COMMONWEALTH OF AUSTRALIA.

[redacted]

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS.

RECORDS.

RECORDS 1956/113.

THE PERMIAN MARINE MACRO-FOSSILS OF THE WOORAMEL AND BYRO GROUPS OF THE WOORAMEL RIVER AREA, WESTERN AUSTRALIA.

by

J. M. Dickins.

THE PERMIAN MARINE MACRO-FOSSILS OF THE WOORAMEL AND BYRO GROUPS OF THE WOORAMEL RIVER AREA, WESTERN AUSTRALIA.

by

J. M. Dickins.

RECORDS 1956/113.

SUMMARY

The marine macro-fossils are identified, and correlated with those of the northern part of the Carnarvon Basin. The fauna of the marine horizon at the base of the One Gum Formation of the Wooramel Group is more closely related to that of the Callytharra Formation than the fauna of the next youngest marine horizon, at the top of the Keogh Formation and the base of the Madeline Formation. The lower part of member of the Madeline Formation can be correlated with the middle part of the Coyrie in its type area and the upper part or member of the Madeline can be correlated with the upper part of the Coyrie Formation or the Mallens Greywacke in their type areas. No fauna as young as that of the Cundlego or Wandagee Formations occurs in the area. The faunas range in age from low in the Artinskian (One Gum Formation) to probably not above the middle of the Artinskian (Bogadi Greywacke).

INTRODUCTION

In 1953 the Callytharra Springs area was visited by a Bureau Party (M.A. Condon, M.H. Johnstone and P.E. Playford) and collections of marine fossils were made from the Callytharra Formation, and the Carrandibby Formation. In 1953 a West Australian Petroleum Pty.Ltd. party visited and mapped the Wooramel River area (McWhae, Parry and Stanley, 1954).

In 1955 the Wooramel River area was mapped at photo-scale (1:50,000) by another Bureau party (M.C. Konecki, J.M. Dickins, T.Quinlan, W.M. Burnett and D. Moore) and fossils were collected throughout the entire Permian sequence . Work was also carried out by another party (M.A. Condon and K.G. Smith) in the same area.

Only the faunas from the Wooramel and the Byro Groups are dealt with in this report. The fossils from the Carrandibby Formation and the Lyons Group are treated separately together with the faunas from the Lyons Group elsewhere (Dickins and Thomas M S). The fauna of the Callytharra Formation is composed predominantly of brachiopods and bryozoans, and it is not proposed to deal with this fauna in the present report. The identifications are arranged according to field numbers. The Konecki et.al. collections are placed first (W.B. Field Nos.) and the Condon et.al. collections second (C.C. Field Nos.)

P.J. Coleman's manuscript has been available to the author and his names have been used in this paper.

G.A. Thomas has supplied considerable information on the brachiopods but the identification and opinions expressed are the responsibility of the author alone.

STRATIGRAPHY

A detailed account of the geology of the area is given in Konecki, Condon, Dickins and Quinlan, M S.) and only a summary of the Permian sequence is presented in this record. The succession in descending order is as follows:-

Byro Group

Warra Warringa Formation

Dark micaceous siltstone and fine-grained quartz greywacke, in the main laminated and with red ?phosphatic and calcareous beds but few marine fossils, top removed by erosion. Thickness 120 feet +.

Bogadi Greywacke

Thin to thickbedded dark grey (fresh) fine to medium grained micaceous quartz greywacke with calcareous beds and marine fossils. Thickness 200 feet.

Madeline Formation

Mainly laminated dark grey micaceous siltstone and fine-grained quartz greywacke with calcareous beds and red ?phosphatic and calcareous beds near the base and numerous marine fossils in some beds. Thickness 395 +.

Wooramel Group

Keogh Formation

Mainly laminated and ripple-marked fine-grained quartz greywacke with some medium to very coarse beds and siltstone. Contains plant fossils including leaves of Glossopteris but marine fossils are known only from the top part of the formation north of Daurie Creek. Thickness about 140 feet.

One Gum Formation

Fine to coarse grained crossbedded quartz greywacke and quartz sandstone with interbedded siltstone and rapidly changing lithology. Plant fossils scattered throughout and a marine fossiliferous horizon at the base. Thickness about 180 feet.

Nunnery Sandstone

Cross bedded uniform, pale medium-grained quartz sandstone. No marine fossils known except possibly at base. Maximum thickness measured 545 feet.

Callytharra Formation

Thin bedded grey-green hard limestone and calcareous siltstone and quartz greywacke with many marine fossils; brachiopods and bryozoans predominating. Thickness 330 feet near Callytharra Springs.

Carrandibby Formation

Soft dark grey and greenish grey shale with some calcareous and red ?phosphatic beds or lenses. Near the top calcareous sandstone and nodular or concretionary calcareous lenses with pebbles. Marine fossils including Eurydesma, pelecypods predominating. Thickness 193 feet.

GRAPHICAL TABULATION OF TWO SECTIONS OF THE MADELINE FORMATION MEASURED IN THE GAP POOL AREA SHOWING THE LOWER AND UPPER PART

LEGEND

- Calcareous quartz greywacke
- Quartz greywacke
- "Network beds"
- Siltstone

I

Based on type section measured by M.A. Condon starting at 4⅛ miles on a bearing of 42° from Gap Pool and ending at 6 miles on a bearing of 62° from Gap Pool

BOGADI GREYWACKE

CC 157 — 395'

Fine-grained quartz greywacke with some hard calcareous becs (Bogadi Greywacke)

MADELINE FM.

65' Interlaminated siltstone and fine-grained quartz greywacke

350'

4' Hard calcareous medium quartz greywacke with mud balls containing fossils - "Pecten Bed"

45' Fine and fine-medium micaceous quartz greywacke with some siltstone near the top

300'

CC 156 - 262'

250'

59' Fine-grained quartz greywacke with beds of calcareous fine to medium quartz greywacke

CC 155 - 226'

UPPER PART

2 feet siltstone (203-205 feet)

200'

47' Fine-grained quartz greywacke with fine laminae of siltstone

Ferruginous (? calcareous) bed (193 feet)

175'

150'

LOWER PART

88' Dark micaceous siltstone and fine-grained micaceous quartz greywacke. Amount of silt decreasing upwards. No "network beds"

100'

CC 153 - 76'

CC 152 - 63'

50'

87' Dark micaceous siltstone with lenses of fine grained quartz greywacke and marine fossils. Near base hard ferruginous coarse quartz greywacke beds and in top part ? phosphatic red "network beds"

MADELINE FM.

0'

KEOGH FORMATION

II

Based on section measured by J.M. Dickins, W.M. Burnett and D. Moore beginning at 1¾ miles on a bearing of 48° from Gap Pool and ending at 1½ miles on a bearing of 74° from Gap Pool

?f. 508'

500'

W.B. 87

13' Calcareous and non-calcareous fine-grained quartz greywacke with 1ft very fossiliferous bed at base and 3-5' very fossiliferous bed 2' below top - "Pecten Bed"

31' Interlaminated grey micaceous siltstone and fine-grained quartz greywacke

450'

90' Poor outcrop - soft grey and greenish grey fine-grained quartz greywacke with occasional calcareous beds and marine fossils. At top a distinct 3-5' calcareous bed with marine fossils and coarse to very coarse quartz grains.

400'

350'

84' Fine-grained quartz greywacke with some siltstone and a few calcareous beds

300'

250'

50' Laminated and thinbedded grey to greenish fine-grained quartz greywacke with a little siltstone and calcareous lenticular beds with some fossils

20' Laminated to thinbedded dark siltstone with some lenses of fine-grained quartz greywacke

UPPER PART

18' As below but calcareous (less calcareous laterally)

200'

18' Finegrained micaceous greenish quartz greywacke

174'

10' Calcareous fine-grained quartz greywacke

150'

LOWER PART

100'

118' Thinbedded friable dark micaceous siltstone without nodules or concretions but with gypsum and some fine-grained quartz greywacke. Quartz greywacke increasing in amount towards the top.

50'

44' Mainly dark micaceous siltstone with lenticular calcareous ? phosphatic "network beds" and with some fine grained quartz greywacke and medium to coarse quartz grains. Marine invertebrate fossils

MADELINE FM.

0'

12' Thinbedded micaceous siltstone interbedded with ferruginous fine-grained quartz greywacke and with coarse to very coarse lenticles.

KEOGH FORMATION

Bureau of Mineral Resources Geology and Geophysics

Lyons Group

Poorly sorted and roughly bedded siltstone and quartz greywacke with pebbles, cobbles and boulders, much with tillitic texture. Marine fossils restricted to a few horizons. Thickness variable - 104 feet near Callytharra Springs; 2,640 feet, near Coordewandy Homestead.

The Lyons Group unconformably overlies the crystalline Precambrian rocks. The Carrandibby Formation is considered to be part of the Lyons Group although this is not the unanimous opinion of all the workers in this area. Reasons for placing the Carrandibby Formation in the Lyons Group are that in lithology it resembles sediments recorded from the Lyons Group with the exception that no boulders are known, the base of the Callytharra Formation represents the main change in lithology and the present concept of the Lyons Group requires no change. In connection with the absence of boulders, McWhae et al. (1954) give a section in Belang Creek (a tributary of the Wooramel on the eastern edge of the basin). The section shows a shale unit at the top of the Lyons Group, similar to the Carrandibby Formation, except that boulders are present near the top, thus suggesting that the absence of boulders in the Callytharra Springs area may be because of a local difference in sedimentation. The fauna of the Carrandibby Formation is similar to that of the rest of the Lyons Group and is distinct from that of the Callytharra Formation. The main reasons for placing the Carrandibby Formation outside the Lyons Group are that its lithology is sufficiently distinct and there is a marked change of lithology at its base.

In the field two parts of the Madeline Formation were recognized as members. The lower part or member is composed predominantly of siltstone whereas the upper part or member is composed of interlaminated and interbedded siltstone and fine-grained quartz greywacke. In some places outside the type area the upper part appears to have a greater proportion of quartz greywacke but can be recognized because of its stratigraphical position and because its lamination or thinbedding distinguishes it from the more thickly bedded overlying Bogadi Greywacke. Two generalized graphical sections of the Madeline Formation are shown in the accompanying figure. In section I it would alternatively, be possible to place the boundary of the lower part a little higher, at 193 feet where apparently the lowest calcareous quartz greywacke bed of the upper part is found.

The faunas of the two parts are treated separately and it is shown that there are significant differences. These differences as well as the differences in sedimentation can be recognized in the type area of the Coyrie Formation in the Moogooree area to the north.

HOSKING'S TYPE LOCALITIES

Hosking (1931 and 1933) has described a number of fossils from the Wooramel River area including a number to which she gave new specific names. During the present survey an endeavour was made to collect material from these type localities. The stratigraphical positions of Hosking's localities are tabulated below and where material has been collected at these localities, the field numbers are shown.

1931

(1) "Two miles E.S.E. of Survey Station R.20" - upper part of Madeline Formation - probably same horizon as WB81.

(2) "On Wooramel River, two miles almost East of Survey Station R20" - upper part of Madeline Formation, near top - WB81 (McWhae et al. Pl. and P2).

(3) "Bed and Bank of Wooramel River, three miles above R20". Close to horizon of WB80 and WB99 which are at the same base of the Bogadi Greywacke. Alternatively possibly from the top beds of the upper part of the Madeline Formation.

(4) "Creek ½ mile west of Callytharra Springs" - Callytharra Formation - position in Callytharra not clear.

(5) "South bank of Wooramel River, ¼ mile above Callytharra Springs". Callytharra Formation - position in Callytharra not clear.

(6) "1 mile from south bank of Wooramel, 1 mile above Callytharra Springs". Hosking has a footnote that this locality is an incorrect one. With the possible exception of one species, Deltopecten subquinquelineatus McCoy var. comptus Dana, the fauna is a Callytharra one.

(7) "South bank of Wooramel, below Callytharra Springs" - Callytharra Formation - position in Callytharra not clear.

(8) "South bank of Wooramel, 1 mile above Callytharra Springs" - Callytharra Formation - position in Callytharra not clear.

(9) "Bogadi Outcamp, 7 miles south of Survey Station R18" - Bogadi Greywacke.

(10) "Ferruginous Ridge near telephone line, ½ mile from Bogadi Outcamp" - Bogadi Greywacke.

1933

(1) "Two miles south-east of Madeline Hill, Wooramel River District"- upper part of Madeline Formation.

(2) "Between Callytharra Road and No.2 Bore Road about five miles from Bogadi, Wooramel River District" - probably upper part of Madeline Formation or base of Bogadi Greywacke and close to horizon of WB76.

IDENTIFICATIONS

One Gum Formation

W.B.9 (1¼ miles on a bearing of 285° from Keogh Hill).

Pelecypods

Deltopecten sp. (cf. species from Lyons and Callytharra. No secondary ribs visible).

Brachiopods

Permorthotetes (Thomas, in press) sp.

Strophalosia sp. nov. A (this species resembles a species from the Callytharra in shape and spine arrangement and in having a sulcus. It differs from the species occurring higher in sequence.

Neospirifer sp. similar to type in Callytharra

Cleiothyridina sp. similar to Callytharra type but appears different to Bush Creek (Madeline Formation) species.

Bryozoans

Hexagonellidae sp.

Fenestellids

Polyporids

Lyroporella sp.

WB69. (2¼ miles on a bearing of 258° from Keogh Hill)

Pelecypods

Deltopecten sp. (a few secondary ribs)

Brachiopods

Neospirifer sp. a wide alate form with shallow sulcus and no deep fasciculation.

Pseudosyrinx sp.

Orthotetoid indet

Bryozoans

Polypora sp.

CC151 (1¼ miles on a bearing of 282° from Keogh Hill)

Brachiopods

Neospirifer sp.

Permorthotetes (Thomas, in press) sp.

Bryozoans

Hexagonellidae gen et sp.

The marine fossils in the One Gum Formation are confined to a thin band at the base of the unit. The outstanding feature of the fauna is its similarity to that of the Callytharra and its distinctiveness from the next marine fossils found higher in the sequence, in the top beds of the Keogh Formation and the basal beds of the lower part or member of the Madeline Formation. This horizon in its limited fauna contains two species, Deltopecten sp. and Strophalosia sp. nov., not previously recorded from above the Callytharra Formation.

Keogh Formation

WB184 (4-1/5 miles on a bearing of 11° from Monument Bore)

Pelecypods

Astartila blatchfordi (Hosking) 1931

Praeundulomya cf. concentrica Dickins, in press.

Aviculopecten sp. ind.

WB230 (6-3/5 miles on a bearing of 355° from Monument Bore)

Pelecypods

Gen. indet. (probably Atomodesma mytiloides Beyrich 1865)

Marine fossils were found in this Formation only in the area north of Daurie Creek and here they are confined to the top beds. Elsewhere marine fossils are found only in the lower part of the Madeline Formation immediately overlying the Keogh Formation. The species present also occur in the lower part of the Madeline Formation.

Madeline Formation

Lower Part or Member

WB50 (4-3/8 miles on a bearing of 148° from Callytharra Springs)

Brachiopods

Permorthotetes (Thomas, in press) sp.

Strophalosia prideri Coleman, in press

Linoproductus (Cancrinella) sp.

Streptorynchid sp.

Neospirifer sp. nov.B. (strongly fasiculate, non-alate).

WB51 (2¼ miles on a bearing of 225° from Keogh Hill)

Pelecypods

Astartila blatchfordi Hosking 1931

Glyptoleda sp. nov. Differs from G.coleyi Fletcher in that the V-ing of the ribbing is on rear part of shell. Cf.species from about 240 feet above base of type section of Coyrie Formation.

Aviculopecten cf. subquinquelineatus (McCoy) 1847.

Brachiopods

Orbiculoid gen.et sp.

Strophalosia prideri Coleman, in press

Strophalosia sp. nov. B?

Aulosteges ingens Hosking 1931

Linoproductus (Cancrinella) sp.

"Chonetes" sp. nov. A, sulcate form

"Chonetes" sp. nov.B, non-sulcate form.

Lacks radiating ornament.

Kiangsiella condoni Thomas, in press

Pseudosyrinx sp.

Neospirifer sp.nov. A.Alate strongly fasciculate.

Neospirifer sp.nov.B. Non-alate strongly fasiculate.

Bryozoans

Fenestella sp.

Polypora sp.

WB60 (3-3/8 miles on a bearing of 169° from Callytharra Springs)

Pelecypods

Astartila blatchfordi (Hosking) 1931

Gastropods

Indet.

Brachipods

Orthetacea gen. et sp. indet.

Strophalosia prideri Coleman, in press

Aulosteges ingens Hosking 1931

Linoproductus (Cancrinella) sp.

Neospirifer sp. nov.B.

Bryozoans

WB66 (3-3/8 miles on a bearing of 212° from Keogh Hill)

Pelecypods

Astartila blatchfordi (Hosking) 1931

Brachiopods

Strophalosia prideri Coleman, in press

Neospirifer sp.nov.A.

Neospirifer? nov.sp.C. Alate with a very high area - appears to have simple ribbing but not a Pseudosyrinx.

WB73 (7/8 mile on a bearing of 125° from Keogh Hill)

Pelecypods

Astartila blatchfordi (Hosking) 1931 Some specimens have a highly developed umbo not seen in specimens from the upper part of the Madeline Formation.

Glyptoleda sp. nov.

Aviculopecten cf. subquinquelineatus. Definite primary secondary and tertiary ribs.

Pseudomyalina sp.

Brachiopods

Strophalosis prideri Coleman, in press

Pseudosyrinx sp.

Neospirifer nov. sp.A.

Neospirifer nov. sp.B.

"Dielasma" trigonopsis (Hosking) 1933

WB74 (3¼ miles on a bearing of 092° from Bogadi Outcamp)

Pelecypods

Praeundulomya concentrica Dickins, in press.
Astartila blatchfordi (Hosking) 1931

WB82 (4/5 mile on a bearing of 160° from Six Mile Bore)

Pelecypods

Glyptoleda sp. nov.

Brachiopods

Strophalosia prideri Coleman, in press
Neospirifer sp. nov.B.

Bryozoans

WB95 (3/5 mile on a bearing of 264° from Deep Bore)

Brachiopods

Strophalosia prideri Coleman, in press.
"Chonetes" sp. nov. B
Neospirifer sp. nov.A?

Bryozoans

Indet

WB100 (5 miles on a bearing of 161° from Deep Bore)

Pelecypods

Astartila blatchfordi (Hosking) 1931
Atomodesma mytiloides Beyrich 1865
Glyptoleda sp. nov.
Chaenomya? sp. nov.
Praeundulomya concentrica Dickins, in press
Sphenotus? sp.

Gastropods

Indet.

Brachiopods

Productacea gen. et sp. ind.

Plants

Glossopteris sp.

Equisetale wood remains

WB136 (2 miles on a bearing of 42° from Mt.Madeline Trig)

Brachiopods

Strophalosia prideri Coleman, in press

Other remains

Layered material: Coral or sponge.

WB179 (2-3/8 miles on a bearing of 359° from Breakaway Bore)

Pelecypods

Astartila blatchfordi (Hosking) 1931
Aviculopecten cf. subquinquelineatus (McCoy) 1847

Brachiopods

Strophalosia prideri Coleman, in press
Kiangsiella condoni Thomas, i n press
Neospirifer sp/ nov. B
"Chonetes" sp. nov.B.

Bryozoans

Indet

WB182 (2-1/5 miles on a bearing of 358° from Monument Bore)

Pelecypods

Atomodesma mytiloides Beyrich 1865
Astartila blatchfordi (Hosking) 1931
Aviculopecten cf. subquinquelineatus (McCoy) 1847

Brachiopods

"Chonetes" sp. nov. B
Neospirifer sp.nov.A?

Conulariids

Conularia sp.

WB183 (3-4/5 miles on a bearing of 004° from Monument Bore)

Pelecypods

Atomodesma mytiloides Beyrich 1865
Astartila blatchfordi (Hosking) 1931
Praeundulomya concentrica Dickins, in press
Aviculopecten cf. subquinquelineatus (McCoy) 1847
Streblochondria sp.

Gastropods

Baylea? sp.nov. Same as species in type area of Coyrie Formation.

Cephalopods

Indet. coiled nautiloid

Brachiopods

"Chonetes" sp. nov.B

Wood fragments.

CC152 (63 feet above base of Condon's Section)
(4 miles on a bearing of 220° from Mt.Madeline)

Brachiopods

Strophalosia prideri Coleman, in press
Linoproductus (Cancrinella) sp.
Kiangsiella condoni Thomas, in press
"Chonetes" sp. nov.A.
"Chonetes sp.nov.B.

Bryozoans

Fenestellids

CC153 (76 feet above base of Condon's Section)
(same locality as CC152)

Pelecypods

Aviculopecten cf.subquinquelineatus (McCoy) 1847

Brachiopods

Linoproductus (Cancrinella) sp.
Neospirifer sp.
Cleiothyridina sp.
"Martiniopsis" sp.nov.

CC163 (Base Madeline - slightly north of Daurie Creek, Coordewandy Station - 1-2/5 miles on a bearing of 279° from Monument Bore).

Pelecypods

Atomodesma mytiloides Beyrich 1865
Astartila blatchfordi (Hosking) 1931
Aviculopecten cf. subquinquelineatus (McCoy) 1847

Gastropods

Mourlonia? sp.

Brachiopods

"Chonetes" sp. nov.A.

The fossils of the lower member of the Madeline Formation are quite unlike those of the basal horizon of the One Gum Formation and there are few species in common. On the other hand most of the species also occur in the upper member of the Madeline Formation. In the area covered by this report the following species appear to be confined to the lower member and have not been recorded in these collections from the upper member.

These are: Strophalosia prideri Coleman, in press
Kiangsiella condoni Thomas, in press ✲
Neospirifer sp.nov.A
Pseudosyrinx sp.
Glyptoleda sp.nov.
Baylea? sp.nov.

(✲ - see page 11).

Many specimens of Astartila blatchfordi from the lower part of the Madeline Formation have a more prominent beak than those found in the upper part and it is possible that these should be separated out as a different variety.

Pseudosyrinx sp., Glyptoleda sp. nov. and Baylea? sp. nov. also occur in the middle part of the Coyrie Formation. ¥ On this basis the lower part of the Madeline Formation can be correlated with the middle part of the Coyrie Formation in its type area. Additional evidence for this correlation is afforded by the upper part of the Madeline Formation which can be correlated with the top part of the Coyrie Formation and the Mallens Greywacke in their type areas.

Based on the 1955 field work the stratigraphical evidence indicates the upper part of the Madeline Formation is the equivalent of the top part of the Coyrie Formation and possibly the basal part of the Mallens Greywacke.

Some of the specimens of Aviculopecten cf. subquinquelineatus from the lower part of the Madeline Formation show more advanced ribbing than any known from the Coyrie in its type area. This may be due to an accident of collection or preservation, or to different environmental conditions or the lower part of the Madeline Formation may be slightly younger than its stratigraphical equivalent in the middle part of the Coyrie Formation.

Outside the Wooramel River area Strophalosia prideri, Kiangsiella condoni and Neospirifer sp. nov. A have been recorded only from the Lyndon River area where the beds in which they occur have been placed in the lower part of the Bulgadoo Formation. Neospirifer sp. nov. B, which also occurs in the upper part of the Madeline Formation, is also known elsewhere only from the Lyndon River locality.

It is probable that Strophalosia sp. nov. B. which is very common in the upper part of the Madeline Formation also occurs in the lower part. Because of the type of preservation however, it is not easy to distinguish from Strophalosia prideri in the lower beds.

In the Callytharra/Gap Pool area, i.e. in the widest and possibly the deepest development of the Byro Basin, the brachiopods predominate in number over the pelecypods. However, at the southern end of outcrop near Deep Well, and in the north of the basin in the Daurie Creek-Congo Creek area pelecypods predominate in numbers over brachiopods. The sediment is coarser in these directions and the change in ratio of brachiopods to pelecypods thus reflects either a change in the depth of water or a change in the conditions of sedimentation, or both.

Upper Part or Member

WB11 (1½ miles on a bearing of 143° from Mt. Madeline)

Pelecypods

Atomodesma mytiloides Beyrich 1865

Astartila blatchfordi (Hosking) 1931

Chaenomya sp. nov.

Page 10 ¥. Thomas (in press) records a single specimen of Kiangsiella condoni from the upper part of the Madeline Formation. The specimen has been examined and compared with the specimens from the other samples by G.A. Thomas and the author and the type of preservation and matrix indicate that the specimen became displaced in the collections after the present identifications were made. The specimen comes from the lower part of the Madeline Formation.

¥ At about 240 feet above the base of the type section measured by M.A. Condon.

Heteropecten sp. nov. (same species is present in Mallens Formation in type area. Differs from species in Cundlego Formation which has more constant ribbing. Left valve flatter, umbo less pointed, shell elongated more posteriorly.

Gastropods

Ptychomphalina maitlandi Etheridge Jnr. 1903.

Stachella? sp.

Mourlonia? sp.

Conulariids

Conularia sp.

Brachiopods

Strophalosia sp.nov.B. (Lacks distinct ears of S.prideri).

Aulosteges ingens Hosking 1931.

Aulosteges sp. nov.?

"Chonetes" sp. nov.A.

Linoproductus (Cancrinella) sp.

Neospirifer nov. sp.B

Crinoids

Calceolispongia sp. nov. C.

WB75 (1-3/8 miles on a bearing of 176° from Bogadi Outcamp)

Pelecypods

Astartila blatchfordi (Hosking) 1931

Volsellina sp.

Aviculopecten cf. subquinquelineatus (McCoy) 1847.

Heteropecten sp. nov.

Brachiopods

Neospirifer sp.nov.B. Non-alate, strongly ribbed.

WB76 (3¼ miles on a bearing of 248° from Bogadi Outcamp)

Pelecypods

Heteropecten sp.nov.

Brachiopods

"Dielasma" trigonopsis (Hosking) 1933

Neospirifer rostalinus var. crassus and var.aurita (Hosking) 1931

WB77 (5½ miles on a bearing of 150° from Mt.Madeline).

Pelecypods

Astartila blatchfordi (Hosking) 1931

Pseudomyalina cf. mingenewensis (Etheridge Jnr.) 1907.

Heteropecten sp.nov.

Brachiopods

"Martiniopsis" sp. nov. (Most specimens are smooth but a few show radiating plicae).

Crinoids

Calceolispongia sp. nov.B. Large square edged basals- like C.spectabilis but with different shape and finer pustules.

WB81 (2-3/8 miles on a bearing of 046° from Keogh Hill)

Pelecypods

Astartila blatchfordi (Hosking) 1931

Stutchburia sp. nov.

Pseudomyalina sp. Fine radiating ornament with secondary ribs.

Heteropecten sp. nov.

Gastropods

Ptychomphalina maitlandi Etheridge Jnr. 1903

Warthia sp.

Macrocheilus? sp.

Conulariids

Conularia sp.

Brachiopods

"Dielasma" trigonopsis (Hosking) 1933

"Dielasma" sp. (either a young "D".trigonopsis or another species).

Neospirifer rostalinus var. aurita and var. crassus (Hosking) 1931

"Martiniopsis" sp. nov.

Crinoids

Calceolispongia sp. nov. A (Belonging to C.barrabiddiensis, acuminata, truncata series).

Bryozoans

Streblotrypa sp.

Stenopora or Batostomella sp.

Plants

Glossopteris sp.

WB87 (1-2/5 miles on a bearing of 73° from Gap Pool)

Pelecypods

Stuchburia sp. nov.(wider at back than at front - a distinct posterior ridge - very tumid in middle part of shell).

Gen. Incert. (like a young Oriocrassatella but has a crenulated margin).

Praeundulomya concentrica? Dickins, in press (hinge not preserved, ribbing concentric).
Aviculopecten cf. subquinquelineatus (McCoy) 1847
Heteropecten sp. nov.

Gastropods

Ptychomphalina maitlandi Etheridge Junr.1903
Bellerophon sp.

Scaphopods

Gen.Indet

WB104 (3/4 mile on a bearing of 024° from Pindilya Hill) "Aulosteges Horizon" near Pindilya Hill.

Pelecypods

Atomodesma mytiloides Beyrich 1865
Aviculopecten cf. subquinquelineatus (McCoy) 1847

Gastropods

Mourlonia? sp.

Conulariids

Conularia sp.

Brachiopods

Strophalosia sp. nov.B.
Aulosteges ingens Hosking 1931
Neospirifer sp. nov. B.
Neospirifer byroensis (Glauert) 1912

WB108 (1-3/4 miles on a bearing of 232° from Dilba Bore), (probably from the uppermost beds of the Madeline Formation)

Brachiopods

Strophalosia cf. sp. nov.B.
Aulosteges ingens Hosking 1931

Worms

Burrows with regular transverse ornament like a crinoid stem.

WB135 (2½ miles on a bearing of 102° from Mt.Madeline)

Brachiopods

Strophalosia sp. nov. B.
Aulosteges ingens Hosking 1931
Streptorhynchus sp.
"Dielasma" trigonopsis (Hosking) 1933 (one of specimens is very similar to the single specimen from the Coyric Formation in its type area).
Neospirifer rostalinus var. crassus (Hosking) 1931
Cleiothyridina sp.

Crinoids

Calceolispongia sp. nov.C. (This species is hand shaped and conspecific or closely related forms occur in the top part of the Coyrie Formation in the type area, and on the Lyndon River in beds which have been placed as Lower Bulgadoo).

WB166 (2 miles on a bearing of 242° from Dilba Bore).

Pelecypods

Astartila blatchfordi (Hosking) 1931

Pseudomyalina cf. mingenewensis (Etheridge Jnr.) 1907

Aviculopecten cf. subquinquelineatus (McCoy) 1847

Conulariids

Conularia sp.

Brachiopods

Strophalosia sp. nov. B.

Aulosteges ingens(Hosking)1931

Streptorynchus sp.

"Dielasma" trigonopsis (Hosking) 1931

Neospirifer sp. nov. B.

Neospirifer rostalinus? (Hosking) 1931

WB169 (4-1/8 miles on a bearing of 205° from Mt.Madeline.

Pelecypods

Astartila blatchfordi (Hosking) 1931

Stuchburia sp. nov.

Brachiopods

Strophalosia sp. nov. B.

Aulosteges ingens(Hosking)1931

Aulosteges sp. nov.? Triangular area, no trail, fine spines cf. A.spinosus(Hosking)1931

Streptorynchus sp.

"Dielasma" trigonopsis (Hosking) 1933

Neospirifer nov. sp. B

Neospirifer rostalinus var. aurita (Hosking) 1931

Neospirifer? nov.sp. C.? (High area, pedicle adductor muscle does not project. Strong ridge on either side of sulcus in pedicle valve. Appears to be fasciculate).

Crinoids

Calceolispongia sp. nov. C.

CC155 (4¼ miles on a bearing of 203° from Mt.Madeline) (225' above base of Madeline, Condon's Section).

Pelecypods

Atomodesma mytiloides Beyrich 1865

Pseudomonotis sp.

Brachiopods

Strophalosia sp. Fine scattered spines, rather flattish .

Streptorynchus sp.

Linoproductus (Cancrinella) sp.

Hustedia? sp.

CC156 (same locality as CC155 - 262' above base of Madeline, Condon's Section).

Pelecypods

Aviculopectinidae gen. et sp. indet.

Gastropods

Ptychomphalina maitlandi Etheridge Jnr. 1903

Conulariids

Conularia sp.

Brachiopods

Strophalosia sp. nov. B

Aulosteges ingens (Hosking) 1931 (Very closely related or conspecific with A. lyndonensis Coleman, in press, from beds placed as Lower Bulgadoo).

Streptorynchus sp.

"Dielasma" trigonopsis (Hosking) 1933.

Neospirifer sp. nov. B.

"Martiniopsis" sp; nov. (only 1 specimen, well developed costae).

Neospirifer rostalinus var. crassus and var. aurita (Hosking) 1931.

Crinoids

Calceolispongia sp. nov. C.

CC158 ($2\frac{1}{4}$ miles on a bearing of 045° from Keogh Hill) (same horizon as WB81.)

Brachiopods

"Dielasma" trigonopsis (Hosking) 1933

Neospirifer rostalinus var. crassus (Hosking) 1931.

CC159 ($4\frac{1}{4}$ miles on a bearing of 060° from Keogh Hill).

Pelecypods

Stutchburia sp. cf. S. sp.nov.

Schizodus sp.

Solenomorpha? sp.

Aviculopectinidae gen.et sp.indet.

Gastropods

Ptychomphalina maitlandi Etheridge Jnr. 1903.

A number of forms not present in the lower part of the Madeline Formation appear in the upper part. Notable amongst these are the pelecypod Heteropecten sp. nov., the brachiopod Neospirifer rostalinus with its two varieties and three new species of Calceolispongia.

For correlation with the northern part of the basin important forms are Heteropecten sp. nov. which also occurs in the Mallens Greywacke, Strophalosia sp. nov.B, which occurs in the top part of the Coyrie Formation in its type area and Calceolispongia nov.sp.B. which has a closely related or conspecific form in the top part of the Coyrie Formation in its type area and on the Lyndon River in the beds placed in the Lower Bulgadoo. Aulosteges ingens and probably "Dielasma" trigonopsis also occur in the Coyrie Formation in the type area.

This evidence would indicate that the upper part of the Madeline Formation can be correlated with the upper part of the Coyrie Formation or possibly part of the Mallens Greywacke.

Doubtful Horizons in Madeline Formation

WB103 (3-1/8 miles on a bearing of 107° from Bogadi Outcamp, (from lithology appears to be basal Madeline)

Pelecypods

Atomodesma mytiloides Beyrich 1865

Brachiopods

Neospirifer sp. nov.A

Wood

The presence of Neospirifer sp. nov.A would suggest this sample is from the lower part of the Madeline Formation.

WB107A (3/8 mile on a bearing of 349° from Dilba Bore)

Brachiopods

Strophalosia sp. ind.

"Chonetes" sp. nov. A

Kiangsiella? sp. ind.

Conulariids

Conularia sp. ind.

The presence of Kiangsiella would suggest this sample is from the lower part of the Madeline Formation. However, the record is a doubtful one.

WB167 (2¾ miles on a bearing of 326° from Dilba Bore)

Pelecypods

Atomodesma mytiloides Beyrich 1865

Astartila blatchfordi (Hosking) 1931

Brachiopods

"Chonetes sp. nov. B.

Neospirifer sp. nov. A.

The presence of Neopsirifer sp. nov.A would suggest this sample is from the lower part of the Madeline Formation although it is labelled "Aulosteges Horizon"? i.e. from the upper part.

WB223 (6-3/5 miles on a bearing of 355° from Monument Bore)

Brachiopods

Strophalosia cf. prideri Coleman, in press

Orthotetacea gen. et sp.

Kiangsiella condoni Thomas, in press

Neospirifer sp. nov.B.

The preservation is poor but the presence of Kiangsiella condoni would suggest the sample is from the lower part of the Madeline Formation.

Bogadi Greywacke

WB78 (6 miles on a bearing of 323° from Bogadi Outcamp) (near top, close to type horizon of Neospirifer byroensis)

Brachiopods

"Dielasma" trigonopsis (Hosking) 1933

Neospirifer byroensis (Glauert) 1912

WB79 (6 miles on a bearing of 322° from Bogadi Outcamp, close to type horizon of Neospirifer byroensis)

Brachiopods

"Dielasma" trigonopsis (Hosking) 1933

Neospirifer byroensis (Glauert) 1912

Crinoids

Calceolispongia sp. (related to a group found in Bulgadoo and above)

WB80 (4-3/8 miles on a bearing of 059° from Keogh Hill, near base)

Pelecypods

Astartila blatchfordi (Hosking) 1931

Heteropecten sp. nov.

Gastropods

Ptychomphalina maitlandi Etheridge Jnr. 1903.

Cephalopods

Propinoceras sp. ind.

Brachiopods

"Dielasma" trigonopsis (Hosking) 1933

Neospirifer rostalinus var. crassus and var. aurita (Hosking) 1931

"Martiniopsis" sp.

Crinoids

Calceolispongia sp. nov. C.

WB98 (5 miles on a bearing of 062° from Keogh Hill)

Crinoids

Calceolispongia sp. cf. C. nov. sp.A.

WB99 (4½ miles on a bearing of 059° from Keogh Hill) probably one of type localities of Aulosteges ingens)

Brachiopods

Neospirifer rostalinus var. crassus (Hosking) 1931.

Aulosteges sp. ind.

WB110 (4½ miles on a bearing of 234° from Dilba Bore)

Conulariids

Conularia sp.

Crinoids

Stemo ossicles

WB171 (1-3/8 miles on a bearing of 233° from Bogadi Outcamp)

Pelecypods

Aviculopectinidae gen. et sp. indet.

Conulariids

Conularia sp. ind.

Brachiopods

Neospirifer sp. ind.

Crinoid stems

Wood fragments

Limonitic pseudomorphs after pyrite

CC157 (3-7/8 miles on a bearing of 194° from Mt.Madeline)

Pelecypods

Astartila blatchfordi (Hosking) 1931

Heteropecten sp. nov.

The fauna of Bogadi Greywacke has less individuals and is less diverse in species and genera than that of the Madeline Formation. All the species recorded are also present in the Madeline Formation with the exception of Calceolispongia sp. which belongs to a group of Calceolispongids not known from the Mallens of the Coyrie but only from formations higher in the sequence in Western Australia.

No macro-fossils wereccollected from the Warra Warringa - the youngest formation of the Byro Group cropping out in this area.

CONCLUSIONS

The oldest marine fauna dealt with in this report is that from the One Gum Formation. The important feature of this fauna is its similarity to that of the Callytharra Formation and its distinctness from the next youngest fauna found in the top of the Keogh Formation and the base of the Madeline Formation.

The fauna of the top of the Keogh Formation is a small one and the same species are present in the lower part of the Madeline Formation. Most of the species present in the lower part are also found in the upper part of the Madeline Formation but the lower part is characterised by the presence of Strophalosia prideri, Kiangsiella condoni and Neospirifer sp. nov. A. Pseudosyrinx sp., Glyptoleda sp. nov., and Baylea? sp. nov.,

which also occur in the Coyrie type section, have likewise been recorded only from lower part of the Madeline Formation.

On the other hand Heteropecten sp. nov., Neospirifer rostalinus and three new species of Calceolispongia are present in the upper but absent from the lower part. These forms, together with Strophalosia sp. nov. B., allow the upper part of the Madeline Formation to be correlated with the top part of the type Coyrie Formation or possibly part of the Mallens Greywacke.

The study of the fauna of the Madeline Formation suggests that the beds on the Lyndon River containing a related fauna may be rather the equivalent of the Coyrie Formation than the Bulgadoo Formation as has been previously thought. Re-examination of field notes and photographs indicates this suggestion may be correct (M.A. Condon, personal communication).

The fauna of the Bogadi Greywacke with the exception of Calceolispongia sp., does not afford additional information for correlation. Calceolispongia sp., which occurs near the top of the Bogadi Greywacke, is of a type not known from below the Bulgadoo shale.

Above the Bogadi Greywacke no fossils were collected from the Warra Warringa Formation.

In the faunas examined there is no indication of any forms characteristic of the Wandagee Formation or even the Cundlego Formation whereas there is definite evidence of forms which are older than those of Wandagee Formation. The Wandagee Formation has characteristic species of nuculanids, pectinids, spiriferids and calceolispongids, as well as other forms, which have not been found in the Wooramel River area.

Following Teichert (1941, p.399, fig.6; 1942, p.222 and fig.2) it has been general to correlate the base of the Callytharra Formation with the base of the Artinskian Stage of the Standard Permian sequence of the Urals of the U.S.S.R. Although this correlation is approximate present evidence (see Thomas and Dickins, 1954) would appear to allow only a slight re-adjustment of these boundaries and the Callytharra Formation can be regarded as containing rocks of Lower Artinskian age. The upper boundary of the Artinskian Stage can be correlated with beds between about the top of the Norton Greywacke and the base of the Coolkilya Greywacke. In the absence of marked faunal breaks, the gradual changes in the faunas, the stratigraphical position and the correlations with the formations to the north it can be concluded that all the faunas considered in this record are of Artinskian age and appear to range from Lower Artinskian (One Gum Formation) to not younger than the middle part of the Artinskian (Bogadi Greywacke).

REFERENCES.

COLEMAN, P.J., in press - Permian Productacea of Western Australia. Bur.Min.Resour.Aust. Bull. 40.

CONDON, M.A., 1955 - Progress Report on the Stratigraphy and Structure of the Carnarvon Basin. Bur.Min.Resour. Aust.Rep. 15.

DICKINS, J.M. in press - Lower Permian Pelecypods and Gastropods from the Carnarvon Basin, Western Australia. Bur. Min.Resour.Aust.Bull. 41.

DICKINS, J.M. and THOMAS, G.A., MS. - The Marine Fauna of the Carrandibby Formation and the Lyons Group of the Carnarvon Basin, Western Australia.

HOSKING, L.F.V., 1931 - Fossils from the Wooramel District, Western Australia. J.roy.Soc.W.Aust., 17 - 15.52

HOSKING, L.F.V., 1933 - Fossils from the Wooramel District, Series 2. Ibid,19,43-66.

KONECKI, M.C., CONDON, M.A., DICKINS, J.M. and QUINLAN, T., M.S. - The geology of the Coastal Area between the Gascoyne and Murchison Rivers, Western Australia.

McWHAE,J.R.H., PARRY,J.C., and STANLEY, D.J., 1954. - The Geology of the Gascoyne - Wooramel Area, Coastal District, Western Australia. Report to West Australian Petroleum Pty. Ltd. (unpublished).

TEICHERT, C. 1941 - Upper Palaeozoic of Western Australia: Correlation and Palaeography. Bull.Amer.Ass. Petrol. Geol., 25, 371-415.

TEICHERT., C., 1942 - Permain Ammonoids from Western Australia. J. Paleont.,16(2), 221-232.

THOMAS, G.A., in press - Permian Orthotetacea of Western Australia. Bur.Min. Resour.Aust. Bull., 39.

THOMAS, G.A., and DICKINS, J.M., 1954 - Correlation and Age of the Marine Permian Formations of Western Australia. Aust.J.Sci.,16(6), 219-223.