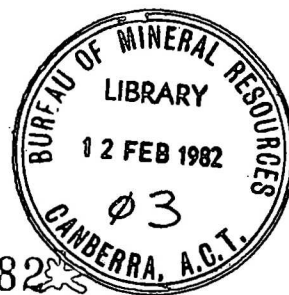


1981 / 68

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BMR PUBLICATIONS COMPACTUS
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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD

Record 1981/68

WELL COMPLETION REPORTS FOR BMR
RODINGA NOS. 1, 1A, 2, 2A, and 3,
AMADEUS BASIN, NT.

by

E.A. Felton

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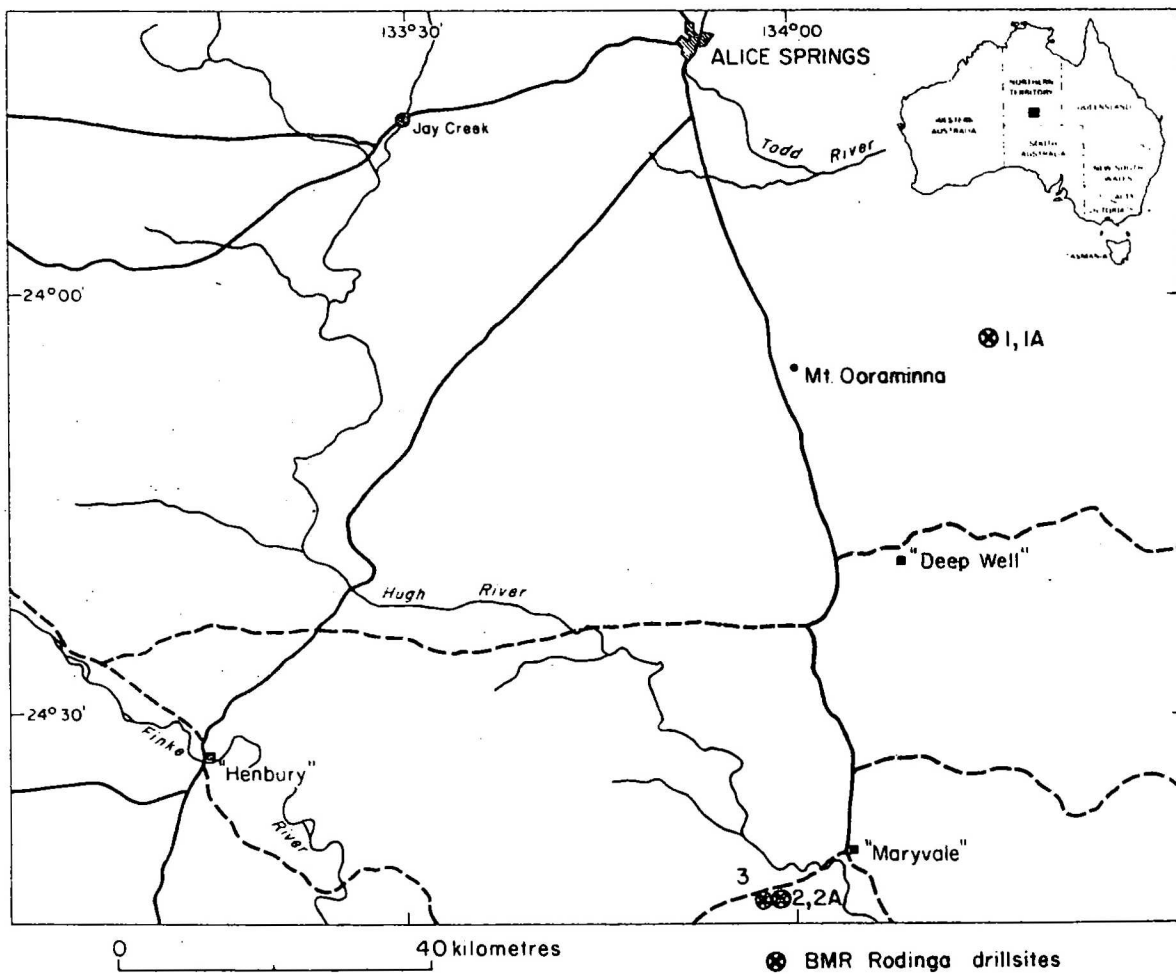
4. Lithological graphic log, BMR Rodinga No. 2A.
5. Lithological graphic log, BMR Rodinga No. 3.

ABSTRACT

Five fully cored diamond drillholes, aggregating 335.80 metres, were drilled in the Cambrian Chandler Limestone of the Amadeus Basin in 1980 for the purpose of assessing the unit's potential.

The Chandler Limestone consists mainly of red and green calcareous and non-calcareous mudstone and shale, with 30 percent grey limestone and tan dolostone in strata up to 4.5 metres thick. Oil staining was present in cherty tan dolostone at 133 metres depth in BMR Rodinga No. 1A. Films and blebs of black organic matter were present in many carbonate horizons. Black shale is present only as laminae and thin bands in carbonate horizons and does not constitute a volumetrically significant source rock in the areas drilled.

Overall, the reservoir potential of the Chandler Limestone appears low. The red-brown silty mudstone of the unit is an effective seal for underlying reservoirs.



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Fig.1 Location map

12/NT/1

INTRODUCTION

Shallow drilling was carried out in the Cambrian rocks of the eastern Amadeus Basin in August, September, and October, 1980 with a BMR Mayhew 1000 rig. Five fully cored holes, locations shown in Figure 1, were drilled, aggregating 335.80 m. Two of these holes were redrilled holes and no core was recovered from one hole, BMR Rodinga No. 2.

Foetid limestone has been reported from the Early Cambrian Chandler Limestone in several BMR publications. The drilling program was designed to test the full section of the Chandler Limestone in three areas: Ooraminna Anticline, Maryvale, and Henbury (Fig. 1). The objectives were to obtain fresh samples for hydrocarbon source rock evaluation and examine the nature of the contact between the Chandler Limestone and the underlying formation. The holes were sited at the stratigraphic top of the unit as shown on the Rodinga 1:250 000 geological sheet (Randord & Cook, 1968) and were named after that map sheet i.e. BMR Rodinga No. 2A is a redrill of the second BMR hole on the Rodinga 1:250 000 Sheet area. The hole planned for Henbury was not drilled because of structural disturbances in the formation at this locality and because the overall source potential appeared low after drilling the holes at Ooraminna Anticline and Maryvale.

GEOLOGY

SUMMARY OF PREVIOUS WORK

The Amadeus Basin has been mapped at 1:250 000 scale by BMR and its geology is described by Wells & others (1970). More detailed reports on several areas of the Basin are listed in a selected bibliography at the conclusion of this report.

Geological maps of the northeastern part of the basin margin have been re-compiled and published at 1:100 000 scale by BMR since 1974: however detailed new work was largely confined to the metamorphic basement. Basin sediments were reinterpreted using aerial photographs and reconnaissance traverses.

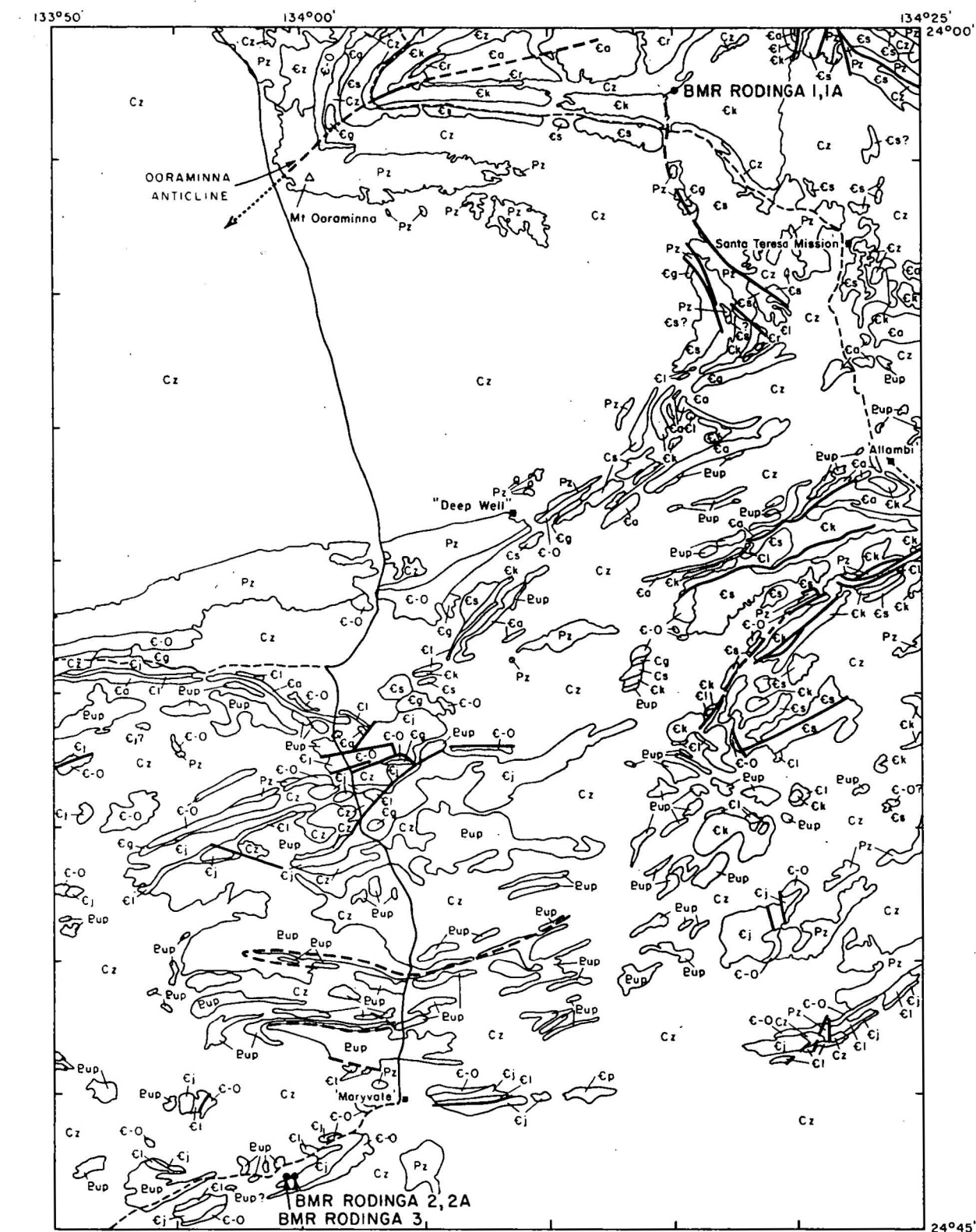
R. Oaks, a consultant geologist for Magellan Petroleum Corporation (Magellan), carried out detailed mapping during 1979 and 1980 on oil exploration permit OP 175 held by Magellan and OP 189 held by Coastal Caribbean Oils and Minerals Ltd. The sedimentology of Middle and Late Cambrian carbonates and the regional structure have also been investigated by Magellan, but no reports are publicly available.

A number of petroleum exploration wells have been drilled in the basin; well completion and other reports relating to some of these wells are listed as references. All available core material from these wells has been examined for its suitability for source rock analysis and all suitable material has been analysed by conventional methods (McKirdy, 1977; Saxby & Bruen, 1978).

BMR RODINGA NOS. 1 AND 1A

Drillsite Geology

The drillsite is situated in the northern part of the Rodinga 1:250 000 geological sheet (Ranford & Cook, 1968), on the southern flank of the Ooraminna Anticline. Most of the Cambrian sedimentary section crops out in the Ooraminna Anticline, a south-southwest-trending and gently plunging structure located 50 km southeast of Alice Springs (Fig. 2.)



BMR RODINGA 1A



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Fig. 3 Lithological graphic log - BMR Rodinga No. 1A

12/NT/3

Although not shown on published geological maps, the Lower Cambrian Chandler Limestone has recently been recognised in the Ooraminna Anticline (R. Oaks, Magellan, personal communication, 1980). Its outcrop is poor compared with that of other units in the area so that its relationships with older and younger rock units are not visible. Conformable or paraconformable relationships are inferred from structural conformity in the sequence and from conformable relationships observed elsewhere in the northeastern part of the basin.

The drillhole was spudded in, in the lowest outcropping beds of the Giles Creek Dolomite, stratigraphically and topographically above the Chandler Limestone. The Giles Creek Dolomite here consists of medium to thin-bedded limestone with thin shale interbeds. Dips are low, about 10° .

Chandler Limestone underlies a low-lying area between hills of Giles Creek Dolomite and Todd River Dolomite. The best outcrops occur on the slopes of small hills about two kilometres east of the drillsite. Here the section consists of about 80 percent red-brown silty mudstone and 20 percent light grey thin carbonate beds, with rare thicker (up to four metres) carbonate beds in the middle part of the section. Chert bands and nodules are conspicuous in some carbonate beds. A 1.5-m thick dark grey to brown dolostone unit, the lowest outcropping unit in the section, is thin-bedded, contorted and in places brecciated, and emits a foetid odour when struck with a hammer.

Near the drillsite, the Todd River Dolomite consists of a pink crystalline dolostone about 4 m thick, underlain by poorly outcropping thin-bedded dolostone and limestone.

Formations penetrated

The Chandler Limestone in BMR Rodinga No. 1A consists of dolostone and limestone with 10 percent green and red calcareous silty mudstone in the top 87.80 metres, followed by calcareous red siltstone with 20 percent dolostone and limestone from 87.80 m to 175.50 m. An erosional contact with the Todd River Dolomite was encountered at this depth. The hole terminated in pink crystalline dolostone of the Todd River Dolomite at 178.000 m (Fig. 3).

Dip is 10° or less throughout, except in some thicker carbonate horizons where beds are steeply dipping and brecciated. Weathering effects extent to about 40 metres depth; evidence of water flushing is present in the form of iron staining on open joints throughout hole depth.

Possible trilobite fragments were noted at 32.99 m in grey silty shale in BMR Rodinga No. 1.

BMR RODINGA NoS. 2, 2A, AND 3

Drillsite geology

The drillsites are located on the southern flank of the east-northeasterly trending and plunging Mount Burrell Anticlinorium 10 km west of Maryvale (GR 186930, Rodinga 1:250 000 geological sheet, first edition 1968).

Near the drillsites the late Precambrian Pertatataka Formation consists of interbedded purple medium-grained quartzose arenite, commonly containing clay pellets, and purple to green shale, haematitic in part. An unconformity or fault is inferred between the Pertatataka Formation and the overlying Chandler Limestone. The Chandler Limestone consists of 80 percent red-brown siltstone and 20 percent limestone. The siltstone crops out very poorly and is commonly mantled by aeoline sand. It is rarely exposed in gullies. The limestone interbeds are better exposed and consist of strata up to 30 cm thick of thin-bedded and laminated medium to coarse-grained limestone. The lowest outcropping limestone consists of a series of mound-like outcrops up to 3 m in height and thickness, about 60 m apart along strike, separated by intervals of almost no outcrop. This limestone unit consists of contorted thin-bedded to laminated dark dolomitic limestone with chert bands and nodules. It emits a foetid odour when freshly broken.

The top of the Chandler Limestone is marked by a break in slope where medium-bedded limestone mapped as Jay Creek Limestone crops out stratigraphically and topographically above the Chandler Limestone. The contact is not exposed, but is inferred to be conformable or paraconformable because of lithological gradation between the formations and structural continuity of the sequence.

BMR RODINGA 2A

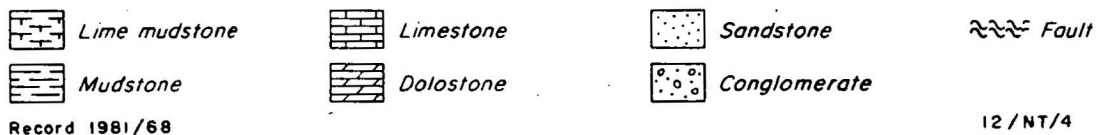
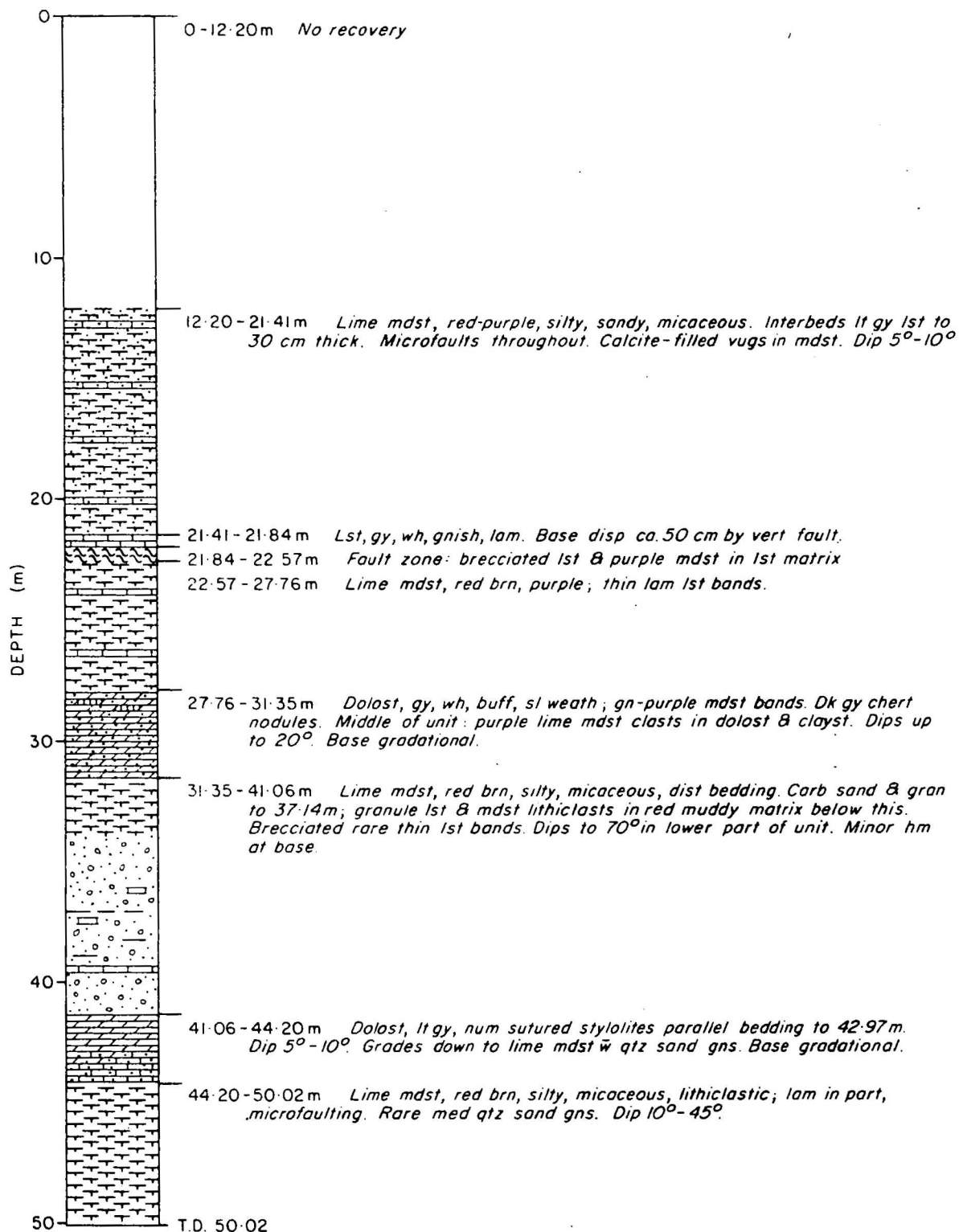
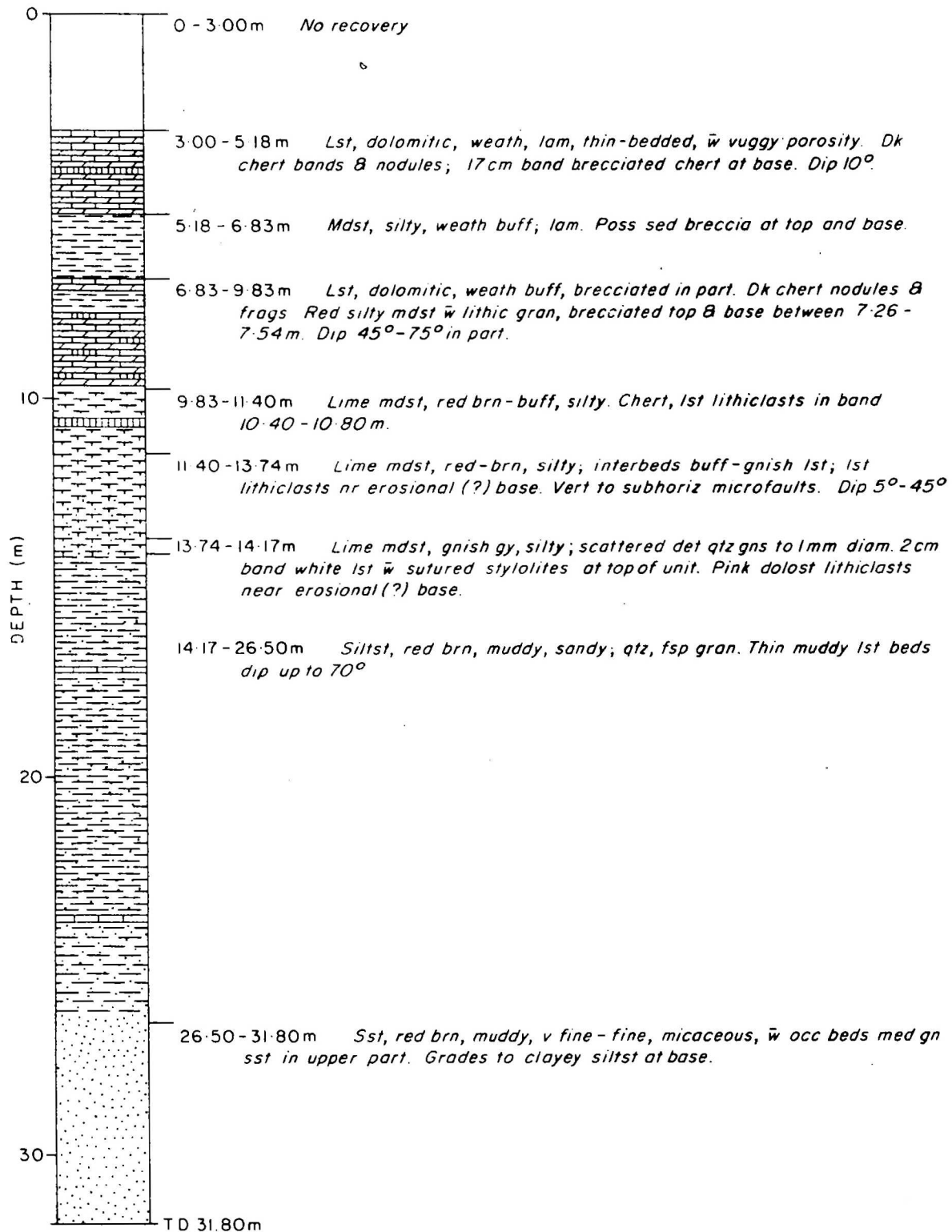


Fig. 4 Lithological graphic log - BMR Rodinga No 2A

BMR RODINGA 3



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12/NT/5

Fig.5 Lithological graphic log - BMR Rodinga No.3

Formations penetrated

BMR Rodinga No. 2A spudded in, in the top of the Chandler Limestone and penetrated a 3.6 m thick dolomitic limestone at 27.76 m (Fig. 4). An erosional unconformity is recognised above a 1.90 m thick dolostone bed at 41.06 m; this bed possibly correlates with the Todd River Dolomite stratigraphically below the Chandler Sandstone. Red silty and sandy sediments below this bed may then correlate with the Arumbera Sandstone or the Eninta Sandstone. Alternatively, the hole was cored entirely in the Chandler Limestone.

BMR Rodinga No. 3 spudded in, in the dolomitic limestone mentioned above and penetrated a similar sequence to that described above (Fig. 5). In this hole, the bed that may correlate with the Todd River Dolomite is markedly thinner than in BMR Rodinga No. 2A.

RESERVOIR ROCKS

Fracture porosity and vuggy porosity are developed in most of the dolostone and limestone beds intersected in the drillholes. The fractures and vugs are rarely interconnected. Tests on samples from the oil-stained tan dolostone bed has excellent reservoir characteristics (Table 1).

The red-brown calcareous siltstone appeared tight throughout. Although some porosity is present, permeability is lacking.

SOURCE ROCKS

The results of laboratory geochemical analyses for BMR Rodinga No. 1A are presented in Table 2. Most samples have low total organic carbon, indicating lean source potential. The sample with three percent total organic carbon (TOC) yielded little extract. A sample from the oil-stained tan dolostone at 133.0 metres, containing 0.75% TOC, yielded sufficient extract to be rated as a good source of hydrocarbons. However, the naphthenic character of the saturated hydrocarbon fraction of this extract indicates that the oil is biodegraded and may have migrated into its present site.

HYDROCARBON INDICATIONS

All carbonate strata below 85 metres in BMR Rodinga No. 1A emitted foetid odours when freshly broken. Thin films of black material were present on many bedding planes and fractures in these strata.

Oily films accumulated on the mudpit surface during drilling of the intervals 118.12-123.08 metres and 132.82-136.19 metres. Patchy light oil staining was encountered in dolostone between 133.10-135.95 metres. Black, possibly bituminous, material was present in vugs in this interval.

There were no hydrocarbon indications in the other holes drilled in the Chandler Limestone.

SELECTED BIBLIOGRAPHY

- COOK, P.J., 1968 - Henbury, Northern Territory - 1:250 000 Geological Series. Bureau of mineral Resources, Australia, Explanatory Notes SG/53-1.
- FEHR, A., 1966 - Petrological study of Cambrian sediments in Alice No. 1 well, Amadeus Basin, Northern Territory. Bureau of Mineral Resources, Australia, Record 1966/5 (unpublished).
- McKIRDY, D.M., 1977 - Diagenesis of microbial organic matter. Ph.D. Thesis, Australian National University (unpublished).
- McTAGGART, R.R., PEMBERTON, R.L., & PLANALP, R.N., 1965 - Well completion report, Mt Charlotte No. 1. Report by Transoil (M.T.) Pty Ltd. (unpublished).
- PEMBERTON, R.L., CHAMBERS, S.S., PLANALP, R.N., & WEBB, E.A., 1963 - Well completion report, Exoil Alice No. 1. Report by E.A. Webb, Consulting Geologist (unpublished).
- PLANALO, R.N., & PEMBERTON, R.L., 1963 - Well completion report, Exoil Ooraminna No. 1. Report for Exoil (N.L.) (unpublished).
- RANFORD, L.C., & COOK, P.J., 1968 - Rodinga, Northern Territory - 1:250 000 Geological Series. First edition. Bureau of Mineral Resources, Australia, Explanatory Notes SG/53-2.
- RANFORD, L.C., COOK, P.J., & WELLS, A.T., 1965 - The geology of the central part of the Amadeus Basin, northern Territory. Bureau of Mineral Resources, Australia, Report 86.
- SAXBY, J.D., & BRUEN, L., 1978 - A report to the Bureau of Mineral Resources, Canberra. CSIRO Restricted Investigation Report 967R.
- SCHMERBER, G., - Petrological report on Ooraminna No. 1 well, Amadeus Basin, Northern Territory. Bureau of Mineral Resources, Australia, Record 1966/82 (unpublished).

SCHMERBER, G., & OZIMIC, S., 1966 - A petrological study of the sediments from Mount Charlotte No. 1 well, Amadeus Basin, Northern Territory. Bureau of Mineral Resources, Australia, Record 1966/120 (unpublished).

SHAW, R.D., LANGWORTHY, A.P., STEWART, A.J., OFFE, L.A., JONES, B.G. & O'DONNELL, I.C., 1979 - Alice Springs N.T., 1:250 000 Geological Series. Second edition preliminary. Bureau of Mineral Resources, Australia.

WELLS, A.T., FORMAN, D.J., MILLIGAN, E.N., STEWART, A.J., SHAW, R.D., & KRUGER, N.L., 1966 - Alice Springs, N.T., 1:250 000 Geological Series. First edition. Bureau of Mineral Resources, Australia, Explanatory Notes, SG/53-14.

WELLS, A.T., RANFORD, L.C., STEWART, A.J., COOK, P.J., SHAW, R.D., 1967 - Geology of the north-eastern part of the Amadeus Basin, Northern Territory. Bureau of Mineral Resources, Australia, Report 113.

WELLS, A.T., FORMAN, D.J., RANFORD, L.C., & COOK, P.J., 1970 - Geology of the Amadeus Basin, Central Australia. Bureau of Mineral Resources, Australia, Bulletin 100.

APPENDIX 1

WELL HISTORIES - BMR Rodinga Nos. 1 and 1A

General data

Well name and number: BMR Rodinga No. 1, 1A.
Location: Lat. 24°02'40"S, Long. 134°15'11"E.
Area: Amadeus Basin, Northern Territory,
Petroleum title holder: Coastal Caribbean Oils and Minerals Ltd.
Title number: OP 189.
Total depths: No. 1 (Driller:) 65.20 m; No. 1A
178.00 m.
Date drilling commenced: No. 1 20 August 1980; No. 1A 2 September
1980.
Date drilling completed: No. 1 1 September 1980; No. 1A 26
September 1980.
Date rig released: 26 September 1980.
Drilling time to total depths: Drilling and reaming: No. 1: 16.5 hrs.;
No. 1A: 20 hrs Coring: No. 1: 31 Hrs.;
No. 1A: 71 hrs.
Elevations: Rotary table: 1.20 m above groundlevel.
Ground level: 488 m approx.
Status: No. 1: plugged and abandoned.
No. 1A: capped.

Drilling data

Drilling by: Bureau of Mineral Resources,
Canberra, ACT
Drilling plant: Make: Mayhew.
Type: 1000.
Rate capacity: 305 m with 6.03 cm drill
Pipe.
Mast: Make: Mayhew.
Type: tubular, 7.01 m.
Pumps: Rated capacity: 18 000 kg.
Make: Gardner Denver.
Size: 5 x 6.
Motors: As for rig.
Compressor: Make: Gardner Denver.
Model: WXH
Motors: As for rig.
Blowout preventer: None.

Hole sizes:	No. 1: 15 cm to 10.60 m; 6.35 cm to T.D. No. 1A: 15cm to 10.00 m; 11.25 cm to 99.00 m; 6.35 cm to T.D.
Casing Strings: Size:	No. 1: 15 cm; No. 1A: 15 cm.
Grade:	No. 1: Water-bore; No. 1A: Water-bore.
Set at:	No. 1 10.60 m; No. 1A: 10.00 m.
Casing cement:	No. 1: 8 bags; No. 1A: 7 bags
Drilling fluid:	No. 1 Water to 13.70 m, Red Devil Gel mud to T.D. No 1A Super Gel mud to 65 m, Red Devil Gel mud to 86 m, Ro-Ben mud to T.D.
Water supply:	Drinking and drilling water obtained from Santa Teresa Mission.
Perforation and shooting records:	None.
Plugging back:	BMR Rodinga No. 1 : 17.00 m, 59.00 m. BMR Rodinga No. 1A : 17.00 m, 58.70 m, 70.30 m, 77.20 m, 83.00 m.
Side tracked hole:	None.
Finishing operations:	Unsuccessful attempts were made to retrieve HQ barrel and 8 drillpipes stuck in BMR Rodinga No. 1.

Personell and administrative

Shifts run:	Daily: 1. Weekly: 5.
Hours per shift:	10.
Party leader:	A, Zoska.
Driller:	E.D. Lodwick.
Driller's assistant:	B. Watler.
Mechanic:	J. Keyte.
Cook:	R. McGrane.

Logging and testing

Cuttings:	None.
Cores:	

(1) BMR Rodinga No. 1.

Twenty-three cores were taken between 4.00 and 65.20 metres. They were cut with a 3.05 m HQ wireline core barrel using an HQ 4 step diamond corehead which cut 6.35 cm maximum diameter cores. Good core recovery was obtained.

(2) BMR Rodinga No. 1A.

Fifty-nine cores were taken between 14.00 and 178.00 metres (total depth), using equipment as detailed for BMR Rodinga No. 1. Core recovery was 95 percent overall.

Sidewall sampling:	Nil.
Well-logging:	Nil.
Gas-log:	Nil.
Formation testing:	Nil.
Deviation study:	Nil.
Other hole surveys:	Nil.

Summary of drilling operations

BMR Rodinga No. 1 was plugged and abandoned at 65.20 m after the HQ core barrel, core head, and eight drill pipes became stuck in the hole. The sticking pipes were caused by mud separation in porous carbonates. During drilling, circulation was lost in two fracture zones at 17.00 metres and 59.00 metres. Coring was slow in the red siltstone intervals. Overall core recovery was 100 percent.

BMR Rodinga No. 1A was sited approximately one metre from BMR Rodinga No. 1 and continuously cored from 14.00 metres when it was found that coring was faster than drilling in hard carbonates. Circulation was lost at 17.00 metres, 58.70 metres, 70.30 metres, 77.20 metres, and 83.00 metres, usually in fractured carbonates. Difficulties were encountered with mud separation and sticking drill pipes in the interval 59.00 metres and 99.00 metres. The problem was alleviated by periodically reaming the hole to 11 cm diameter. Core recovery was 95 percent.

APPENDIX 2

WELL HISTORIES - BMR RODINGA NOS. 2, 2A, 3

General data

Well names and numbers: BMR Rodinga Nos. 2, 2A, 3.

Location: Nos. 2 & 2A: Lat. 24°43'00"S. Long. 133°58' 00"E.
No. 3: Lat. 24°43'00"S Long. 133°58'00"E.

Area: Amadeus Basin, Northern Territory.

Petroleum title holder: None.

Total depths (driller): No. 2: 11.00 m; No. 2A: 50.00 m;
No. 3: 31.80 m.

Dates drilling commenced: No. 2: 2nd October, 1980.
No. 2A: 12th October, 1980.
No. 3: 17th October, 1980.

Dates drilling completed: No. 2: 10th October, 1980.
No. 2A: 16th October, 1980.
No. 3: 21st October, 1980.

Date rig released: 21st October 1980.

Drilling time to total depths: Drilling and reaming:
No. 2: 20 hours; No. 2A: 14 hours;
No. 3: 2 hours.
Coring:
No. 2: 2 hours; No. 2A: 26 hours;
No. 3: 10 hours.

Elevations: Rotary table: 1.20 m above ground level.
Ground level: Nos. 2 and 2A: 387 metres approx.; No. 3: 380 metres.

Status: No. 2: Plugged and abandoned.
Nos. 2A and 3: Capped.

Drilling Data

As for BMR Rodinga Nos. 1 and 1A except where specified below -

Hole sizes: No. 2: 18.7 cm to 6.44 m; 6.50 cm to T.D.
No. 2A: 18.7 cm to 12.65 m; 6.50 cm to T.D.
No. 3: 18.7 cm to 1.00 m; 6.50 cm to T.D.

Casting Strings: Size: Nos. 2, 2A, & 3: 15 cm
Grade: Water-bore.
Set at: No. 2: 6.44 m; No. 2A: 12.65 m;
No. 3: 1.00 m.

Casing cement: No. 2: 3 bags; No. 2A: 8 bags;
No. 3: not recorded.

Drilling fluid: No. 2: Supergel mud; Nos. 2A and 3:
Spud mud.

Water supply:	Drinking and drilling water were obtained from the Government bore at Maryvale.
Perforation and shooting records:	None.
Plugging back:	None.
Side tracked hole:	None.
Fishing operations:	None.

Personnel and administrative

As detailed for BMR Rodinga Nos. 1 and 1A.

Logging and testing

Cuttings: None.

Cores:

(1) BMR Rodinga No. 2:

Two cores were taken between 3.80 and 6.20 metres in weathered red siltstone before the hole collapsed. No core was retained.

(2) BMR Rodinga No. 2A:

Fourteen cores were taken between 12.20 and 50.00 metres (T.D) using a 3.05 metre HQ wireline core barrel and Triefus 8 step diamond corehead which cut 6.35 cm diameter cores. Core recovery was 100 percent.

(3) BMR Rodinga No. 3:

Eleven cores were cut using equipment as for BMR Rodinga No. 2A. Core recovery was 100 percent.

Other sampling and surveys : nil.

Summary of drilling operations

BMR Rodinga No. 2 was plugged and abandoned at 12.35 m due to circulation loss and casing difficulties. BMR Rodinga No. 2A was sited 1 metre from Rodinga No. 2, cased to 12.20 m, and cored to 50.00 m. Core recovery was 100 percent. Hole was drilled with mud to 35.00 m then with fresh water.

BMR Rodinga No. 3 was sited approximately 500 metres west of BMR Rodinga No. 2. Cores were taken between 3.00 metres and 31.80 metres with 100 percent recovery.

Table 1. Porosity and permeability data - BMR RODINGA No. 1A

Sample Depth (metres)	Sample Orientation	Porosity (% of bulk vol.)	Permeability (md.)	Dry Bulk Density (gm/cc.)	Apparent Grain Density (gm/cc.)	Oil Saturation (% of Pore Vol.)	Acid Solubility (% by wet.)	Fluorescence of extracted oil	
133.66-133.87	Parallel to core axis	24.9	9.6	2.13	2.84	0.18	N.D.	Bright yellow	Dolostone. No vugs.
133.66-133.87	Rt. L ^s to core axis	26.1	15.0	2.10	2.84	N.D.	N.D.	N.D.	Dolostone. Fine vugs obvious.
	Piece only; non-vugular	29.1	N.D.	2.02	2.85	N.D.	94	N.D.	Dolostone. No vugs.
*	Piece only; vugular	18.0	N.D.	2.19	2.67	N.D.	N.D.	Strong golden	Limestone, some vugs. Interbedded crystalline calcite
126.42-126.50	Slab sample	17.5	0.001	2.31	2.80	N.D.	44.2	N.D.	Red-brown calcareous siltstone.

Acid solubility was obtained using cold, 16% hydrochloric acid.

*Results suspect due to presence of vugs.

Benzidine test for smectites was negative.

TABLE 2. SOURCE ROCK DATA - BMR RODINGA NO. 1A

Depth (m)	TOC (%)	EOM (ppm)	SATS (ppm)	AROM (ppm)	POLAR (ppm)	ASPH (ppm)	Pr/nC ₁₇	Ph/nC ₁₈	Pr/Ph	Rock type	Source rating
86.5	0.15	131	23	1	20	38	0.46	0.41	0.69	Cherty lst	Lean-barren
93.0	0.40	126	34	7	26	31	0.36	0.38	1.07	Dk gy shale	Fair (gas)
106.0	<0.05	56	20	2	10	11	0.36	0.41	0.80	Red/bn siltstone	Barren
108.0	<0.05	187	7	3	44	82	0.57	0.54	1.24	Gy mudstone	Barren
108.5	0.20	177	36	7	45	67	0.39	0.33	1.15	Gy mudstone	Lean-barren
108.9	3.00	686	128	57	169	163	0.40	0.28	1.74	Dk bn shale and lst	Fair (gas)
113.3	0.20	103	7	7	24	30	0.48	0.39	0.76	Gy to dk gy (?) bituminous lst	Lean-barren
118.1	0.10	77	18	6	21	22	0.31	0.26	0.92	Gy mudstone	Lean-barren
118.5	0.15	131	21	9	25	74	0.59	0.55	1.08	Dk gy mudstoen	Barren
119.8	0.70	328	100	4	69	100	0.27	0.23	1.26	Dk gy shale	Fair
120.0	0.10	126	27	2	24	59	0.28	0.26	1.12	Lst,(?) bituminous laminae	Barren
133.0	0.75	1143	247	48	521	270	0.72	1.91	0.41	Tan bituminous dolostone	Good
155.2	0.05	54	15	1	9	20	0.34	0.39	1.04	Red/bn silty mudstone	Barren
TOC - total organic carbon				AROM - aromatic hydrocarbons				Pr/nC ₁₇ - pristane to nC ₁₇ ratio			
EOM - extractable organic matter				POLAR - (N,S,O - containing) organic compounds				Ph/nC ₁₈ - phytane to nC ₁₈ ratio			
SATS - saturated hydrocarbons				ASPH - asphaltenes				Pr/Ph - pristane to phytane ratio			