GEOLOGICAL COMPLETION REPORT, BORES BMR No.8 and BMR No.9, BYRO BASIN, WESTERN AUSTRALIA

by

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RECORDS 1959/149

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SUMMARY

Bores BMR No.8 (Mt. Madeline) and BMR No.9 (Daurie Creek) were drilled in the Permian rocks of the Byro Basin, Western Australia, to ascertain the petroleum source possibilities of the area and to obtain information on relations between structure and sedimentation. The tops of the formations were obtained and their lithologies were recorded by inspection of cores and ditch cuttings.

Possible petroleum reservoir strata were noted at 1513 to 2085 feet at BMR No.8 and 1665 to 2643 feet at BMR No.9. They are both permeable and porous marine quartz sandstones in the Lyons Group. Electric logging indicated that they contain salt water.

The upper One Gum Formation at BMR No.8 has been correlated with a formation at BMR No.9 of similar lithology but occupying the stratigraphic position of the outcropping Keogh Formation at Daurie Creek. This formation is considered to be the equivalent of the One Gum Formation. The equivalent of the Keogh Formation at BMR No.9 has changed into the lithology of the Madeline Formation and is represented only by a lower sandy and silty member of that formation. The lower part of the One Gum Formation at BMR No.8 has been correlated with the upper Monument Formation at BMR No.9.

INTRODUCTION

BMR No.8 (Mt. Madeline) and BMR No.9 (Daurie Creek stratigraphic test bores were drilled by the Bureau of Mineral Resources between May 25, 1959 and August 12, 1959. The purpose of the project was to assess the petroleum source and reservoir capabilities of the Permian strata of the Byro Basin and to improve the understanding of the geology, particularly the relationships between structure and sedimentation.

The area is located between the Wooramel River to the south, Congo Creek to the north-east, and the Carrandibby Range to the west within the Glenburg 4-mile sheet (Fig.2).

BMR No.8 can be reached by a branch road which leaves the main Mullewa-Carnarvon road two miles north of Byro station homestead and runs some 40 miles to the north-west. The bore is located on Byro station property.

BMR No.9 is reached by following the road from Coordewandy homestead (on the Mullewa-Carnarvon Highway) to a point 6 miles west of the homestead. It is located on Coordewandy station property.

The bore sites were pegged in February 1959 by M.A. Condon who at the same time showed me several outcrop sections typical of the formations expected in the bores.

BORE HISTORY

BMR No.8 was located on the south-east flank of the Madeline anticline to the east of the Carrandibby Range. The map coordinates are Lat.25°46'S. and Long.115°34'E. The bore spudded the uppermost Keogh Formation May 25, 1959 and was completed in Lyons Group at 3000 feet July 12, 1959. BMR No.8 is about 800 feet above sea level (by estimation of height relative to the BMR gravity station in the area).

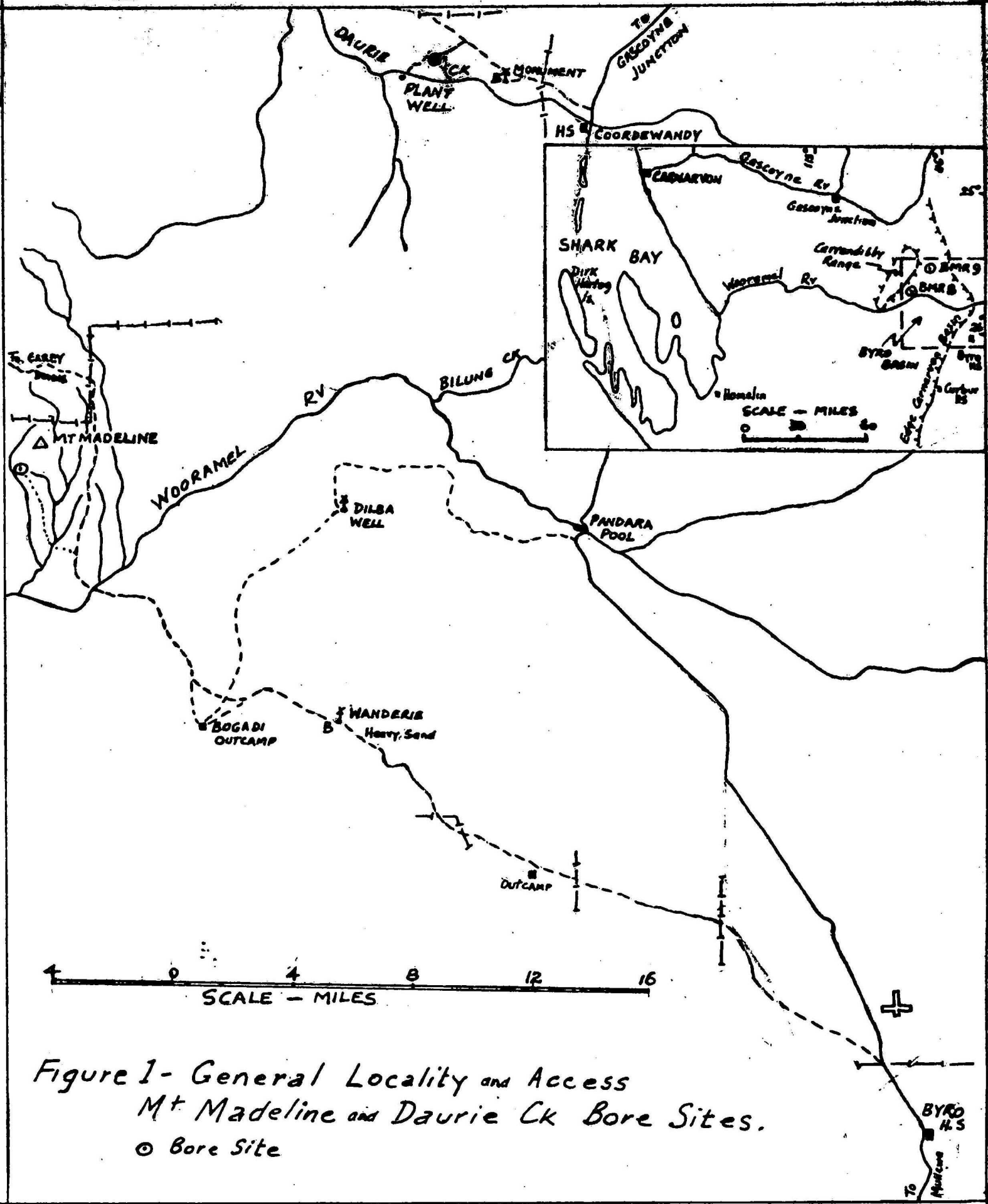

Figure 1- General Locality and Access
Mt Madeline and Daurie Ck Bore Sites.
⊙ Bore Site

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Fig.1: Map showing location of bores BMR No.8 and BMR No.9.

BMR No.9 was located on the axis of the Plant Well Syncline at Lat.115°53'E. and Long.25°32'S. The bore spudded in Bogadi Greywacke July 16, 1959 and was completed in the Lyons Group at 2299 feet August 12, 1959. BMR No.9 is about 900 feet above sea level (by estimation of height relative to the BMR gravity stations in the area).

Both bores were abandoned with surface casing and cement plugs, BMR No.9 also has a cement plug at 2030 feet.

Petroleum Permit to Explore 28H covering the area is held by West Australian Petroleum Pty. Ltd., 251 Adelaide Terrace, Perth, Western Australia.

DRILLING DATA

Oil Drilling and Exploration Company, 237 Adelaide Terrace, Perth, W.A. was contracted for the work. They used a Failing 2500 drilling rig belonging to the Bureau of Mineral Resources. The rig has a capability of 4500 feet.

The drilling assembly included four $4\frac{1}{2}$ inch drill collars with $2\frac{3}{8}$ inch drill pipe in double stands. One 1.65 foot sub was used to connect the drill collars with the string of drill pipe. A 2 to 3 ton weight was maintained on the drilling bit.

The rig employed a Rank-Wheatly 75 H.P. mud pump and after 1000 feet at BMR No.8, this alternated with a Gardner-Denver 29 H.P. auxiliary pump.

BMR No.8. Pump pressure averaged 100 to 150 psi from surface to 200 feet; 200 to 300 psi from 200 to 500 feet and 350 to 400 psi from 500 feet to the total depth at 3004 feet. Rotary speed was maintained between 60 and 90 rpm. Water was used for the first 89 feet of drilling after which mud was added. Viscosity was maintained at 30 to 40 secs. until 1350 feet where 40 to 50 secs was established. The weight of the mud averaged 73 to 76 lbs/c.ft.

The hole was spudded to 89 feet using a Wallace $7\frac{7}{8}$ inch KWY 3-cone bit. Surface casing was set at 83 feet and cemented. For the remainder of the drilling programme a $5\frac{5}{8}$ inch bit was used for drilling and a $4\frac{3}{4}$ inch bit for coring. Ten foot cores were taken at approximately 100 foot intervals. The diameter of the completed hole was $5\frac{5}{8}$ inches except for the final coring interval of 5 feet, where the diameter is $4\frac{3}{4}$ inches.

On completion the rig exerted 45,000 lbs pull on the surface casing but failed to loosen it. A 10 foot plug was set at the top of the casing and BMR No.8 was abandoned.

BMR No.9. Pump pressure averaged 100 to 150 psi for the first 300 feet, 150 to 250 psi from 300 to 1000 feet and 250 to 300 psi from 1000 to 2300 feet. Rotary speed varied from 50 to 100 rpm.

Water was used for the first 100 feet. Mud was then added. Mud viscosity was kept at 40 to 50 secs and mud weight maintained at 75 to 80 lbs/c.ft. for the remainder of the drilling. The hole profile is $5\frac{5}{8}$ inch except for the final 4 feet of coring where the diameter is $4\frac{3}{4}$ inch.

On completion of the Daurie Creek bore, a plug was set at 2030 feet and bailing began in order to observe suspected oily water. The water level rose rapidly in the hole, however, due to a swabbing action by the bailer. The sand line broke and the 40 foot bailer dropped to the cement plug at 2030 feet. Following two unsuccessful attempts to recover the lost bailer, the hole was abandoned. A ten foot plug was set at the surface.

Ditch-cuttings samples were taken every 5 feet continuously during the drilling of both holes. A core was taken every 100 feet keeping within about 20 foot on either side of the 100 foot mark. Coring intervals vary because it is expedient to start coring at any time the drilling assembly is withdrawn from the hole near the 100 foot mark.

Logging. A Widco 4000 electric logging unit was used to obtain a self-potential and resistivity log. It was operated by F. Jewell, Geophysical Section, Melbourne, Victoria (Jewell 1959; also Wiebenga and Jewell 1959).

Deviation. Deviation records were obtained by a Totco recorder. At no time was deviation over 2^{o}.

GEOLOGY

Previous Work. The first work in the area was a line reconnaissance by W.G. Woolnough (1928).

Waterford made a detailed study of fossils in the Permian strata, and prepared a map of the area, which was not published. During the period from 1947 to 1955 investigations were carried out in the Carnarvon Basin by geologists of the Bureau of Mineral Resources (Condon 1954, Konecki et al, 1958) and from 1952 to 1954 by geologists of West Australian Petroleum Pty Ltd. (McWhae et al, 1958).

Fig 2

GEOLOGICAL SKETCH MAP BYRO BASIN

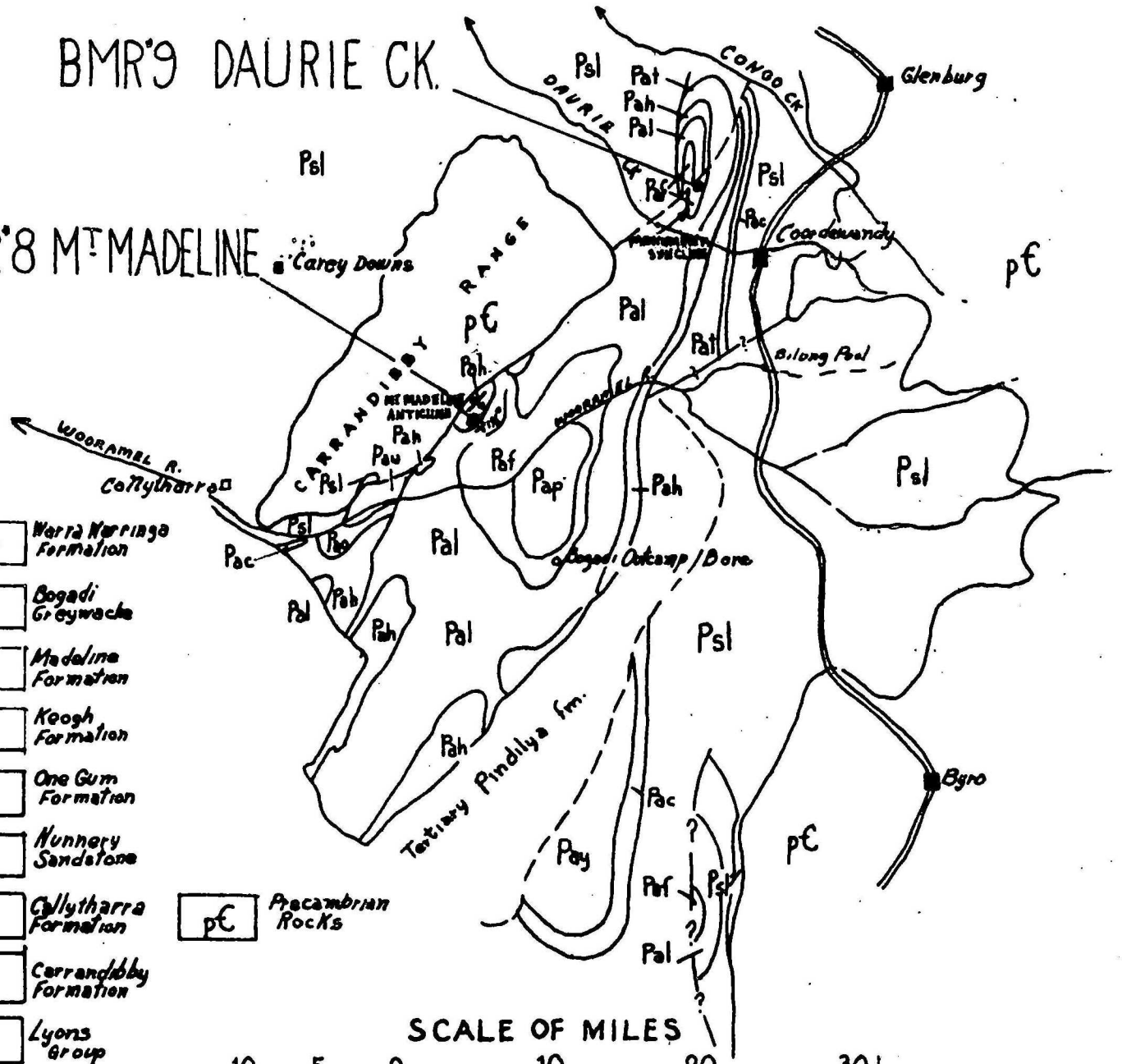

Fig. 2

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Dickins (1956) determined marine macro-fossils in the Gap Pool area and tabulated sections of the Madeline Formation. Work was done on marine faunas in the Lyons Group. The report by Konecki et al. (1958) gives the most detailed information available on the geology of the Byro Basin.

Fig.2. Geological sketch map, central part of the Byro Basin (after Konecki et al. 1958) showing the location of bores BMR No.8 and BMR No.9.

The structure at Mt Madeline is an anticline interpreted (Konecki et al., 1958) as abutting and faulted against the east flank of the Precambrian Carrandibby Range. The cross section (Fig.3) has been adapted to show formation depths obtained in the bore. The rig has been placed to the east of the anticline to intersect a possible pitching axial plane at depth.

All formations are of Permian age. The Callytharra Formation and younger are Artinskian. The Lyons group is Sakmarian.

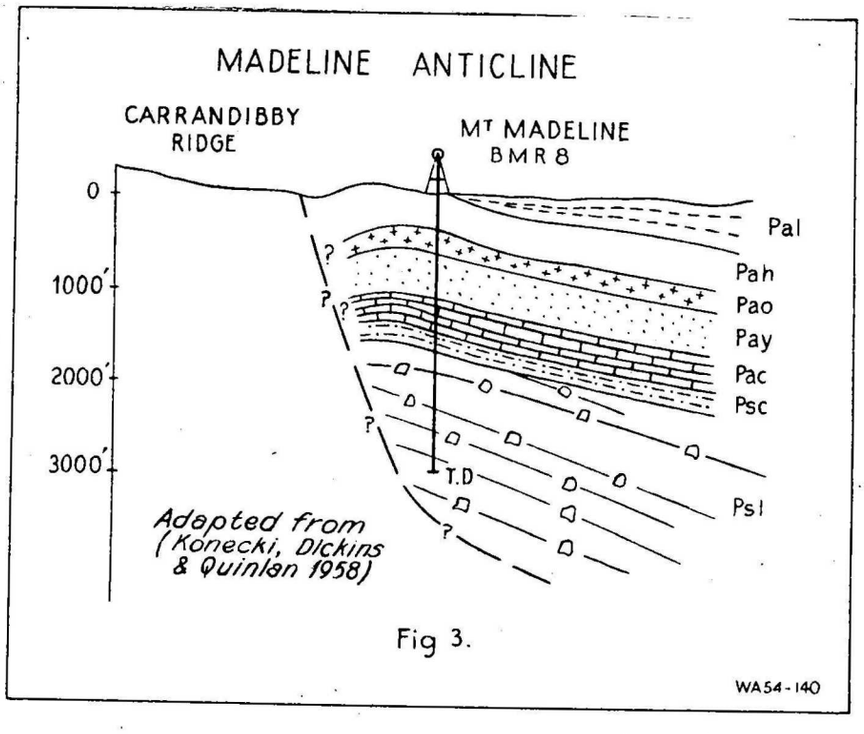


Fig.3. Section east-west through BMR No.8 (adapted from Konecki et al., 1958, plate 3, section 3).

BMR No.8

BMR No.8 spudded the upper part of the Keogh Formation about 100 feet west of its contact with the outcropping Madeline Formation. The bit penetrated 70 feet of weathered siltstone and fine quartz greywacke before entering 330 feet of dark carbonaceous siltstone and greywacke typical of the Keogh Formation profile; making a total thickness of 400 feet of Keogh Formation in BMR No.8.

Very generally there are four thin coal or coaly-shale beds spaced at 50 to 100 foot intervals. They are followed closely on either side by silty quartz sandstone and quartz greywacke, which gives way to thicker sections of fine quartz siltstone and shale. Cyclothemic sequences of mixed marine and continental environments are not uncommon in the coal measures of Europe and North America. It would seem such conditions have existed here. This would assume gentle fluctuations in sea level bringing a mixture of continental fluvial with marine or lagoonal-estuarine conditions preparatory to the fully marine environment of the Byro Group. The finding of sporadic marine fossils along with animal trails and wood in the upper Keogh Formation, strongly supports a transitional environment concept (Konecki et al., 1958, p. 37).

The type section of the Keogh Formation is 145 feet thick and was measured by M.A. Condon in 1955 at a locality between Gap Pool in the Wooramel River and Keogh Hill (Condon 1955). This is approximately 15 miles south of the bore. The base is marked by a change from poorly sorted, rough-bedded quartz greywacke with quartz sandstone beds to medium and fine-grained quartz greywacke "with laminated and carbonaceous siltstone above" (Konecki et al, 1958, p. 36). Some difficulty was encountered interpreting the upper weathered sections in both bores because cuttings here must be compared with the unweathered cuttings in the lower section. However the first recognizable coarse quartz sandstone rather unevenly bedded and possibly ferruginous below the last carbonaceous siltstone bed at 400 feet was chosen as the lower boundary of the Keogh Formation. There is doubt however as to the authenticity of the ferruginous staining. Surface weathered scree may have blown into the cuttings ditch during a strong dust storm and contaminated the samples.

The underlying 145 feet of cuttings has been identified as the One Gum Formation. This correlation is made on the basis of its position in the stratigraphic column, electric log relationships (alignment above and below), and the broad similarity of its lithology to the type section at Gap Pool.

There are two distinct members at BMR No.8. The upper member is a pyritic and very poorly sorted quartz sandstone 65 feet thick. It possibly contains ferruginous staining and cementing at the top. The lower member is a massive fossiliferous and slightly argillaceous limestone, 80 feet thick.

The type section of the One Gum Formation is 180 feet thick and outcrops about 12 miles S.S.W. of BMR No.8 (Condon 1955). It is about $2\frac{1}{2}$ miles east of the outcrop of Precambrian schist of the Carrandibby Range; the Mt. Madeline bore is about $\frac{3}{4}$ mile east of the schist outcrop. The top section is 162 feet thick and contains quartz greywacke, often silty and cross-laminated. The lower section consists of 18 feet of soft siltstone which is fossiliferous, ferruginous, and possibly calcareous in part (Konecki et al, 1958, p. 32). The upper section is much like the upper member at BMR No.8 being generally a quartz sandstone and quartz greywacke. The lower outcropping siltstone section is probably equivalent to part of the lower limestone section at BMR No.8. The One Gum Formation was identified in outcrop by the field party only in the Wooramel River area. There is no continuous outcrop between there and the Daurie Creek area where the lithological sequence of the One Gum Formation was not recognized.

Below the One Gum Formation BMR No.8 passes into 560 feet of clean, well-sorted, massive and very poorly cemented sandstone. It is believed this corresponds to the sandstone sequence 545 feet thick measured by M.A. Condon about 1.3 mile west of Gap Pool, 12 miles south of the bore-site. It compares both lithologically and stratigraphically. It has been designated the Nunnery Sandstone and is so correlated here. It is non-fossiliferous.

The base of this monotonous quartz sandstone is marked by a sharp change in lithology to a light tan crystalline massive limestone at 1110 feet. It very rapidly becomes sandy and argillaceous and by 1200 feet is almost 90% shale. From here it is variably a sandy and silty shale down to 1280 feet where it begins to vary between an

argillaceous calcilutite and a sandy argillaceous limestone. At 1330 feet it is light grey to tan limestone still argillaceous but crypto-crystalline. At 1375 feet it becomes more argillaceous and softer until at 1450 feet it is a very soft and sandy limestone and the shale is distinct and carbonaceous.

The sequence between 1110 feet and 1450 feet is considered equivalent to the type section of the Callytharra Formation which is 330 feet thick (Konecki et al. 1958, p.24). The section in BMR 8 is also 330 feet thick. The electric log of this sequence shows much interbedded limestone and argillaceous limestone in both bores.

At this depth the bore passes through a sandy limestone and calcilutite to predominantly shale at 1550 feet. The electric log reveals a decrease in limestone, which rapidly changes to dense bands of carbonaceous shale (Jewell 1959, p.5). The lithology of the cuttings as revealed under the microscope frequently shows a small coiled pelecypod (presumably Eurydesma). The crinoid fragments and productid spines common in the Callytharra Formation above, are missing.

This sequence has been correlated with "the sequence of shale, calcilutite and sandstone which rests with apparent unconformity on the Lyons Group and is conformably overlain by the Callytharra Formation" (Konecki, Condon, Dickins, and Quinlan in McWhae et al, 1958, p.72), that was named the Carrandibby Formation. Further evidence for this correlation is given by the change in faunas. The marine pelecypod is present to the exclusion of the richer fauna above. This would correspond to the description of the top of the Carrandibby Formation given by Konecki, et al. 1958, p.22. "The top of the Carrandibby Formation is taken at the top of a bed of hard calcareous quartz greywacke containing marine fossils (including Eurydesma) which marks the change in lithology from the predominantly calcareous sequence of the Callytharra Formation with a more varied fauna which includes brachiopods, molluscs, solitary corals, crinoids, bryozoans, gastropods and foraminifera." The "hard bed" referred to presumably could be the one from 1440 to 1425 just above the very soft 10 feet at 1450 (see log of drilling times).

At the base of this sequence a very sharp break occurs and a marine limestone is encountered. It shows up well both on the log and in the lithology. This limestone at the base of the Carrandibby Formation is apparently of great horizontal extent. It is well-defined at BMR No.9, both in the lithology and on the electric log. It is characteristically 10 feet of limestone, white to light tan in bore cuttings. It is very sandy and where it is light coloured it resembles cement. It rapidly becomes almost 70% quartz sandstone, very calcareous and containing much argillaceous material for 10 to 15 feet. It then increases in limestone content for 10 to 15 feet after which it rapidly becomes argillaceous, and 50 feet from the top, it has become a black dense shale very brittle and friable.

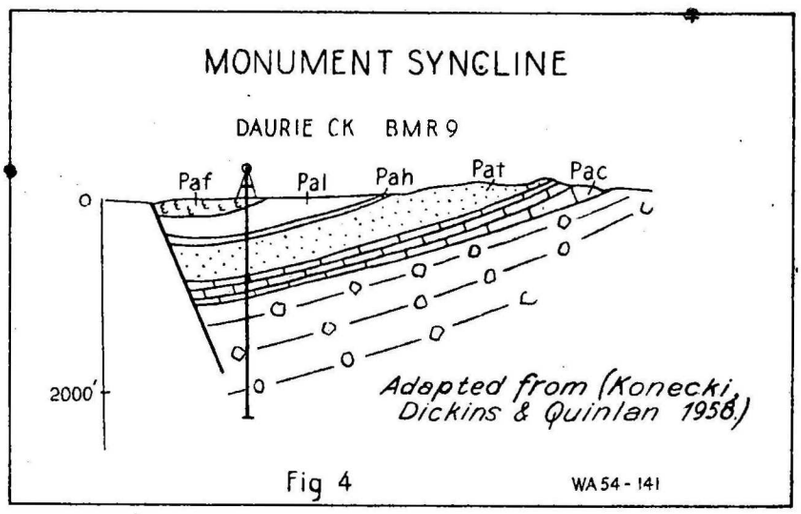
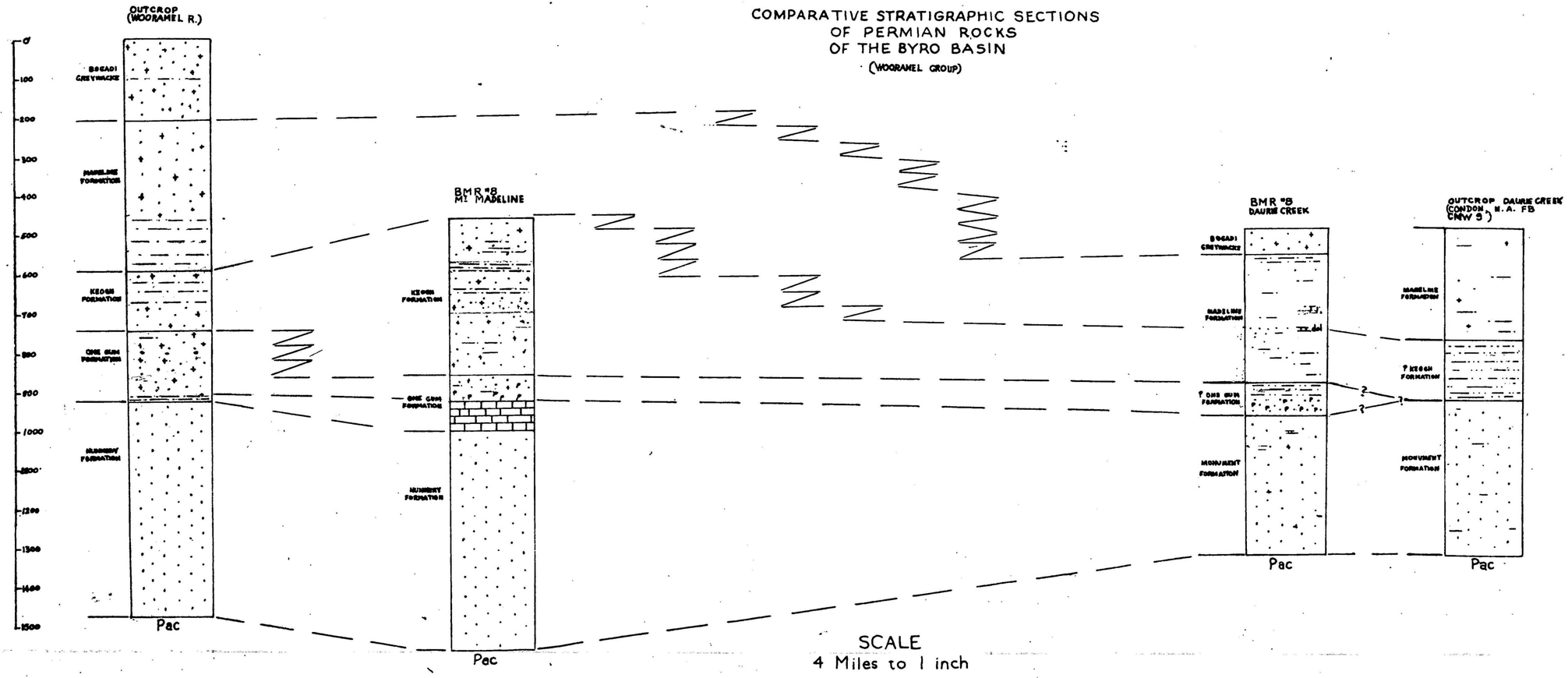


Fig.4. Section east-west through BMR No.9 (adapted from Konecki et al. 1958, Plate 3, section 2).

COMPARATIVE STRATIGRAPHIC SECTIONS OF PERMIAN ROCKS OF THE BYRO BASIN

(WOORAMEL GROUP)



SCALE

4 Miles to 1 inch

4 0 4 8 12 Miles

FIG. 5

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This bed has been tentatively picked as marking the top of the Lyons Group although it is perhaps more closely allied with a Carrandibby or Callytharra Formation environment. No such limestone bed at the base of the Carrandibby Formation has been reported in outcrop. Nevertheless a second boundary has been chosen at 1805 feet. This was picked from lithology and log and more closely represents the top of the Lyons Group as illustrated in the following description. "The top of the Lyons Group is placed at the sharp change in lithology from poorly sorted generally non-calcareous glacial sediments to sediments of generally calcareous lithology containing marine fossils of either Callytharra Formation or Carrandibby Formation" (Konecki et al, p.17).

The first boulder tillites occur at 1850, only 45 feet below the second boundary and this certainly represents true Lyons Group. Although this lower boundary was correlated at BMR No.9 it is doubtful whether the boundary can be correlated regionally. It cannot be picked unless the upper boundary is located first.

The next section of the Lyons Group consists of shale, very fine quartz sandstones and siltstones extending to 2084 feet. It is within this section that good petroleum reservoir possibilities are believed to exist, especially between 1665 to 1698 feet and 1950 to 2321 feet. The sands are both porous and permeable. Geophysical logging indicates that they contain salt water (Jewell 1959, page 6).

Below this zone, a tillitic sequence continues, containing boulder beds, sandstones, siltstones and shales alternating with tillitic beds of the same character all poorly sorted and typically of the lithologies associated with glacial action.

At 2640 feet a bed of remarkably pure, massive limestone was encountered. It becomes sandy at 2700 feet and reverts to finely tillitic shale at 2780 feet. This limestone bed has not been observed in outcrop and is certainly of deeper sea environment than the rest of the Lyons Group. Presumably, it was some distance removed from the glacial environment characteristic during Lyons time.

From 2780 to total depth at 3004 the bore passed through a hard dense black shale which contains rare granite gneiss pebbles, some an inch or more in diameter. By 2900 the pebbles are absent and the bore continues to total depth in uniformly massive dense shale.

BMR No.9

At BMR No.9 Daurie Creek the rig spudded a quartz greywacke and greywacke siltstone considered to be the Bogadi Greywacke. There is a small hill about ½ mile to the south of the Bore with outcropping Bogadi Greywacke, the stratigraphic horizon of which passes under the spudding site. The weathered cuttings are almost identical with the outcropping Bogadi Greywacke. The sequence is 70 feet thick.

The bore then passes through 300 feet of fine-grained quartz greywacke-siltstone. It is carbonaceous and finely micaceous. There is considerable shale and frequently the boundary between the shale and fine quartz greywacke is gradational. The lower part from 245 to 390 feet is very silty and often arenaceous. This sequence of strata has comparable lithology with the Madeline Formation observed at its type section at Madeline Creek. The name was first used

in a report of McWhae et al. (1959) for that unit which underlies the Bogadi Greywacke and overlies the Keogh Formation. M.A. Condon measured a section 395 feet thick at Gap Pool in 1955 (Condon, 1955). Dickins, Burnett and Moore measured a nearby section 508 feet thick (Dickins, 1955, plate on page 2). The Madeline Formation at BMR No.9 is 390 feet thick. A section measured at the Dauric Creek area is 284 feet thick (Konecki et al. 1958, p.945). The thickness of the Madeline Formation is known to vary widely. It is 635 feet only 3 miles south west of the 395 foot type section (Konecki et al, 1958, p. 45).

It will be noticed from the log that the Madeline Formation at BMR No.9 becomes increasingly sandy and silty at 245 feet. It is marked here by a dolomitic bed. From 245 to 270 feet it is composed largely of fine quartz greywacke. It then reverts to carbonaceous shales from 270 to 315 feet. From 315 to 325 feet a very gritty quartz greywacke is encountered. Although this lower section from 245 to 390 feet is more closely allied with the Madeline Formation as it is recognized in outcrop, it may represent a lateral variation of the Keogh Formation at BMR No.8. A similar lithology and favourable electric log comparison below the Madeline Formation tend to support this. The stratigraphic relationship as described below also favours this relationship.

At 390 feet the bore passes into an 80 feet sequence of quartz greywacke and siltstone, carbonaceous and very poorly sorted. It shows increasing sand grains and increasing pyrite downward. The amount of pyrite reaches 20% at 460 feet. (This was first thought to be the Keogh Formation because of its stratigraphic position.) Continuing downward the bore passes into 390 feet of sandstone largely of quartz greywacke composition. It is fairly clean and well-sorted. This massive zone is recognized as certainly the Monument Formation. It has almost the same lithology as the 400 feet of type section measured at Dauric Creek near Monument Bore and only a few miles from the Dauric Creek bore (Konecki et al, 1958, p. 34). The type section was measured by M.A. Condon in 1955 (Condon, 1955). This section at the bore and at the type outcrop are both non-fossiliferous.

However the intermediate zone (430-465') with the pyrite immediately above this massive sandstone must be recognized as the horizontal equivalent of either the Keogh Formation, the One Gum Formation or the upper Monument Formation. Although the interval from 400 to 465 feet is in the stratigraphic position of the Keogh Formation relative to the Madeline and Monument Formation, it is not at all like the cyclothemic Keogh Formation of the type locality or at BMR No.8. Moreover it is much like the upper One Gum Formation at BMR No.8. If the electric log and lithology of this interval are compared with the upper One Gum Formation at BMR No.8, and the limestone of the lower One Gum Formation at BMR No.8 is correlated with the calcareous upper Monument Formation in BMR No.9 a harmonious situation immediately becomes apparent. The total thickness of the two units of One Gum at BMR No.8 is 150 feet as compared with 180 feet in the outcropping One Gum section (Condon, 1955). This would bring the cyclothemic Keogh Formation at BMR No.8 into line with the lower sandy and silty section of the Madeline Formation at BMR No.9. It is suggested that these horizons are equivalent. At BMR No.9 the entire Wooramel Group has become finer grained and its upper part has passed into the Madeline Formation. The upper part of the Madeline Formation has a variable contact in relation to the Bogadi Greywacke

above it. Correlative stratigraphic columns have been introduced to show this relationship (Fig.5).

The Monument Formation at BMR No.9 is underlain by the Callytharra Formation. It is well defined on the log, as in the lithology, being 80% limestone and fairly uniform throughout. It contains abundant productid spines and crinoid fragments. It is readily distinguishable from the Carrandibby equivalent below by lithology. Both these formations here compare well with the same formations at BMR No.8. The Carrandibby formation is not recognized as outcropping in the field in this area although a thick shale sequence has been observed in several places in the area between the base of the Callytharra Formation and the top of the definite Lyons Group (M.A. Condon personal communication). However the cuttings indicate the marine fossil Eurydesma and exclude the richer fauna of the Callytharra Formation above. The evidence supports a facies equivalent of the Carrandibby Formation as it is recognized both at BMR No.8 and also at the outcrop of the type section at the Wooramel River. However the Daurie Creek Callytharra section has Callytharra fossils right to the bottom and immediately overlies definite Lyons Group.

The Callytharra Formation is 265 feet thick here as compared with 330 feet at BMR No.8. It is 330 feet thick in the type section (Konecki et al. p.97). The Carrandibby equivalent is 230 feet thick as compared with 264 feet at BMR No.8. It is 193 feet in the type section (Konecki et al. p.97). A section measured in the field at Daurie Creek is 240 feet thick (Konecki et al, 1958, p.26). This is within a few miles of the bore. As the combined sections of the bore total 495 feet it is possible that these two sections are not comparable in all respects.

The well-defined limestone bed of possible Lyons top is again easily recognizable at 1320 feet but closely resembling Carrandibby environment. The alternative top below has been picked in relation to it. Without first locating the upper boundary it would be difficult to find the lower one. There is no boulder bed directly below the lower marker bed at BMR No.9 and generally the Lyons Group is cleaner, finer grained and better sorted than at BMR No.8.

From 1513 to 1641 a permeable sandstone bed was encountered which showed good reservoir characteristics. It is apparently filled with salt water (Wiebenga and Jewell, 1959, p.4). A silty section then follows and a permeable sandstone bed from 1749 to 2011 was encountered. It contains thin bands of limestone. A bentonite shale bed occurs between 2000 and 2050 feet. From 2050 to 2100 feet boulders occur in a tillitic quartz sandstone matrix. BMR No.9 intersected 25 feet of varved clays at 2200 and finished in dense black shale at 2299, all within the Lyons Group.

In conclusion it might be said that the geological column at BMR No.9 is much finer grained and better sorted than that at BMR No.8. The sections are thinner and more uniform. The percentage of total quartz greywacke decreases and is represented by quartz sandstone at BMR No.9. Certainly the source of sediments was closer at BMR No.8 than at BMR No.9.

The Bogadi bore which is 10 miles east of BMR No.8, and more centrally located in the basin, drilled Bogadi and Madeline Formations, and also part of the Wooramel Group. At no time were coarse sediments or even greywacke reported.

Puggy dark shales were reported for the Madeline Formation and fine grained sandstones for the Wooramel Group (Konecki, et al, 1958, p.115). The area from the Bogadi bore through BMR No.9 and also Daurie Creek area seems to have been more centrally located in the basin and farther from the source of sediments than BMR No.8.

STRUCTURE

Determination of structure from bores demands that they be placed at not too great a distance from one another in relatively undeformed strata. Large faults through the Byro basin would preclude such a determination here. However Figures 2 and 3 have been adjusted to show formation depths as a result of the drilling. The structures shown were taken from the report by Konecki et al (1958).

No discernible dips were apparent in the cores. Current bedding was present in some of the quartz sandstone cores, but no definite regional dips were noted.

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BORE BMR 9 DAURIE CREEK

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

STATE: WESTERN AUSTRALIA   BASIN: CARNARVON   AREA: BYRO BASIN

LOCATION:
LATITUDE: 25°32'30"S
LONGITUDE: 115°52'50E
ELEVATION: GROUND APPROX900' ROTARY TABLE: 900'± +4'
DATE SPUDDED: 16 July 1959   COMPLETED: 12 Aug 1959
TOTAL DEPTH (FROM R.T.): 2299'   STATUS: ABAND?
CASING: 6⅝ 0-70ft
PROFILE: 6⅝" 0-70ft 5⅝" 70-2294 4¾ 2294-2299
PLUGS: 2030 and Casing-head
LITHOLOGY: C.R.Mercer

ELECTRIC LOG DATA - F. Jewell
DATE: 12th Aug 1959
INTERVAL LOGGED: 115'-2295'
MUD:- NATURE Bentonite
DENSITY 78/cu ft
VISCOSITY 40-50 secs av.
RESISTIVITY 4.1 ohm/mtr @ 16°C

LITHOLOGY - SYMBOLS
QUARTZ SANDSTONE
QUARTZ GREYWACKE
SILTSTONE
LIMESTONE
SHALE
PYRITE

DEPTH Feet
DRILLING RATE feet per hour
S.P. CURVE 10 mv per divis.n
GRAPHIC LOG
RESISTIVITY POINT CURVE 10.0 ohm per division
LITHOLOGY
FORMATION
AGE
CORES %REC BLACK
CSG 70'
70 MADELINE TOP
MUD LEVEL
?KEOGH EQUIV TOP
KEOGH FORMATION EQUIVALENT
390 ?ONE GUM TOP
465 MONUMENT TOP
550 BOT LOWER ONE GUM EQUIV (LS) BMR 8
825' CALLYTHARRA TOP
1090'
? CARRANDIBBY EQUIVALENT?
1320' ?LYONS TOP
1405' LYONS TOP
T.D. 2299'
10-70 Sandstone + greywacke-siltstone; light tan, grey, red .3mm angular poor sorting, weathered porosity, calcareous with mica flakes, gypsum flakes from 40' to 70' 5%.
70-110 Fine quartz greywacke, argillaceous, micaceous harder than above 20% siltstone + quartz greywacke non-argillaceous, micaceous, some sand grains with 20% siltstone greywacke, non-argillaceous.
110-250 Shale greywacke, black, slightly silty, slightly limey soft carbonaceous, micro-micaceous, 10% fine silt.
250-275 Fine quartz greywacke, light grey brown, very limey, kaolinitic, .3mm grain size with 5% shale greywacke.
275-400 Shale, black micro-micaceous, dense with 15% quartz greywacke interbedded.
400-430 Quartz greywacke, grey sandy .2mm kaolinitic fair porosity with some shale black dense.
430-465 Quartz Sandstone grey, grey brown, ang quartz grains with sub-rounded frosted grains 10% pyrite.
465-685 Quartz greywacke, grey 1mm-2mm gr angular, poor kaolin cementing with 10% shale black, carbonaceous interbeds evenly grained, good sorting, massive, slightly calcareous, very calcareous in part
550 Quartz greywacke as above but non-calcareous
685-825 Quartz Sandstone as above with slight increase carbonaceous material and muddy shale beds.
825-890 Calcilutite, grey brown, argillaceous silty and sandy in part microfossiliferous, varying amounts sandstone angular 40%, shale, black, pyritic 20% phosphatic brach. shells.
890-920 Calcilutite limestone, dark grey green, .3mm u fossiliferous, argillaceous becoming light grey cream with green tinge.
920-1090 Calcilutite 20%, limestone 80% white light grey sub-crystalline, sub massive slightly fossiliferous in part fair to very argillaceous.
1000 Quartz Sandstone and siltstone 30% in limestone matrix, very argillaceous.
1090-1105 Shale black, dark grey, very lime, 20% silt, quartz greywacke in matrix of shale becoming black very limey.
1105-1130 Shale as above with siltstone, very fine quartz greywacke composition, limey 20%.
1130-1210 Shale, black, limy dense with ½ siltstone sub greywacke composition very fine, limy in thin laminae, increasing limeyness with silt.
1210-1255 Shale, black, dark grey, silty in part, very limey micaceous flecks.
1255-1275 Limestone, grey brown, translucent in part micro-fossiliferous, trace green brown in part with incorporated sand grains .8mm 20%.
1275-1320 Shale, dark grey, black very finely silty in part 40% sub greywacke comp fine, micro-micaceous, the black shale is tillitic and non-limey
1320-1340 Calcarenite with limestone white very sandy giving cement appearance some limestone clear.
1340-1355 Quartz Sandstone, white, .02mm with limestone cement, greywacke in part shale, black, slightly silty, tillitic.
1355-1365 Limestone, white, finely silty + sandy .05mm cleaner than above, trace limestone black, fossiliferous.
1365-1385 Limestone as above considerable interbedded shale, black, dense.
1385-1405 Limestone white cementing sand .8mm 5% fairly clean.
1405-1520 Shale, black, dense, massive, hard, micro-tillitic.
1520-1590 Quartz Sandstone white, .1mm to 1mm 80% .4mm, angular poor sorting poor kaolin cementing friable, considerable porosity, at 1535 70% 2 to 3mm light tan frosted grains, trace of boulder material between 1530-1545 brown staining probably ferruginous.
1590-1615 Quartz Sandstone, siltstone, grey, argillaceous .1mm grains fair sorting, fair cementing 30% tillitic shale black dense.
1615-1725 Siltstone, grey, argillaceous, .1mm grains, fair sorting, sub angular, tight laminae often very fine grained, 1670 becoming very sandy with suspected glauconite.
1725-1740 Shale black, dark grey, very silty, in fine laminae limy slightly carbonaceous.
1740-1860 Quartz Sandstone, grey, .4mm grains, with occasional .1mm red grains scattered fair porosity, limy with thin argillaceous laminae generally poor cementing throughout with scattered 1-2mm frosted quartz grains, brown staining 1740-1760.
1860-1900 Quartz Sandstone, white, light grey .2mm with limestone cement 30% volume of quartzic groundmass in limestone matrix.
1900-2030 Quartz Sandstone, white, 3mm grains, fair sorting, fair cementing limy sub-rounded fairly clean very pyritic 2015-2030 generally massive and uniform.
2030-2035 Shale, black, dark grey, micro-tillitic, dense, slightly limey, pyritic slightly silty with 5% granite pebbles.
2035-2045 Shale as above with interbedded bentonite 40% white dense fairly hard.
2045-2085 Quartz Sandstone, light grey .2-1mm. poor sorting, fair cementing, sub angular, tight lime cement, trace boulder fragments to 2060 where 30% boulders starts continue to 2080 with fair limestone.
2085-2115 Shale, black, dark grey, tillitic, massive, sandy + silty in part 30% with small pebbles granite 1" diameter with black shale flecks in lighter parts.
2115-2120 Limestone, tan, silty .1mm grains, slightly argillaceous with siltstone, white, fairly clean, well-sorted, limestone.
2120-2155 Shale, light grey, dense smooth finely silty with siltstone white .1mm grains limy with 10% limestone silty.
2155-2170 Siltstone, white .1mm grains sand fine rounded sorting gradational to shale below.
2170-2200 Shale, black, light grey, dark grey finely silty in part dense massive.
2200-2225 Shale, black, light grey, VARVED in .5mm-1mm bands, dense, massive.
2225-2230 Shale, grey light grey, finely silty in part limy dense massive.
2230-2240 Shale, grey with 40% sandstone and shale quartz greywacke brown tillitic 10% sandstone white, .2mm quartz greywacke composition in part
2240-2250 Limestones, brown v silty very argillaceous.
2250-2299 Shale, black, dark grey, in silty areas, limey friable, dense, hard.
BOGADI
MADELINE
? ONE GUM
MONUMENT
CALLYTHARRA
LYONS
PERMIAN
ARTINSKIAN
SAKMARIAN

WA 54-139

BORE BMR8 MT MADELINE

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

STATE : WESTERN AUSTRALIA BASIN: CARNARVON AREA : BYRO BASIN

LOCATION :
LATITUDE 25° 46'S
LONGITUDE 115°39'E
ELEVATION: GROUND APPROX.800' ROTARY TABLE 800± +4'
DATE SPUDDED: 25TH MAY 1959 COMPLETED: 12TH July 1959
TOTAL DEPTH (FROM R T): 3004ft STATUS: ABAND°
HOLE PROFILE 6⅝" 0-83 ft., 6" 83-976., 5⅝" 976-2994., 4¾" 2994-3004
CASING 6⅝" 0-83 ft
PLUGS Casing-head
LITHOLOGY BY C.R.Mercer

ELECTRIC LOG DATA F. Jewell
DATE 12TH July 1959
INTERVAL LOGGED: 142-3002
MUD - NATURE: Bentonite
DENSITY: 73-75
VISCOSITY: 30-50 sec
RESISTIVITY : 4·1ohm/mtr

LITHOLOGY - SYMBOLS
QUARTZ SANDSTONE
QUARTZ GREYWACKE
SILTSTONE
LIMESTONE
SHALE
PYRITE
COAL & COALY SHALE

LITHOLOGY		FORMATION	AGE
0-60	Siltstone, largely quartz greywacke composition, light tan to gr with sandstone angular to sub-angular quartz grains, Kaolin cementing with ferruginous cement weathered at the top 5 feet, very slightly calcareous in part with 50% sandstone .25mm, and medium grained, angular, Kaolin and ferruginous weathered cementing.	KEOGH	PERMIAN – ARTINSKIAN
60-90	Siltstone, brown, ferruginous staining and cementing, scattered fair to poor porosity with some sandstone, tan, gritty, slightly micaceous.		
90-100	Quartz Sandstone, light grey, medium-fine grained, sub-angular coarse angular quartz 80% of 95' sample, slight calcareous.		
100-108	Coaly shale, black, finely gritty, sub-bituminous, dense, very friable with bedded siltstone sandy carbon banding.		
108-125	Fine quartz greywacke, grey, micaceous, gritty with green, black amber colouring.		
125-150	Shale with siltstone, dark grey, silty, carbonaceous + micaceous, very slightly calcareous sandy + silty material.		
150-170	Quartz Sandstone, argillaceous dark grey + brown, fine-medium grained, micaceous quartz greywacke composition in part.		
170-175	Shale, black, micro-micaceous, carbonaceous, silty, dense.		
175-190	Quartz Sandstone same as 150'-170'.		
190-205	Shale, silty, black, carbonaceous, dense with thin interbeds micaceous grits.		
205-230	Quartz Sandstone, grey, fine grained, sub angular, micro-micaceous some silt and shaly material.		
230-235	Shale, black, dense, micro-micaceous, dense.		
235-240	Quartz Sandstone, white, very coarse grained >1.00mm, clean, well rounded.		
240-245	Shale, coaly, black, pyritic.		
245-280	Quartz Sandstone, white, coarse grained, sub angular, poor cementing quartz grains >1.5mm interbedded carbonaceous and sandy material in part, - largely sugary.		
280-282	Shale, black, very carbonaceous coaly.		
282-320	Quartz Sandstone, white light grey medium-very coarse grained >2.5mm angular, sub rounded poor cementing separate quartz grains, with some interbedded siltstone at 300'.		
320-335	Shale, black, carbonaceous dense with some sand grains.		
335-355	Quartz Sandstone, white, coarse grained 1-2mm, clean, poor cementing with fine quartz greywacke, light grey, gritty.		
355-365	Shale black, very carbonaceous, coaly.		
365-395	Quartz Sandstone + Siltstone, gritty grey greywacke composition in upper part, becoming cleaner and coarser grained in lower part followed by thin band of shale.		
395-400	Very coaly shale bed ? 1 foot		
400-440	Quartz Sandstone, reddish brown (ferruginous) fine, medium coarse grained size with trace siltstone, ferruginous cementing becoming coarser grained 1.5mm and cleaner rounded, considerable pyrite 430-440	ONE GUM	
440-465	Quartz Sandstone white, coarse grained >2.5mm angular, clean, slightly frosted 25% pyrite		
465-474	Quartz Sandstone as above with shale black, soft carbonaceous.		
474-500	Limestone white, massive fragmental in lower part, fossiliferous (crinoids + fenestellid)		
500-530	Limestone, white massive fragmental x-taline, fossiliferous many productid spines. Trace of silt and generally more argillaceous from 510-520.		
530-920	Quartz Sandstone, white, .2-.8mm, sub rounded, good sorting, clean, poor Kaolin cementing, frosted grains, received at shale shaker as sand, uniformly massive.	NUNNERY	
600	Quartz Sandstone as above trace carbonaceous mudstone, some pyritic material.		
775	Quartz Sandstone as above with 0.1mm grs 90%, decreasing size.		
920-945	Quartz Sandstone as above with shale black mud in thin interbeds + laminae, largely mudstone.		
945-1110	Quartz Sandstone as 550-920 massive.		
1110-1145	Limestone, light tan slightly xtaline, to massive fossiliferous with shale interbeds, black, slightly silty carbonaceous, calcareous.	CALLYTHARRA	
1145-1155	Quartz Sandstone, white, .3-.6mm sub rounded good sorting clean with shale black carbonaceous 20%.		
1155-1190	Limestone, arenaceous, dark grey, tan, fossiliferous with shale, black calcareous 30%-60% transition to shale below at 1190.		
1190-1275	Shale, black, calcareous slightly carbonaceous, silty, dense increasingly calcareous at base, sandstone at 1240 up to 12%.		
1275-1305	Calcilutite with shale grey black slightly fossiliferous with limestone tan crypto-xtalline, semi massive in transition zone to limestone below 10% sandstone + siltstone.		
1305-1440	Limestone, tan, crypto xtalline in part calcilutite, grey, tan slightly silty and argillaceous, fossiliferous. shale with the limestone as shown largely mudstone.		
1440-1485	Limestone as above with decreasing shale and Sandstone 20% frosted grains sequence softer than above, limestone more distinct fragmental than above.	CARRANDIBBY	
1485-1555	Shale, black, dense "poker chip" friability with siltstone 10%, light grey sandy 10%-15% limestone cavings? with calcite cleavage faces generally pyritic throughout (5%).		
1555-1664	Shale black, slightly carbonaceous and calcareous, dense, massive.		
1664-1667	Limestone, light tan, grey, cleavage surfaces 1mm across, fossiliferous with scattered sand grs .03-.2mm 15%, pyritic.	?	
1670-1710	Limestone as ab. with siltstone, grey, fine sand grs .01mm occasional angular quartz fragment.		
1710-1740	Shale, black, slightly carbonaceous, dense with 10% siltstone light grey sandy some scattered quartz grains, angular.		
1740-1805	Siltstone white, light grey calcareous with interbedded gritty quartz Sandstone .005 to .5 mm grain size about 20% shale dense. Considerable limey material at 1740 and 1805. Samples are non-uniform much interbedding and cross-bedding of above.		
1805-1850	Shale, black, dense, carbonaceous brittle, hard, increasing siltstone approaching 1850, contains thin limestone bed with quartz grains.	LYONS	SAKMARIAN
1850-1880	Shale as above but slightly siltier with 10%-30% granite boulder chips.		
1880-1950	Siltstone, grey, argillaceous very finely sandy with black carbonaceous flecks & brittle, fairly hard.		
1950-1975	Quartz Sandstone-Siltstone increasing grainsize from above but generally poor sorting good cementing.		
1975-1995	Shale, black, carbonaceous, dense, brittle with 20% siltstone-sandstone as above.		
1995-2015	Siltstone very finely sandy with shale 10% black, slight increase in grain size downward.		
2015-2030	Shale, black, carbonaceous, dense, brittle, trace quartz grains.		
2030-2050	Quartz Sandstone, white, light grey, .1-.5mm grain size, sub rounded, poor cementing, separate grains grading to siltstone by 2050.		
2050-2080	Quartz Sandstone 10% grey .3mm fair kaolin cement Siltstone 40% light grey, shale black 10% carbonaceous silty, Granite boulders 20% generally massive, trace of bedding.		
2080-2110	Siltstone, light grey .01mm grain size, fairly clean.		
2110-2135	Quartz Sandstone light grey .3mm fair cementing, good sorting, sub-rounded.		
2135-2150	Shale, black, carbonaceous, dense brittle with 20% sandstone .1mm rounded grains with Sandstone 30% angular quartz becoming tillitic at base.		
2150-2200	Quartz Sandstone, white, black, sub greywacke composition, tillitic, sub angular and sub-rounded, 40% black grains (smokey quartz?) some 30% granite boulder fragments, 5% biotite flakes.		
2200-2250	Siltstone tillite, dark grey, grey, many rounded sand grs with 10% dark mineral fragments - sugary white siltstone in places to dark and carbonaceous in others, often gritty, very limey in part.		
2250-2300	Boulders in quartz Sandstone-siltstone micro-tillite many granitic gneiss and quartz splinters a few limey marble boulders, often lime cemented sandstone grit which is silty in part only some 10% limestone flakes and even sugary siltstone in places broken and re-cemented.		
2300-2335	Quartz Sandstone light grey .01-.6mm poor cementing, fair-good sorting.		
2335-2360	Shale, black, fine, gritty hard black specs, trace boulder fragments.		
2360-2390	Siltstone, black, carbonaceous, hard, dense, massive.		
2390-2490	Quartz Sandstone-Siltstone with 5% boulders with moderate to poor sorting, sometimes grey .3mm gr in lime cement, poor sorting with 20% quartz sandstone .2mm grain size fair sorting 70% siltstone dark grey, gritty hard poor sorting, 10% shale dense fractured quartz fragments, considerable shale throughout.		
2490-2525	Shale, black, quartz greywacke micro-tillitic and increasing boulder fragments of gneiss shist to 95% of sample 2520.		
2525-2555	Quartz Sandstone, grey .3mm. fair-poor sorting, fair poor cementing feldspar kaolin cement.		
2555-2570	Limestone, light tan, grey calcilutite in part .02mm size slightly dolomitic fossiliferous, very argillaceous.		
2570-2580	Siltstone greywacke grey gritty, sandy calcareous.		
2580-2640	Quartz Sandstone grains, light grey .2mm sub angular poor cementing with shale black silty 10% siltstone grey, quartzic.		
2640-2710	Limestone, dark grey, very silty + sandy, argillaceous in part argillaceous in part slightly fossiliferous in part crinoid stems.		
2710-2775	Limestone (calcarenite) argillaceous as above with 30% quartz grains in 5% shale.		
2780-2900	Shale, black silty, tillitic, massive clear + dark mottled scattered through with considerable small pebbles 15% scattered quartz fragments.		
2900-3000	Shale, black, dense, massive, trace silty in part, slightly calcareous in part.		

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