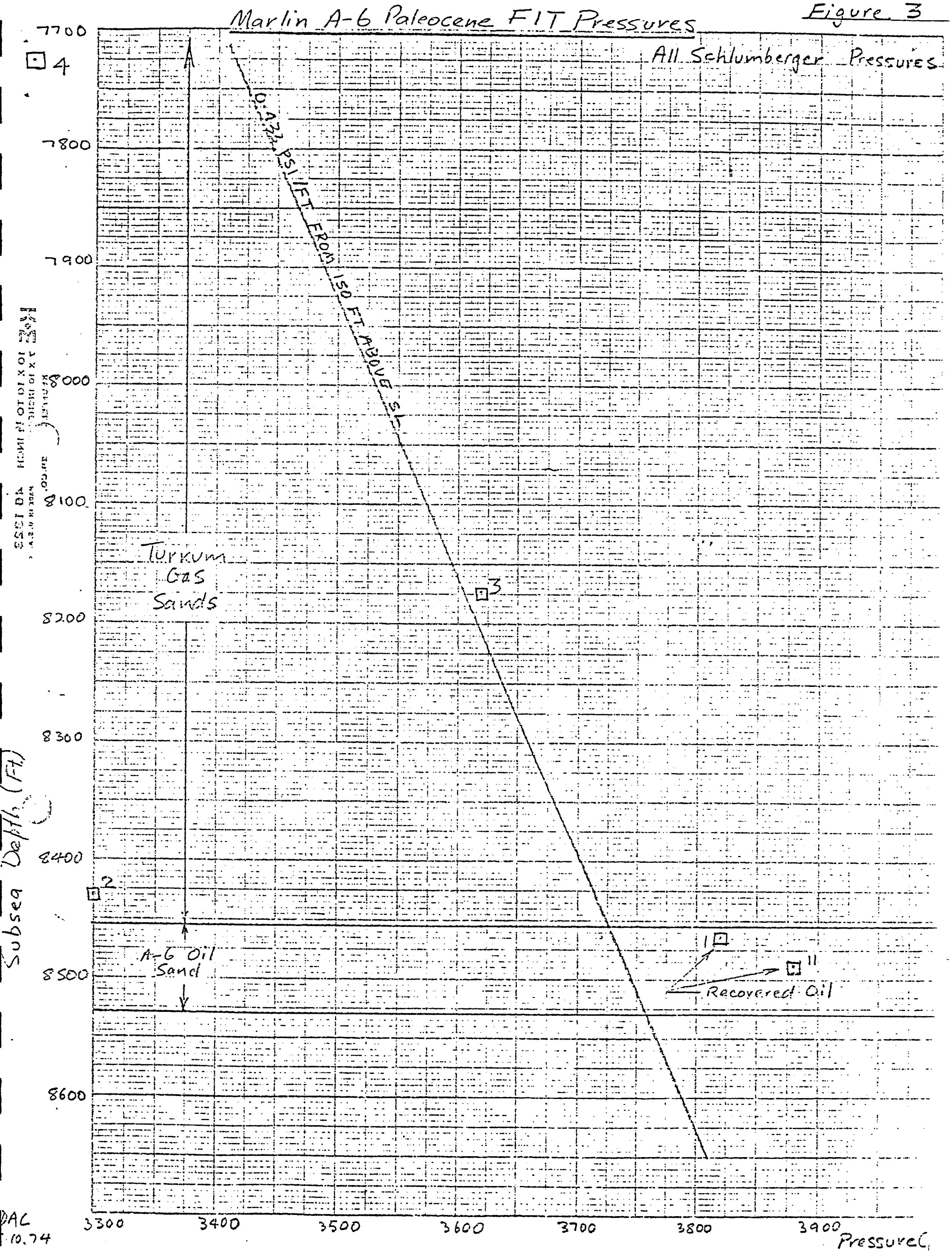
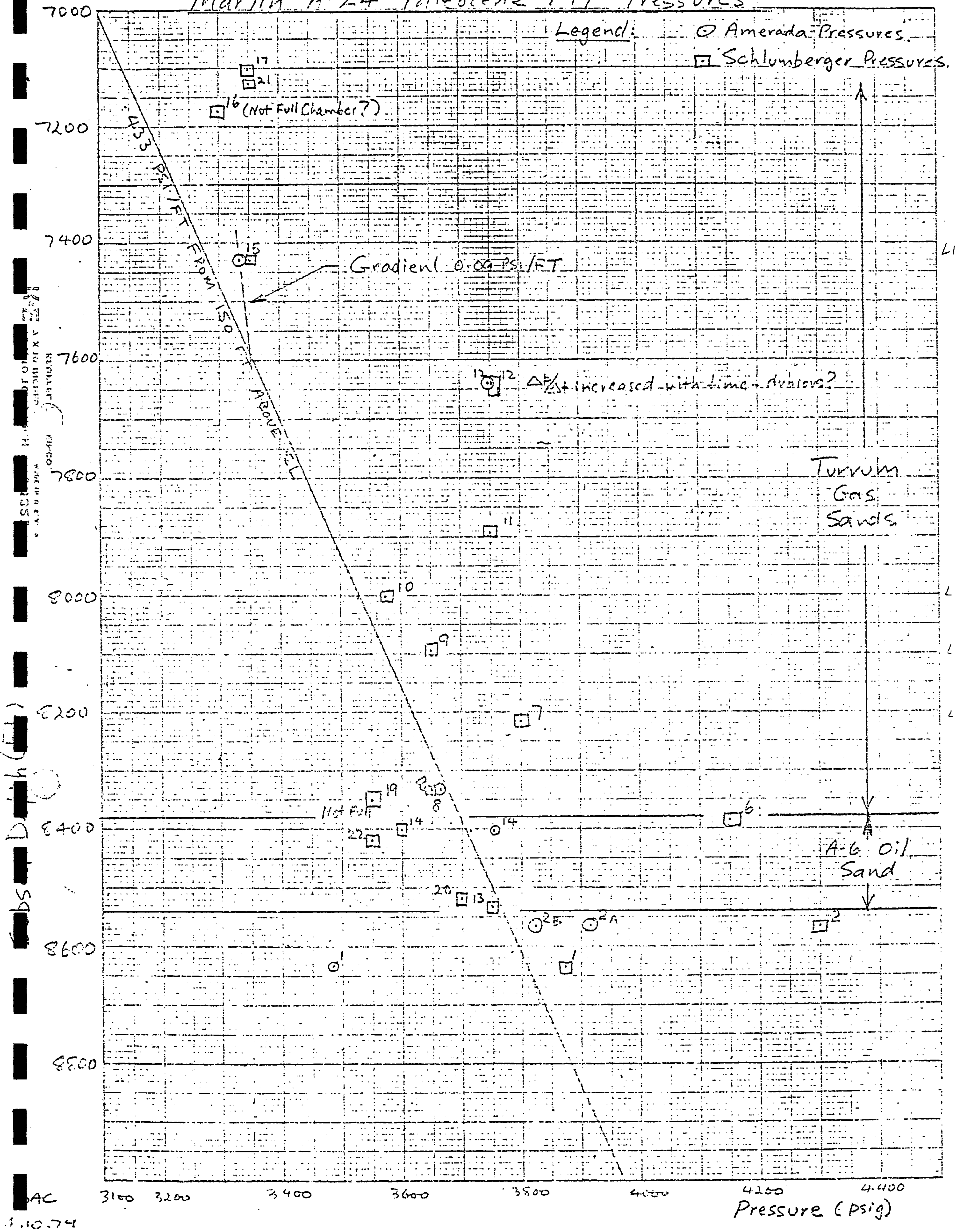

Marlin A-6 Paleocene FIT Pressures
Figure 3
All Schlumberger Pressures
0.433 PSI/FT FROM 150 FT ABOVE SL
Turkum Gas Sands
A-6 Oil Sand
Recovered Oil
Subsea Depth (Ft)
Pressure
7700
7800
7900
8000
8100
8200
8300
8400
8500
8600
3300
3400
3500
3600
3700
3800
3900
1
2
3
4
11
DAC
10.74

Figure 4.

Marlin A-24 Paleocene FIT Pressures



AC
1.10.74

Figure 5

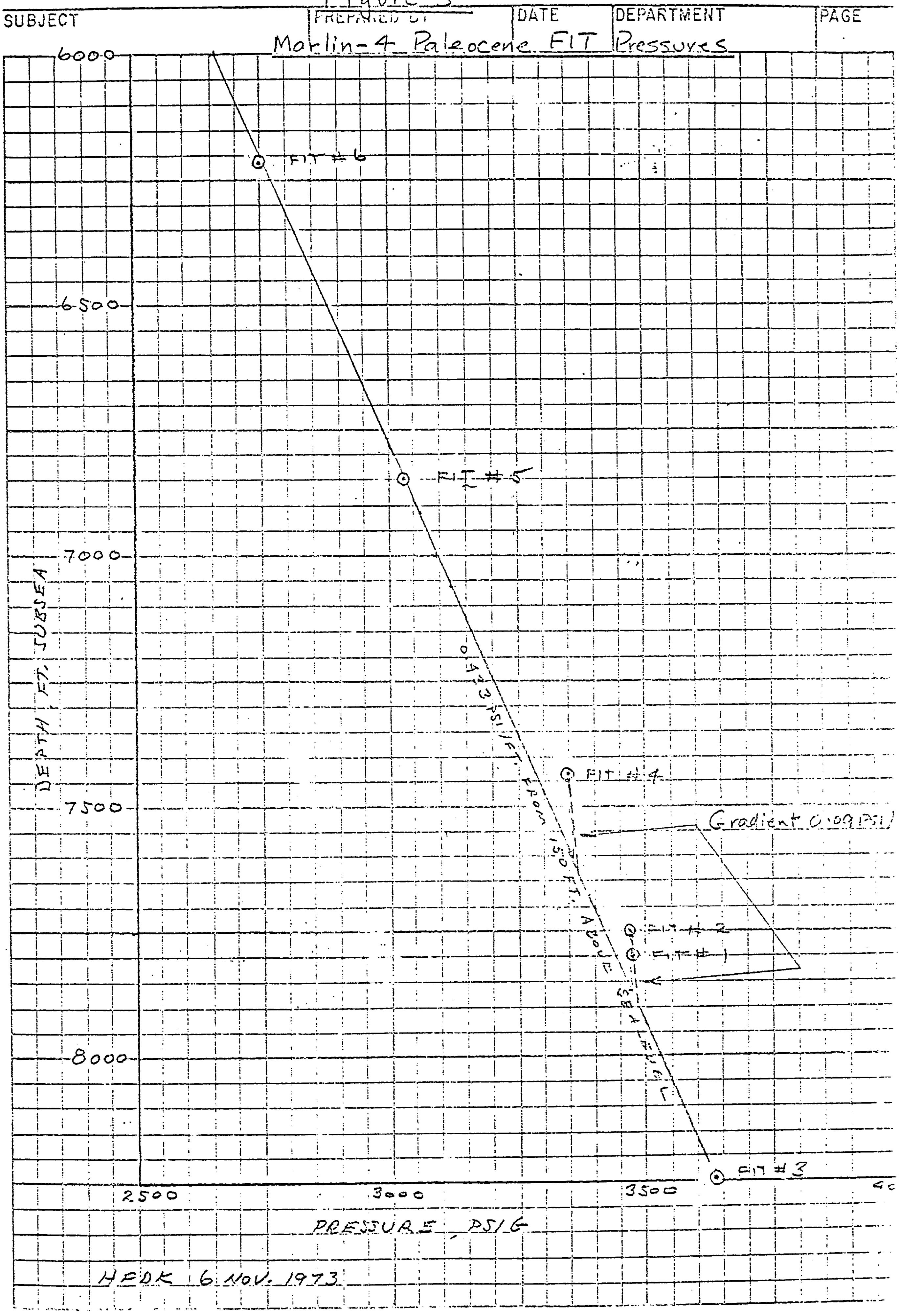
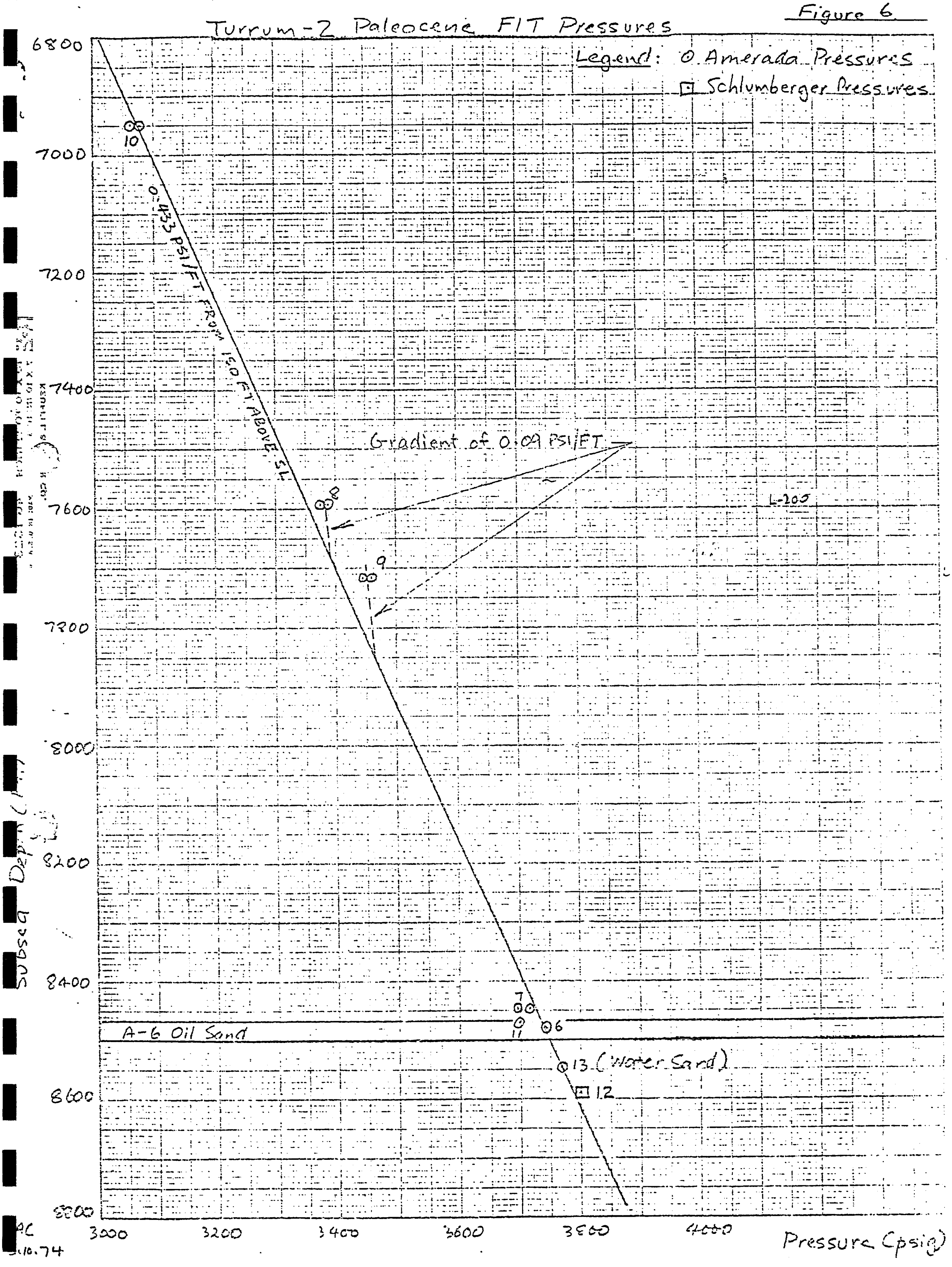

SUBJECT
PREPARED BY
DATE
DEPARTMENT
PAGE
Marlin-4 Paleocene FIT Pressures
6000
6500
7000
7500
8000
DEPTH, FT. SUBSEA
FIT #6
FIT #5
FIT #4
FIT #2
FIT #1
FIT #3
0.433 PSI/FT. FROM 150 FT. ABOVE SEA LEVEL
2500
3000
3500
PRESSURE, PSIG
HEDK 6 NOV. 1973

Figure 6



Turrum-2 Paleocene FIT Pressures
Legend: O Amerada Pressures
Schlumberger Pressures
0.433 PSI/FT FROM 16.0 FT ABOVE SL
Gradient of 0.09 PSI/FT
A-6 Oil Sand
13 (Water Sand)
12
6
7
8
9
10
11
6800
7000
7200
7400
7600
7800
8000
8200
8400
8600
8800
3000
3200
3400
3600
3800
4000
Pressure (psig)
Subsea Depth

SUMMARY

This report details the results of two suites of RFT's run in March/April 1985. Suite 1, run on March 29-31, 1985, investigated the interval 1575-2695 m KB; while Suite 2, run on April 15, 1985, re-tested the L-1.4.2 oil accumulation around 2620 m KB.

The objective of these tests was to investigate hydrocarbon shows seen in the logs and hence to delineate the Turrum L-1.4.2 oil reservoir and the overlying gas and oil reservoirs.

In general, comparison of the results of these tests with existing Turrum data confirms our current understanding of the Turrum field. Ten independent gas and gas/oil systems have been identified, seven of which have been intersected by previous wells. Figure 1 attached, shows the gas and oil systems identified using the RFT pressure data. The following is a brief summary of the hydrocarbon systems seen in the well logs and confirmed by RFT:-

1. L-1.1.1 (Gas/Oil)

   A 2.50m net oil sand in the interval 2153.5m-2157.0m KB with an estimated oil column of 10m and an overlying gas cap of 10.75m net sand and 14m column.

2. L-1.1.2, L-1.1.3, L-1.2.1, L-1.2.3, L-1.3 (Gas)

   Five independant gas systems in the interval 2180m-2520m KB with net sands varying between 0.75m and 17.00m and estimated gas columns varying between 51.5m and 125.5m.

3. L-1.4.2 (Gas/Oil)

   A 5.50m net oil sand in the interval 2604.0m-2611.0m KB with an estimated oil column of 11m and an overlying gas cap of 12.00m net sand and 19m column.

4. Accumulations A, B (Gas)

   Two independent gas systems in the interval 2008.0m-2115.0m KB with net sands of 7.50m and 2.25m and estimated gas columns of 33m and 47m.

5. Accumulation C (Oil)

   A 1.50m net oil sand in the interval 2619.0m-2621.0m KB with an oil column of 2m.

Note that accumulations A, B and C have not be intersected by previous wells drilled into Turrum.

RESULTS AND DISCUSSION

The results of these tests are documented in the following attachments:

Table 1	Hydrocarbon Accumulations Confirmed by RFT
Table 2	RFT Pretests
Table 3	RFT Samples
Figure 1	Turrum-3 RFT Plot (Overview)
Figures 2-8	Turrum-3 RFT Plots (By Accumulation)

Notes

1. A water line of gradient 1.43 psi/m has been drawn throughout pretests 1/1, 1/2, 1/3 and 1/28. This water line applies from 2000m KB to the bottom of the log interval. Above 2000m KB the pretest points stagger progressively further to the left. No hydrocarbons were found in this upper section of the well. The original Gippsland aquifer gradient of 1.42 psi/m plots between 20 and 25 psi to the right of the 1.43 gradient in the lower section of the well. Above 2000m KB the drawdown relative to the original gradient increases from 40 psi at 1950m KB to 110 psi at 1550m KB.

.../2

2. Unless otherwise stated, all contacts quoted in this report are based on RFT pressure data and the water line in (1) above.

3. The gas gradients used in this report are based on an average gas density of 0.1921 gm/cc reported in the reservoir data book, corrected for P, T and Z using the 'PYLD' program.

4. This report assumes that there are no oil legs at the base of the gas-only columns intersected by this well.

5. KB to SS is -21m.

Suite 1

Suite 1 investigated the interval 1575.0-2695.0 m KB. In the 9 RFT runs made, 54 pretests were successful and 7 sampling runs were completed. Run 2 was aborted because of poor hole conditions and a wiper trip carried out prior to starting run 3.

The main results are illustrated in Figure 1. A discussion of these results follows:

1. L-1.1.1 (Gas/Oil) - Figure 2

This accumulation has a GOC at 2153.5 m KB and an OWC at 2163.5 m KB. The GOC is interpreted from logs. This, in turn, implies a gas column of 14 m and an oil column of 10m. RFT 7/52 taken at 2156.5m KB, sampled one litre of oil from the 10.4 litre container.

The above quoted GOC and OWC are in some doubt as only one pretest was taken in each of the gas, oil and water zones at this depth. Using an oil gradient of 0.90 psi/m through pretest 1/29 gives the quoted OWC at 2163.5m KB. Log interpretation indicates water as high as 2160.3m KB. Given that pretest 1/29 is valid, it is concluded that the OWC for this oil leg is down-structure from the well location and that pretests 1/28 and 1/29 are not in direct communication. Should pretest 1/29 be invalid the OWC would then be inferred from the logs at between 2157.3 and 2160.0m KB and the oil column reduced to between 3.8m and 6.5m. The GOC is arbitrarily picked at 2153.5m KB (in the middle of a dolomite) from the logs given that gas is interpreted as low as 2153.0m KB and oil as high as 2154.2m KB. This interpretation is in conflict with pretest 1/30 in the gas. Assuming the log interpretation is correct, this puts pretest 1/30 1.5psi to the right of the gas line.

2. L-1.1.2 (Gas) - Figure 3

Pretests 1/25, 1/26 and 1/27 lie roughly on the same 0.28 psi/m gas gradient and are therefore reported as being in the same system with a single GWC at 2272 m KB. The well intersected 7.25m of net sand and the column is estimated at 91.0m.

The dolomitic sections seen in the logs appear to be contributing to the spread of pressure data and hence also to the difficulties in interpreting that data. The sands in which the above three pretests were taken could be independent resulting in three gas columns with separate GWC's.

3. L-1.1.3 (Gas) - Figure 4

Again, assuming pretests points 1/21 and 1/23 are part of the same system, a GWC is interpreted at 2408 m KB. The well intersected only 0.75m of net sand although the gas column is estimated at 110m.

Both tests 1/21 and 1/22 were taken in a siltstone and 1/22 has been neglected as tight. A gas gradient of 0.29 psi/m can be drawn through 1/21 and 1/23 hence the assumption of a single system. Four attempts were made to obtain a sample in the siltstone between 2319m and 2332m KB, but each of these attempts was unsuccessful because of the tight formation.

.../3

4. L-1.2.1 (Gas) - Figure 4

Using a gas gradient of 0.29 psi/m through pretests 1/19 and 1/20 gives a GWC at 2431.0m KB. The well intersected 2.25m of L-1.2.1 net sand and the gas column is estimated at 90m.

5. L-1.2.3 (Gas) - Figure 5

Pretests 1/15, 1/16 and 1/17 define a gas system with a GWC at 2474.0m KB; assuming a gradient of 0.30 psi/m. 15.25m of L-1.2.3 net sand was intersected with an estimated 51.5m gas column. Sample 5/46 at 2442.0m KB recovered 43.4cf of gas in the 10.4 litre chamber after the contents of the 22.7 litre chamber were lost while opening.

6. L-1.3 (Gas) - Figure 6

This gas system, identified by a 0.31 psi/m gas gradient through pretests 1/11, 1/12 and 1/13 has a GWC at 2615 m KB and a 125 m gas column. 17m of L-1.3 net sand was intersected.

Pretests 1/8, 1/9 and 1/10 may be in gas sands which are in communication with this system but this conclusion cannot be confidently drawn because the pressure data from these pretests has been affected by the dolomitic sands with possible supercharging. These sands are protected above and below a series of coals further decreasing the possibility of communication. Sample 4/45, taken from the same sand as pretest 1/8, recovered 138.5 cf of gas and one litre of condensate. The 10.4 litre chamber was preserved for analysis of the gas.

7. L-1.4.2 (Gas/Oil) - Figure 7

The L-1.4.2 is the major Turrum oil reservoir. The RFT pressure data for this system indicates a GOC at 2604.0m KB and an OWC at 2615.0m KB. The well logs indicate a dolomitised section from 2597 to 2611m KB and a shale section from 2611 to 2619m KB and consequently provide no useful contact information. The GOC is in agreement with interpretation of previous Turrum wells. The L-1.4.2 OWC has not been positively logged in any of the wells drilled into Turrum. The predrill prediction of between 2617 and 2625m TVDKB was based on low proved oil and high proved water in the previous wells. The RFT interpreted OWC at 2615m TVDKB is 2m shallow of this range and may indicate an areal variation in OWC. Note that pretest 1/4 at 2621.5m TVDKB was taken in the small independent oil sand discussed in 10. below.

The well intersected 5.5m of net oil sand and 12m of net gas sand. The oil and gas columns are estimated at 11 and 19m respectively. Sample 3/44, taken at 2609.5m KB, recovered 5.25 litres of 38° API oil and 25.2cf of gas. The 3.7 litre chamber was preserved for analysis.

8. Accumulation A (Gas) - Figure 8

Pretests 34 and 35 are in net gas sands of 1.0 and 6.5m respectively. Assuming the two sands are in communication and conservatively drawing a gas gradient through the shallow pretest point (35) yields a GWC at 2041m KB.

9. Accumulation B (Gas) - Figure 2

Pretests 32 and 33 are in small net gas sands of 0.5 and 1.75m respectively. As for Accumulation A above the sands are assumed in communication and a gas gradient of 0.27 psi/m through 33 results in a GWC at 2150m KB.

.../4

10. Accumulation C (Oil)

A 1.50m net oil sand is interpreted from log and sample information. The OWC is interpreted from logs at 2621m KB with a 2m oil column. RFT pressure data infers the presence of hydrocarbons but provides conflicting contact information. Pretest 1/4 is therefore ignored in the OWC interpretation.

Sample 8/55 at 2619.5m KB recovered a scum of oil in the 22.7 litre containers and 0.1 litres of oil in the 10.4 litre container. Sample 9/56 at 2619.8m KB recovered 21.4 and 9.4 litres of filtrate and scums of oil in the 22.7 and 10.4 litre containers respectively. Sample 9/56 was the only run of Suite 2, and was used to check the results of sample 8/55.

Suite 2

Suite 2 was used to re-sample the possible oil column at 2619-2621 m KB following the confusing data obtained from sample 8/55 at 2619.6 m KB. The results of this re-sample are discussed in Suite 1 above under heading 10 - Accumulation C (Oil).

TABLE I

TURRUM-3

HYDROCARBON ACCUMULATIONS CONFIRMED BY RFT

Accumulation	Top of Accumulation (m KB)	Base of Accumulation (m KB)	GOC (m KB)	GWC (m KB)	OWC (m KB)	Column (m)	Net Sand (m)	Comments
L-1.1.1 (a) Gas	2139.5	-	2153.5	-	-	14.0	10.75	GOC by logs.
(b) Oil	-	2157.0	2153.5	-	2163.5	10.0	2.50	GOC by RFT and logs.
L-1.1.2	2181.0	2203.0	-	2272.0	-	91.0	7.25	)
L-1.1.3	2300.0	2332.0	-	2408.0	-	110.0	0.75	)
L-1.2.1	2341.0	2353.0	-	2431.0	-	90.0	2.25	) GWC by RFT
L-1.2.3	2422.0	2442.3	-	2474.0	-	51.5	15.25	)
L-1.3	2490.0	2522.0	-	2615.0	-	125.5	17.00	)
L-1.4.2 (a) Gas	2585.0	-	2604.0	-	-	19.0	12.00	GWC by RFT
(b) Oil	-	2611.0	2604.0	-	2615.0	11.0	5.50	OWC by RFT
A. Gas	2008.0	2023.0	-	2041.0	-	33.0	7.50	GWC by RFT
B. Gas	2105.0	2115.0	-	2150.0	-	47.0	2.25	GWC by RFT
C. Oil	2619.9	2621.0	-	-	2621.0	2.0	1.50	OWC by logs

*Accumulations A, B and C have not been correlated with units seen by previous wells.

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TURRUM-3 RFT PRETEST RESULTS
(KB 21 m Above Sea Level)

Suite 1, 29/3/85-31/3/85, 1575-2695 m KB

Run/Pretest	Depth (m KB)	Pressure HP (psig)	Comments
1/1	2695.2	3843.2	
1/2	2644.3	3770.9	
1/3	2635.0	3757.7	
1/4	2621.5	3740.4	
1/5	2609.5	3723.1	
1/6	2595.2	3714.4	
1/7	2587.7	3712.9	
1/8	2551.5	3719.4	Supercharged
1/9	2547.5	3719.7	Supercharged
1/10	2526.2	3716.3	Supercharged
1/11	2518.0	3699.1	
1/12	2502.8	3692.6	
1/13	2491.5	3690.2	
1/14	2475.5	3579.7	
1/15	2442.0	3519.5	
1/16	2435.9	3517.0	
1/17	2423.2	3511.5	
1/18	2377.0	3472.1	
1/19	2350.4	3441.8	
1/20	2343.9	3439.3	
1/21	2331.1	3410.5	Tight, Valid
1/22	2320.0	3415.1	Tight
1/23	2301.3	3403.2	
1/24	2266.8	3348.4	
1/25	2201.0	3218.9	
1/26	2189.9	3213.2	
1/27	2181.2	3216.0	
1/28	2162.5	3082.6	
1/29	2156.5	3077.8	
1/30	2152.5	3076.6	
1/31	2114.0	3064.5	
1/32	2105.0	3052.9	
1/33	2021.0	2907.4	
1/34	2008.4	2899.7	
1/35	1971.4	2828.4	
1/36	1810.0	2559.7	
1/37	1694.5	2362.5	
1/38	1631.0	2254.4	
1/39	1585.0	2176.0	
→ 1/40	1582.5	2172.5	
1/41	1579.0	2167.9	
1/42	1575.5	2162.4	
2/--	-	-	Aborted for Wiper Trip
→ 3/43	2606.5	3721.5	
3/44	2609.5	3722.5	Sample
4/45	2551.5	3721.5	Sample
5/46	2442.0	3518.3	Sample
→ 6/47	2331.0	3406.1	Tight, Sample Attempted
→ 6/48	2330.7	3401.8	Tight, Sample Attempted
→ 6/49	2331.2	3435.3	Tight
→ 6/50	2319.5	3401.1	Tight, Sample Attempted
6/51	1579.0	2164.9	Sample
7/52	2156.5	3078.2	Sample
→ 8/53	2618.4	-	Tight
8/54	2604.3	3729.9	Tight, Sample Attempted
8/55	2619.6	3742.4	Sample, Supercharged?

Suite 2

Run/Pretest	Depth (m KB)	Pressure HP (psig)	Comments
9/56	2619.8	3738.8	Sample

TABLE 3

TURRUM-3 RFT SAMPLES

RFT No.	Depth (m KB)	Temperature (°C)	Chamber Size (L)	Choke Size (mm)	Fill Time (min)	Sample SI Pressure (psia)	Sample Surface Pressure (psig)	Sample Contents: Gas (ft^3)	Sample Contents: Oil (L)	Sample Contents: Water (L)	Sample Contents: Cond. (L)	Comments
Suite 1, 29/3/85-31/3/85, 1575-2695 m KB												
3/44	2609.5	85.0	22.7	0.76	8	3737.2	1500	25.2	5.25	13.50	0	38° API @ 15°C. GOR 760 scf/STB
			3.8	0.76	2	3734.4	--------	Sample Preserved		--------		RFS - AD 1116
4/45	2551.5	86.1	22.7	0.76	7	3736.1	2150	138.5	0	3.20	1.0	Filtrate. Cond. 58.3° API @ 15°C
			10.4	0.76	3	3734.4	--------	Sample Preserved		--------		RFS - AE 1222
5/46	2442.0	88.9	22.7	0.76	45[1]	3533.0	1250	Lost[2]	0	6.0	0.2	Filtrate. Cond. 51.0° API @ 15°C
			10.4	0.76	24[1]	3529.6	1500	43.4	0	1.0	0.2	Filtrate. Cond. 54.6° API @ 15°C
6/51	1579.0	75.0	22.7	0.76	2	2179.6	1450	22.4[3]	0	18.0	0	Filtrate
			10.4	0.76	3	2181.8	100[4]	1.4[4]	0	9.25	0	Formation water
7/52	2156.5	87.2	22.7	0.76	10	3092.9	1400	14.5	0	19.4	Film	Filtrate
			10.4	0.76	4	3091.9	1600	18.4	1.0	6.0	0	45.3° API @ 15°C. GOR 2920 scf/STB
8/55	2619.6	105.6	22.7	0.76	6	3757.3	500	3.2[5]	Skum	21.25	0	Filtrate
			10.4	0.76	5	3753.3	400	1.3	0.1	9.4	0	38° API @ 15°C[6]
Suite 2, 15/4/85, 2619.8 m KB												
9/56	2619.8	91.0	22.7		6	3753.5	300	0.55	Skum	21.4	0	Filtrate
			10.4		3	3751.9	250	TR	Skum	9.4	0	Filtrate

Notes:

1. Chamber not filled.
2. Gas lost to atmosphere during surface opening of chamber.
3. 22.7 L chamber was also opened at 2331.0, 2330.7 and 2319.5 m KB. The gas seen in this chamber probably came from the sampling attempt at 2319.5 m KB.
4. Surface sample pressure estimated to be 100 psi. Incorrect opening of valve resulted in gas volume being measured, but no sample taken.
5. 22.7 L chamber was also opened for five minutes at 2604.3 m KB. The pretest indicated a tight zone.
6. The measured gravity of 38° API is probably low. The gravity was measured two days after the sample was taken and the light ends would be largely lost from the sample in that time.

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FIGURE 1: TURRUM-3 RFT SURVEY

OVERVIEW

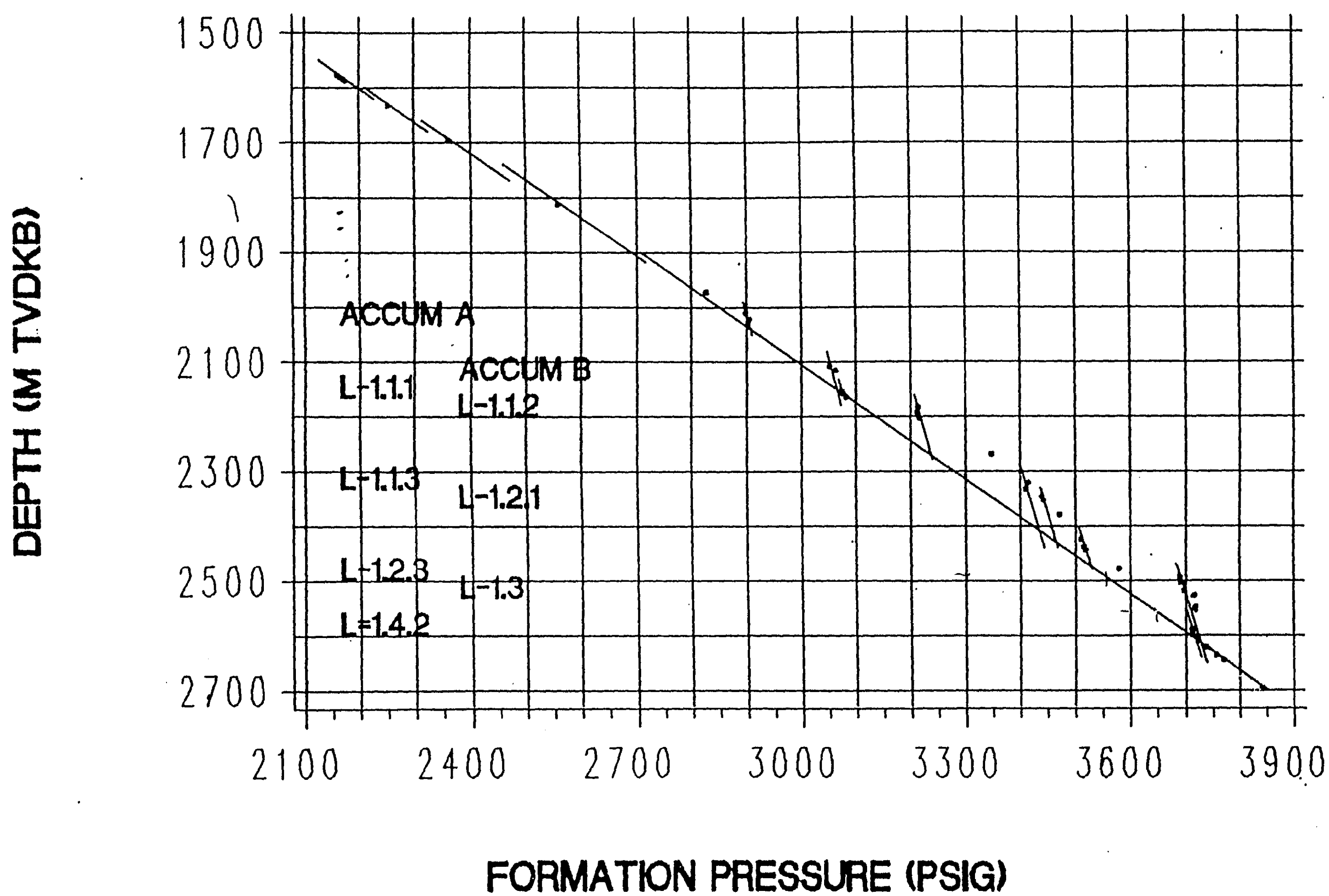


FIGURE 2: TURRUM-3 RFT SURVEY

RESERVOIR: L-1.1.1 & ACCUMALATION B

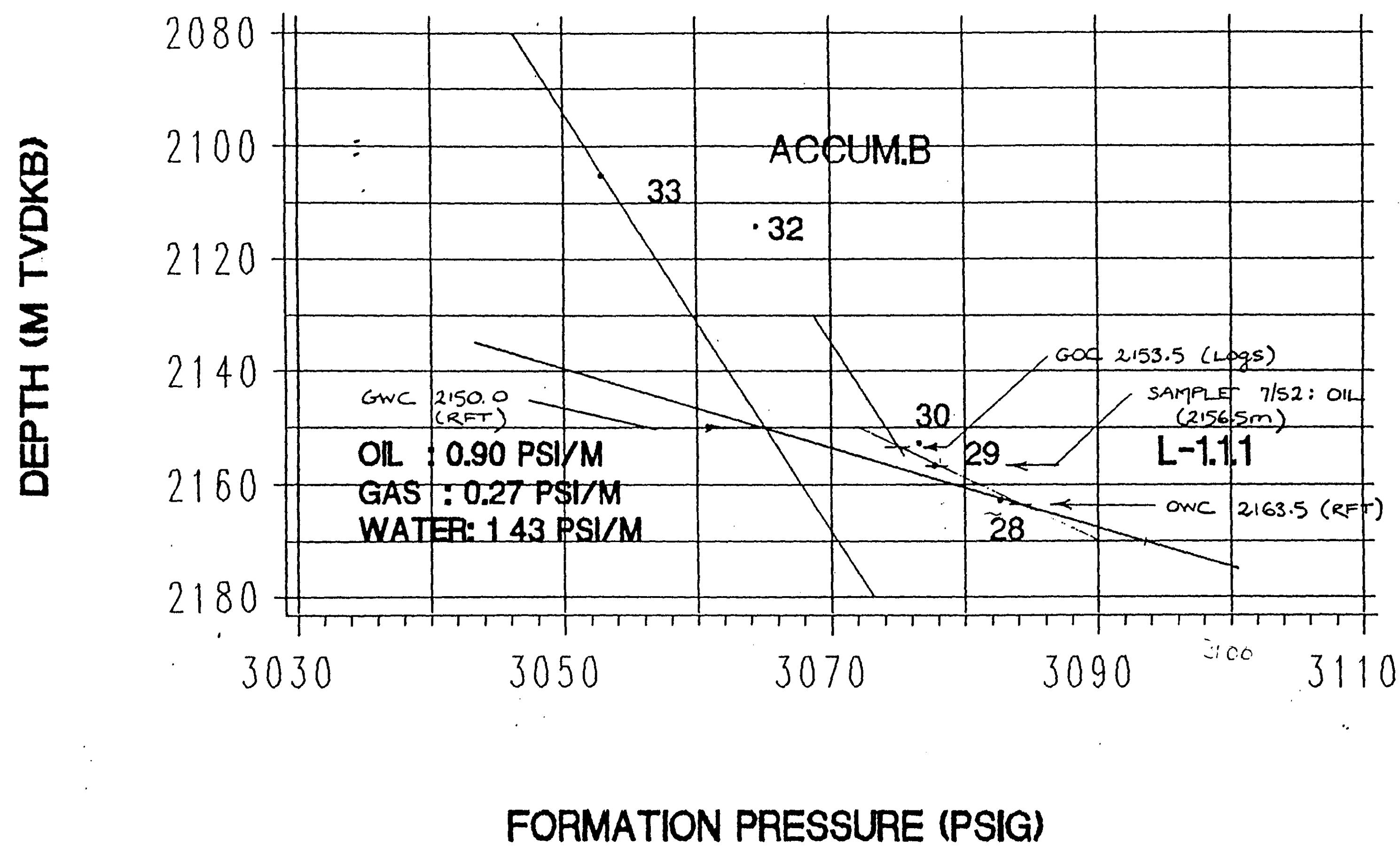


FIGURE 3: TURRUM-3 RFT SURVEY

RESERVOIR: L-1.1.2

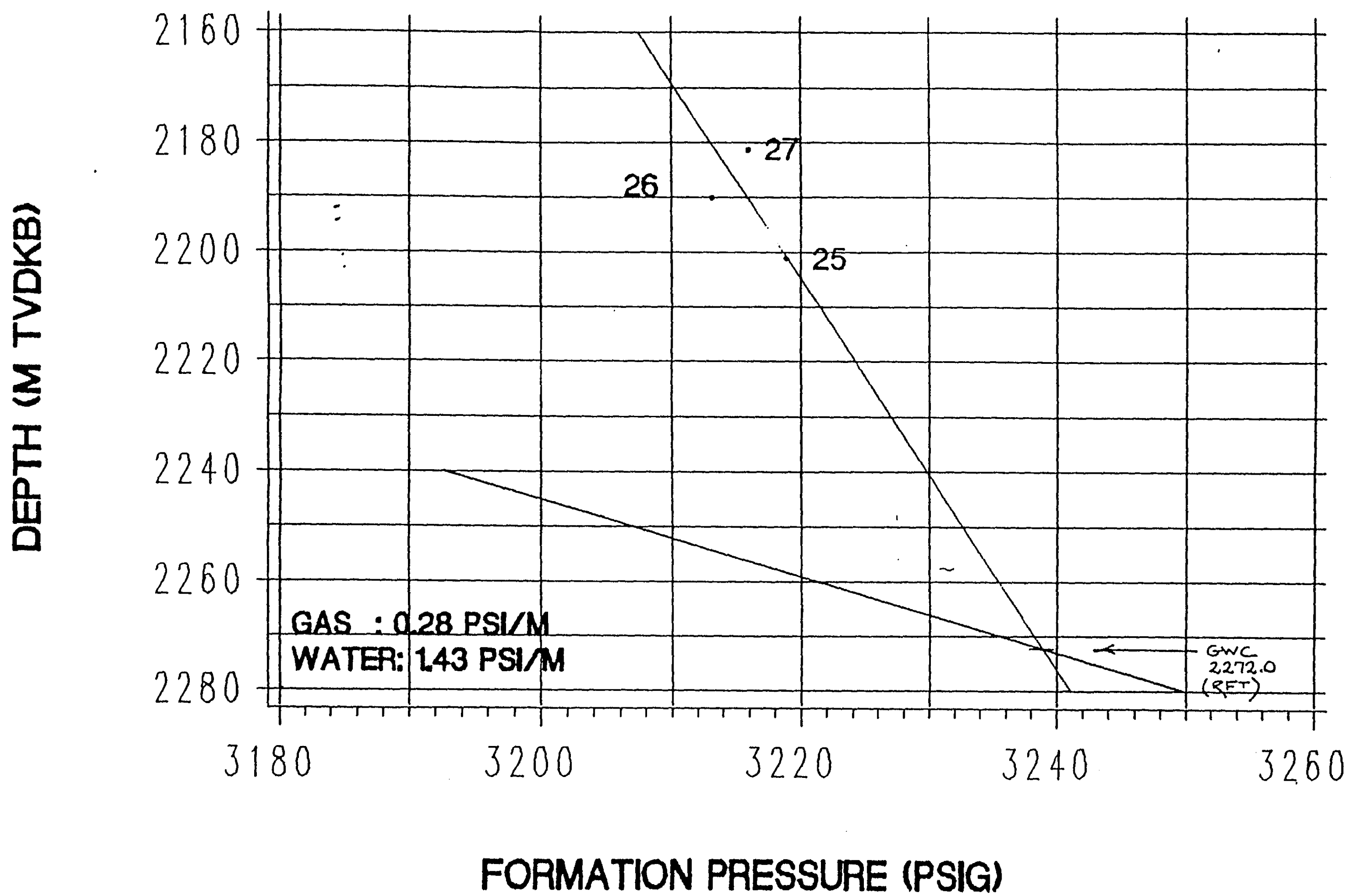


FIGURE 4: TURRUM-3 RFT SURVEY

RESERVOIR: L-1.1.3 & L-1.2.1

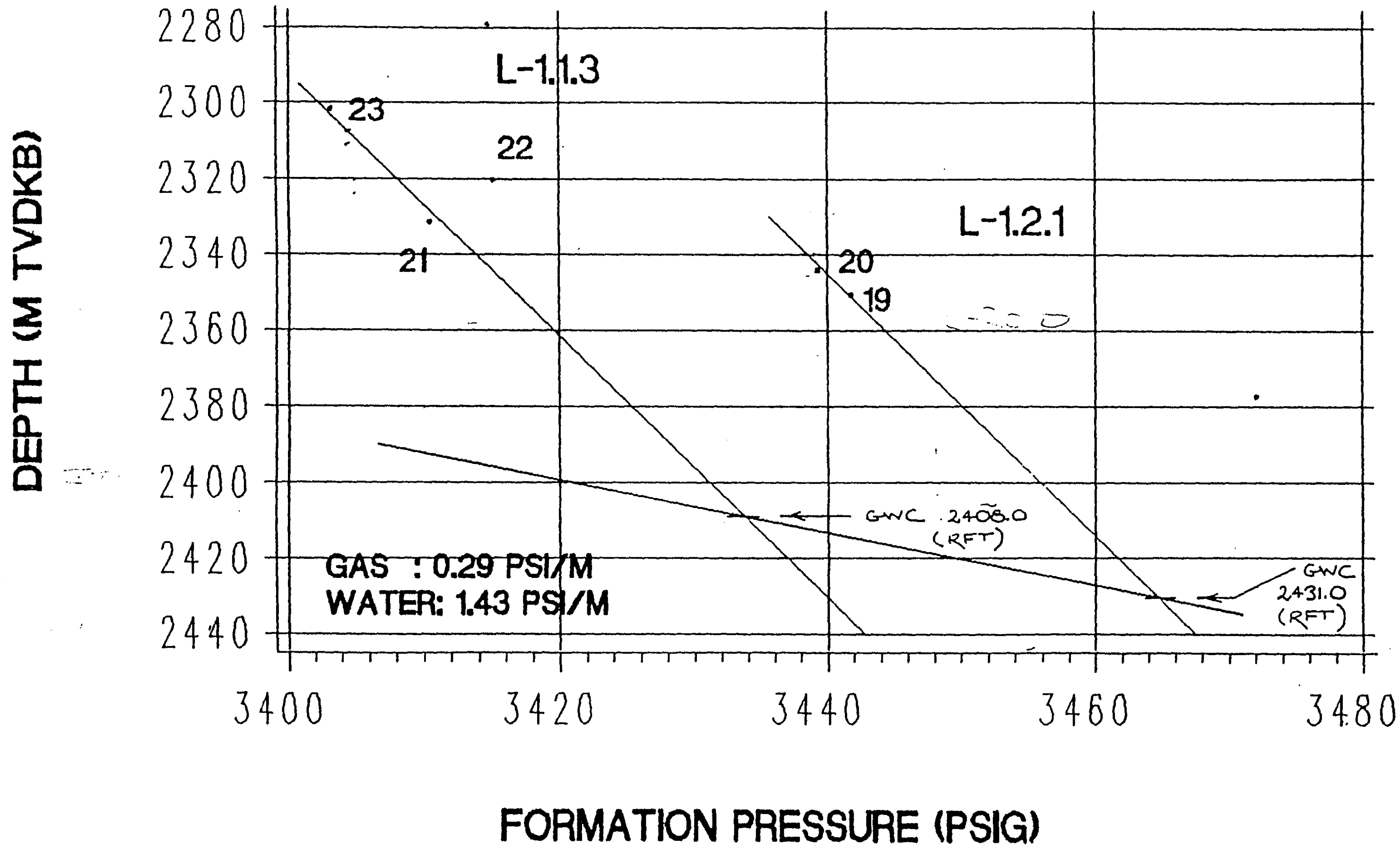


FIGURE 5: TURRUM-3 RFT SURVEY

RESERVOIR: L-1.2.3

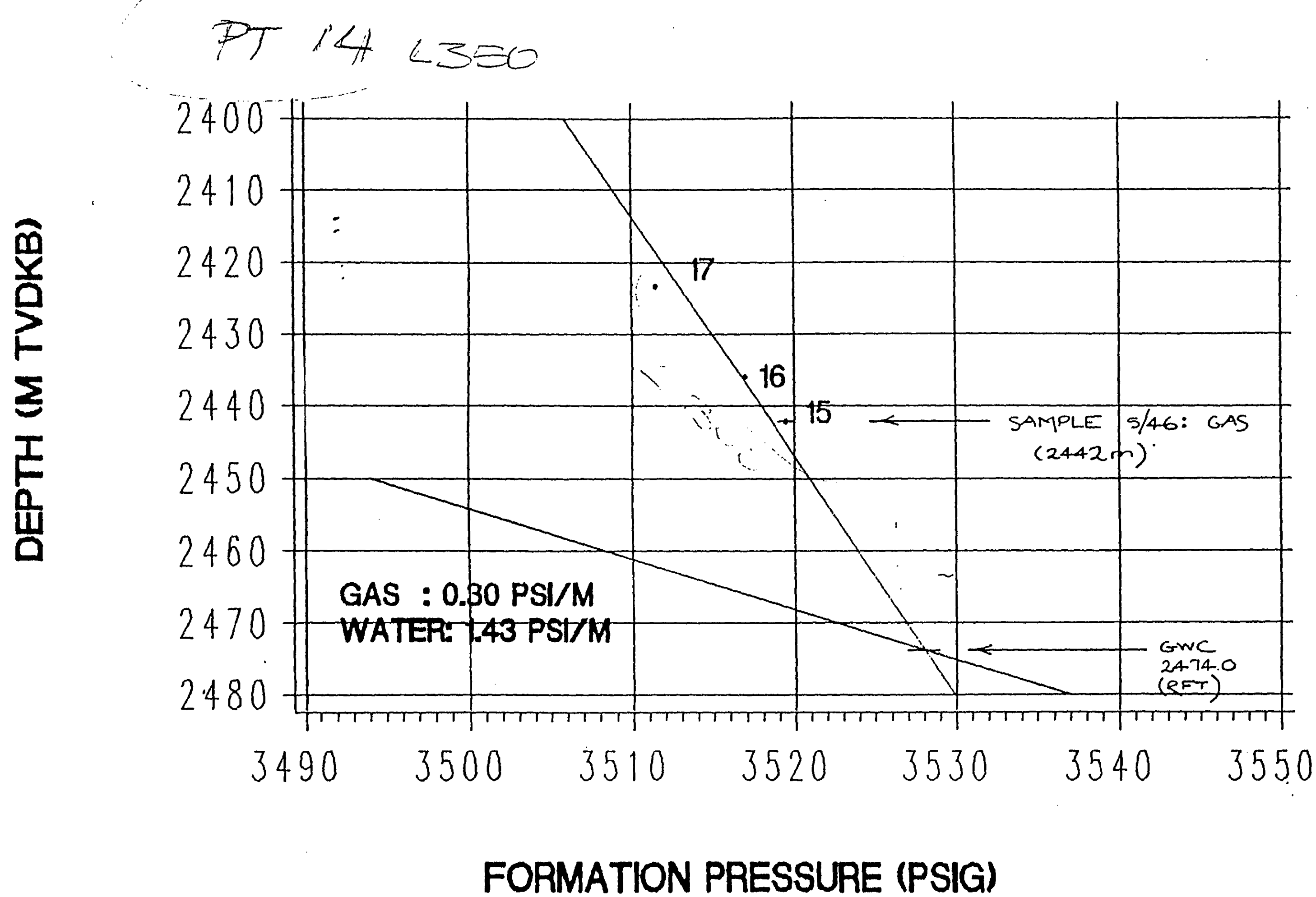


FIGURE 6: TURRUM-3 RFT SURVEY

RESERVOIR: L-1.3

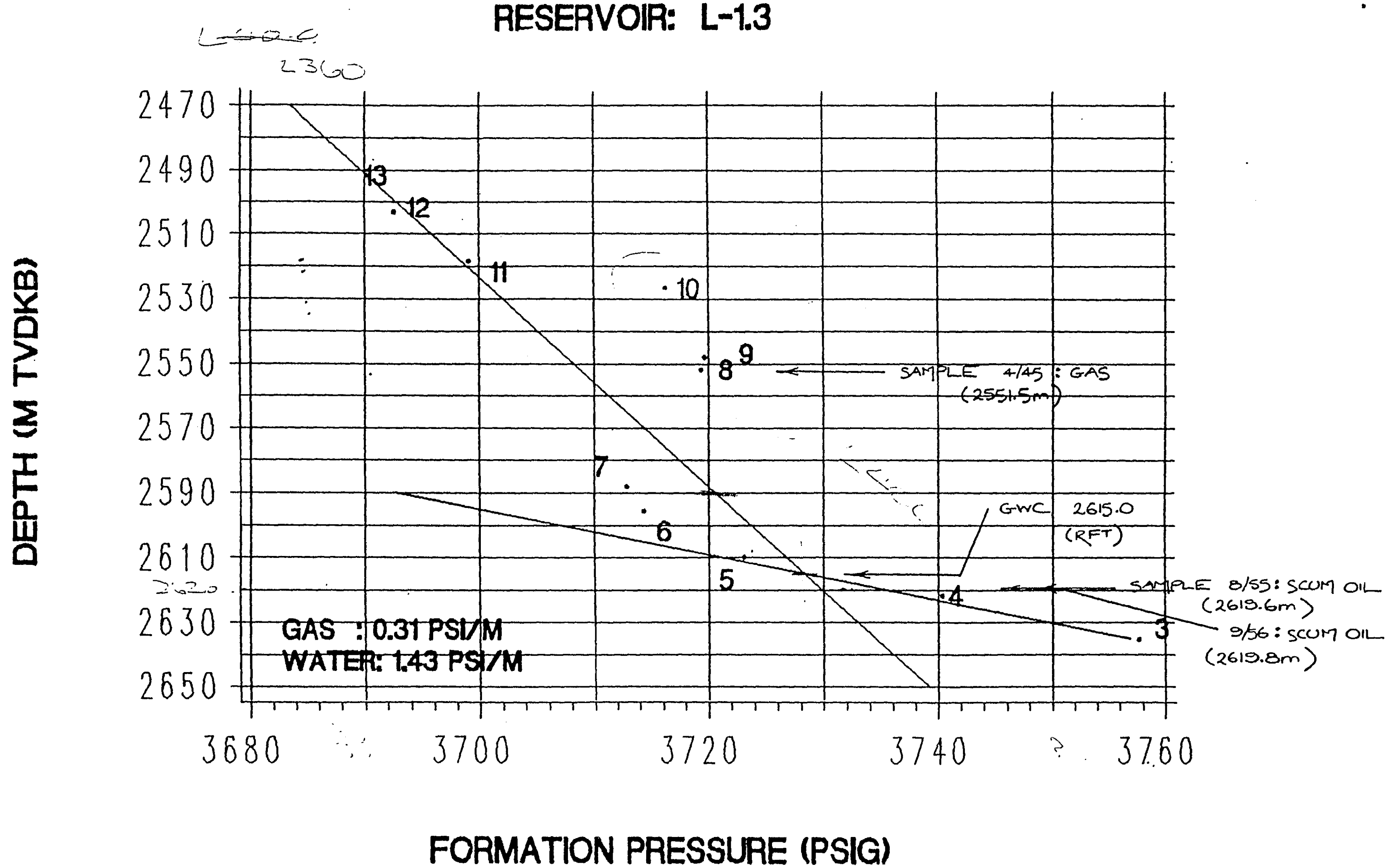


FIGURE 7: TURRUM-3 RFT SURVEY

RESERVOIR: L-1.4.2

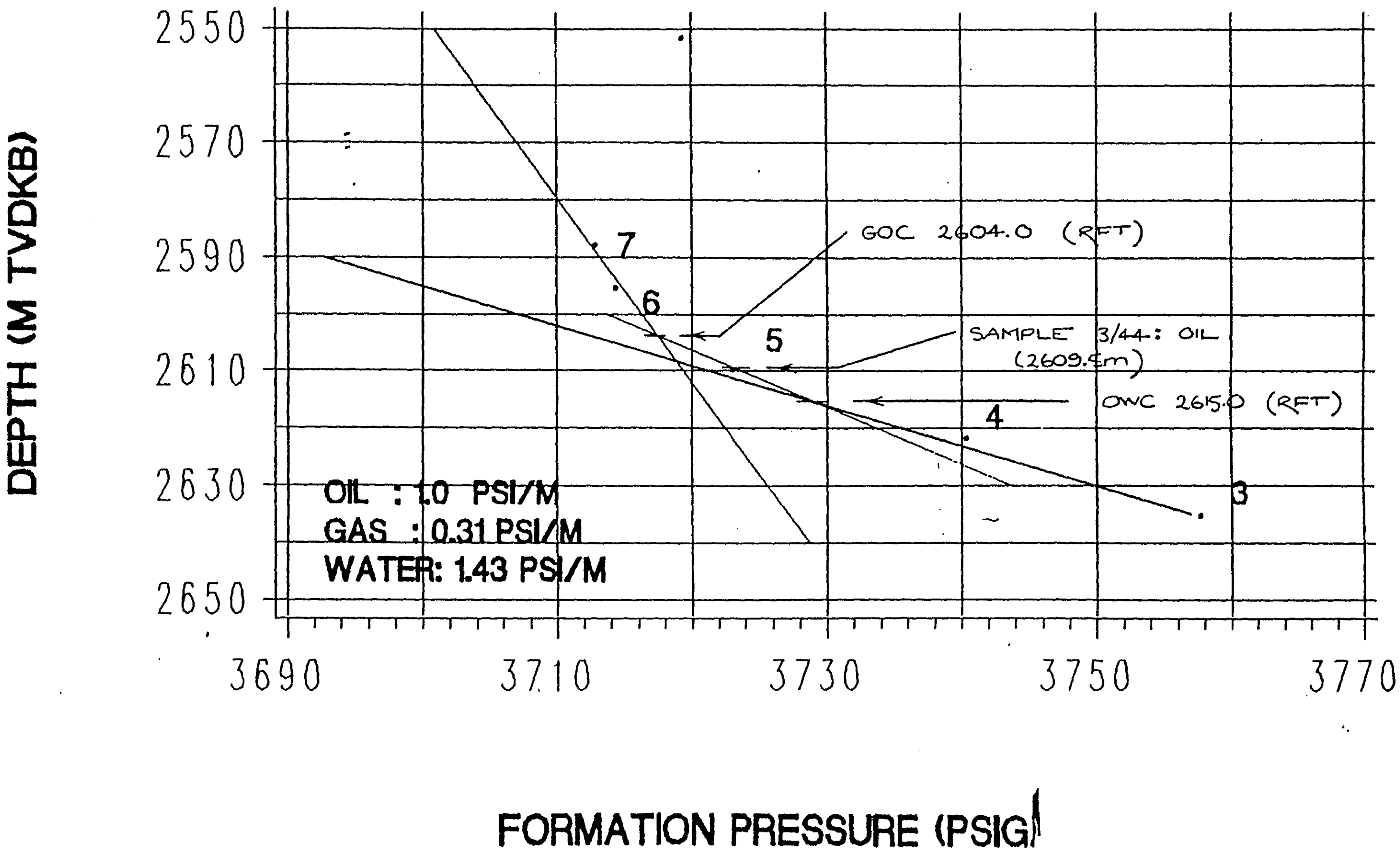
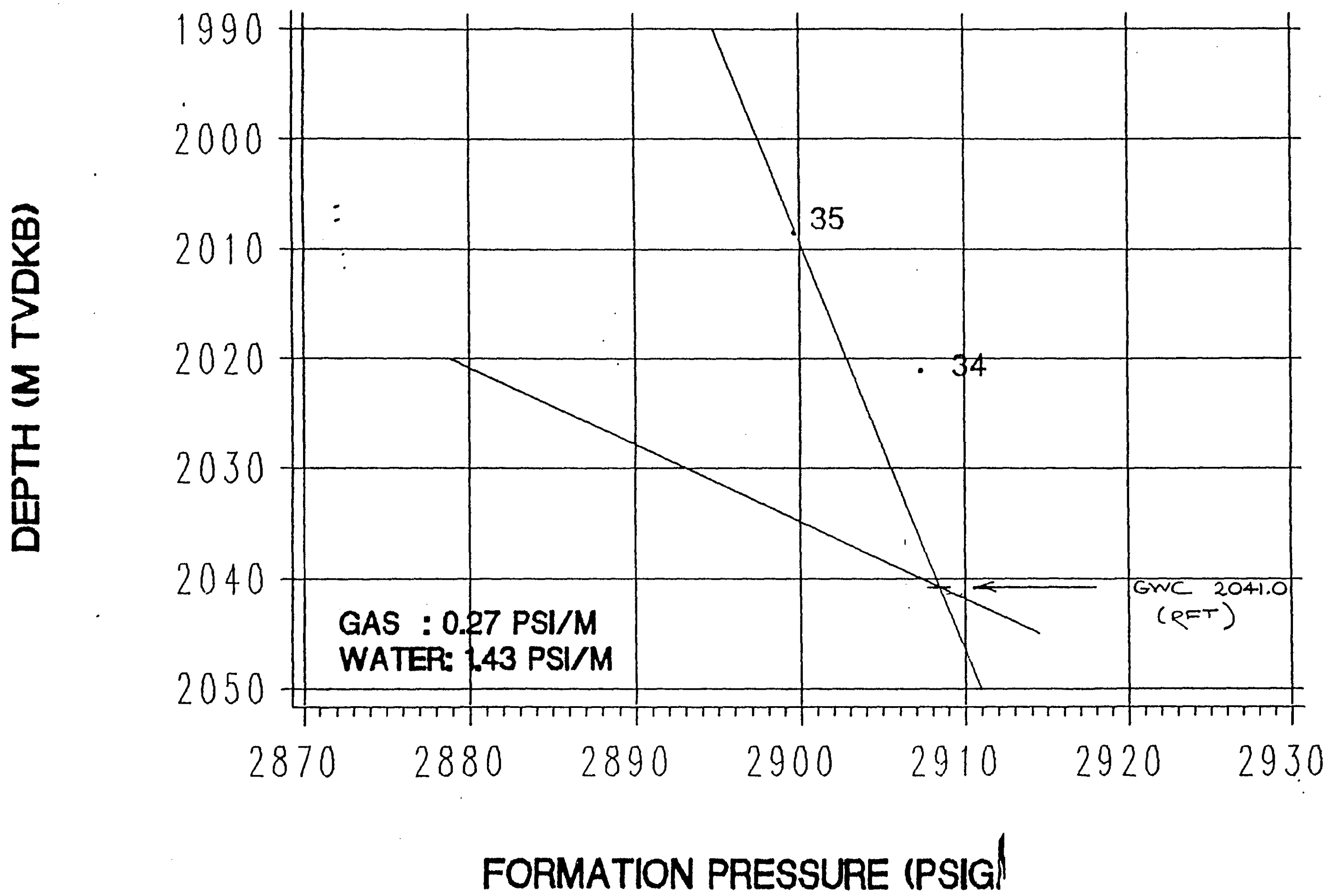


FIGURE 8: TURRUM-3 RFT SURVEY

RESERVOIR: ACCUMULATION A



ENCLOSURES

ENCLOSURES

PE900978

This is an enclosure indicator page.
The enclosure PE900978 is enclosed within the container PE900975 at this location in this document.

The enclosure PE900978 has the following characteristics:

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     ITEM_BARCODE = PE900978
CONTAINER_BARCODE = PE900975
             NAME = Structure Map - Latrobe group
            BASIN = GIPPSLAND
           PERMIT = VIC/L4
             TYPE = WELL
          SUBTYPE = HRZN_CNTR_MAP
      DESCRIPTION = Structure Map - Latrobe group for
                    Turrum-4
          REMARKS =
     DATE_CREATED = 31/01/90
    DATE_RECEIVED = 16/03/93
             W_NO = W1069
        WELL_NAME = Turrum-4
       CONTRACTOR = ESSO
     CLIENT_OP_CO = ESSO
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(Inserted by DNRE - Vic Govt Mines Dept)

PE900979

This is an enclosure indicator page.
The enclosure PE900979 is enclosed within the container PE900975 at this location in this document.

The enclosure PE900979 has the following characteristics:

ITEM_BARCODE =	PE900979
CONTAINER_BARCODE =	PE900975
NAME =	Depth Structure Map
BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	HRZN_CNTR_MAP
DESCRIPTION =	Depth Structure Map L100 Resevoir for Turrum-4
REMARKS =	
DATE_CREATED =	31/03/93
DATE_RECEIVED =	16/03/93
W_NO =	W1069
WELL_NAME =	Turrum-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE900980

This is an enclosure indicator page.
The enclosure PE900980 is enclosed within the container PE900975 at this location in this document.

The enclosure PE900980 has the following characteristics:

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CONTAINER_BARCODE =	PE900975
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BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	HRZN_CNTR_MAP
DESCRIPTION =	Intra Lower L.Balmei Depth Structure Map for Turrum-4
REMARKS =	
DATE_CREATED =	31/03/93
DATE_RECEIVED =	16/03/93
W_NO =	W1069
WELL_NAME =	Turrum-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE900981

This is an enclosure indicator page.
The enclosure PE900981 is enclosed within the container PE900975 at this location in this document.

The enclosure PE900981 has the following characteristics:

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CONTAINER_BARCODE =	PE900975
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BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	HRZN_CNTR_MAP
DESCRIPTION =	L500 Reservoir Depth Structure Map for Turrum-4
REMARKS =	
DATE_CREATED =	31/03/93
DATE_RECEIVED =	16/03/93
W_NO =	W1069
WELL_NAME =	Turrum-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600803

This is an enclosure indicator page.
The enclosure PE600803 is enclosed within the container PE900975 at this location in this document.

The enclosure PE600803 has the following characteristics:

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CONTAINER_BARCODE =	PE900975
NAME =	Formation Evaluation Log/Mud Log
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	MUD_LOG
DESCRIPTION =	Formation Evaluation Log/ Mud Log for Turrum-4
REMARKS =	
DATE_CREATED =	9/09/92
DATE_RECEIVED =	16/03/93
W_NO =	W1069
WELL_NAME =	Turrum-4
CONTRACTOR =	HALLIBURTON GEODATA SDL
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600804

This is an enclosure indicator page.
The enclosure PE600804 is enclosed within the container PE900975 at this location in this document.

The enclosure PE600804 has the following characteristics:

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CONTAINER_BARCODE =	PE900975
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BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	COMPLETION_LOG
DESCRIPTION =	Well Completion Log for Turrum-4
REMARKS =	
DATE_CREATED =	15/09/92
DATE_RECEIVED =	16/03/93
W_NO =	W1069
WELL_NAME =	Turrum-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE900982

This is an enclosure indicator page.
The enclosure PE900982 is enclosed within the container PE900975 at this location in this document.

The enclosure PE900982 has the following characteristics:

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CONTAINER_BARCODE =	PE900975
NAME =	Synthetic Seismogram
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	SYNTH_SEISMOGRAM
DESCRIPTION =	Synthetic Seismogram for Turrum-4
REMARKS =	
DATE_CREATED =	31/03/93
DATE_RECEIVED =	16/03/93
W_NO =	W1069
WELL_NAME =	Turrum-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600805

This is an enclosure indicator page.
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The enclosure PE600805 has the following characteristics:

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CONTAINER_BARCODE = PE900975
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BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = VELOCITY_CHART
DESCRIPTION = Seismic Calibration Log for Turrum-4
REMARKS =
DATE_CREATED = 14/09/92
DATE_RECEIVED = 16/03/93
W_NO = W1069
WELL_NAME = Turrum-4
CONTRACTOR = SCHLUMBERGER
CLIENT_OP_CO = ESSO

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