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Well Report Scanned Image File

Well Name	Aquarius 1
Operator	Australian Gulf Oil Company
Contractor	Reading and Bates (Australia) Pty Ltd
Date of Report	1970
State	QLD
Comment	

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Australian Gulf Oil Company

Royal Exchange Building
66 Pitt St., Sydney.
Telephone: 27-3064

Postal Address:
G.P.O. Box 4231
Sydney, N.S.W. 2001

Cables: AUSGULF Sydney

November 3, 1970

CR. 2638(G)

The Under Secretary,
Department of Mines,
Mineral House,
2 Edward Street,
Brisbane,
Queensland 4000.

S.D.U



Dear Sir,

ANNUAL REPORT September 1, 1969 -August 1970
EXPLORATION PERMITS Q/4P, Q/5P, Q/6P, Q/7P
Land Mass Q/146P, Q/148P, Q/150P, Q/152P

Exploration activities during this permit year have been curtailed as a result of the current Royal Commission Inquiry into drilling in the Great Barrier Reef province.

During this period exploration activity consisted of completion of the aerial photographic survey over Q/6P and Q/7P on September 20, 1969 and reprocessing of seismic data in the vicinity of Aquarius-1 well. Revision of the report of the Aeromagnetic interpretation of Q/6P and Q/7P was submitted.

Office studies of exploratory data already obtained have been continued. There were no field geological operations.

GEOLOGY

Office studies to synthesize new and old exploration were carried out. A revised cross-section between the Capricorn-1A and Aquarius-1 wells, and with adjacent wells, incorporating revised stratigraphic data has been prepared and is transmitted with this report.

.../2



Incorporated in Delaware, U.S.A. with limited liability

Australian Gulf Oil Company

Studies of coal diagenesis were carried out by the C. S. I. R. O. laboratory, Sydney, on cutting samples of the lignites in the Aquarius-1 well. The report by J. D. Brooks herewith transmitted, indicates that the geothermal gradient affecting lignites in the 4000'-4500' depth interval in this well would be unfavourable for the generation of hydrocarbons.

GEOPHYSICS

The revision of the aeromagnetic interpretation report for the work in Q/6P and Q/7P transmitted during this period did not result in any substantial modification of that previously submitted.

Seismic lines 123 and 233 were reprocessed in the vicinity of Aquarius-1 well Q/4P, to enhance deep reflection data. Unfortunately there was no notable improvement.

AIR PHOTOGRAPHY

The aerial photographic coverage of all four permits is now complete. These have proven very useful in defining hitherto unmapped reef masses. The negatives of the black and white photos at a scale of 1:55,000 have been forwarded to the Division of National Mapping, Department of National Development, Canberra.

Planimetric maps of this new coverage on scales of 1:100,000 and 1:500,000 have been made by the contractors.

PERSONNEL

During the past year, John Wonfor, Senior Geologist and Douglas Copeland, Senior Geophysicist, were added to the staff of Australian Gulf Oil Company. Both of these men have over 20 years of experience with Gulf.

ROYAL COMMISSION INQUIRY

Considerable time has been devoted by the staff to the preparation of submissions to the Royal Commission Inquiry into Petroleum Drilling on the Barrier Reef. These were made on behalf of the Australian



Australian Gulf Oil Company

Petroleum Exploration Association (A. P. E. A.) and the Australian Gulf Oil Company.

The submissions were directed to topics 1, 2, 3 and 5, namely, Topography, Hydrology, Meteorology, and Geology and Petroleum Potential and were presented during the first session.

FUTURE PROGRAM

The additional seismic work programmed for the second permit year and required to further evaluate these permits and locate new drill sites has been deferred because of the current Royal Commission Inquiry into petroleum exploration in the Great Barrier Reef Province. The future program will depend on the outcome of the Inquiry .

EXPENDITURES

A tabulation of expenditures is attached. There were no subsidy reimbursements during this year.

Yours faithfully,



Eric K. Ericson
EXPLORATION MANAGER

Enclosures: 1. Well Section, Rev. 1970
2. Aquarius well samples by C. S. I. R. O.

EKE:mc



ANNUAL EXPENDITURE
EXPLORATION PERMITS Q/4P, Q/5P, Q/6P, Q/7P
AND LAND MASSES

September 1, 1969 - August 31, 1970

	Q/4P 146P	Q/5P 150P	Q/6P 152P	Q/7P 148P
<u>Administrative and General</u>	\$	\$	\$	\$
Salaries & Employees Exp.	11,807	11,807	11,807	11,807
Office Rentals	1,699	1,699	1,699	1,699
Utilities, Supplies & Equipment	586	586	586	586
Services	993	993	993	993
Sub-Total	15,085	15,085	15,085	15,085
<u>Exploration</u>				
Seismic Processing	695			
Magnetometer			3,546	3,547
Aerial Photography			44,785	44,785
Sub-Total	695		48,331	48,332
TOTAL	15,780	15,085	63,416	63,417



CSIRO DIVISION OF MINERAL CHEMISTRYAQUARIUS NO. 1 WELL, CAPRICORN EMBAYMENT, QUEENSLAND

Cuttings supplied by Australian Gulf Oil Co.

Examination of coals from Tertiary sediments

The coals were hand picked from cuttings obtained from 4,000 to 4,500 ft. Reflectance determinations were made on grain mounts and the elementary composition obtained by microanalysis after treating with hydrochloric/hydrofluoric acid to reduce ash contents to acceptable levels.

The coals proved to be lignites with relatively high sulphur contents, and are still at the very low rank stage. Because of the low geothermal gradient, it is estimated that the temperature required for the generation of hydrocarbons would not be reached until depths of 12-13,000 ft were attained. However, the presence of coal was not recorded in sediments below about 5,000 ft, and in this part of the basin neither the degree of diagenesis of organic matter nor the depth of suitable sediments are sufficient for the generation of petroleum to have occurred.

Depth (ft)	Carbon Hydrogen Sulphur			Reflect- ance (%)	Lab. Number
	(% dry, demineralized)				
4120	66.6	2.5	4.6	0.34	27157
4150	64.4	4.8	3.4	0.38	27158
4440	67.4	6.3	3.5	0.44	27159
4490	65.5	4.6	3.2	0.45	27160

J.D. Brooks

2nd July, 1970

RECEIVED AUSGULF MARCH 2-70	
E.K.E.	<input checked="" type="checkbox"/>
J.S.W.	<input checked="" type="checkbox"/>
D.S.C.	<input checked="" type="checkbox"/>
W.J.B.	<input type="checkbox"/>
FILE	<input checked="" type="checkbox"/>
OPENED BY <i>91</i>	

CR 2438

FROM N. D. Coggeshall AT Houston

TO E. K. Erickson AT Sydney

IN REPLY
REFER TO 4432EL89

DATE February 20, 1970

Subject Reprocessing of Seismic Data
Swain Reefs Project
Australia

SEIS Phase III

Attached are portions of Seismic Lines 123 and 233 in the immediate area of the Aquarius No. 1 test. These data have been reprocessed to determine if deep reflection information is present which might be resolved through changes in the former processing parameters.

The velocity information from the survey in the Aquarius test and from velocity analyses of the field data were used in determining the optimum parameters for normal move-out corrections. The deep section was processed experimentally using increased velocities to see if continuity of data could be realized below the level of reliable velocity information. Final filter selections were also investigated in our effort to enhance the deeper data presentation.

The enclosed sections represent the final results of our experimental work. They indicate that we have not achieved any significant data enhancement at depth. We therefore believe that useable deep information was not recorded on the seismic control obtained in this general area.

The seismogram syntheses from the log data of the Aquarius test indicate the presence of a strong deep reflector. Since we have been unable to resolve such an event on the field data, it is suggested that the seismic energy was insufficient to penetrate the section to depth. The strong reflectors in the shallower section may tend to restrict penetration of the source energy.

We regret the delay in the report of this work and will see that future requests are kept to schedule.

N. D. Coggeshall

By:

J. A. Hafer
J. A. Hafer

Enclosures-2

cc: MJHill w/o encl.

*See 8/10/34.*GROSS, HISC
EXPL. SERV. DIV.

REC'D AUG 25 1969

*HAS**XX-65*

DATE August 22, 1969

REFERENCE 44202DC10

RETURN TO

CR 2438.

FROM

R. B. Ross

AT

Harmarville

TO

Dr. H. A. Shillibeer

AT

Houston

SUBJECT

Attn: Dr. G. Steele

BORON ANALYSIS OF CORE SAMPLES,

AQUARIUS No. 1 WELL, AUSTRALIA

Ref: Your Subject 4431DG41*CR. 2438(I)*

Under cover of a letter from H. A. Shillibeer to R. B. Ross, dated June 13, 1969, we received core samples from the subject well with a request for boron-paleosalinity analysis. Accordingly, the <1 μ fraction of the samples was extracted by wet sedimentation and boron determined. The samples from the upper part of the section were quite calcareous and required digestion in acetic acid prior to clay extraction.

The results of the analyses are shown in Table 1 (see attachment). The cores show considerable variation in lithology and clay mineralogy. Such variations make comparison of boron data from different parts of the section somewhat difficult.

The lowest sample studied (core 20) is an indurated, black, illitic shale with about 60 ppm B in the clay fraction. This concentration in an illitic clay is characteristic of a fresh-to brackish-water sediment.

Immediately overlying is a thick redbed sequence (cores 12-18), conglomeratic at the base and becoming a red to brown clay higher in the section. This entire interval shows virtually no boron and is judged to be continental.

Above the redbed sequence is a "glaucinitic" sand (cores 10-11). The major clay mineral in the rock is a 7 Å mineral recorded as "kaolinite + chlorite" (Table 1). The mineral may, however, be chamosite. This unit contains 140-180 ppm boron in its clay fraction and is probably marine.

Above the "glaucinitic" sand is a sandy clay, containing about equal amounts of montmorillonite and kaolinite + chlorite in its clay fraction. Two samples show 65 and 101 ppm B in the clay fraction and are interpreted as brackish deposits.

Overlying the sandy clay is a calcareous interval (cores 2-6). This interval appears to be gradational from the sandy clay (core 7), which is non-calcareous, to a limestone in core 2. The mineralogical composition, carbonate content, and boron concentration appear gradational throughout the interval.

RECEIVED	
AUG 26 1969	
<i>Sept 1</i>	
E.K.E.	
W.J.S.	
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OPENED BY	

GROSS, HISC	
EXPL. SERV. DIV.	
REC'D AUG 25 1969	
<i>HAS</i>	
<i>XX-65</i>	
DATE August 22, 1969	
REFERENCE 44202DC10	
RETURN TO	
GEOLOGY SECTION	
AUG 26 1969	

The boron concentrations in the clay-mineral fraction of these rocks range from near 100 ppm in core 6 down to 60-70 ppm in cores 4 and 5, and then up to 183 ppm in core 2. Cores 4-6 are interpreted as brackish, being more saline downward, and core 2 appears to represent a marine unit.

The analyses were made by E. L. Couch.

R. B. Ross

By

In Duplicate ✓
ELC:jbw

cc: RBR
WMZ
IHM
ELC

TABLE I
Aquarius No. 1 Well, Australia

Core No.	Depth (Feet)	Boron (ppm)	Clay Mineralogy*	Lithology	Interpretation
2	1500	183	K+C, M, (I)	Limestone	Marine
	1506	120	K+C, M, (I)	(5% insol.)	
4	2062	72	<u>M</u> ,K+C, (I)	Argillaceous Limestone (25-35% insol.)	Brackish
	2068	76	<u>M</u> ,K+C, (I)		
	2074	68	<u>M</u> ,K+C, (I)		
5	2895	66	<u>M</u> ,K+C, (I)	Calcareous clay (50-70% insol.)	
	2907	71	<u>M</u> ,K+C, (I)		
	2919	65	<u>M</u> ,I, (K+C)		
6	3430	82	M,K+C, (I)		
	3448	93	<u>K+C</u> ,M,I		
	3452	92	<u>M</u> ,K+C, (I)		
	3458	97	M,K+C, (I)		
7	3967	65	M,K+C	Sandy Clay	
	3973	101	K+C,M, (I)		
10	5069	152	K+C,I	"Glaucconitic" sandstone	Marine
11	5412	178	I,K+C,M		
	5420	143			
	5428	153			
	5432	176			
12	5758	0	<u>M</u> , (K+C)	Red and Brown Clay	Continental
	5770	2			
	5776	0			
13	6312	0	<u>M</u> , (K+C)		
	6321	0			
	6330	0			
14	6815	0			
	6824	0	<u>M</u> , (K+C)		
	6833	0			
15	7731	0			
	7349	0			
16	7830	2	<u>M</u> , (K+C)		
17	8238	1	<u>K+C</u> , (I) , (Mx)		
18	8621	7	<u>K+C</u> ,I, (Mx)		
20	8691	57	I, K+C,	Black shale	Brackish?

*Clay minerals listed in approximate order of decreasing abundance.

M = montmorillonite

K+C = kaolinite plus chlorite

I = illite

Mx = mixed-layer clay

— = dominant

== = very dominant

() = very minor

Q/4P/45.

CSIRO DIVISION OF MINERAL CHEMISTRY

AQUARIUS NO. 1 WELL, CAPRICORN EMBAYMENT, QUEENSLAND

Cuttings supplied by Australian Gulf Oil Co.

Examination of coals from Tertiary sediments

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J.D. Brooks

2nd July, 1970

CR 2438

CR. 2438 (H)

FROM J. E. Warren

AT Houston

IN REPLY
REFER TO

4431C2403

TO E. K. Ericson

AT Sydney

DATE

August 22, 1969

Special Studies-Aquarius #1
Q/4 P Samples

In compliance with Dr. T. C. Wilson's letter dated December 18, 1968 we are sending you by this letter the results of our study. The number of palynomorphs present in the examined well were adequate to date the section but would be rated fair to poor if compared to normal frequencies. All data were obtained from cores, therefore contamination was not a factor.

The section below 1999' and above 5770' could be further subdivided using palynology if desired. Our instructions from Dr. Wilson, however, limited our investigation to the barren zone below 5770'. We did not feel we had the authority or that any value would be gained by a more finite breakdown of the Miocene - Eocene section.

Samples Examined and Age Assignment

<u>SAMPLE</u>	<u>DEPTH (feet)</u>	<u>AGE</u>	<u>REMARKS</u>
Core 1	1000 - 1002.6	Pleistocene	Foraminifera Report
2	1500 - 1503	Lower Pliocene	Foraminifera Report
3	1999 - 2001	Upper Miocene	Foraminifera Report
4	2060 - 2068	Upper Miocene	Foraminifera Report
5	2907 - 2910	Miocene	Foraminifera Report
6	3452 - 3454	Miocene?	Foraminifera Report
7	3967 - 3976	Eocene	
10	5069 - 5072	Eocene	
11	5425 - 5427	Eocene	
12	5770 - 5773	?	No th. Diagnostic
13	6321 - 6324	?	Barren
14	6824 - 6830	U. Cretaceous (Maestrichtian)	
15	7343 - 7349	U. Cretaceous (Maestrichtian)	
16	7830 - 7833		Barren
17	8238 - 8240		Barren
18	8615 - 8616		Barren
20	8691 - 8694		Barren

Observations

Cores 20, 18, 17, & 16

The lower four cores were barren of palynomorphs. This interval did yield

recognizable organic matter which was altered to stages 4 and 5 on our thermal alteration index, see data sheet on kerogen.

Cores 14 & 15

These two cores are dated as Upper Cretaceous based on limited floral recovery. The ranges of selected species are plotted on the two attached range charts. No microplankton were recovered suggesting that this sequence is non-marine.

Further evidence for these cores to be older than the overlying ones is the darker color of the spores and pollen. There is a preservation break between Core #14 and the overlying Core #13 at 6312 - 15'. Both stratigraphic ranges of selected species, coupled with the preservational difference suggest an age difference as well as a possible time break. The unconformity suggestion is interpretive because overlying Cores #13 and #12 were barren of palynomorphs, yet did yield organic matter.

Cores 13 & 12

Essentially barren of palynomorphs.

Cores 7, 10, & 11

All of these cores contain the U. Paleocene to Upper Eocene index form Protaacidites pachypolus Cook & Pike (1954). Other forms are also present and their known stratigraphic ranges, while not as restricted as P. pachypolus, don't conflict with an Eocene age assignment.

Core 6

No age assignment attempted in this core.

Cores 3, 4, & 5

All of these cores are dated as Miocene based on the occurrence of the world-wide spore Crassoretitriletes vanraadshooveni Germeraad, Hopping et Muller (1968). Along with this cosmopolitan spore is found Varrucatosporites usmensis Van Der Hammen (1956). These forms have been reported from the Globeratalia foshi foshi zone in South America, Nigeria, and Borneo. Current foraminifera data from the Aquarius cores corroborate this Miocene age.

Cores 1 & 2

These cores are dated on Foraminifera as Pleistocene and Lower Pliocene respectively, palynology can offer nothing more definitive.

Discussion of Results

The original objective of the palynological examination was to date the section below 5750 feet, which was the lowest point foraminifera had been recovered.

The 5770 - 6324 feet, (Cores #12, #13) were essentially barren of palynomorphs. Core #14 was dated as Upper Cretaceous based on the occurrence of selected palynomorphs shown on the attached range charts. Above this interval the rocks are dated as Eocene based on the occurrence and abundance of P. pachypolus. This form was originally thought to be an Eocene index fossil, but a recent comprehensive study by Harris, 1965

reported P. pachypolus from the Princetown member of the Dilwyn Clay of Upper Paleocene age. This extends the range from Upper Paleocene to U. Eocene of P. pachypolus. The lower microfloral assemblage of Harris from the Pebble Point formation of the Dilwyn Clay is characterized by the Triorites edwardsii, Camazonosporites bullatus, and Dacrydiumites ellipticus, and none of those were identified. This is of course negative evidence for assuming that the Paleocene is not present in this hole. The Paleocene could be represented by the barren interval 5770 - 6324 feet, Cores #12 and #13.

All of the samples from the rocks dated as Tertiary yielded microplankton along with the palynomorphs, while those rocks dated as Upper Cretaceous yielded only palynomorphs.

The above reported study was done by Mr. J. D. Burgess.

J. E. Warren

By: Grant Steele

cc: M. J. Hill - Pittsburgh

REFERENCES

- Cookson, Isabel C. - A PALYNOLOGICAL EXAMINATION OF NO. 1 BORE, BIRREGURRA, VICTORIA, Reprinted From Proc. Roy. Soc. Victoria, Vol. 66, (New Series) issued separately December 1, 1954.
- Couper, R. A. - NEW ZEALAND MESOZIC AND CAINOZOIC PLANT MICROFOSSILS, New Zealand Geological Survey Paleontological Bulletin 32, September, 1960.
- Harris, Wayne K. - BASAL TERTIARY MICROFLORAS FROM THE PRINCETOWN AREA, VICTORIA, AUSTRALIA, Sonder-Abdruck aus Palaeontographica Beitrage zur Naturgeschichte Der Vorzeit, Band 115. Abt. B, 1965.

CORE # 14 6833-35'

EUROPEAN EQUIVALENTS	N.Z. SERIES	N.Z. STAGES
PLEISTOCENE	WANGANUI	NUKUMARUAN (UPPER)
		NUKUMARUAN (LOWER)
PLIOCENE		WAITOTARAN
	TARANAKI	OPOITIAN
		KAPITEAN
		TONGAPORUTUAN
MIOCENE	SOUTHLAND	WAIAUAN
		LILLBURNIAN
		CLIFDENIAN
		ALTONIAN
U M L OLIGOCENE	PAREORA	AWAMOAN
		HUTCHINSONIAN
		OTAIAN
	LANDON	WAITAKIAN
		DUNTRONIAN
		WHANGAROAN
EOCENE	ARNOLD	RUNANGAN
		KAIATIAN
		BORTONIAN
EOCENE	DANNEVIRKE	PORANGAN
		HERETAUNGAN
		MANGAORAPAN
		WAIPAWAN
PALEOECENE	MATA	TEURIAN
DANIAN		HAUMURIAN
MAESTRICHTIAN		PIRIPAUA
SENONIAN	RAUKUMARA	TERATAN
		MANGAOTANEAN
		AROWHANAN
TURONIAN	CLARENCE	NGATERIAN
CENOMANIAN		MOTUAN
		URUTAWAN
ALBIAN		COVERIAN
NEOCOMIAN	TAITAI	KORANGAN
		MOKOWIAN

Potacidites cf. scabroatus
Tricolpites cf. lilleyi
Tricolpites sp. indet.
Gleicheniadiella
Lycopodium verrucatus
Chomotriletes sp.
Dacrydium nova mexicanum
Dacrydium prae-cupressinoides
Podocarpidites cf. mawsonii
Microcachrydites sp.
Trisaccites antarcticus
Trisaccites microsaccatus

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com J. E. Warren
o E. K. Ericson

AT Houston
AT Sydney

IN REPLY
REFER TO 4431C2403
DATE August 22, 1969

Kerogen Analysis Aquarius #1

Kerogen examination of the Aquarius cores is an attempt to relate visual properties of the recovered organic matter to oil source potential. Also, to relate regional thermal history, based on organic matter color, to the likelihood of finding commercial hydrocarbon accumulations.

The attached data sheet summates observations made while examining these organic residues. You will note that there is a darkening of organic matter down hole along with an increase in alteration index to stages 4 and 5 in cores 16 through 20. The alteration stage 4 represents severe thermal alteration and reduce the likelihood of finding anything but dry gas, while stage 5 almost precludes any hydrocarbon retention.

The initial type of organic matter deposited is interpreted to be important. Two broad types of organic matter can be differentiated, structured plant debris derived from terrestrial sources, and amorphous organic matter derived from an aquatic environment. The chemistry of these two types suggests that the terrestrially derived debris is more apt to source gas, while the amorphous material is more like liquid hydrocarbons. Organic matter recovered from Aquarius cores was all of the terrestrial type, which is not promising in the context of source rock evaluation.

The source potential of this organic matter is rated poor for liquid hydrocarbons. The gas potential would be rated good except in the lower part of the hole where thermal alteration has proceeded too far to make attractive source beds even for gas.

The above kerogen evaluation was made by J. D. Burgess.

J. E. Warren

By: *Grant Steele*
Grant Steele

A = ABUNDANT (10 +)
F = FREQUENT (7-10)
S = SPARSE (4-7)
R = RARE (1-3)
✓ = PRESENT (ANY AMOUNT).
() = REWORKED