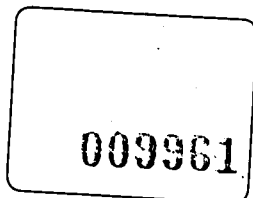


COMMONWEALTH OF AUSTRALIA.



DEPARTMENT OF SUPPLY AND SHIPPING  
MINERAL RESOURCES SURVEY.

REPORT No. 1945/14.  
(PLAN No. 1187.)

## THE HUTTON CREEK BORE, QUEENSLAND.

REPORT No. 1945/15.  
(PLAN No. 1188.)

## THE ARCADIA BORE, QUEENSLAND.

BY

IRENE CRESPIAN, B.A.,  
COMMONWEALTH PALAEONTOLOGIST.

CANBERRA.

16th FEBRUARY, 1945.

By Authority:

L. F. JOHNSTON, Commonwealth Government Printer, Canberra.

DEPARTMENT OF SUPPLY AND SHIPPING

MINERAL RESOURCES SURVEY

THE HUTTON CREEK BORE, QUEENSLAND.

(Report No.1945/14, Plan No.1187).

-----

In the search for oil in Queensland, Drillers Limited, a subsidiary of Oil Search Limited, Sydney, put down a deep bore at Hutton Creek near Injune, in the parish of Simmie, county of Westgrove and 60 miles north of Roma. Drilling operations, which began in 1935 and ceased in 1938 when the depth of the bore was 4,688 feet, were carried out with a Commonwealth Government plant. The major part of the drilling was done by the percussion method, but cores were taken at various depths down to 4,678 feet. No samples were received for microscopic examination until the bore had reached the depth of 650 feet, but from this depth to the bottom of the bore-hole, 638 samples of cuttings and cores were examined. Core samples were taken at more frequent intervals towards the bottom of the bore-hole than higher up.

A study of the cores and cuttings from the bore-hole suggests subdivision of the section into three stratigraphic units:

- (1) Marine sediments, containing foraminifera and brachiopod remains, from 657 feet to 886 feet.
- (2) Freshwater sediments with plant remains from 892 to 3,959 feet.
- (3) A mixed assemblage of marine (radiolaria) and freshwater fossils (plant remains) from 3,959 to the bottom of the hole at 4,688 feet.

(1) Marine sediments referable to the Permian were encountered at 657 feet and were present down to 886 feet. Fragments of brachiopod shells including productid spines were common from 657 feet down to 800 feet. Permian foraminifera (Ammodiscus milletianus Chap. and Trochammina sp.) were noted at 770-790 feet. Similar foraminifera have been found in sediments belonging to the Middle Bowen Series in the Springsure area, but this does not indicate that they are restricted forms.

(2) The first evidence in the drill cuttings of the presence of freshwater Permian sediments, was at 892 feet when fragments of dark carbonaceous shale were noted. These carbonaceous shales are present from this depth to the bottom of the bore hole, but are only purely freshwater down to 3,959 feet. In the stratigraphic section of the bore compiled by Oil Search Limited, 25 feet of coal is shown from 900 feet to 925 feet. Further beds of coal were logged between 1,096 and 1,105 feet, 1,337 and 1,370 feet and 1,540 and 1,545 feet. The first fragment of Glossopteris recognised by the writer occurred at 1,814 feet, but according to the Company's records Dr. F.W. Whitehouse determined Glossopteris Browniana, G.indica and G.parallela from the coal band at 1,540 feet. Fragments of Glossopteris were observed in cuttings at 2,198 feet.

(3) The sediments from 3,959 feet down to the bottom of the bore at 4,688 feet consist of carbonaceous shales sandstones, and indurated shale showing fracturing and slickensiding and a decided dip. Fine bedding with a dip of about 30 degrees was first noticed in a core consisting of grey carbonaceous shale at 3,959 feet. A similar dip was observed down to 4,079 feet. Below that depth the cores recovered represent grey indurated shales showing a dip of 60 degrees. Glossopteris

Browniana was present in a core at 3,959 feet and G.indica (determined by Dr. Whitehouse) at 4,325 feet, the specimens being well preserved. Fragments of Glossopteris were noted in the cuttings at various depths down to 4,511 Feet.

Many thin sections of cores from 3,595 feet down to 4,678 feet were examined. They all contain fine angular quartz grains in a carbonaceous groundmass and show evidence of bedding. Also present are numerous tests of radiolaria of the spumellarian type. These were identified in sections of cores taken at 4,263 feet, 4,323 feet, 4,337-4,339 feet, 4,345-4,350 feet, 4,354 feet, 4,448 feet, 4,465 feet, 4,571 feet and 4,678 feet. The genera include Cenosphaera, Carposphaera, Heliosphaera and Haliomma, all of which have been previously recorded from Palaeozoic rocks in Australia, but not from the Permian. The tests are large, a feature common in Palaeozoic radiolaria, the diameter of the tests varying from 30 microns to 90 microns. Many of the tests are well preserved and some are replaced by glauconite. Some minute siliceous sponge spicules are also present.

Radiolaria are exclusively marine organisms and, being planktonic have a wide distribution. The fact that at the present time they are found most abundantly in tropical waters, suggests that the sediments in which they occur as fossils were deposited under warm climatic conditions. Usually radiolaria are deposited at considerable depth, from 12,000 to 25,000 feet, but they are known to be present in shallow water deposits. In the latter case the deposits are regarded as purely local. (Twenhofel, 1932). There is not enough evidence at present available regarding the occurrence of radiolaria in the Hutton Creek bore to indicate the exact origin of the deposit, but the association of radiolaria with carbonaceous shales containing Glossopteris suggests that the beds were laid down in shallow water under warm climatic conditions. Unfortunately there are no known surface deposits containing radiolaria in the area with which this part of the section can be correlated.

The fact that a marked change of dip was noted between the depths of 3,959 feet and 4,080 feet and that the sediments show evidence of deformation below 3,959 feet, has been interpreted in two ways. Some geologists have thought that the bore may have passed through an unconformity between the Permian and Devonian, others that a fault zone had been met with. In view of the evidence reviewed in this paper there cannot be much doubt that the latter hypothesis is the correct one and that the bore was in Permian sediments when drilling ceased.

The company's geologists report that the bore commenced in grey sandstones, which probably represents the Bundamba Sandstone, a member of the Upper Triassic, and an inspection of the company's log suggests that the base of this sandstone was at the depth of approximately 340 feet. It was considered by Dr. Frank Reeves, formerly attached to Oil Search Limited, that the Bundamba Sandstone overlaps the lower stages of the Triassic in the Hutton Creek area. His geological cross section of the area indicates the Bundamba Sandstone as directly overlying the upper Bowen Series (Permian). The evidence reviewed in this paper suggests that the Upper Bowen Series may not be present at Hutton Creek and that the Bundamba Sandstone rests upon the Middle Bowen Series. Furthermore, the evidence points to the whole of the Hutton Creek bore Section from 650 feet down to 4,688 feet being within the Middle Bowen Series.

No oil was recorded throughout the drilling of this bore, but some small gas showings were noted.

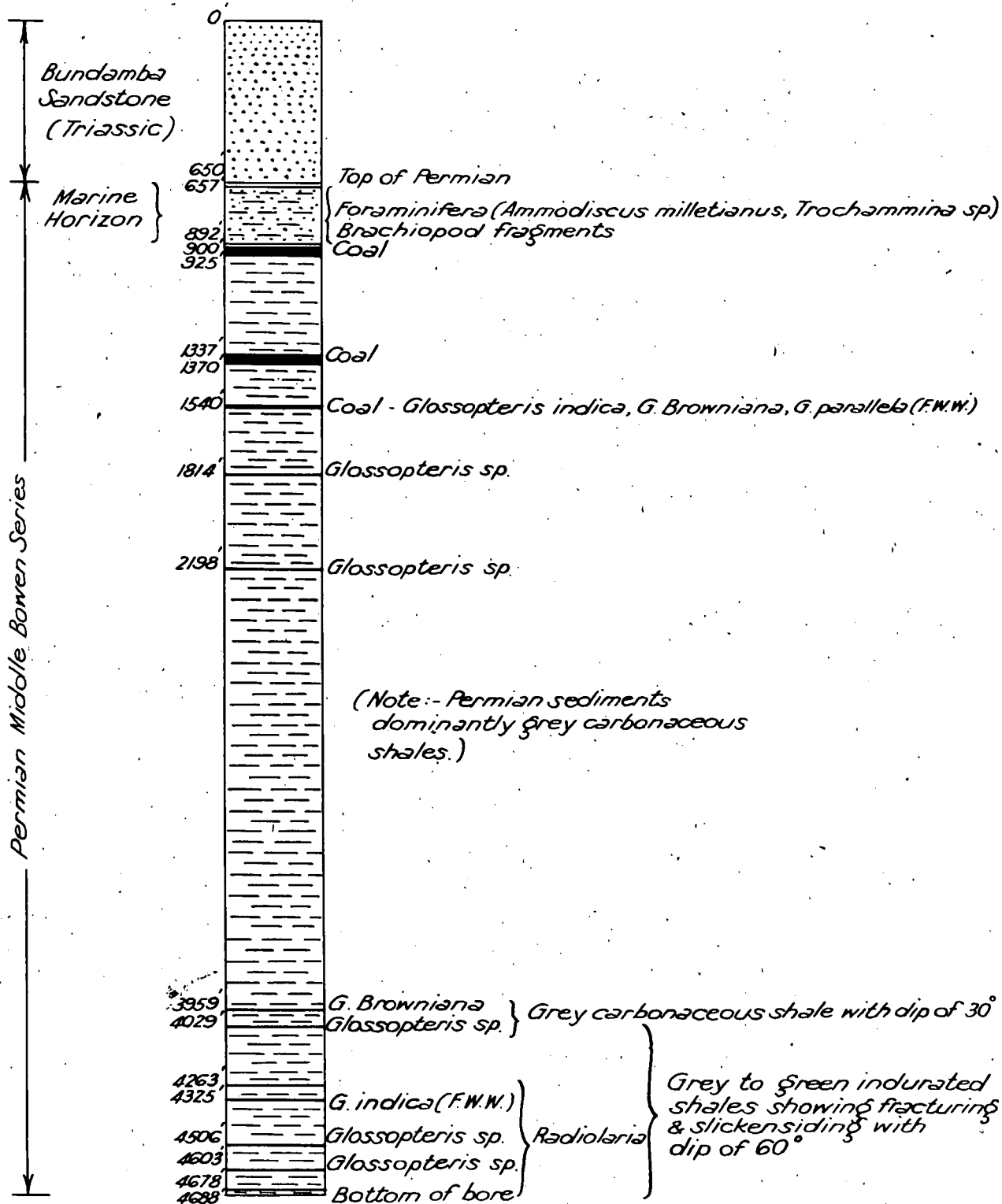
The diagrammatic log accompanying this paper, which summarises the geological evidence revealed by the bore, is compiled from the company's records and from the writer's observations.

References are given at the end of the report on the Arcadia Bore.

CANBERRA.  
16th. February, 1945.

(Irene Crespín)  
COMMONWEALTH PALAEONTOLOGIST.

# DIAGRAMMATIC LOG OF THE HUTTON CK. BORE



DEPARTMENT OF SUPPLY AND SHIPPINGMINERAL RESOURCES SURVEY- THE ARCADIA BORE, QUEENSLAND, -

(Report No. 1945/15, Plan No. 1188).

The Arcadia bore is situated in the parish of Arcadia, county of Westgrove, 85 miles north of Roma and 40 miles north-north-east of Injune, the nearest rail town. It is about 25 miles north of the Hutton Creek bore. Drilling operations extended from 1936 to 1939 and were carried out by Drillers Limited, a subsidiary of Oil Search Limited, with financial assistance from the Commonwealth Government. The bore was drilled in a large dome structure developed in Triassic and Permian sediments. A closure of more than 700 feet was proved. The geological mapping was done under the supervision of Dr. Frank Reeves for Oil Search Limited (1936).

The well was drilled with cable tools to a depth of 4,110 feet and was shut down at that depth for over twelve months, the depth capacity of the plant having been reached. Following the completion of the Hutton Creek bore, the Commonwealth Government plant, which had been used at that site, was transported to Arcadia in 1939. Drilling was concluded in September of that year at the depth of 6,036 feet.

The well was cased with 11 $\frac{3}{4}$  inch casing to 141 feet, 8 $\frac{5}{8}$  inch casing to 1,061 feet, and 6 $\frac{5}{8}$  inch casing to 2,549 feet. On completion of testing, the well was plugged, filled with heavy mud and fitted with a control valve. Unfortunately, the maximum casing head pressure was never determined but records show that it was in excess of 250 lb. per square inch. The drilling indicated that the country was well suited for cable tool plants and that no water troubles were likely to be encountered.

Only small films of oil were met with during drilling, but considerable flows of gas were encountered between the depths of 2,487 feet and 4,110 feet, with small quantities down to 5,940 feet. At 640 feet films of oil were noted and gas was met at 750 feet and 1,187 feet. At the latter depth the gas had the following analysis: Methane - 78.3%; Ethane and higher homologues - 7.0%; Carbon dioxide - 4.9%; Inert gas 9.8%. It was estimated that the flow of gas at 1,187 feet was about 250,000 cubic feet per day.

Between the depths of 2,487 feet and 2,900 feet other horizons were encountered yielding gas of a type different from that obtained at higher levels. The composition of this gas was as follows: Methane - 22.50%; Ethane and higher homologues - 3.0%; Carbon dioxide - 70.7%; Inert gas - 3.8%. The measured rate of the flow of gas at 2,900 feet over a considerable period of time was 3,000,000 cubic feet per day. Further flows were met with below 2,900 feet, but these were of no economic importance.

The Arcadia bore is the second deep bore in Queensland (the first being Hutton Creek bore) from which a comprehensive series of samples has been examined for their microfaunal content. This examination was carried out on 1,256 samples consisting of drill cuttings taken over every five feet and of cores taken at numerous depths below 4,112 feet.

Dr. Reeves indicates that the bore started in an horizon

in the Upper Bowen Series 2,000 feet below the base of the Carnarvon Sandstone (Basal Triassic).

The first sample sent in for examination was from the depth of 170 feet. From this depth down to 1,785 feet, the drill cuttings consist of fragments of light to dark grey shale, calcareous sandstone and carbonaceous shale, indicating freshwater conditions. These beds are referred to the lower portion of the Upper Bowen Series. In this part of the Arcadia structure therefore the Upper Bowen has a thickness of about 3,700 feet.

From 1,785 feet down to 5,994 feet, the sediments are referred to the Middle Bowen Series and are comparable with the Hutton Creek bore section. As in that bore three facies are present:

- (1) A marine one consisting of grey shales containing foraminifera and ostracoda, from 1,785 feet down to 2,390 feet.
- (2) A freshwater one from 2,390 feet down to 4,374 feet, consisting of grey sandstone, grey to dark grey carbonaceous shales with thin bands of coal and plant remains indeterminate.
- (3) A mixed assemblage of marine and freshwater fossils in carbonaceous shale, sandstones, conglomerates, from 4,374 feet down to 5,955 feet with a basal conglomerate from 5,955 feet down to 5,994 feet.

(1) The grey shales which were present in the drill cuttings from 1,785 feet down to 2,390 feet contain an assemblage of marine fossils including foraminifera, spines of brachiopoda and ostracoda. The foraminifera are represented by arcaceous forms such as Ammodiscus multicinctus Cressin and Parr, Hyperamminoides acicula Parr, Ammobaculites woolnoughi Cressin and Parr, Haplophragmoides sp. and Trochammina sp. and the ostracoda by one specimen possibly referable to the genus Basslorella. This assemblage of foraminifera is found in the Middle and Lower Bowen Series in the Springsure area, Queensland, and in the Upper and Lower Marine Series in the Hunter River district, New South Wales. Little micro-faunal investigation has been done on the Permian rocks of Queensland and as a result an exact correlation of the subsurface marine beds with surface exposures is not at present possible. This marine horizon is possibly equivalent to the marine beds which overlie the coal measures at Collinsville. (Reid 1929, 1930).

(2) Sediments of freshwater origin were recognised from 2,390 feet down to 4,374 feet. From 2,390 feet down to 2,585 feet the drill cuttings consist of fine grey sandstone. From 2,585 feet down to 4,374 feet (the first core sample was taken at 4,112 feet) the bore passed through grey to dark grey carbonaceous shales containing plant remains indeterminate and some thin bands of coal. Coal was recorded at 4,110, 4,237, and 4,255 feet.

(3) At 4,374 feet the bore passed into a series of sediments consisting of dark grey to black carbonaceous shales, carbonaceous sandstones, grits, breccias and conglomerates. The greenish grey conglomerates from 5,955 feet down to 5,994 feet are regarded as representing the base of the Middle Bowen Series in the bore section.

Slickensiding and fracturing are noticeable in some of the cores below 4,618 feet, and the company's field geologist

Mr. Peter Dunlop records various angles of dip ranging from 16 degrees to 51 degrees in the beds between the depths of 4,618 feet and 5,463 feet.

Fragments of Glossopteris were noted by the writer in cores taken at various depths between 4,251 feet and 5,743 feet. Glossopteris Browniana was recognised at 5,544 and 5,551 feet, cf. Vertebraria at 5,455 feet and cf. Noeggerathiopsis at 5,446 feet. Noeggerathiopsis Hislopi (determined by Dr. Walkom) occurred at 5,553 and 5,746 feet.

Numerous thin sections of cores were examined in this part of the bore. From 4,374 feet down to 5,853 feet radiolaria and some siliceous sponge spicules were present in rocks similar in lithology to those in which they were found in the Hutton Creek bore. Similar genera of radiolaria such as Carpasphaera, Cenosphaera and Haliomma were noted but the tests were not so well preserved as in the Hutton Creek material.

Green andesites which have suffered intense carbonation (determination by Dr. Germaine Joplin) occur from 5,994 feet down to the bottom of the bore at 6,036 feet, which are probably referable to the Lower Bowen Series. Andesites form the base of the section in the Bowen River coalfield. (Reid, 1929).

The following is a tentative interpretation of the sequence proved in the Arcadia Bore, based on the above observations:

Upper Bowen Series - 170 to 1,785 feet.

Marine zone - 1,785 to 2,390 feet.

Middle Bowen Series- Freshwater zone - 2,390 to 4,374 feet.

Mixed marine and freshwater zone - 4,374 to 5,994 feet.

Lower Bowen Series - 5,994 to 6,036 feet.

The diagrammatic geological section accompanying this paper is based on the company's records and the writer's observations.

CANBERRA  
16th Feb., 1945.

Irene Crespin  
Commonwealth Palaeontologist.



References.

- Crespin, I., 1944. Some Permian Foraminifera from Eastern Australia. Proc. Roy. Soc. Qld.
- \_\_\_\_\_. 1944. Some Permian Ostracods from Eastern Australia. Proc. Roy. Soc. Qld.
- \_\_\_\_\_. and Parr, W. J., 1941. Arenaceous Foraminifera from the Permian Rocks of New South Wales. Journ. & Proc. Roy. Soc. N.S.W. 76, pp. 300-311.
- Parr, W. J., 1940. Foraminifera and a Tubiculous Worm from the Permian of the North-West Division of Western Australia. Journ. Roy. Soc. W.A. 27, pp. 97-111.
- Reeves, F., 1936. Unpublished Reports to Oil Search Limited, Sydney, on the Geology of the Roma-Springsure Area, Queensland.
- Reid, J. H., 1929. Geology of the Bowen River Coalfield. Geol. Surv. Queensland Publ. No. 276.
- \_\_\_\_\_. 1930. The Queensland Upper Palaeozoic Succession. Geol. Surv. Queensland Publ. No. 278.
- Twenhofel, W. H., 1932. Treatise on Sedimentation. 2nd edition, p. 164.

# DIAGRAMMATIC LOG OF ARCADIA BORE, Q'LD.

