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Pacific Oil & Gas Pty. Limited

**COMBINED SECOND ANNUAL REPORT
AND RELINQUISHMENT REPORT
FOR EP 34, NORTHERN TERRITORY,
FOR THE SECOND AND FINAL PERMIT
YEAR ENDING 4TH MARCH 1992**

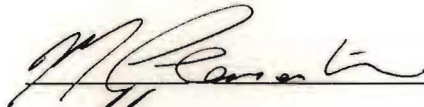
AUTHOR: G. J. Wakelin-King

DATE: April 1992

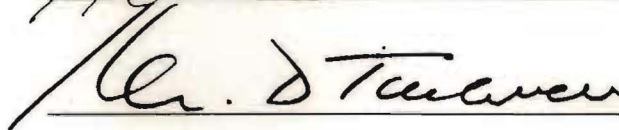
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ACCEPTED BY:



ONSHORE

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CRAE Report No. 304568

Onshore

PR93/028

TABLE OF CONTENTS

	Page No.
1 SUMMARY	1
2 INTRODUCTION	1
3 PREVIOUS WORK	2
4 EXPLORATION ACTIVITY 1991/1992	3
4.1 Geology	3
4.2 Geophysics	3
4.2.1 Magneto-telluric Soundings (MT)	3
4.2.2 Potential Field Analysis - NPO "Sibgeo"	4
4.2.3 Seismic Reprocessing	4
4.2.4 Seismic Interpretation - NPO "Sibgeo"	4
4.2.5 Post Murphy 1 Seismic Re-interpretation - G. I. Collins	4
5 PROSPECTIVITY	5
5.1 Depth of Section	5
5.2 Structure (Plan PetNTcw5126)	7
5.3 Source	7
5.3.1 Murphy 1	8
5.3.2 Erldunda 1	9
5.4 Reservoir	9
5.5 Explorability	10
5.6 Prospectivity Summary	10
6 EXPENDITURE	10
KEYWORDS LOCATION & DESCRIPTOR	11
REFERENCES	11

LIST OF APPENDICES

Appendix 1	List of Graticular Blocks	
Appendix 2	Proposed and Actual Work Programme	-

LIST OF TABLES

Table 1	Estimated Depth of Target Horizon From Seismic
Table 2	Organic Maturity From Murphy 1
Table 3	Expenditure EP 34

LIST OF PLANS

Plan Number	Title	Scale
PetNTcw5127	EP 34 NT (Mt Connor) Location	Plan as shown
PetNTcw5125	EP 34 NT Petroleum Exploration Activity	1:1 000 000
PetNTcw5128	Annotated Seismic Interpretation through EP 34	1:1 00 000

1 SUMMARY

This report details exploration activity carried out in EP 34 by Pacific Oil & Gas Pty. Limited in permit year two, 5 March 1991 to 4 March 1992. Activity and data from previous work are summarised and the reasons for permit _ relinquishment are presented.

EP 34 was granted to Pacific Oil & Gas on 5 March 1990. The area is located close to the southern margin of the Amadeus Basin south of the Lassiter Highway (PetNTcw5127). EP 34 is adjacent to EP 26 also held by Pacific Oil & Gas Pty. Limited. The permit was acquired to secure tenure over the full extent of a subsurface structure at Murphy's Range in EP 26, and possible other structures in the area.

No drilling or seismic exploration has been carried out in EP 34 by Pacific Oil & Gas. The permit has been explored with potential field and magneto-telluric geophysical methods and by reprocessing and re-interpretation of existing seismic.

Based on the negative results of drilling at Murphy's Range (**Murphy 1**, Menpes 1991), the failure of seismic data to allow reliable mapping of any sub-salt reflectors, discouraging source rock and structural indicators and the failure of magneto-telluric methods to assist exploration, the area has been assessed as non-prospective and an application to surrender the permit was lodged on 5th February 1992 to be effective from 4th March 1992.

2 INTRODUCTION

Exploration Permit 34 ("Mt Connor") covers an area of 67 five minute blocks (approximately 5200 km²) in the Amadeus Basin, Northern Territory. The permit occupies part of the southern Amadeus Basin between the Lasseter Highway and the southern margin of the basin. The Proterozoic sequence has been considered prospective for oil and gas within the area by analogy with apparently similar environments in Siberia.

Assessments of prospectivity have been derived from work carried out within the permit, re-examination of existing data, and by inference from work carried out in the adjacent EP 26 "Curtin Springs".

This report covers work undertaken during permit year two (1991 - 1992). This work, has downgraded the prospectivity of this permit, and resulted in a decision to surrender the permit.

3 PREVIOUS WORK

The following petroleum exploration activities occurred wholly or partly within the current area of EP 34 Northern Territory.

- | | |
|-------------|---|
| 1949 - 1964 | <u>BMR</u> Regional Mapping |
| 1957 - 1962 | <u>BMR</u> Reconnaissance Gravity |
| 1964 | <u>Exoil Pty Ltd</u>
Erlunda Seismic Survey OP 78 |
| 1965 | <u>BMR</u> Regional Magnetics, Radiometrics. |
| 1982 | <u>Weeks Australia Limited</u>
Seismic exploration at Murphy's Range and Parrara, OP's 214 and 213; aeromagnetic surveying. |
| 1982 | <u>Robertson Research</u>
Regional Gravity for Diano Nominees Pty Ltd. OP 220. |
| 1988 - 1989 | <u>Pacific Oil & Gas Pty. Limited</u>
Data review of EP 26 including incorporation of previous regional seismic and other geophysical ¹ data. Field reconnaissance (Menpes 1989). Landsat TM scenes acquired ¹ . |
| 1989 - 1990 | <u>Pacific Oil & Gas Pty. Limited</u>
Reconnaissance field geology and measured sections at Mt Connor. Reprocessing 1982 Weeks Australia seismic data, of which 4 lines extend into EP 34. Reprocessing of 1985 BMR seismic line 1985-OIE of which approximately 5 km extends into EP 34 (Menpes 1990.). |
| 1990 - 1991 | <u>Pacific Oil & Gas Pty. Limited</u>
Independent re-interpretation of combined 1989 Pacific Oil & Gas, and 1982 Weeks Australia Ltd seismic data in EPs 26 and 34 (Collins 1991). ¹ |

¹ Material is currently being made up in to a data package for submission to the Department of Mines and Energy.

4 EXPLORATION ACTIVITY 1991 - 1992

4.1 Geology

No field work was undertaken. Interpretations of the geologic section are inferred from the adjacent well **Murphy 1** (Pacific Oil & Gas 1991 - **Murphy 1 Well Completion Report**).

4.2 Geophysics

4.2.1 Magneto-telluric Soundings (MT)

Poor seismic energy transmission through the evaporitic Bitter Springs Formation has led to problems detecting horizons beneath the Bitter Springs Formation salt on seismic sections, particularly with the depth and thickness of salt in the EP 26 - EP 34 area.

Alternative methods of detecting the Heavitree Quartzite or basin/basement interface were sought. As magneto-telluric (MT) soundings respond to the electrical properties of rock (cf seismic which utilises the sonic properties of rock) it was considered a potential solution to the problem.

Resistivity logs from three wells in the southern Amadeus Basin were used to investigate the use of MT to detect sub-salt horizons. Values of resistivity and thickness for the lower part of the Bitter Springs Formation, the Heavitree Quartzite and Basement were estimated as they have not been intersected in any previous wells.

Geophysical modelling showed that at a depth of 2km to 4km information relating to the Bitter Springs Formation/Heavitree Quartzite and Heavitree Quartzite/basement interfaces would lie within the normal range of frequencies measured during an MT survey, provided the Heavitree Quartzite was sufficiently thick and porous.

In EP 34, one MT sounding was carried out at the intersection of seismic lines MR 82-02 and MR 82-03. This was part of a larger survey in August 1991, with nine locations in EP 26, 2 in EP 38 and one in "open" acreage.

The final interpretation of this data is still in preparation, however, it is apparent from the work that this method is in fact not successful in this area due to significant lateral inhomogeneities in the resistivity of the strata and insufficient contrast between the resistivity of the Heavitree Quartzite and surrounding rocks.

4.2.2 Potential Field Analysis - NPO "Sibgeo"

Geophysicists from NPO "Sibgeo" modelled gravity (BMR's regional gravity data, Pacific's detailed gravity data along 1989 seismic lines) and aeromagnetic data (BMR's regional aeromagnetic data, Exoil's Charlotte Waters Survey) to produce a depth to magnetic basement map of the central-southern Amadeus Basin.

An English translation of this report (CRAE Report No. 304346) detailing results of their work is being forwarded to the NTDME under separate cover.

Gravity modelling along selected profiles coinciding with reprocessed Weeks Australia Ltd. and Pacific seismic lines indicated that the broad structural high in the Murphy's Range area visible in the seismic data at the intersection of MR82-03 and MR82-02 in EP 34 is matched by the basement structure and that the main Bitter Springs Formation salt horizon is probably continuous across the structure. A north south profile through EP 34 indicated that a broad basement uplift coincides with the structure visible on seismic.

The structure could not be well defined on the gravity, and modelling indicated that depths to prospective horizons would be considerably in excess of the total depth of **Murphy 1** (2882m). Structural closure of the high at basement level could not be assured.

4.2.3 Seismic Reprocessing

Seismic data acquired by Weeks Australia in 1982 was reprocessed by Pacific in 1990 with a considerable improvement in data quality. This work is referred to in the first annual report of EP 34 and second annual report for EP 26. This data has been previously lodged with the Department of Mines and Energy. Interpretation of this data was performed in the current permit year (See 4.2.5).

4.2.4 Seismic Interpretation - NPO "Sibgeo"

A geologist from NPO "Sibgeo" interpreted seismic lines from the reprocessed Weeks' Amadeus Seismic Survey, Pacific's Murphy's Range Seismic Survey and Exoil's Kulgera Seismic Survey. Modelling of potential field data was used to map the top basement horizon because the basin/basement interface is generally not resolvable in the seismic data set.

4.2.5 Post-Murphy 1 Seismic Re-interpretation - G. I. Collins

G. I. Collins, an independent seismic geophysicist with extensive experience in salt tectonics, was retained to re-evaluate the seismic after the drilling of **Murphy 1**. His report will be presented under separate cover.

5 PROSPECTIVITY

Initial indications of prospectivity for EP 34 were based on the continuation of the Murphy's Range Structure in EP 26 into EP 34. This structure was drilled in 1990-1991 (Murphy) without encountering significant hydrocarbons. It became apparent from the results of **Murphy 1** that the target Heavitree Quartzite was substantially deeper than prognosed, and was not intersected in the drill hole.

No other interval in the **Murphy 1** hole gave indications of sufficient source, reservoir or seal characteristics to warrant consideration as a hydrocarbon target. The prospectivity of EP 34 is thus considered in terms of the Heavitree Quartzite target only.

5.1 Depth of Section

Information on depth to basement is derived from published geological and geophysical information and interpretation of 1982 Weeks Australia seismic data as reprocessed by Pacific.

Available published data (Young & Shelley 1969) for magnetic depth to basement indicate that basement rises from a depth of approximately 10 - 12,000 ft. in the northern part of the permit to a depth of 8 - 10,000 ft. on the southern margin. It was noted that magnetic rocks within the sedimentary section may have affected these results.

This original BMR data plus other material was compiled by Wellman (1991) into a depth to magnetic basement map (PetNT/cw5126). Depths for EP 34 range from 2 - 4 km, however, very limited data was available for this part of the basin. The majority of EP 34 lies between 3 and 4 km depth to magnetic basement.

Available seismic depths are based on:

- 1 small "windows" in the data whereby basement may be effectively interpreted.
- 2 use of the estimated thickness of the section below the top of the Bitter Springs Formation salt (or other interpretable reflector) to estimate depth to basement below the reflector.

LOCATION	DEPTH TO HTQ BASEMENT	HOW DERIVED
SE 89-105	?4000m	top halite + 1200m
SW 89-102	?4000m	Bitter Springs u/c + 1200m
NE 82-01	3200m	?basement or HTQ resolved
NE 82-01	2800m	basement or HTQ resolved
SW 82-01	3050m	basement or HTQ resolved
INT 82-02/82-03	3500m	top BSF + 1500m
MID 82-04a	3500m	mid BSF u/c + 1200m
MID 82-04b	3700m	mid BSF u/c + 1200m
N.B. BSF = Bitter Springs Formation u/c = unconformity HTQ = Heavitree Quartzite		

TABLE 1 Estimated Depth to Target Horizon from Seismic

Depth estimates use the conservative value of 1200m for the thickness of Bitter Springs formation below the mid Bitter Springs Formation unconformity (= top salt in most cases). This value in fact ranges rapidly and widely between 1200 and 1700m due to the influence of the mobile salt within this section and can only be measured in the few cases where a possible basement or possible Heavitree Quartzite reflector is interpretable. It is not possible to resolve and distinguish the Heavitree Quartzite from basement so these figures have an additional error of ± 200 m corresponding to the thickness of the Heavitree Quartzite.

There is a general agreement of trends in basement depth between the magnetics and the seismic. Given the lack of good interpretable data and velocity information from which to calculate true depths and thicknesses of the lower units, and the inherent variability between differing magnetic depth calculation algorithms, the discrepancy between seismic and magnetic depths of up to 500m is acceptable.

The depths to the reservoir target formation in EP 34 are substantially greater than in other permits in the area held by Pacific. Difficulties in seismic imaging of the reservoir structure and depth are also more extreme in EP 34 than in other permits.

5.2 Structure (Plan PetNTcw5126)

Structure in EP 34 and the adjacent areas of EP 26 are generally the result of salt tectonics and have been classified into two types (G. Collins 1991).

Type 1 Thrust/backthrust pair of relatively high angle and with basement involved.

Type 2 Relatively shallow thrusts without basement involvement.

A Type 2 structure is visible on line 82-03 and 82-02 to the north of the intersection (Mallee Structure).

Minor south over north thrusting is recognisable on line 82-04 extending to the southern edge of the permit where dips begin to rise steeply adjacent to the basin margin.

A small (3km wide) anticline is apparent on the upthrust side of a thrust fault in the southern half of section 82-04, in the reflectors below the Cambrian. No data is available on the orientation or length of this feature, nor if it is reproduced in the basement or reservoir horizons. By comparison with other Type 2 features this is unlikely.

5.3 Source

Source rock data are derived from the **Murphy 1** and **Erdunda 1** drill holes and from regional compilations of source rock results.

From the following data summaries it can be stated that the base Bitter Springs/Heavitree Quartzite target zone is grossly overmature on the northern margin of EP 34. The depth to the target horizon does not decrease from north to south across the permit, and the thermal and tectonic influence of the Cambrian. Peterman Ranges Orogeny can be expected to increase in a southerly direction toward the tectonic margin of the basin. Source maturity can therefore be expected to further deteriorate southward through EP 34.

5.3.1 Murphy 1

INTERVAL (m)	FORMATION	TOTAL ORGANIC CARBON	MATURITY	COMMENT
1050-1056	Inindia unit 2 shale	3.19%	TAI 3.25	Gas/ condensate
1647-1656	U. Gillen Mbr Limestone	0.17-0.49%	very high	bitumen contamination
1683-1746	U. Gillen Mbr Limestone	LOW	TAI 3.25-4.0-	Gas
1772-1776	U. Gillen Mbr Limestone	0.31-0.32%	not pyrolised	
2517	Gillen Mbr	0.81%	?very high Ro 1.5+	high temp bitumen contamination

TABLE 2 Organic Maturity from **Murphy 1**

N.B. TAI = Thermal Alteration Index from Palynology

Organic rich facies in **Murphy 1** were generally very low in volume. Dark rocks were encountered in two zones. The upper zone occurs over 6m in unit 2 of the Inindia Beds. Maturity indicators, (spore coloration and general microscopic appearance of organic matter) suggests a very high level of maturity, however, the pyrolysis taken at face value would suggest low maturity.

The visibly thermally degraded nature of the organic matter is considered the more reliable indicator and the anomalous Rock - Eval pyrolysis result is taken to indicate contamination of the sample by bitumens that are cracking and becoming mobile during the pyrolysis phase of analysis.

The second zone of organic rich rocks occur at the top of the Gillen Member of the Bitter Springs Formation. Numerous very thin stringers of dark grey limestone were intersected over an interval of 1646 to 1780m. The total organic rich proportion of the section was very small, probably only a few metres in total. Total organic carbon (TOC) derived from chemical analysis was generally very low, the majority of samples falling between 0.17 and 0.33%, and only one sample in this interval reaching 0.49%.

A single sample at 2517m contained 0.81% TOC. The exact nature and origin of this cuttings sample is uncertain as no zone of shaly or organic rich rock is identifiable on wireline logs at this depth.

Low organic yield from palynological preparation are consistent with this figure.

Maturity was again inconsistent between methods, Rock-Eval pyrolysis results being considered unreliable due to bitumen contamination. TAI from palynology indicated gas only. Reflectance of alginite measured from the Gillen Member was 1.5 - 1.6 R_o indicating a rock well advanced into the gas zone with little or no remaining generation potential.

5.3.2 Erldunda 1

Geochemical samples were taken for analysis from material stored at the Department of Mines and Energy Core Store in Alice Springs and submitted for source rock analysis. These results are formally presented with reporting for EP 26 as the **Erldunda 1** hole falls within EP 26, however, they may be summarised as follows:

Organic bearing rocks are confined to:

- 1 The lower part of the Winnall Beds, (TOC 0.2 - 0.73%).
- 2 A 20m rich zone in the Inindia Beds, (TOC 0.5 - 3.23%).
- 3 Sporadic very thin zones in the upper Bitter Springs Formation, (TOC 0.13 - 0.6%).

Source richness is uniformly low due in part to their extremely high maturity. Pyrolysis indicates that virtually all pyrolysable kerogen had been spent ($H_I < 5$, P_I 0.5 - 1.0, S_2 low and poorly defined). These results indicate that the section is grossly overmature for oil.

5.4 Reservoir

No information on the quality of the proposed reservoir rock is available from inside EP 34. From the **Murphy 1** and **Erldunda 1** wells nearby, no significant porosity is described in the section below the Rodingan unconformity. Above this surface the Mereenie Sandstone is porous and permeable and is a copious water producer but is non-prospective for hydrocarbons due to the absence of sufficient seal above it.

The section below the Bitter Springs salt is considered the main target for exploration in this area but has never been assessed by drilling.

5.5 Explorability

Exploration for Heavitree Quartzite targets requires a method which will reliably detect depth to, and structure on basement and/or the Heavitree Quartzite. To date, seismic exploration, regional magnetics and magneto-telluric methods have failed, despite sophisticated processing and interpretation. The presence within the section of several unconformity surfaces and mobile salt horizon(s) renders impossible the inference of basement structure from that of overlying strata.

As no other target reservoirs are recognised in the section this inability to identify structure at the Heavitree Quartzite level using existing techniques means that EP 34 cannot be effectively explored.

5.6 Prospectivity Summary

EP 34 is no longer believed to be prospective. Thermal maturity is interpreted to be too high and a technique to recognise structures of the only potential reservoir target, being of great depth and beneath thick salt, has not been found. Further work in EP 34 is therefore unjustified and would divert resources from Pacific's other, more prospective, tenements in the Amadeus basin.

No individual structure or other target feature within EP 34 currently justifies diversion of exploration effort from those areas.

6 EXPENDITURE

Direct Drilling	\$0
Contract Exploration	\$594
Laboratory Analysis	\$0
Tenement Payment	\$1,005
Rent & Property	\$12,788
Payroll & Benefits	\$30,144
Field & Transport	\$3,725
Travel & Accommodation	\$10,890
Computer Services	\$1,930
Professional Charges	\$480
Office & Miscellaneous	\$8,087
Overheads	\$23,901
TOTAL	\$93,544

TABLE 3 Expenditure - EP 34, 1/3/91 - 28/2/92

Total permit expenditure over two years:- \$138,125.

KEYWORDS

Petroleum, Oil, Gas, Proterozoic, Structural Trap, Geochemistry, Geophysics, Geophysical Interpretation, Ground EM Survey, Image Interpretation, LANDSAT, Satellite Imagery, Seismic Survey, Maturation, Porosity, Reservoir Rock, Source Rock_Analysis, Palynology.

LOCATION

EP 34 (Mt Conner) Northern Territory

1:250 000 Mapsheets

Finke	SG 53-6
Kulgera	SG 53-5
Ayers Rock	SG 53-8

DESCRIPTOR

This report details all work carried out by Pacific Oil & Gas Pty. Limited during the second and final permit year of EP 34 ending 4 March 1992. Prospectivity of the area is briefly discussed.

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APPENDIX 1

LIST OF GRATICULAR BLOCKS
EP34 NORTHERN TERRITORY

GRATICULAR BLOCKS
EP34 NORTHERN TERRITORY

PETERMANN RANGES 1:1 000 000 Block Identification Map

1221
1222
1223
1224
1293
1294
1295
1296
1365
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1368
1437
1438
1439
1440

OODNADATTA 1:1 000 000 Block Identification Map

1225	1233	1241	1304	1312	1375
1226	1234	1297	1305	1313	1376
1227	1235	1298	1306	1369	1377
1228	1236	1299	1307	1370	1378
1229	1237	1300	1308	1371	1379
1230	1238	1301	1309	1372	1380
1231	1239	1302	1310	1373	1381
1232	1240	1303	1311	1374	1382

67 BLOCKS

APPENDIX 2

PROPOSED AND ACTUAL WORK PROGRAMME

WORK PROGRAMME & EXPENDITURE SUMMARY

PROJECT - Amadeus Basin
 ACQUIRED - 05/03/90
 EXPIRES - 04/03/95
 TOTAL AREA - 5183km²
 TOTAL BLOCKS - 67
 HOLDER - Pacific Oil & Gas Pty. Limited

YEAR	WORK PROGRAMME	LICENCE COMMITMENT
ONE 05/03/90 to 04/03/91	Air photo interpretation. Open file data review. Field mapping. Year 1 \$45,060	Data collation. \$50,000
TWO & THREE 05/03/91 to 04/03/93	Consultant seismic interpretation. SIBGEO studies. Magnetic modelling. Year 2 \$93,065	Development of techniques. 120km seismic. \$500,000
FOUR 05/30/93 to 04/03/94		One well. \$500,000
FIVE 05/03/94 to 04/03/95		One well. \$1,000,000
TOTAL	To end Dec 1991 (approx.) \$138,125	\$2,050,000

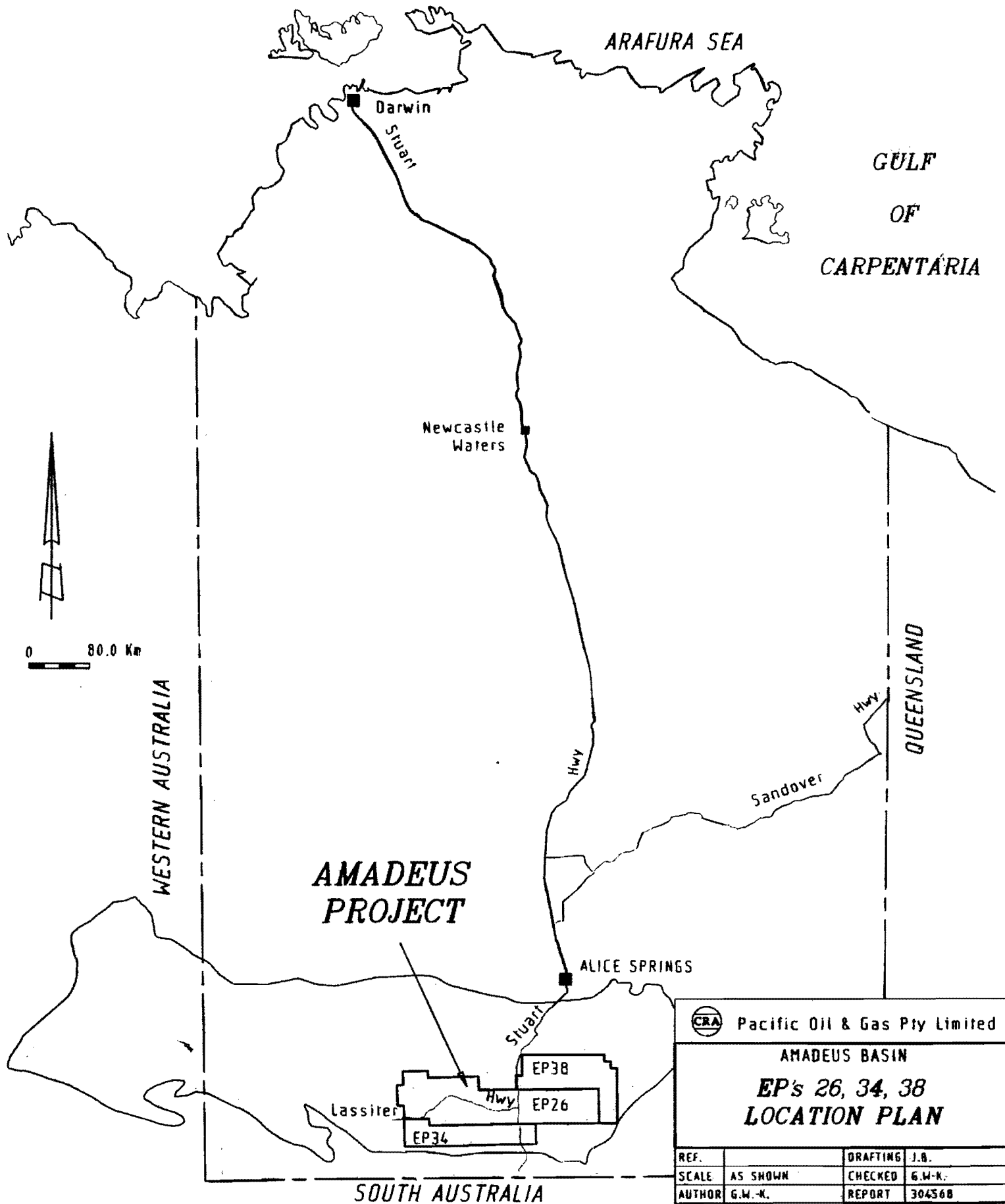
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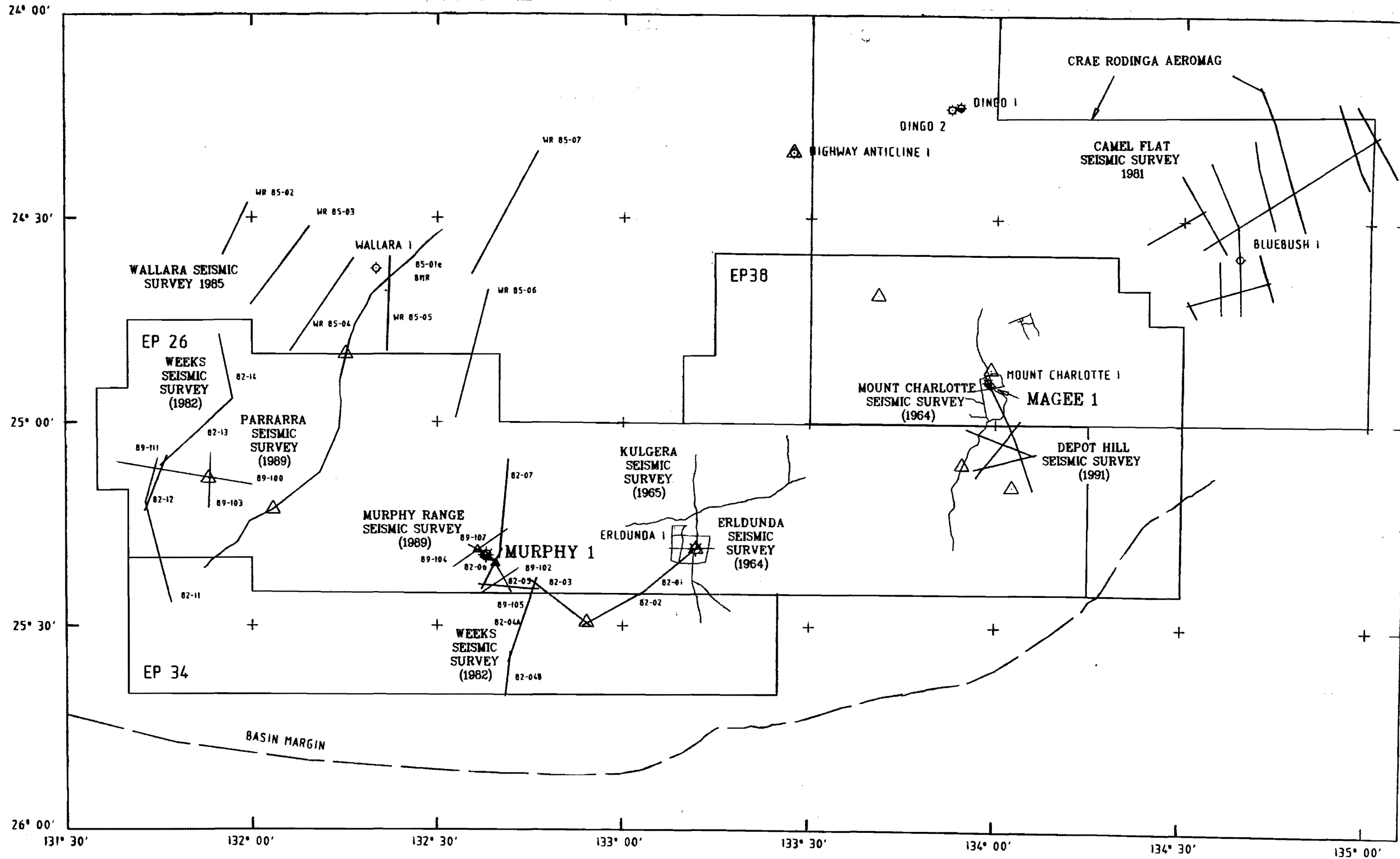
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AMADEUS BASIN PROJECT AREA

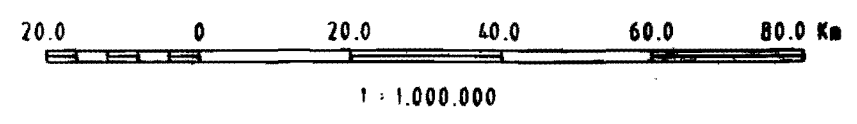
NORTHERN TERRITORY



 Pacific Oil & Gas Pty Limited			
AMADEUS BASIN EP's 26, 34, 38 LOCATION PLAN			
REF.		DRAFTING	J.B.
SCALE	AS SHOWN	CHECKED	G.W.K.
AUTHOR	G.W.K.	REPORT	304568
DATE	MAY 92	PLAN No.	PeINTcw 5127

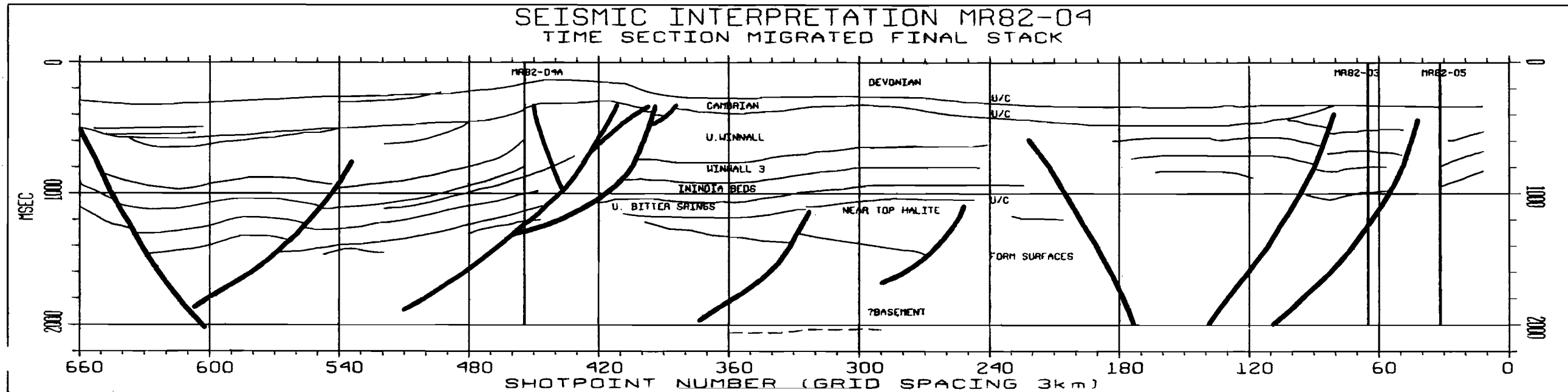
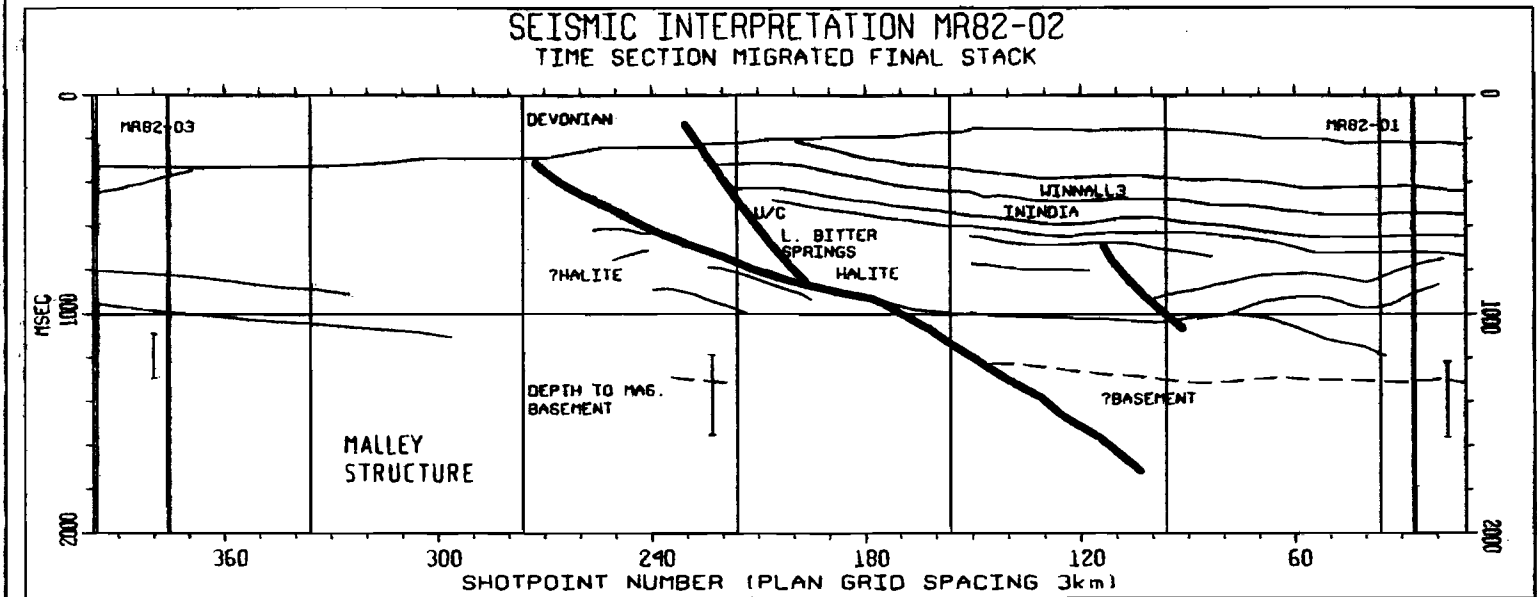
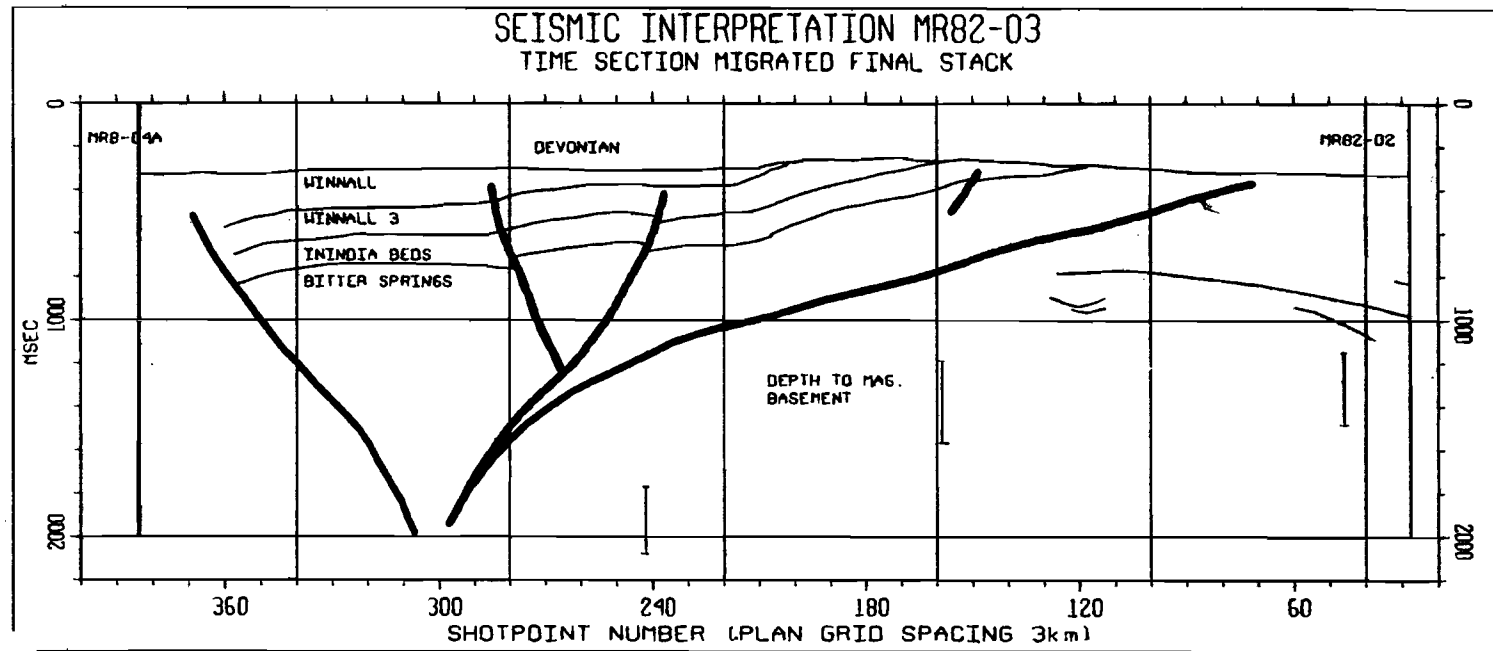


- PACIFIC SEISMIC DATA
- PACIFIC REPROCESSED WEEKS DATA
- OTHER COMPANIES PREVIOUS SEISMIC DATA
- △ MT SOUNDINGS



CRA Pacific Oil & Gas Pty Limited
 SOUTHERN AMADEUS BASIN
 EP26, EP34 AND EP38
EXPLORATION ACTIVITY

AMENDMENTS		REF.	DRAFTING
SEPT 92	TITLE ALTERED	SCALE 1:1000000	J.B.
OCT 92	AUTHOR	G.W.K.	CHECKED G.W.K.
MAGEE 1 ADDED	DATE	MAY 92	REPORT 304707
			PLAN No. PeINTCw 5125



Pacific Oil & Gas Pty Limited			
AMADEUS BASIN			
ANNOTATED SEISMIC INTERPRETATION			
EP 34 N.T.			
REF.		DRAFTING	L.I./I.B.
SCALE		CHECKED	G.W-K.
AUTHOR	G.W-K.	REPORT	304568
DATE	MAY 92	PLAN No.	PeINTcw 5128