COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS:

1963/124

COMPLETION REPORT: STRATIGRAPHIC BORE, BMR 5, GIRALIA, WESTERN AUSTRALIA

by

L.V. Bastian and S.P. Willmott*

(* West Australian Petroleum Pty Limited)

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SUMMARY

The Bureau of Mineral Resources Stratigraphic Bore BMR 5 (Giralia) was located on the northern plunge of the axis of the Giralia Anticline.

The bore penetrated a Cretaceous succession to 1570 feet. The bore started in Korojon Calcarenite, entered Toolonga Calcilutite at 115', Gearle Siltstone at 264', Windalia Radiolarite at approximately 1030', Muderong Shale at 1285' and Birdrong Formation at 1509'. From 1570 to 1580 feet a section containing Jurassic spores was recorded, and below 1580 feet a Permian succession belonging to a part of the Byro Group was encountered, down to the total depth of 2070 feet.

The unconformity between the Mesozoic and Permian rocks was encountered over a thousand feet shallower than expected from the interpretation of the seismic reflection cross-section. There was possibly little Jurassic sedimentation beneath the Giralia structure: the Jurassic spores in the interval 1570 to 1580 feet may be from a fossil soil horizon on the Permian rock.

No significant occurrences of hydrocarbon were recorded.

INTRODUCTION

BMR 5 was drilled in 1958 for the Bureau of Mineral Resources. No completion report was prepared by the B.M.R. well-site geologist, and the material had to be re-examined by L.V. Bastian in 1962. This report is based on a preliminary report made by Mr. S.P. Willmott in the capacity of observer for West Australian Petroleum Pty Ltd (WAPET) at the well-site, and the B.M.R. is indebted to WAPET for permission to include a palynological note by Mr. B.E. Balme which appeared as an appendix to Willmott's report. Only minor alterations to the preliminary report were found necessary, as later work supported his main conclusions.

BMR 5 was drilled by Oil Drilling and Exploration (WA) Pty Ltd under contract to the Bureau of Mineral Resources. The hole was located at shotpoint 3 of S.S.L. line B-I across the northern plunge of the Giralia Anticline (Plate I).

As a result of seismic work carried out by the B.M.R. and later by Seismograph Services of London, it was predicted that an unconformity lay at a shallow depth beneath the surface anticline, and that the Giralia Anticline was underlain by a Palaeozoic syncline with its axis about half a mile west of the axis of the surface anticline. The well was drilled to investigate the stratigraphic succession down to the suspected unconformity and to investigate the nature of the unconformity.

Estimates on the depth of the unconformity varied considerably. Watson (1952) stated that the surface anticline persisted to a maximum depth of 2000 feet, and placed the unconformity at 1500 feet over the crestal area. Chamberlain et al.(1952) considered that the shallow anticline existed to a depth of approximately 3000 feet. Condon et al. (1956) considered (mainly on the basis of measured surface sections) that the depth of the Permian-Mesozoic unconformity was not likely to be more than 2000 feet, and sections of the Cretaceous formations exposed on the Giralia Anticline measured by them suggested that the base of the Cretaceous should occur about 1300 feet. A Jurassic section was anticipated from about 1300 feet to the unconformity.

BORE HISTORY

Drill-hole Data

Location :

Geographic Co-ordinates:22° 39' 31"S. 114° 14'45"E.

Grid Co-ordinates: 1, 173, 400 N. 202, 800 E.

Map Sheet: SF 50 - 9, Yanrey, 1:250,000 series.
30 yds north of the road connecting Giralia and Bullara Homesteads, 8.2 miles from Giralia.

Elevation:

Rotary Table:	248' approx.
Ground:	243' approx.
Date spudded:	26th June, 1958.
Date completed:	31st July, 1958.
Total Depth (R.T.):	2070'
Hole Profile:	Surface to 96' : 8¾" 96' to 2070' : 5⅝"
Casing Run:	88' of 7" 29.9 lb/ft. casing set at 93'
Plug Depths:	1397' and 110'
Status:	Abandoned
Drilling Contractor:	Oil Drilling & Exploration Ltd.

Personnel:

Toolpusher:	A. Madge
Well-site Geologists:	J.M. Pulley (B.M.R.), S.P. Willmott (WAPET)
E Log Operator:	N.D. Jackson

Drilling History

BMR 5 was drilled by a Failing 2500 Holemaster truck-mounted rig. It was spudded on June 26th 1958, and on the same day 7 inch casing was set and cemented at 93 feet after electric and radioactive logs were run. As a result of mechanical trouble, drilling was then suspended while the rig motor was overhauled in Perth.

Drilling was resumed on July 12th, and continued with only one major interruption; twelve hours were spent in the recovery of three stands of drill-collar lost during a trip at 1312 feet. Drilling was completed on July 30th, and plugs were set at 1397 feet and 110 feet on the following day.

Lithological Logging

Ditch samples were collected from surface to total depth at 5-foot intervals during both drilling and coring.

The programme called for 10 feet of core in each 100 feet drilled. Altogether twenty-two cores were cut using a Reed "Kor-King" core barrel with 4¾" soft formation core heads and a hard formation core head. A total of 205 feet of formation was cored, of which 126 feet (61.5%) was recovered. Details of cores cut are listed in Appendix C.

Electric Logging

Several logging runs were made with a 2000' Widco Logging Unit and a 4000' Logging Unit. Several runs of a Gamma Ray Log were also made on the Widco 2000' Logging Unit. These runs have been combined into one log recording Gamma Ray, Self-Potential and a single point Resistivity curve

(Dyson & Jackson 1958). Dyson and Jackson noted the presence of minor irregularities, or "hunting", on the Self-Potential and Resistivity curves, superimposed upon the principal features of the log, and also that a reversal of S.P. polarity occurs below 750', possibly caused by a drilling mud more saline than the pore solutions. The S.P., Resistivity and Gamma Ray curves from the B.M.R.'s published report are used as a base for the accompanying Composite Log.

Electric Log Data : BMR 2000' and 4000' Widco Logging Units

Run Number	1.	2.	4.	5.
Date	27th June 1958	23rd July 1958	29th July 1958	30th July 1958
Interval	20' - 96'	93' - 1313'	98' - 2009'	93' - 2070'
Mud-Nature	Clay base	Lime base	Lime base	Lime base
Mud-Resistivity			0.5 - 0.8	0.9 at 72°F
Mud-Weight			77lbs/cu.ft.	77lbs/cu.ft.
Mud-Viscosity			55 secs.	55 secs.
Mud-Water Loss			30 cc/30 min.	30cc/30 min.
Mud pH			12.6	8.2

Run 3: logged 25th July, to depth 1090'. No Further information.
Gamma Ray Log: Run 1, 30th July 1958. 20' - 2070'.

Drilling Time and Gas Log

Drilling time records were kept for five foot intervals during both drilling and coring.

No continuous gas detection equipment was used on the well. A portable JW Gas Detector was used to test the mud returns for gas at regular intervals and at soft drilling breaks. No signs of gas were recorded with this instrument nor in any flame test on cores.

Formation Tests

No formation tests were conducted in this well.

Deviation Records

Hole deviation was recorded at several intervals, and the results are incorporated in the Composite Log.

Calcilog.

A Calcilog of the available cuttings was run by L.V. Bastian in the B.M.R. Laboratory at Acton, Canberra, and is incorporated in the Composite Log. Details of the method of calcilogging are given in Bastian 1962 (p.5). Tests were carried out at 10 feet intervals on the carbonate-rich lithologies, and at about 50 feet intervals on the carbonate-poor lithologies.

GEOLOGY

Following upon an original study of cores and cuttings by the well-site geologists, Messrs. J.M. Pulley and S.P. Willmott, all available material from the bore was re-examined by L.V. Bastian in the B.M.R. Laboratory at Canberra. The study suffered from the disadvantage that some of the distinctive characters of the lithologies can be seen only when the cores are coming from the hole still wet. Willmott states this was particularly so for the change of formation at about 1030'. The change, which is well-known in Carnarvon Basin drilling, is easy to pick only on fresh material coming from the hole.

Previous Work.

Raggatt (1936) noted the existence of the Giralia Anticline, and used the Divisions "Winning Series" and "Cardabia Series" for the Cretaceous rocks exposed in this region. Condon *et al.*(1956) described the Giralia and Marilla Anticlines in detail, and noted that they were asymmetrical anticlines with steepest flanks to the east. The amended divisions Winning Group and Cardabia Group were used, and they did not record Toolonga Calcilutite (the lowest unit of the Cardabia Group) on the surface in the Giralia Anticline. In McWhae *et al.*(1958) Korojon Calcarenite is described as thickening to the north at the expense of Toolonga Calcilutite, which is thin or absent on the Giralia Anticline.

Formations

BMR/5 spudded in the Korojon Calcarenite and penetrated the usual Cretaceous sequence of the Carnarvon Basin. A thin (10 feet) bed of Jurassic siltstone was encountered between the Cretaceous Birdrong Formation and the Permian Byro Group.

The following formation tops were recognised by means of electric logs and lithology. Ages and stratigraphic correlations are taken from McWhae *et al.* (1958), and Belford (1958).

Age	Formation	Depth R.T.	Depth Subsea	Thickness
Cretaceous	Korojon Calcarenite	5'	+ 243'	110'+
	Toolonga Calcilutite	115'	+ 133'	149'
	Gearle Siltstone (Upper)	264'	- 16'	106'
	Gearle Siltstone (Lower)	370'app.	- 122'	660'
	Windalia Radiolarite	1030'app.	- 782'	255'
	Muderong Shale	1285'	- 1037'	224'
	Birdrong Formation	1509'	- 1261'	61'
Jurassic	?	1570'	- 1322'	10'
Permian	Byro Group	1580'	- 1332'	490'+
	T.D.	2070'	- 1822'	

Cretaceous

Korojon Calcarenite (Campanian to Lower Maestrichtian) (5'-115'). The outcropping formation consists of fine-grained cream to yellow and yellow-brown, clayey calcarenite, with some glauconite and is generally rich in *Inoceramus* fragments and foraminifera.

The base of the formation is placed at the point where yellow calcilutite with *Inoceramus* gives way quite sharply to green calcilutite without *Inoceramus*. A sharp electric log break at 115' corresponds to the distinctive lithologic break noted in the samples.

The Korojon Calcarenite has a widespread distribution both in surface outcrop and in the sub-surface in the north-western portion of the Carnarvon Basin.

The age of the formation has been determined on previous samples from outcrop and bores as being Upper Campanian to Maestrichtian (Belford 1958). The age is accepted here as the lithologic correlation is undoubted.

Toolonga Calcilutite (Santonian to Campanian) (115' - 264'). This formation consists of green to bluish-green, very clayey calcilutite with dark green lenticles, grading to marlstone; also with lenses and stringers of pyrite or marcasite. The calcilog shows a range from about 50% to 75% calcite, with the percentage dropping off rather unevenly downwards. Scattered foraminifera and belemnite fragments occur throughout.

The boundaries of the formation are well marked on both lithological and electric log characteristics, but the latter reflect strongly the gradual increase in clay content within the unit itself.

The Toolonga Calcilutite has a widespread distribution over the western portion of the Carnarvon Basin from the Murchison River to Cape Range, and east to Yanrey No.1 and BMR 5. As noted above, the formation was not mapped in surface exposures in the Giralia Anticline, probably due to paucity of exposures, although the unit may have been included in the Korojon Calcarenite or, more likely, in the Gearle Siltstone.

The age of the formation has been determined from previous bores and from outcrops near the mouth of the Murchison River. The accepted dating (Belford 1958) is Santonian to Lower Campanian.

Gearle Siltstone (Albian to Turonian) (264' - 1030' approx.). This formation consists of two rather distinct lithologies and can be subdivided into the Upper Gearle Siltstone and the Lower Gearle Siltstone.

The upper member of this formation consists of a dark grey to light grey slightly silty calcareous claystone, with abundant foraminifera and aggregates of pyrite.

Samples from the vicinity of formation change to the lower unit were not available to the author; Willmott notes however that on ditch samples the base of this lithology and the first appearance of the underlying bentonitic shale occurs about 365'. No marked change in electrical character takes place at this point.

The Upper Gearle Siltstone is similar to the unit identified in the Rough Range wells as it consists of a non-bentonitic dark claystone; but it is not as calcareous in this well as it is in Rough Range.

This upper unit has been identified in the Rough Range Wells, Yanrey No.1, Warroora No.1, and BMR 5. It does not occur in the Cape Range wells and has not been identified in wells south of Carnarvon.

The lower unit of the Gearle Siltstone occurs between about 365' and 1030' approx. The lithology consists of dark grey to black, bentonitic claystone, rather fissile, with glauconitic beds and lenses, in part grading into a very fine silty claystone. Samples show the characteristic finely mottled appearance of a bentonitic shale; the proportion of bentonite ranges from 5% to 15%. The formation has foraminifera throughout. Sporadic sideritic beds (generally 5%-10% siderite, but in parts much richer) are present in this unit; they are well marked by sharp peaks of resistivity and slow drilling rates in hard rock. The strongest beds are at 723', 983', and 986'. Core 10 contains one of the sideritic beds, (described in Appendix E), which is cut by a vein of calcite. Willmott (1959, p.6) noted the presence of several beds of dolomite in the lower fifty feet of the formation, but these were not seen by Bastian.

The Gearle Siltstone occurs in the sub-surface over the western part of the Carnarvon Basin from Peron Peninsula to near Onslow, and its age is accepted as Albian to Turonian.

The lower boundary is placed rather arbitrarily, about 1030' on a fairly prominent bed on the gamma ray log. A lithologic change to medium grey rather calcareous claystone occurs near this point.

Windalia Radiolarite (Aptian to Lower Albian) (1030'approx. - approx. 1285'). This formation consists of medium grey, slightly calcareous, pyritic slightly micaceous claystone, rather fissile in parts; with minor medium grey glauconitic, silty claystone grading to siltstone. The formation is fossiliferous in the upper part with abundant foraminifera and scattered large pelecypods. In part the shale is permeable. Further beds of siderite are present at 1080', 1151' and 1170'.

The lithology change to Windalia Radiolarite was not obvious to the later author on the dry specimens. As noted elsewhere, it was apparently quite obvious on the fresh wet samples at the well-site, the nature of the change being quite distinctive in bores throughout this region.

The age of the formation is accepted as Aptian to Lower Albian.

<u>Muderong Shale</u> (Aptian)(1285' - 1509'). This formation begins with a thick bed of green to green-grey and grey fine-grained to very fine-grained, very glauconitic, very poorly sorted, silty and clayey, <u>sandstone</u> with some pyrite and mica. The unit passes down into dark green and grey-green glauconitic, slightly micaceous <u>siltstone</u> with some pyrite and scattered very fine grains of <u>quartz</u>. A feature of the formation is the abundance of glauconite. There is a thin (1')transition zone into the underlying Birdrong Formation.

The unit is well shown on all logs, with a higher natural radioactivity than the Gearle Siltstone, and rise in S.P. and resistivity. No shale is present here, but the high glauconite content leaves little doubt as to its equivalence with Muderong Shale.

The age of the formation is accepted as Aptian on previously recorded palaeontological data.

<u>Birdrong Formation</u> (Neocomian to Aptian) (1509' - 1570'). This formation consists of medium-grained, very friable, greenish-grey glauconitic <u>sandstone</u>, with well rounded grains. It is poorly sorted with abundant finely divided mica in a silty matrix. The age of the formation appears to be Neocomian to Aptian.

No signs of hydrocarbons were observed. The reversed SP curve suggests fairly fresh water saturation.

<u>Jurassic</u>:

<u>Upper Jurassic</u> (1570' - 1580'). As a result of palynological examination, Upper Jurassic spores were found in Core 16 (1574'-1580'). The core consists of light grey, permeable, micaceous, fine <u>siltstone</u>, with abundant black vitreous specks. Interlaminated with this siltstone is fine-grained and very fine-grained, poorly sorted, kaolinitic, white <u>sandstone</u> passing into kaolinitic coarse <u>siltstone</u>.

Interpretation of the electric logs and gamma ray log restricts the Jurassic lithology to a 10-foot bed. The underlying beds are the sub-greywackes, siltstones and sandstones of the Permian Byro Group. A prominent feature of the gamma ray log is the very high radioactive count of this bed which is considerably higher than that recorded in all other shales and siltstones in the well. Such a concentration of radioactivity often indicates a fossil soil horizon.

The laminae and lenses of sandstone and siltstone in the core are lithologically identical to similar lenses in the underlying Permian rocks. The siltstone is also similar apart from its light colouration and permeability. Thus, on lithologic grounds this Jurassic lithology could be interpreted as the weathered surface of the underlying rocks.

Two interpretations of these facts are:

(a) a very thin Jurassic sequence was deposited, and with possible losses due to post-Jurassic, pre-Birdrong erosion, only a very thin veneer has been left at the location;

(b) the thin section containing a Jurassic spore assemblage represents a fossil residual soil horizon. In this case there was probably no Jurassic deposition. Under wet conditions an abundant vegetation could have been supported in Jurassic times and the resulting spores washed into the immediately underlying weathered rocks. Balme states the Jurassic microflora is not diverse, which would be expected of a flora growing <u>in situ</u>. The variation in electric log character could be caused by weathering of the old Permian surface.

Nevertheless no open joints or fractures are apparent which could have permitted spores to enter, and thus whereas Willmott (1959, p.7) has preferred the second alternative, Bastian favours the first.

Permian:

Byro Group (Upper Artinskian) (1580' - 2070'). This group begins with fine and very fine-grained light grey, micaceous subgreywacke with laminae of dark grey siltstone and white fine-grained, rather feldspathic sandstone with some carbonaceous beds. The bedding in many places throughout the section shows marked slumping and cross-bedding. Almost imperceptibly, this lithology passes into dark grey, very micaceous siltstone with laminae of white, fine-grained, calcareous sandstone and coarse siltstone; and then to dark grey sandy siltstone with laminae of feldspathic fine-grained sandstone and calcareous sandstone. The rocks become more fissile downwards, and within the lowest 100 feet consist of dark grey shale with minor laminae of white calcareous sandstone and siltstone, and black micaceous siltstone.

A slight increase of carbonates is shown by the Calcilog for this unit as a whole, but never exceeding 10%. Reactions in the Calcimetry continued for longer times than in higher units, and probably are caused by reactions upon siderite, which appears in nodules and as cement. Cores 20, 21 and 22 show rapid and sharp changes of sediment type, and carry evidence of strong disturbance, such as sand lenses broken and rolled out into balls by strong agitation, and twisted cross-bedding. Numbers of vertical burrows are also present, and with the evidence above, suggest a shallow water environment.

The formation can be correlated readily with the Byro Group on lithology and age dating. However what part of the Byro Group is represented is not clear, as no distinctive changes of lithology can be recognized.

Balme determined the age of the formation as Artinskian, probably Upper Artinskian. This dating is accepted.

No foraminifera were observed. However spores, pollen grains and microplankton were found by Balme, and Evans (Appendix B) notes the presence of rare microplanktonic hystrichospheres in Cores 18 to 22.

Structure

BMR 5 (Giralia) was located on the northern plunge of the surface axis of the Giralia Anticline. Dips throughout the Cretaceous were flat, while dips throughout the Permian averaged $3^\circ - 5^\circ$.

The evidence gained from this core does not change the structural interpretation of the Giralia Anticline, namely that the surface anticline overlies a post-Permian, pre-Cretaceous fault-controlled syncline.

Hydrocarbon Shows

No hydrocarbon was noted throughout the drilling of this bore.

CONTRIBUTIONS TO GEOLOGICAL KNOWLEDGE

The contributions to geological knowledge made by this bore may be summarised as follows:

(a) The seismic unconformity indicated at about 2700 feet is not the Permian-Mesozoic unconformity, as this was encountered at 1570 feet.

(b) The Permian-Mesozoic unconformity was encountered at 1570 feet, in a zone without seismic reflections.

(c) Probably little or no sedimentation took place in this area during Jurassic times. The thick Jurassic sedimentation of Cape Range (12,000'+) and the paralic sedimentation of Rough Range (2,500') therefore probably did not extend as far east as the Giralia Anticline.

(d) The Gearle Siltstone (766' approx.) is thicker than in other parts of the Giralia Anticline, where it varies between 450' and 535' (McWhae et al.,1958).

(e) Muderong Shale was defined (Condon,1954) as "the formation of bentonitic shale, claystone and siltstone conformable between the Birdrong Formation below and the Windalia Radiolarite above". In McWhae et al.(1958) it is described as containing greensand as well. The formation here is mainly sandy siltstone and therefore differs, although the high glauconitic content leaves little doubt as to its lithological continuity with the formation elsewhere.

(f) Windalia Radiolarite also differs from its defined lithology, and, although lithological continuity with true radiolarite is accepted, the interval is better considered here as a subdivision of the Gearle Siltstone.

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at the present time. Sample C is thought to be Artinskian, also perhaps Upper Artinskian.

APPENDIX "A" Report No.GDP 30.

by B. E. Balme

SAMPLES SUBMITTED BY WEST AUSTRALIAN PETROLEUM PTY. LIMITED.

8th May, 1958.

Sample A. B.M.R. No.5 (Giralia). Core 16, 1574' - 1580'

Grey siltstone.

Assemblage

Araucariacites australis

Pityosporites spp.

Classopollis torosus

Cyathidites minor

Cicatricosisporites cooksoni

Zonalepollenites dampieri

Z. trilobatus

Osmundacidites comaumensis

Remarks

The microflora is not a diverse one but is almost certainly of Upper Jurassic age.

Sample B. B.M.R. No.5 (Giralia). Core 18, 1690'-1700'

Black and grey claystone

Assemblage

Marsupipollenites triradiatus

Granulatisporites trisinus

Lueckisporites limpidus

L. amplus

L. fusus

Cirratriradites spp.

Leiotriletes directus

Acanthotriletes tereteangulatus

Apiculatisporites levis

Florinites eremus

Nuskoisporites spp.

Marsupipollenites scutatus

The microflora also contained a number of undescribed forms as well as fairly plentiful spinose hystrichosphaerids.

Remarks

Despite the diversity of this assemblage it is not easy to date it precisely. It is undoubtedly post-Sakmarian and from the abundance of the genera Marsupipollenites and Lueckisporites appears to be younger than the Poole Sandstone in the Fitzroy Basin. On the other hand it contains none of the forms that characterise the Liveringa Formation in the Fitzroy Basin or the Upper Permian coals of N.S.W.

An Artkinskian, probably Upper Artinskian age is suggested.

Sample C. B.M.R. No. 5 (Giralia) Core 22, 2060' - 2070'

Black shale.

Remarks

The assemblage in this sample is basically similar to that in sample B. Differences do exist but it is not possible to assess their stratigraphical significance, if any, at the present time. Sample C is thought to be Artinskian, also perhaps Upper Artinskian.

APPENDIX B

Notes on the Spores and Microplankton of

B.M.R. No. 5 (Giralia).

by

P.R. Evans

Samples from cores 2 - 22 inclusive of BMR 5 have been processed for spores and microplankton. No detailed study of these samples has yet been carried out, but a preliminary examination has produced the following results:

c. 2	193 - 203 feet	Upper Cretaceous (?Turonian-Santonian)
c. 3 to c.12	295 - 305 feet to 1200 - 1210 feet	Lower-Upper Cretaceous. The boundary between epochs cannot be defined at present. Microplankton are generally abundant, spores are not common.
c.13 to c.15	1302 - 1312 feet to 1505 - 1515 feet	Lower Cretaceous. Marine. Many spores; contains a microplankton assemblage typical of a lower division of the marine Cretaceous of the Great Artesian Basin which includes the Roma Formation. This assemblage is so distinct that its zone could and probably will be named after a good marker, Dingodinium cerviculum.
c.16	1574 - 1580 feet	Mesozoic: Upper Jurassic or Lower Cretaceous. No microplankton observed, spores only.
c.17 to c.22	-1608 - 1618 feet to 2060 - 2070 feet	Permian. Undifferentiated. Rare microplanktonic hystrichospheres in cores 18 to 22 suggested brackish or marine origins.

APPENDIX C

List of Cores

Core No.	Type of Corehead	Depth	Footage Cored	Recovery	Lithology
1	SF	100'-110'	10'	9'	Calcilutite with *Inoceramus*
2	SF	193'-203'	10'	7½'	Calcilutite, green
3	SF	295'-305'	10'	8	Calcareous claystone
4	SF	397'- 405'	8'	4'	Silty claystone rather fissile
5	SF	500'- 507'	7'	6'	Silty shale
6	SF	604'- 611'	7'	5'	Fine siltstone
7	SF	705'- 715'	10'	5½'	Claystone
8	SF	810'- 820'	10'	1'	Claystone
9	SF	892'- 902'	10'	9'	Claystone, rather fissile
10	HF	985'- 995'	10'	1'	Sideritic claystone with calcite vein
11	SF	1096'-1106'	10'	6'	Calcareous claystone
12	SF	1200'-1210'	10'	1¼'	Calcareous claystone
13	SF	1302'-1312'	10'	3'	Greensand
14	SF	1400'-1409'	9'	¼'	Glauconitic coarse siltstone
15	SF	1505'-1515'	10'	3½'	Glauconitic siltstone
16	SF	1574'-1580'	6'	4½'	Fissile siltstone and/subgreywacke
17	SF	1608'-1618'	10'	7'	Subgreywacke
18	SF	1690'-1700'	10'	10'	Siltstone and sub-greywacke
19	SF	1794'-1802'	8'	7½'	Siltstone and fine sandstone
20	SF	1896'-1906'	10'	10'	Siltstone
21	SF	1999'-2009'	10'	10'	Black shale
22	SF	2060'-2070'	10'	7'	Black shale

APPENDIX D

Preliminary Note on the Foraminifera, cores Nos. 15 to 22, B.M.R. No.5, Giralia, Carnarvon Basin, Western Australia.

by

Irene Crespin

Small portions of cores Nos. 15 to 22 were recently received from BMR. No.5, Giralia, Carnarvon Basin, which is situated about 30 miles north of WAPET'S Giralia No.1 Bore. A note attached to Core No. 15 (1505-1515 feet) suggested that the bore may have entered the Permian at that depth. This was not confirmed by microfossil examination. The rock when washed was a dark grey micaceous siltstone with glauconite and contained Lower Cretaceous foraminifera.

The lithology of Core No.16 at 1574-1584 feet was a grey unfossiliferous fine-grained silty sandstone. This lithology is frequently found at the base of the Mesozoic section.

It is suggested here that the bore penetrated the Permian in Core No.17 at 1608-1618 feet, when the lithology changed to grey and dark grey, carbonaceous and micaceous sandy siltstone. This lithology persisted down to the last core received, Core No. 22 at 2060-2070 feet. No foraminifera were present in the small amount of rock available for examination from Core 17; it is quite probable that they will be found when further material arrives. Permian foraminifera were present in Cores No.18, 19, 21 and 22, the last core containing a good assemblage of species. No foraminifera were found in Core 20 at 1896-1906.

The following foraminifera were found in these cores.

Core 18 - 1690-1700 feet

Hyperammina sp.
Ammodiscus nitidus Parr

Core 19 - 1794-1802 feet

Rectoglandulina serocoldensis (Crespin)
Frondicularia sp.

Core 21 - 1999-2006 feet

Hyperammina sp.

Core 22 - 2060-2070 feet

Ammodiscus nitidus Parr
Frondicularia woodwardi Howchin
Flectospira prima Crespin and Belford
Giraliarella angulata Crespin
Glomospirella nyei Crespin
Hemigordius harltoni Cushman and Waters
Hyperammina callytharraensis Crespin
Hyperammina fusta Crespin
Hyperammina cf. *elegantissima* Plummer.
Nodosaria raggatti Crespin
Nodosaria conico-densestriata Paalzow
Pelospina ampulla Crespin
Psammosphaera pusilla Parr
Reophax emaciatus Plummer
Spiroplectammina carnarvonensis Crespin
Thuramminoides sphaeroidalis Plummer
Trochammina subobtusa Parr

The assemblage in Core 22, with the calcareous imperforate forms, *Flectospira prima* and *Hemigordius harltoni* and the calcareous forms, *Nodosaria raggatti*, *N. conico-denestriata* and *Frondicularia woodwardi* was found between the depths of 420 feet and 660 feet, the top horizon of Permian foraminifera in Giralia No.1 Bore, 30 miles to the south. *Flectospira prima* was described from the depth of 560-570 feet in that bore and *Hemigordius harltoni* was recorded at 620-630 feet. *Spiroplectammina carnarvonensis* was described from 420-440 feet. The assemblage is regarded as the equivalent to that of the basal part of the Byro Group.

F. prima, *H. harltoni* and *N. raggatti* are also characteristic of the Noonkanbah Formation of the Canning (and Fitzroy) Basin. So far indications are that they are restricted to beds younger than the Callytharra Formation.

Permian foraminifera were first recognised in the Giralia No. 1 Bore in Core 11 at 380-390 feet.

APPENDIX E

PETROLOGY OF SAMPLES FROM CORE 10, BMR 5, GIRALIA

by

W.B. Dallwitz

Following are brief descriptions of two specimens from 985 feet to 995 feet, core No.10, BMR. 5, Giralia, Carnarvon Basin, Western Australia.

The first specimen, from the upper part of the core, is a fine-grained, somewhat porous, dark grey rock containing a vein of coarse, yellow calcite, which is separated from the black rock by a pale buff vein about 1 mm. wide. A vein of the pale buff mineral also traverses the dark grey rock at right angles to its junction with the calcite vein.

The dark grey rock consists almost entirely of rudely spherical masses of buff-coloured siderite (or other iron-bearing carbonate) whose size ranges from 0.04mm. to 0.16 mm., the average being 0.10 to 0.12 mm. Some of these carbonate bodies have a suggestion of a spherulitic or part-spherulitic structure, and all show irregular or wavy extinction. Where the spheres are contiguous they tend to be polygonal in outline, but most are separated by thin films or small pockets of brown, almost isotropic material containing minute grains of hydrated iron oxide and scattered flakes of a green, chloritic mineral. The brown material is probably clay, but may possibly be chamosite.

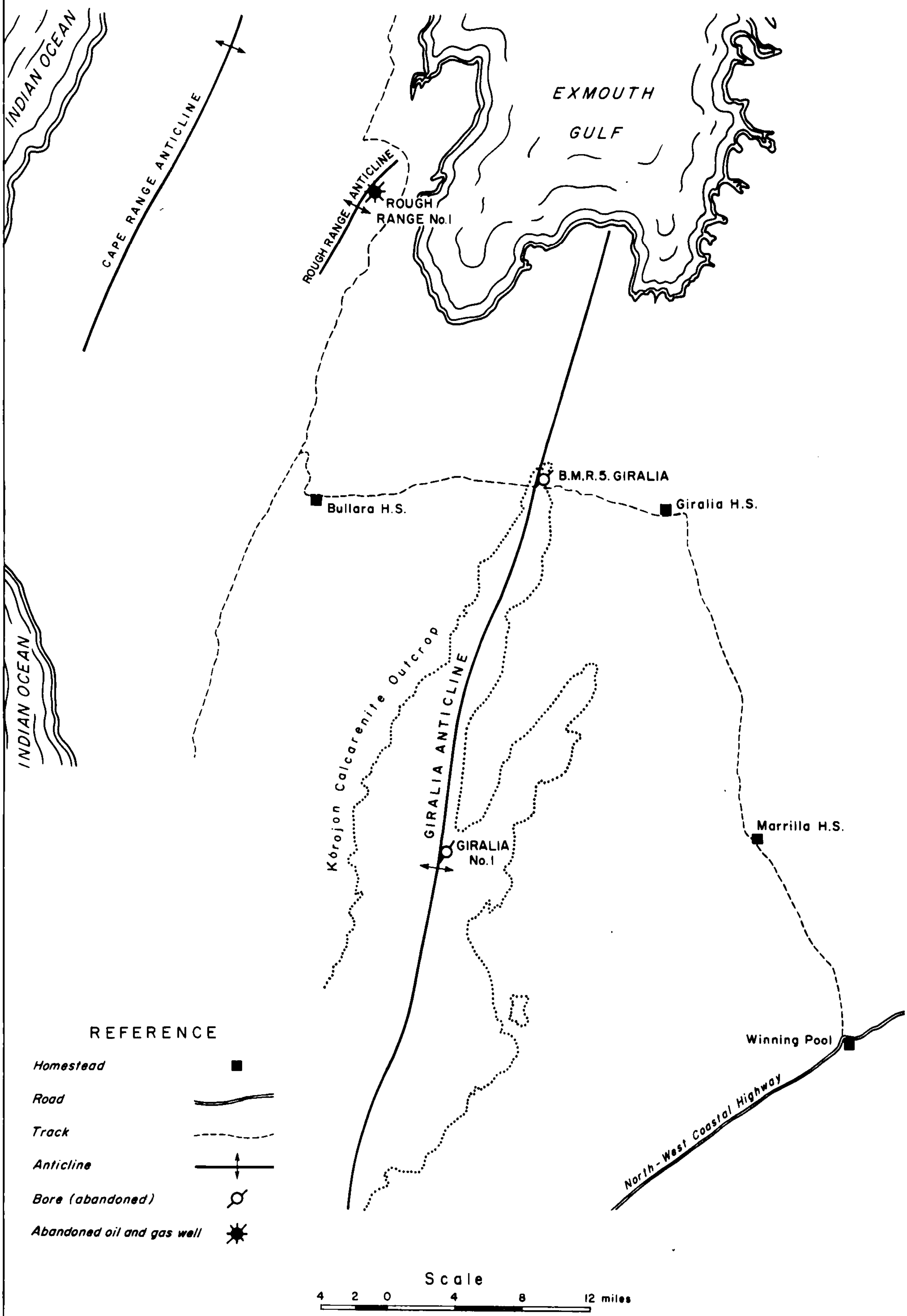
Pyrite occurs as accessory grains throughout the rock, which is probably best described as a clay ironstone.

The vein separating the clay ironstone from the yellow calcite consists of an iron-bearing carbonate which is very much less deeply coloured than that in the spherules. The vein has a pronounced comb structure, and crystals with sharply-pointed terminations project into the calcite.

The second specimen, from the lower part of the core, is a clay-ironstone similar to that just described, but is notably more friable and porous. The component "spherules" are slightly smaller, and their shapes are highly irregular. A few minute grains of quartz are scattered through the slide. The material which is interstitial between the carbonate-bodies is generally much lighter than that in the previously described specimen; it appears to be largely chloritic, and may be chamosite.

PLATE I.

LOCALITY MAP OF B.M.R. 5, GIRALIA



Bureau of Mineral Resources, Geology and Geophysics. October 1963. To accompany Record No 1963/124.

F50/A5/2

B.M.R. 5 GIRALIA

COMPOSITE LOG

STATE: WESTERN AUSTRALIA   BASIN: CARNAVON   LOCALITY: GIRALIA

LOCATION: Latitude: 22°39'25.5"S
Longitude: 114°14'45"E

ELEVATION: Surface: 243' approx.
Rotary Table: 248' approx.

DATE SPUDDED: 26/6/58

DATE COMPLETED: 31/7/58

TOTAL DEPTH (from R.T.): 2070'

STATUS: Abandoned

HOLE PROFILE: 8½" 0-96'
5⅝" 96'-T.D.

CASING PROFILE: 7" to 93'

PLUG DEPTHS: 1397' and 110'

ELECTRIC LOG DATA:

INSTRUMENT: Electrical log 4000' Widco
Radioactive log 2000' Widco

DATE: 30th. July 1958

INTERVAL: 93'-2070'

MUD NATURE: Lime base

DENSITY: 77 lbs/cu.ft.

VISCOSITY: 55 S

RESISTIVITY: 0.9 ohm m. at 72°F

pH: 8.2

WATER LOSS: 3 c.c per 30 mins.

Drilling Contractor: Oil Drilling and Exploration Ltd.

Lithology by: S.P. Willmott and L.V. Bastian

LITHOLOGY

- Medium-coarse sandstone
- Fine sandstone
- Siltstone
- Claystone / shale
- Calcarenite
- Calcilutite
- Marl
- Siderite rock

SYMBOLS

- Pyrite
- g Glauconite
- r Radiolarian remains
- Macrofossils
- Plant fossils
- Microfossils
- Spores
- Casing shoe
- 5° Cored interval, showing recovery and dip
- ½° Deviation