COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

PETROLEUM SEARCH SUBSIDY ACTS

Publication No. 41

PHILLIPS-SUNRAY BUCKABIE No. 1, QUEENSLAND

OF

PHILLIPS PETROLEUM COMPANY

AND

SUNRAY MID-CONTINENT OIL COMPANY

**Issued under the Authority of Senator the Hon. W. H. Spooner,
Minister for National Development
1962**

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

Minister: SENATOR THE HON. W. H. SPOONER, M.M.

Secretary: H. G. RAGGATT, C.B.E.

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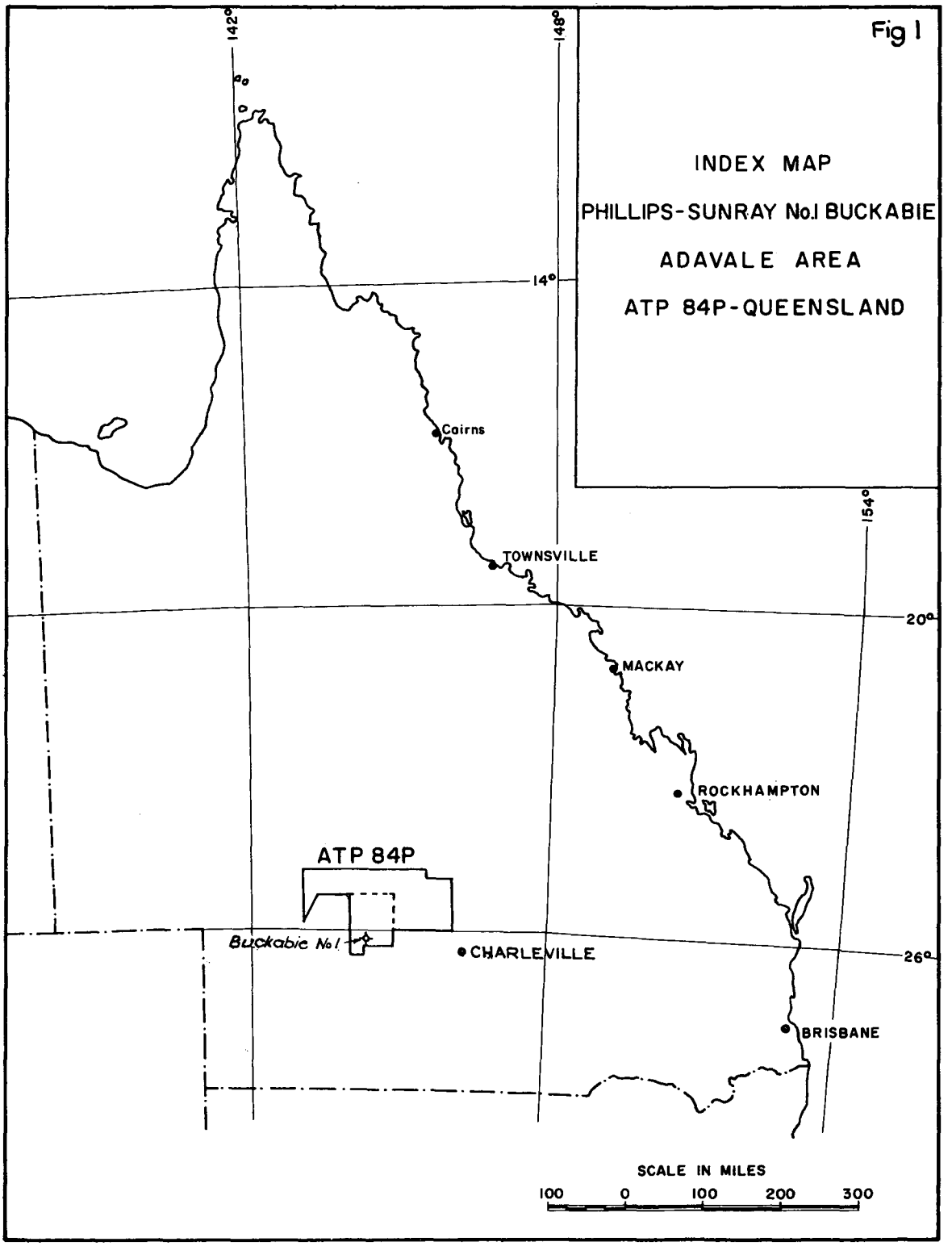

INDEX MAP
PHILLIPS-SUNRAY No.1 BUCKABIE
ADAVALE AREA
ATP 84P-QUEENSLAND
142°
148°
154°
14°
20°
26°
Cairns
TOWNSVILLE
MACKAY
ROCKHAMPTON
ATP 84P
Buckabie No.1
CHARLEVILLE
BRISBANE
SCALE IN MILES
100 0 100 200 300

BUCKABIE No. 1 WELL COMPLETION REPORT

by

W.L. Kitsman, J.H. Lewis, and S.M. Rowe

SUMMARY

Phillips Petroleum Company-Sunray Mid-Continent Oil Company Buckabie No. 1 Well was drilled from 1st May to 25th July, 1961 to a total depth of 9,070 feet. A normal Mesozoic section was penetrated from the Winton Formation on outcrop through the Walloon Formation, which at 5,216 feet lies unconformably on a series of continental clastic strata of undetermined age, here referred to as the 'Buckabie beds'. The well was completed as a dry hole after penetrating dense, steeply dipping, slightly metamorphosed mudstone at 8,810 to 9,070 feet. Twenty-three cores were cut and the well was logged with electric, radiation, and acoustic tools. No appreciable shows of oil or gas were obtained and five drillstem tests failed to recover formation fluids of any kind.

INTRODUCTION

Buckabie No. 1 was drilled on the crest of a structure mapped by seismic methods to determine the petroleum prospects in a thick sedimentary section. The formations of Cretaceous and Jurassic age in the upper 5,000 feet were fairly well known from water bore data. Regional seismic surveys indicated that the known section of the Great Artesian Basin overlies, with angular unconformity, stratified rock up to 15,000 feet thick. This deeper sequence had not been penetrated by the bit and its age and lithology were completely unpredictable. Continuity of seismic reflections suggested uniform lithology over wide areas which in turn suggested that at least part of the section might be marine. Thick sections of Palaeozoic formations are known to underlie the Mesozoic sediments unconformably at the eastern, western and southern edges of the basin but physical continuity or age correlation could not be assumed confidently between them and the deep seismic section in the vicinity of Buckabie.

WELL HISTORY

General Data

Well Name and Number:	Phillips-Sunray Buckabie No. 1
Location:	Latitude 26°11'40" South, Longitude 144°16'15" East, Queensland, Australia. Sheet G/55-9, Quilpie 1:250,000, Australian National Grid.
Name and address of Tenement Holder:	Phillips Petroleum Company and Sunray Mid-Continent Oil Company, 30 Tank Street, Brisbane, Queensland, Australia.
Details of Petroleum Tenement:	Authority to Prospect 84P.
District:	Warrego
Total Depth:	9,070 ft

General Data (cont.)

Date drilling commenced:	1st May, 1961
Date drilling completed:	8th July, 1961
Date well abandoned:	20th July, 1961
Date rig released:	25th July, 1961
Drilling time in days to Total Depth:	69 days
Elevation:	Ground 723.8 ft A.S.L. Rotary Kelly Bushings 737.7 ft A.S.L.
Status:	Abandoned by placing cement plugs from 8,230 ft to 7,920 ft, 5,825 ft to 5,625 ft, 245 ft to 145 ft, and welding steel plate on top of 9-5/8" casing.

Drilling Data

Drilling contractor:	Delta Drilling Company, Piccadilly Arcade, Brisbane, Queensland, Australia.
Drilling rig:	National Model 130
Rated:	16,000 ft w/4 1/2" drillpipe 20,000 ft w/3 1/2" drillpipe
Motors:	5 Superior PTD-6 Diesel rated at 325 BHP each at 900 rpm
Mast:	142 ft Lee C. Moore Cantilever type rated 830,000 pounds with 12 ft substructure
Pumps:	2-Ideal C350 7 3/4" x 18" duplex pumps driven off compound. Rated at 495 horsepower each. 1-Ideal C250 7 1/4" x 15" duplex pump rated at 320 horsepower independently driven by 1 PTD6 Superior diesel engine.
Blowout Preventer Equipment:	1-Hydril GK 12" Series 900 blowout preventer 1-Hydril GK 10" Series 1,500 blowout preventer 2-Shaffer Model 34 18" Series 600 single gates w/18" Series 600 connecting spool 1-Shaffer Model B12" Series 900 double gate hydraulic blowout preventer 1-Shaffer Model B10" Series 1,500 double gate hydraulic blowout preventer 1-Hydril Model HB 17-K80 automatic pump accumulator unit 1-Hydril triple unit control manifold

Hole sizes and depths:

26" hole to 49' R.K.B.
17 1/2" hole to 802' R.K.B.
12 1/4" hole to 5,725' R.K.B.
8 5/8" hole to 9,070' R.K.B.

Casing details:

Size:	20" Cond.	13 3/8"	9 5/8"	
Weight:	94lb./ft	48lb./ft	36lb./ft	40lb./ft.
Grade:	H40	H40	J55, N80	
Range:	1	2	2, 3	
Setting Depth:	48'	799'	5725'	

Casing and Cementing Details:

Size:	20"	13 3/8"	9 5/8"
Setting Depth:	48'	799'	5725'
Quantity Cement (Sacks)	125	775	2000
Cemented to:	Surface	Surface	2006'
Method used:	Displacement	2 plug	2 plug

Drilling Fluid:

Type:	Low solids, low viscosity Driscose mud
Average Wgt:	11-11.9 pounds per gal.
Treatment:	Driscose, caustic, barytes, Q Broxin, tannin

Average Weekly Analysis:

Wgt: 11.9 pounds per gal.
Vis: 45 sec.
Water Loss: 4.5 cc
Filter Cake: 1/32"
pH: 9
Sand content: 0.5%

Water supply: Constructed earthen dam and trapped surface water adjacent to location.

Perforating and shooting record: Nil

Plugging back and squeeze cementation jobs: In the course of testing and abandoning well, cement plugs were spotted through 4 1/2" drillpipe as follows:

	Amount	Depth	Remarks
(1)	105 Sacks	8030' to 8230' *	Open hole
(2)	105 Sacks	7920' to 8091'	Open hole
(3)	85 Sacks	5625' to 5825'	Across 9 5/8" casing shoe
(4)	34 Sacks	145' to 245'	In 9 5/8" casing

* Plug 8030 ft to 8230 ft. drilled off to 8091 ft for drillstem test anchor seat. Plugs (1) and (2) were tested by setting 30,000lb. weight on plug.

Fishing Operations:	After reaming 12 1/4" hole to 5,475 ft and while going in the hole with a new bit, the 1 1/4" drilling line broke when 9 stands off bottom. Travelling blocks, elevators and drillpipe fell to derrick floor parting 4 1/2" drillpipe 290 ft below rotary table. Went in with 12 1/4" bit and found top of 4 1/2" drillpipe at 1,136 ft. Ran overshot with jars and engaged fish. Could not jar loose. Ran Welex free point indicator and found fish free at 5,064 ft. Ran Welex string shot and backed off at 5,016 ft. Pulled out of hole. Ran in with jars, 15-6 1/4" drill collars and open ended joint. Screwed into fish and jarred loose. Recovered all of fish.
Side-tracked Hole:	None

Logging and testing:

Ditch Cuttings:

Samples were taken by Core Laboratories Inc. out of mud passed from the flowline over a shale shaker in their logging unit. The samples were taken at two to ten foot intervals depending on the drilling rate, examined under a binocular microscope and tested for fluorescence and gas content. The samples were sacked in ten foot intervals, the depths marked on the sacks being true depth which was calculated from the lag time. The lag time was established at frequent intervals by putting a tracer in the mudstream and timing the travel from derrick floor to shale shaker. This interval less 15 percent for travel down the drillpipe was taken as the lag time.

Coring:

Coring was carried out in accordance with the proposed programme with the exception that a core was not cut in the transition between the Tambo and Roma Formations, as the transition was not recognised in the ditch cuttings. Cores were taken at the base of the Winton Formation (Core No. 1), in the Transition Beds of the Blythesdale Group (Core Nos. 2 and 3: No. 2 no recovery), in the Fossil Wood Beds (Core No. 4), and Gubberamunda Sandstone, members of the Blythesdale Group (Core No. 5). Core No. 6 at 5,226 feet was taken following a drilling break in sandstone underlying the Walloon Coal Measures. Continuous Cores Nos. 7 to 14 from 5,500 to 5,620 feet were taken to intersect the unconformity expected at 5,600 feet from seismic evidence. Due to seismic velocities being lower than expected, the unconformity was actually met at 5,216 feet. Seven more cores were taken in the pre-Jurassic sediments and two in basement.

In all, twenty-three cores were cut for a total footage of 308 feet. Of the footage cut 203.2 feet were actually recovered, giving a percentage recovery of 66%. A Hughes type J core barrel with 7 7/8" hard formation cutter heads was used for cores 1 through 22 with the following exceptions: Cores Nos. 1 and 2, 7 1/2" soft formation cutter head Core No. 3, 7 1/2" hard formation cutter head; Core No. 8, 7 7/8" soft formation cutter head. Core No. 23 was obtained with D & S diamond core barrel and Truco 8 9/16" PD2M diamond core head. Description of cores may be found in Appendix 3.

Sidewall Cores:

A series of twenty sidewall cores were planned in the Mesozoic section for palynological and stratigraphic studies. However, the hole was completely bridged over at the top of the Blythesdale Group so that lower depths could not be reached. Previous difficulty in running the caliper tool, with bridging conditions, indicated that reconditioning the hole would not guarantee the safe passage of the sidewall coring tool.

Above the Blythesdale Group, sidewall cores were taken at seven depths. At four of these depths a second core was taken after the first core when questionable recovery was suspected. Actual recovery was 100 percent. The cores from the same approximate depth indicate the rapid variation and alternation typical of the lithology of this section. Description of sidewall cores may be found in Appendix 3.

Electrical and Other Wireline Logging:

Four runs of wireline logs were made by Welex as follows:

	Run 1	Run 2	Run 3	Run 4
Induction Electric	798-5978	5723-8276	8276-9064	
Radioactivity	50-5688	5688-8280	8280-9070	
Acoustic Velocity	50-1120	1000-5750	5723-8276	8276-9066
Caliper	42- 770	793-5706	8250-8650	5716-9069
FoRxo	796-5750	5723-8279	8279-9069	
Guard	5723-9065			
Temperature	150-3000			

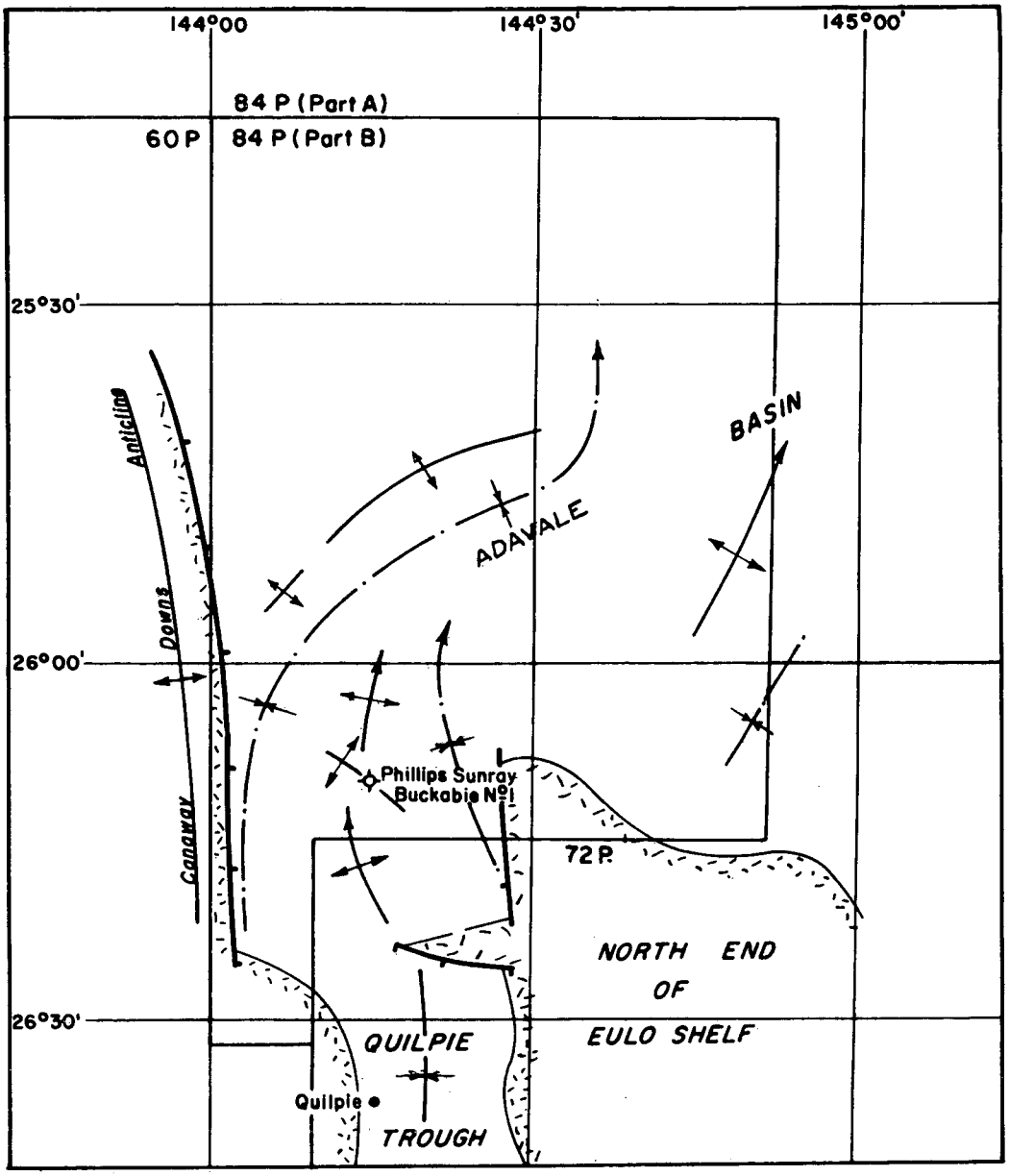
Copies of the complete logs are held at the Bureau of Mineral Resources, Canberra, and are available for inspection.

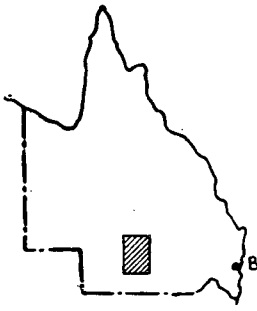
Drilling Time and Gas Log:

Mud logging service was provided by Core Laboratories, Inc. The logging unit was manned by three geologists, each working an eight-hour tour. The service included catching the samples, binocular examination, analysis of cores, continuous recording of any hydrocarbons in the mudstream, and checks for hydrocarbons in the cuttings. Related data, such as rate of penetration, pump pressure, weight on bit, and mud pit level were also continuously recorded. A weekly 'Grapholog' with a vertical scale of 5" = 100', was produced, showing lithology, rate of penetration and continuous hydrocarbon indication log. A copy of this 'Grapholog' is held at the Bureau of Mineral Resources.

Formation Tests:

Five drillstem tests, using Halliburton testing equipment, were run in the open hole below the intermediate casing string to evaluate formation fluids in the pre-Jurassic sediments. DST No. 1 (8398-8560') and DST No. 4 (7888-8090') were unsuccessful as the packers failed to seat properly. DST No. 2 (8489-8650') DST No. 3 (7901-8091') and DST No. 5 (7688-7920') were mechanically successful but no oil, gas, or water was produced.





GEOLOGIC INDEX MAP

DISTRIBUTION OF SEDIMENTARY AND BASEMENT ROCK
AND STRUCTURAL AXES
BENEATH THE GREAT ARTESIAN BASIN

SCALE
16 0 16 32 Miles

FIGURE 2

The formation tests are summarized on the Composite Log (Plate 1) and further details on the Drillstem test data (including Pressure Charts) are held at the Bureau of Mineral Resources.

Deviation Surveys:

As may be seen from examination of the attached composite log, hole deviation checks were run at frequent intervals and did not assume important magnitude at any time. The maximum deviation recorded was 2 1/2° at 6,640 feet. In general, the deviations recorded were less than two degrees.

Temperature Surveys:

No temperature survey, as such, was run. A Welex survey was run to find the top of cement after 9 5/8" casing had been run and maximum temperatures were recorded when electric logs were run. These maxima were: 201°F to 5,985 feet, 236°F to 8,280 feet, and 242°F to 9,070 feet.

Other Well Surveys:

Velocity surveys were run at 5,985 feet and again at total depth. Full details of these surveys and their interpretation may be examined at the Bureau of Mineral Resources.

GEOLOGY

Previous Work

Geological

No surface geological work has been published on the area under consideration. Whitehouse (1954) reviewed the stratigraphy and structure of the Mesozoic Great Artesian Basin, based mainly on water bore data. The Buckabie area lies in the east-central portion of the Thompson Sub-basin defined by Whitehouse. The Tectonic Map of Australia (1960) shows a number of north-south-trending anticlinal axes in this general area. This northerly trend is confined to the west of the large Canaway Downs surface anticline, whereas shallow seismic data indicate predominantly northeasterly trends to the east. Shallow structure, furthermore, appears to be limited to gentle draping over much more marked deep structure.

Geophysical

Seismic reconnaissance surveys carried out by Petty Geophysical Engineering Company under the direction of Phillips Petroleum Company during 1960 and 1961 mapped basins or troughs containing a thick sequence of beds unconformable beneath the Great Artesian Basin. Of these, the Quilpie trough and the south part of Adavale Basin were mapped in semi-detail. The Buckabie prospect, near the junction of the Quilpie and Adavale Basins, was found to be the most favourable for a test of the lower part of the deep section.

Aerial magnetometer surveys also were flown over ATP's 72P and 84P to determine basement structure.

Drilling

No stratigraphic drilling was done on the Buckabie Anticline prior to drilling Buckabie No. 1 Well.

Stratigraphy

Regional Stratigraphy:

The Buckabie Anticline lies in the central part of the Mesozoic Great Artesian Basin. Geophysical surveys indicate that this basin covers and obscures the older Adavale Basin (Figure 2). This older basin appears to be bounded on the west by a series of surface anticlines or horsts which were active both before and after Mesozoic deposition, and on the south and south-east by the Eulo-Nebine Shelf. The northern and eastern limits have not been determined.

The nearest surface outcrop of sediments older than the Great Artesian Basin sequence is in the Springsure area 200 miles to the north-east. This section has been described in various reports which in turn have been summarized by Hill (1957). The sediments exposed are approximately 30,000 feet thick, range in age from Triassic to Middle Devonian, are predominantly of continental clastic origin, and include several unconformities. Marine strata are restricted to the Devonian with the exception of one thin marine incursion in the Middle Permian. The sequence rests on the Anakie Metamorphics, possibly early Palaeozoic in age.

Four wells and one water bore within a radius of 250 miles of Buckabie No. 1 terminated in sediments older than the Mesozoic Great Artesian sequence. Innamincka No. 1 (Ryan, 1961), 225 miles south-west of Buckabie No. 1, penetrated 5,587 feet of Devonian (?) varicoloured shales and fine-grained sandstone. D.F.S. Betoota No. 1 (Harrison et al. 1961), 250 miles west-north-west of Buckabie No. 1, penetrated 4,067 feet of steeply dipping red and green greywacke, shale and conglomerate of assumed early Palaeozoic or Proterozoic age. W.O.L. No. 3 Warbrecan (Whitehouse 1955), 160 miles north-west of Buckabie No. 1, penetrated 796 feet of varicoloured shales which were tentatively correlated with the Carboniferous-Upper Devonian Drummond Group. South Pacific Pty Ltd No. 1 Birkhead (Grissett, 1957), 170 miles north-east of Buckabie No. 1, penetrated over 3,900 feet of shale, sandstone and conglomerate of Permian to possibly Carboniferous age.(1) The Springleigh bore about 115 miles north-north-east of Buckabie No. 1 penetrated approximately 1,750 feet of possible Lower Triassic-Permian pre-Walloon sediments.

Formations Penetrated

Surface soil, duricrust and laterite (14 - 126') — Thickness 112'

Winton Formation (126 - 1126')
Upper Cretaceous — Thickness 1000'

Predominantly grey, soft, silty shale grading to siltstone with interbedded light grey to white, soft, fine-grained, calcareous sandstone; lignite fragments and thin beds throughout.

Footnote by Bureau of Mineral Resources

(1) The upper limit of known Permian on palaeontological evidence is at 2,630 feet; below this depth approximately 2,500 feet of pre-Mesozoic sediments were penetrated; pre-Permian fossils were recognised at 5,000 feet.

Tambo and Roma Formations (1126 - 3164')

Lower Cretaceous — Thickness 2033'

Grey shale, with interbedded silty shale, siltstone and fine-grained sandstone. Traces of brown dense microcrystalline limestone. Carbonaceous and shell fragments throughout, with glauconite common in the predominantly shale section below 1,747 feet. The most pronounced lithologic change occurs at 1,747 feet, and may indicate the boundary between Upper Albian siltstones, sandstones and shales and Lower Albian dark grey shales. The Toolebuc equivalent at the base of the Tambo is probably represented by dark brown calcareous white-speckled shale. This shale (2,342 - 2,354' by Gamma Ray) is more radioactive than surrounding shales, and for lack of other means, the top of the Roma Formation has been chosen at the base of this shale.

Blythesdale Group (3,164 - 4,808')

Lower Cretaceous-Jurassic — Thickness 1,644'

Transition Beds (3164 - 3434') — Thickness 270'

Interbedded grey silty slightly glauconitic shale, light grey siltstone and very fine to medium-grained friable sandstone. Carbonaceous fragments common. Some interbeds with abundant shell fragments. Trace of coal.

Mooga Sandstone (3,434 - 3,952') — Thickness 518'

White sandstone, fine to coarse-grained, sub-angular to rounded, clear to milky quartz, some salt-and-pepper, poorly consolidated, some calcareous cement, with interbedded grey shales and carbonaceous siltstones towards base.

Fossil Wood Beds (3,952 - 4,106') — Thickness 154'

Hard, thinly laminated, grey carbonaceous shale, light brown, slightly micaceous shale with thinly interbedded light grey siltstone and fine to medium-grained sandstone.

Gubberamunda Sandstone (4,106 - 4,808') — Thickness 702'

White sandstone, fine to coarse-grained, poorly consolidated to compacted, angular to well rounded, moderately to poorly sorted, with interbedded white, soft, silty shale and brown lignitic shale from 4,240 - 4,410 feet.

Walloon Coal Measures (4,808 - 5,216')

Jurassic — Thickness 408'

White, buff and pale green sandstone, mainly very fine to fine-grained, with interbedded grey, lignitic shales with traces of coal.

'Buckabie beds' (5216 - 8810') (informal terminology)[2]

Undetermined age — Thickness 3594'

Upper sandstone unit (5216 - 7726') — Thickness 2510'

Sandstone, mainly reddish-brown with thin white, pinkish-orange and light orange beds, buff coloured and clean in upper 50 ft; poorly sorted, fine to coarse-grained, silty clayey matrix, predominantly quartzose, angular to rounded grains frequently frosted, slightly to moderately calcareous, low porosity; minor red-brown, maroon, green and purple shales in lower part of the section.

Shale-sandstone unit (7726 - 8540') — Thickness 814'

Varicoloured (red, green, grey-purple, maroon) micaceous shales finely interbedded with white, pale green and light brown hard calcareous siltstone, occasionally mottled and laminated with red siltstone and green, white, pink and red fine-grained sandstone.

Lower sandstone and conglomerate unit (8540 - 8810') — Thickness 270'

Sandstone, reddish-brown though mainly white in upper 40', normally coarse-grained but often poorly sorted with fine and medium grains and quartzite pebbles and cobbles, predominantly clear quartz with variable amounts of orange grains, clayey matrix giving low porosity.

Basement (8810 - 9070') — Thickness 260'+

Unknown age

Phyllitic mudstone, green and grey, lustrous, containing chlorite, sericite, and clay minerals with interbedded fine to medium-grained quartzitic sandstone dipping at 75 - 80°. Strong steep slickensiding. Poorly developed slaty cleavage at acute angle to bedding.

Structure

Seismic surveys outline the Buckabie Anticline as a cross-fold on a large north-plunging anticline which has a relief of 6000 to 7000 feet on a deep phantom horizon (Figure 4). The closure on this horizon for the Buckabie Anticline is 450 feet over an area of approximately 4 miles by 2 miles. The seismic structure map on the Lower Cretaceous Blythesdale Group (Figure 5) shows a closure of 100 feet over a similar area. The structure as conceived before drilling is shown in Figure 3.

Footnote by Bureau of Mineral Resources

(2) This thick sequence of predominantly reddish-brown arenites, informally designated the 'Buckabie beds' throughout this report (or 'red-beds' in the palynological report appended) underlies known Permian strata but is itself of unknown age.

Relevance to Occurrence of Petroleum

Buckabie No. 1 Well was dry with no significant indication of gas or oil in the gas detectors nor oil fluorescence in the cutting samples. A 'show' zone with 5 to 20 percent yellow fluorescence was found between 3880 and 3930 feet in buff fine-grained sandstone. A moderate fluorescence, and oil cut with carbon tetrachloride, resulted from a crushed sample of this zone, but no increase in gas reading was observed. Mineral fluorescence was also present in this interval. 'Shows' were also logged in white silty clay from 7736-7750 feet and 7796-7818 feet, and in white silty sandstone from 7854-7864 feet. The samples showed a dull pale blue mineral fluorescence and a pale yellow cut with carbon tetrachloride, which are regarded as due to contamination by an asphaltic mud additive and rig grease.

The continental 'Buckabie beds' have no potential as source beds for the generation of petroleum. Examination of ditch cuttings and core analysis showed these beds to have a low porosity, and the poor reservoir characteristics were indicated by the failure of drillstem tests to produce any formation fluids.

Reflection seismic surveys indicate a stratigraphic section beneath the Great Artesian Basin with a maximum thickness of 13,000 feet immediately west of Quilpie and 16,000 feet north of Adavale. The Buckabie No. 1 Well penetrated only 3594 feet of these sediments and thus cannot be regarded as a complete test for this thick sequence.

Porosity and Permeability of Sediments Penetrated

The Lower Cretaceous-Jurassic sequence contains several beds of known porous and permeable nature. These beds are friable to poorly consolidated and some are important aquifers elsewhere. Since no indications of hydrocarbons were noted as these beds were drilled, except for the poor show from 3880 to 3930 feet, no tests for fluid content were made. Electric logs, however, indicate that the formation fluids are fresh water.

Porosity measurements were made by Core Laboratories, Inc. on selected cores of the Gubberamunda Sandstone (Core No. 5) and the 'Buckabie beds' (cores No. 6, 7, 8, 9 and 21).

The average porosity of Core No. 5 is 19 percent. Core No. 6 from the upper 'Buckabie beds' just below the unconformity, has a lower measured porosity but is still noticeably more porous than the lower 'Buckabie beds'. The results of these porosity measurements may be inspected at the Bureau of Mineral Resources.

Open hole tests of the 'Buckabie beds' recovered no formation fluids. This is attributed to low permeabilities resulting from clay occupying intergranular space. A permeability measurement from the most porous interval of Core No. 21 indicated only 37.5 millidarcies, rather tight for potential reservoir beds. No other permeability measurements were made.

Contribution to Geological Concepts as a Result of Drilling

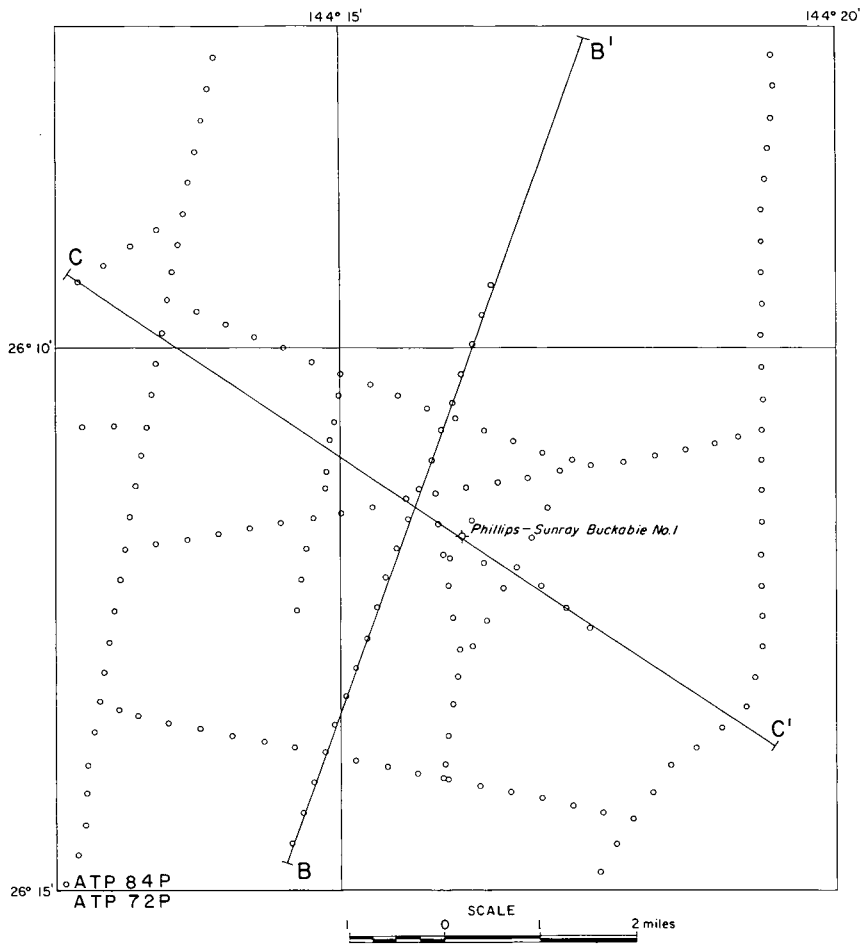
The Buckabie No. 1 Well established the nature of the 'Buckabie beds', between the major unconformity at 5216 feet and basement at 8810 feet, to be a generally uniform epicontinental clastic sequence. Basement for the purposes of petroleum exploration was found to consist of fine-grained, low-grade metamorphic, clastic rocks dipping 75^{o} to 80^{o}.

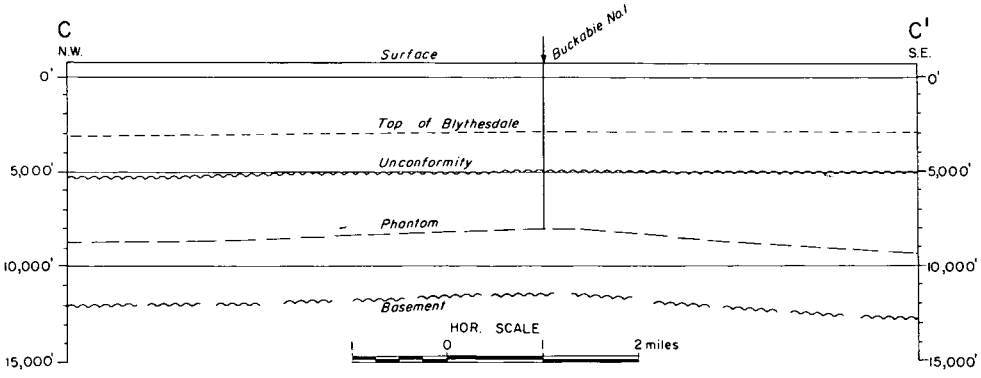
A typical Mesozoic sequence was penetrated to 5216 feet, commencing in the continental shale and sandstone of the Winton Formation, through the marine shale and siltstone of the Tambo and Roma Formations, the paralic to freshwater sandstone and shale of the Blythesdale Group and the freshwater shale and sandstone of the Walloon Coal Measures. Equivalents of the Marburg and Bundamba Formations appear to be absent here, as in the Betoota No. 1 Well.

Buckabie No. 1 penetrated 3594 feet of the 'red-bed' sandstone sequence below an unconformity at 5216 feet; the remainder of the well, from 8810 feet to 9070 feet, was in phyllitic and slaty mudstone. No palaeontological evidence was found to date the 'red-bed' sequence. However, Permian spores were identified above the 'Buckabie beds' in Phillips-Sunray Cothalow No. 1 Well, drilled subsequently to Buckabie No. 1, thus placing the 'Buckabie beds' as pre-Permian in age. A Carboniferous age appears most probable. (see Appendix 4).

REFERENCES

GRISSETT, M.	1957	Final Report SPL Birkhead Well No. 1, Tambo, Queensland. Hycalog Inc., Shreveport, Louisiana, U.S.A. (Unpubl.)
HARRISON, J., et al.	1961	D.F.S. No. 1 Betoota, Queensland, of Delhi-Frome-Santos. Bur. Min. Resour. Aust., Petrol. Search Subs. Act Publ. 10.
HILL, DOROTHY	1957	Springsure - 4 mile Geological Series, Bur. Min. Resour. Aust. explan. Notes. 5.
RYAN, J.C.	1961	Innamincka No. 1 Well, South Australia, of Delhi-Frome-Santos. Bur. Min. Resour. Aust., Petrol. Search Subs. Act Publ. 9.
WHITEHOUSE, F.W.	1954	The geology of the Queensland portion of the Great Artesian Basin. Appendix G to Report on artesian water supplies in Queensland, Dep. Co-ord. Gen. Public Works, Qld Parl. Pap. A, 56-1955.
WHITEHOUSE, F.W.	1955	Geological report on the Warbreccan Deep Bores (in the Oil Permit Area of Westland Oil Co. Ltd.) (Unpubl.).





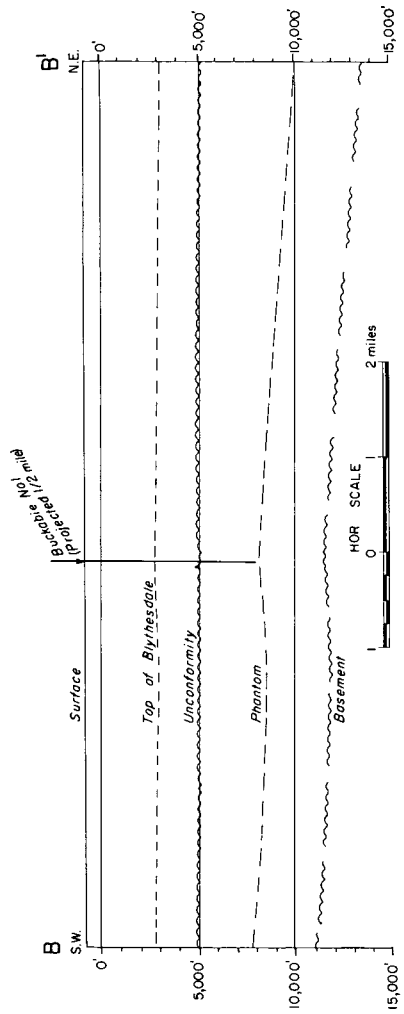


FIGURE 3

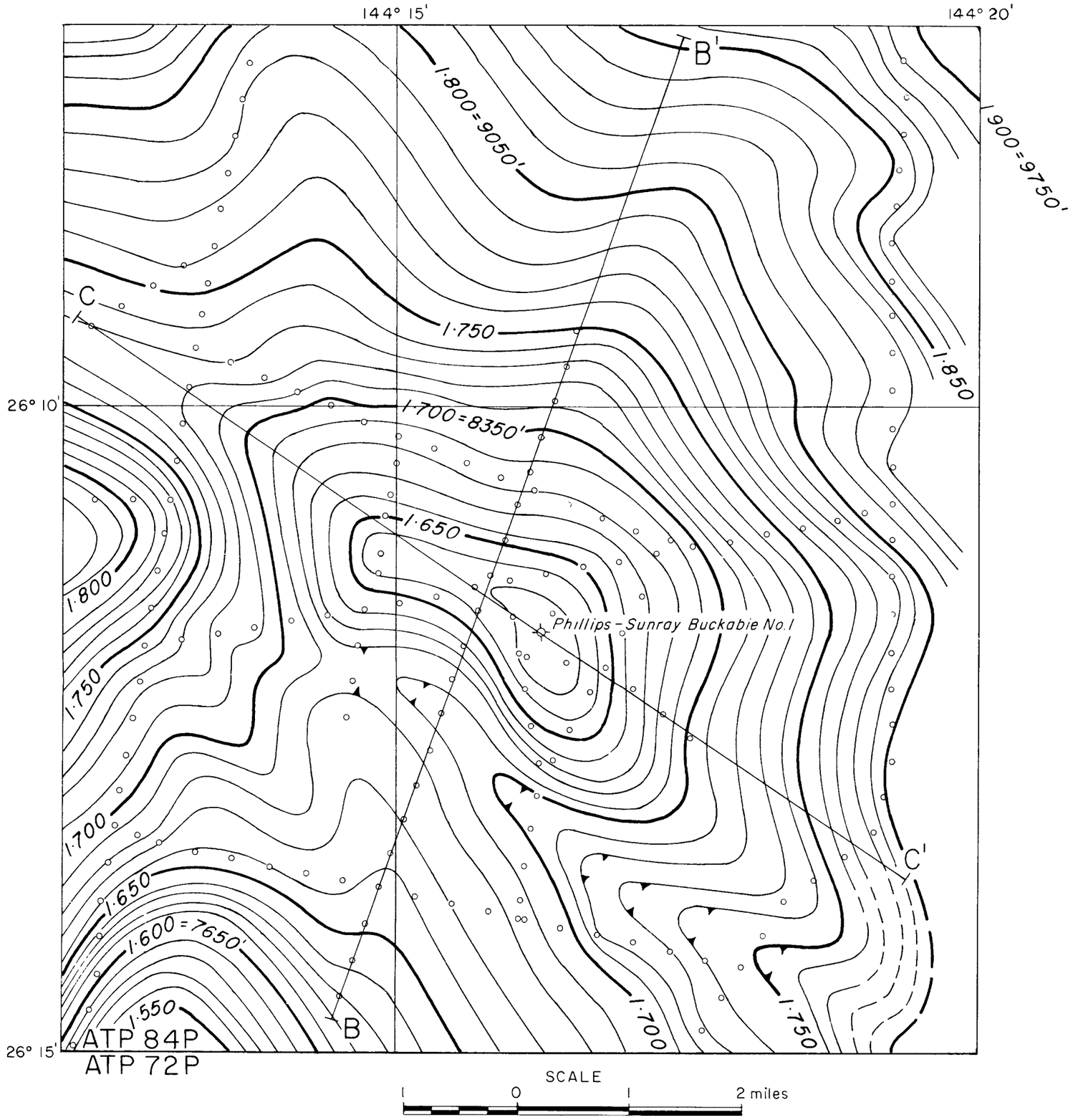
CROSS-SECTIONS

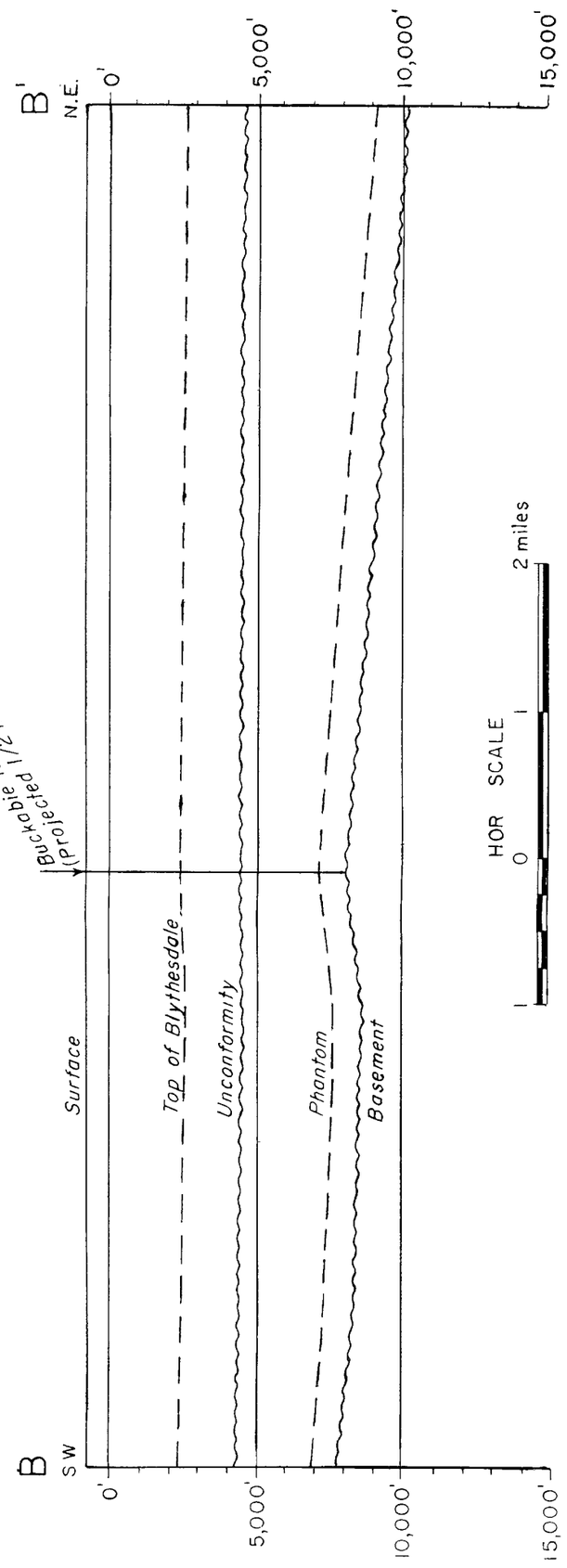
OF

BUCKABIE ANTICLINE

AS CONCEIVED BEFORE DRILLING

ATP 84P-QUEENSLAND





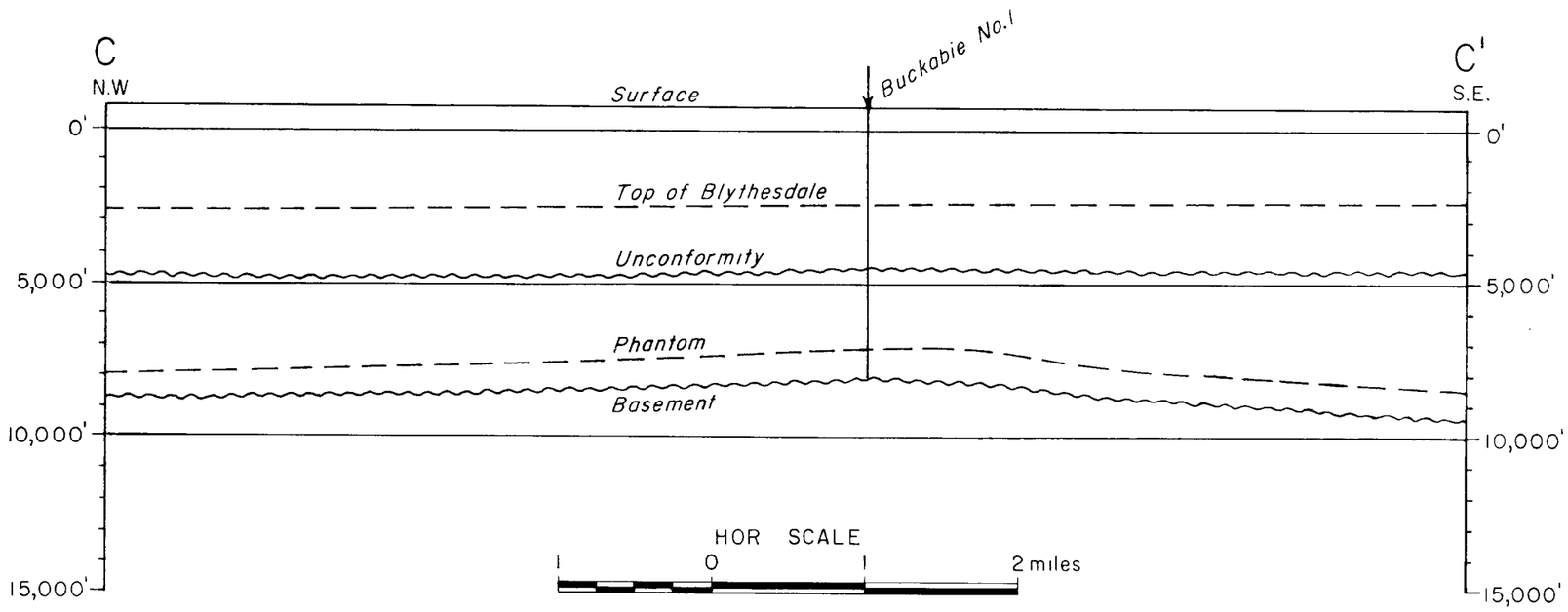


FIGURE 4

STRUCTURE MAP & CROSS-SECTIONS OF BUCKABIE ANTICLINE

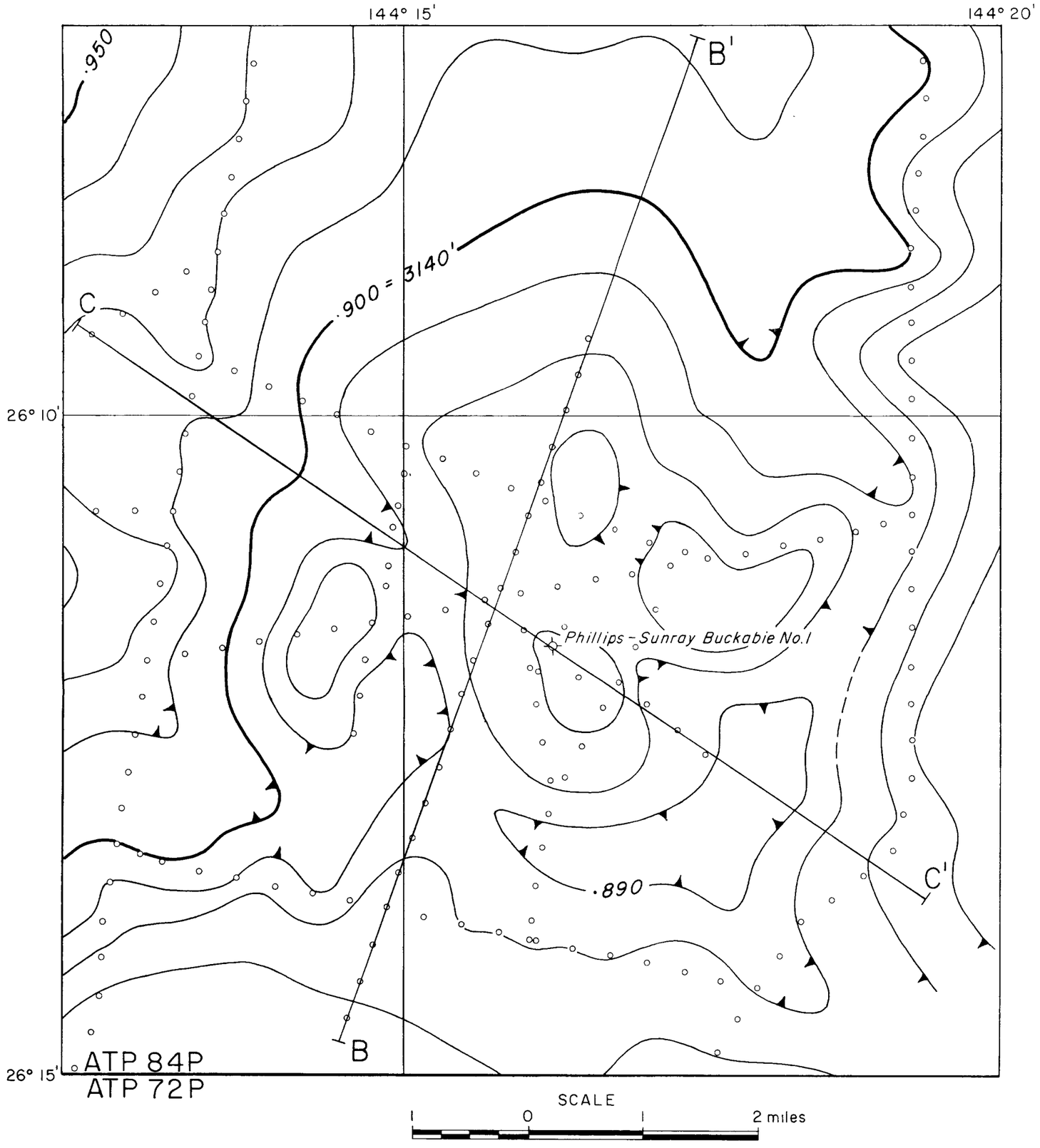
ATP 84P–QUEENSLAND

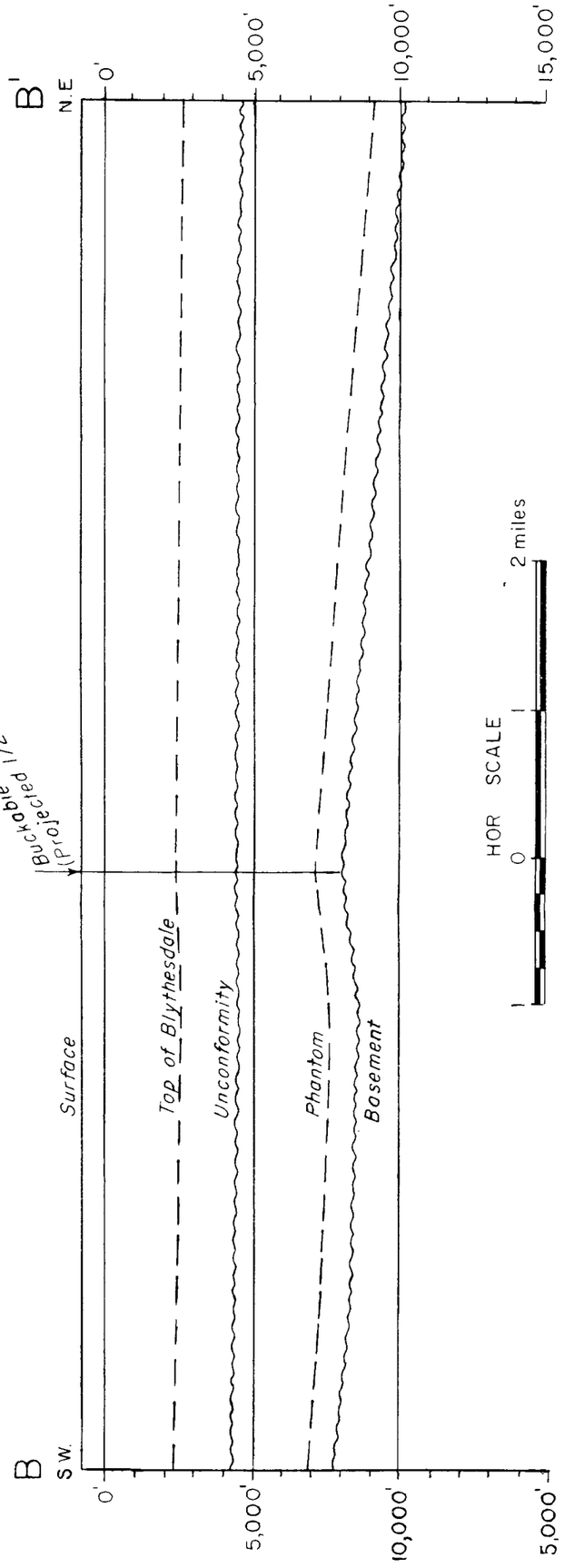
CONTOURS ON A SEISMIC PHANTOM HORIZON

ABOUT 1200 FEET ABOVE BASEMENT

CONT. INT. = ·010 sec = 70' ±

DATUM = 600' A.S.L





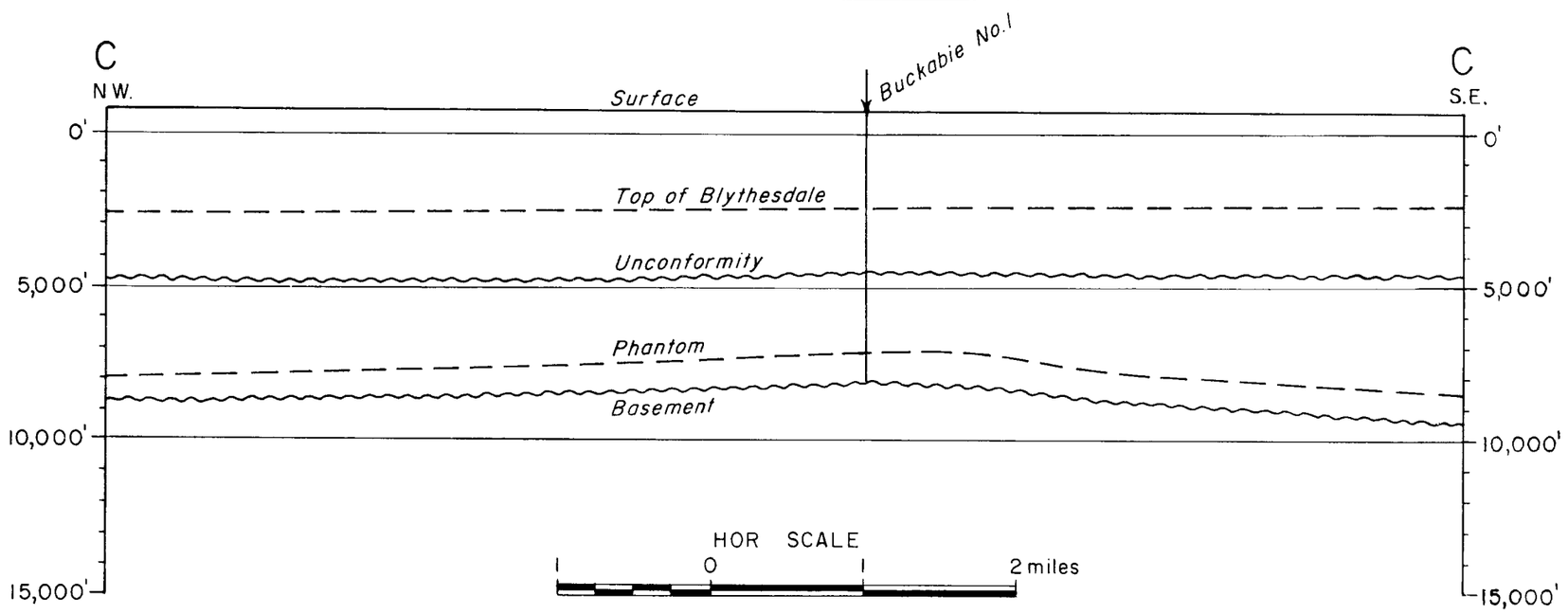


FIGURE 5

STRUCTURE MAP & CROSS-SECTIONS OF BUCKABIE ANTICLINE

ATP 84P-QUEENSLAND

CONTOURS ON TOP OF THE BLYTHESDALE FM.

CONT. INT = ·010 sec. = 36' ±

DATUM = 600' A.S.L.

APPENDIX 1

PETROLOGICAL REPORTS

Samples of cores from near the bottom of the well were examined to determine both the nature of the basement and the source rock of the conglomerate immediately above basement.

Core No. 21 (8542 to 8560 feet): sample from 8542 feet

by

N.C. Stevens, University of Queensland

The specimen is a medium-grained cream coloured sandstone with part of a large included fragment of fine-grained grey sandstone.

The coarser sandstone consists of rounded grains of approximately 1 mm average diameter, in a matrix of relatively coarse calcite. Fragments in the sandstone are quartz, rhyolite and quartzite.

The large fragment is a fine-grained calcareous sandstone consisting largely of angular embayed quartz grains in a cement of calcite and a little chert. Most of the quartz grains are about 0.06 mm in diameter with some coarser to 0.3 mm. There is some untwinned feldspar present, and the accessory minerals include zircon, green-brown tourmaline and a micaceous mineral.

Although the quartz grains are often interlocking, the intergranular calcite does not seem to have recrystallized.

Core No. 22 (9035 to 9043 feet)

by

B.R. Houston, Geological Survey of Queensland

In appearance the rock is massive, dark grey, and very fine-grained. There are a number of shear surfaces, lined with chlorite. Macroscopically, irregular green and light grey bands can be seen in thin section.

Under the microscope, textures are as follows:- Palimpsest; lepidoblastic. The banding represents original bedding; the different beds can be recognised by the differing composition of the bands. Certain of the bands only, display palimpsest texture, i.e. they contain 10 to 15 percent relic sub-rounded to sub-angular phenoclasts, 0.06 to 0.01 mm. The original matrix of these beds now has a lepidoblastic texture as have the other bands.

Constituent minerals consist of quartz and feldspar in relic phenoclasts, and the micas, sericite and muscovite, which display a preferred orientation. ?Quartzofeldspathic material and opaque dust constitute the remainder of the rock.

In composition relic phenoclasts constitute 10 to 15 percent of the coarser bands,

mica 65 to 70 percent and ?quartzofeldspathic material the remainder. Of the finer bands, mica constitutes 50 to 90 percent and ?quartzofeldspathic material the remainder.

This rock is a MICA SLATE which originated by the metamorphism of interbedded siltstone and mudstone.

Core No. 23 (9048 to 9070 feet)

By

J.S. Pittman, Phillips Petroleum Company

In thin section, the sample is seen to be almost entirely composed of silty, sandy, micaceous shale with the bedding indicated by lenses of pure clay shale and by the parallelism of the abundant flakes of muscovite and biotite mica. Within this portion of the rock there is no evidence o metamorphic alteration.

Slick, shiny surfaces on the broken core surface appear to be micro-faults. On a sawed surface, these breaks can be seen to offset the top of one lamina, but not its base nor the adjacent lamina. Possibly the break was refracted to follow the layer that they offset. Additional evidence for this sort of slippage is that the clay minerals seem to be at about a 26 degree angle to the bedding rather than parallel to it as is normal for shales.

APPENDIX 2

THE PALYNOLOGY OF SAMPLES FROM THE PHILLIPS-SUNRAY BUCKABIE No. 1 WELL

by

N.J. de Jersey and R.J. Paten*

INTRODUCTION

The palynological investigation was based on conventional cores, sidewall cores and cuttings. In all, twenty-eight samples were examined; the majority of these were devoid of spores or pollen grains. This was particularly exemplified by the 'red-bed' sequence in the lower part of the well, the sediments of which were entirely lacking in carbonaceous material.

A detailed list of all samples studied is set out in the left hand columns of Table 1.

PALYNOLOGY OF SAMPLES

The detailed palynology of samples from which positive microfossil yields were obtained is set out below.

Cuttings 830 - 840'

Yield : abundant

Araucariacites sp.
Cicatricosisporites australiensis
Corollina
Cyathidites sp.
Cingulatisporites sp.
Dacrydiumites sp.
cf. Entylissa sp.
Foveosporites canalis
Gleicheniadites spp.
Inaperturopollenites sp.
Leiotriletes sp.
L. directus
cf. Liliacidites variegatus
Leptolepidites sp.
Lycopodiumsporites cf. rosewoodensis
L. austroclavitidites
? monoporate pollen grain
Microcachrydites antarcticus
Osmundacidites sp.
Podosporites sp.
Pityosporites sp.
P. grandis
Sphagnumsporites spp.
S. australis
S. tenuis

Sidewall Core 1,060'

Yield : poor

Araucariacites sp.
Cyathidites sp.
Microreticulatisporites parviretis

* Geological Survey of Queensland.

C. australis
Inaperturopollenites sp.
Leiotriletes directus
Microcachrydites antarcticus
Pityosporites elliptica
P. cf. similis
Sphagnumsporites tenuis
Todisporites minor

Cuttings 1,090 - 1,100'

Yield : abundant

Araucariacites sp.
Cyathidites sp.
Entylissa nitidus
Gleicheniadites sp.
G. circinidites
Inaperturopollenites sp.
Leiotriletes directus
Microcachrydites antarcticus
Pityosporites spp.
Podosporites micropteris
Polypodiidites arcus
Sphagnumsporites australis
S. tenuis

Sidewall Core 1,737'

Yield : abundant

Araucariacites sp.
Cyathidites australis rimalis
Cyathidites minor
Cicatricosisporites australiensis
C. cooksonii
Entylissa nitidus
Gleicheniadites sp.
G. circinidites
Inaperturopollenites sp.
Ischyosporites sp.
Leiotriletes directus
L. magnus
Leptolepidites verrucatus
rare unidentified microplankton.
Lycopodiumsporites spp.
L. austroclavitidites
L. cf. rosewoodensis
Microcachrydites antarcticus
Polypodiidites arcus
Pityosporites ellipticus
P. similis
P. cf. grandis
Sphagnumsporites australis
S. tenuis
S. adnatus
Todisporites major
Todisporites minor

Sidewall Core 2,351'

Yield : poor

Acanthotriletes sp.
Araucariacites sp.
Cyathidites australis
Granulatisporites dailyi
Inaperturopollenites sp.
Ischyosporites cf. craterus
Lycopodiumsporites austroclavitidites tenuis
Microcachrydites antarcticus
Osmundacidites cf. wellmanii
Pilosisporites sp.
Pityosporites grandis
Sphagnumsporites australis

Leiotriletes directus
Leptolepidites cf. verrucatus
Todisporites major
Trilobosporites cf. trioreticulosus

Sidewall Core 2,370'

Yield : good

Acanthotriletes levidensis
A. pallidus
Araucariacites sp.
Cyathidites sp.
C. australis
C. minor
Cicatricosisporites australiensis
Inaperturopollenites sp.
Leiotriletes directus
rare unidentified microplankton
Lycopodiumsporites austroclavitidites
Pityosporites sp.
P. elliptica
P. grandis
Pilosisporites sp.
Polypodiidites cf. arcus
Sphagnumsporites australis
Trilobosporites trioreticulosus

Core 3 (3,264')

Yield : abundant

cf. Acanthotriletes pallidus
Apiculatisporites wonthaggiensis
Araucariacites spp.
Baculatisporites truncatus
Ceratosporites equalis
Cirratriradites spinulosus
Cyathidites spp.
C. australis
C. minor
C. crassiangulatus
Corollina sp.
C. torosus
Cingulatisporites sp.
C. cf. paradoxus
C. cf. euskirchensoides
Cicatricosisporites australiensis
C. cooksonii
Entylissa nitidus
Granulatisporites sp.
G. dailyi
G. cf. minor
Ischyosporites spp.
Inaperturopollenites spp.
Leptolepidites sp.
L. verrucatus
Lycopodiumsporites spp.
L. cf. circolumenus
L. triangularis
L. austroclavitidites
Leiotriletes sp.
L. directus
Monolites sp.
Microcachrydites antarcticus
Microreticulatisporites parviretis
Osmundacidites spp.
O. cf. wellmanii
Pityosporites spp.
P. similis
P. cf. grandis
Sphagnumsporites tenuis
S. adnatus
S. cf. clavus
Tsugaepollenites dampieri
Todisporites minor
T. cf. major
Verrucosisporites sp.

Total	Araucariacites spp.	5%
"	Cyathidites spp.	27%
"	Corollina spp.	5%
"	Entylissa sp.	3%
"	Inaperturopollenites spp.	6%
"	Lycopodiumsporites spp.	5%
"	Leiotriletes spp.	4%
"	Osmundacidites spp.	14%
"	Pityosporites spp.	7%
"	Todisporites spp.	3%

Each of remainder less than 3%

Cuttings 5,687' (See 'Discussion')

Yield : good

Acanthotriletes levidensis
Cicatricosisporites cooksonii
Concavisporites sp.
C. cf. infirmus
Cingulatisporites sp.
Corollina sp.
Gleicheniadites circinidites
Inaperturopollenites sp.
Ischyosporites cf. Ischyosporites punctatus
Leiotriletes directus
Lycopodiumsporites austroclavitidites
Polypodiidites arcus
Sphagnumsporites sp.
S. adnatus
Undetermined species of microplankton

DISCUSSION

Cuttings from 830 - 840', 1,090 - 1,100', Sidewall Core 1,060'.

As the sidewall core from 1060 feet gave only a poor yield of spores and pollens, further investigation was based on cuttings from the top 1100 feet of the section. This investigation was concentrated on three levels (230 - 240', 830 - 840' and 1090 - 1100') at which coal and coaly shale were recorded. Coal cuttings were separated from the samples from 230 - 240' and 830 - 840' by flotation in carbon tetrachloride (S.G. 1.58) - contamination from shale was thus eliminated. Insufficient coal could be separated by this method from the sample from 1090-1100' and accordingly it was macerated as a shale. Thus some contamination of this sample from shale cuttings in the top 1100 feet of the well is possible.

Unfortunately, although these samples yielded abundant spores and pollens, study of their microflora was hampered by over-maceration which resulted from the unexpected immaturity of the coals and carbonaceous material in the shales. Consequently no detailed quantitative investigation of the species present has been attempted, and the species listed for two of these samples (830-840' and 1090 - 1100') may not be fully representative of the microflora.

Interesting features of the coals are the relatively small size of the spores and pollens (the majority are smaller than 20 microns in diameter) and the dominance of Gleicheniadites spp. over all other forms present. In the sample 830-840' there is the interesting rare occurrence of Angiosperm pollen grains that can be compared with Liliacidites variegatus (Couper) from the Upper Cretaceous (Maestrichtian) to Oligocene of New Zealand.

The microflora from these samples is typically of Cretaceous type. Evans (1961) following the work of Balme (1957) showed from the study of bore strata in the Great Artesian Basin that Cicatricosisporites australiensis is confined to the Cretaceous marine and fresh-water sequences, while Balme (1957) recorded Microreticulatisporites parviretis from strata not older than Neocomian in Western Australia.

In Buckabie No.1 Well, the samples so far considered are from a sequence, which by its coaly lithology and the absence of marine macrofossils and microplankton, may be assumed to be of fresh-water origin. This sequence overlies marine sediments of Cretaceous age and hence may be identified with the Winton Formation - the upper fresh-water sequence of the Cretaceous sediments in the Great Artesian Basin. Whitehouse (1954) suggested a Cenomanian (lower Upper Cretaceous) age for the Winton Formation which was supported by Evans (1961) who stated that the microflora of the Winton Formation showed little variation from that of the underlying (Albian) Tambo Formation.

Sidewall Cores from 1737', 2351', 2370'.

The Cretaceous age of these samples is indicated by the presence of Cicatricosisporites australiensis (1737, 2370'), Acanthotriletes levidensis (2370'), Trilobosporites trioreticulosus (2370') and Granulatisporites dailyi (2351'). The range of Cicatricosisporites australiensis has been considered in the previous section and Balme (1957) recorded the lower range of Acanthotriletes levidensis as Neocomian. Cookson and Dettman (1957) regarded Trilobosporites trioreticulosus as Aptian-Albian in age. It is recorded elsewhere in Queensland from the Styx Coal Measures (Cookson and Dettman, 1957) where it is associated with Albian microplankton (Cookson and Eisenack, 1958) and from Conorada Ooroonoo No. 1 Well (Evans 1961) where it occurred at the top of the range of microplankton near the base of the Winton Formation. Cookson and Dettman (1957) gave the age of Granulatisporites dailyi as Aptian and ?Albian.

On the presence of Trilobosporites trioreticulosus and the absence of microplankton, the samples from 2370' and 2351' were regarded as from the Winton Formation or alternatively from non-marine horizons interbedded near the top of the marine Cretaceous sequence (de Jersey, interim reports dated 13.6.61, 3.7.61). The sample from 1737' was placed in the Winton Formation (de Jersey, interim report dated 28.8.61) on the absence of microplankton and on the evidence of the lower sample from 2370 feet.

Subsequent re-examination of the samples from 1737' and 2370' identified rare microplankton and hence the samples 1737', 2351' and 2370' are here reassigned to the equivalents of the marine Roma and Tambo Formations.

The examination of the cuttings from the top 1800 feet of the well showed the presence of shelly fragments as high as 1520 feet or doubtfully to 1410 feet and coal seams to a depth of 1100 feet or possibly to 1230 feet. This indicates that the transition from marine to

fresh-water deposition occurred within the strata penetrated between 1100 feet and 1520 feet.

Core 3 (3264')

The presence of Cicatricosisporites australiensis and Microreticulatisporites parviretis (Balme 1957) indicates a Cretaceous age for the sample. A Lower Cretaceous age is indicated by the occurrence of rare Tsugaepollenites dampieri (Balme 1957), Apiculatisporites wonthaggiensis, Ceratosporites equalis, Cirratriridites spinulosus and Granulatisporites dailyi (Cookson and Dettman 1957). Tsugaepollenites dampieri (1% of total spore count) is recorded by Balme (1957) from both the Upper Jurassic and Lower Cretaceous of Western Australia, with 1% or less in the Lower Cretaceous compared wih over 5% in the Upper Jurassic. Evans (1961, p.2) noted that this range of abundance of Tsugaepollenites dampieri is paralleled in the Upper Jurassic and Lower Cretaceous sediments of the Conorada Ooroonoo No. 1 Well in the Great Artesian Basin. At Ooroonoo, this species does not range above the basal portion of the marine beds. An interesting feature of the flora is the abundance of Cyathidites spp. (27%).

A non-marine environment of deposition is suggested by the absence of microplankton from the sample. Consequently it is placed within the upper portion (Lower Cretaceous) of the equivalents of the Blythesdale Group. This evidence supports the positioning of the upper boundary of the Group above 3264 feet by the well-site geologist.

Cuttings from 5687 feet

An Upper Jurassic-Lower Cretaceous age has previously been indicated for the microfloral assemblage from these cuttings (de Jersey, interim report dated 26.5.61). Further evidence from cores indicates that this depth represents a horizon within the 'red beds' which are typically devoid of spores and pollens. The microfossils from this sample are thus now considered to be derived from cavings from considerably higher in the sequence and their evidence on the age of this horizon should be disregarded. This conclusion is supported by the company geologists (H. Heikkila and S. Rowe, verbal communication) who have reported appreciable caving in this section of the well.

CONCLUSIONS

The main results of the investigation are as follows:-

(1) The sediments from 3264 feet upwards are regarded as Cretaceous in age. Correlations are suggested of various horizons within this sequence with the marine and non-marine Cretaceous formations of the Great Artesian Basin on the basis of their microfloral and microfaunal content.

(2) Insufficient evidence and material are available for detailed subdivision of the Cretaceous sediments on the basis of microfloral assemblages. However the investigation has indicated certain lines of research on the problem which it is hoped to follow in dealing with other wells that penetrate the Cretaceous sequence in Western Queensland.

(3) Below 3264 feet is a section of sediments, mainly sandstone, from which two cores (Core No. 4 - 3952 feet and Core No. 5 - 4499 feet) were examined. Both proved to be devoid of spores and pollens. From Core No. 6 (5226 feet) downwards, the sediments are of a distinctive 'red-bed' lithology consisting mainly of red and brown sandstone with some red and grey shale and siltstone. All the cores examined from these 'red-beds' (see Table 1) yielded negligible proportions of carbonaceous material and all proved to be devoid of spores and pollens. Such a thickness of sediments so devoid of plant microfossils finds no parallel in any of the Queensland Permian or Mesozoic sequences so far examined the Geological Survey. Consequently these 'red-beds' are tentatively regarded as pre-Permian in age.

ACKNOWLEDGEMENT

The authors wish to acknowledge the assistance of D. Dearne, Geologist of the Geological Survey of Queensland, who assisted in the investigation of some of the samples.

REFERENCES

BALME, B.E. 1957 Spores and pollen grains from the Mesozoic of Western Australia. C.S.I.R.O. Coal Res. T.C. 25.

COOKSON, I.C. 1947 Plant microfossils from the lignites of Kerguelen Archipelago. B.A.N.Z. Antarctic Research Expedition Report. A (II), (Geology) (8).

COOKSON, I.C. 1953 The identification of the sporomorph Phyllocladidites with Cacrydium and its distribution in southern Tertiary deposits. Aust. j. Bot., 1 (1), 64-70.

COOKSON, I.C. 1953 Difference in microspore composition of some samples from a bore at Comaum, South Australia. Aust. j. Bot., 1(3), 462-473.

COOKSON, I.C. and DETTMAN, M.E. 1957 Some trilete spores from the Upper Mesozoic deposits in the Eastern Australian Region. Proc. Roy. Soc. Vic., 70(2), 95-128.

COOKSON, I.C. and EISENACK, A., 1958 Microplankton from Australian and New Guinea Upper Mesozoic sediments. Proc. Roy. Soc. Vic., 70(1), 19-79.

COOKSON, I.C., and PIKE, K.M., 1954 The fossil occurrence of Phyllocladus and two other podocarpaceous types in Australia. Aust. j. Bot., 2(1), 60-68.

COUPER, R.A. 1953 Upper Mesozoic and Cainozoic spores and pollen grains from New Zealand. Bull. geol. Surv. N.Z. 22.

de JERSEY, N.J. 1960 Jurassic spores and pollen grains from the Rosewood Coalfield. Publ. geol. Surv. Qld., 294.

EVANS, P.R. 1961 A palynological report on Conorada Oorconoo No. 1 Bore, Queensland. Bur. Min. Resour. Aust. Rec. 1961/22 (unpubl.).

WHITEHOUSE, F.W. 1954 The geology of the Queensland portion of the Great Artesian Basin. Appendix G in Artesian Water Supplies in Queensland. Dep. Co-ord. Gen. Public Works, Qld. Parl. Pap. A, 56- 1955.

TABLE 1

SUMMARY OF SAMPLES, AGE DETERMINATIONS AND CORRELATIONS

Depth (feet)	Sample	Lithology	Relative Spore Yield *	Age	Equivalent Formation
830-840	Cuttings	Coal-shale	Abundant	UPPER CRETACEOUS (?Cenomanian)	WINTON FORMATION
1060	Sidewall Core	Grey shale	Poor		
1090-1100	Cuttings	Coal	Abundant		
1123	Core No.1	Siltstone	Barren		
1248	Sidewall Core	Sandstone	Barren		
1655	Sidewall Core	Grey siltstone	Barren		
1737	Sidewall Core	Grey shale	Abundant	LOWER CRETACEOUS	ROMA - TAMBO FORMATIONS
1778	Sidewall Core	Grey shale	Barren		
2351	Sidewall Core	Grey shale	Poor		
2370	Sidewall Core	Grey shale	Good		
3264	Core No.3	Shale	Abundant		BLYTHESDALE GROUP
3963	Core No.4	Siltstone	Barren		
4499	Core No.5	Sandstone	Barren		
5226	Core No.6	Sandstone	Barren	?PRE-PERMIAN 'RED BEDS'	
5505'9"	Core No.7	Sandstone	Barren		
5538'1"	Core No.9	Red-brown sandstone	Barren		
5606'9"	Core No.14	Red-brown sandstone	Barren		
5607'8"	Core No.14	Red-brown sandstone	Barren		
5687'	Cuttings	Cavings	Good		
6900'4"	Core No.16	Red sandstone	Barren		
6904'5"	Core No.16	Red sandstone	Barren		
6907'5"	Core No.16	Red sandstone	Barren		
7312	Core No.17	Red sandstone	Barren		
7640	Core No.18	Red sandstone	Barren		
7751	Core No.19	Red shale	Barren		
7760	Cuttings	Red & grey shale	Barren		
7980	Core No.20	Red shale	Barren		
9035	Core No.22	Metamorphosed shale	Barren	BASEMENT	

* Relative Spore Yield

Very poor	0 - 10 spores
Poor	10 - 100 spores
Good	100 - 200 spores
Abundant	200 + spores

APPENDIX 3

CORE DESCRIPTIONS

by

J. H. Lewis *

Core No.	Depth Feet	Feet Recovered	Lithological Description
1	1123.0-41.0 23.0-28.5	13.4	Shale, grey, platy, laminated with thin streaks of light grey siltstone. Some lignite streaks in upper 3 feet. One quarter inch of clean light grey, angular to sub-angular, friable, fine grey sandstone noted at 1128 feet.
	28.5-32.8		Sandstone, clean, light grey, porous, friable, fine to medium-grained, angular to sub-rounded quartz with abundant black and green grains and scattered thin partings of lignite and grey shale.
	32.8-34.0		Shale, grey, thinly laminated, slightly silty.
	34.0-36.4		Sandstone, grey green as above with partings of lignite and shale and scattered shale lenses and pebbles.
	36.4-41.0		Not recovered.
2	3246.0-61.0	0.0	Not recovered.
3	3264.0-69.0 64.0-67.8	3.8	Shale, grey, compact, silty, laminated with possibly fossil shell and carbonaceous fragments. Bottom of core lost.
	67.8-69.0		Not recovered.
4	3952.0-65.5 52.0-64.25	12.25	Siltstone and shale, thinly interbedded; siltstone, clean white to light grey; shale, brown and micaceous. Few thin layers of medium and coarse-grained quartz sandstone. Flat dipping with minute slumping, crossbedding and faulting.

* Phillips Petroleum Company

Core No.	Depth Feet	Feet Recovered	Lithological Description
	3964.25- 65.0		Not recovered.
5	4499.0-4515.0	13.0	
	99.0- 05.5		Sandstone, light grey, medium-grained, sub-angular, thinly crossbedded, friable to well compacted with white clay cement. Occasional orange, pink and black minerals.
	05.5- 12.0		Sandstone, light grey, medium-grained, sub-angular, friable to well compacted, white clay cement, with fine silty irregular bedding planes. Some pink, orange and black minerals.
	12.0- 15.0		Not recovered.
6	5226.0- 37.0	10.6	
	26.0- 36.6		Sandstone, buff with bands and mottling of pale green, fine-grained, sub-angular to sub-rounded, quartz, friable, very slightly calcareous. A few re-cemented fractures dipping about 60^{o} were noted.
	36.6- 37.0		Not recovered
7	5500.0- 18.0	12.6	
	00.0- 12.6		Sandstone, reddish brown with white colour banding, silty to coarse-grained, poorly sorted, well rounded, frosted, moderately well cemented with red clay, some slightly to moderately calcareous streaks.
	12.6- 18.0		Not recovered.
8	5518.0- 37.0	7.6	
	18.0- 30.2	0.8	Sandstone, reddish brown, fine to medium-grained, poorly sorted, silty, with thin white crossbeds of medium-grained sandstone.
	30.2- 37.0	6.8	Sandstone, reddish brown, silty, with white crossbedded streaks, calcareous white band from 5536'8"-5536'11".
9	5537.0- 50.0	13.0	Sandstone, reddish brown, poorly sorted, fine to medium-grained, with few very

Core No.	Depth Feet	Feet Recovered	Lithological Description
			coarse grains, well rounded, frosted, slightly calcareous, crossbedded, some grains orange.
10	5550.0- 69.0	8.8	Sandstone, reddish brown, poorly sorted, silty to coarse-grained, slightly calcareous crossbedded layers up to one inch thick; few layers of white fine-grained quartz sandstone with some muscovite and black minerals. Assumed lost bottom of core.
11	5569.0- 87,0	6.0	
	69.0- 75.0		Sandstone, reddish brown, poorly sorted, silty to coarse-grained, slightly calcareous crossbedded layers up to one inch thick; few layers of white fine-grained quartz sandstone with some muscovite and black minerals.
	75.0- 87.0		Not recovered.
12	5587.0-5603.0	14.6	
	87.0- 88.4		Not recovered.
	88.4- 03.0		Sandstone, reddish brown, silty to medium-grained with few coarse grains, subrounded to rounded, with thin white bands and specks.
13	5603.0- 06.0	1.0	
	03.0- 04.0		Sandstone, reddish brown, silty to fine-grained, rounded to sub-rounded, with numerous white specks.
	04.0- 06.0		Not recovered.
14	5606.0- 20.0	5.9	
	06.0- 11.9		Sandstone, reddish brown, predominantly fine-grained but with poorly sorted medium to coarse-grained streaks, well rounded, slightly calcareous and crossbedded.
	11.9- 20.0		Not recovered.

Core No.	Depth Feet	Feet Recovered	Lithological Description
15	5687.0-5700.0	1.3	
	87.0- 88.3		Sandstone, reddish-brown, predominantly fine-grained but with poorly sorted medium to coarse-grained streaks, rounded to sub-angular, frosted to clear, slightly to moderately calcareous.
	88.3- 00.0		Not recovered.
			Note: Three small pieces of grey shale (typical of shale above) recorded on top of this core.
16	6900.0- 10.0	8.5	
	00.0- 08.5		Sandstone, reddish brown with some pinkish white beds in upper part, silty to medium-grained, slightly calcareous, with red clay matrix and occasional green partings containing white and black flakes of mica. Few reddish brown shale beds up to four inches with mica specks and slickensides and thin partings and fragments of light green scattered throughout.
	08.5- 10.0		Not recovered.
17	7312.0- 22.0	9.0	
	12.0- 21.0		Sandstone, reddish brown, poorly sorted, silty to coarse-grained, sub-angular to well rounded, clear to frosted, slightly to moderately calcareous reaction, finely laminated and crossbedded; crossbedding varies from 25^{o} to 40^{o}; most grains clear or orange with few dark red and fine black grains.
	21.0- 22.0		Not recovered.
18	7640.0- 50.0	10.0	
	40.0- 43.0		Sandstone, reddish brown, silty to fine-grained, sub-angular to sub-rounded, very tight, red clay matrix.
	43.0- 50.0		Sandstone, interbedded light orange to reddish brown, silty to fine-grained with few medium and coarse grains, some

Core No.	Depth Feet	Feet Recovered	Lithological Description
			cross-bedding in lower part, rare partings of green, very fine-grained hard sandstone.
19	7751.0- 59.0	2.3	
	51.0- 53.3		Shale and sandstone, thinly interlaminated; shale is purple to reddish brown, micaceous and brittle, with few vein fillings of a soft brittle transparent mineral; sandstones are light coloured, very hard, compact, tight, slightly calcareous, crossbedded with few shale pellet inclusions. Dip essentially flat. Some small crenulations and faults noted.
	53.3- 59.0		Not recovered.
20	7980.0- 90.5	9.7	
	80.0- 80.9		Sandstone, white, fine-grained, angular. tight.
	80.9- 81.3		Shale, red and green, hard, laminated with red shaly sandstone partings, some biotite in both red and green shale.
	81.3- 83.0		Siltstone, reddish brown, shaly with thin interbeds of fine-grained sandstone and few layers of medium to coarse-grained quartz in silty shale matrix.
	83.0- 84.0		Siltstone and shale, interlaminated, reddish brown, shale very micaceous. Thin streaks of white to red, fine to coarse-grained sandstone. A well polished slickensided fault of approximately 45^{o} noted in red shale. Not recemented.
	84.0- 85.1		Sandstone, reddish brown, coarse-grained, rounded, tight, with an increasing amount of fine-grained sandstone towards the base.
	85.1- 87.0		Sandstone, white to orange, fine to medium-grained, poorly sorted, angular to rounded, tight, with green shale laminae and pebbles.

Core No.	Depth Feet	Feet Recovered	Lithological Description
	87.0- 89.7		Sandstone, reddish brown, silty to coarse-grained, tight.
	89.7- 90.5		Not recovered.
21	8542.0- 60.0	14.8	
	42.0- 56.8		Sandstone, light green, white and reddish brown interbedded silty to coarse-grained sandstone, angular to sub-angular with few streaks rounded, friable to moderately hard, banded with white, light green or red ferruginous clay, occasional pebbles or rock fragments. High angle recemented normal fault with one half-inch throw noted at 8551.9 feet. Dips apparently flat with colour bands at approximately 25°.
	56.8- 60.0		Not recovered.
22	9035.0- 43.0	1.8	
	35.0- 36.8		Phyllite, green, very hard, with near vertical flow or shear structures. No bedding apparent. Some fracture surfaces coated with a dark green fibrous mineral, most probably of the amphibole group.
	36.8- 43.0		Not recovered.
23	9048.0- 70.0	22.0	
	48.0- 49.0		Phyllite, green, very hard, with some fracture surfaces coated with a dark green fibrous mineral, most probably of the amphibole group. Strong irregular fracturing tendency along original bedding, with a shiny, slick surface.
	49.0- 51.0		Quartzite, micaceous, fine-grained, tight, very hard. Thin calcite veinlets.
	51.0- 59.0		Phyllite, as above with less of the dark green fibrous mineral, traces of calcite and pyrite veinlets along contacts.
	59.0- 69.0		Quartzite, as 9049' to 9051' above.
	69.0- 70.0		Phyllite, as above with thin quartzite laminations. Thin calcite layers on some surfaces.
			Note: Contacts between phyllite and quartzite indicate bedding dip of 75° to 80°.

SIDEWALL CORE DESCRIPTIONS

by

J.H. Lewis*

A series of twenty sidewall cores was planned for palynological and stratigraphic studies. However, the hole was completely bridged over at the top of the Blythesdale, so that the lower depths chosen for sidewall coring could not be reached without cleaning out the hole again. A caliper tool was run just previous to the sidewall coring tool, and only with some difficulty succeeded in spudding itself through this same interval. Since the hole had been conditioned for several hours prior to the running of the caliper tool it was felt that reconditioning the hole would not guarantee the passage of the sidewall coring tool. It was decided to make no further attempt to obtain sidewall cores below the top of the Blythesdale.

Above the Blythesdale sidewall cores were taken at seven depths. At four of those depths a secondary core was taken after the first core indicated a questionable recovery. Actual recovery was 100 percent. Those cores from the same approximate depth indicate the rapid variation and alternation typical of the lithology of this section.

Depth in feet		
1060	No. 1	Sandstone, salt-and-pepper, fine-medium-grained, clear and milky quartz and light-dark green and black grains, angular to subangular.
1060	No. 2	Shale, grey, buff speckled, with black lignite(?) flakes and specks.
1248	No. 1	Sandstone, salt-and-pepper, very fine-grained, angular, well sorted, unconsolidated.
1248	No. 2	Sandstone, less striking salt-and-pepper effect, quartz with abundant green and black grains, silt to fine-grained, angular to rounded, poorly sorted.
1655		Siltstone, light grey, poorly compacted with clay, disintegrates in fresh water.
1737	No. 1	Sandstone, laminated light grey fine-grained silty, and dark grey shale (with possible thin seam abundant brown lignite flakes).
1737	No. 2	Shale, grey, moderately soft with abundant disseminated brown specks - possibly lignitic.
1778		Shale, dark grey, with very fine white specks, moderately calcareous. Possibly fossiliferous.
2351		Shale, light grey, sticky and probably swells when wetted, abundant disseminated brown flaky masses, possibly lignite. Trace of possible silt-sized grains of pyrite.
2370	No. 1	Shale, laminated medium grey moderately soft, brown lignite, and light grey siltstone with scattered fine pyrite grains(?).
2370	No. 2	Shale, medium grey, slightly lignitic, thin pyrite-rich seam.

* Phillips Petroleum Company

APPENDIX 4

MAGNETIC MEASUREMENTS ON CORE FROM BUCKABIE No. 1

by

P.M. Stott*

The direction of magnetisation was measured in specimen discs from 'red beds' in Buckabie No. 1 between 5216 feet and 8810 feet which lie below Jurassic 'Walloon' Coal Measures. The beds are flat-lying, so that azimuth is arbitrary and only the inclination measurements are significant.

The results obtained were:

Depth (feet)	Magnetic inclination (degrees from horizontal)
5550	-78
	-71
7318	-69
	-70
8550	-74
	-76

The small scatter of results and small divergence from the dipole field (I=-43) and from the present field (I = -58) suggests that the magnetisation is stable.

Within the limits Upper Palaeozoic to pre-Jurassic, the most likely time of magnetisation (which equals time of deposition, as far as is known) is Carboniferous or Triassic. A Devonian or Permian age is most unlikely, provided the tops of the cores are marked correctly.

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* Geophysicist, Australian National University

APPENDIX 5

POTASSIUM/ARGON AGE DETERMINATION

by

H.W. Krueger*

A potassium/argon age was determined for a sample from Buckabie No. 1 Core No. 23 (9048 feet), consisting of grey phyllite from basement. The sample was crushed to -40/+60 mesh and duplicate potassium/argon measurements made.

The age of the basement was determined as 417 $\pm$ 25 million years, i.e. early Palaeozoic, perhaps Silurian. The rock may be considered as a pre-Silurian sediment which was involved in the Silurian orogeny that affected the entire East Coast of Australia.

Argon Analyses:

Ar^{40} ppm	Ar^{40} /Total Ar	Ave Ar^{40} ppm
0.146	0.903	0.141
0.136	0.895	

Potassium Analyses:

%K	Ave %K	K^{40} ppm
4.17		
4.20	4.24	5.17
4.29		
4.30		

$Ar^{40}/K = 0.0273$ AGE = 417 $\pm$ 25 million years

Constants used :

$= 4.72$ 10^{-10}/year

$= 0.585$ 10^{-10}/year

$K^{40}/K = 1.22$ 10^{-4} g./g.

$$\text{Age} = \frac{1}{\lambda + \lambda Q} \ln\left[\frac{\lambda Q + \lambda e}{\lambda e} \times \frac{Ar^{40\ddagger}}{K\,40} + 1\right]$$

$Ar^{40\ddagger}$ refers to radiogenic Argon-40.

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* Geochron Laboratories Inc., Cambridge, Massachusetts, U.S.A.

APPENDIX 6

LOWER CRETACEOUS FORAMINIFERA IN BUCKABIE NO. 1 WELL

by

Irene Crespin *

This report covers the examination of cuttings from 80 feet down to 3310 feet, which was considered to be the base of the marine Lower Cretaceous section in Buckabie No. 1. Cores 1, 3, 8, and 9 were also examined.

A considerable number of samples of cuttings have been examined to prove the upper and lower limits of the lithological and faunal units recognised. Past examinations of extensive collections of material from the Great Artesian Basin in Queensland have shown the Lower Cretaceous marine sediments to contain characteristic foraminiferal assemblages and, in Buckabie No. 1, the study of the lithology and the first appearance of certain foraminiferal species and of Inoceramus prisms in the downward sequence show that a fairly complete section of the Lower Cretaceous in this south-western portion of Queensland is present. The basal Upper Cretaceous Winton Formation is represented by unfossiliferous carbonaceous sandstones which overlie the Lower Cretaceous marine sediments.

The following cuttings and core samples examined contained no fossils:

80-1130 feet, Core 1 (1123-1141 feet), 1180-1190 feet, 1420-1450 feet, 1480-1490 feet, 1520-1530 feet, 1550-1560 feet, 1620-1630 feet, Core 8 (5518-5537 feet), Core 9 (5537-5550 feet).

Detailed Description of Samples containing Foraminifera or other fossils

Except where stated otherwise, all descriptions are of cuttings.

1220-1230 feet. Calcareous sandstone and some carbonaceous sandy siltstone, with megaspores, Pyribolospora reticulata Cookson and Dettman.

1460-1470 feet. Calcareous sandstone with glauconite, carbonaceous siltstone, megaspores (P.reticulata) and Inoceramus prisms (rare).

1500-1510 feet. Calcareous, glauconitic sandstone and carbonaceous siltstone with megaspores (P.reticulata) and a few Inoceramus prisms.

1530-1540 feet. Calcareous, glauconitic, carbonaceous sandstone, and carbonaceous sandstone with megaspores (P.reticulata), a few fragments of indeterminate shells, and Inoceramus prisms (rare).

1720-1730 feet. Calcareous, glauconitic sandstone and carbonaceous silty sandstone, with Inoceramus prisms (rare).

1740-1750 feet. Calcareous glauconitic sandstone and carbonaceous siltstone, with megaspores (P.reticulata) and a few arenaceous foraminifera (Haplophragmoides sp., Trochammina sp.)

(* Bureau of Mineral Resources)

1760-1770 feet. Grey siltstone and a little carbonaceous material with a few Inoceramus prisms.

1770-1780 feet. Grey carbonaceous siltstone with a few calcareous and arenaceous foraminifera, some tests replaced with pyrite, and Inoceramus prisms.

Foraminifera: Trochammina depressa Lozo
cf. Trochamminoides
Marginulinopsis subcretaceus (Crespin)
Robulus gunderbookaensis (Crespin)

1790-1800 feet. Carbonaceous siltstone and sandstone with pyrite, megaspores (P. reticulata), a few foraminifera (Globigerina cf. planispira Tappan rare, Robulus spp., Spiroplectammina sp.), Inoceramus prisms, shell fragments and indeterminate ostracods.

1800-1920 feet. Carbonaceous siltstone and sandstone with glauconite, a few foraminifera and Inoceramus prisms.

Foraminifera: Bimonilina sp.
Saccammina sp.nov.
Trochammina minuta Crespin
Valvulineria sp.

1920-2030 feet. Carbonaceous siltstone with foraminifera, chiefly arenaceous, fragments of mollusca (Dentalium sp. and indeterminate gastropod) and Inoceramus prisms.

Foraminifera:

Ammobaculites sp.
Dorothia cf. filiformis (Berthelin)
Flabellammina sp.nov. (vitrea Crespin MS)*
Haplophragmoides sp.nov. A (Crespin, MS)
Haplophragmoides spp.
Saccammina sp.
Spiroplectammina sp.nov. (aequabila Crespin MS)
Trochammina sp.nov. (subinflata Crespin MS)
Epistomina australiensis Crespin

2040-2120 feet. Carbonaceous siltstone and sandstone with foraminifera, poorly preserved, and Inoceramus prisms.

2120-2150 feet. Carbonaceous siltstone and sandstone with foraminifera and abundant Inoceramus prisms.

Foraminifera:

Haplophragmoides chapmani Crespin
Reophax deckeri Tappan
Globigerina sp. (rare)
Robulus spp.

* Crespin, Irene 1962 - Lower Cretaceous arenaceous Foraminifera of Australia. Bur. Min. Resour. Aust. Bull. 66 (in press).

2150-2170 feet. Carbonaceous siltstone with abundant carbonaceous fragments, pyrite, a few radiolaria replaced with pyrite (Dictyomitra), a few arenaceous foraminifera (Dorothia sp., Hyperammina sp., Saccammina sp.nov., Trochammina minuta) and numerous Inoceramus prisms.

2170-2180 feet. Carbonaceous siltstone and a little limestone with foraminifera and abundant Inoceramus prisms.

Foraminifera:

Haplophragmoides sp.nov. (wilgunyaensis Crespin MS)
Spiroplectammina sp.
Textularia cf. anacooraensis Crespin
Trochammina sp.nov. (delicatula Crespin MS)
Globigerina planispira Tappan (few)
Globigerina sp. (pyritic)
Epistomina australiensis Crespin

2190-2200 feet. Carbonaceous siltstone with carbonaceous fragments common, a few foraminifera and abundant Inoceramus prisms.

Foraminifera:

Ammobaculites fisheri Crespin
Dorothia sp.
Haplophragmoides sp.
Trochammina sp.nov. (subinflata Crespin MS)
Globigerina sp.

2210-2390 feet. Carbonaceous siltstone and limestone with foraminifera (chiefly Globigerina), abundant Inoceramus prisms and pyritic replacement of radiolaria (Cenosphaera, Dictyomitra).

Foraminifera:

Bimonilina sp.
Flabellammina sp.nov. (vitrea Crespin MS)
Haplophragmoides sp.nov. (wilgunyaensis Crespin MS)
Psammosphaera sp.
Globigerina planispira Tappan (common)
Globigerina sp.

2400-2450 feet. Black carbonaceous siltstone, finely laminated, with pyrite, megaspores (P. reticulata), foraminifera (many tests of Globigerina distorted and crushed), and Inoceramus prisms less common.

Foraminifera:

Bimonilina sp.
Haplophragmoides cf. chapmani Crespin
Haplophragmoides sp.

Verneuilina howchini Crespin
Globigerina planispira Tappan
Globigerina sp.
Gyroidina sp.
Lenticulina sp.
Marginulinopsis australis Crespin

2450-2460 feet. Carbonaceous siltstone but with less carbonaceous material, and glauconitic sandstone, pyrite, a few foraminifera (Ammobaculites sp.nov. (erectus Crespin MS), Trochammina sp. but no Globigerina) and Inoceramus prisms rare.

2470-2490 feet. Siltstone and sandstone with foraminifera, chiefly arenaceous tests.

Foraminifera:

Ammobaculites fisheri Crespin
Ammobaculites sp.nov. (exertus Crespin MS)
Haplophragmoides chapmani (large and distorted)
Hyperammina sp.
Pelosina lagenoides Crespin
Saccammina sp.nov. (globosa Crespin MS)
Trochammina cf. raggatti Crespin
Trochammina spp.
Verneuilinoides kansasensis Loeblich and Tappan
Globigerina planispira (rare, ?derived)
Gyroidina sp.

2520-2540 feet. Silty sandstone, fragments of calcareous rock, with megaspores (P.reticulata) radiolaria, foraminifera not common and a few Inoceramus prisms (? derived).

Foraminifera:

Ammodiscus sp.
Haplophragmoides sp.nov.
Trochammina minuta Crespin
Globigerina sp. (? derived)
Gyroidina sp.

2570-2610 feet. Sandy siltstone, with some glauconite, foraminifera (chiefly arenaceous tests) and ostracoda.

Foraminifera:

Ammobaculites minimus Crespin
Ammodiscus glabratus Cushman
Haplophragmoides chapmani Crespin
Haplophragmoides sp.nov. (wilgunyaensis Crespin MS)
Reophax deckeri Tappan
Saccammina sp.
Verneuilina howchini Crespin

Verneuilinoides kansasensis Loeblich and Tappan
Anomalina mawsoni Crespin
Gavellinella sp.
Globigerina sp. (? derived)
Lenticulina sp.
Marginulinopsis australis Crespin
Ramulina sp.

2630-2640 feet. Carbonaceous siltstone, glauconitic sandy siltstone and limestone fragments with pyrite, pyritic replacements of radiolaria, and foraminifera, and Inoceramus prisms (? derived).

Foraminifera:

Ammobaculites minimus Crespin
Ammobaculites sp.
Haplophragmoides cf. chapmani Crespin
(large and distorted)
Reophax deckeri Tappan
Verneuilinoides kansasensis Loeblich and Tappan
Anomalina mawsoni Crespin
Gyroidina sp.
Marginulinopsis subcretaceus (Crespin)
cf. Nodosaria ithystoecha Loeblich and Tappan
Ramulina sp.

2660-2670 feet. Carbonaceous siltstone, sandy siltstone and calcareous rock, with radiolaria common and replaced by pyrite, and foraminifera including large but distorted tests of Haplophragmoides.

Foraminifera:

Haplophragmoides cf. gigas Cushman
Haplophragmoides spp.
Anomalina mawsoni Crespin
Epistomina australiensis Crespin
Globigerina sp. (? derived)
Marginulina sp.
Ramulina sp.
Robulus sp.

2740-2780 feet. Glauconitic sandy siltstone, with pyrite, megaspores (P.reticulata), pyritic replacement of radiolaria (Cenosphaera), arenaceous and calcareous foraminifera and pyritic replacement of pelecypoda.

Foraminifera:

Ammobaculites sp.
Bigenerina loeblichae Crespin
Bimonilina variana Eicher

Haplophragmoides sp. (pyritic, large)
Reophax deckeri Tappan
Trochammina depressa Lozo
Darbyella subcretaceus Tappan
Epistomina australiensis Crespin
Gavellinella cf. minima (Vieux)
Globigerina planispira Tappan (rare, ?derived)
Marginulinopsis australis Crespin
Patellina jonesi Howchin
Pseudoglandulina regularis Crespin
Valvulineria infracretacea Crespin

2790-2820 feet. Glauconitic siltstone with pyrite, numerous foraminifera, calcareous tests well preserved, and a few crinoid ossicles.

Foraminifera:

Ammodiscus sp.
Ammobaculoides pitmani Crespin
Bathysiphon sp.
Haplophragmoides cf. dickinsoni Crespin
Pelosina lagenoides Crespin
Verneuilinoides kansasensis Loeblich and Tappan
Globigerina sp. (rare, distorted, ?derived)
Lagena sp.
Lenticulina australiensis Crespin
Marginulinopsis subcretaceus (Crespin)
Pyrulina sp.
Nodosaria ithystoecha Tappan
Robulus gunderbookaensis (Crespin)
Valvulineria infracretacea Crespin

2830-2840 feet. Glauconitic sandstone and siltstone, with calcareous foraminifera (Anomalina mawsoni, large, Pseudoglandulina regularis) and pyritic replacement of radiolaria (Dictyomitra).

2860-2870 feet. Glauconitic siltstone and sandy siltstone, with pyrite, numerous arenaceous and calcareous foraminifera, many tests filled wih pyrite, and crinoid plates.

Foraminifera:

Ammobaculoides romaensis Crespin (common)
Ammobaculites minimus Crespin
Bigenerina loeblichae Crespin
Haplophragmoides cf. gigas Cushman (large, distorted)
Hyperammina sp.
Trochammina raggatti Crespin
Trochammina minuta Crespin
Anomalina mawsoni Crespin (large, common)
Dentalina sp.

Marginulinopsis australis Crespin
Robulus gunderbookaensis (Crespin)
Robulus sp.
cf. Turrispirillina

2890-2900 feet. Siltstone with some glauconite and foraminifera.

Foraminifera:

Ammobaculoides romaensis Crespin
Haplophragmoides sp.nov. (arenatus Crespin MS)
Haplophragmoides sp.
Hyperammina sp.
Anomalina mawsoni Crespin (common)
Marginulinopsis subcretaceus (Crespin)
Robulus gunderbookaensis (Crespin)
Robulus sp.

2930-2970 feet. Glauconitic siltstone with pyrite, foraminifera and indeterminate ostracoda.

Foraminifera:

Ammobaculoides pitmani Crespin (common at 2930-2940 feet)
Ammobaculoides romaensis Crespin
Ammodiscus sp.
cf. Bimonilina
Haplophragmoides sp.
Spiroplectammina cushmani Crespin
Trochammina cf.minuta Crespin
Anomalina mawsoni Crespin
Globulina cf. exserta (Berthelin)
Lenticulina australiensis Crespin
Marginulinopsis australis Crespin
Patellina jonesi Howchin (at 2960-2970 feet)

3000-3020 feet. Siltstone with glauconite and pyrite, also foraminifera, many tests crushed, and ostracoda.

Foraminifera:

Ammobaculoides romaensis Crespin
Bathysiphon sp.
Bimonilina variana Eicher
Pelosina lagenoides Crespin
Spiroplectammina edgelli Crespin
Spiroplectammina cushmani Crespin
Trochammina cf.minuta Crespin
Lenticulina spp.
Marginulinopsis australis Crespin
Marginulinopsis spp.

3030-3040 feet. Grey siltstone with glauconite and pyrite, also foraminifera, chiefly calcareous tests, indeterminate shell fragments and several tests of ostracoda.

Foraminifera:

Spiroplectammina cf.edgelli Crespin
Trochammina cf.minuta Crespin
Globulina sp.
Marginulinopsis australis Crespin
Marginulinopsis spp.
Neobulimina minima Tappan (common)

3060-3070 feet. Grey siltstone with pyrite, numerous foraminifera, chiefly calcareous forms with the Lagenidae common, and ostracoda.

Foraminifera:

Ammomarginulina sp.
Hyperammina sp.
Spiroplectammina cushmani Crespin
Pelosina lagenoides Crespin
Trochammina minuta Crespin
Globulina sp.
Gyroidina sp.
Lagena apiculata (Reuss) var.phialaeformis Crespin
Lenticulina sp.
Marginulina spp.
Neobulimina minima Tappan (common)
Robulus gunderbookaensis (Crespin)
Robulus warregoensis (Crespin)
Robulus spp.

3100-3110 feet. Siltstone with pyrite and poorly preserved foraminifera and ostracoda.

3110-3140 feet. Dark grey and brown siltstone and some sandstone with a few poorly preserved foraminifera, tests crushed and stained brown (Haplophgramoides sp., Robulus sp.) and crushed ostracoda.

3150-3240 feet. Sandstone with a few poorly preserved foraminifera (Ammobaculoides pitmani Crespin).

Core 3. 3264' - 3264'6". Micaceous sandstone with crushed arenaceous foraminifera rare (Haplophragmoides sp., Trochammina sp.)

3270-3310 feet. Sandstone, glauconitic siltstone and pyrite, with foraminifera (Ammobaculoides pitmani Crespin, Ammobaculites sp.)

Stratigraphical and Microfaunal Notes on the Samples

The following comments on the stratigraphical sequence in the Buckabie No. 1 Well are based, primarily, on the examination of numerous cuttings selected from those taken between the depths of 80 feet and 3,310 feet, the suggested base of the marine Lower Cretaceous. When trying to determine the upper and lower limits of the units suggested below, cuttings were examined at ten-foot intervals.

Eight units have been recognized; these have been determined on lithology and microfaunal content. Five of these have distinctive marine microfaunal assemblages; one has a characteristic lithology with marine fossils occurring at widely separated intervals; two others have distinctive lithologies but are unfossiliferous. These units are labelled A to H in upward stratigraphical sequence.

Units	Limiting depths in feet	Lithology	Fossils
H	80 - 130	Ochreous sandstone and siltstone	
G	130 - ?1180	Carbonaceous siltstone and sandstone.	
F	?1180 - 1740	Calcareous glauconitic sandstone and some carbonaceous siltstone.	Megaspores, occasional Inoceramus prisms.
E	1740 - 2170	Carbonaceous siltstone.	Foraminifera, Inoceramus prisms
D	2170 - 2450	Carbonaceous siltstone with a little limestone	Globigerina common, Inoceramus abundant in upper part.
C	2450 - 2740	Carbonaceous siltstone with a little glauconitic sandstone towards base.	Foraminifera common, Globigerina and Inoceramus very rare, ?derived.
B	2740 - 3110	Glauconitic sandstone and siltstone.	Foraminifera including type Roma species.
A	3110 - 3310	Sandstone	Foraminifera rare.

These units are discussed in upward stratigraphical sequence.

Unit A. 3310-3110 feet. Few rather poorly preserved foraminifera are present in the sandstone, and these tests are usually stained brown. Two forms, Haplophragmoides sp. and Trochammina sp., were found in the crushings of Core 3 at 3264' - 3264'6". The characteristic Roma species, Ammobaculoides pitmani, was noted in the cuttings. Unit A may correspond to the "Transition Beds" at the base of the marine Lower Cretaceous section in Queensland.

Unit B. 3110-2740 feet. Both arenaceous and calcareous tests of foraminifera are common in the glauconitic siltstone and sandy siltstone of this unit. The family Lagenidae is well represented amongst the calcareous forms. The arenaceous assemblage includes species such as Ammobaculoides pitmani, A. romaensis, Bigenerina loeblichae and Spiroplectammina cushmani which are characteristic of the sediments in the type area for the Roma Formation near Roma. Amongst the calcareous species is Anomalina mawsoni which was common at 2890-2900 feet, the tests being unusually large at 2860-2870 feet. The glauconitic siltstone and sandstone is also a lithological feature of the Roma beds.

Unit C. 2740-2450 feet. The lithology is carbonaceous siltstone with some glauconitic sandstone towards the base of the unit. Arenaceous and calcareous foraminifera are present but the typical Roma species listed in Unit B were not noted. Radiolaria are common at 2600-2670 feet, all tests being replaced with pyrite. Globigerina and Inoceramus prisms are very rare and it is most probable that the specimens that are present were derived from the overlying Unit D.

Unit D. 2450-2170 feet. The lithology is mainly carbonaceous siltstone; some fragments of limestone were noted. Foraminifera are present, with Globigerina very common in some cuttings. Inoceramus prisms are abundant in some samples but decrease in number from 2450 to 2400 feet. Between these two depths, the rock is a finely laminated carbonaceous siltstone in which the many tests of Globigerina are distorted or crushed. The abundance of Globigerina and Inoceramus prisms wihin this unit suggests an equivalent of the Toolebuc Limestone Member of the upper part of the Wilgunya Formation in western Queensland.

Unit E. 2170-1740 feet. The lithology is carbonaceous siltstone. Foraminifera are not common and arenaceous tests are predominant; Globigerina occur rarely. Inoceramus prisms increase in number towards the base of the unit, between 2170 and 2120 feet. This unit shows some resemblance to the upper part of the Wilgunya Formation of western Queensland.

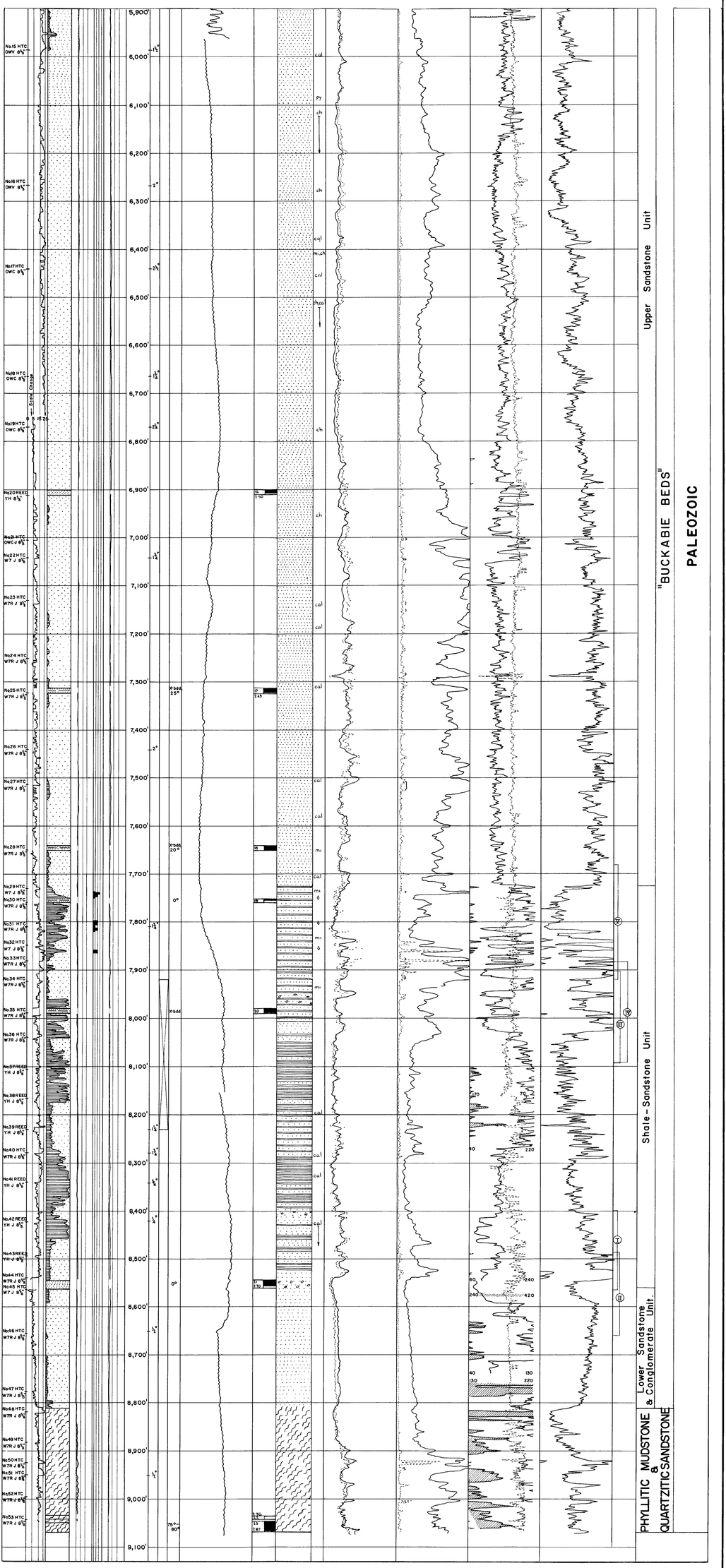
Unit F. 1740 - ?1180 feet. The characteristic rock in the cuttings is calcareous glauconitic sandstone in which the marine influence is shown by the presence of a few Inoceramus prisms at 1720-1730 feet, 1530-1540 feet, 1500-1510 feet and 1460-1470 feet. The Cretaceous megaspore, Pyribolospora reticulata was recorded at 1530-1540 feet, 1500-1510 feet, 1460-1470 feet and 1220-1230 feet. The upper limit of this unit is given as approximate only, as the fragments of calcareous glauconitic sandstone associated with the carbonaceous siltstone of the overlying unit G are small immediately above the cuttings at 1180 feet.

Unit G. ?1180-130 feet. The lithology is carbonaceous siltstone and sandstone. No evidence of marine conditions was recognized.

Unit H. 130-80 feet. The cuttings consist of unfossiliferous ochreous sandstone and siltstone.

The detailed examination of many cuttings within unit F was prompted by the comments of N. de Jersey and R.J. Paten (see Appendix 2). They stated "Cuttings showed the

the presence of shelly fragments as high as 1,520 feet or doubtfully to 1410 feet and coal seams to a depth of 1100 feet or possibly to 1230 feet. This indicates that the transition from marine to freshwater deposition occurred within the strata penetrated between 1100 feet and 1520 feet". The writer tentatively suggests that the dominating presence of calcareous glauconitic sandstone in the numerous cuttings examined between the depths of 1740 feet and 1180 feet, and referred to as Unit F., may represent transitional beds between the foraminiferal- bearing sediments below 1740 feet and the freshwater beds above 1180 feet, or at least above and including Core 1 at 1123'-1136'6". This tentative suggestion would, however, require considerable field work for its substantiation.



FORMATION TESTS

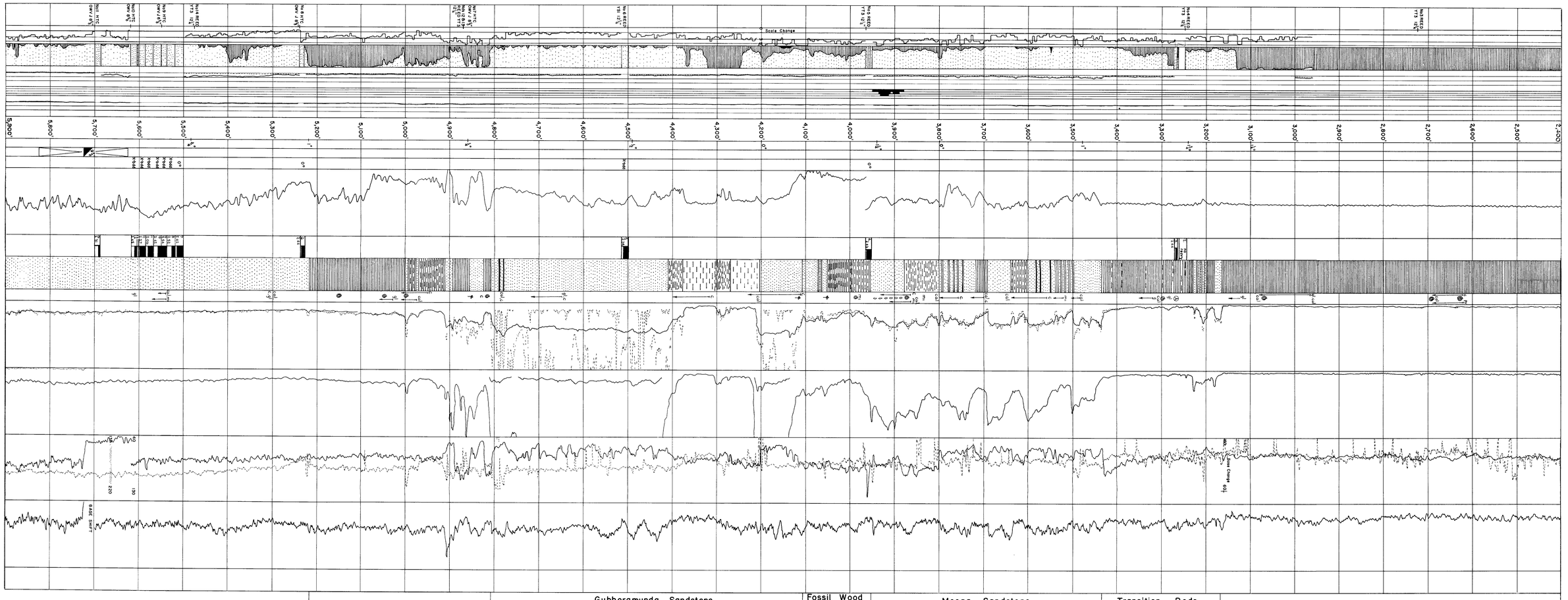
I DST No.1 8398'-8650' Misrun - packer seat failed.

II DST No.2 8488'-8650' Initial & final shut in pressures 30 mins. Tool open 30 mins, with immediate weak blow decreasing to faint blow at end of test. Recovered 90' of drilling mud. No show of gas, oil or water. IHP 5117, ISIP 150, IFP 150, FFP 150, FSIP 160, FHP 5098.

III DST No.3 7901'-8091' Initial shut in pressure 30 mins. Tool open 17 mins., very weak blow after 2 mins, died after 8 mins. Packer failed after 15 mins. Recovered 90' of drilling mud. No show of gas, oil or water. IHP 4738, ISIP 862, IFP 197, FFP 197, FHP 4678.

IV DST No.4 7888'-8090' Misrun - packers failed.

V DST No.5 7688'-7920' Initial & final shut in pressures 30 mins. Tool open 45 minutes, no blow. Recovered 29' of drilling mud. IHP 4668, ISIP 3414, IFP 199, FFP 199, FSIP 1613, FHP 4668.



"BUCKABIE BEDS"	WALLOON COAL MEASURES	Gubberamunda Sandstone	Fossil Wood Beds	Mooga Sandstone	Transition Beds	ROMA & TAMBO FORMATION UNDIFFERENTIATED
		BLYTHESDALE GROUP				
	JURASSIC	(JURASSIC - CRETACEOUS TIME BOUNDARY UNKNOWN)				

COMPOSITE WELL LOG

PHILLIPS PETROLEUM CO - SUNRAY MID-CONTINENT OIL CO.

AUTHORITY TO PROSPECT 84P(B) BUCKABIE NO.1

QUEENSLAND 4 MILE SHEET 34 GREAT ARTESIAN BASIN WELL STATUS : ABANDONED

LOCATION - Lat. 26°11'40"S Long.144°16'15"E
ELEVATION - R.K.B 738' A.S.L.
Ground 724'

Date Spudded May 1, 1961
Date Drilling Stopped July 8, 1961
Date Rig Off July 31, 1961
Total Depth Driller 9070' R.K.B.

Well Head Fittings Steel plate welded on 9 5/8"
Drilled by Delta Drilling Co.
Drilling method Rotary
Logged by Welex
Mud logging by Core Lab
Cemented by Halliburton

RESISTIVITY LOG DATA

TYPE OF LOG	INDUCTION - ELECTRIC			GUARD
RUN NUMBER	1	2	3	1
DATE	25-5-61	25-6-61	9-7-61	11-7-61
FOOTAGE LOGGED	5179'	2553'	788'	3332'
LOGGED FROM	798'	5723'	8276'	5723'
LOGGED TO	5977'	8276'	9064'	9065'
TOTAL DEPTH - ELECTRIC LOG	5981'	8279'	9068'	9070'
TOTAL DEPTH - DRILLER	5985'	8280'	9070'	9070'
CASING SHOE - ELECTRIC LOG	798'	5723'		5723'
CASING SHOE - DRILLER	799'	5725'	5725'	5725'
BIT SIZE	12 1/4" - 8 5/8"	8 5/8"	8 5/8"	8 5/8"
MUD - KIND	Water base	Water base	Water base	Water base
- TREATMENT	Driscose	Driscose	Driscose	Driscose
WATER LOSS cc's/30 min.	4·9	4·4	4·4	4·7
WEIGHT lbs/gal	10·7	11·0	11·9	11·8
VISCOSITY (Marsh) sec.	50	42	46	45
pH	9·0	9·0	9·0	8·9
RESISTIVITY Rm	2·3 - 70°	1·55 at 65°	2·1 at 65°	1·8 at 80°
RESISTIVITY Rmf	1·9 - 70°	0·85 at 65°	0·82 at 65°	1·1 at 70°
RESISTIVITY Rmc	4·1 - 70°	2·80 at 65°	3·96 at 65°	3·6 at 70°
MAX TEMPERATURE	201°	236°	242°	242°
RECORDED BY	Bracke	Bracke	Bracke	Bracke

RADIOMETRIC LOG DATA

TYPE OF LOG	GAMMA RAY - NEUTRON		
RUN NUMBER	1	2	3
DATE	3-6-61	25-6-61	9-7-61
TOTAL DEPTH - DRILLER	5985'	8280'	9070'
TOP OF LOGGED INTERVAL	40'	5725'	8280'
BOTTOM OF LOGGED INTERVAL	5688'	8276'	9070'
TYPE OF FLUID IN HOLE	Mud	Mud	Mud
FLUID LEVEL	205	Full	Full
MAXIMUM RECORDED TEMPERATURE		236°	242°
NEUTRON SOURCE, STRENGTH	Ra-Be 400mg		
SOURCE SPACING - IN.	19"	19"	19"
LENGTH OF MEASURING DEVICE	28/14"	28/14"	28/14"
O.D. OF INSTRUMENT - IN.	3 5/8"	3 5/8"	3 5/8"
TIME CONSTANT - SECS.	2/2	2/2	2/2
LOGGING SPEED - FT/MIN.	30	35	25
STATISTICAL VARIATION - IN.		·34/27	
SENSITIVITY REFERENCE	90/500	100/500	200-100/500
RECORDED BY	Bracke	Bracke	Bracke

Hole size (in)	From	To
26"	0'	49'
17 1/2"	49'	802'
12 1/4"	802'	5725'
8 5/8"	5725'	9070'

Casing

In.	Wt	Gr.	Depth	Cmt	Cmt'd to
20	94	H40	49'	125'	Surface
13 3/8	48	H40	799'	775'	Surface
9 5/8	36	J55			
	40	J55			
	40	N80	5725'	2000'	2006'

Cement Plugs

From	To	Sacks
7920'	8230'	210
5625'	5825'	85
145'	245'	34

Other Bore-Hole Logs: FoRxo, Temperature, Caliper

SYMBOLS

Core number, recovery, specific gravity.
(2) ▶ Sidewall core, number taken
Formation test in open hole
Plugged interval
Fluorescence
Fossils: Macro, Plant, Spore, pollen

LITHOLOGIC REFERENCE

Conglomerate
Sandstone
Laterite
Siltstone
Soil
Claystone
Shale
Limestone
Coal
Metamorphics Phyllite & Quartzite

mi Micaceous
cal Calcareous
gl Glauconitic
py Pyritic
c Carbonaceous
ch Cherty

Note: Sandstone or Siltstone on Core Lab Graphalog