#### COMMONWEALTH OF AUSTRALIA

### DEPARTMENT OF NATIONAL DEVELOPMENT

## BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

1944/24

FORAMINIFERA IN THE PERMIAN ROCKS OF AUSTRALIA

bу

I. Crespin

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## DEPARTMENT OF SUPPLY A CHAPTER.

#### Mineral Recourses Survey Brench.

#### PORAMETERRA IN THE PERMIAN ROCKS OF AUSTRALIA.

#### Report No. 49/h/2h.

#### LIMICOUCTION.

The presence of foreminifers in the Permian sediments of Australia was recorded as early as 1882. Some systematic work was done up to 1905, but there was no further investigation into these micro-fossils until 1937. Since that date, four papers on Fermian foreminifers have been published (1937, 1940 (2), 1944). However, it was not until about ten years ago that systematic sampling of outcrops, cores and cuttings from bores was commonced with the object of seeing whether micro-faunal somes could be established.

Since 1933 extensive collections of Permian rocks have been made in New South Vales and Western Australia and amailer ones in Queensland, by geologists attached to private companies who were carrying out a search for oil in Australia. Subsidiary companies of Oil Search Limited drilled two deep bores in New South Vales, and two in Queensland, which were partly or wholly in Permian sediments; and the Freney Kimberley Oil Company was drilling a deep bore in Vestern Australia, which is wholly in Permian bods and which, when operations were suspended in 1942 owing to the war, had reached a depth of 5,271 feet. Core samples and drill cuttings from these bores have been examined and a micro-fauna rocks in Tasmania, and the only foreminifers recorded are those described by Howchin in 1895 from the Piper River, near Karoola.

A considerable assumt of research is still necessary before it can be stated whether or not a definite system of zoning, based on the nicro-faunas, can be applied to the Permian rocks of Australia. It seems possible, however, that certain species may be characteristic of the Upper and Middle Permian deposits. In the extensive collections of Permian rocks examined from the Hunter River District in New South Wales, assemblages of foreminifera rather than restricted species have proved useful for sonal purposes and this method of zoning should prove valuable when more material is examined from the Permian deposits of other States.

A noteable feature of the foreminiferel assemblage in the Permian rocks of Australia, is the almost complete absence of the world-wide zonal forms, the Pusulinidae. The only record of their occurrence is the two poorly preserved specimens from the Upper Perruginous Series in the Seat Kimberley Area, Restern Australia, referred to the genera Verbecking and Nepschmarering by Chapman and Perr (1937). These important foreminifors are recorded from Sumatra, India, China and Sapan.

#### HIGHORICAL HATEDS.

The first reference to the presence of Formian foreminifera in Australia was made by Professor Rupert Jones in his Catalogue of the Fossil Foreminifera in the British Huseum (1882). The locality was given as Piper River, Tasmania. These Stephena (1889) published a note in the Royal Society of Tasmania on the discovery by S. R. Stheridge of Permo-Carboniferous foreminifera in a limestone from the "right bank of the Piper River, not very far from a place called Lilydale" (Howehia, 1894). Etheridge stated that this was the first record of the occurrence of foreminifera in the Permo-Carboniferous rocks of Australia and Tasmania. The Piper River material was further examined by Howehin (1884) when he recorded four species from thin sections of limestone.

In 1895 Howehin described four new species of foreminifera from the "Carboniferous" beds, Irein River area, Western Australia. This work, together with that by Chapman and Howehin in 1905 on the Permo-Carboniferous foreminifera of New South Wales formed a basis for investigations on Permian foreminifera in Australia for many years. The nomenclature used by Chapman and Hoschin in the latter paper (1905) was revised by those authors in collaboration with W. J. Parr in 1936.

In 1907, Etheridge Jur., listed Permian foreminifera from a bore at Port Koats, Borthern Territory.

in 1937. Chapman and Parr recorded the occurrence of two genera of Fusulinids in rocks from the West Kimberley area in Western Australia.

Two papers containing descriptions of new species opposed in 1940. One was by W. J. Parr and the writer on species of Permian foreminifers from New South Males and the other by Parr on forms from Western Australia. The writer has recently published (1944) descriptions of four new species from Queensland and New South Males.

# DESCRIBUZION OF PORALITIES A IN THE PROBLEM DESCRI

#### 1. Queenelend.

- (a) General. Little micropalacontological inventigation has been undertaken on the Permian rocks of this State. The writer has examined fairly extensive collections of rocks from the Spring-sure area as well as samples from two deep bores, namely the Mutten Creek Bore, Grilled to the depth of h.688 feet and the Arcadia bore, to 6.036 feet. This material was submitted for exemination by private companies engaged in the search for oil in Queenalend.
- (b) Riginal ton Table. The following table summarises the information evaluable concerning the occurrence and distribution of foreminifers in the Middle and Lower Down Series of Gueensland. Samples from all the localities listed have been examined by the writer. For convenience, latter designations are given to the localities which are listed below the table.

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#### Localities referred to Middle Bowen Series.

- a. Dry Greek, "Inglelere" property, Springeure.
  b. Argus's Selection, Springeure.
  c. Arcadia Bore from 1,800 feet down to 2,390 feet.
  d. Hutton Greek Bore from 770-790 feet.

#### Localities referred to Lower Hoven Series.

- A. N.bank, Cattle Greek, 44 miles S.S. of Springeure. B. In Cattle Greek below Waterfall.
- C. Watershed between Little Gorge and Cabbage Tree Grooks.
- D. Watershed between Sandy and Dry Creeks, S. end of Serocold Structure.
- Mr. Reid's Section through Mt. Hope, 20 miles S. of Springswe.
- Staircase Gully just below Old Rolloston Road Gross-ATAM
- O. Stalwoode Gully.
- M. 2.5 miles from Mantuan Downs Station, on Springsure Mond.
- I. Mantuan Downs Station.
- J. 3 miles from Gracow on road to Theodore.
- K. Quarry beside Banana-Riana read, 9.6 miles from Banana,
- L. Ironberk or Little Gorge Greek, Springeuro-Rolleston Roed.
- M. Staircase Grock at base of Mt. Sirius.
- N. Aldbaran Crock, 4 miles N.B. of Mt. Catherine.
- (v) Lotes on the Assemblage of formulations which tay be of some importance is that which contains Coloromella atophens. Release a smoothensie, Proposed and Sala Links in Color and Sala Links in Color and Sala Links in Color and Sala Color and the Lower Bowen Series. As pointed out inter in this paper, the majority of these species may constitute a distinct assemblage in the Lower Marine Series of New South Wales, and in the Callytharra limestone and Fosell Cliff bods in Western Australia which can be correlated with the Lower Marine Series of New South Wales, and the Lower Bowen Series of Queeneland.
- Of the above species, the only one which ranges up to the Middle Bowen Series is <u>N.woodwardi</u>. <u>N.serocoldensia</u> has only been described recently (1944). It is possible that this species may form a valuable addition to the Lower Bowen assemblage.

Most of the species listed from the Middle Bowen, range from the Lower Bowen to that Series. It will be necessary for further collections of codinents to be made from both Series before soning of the Middle Bowen will be possible.

#### 2. Now South Vales.

- (a) General. Geologists from Oil Search Limited and the Cormon-wealth Oil Refineries Limited made extensive collections of rocks in the Hunter River District in the hope that micro-faunal sones could be established. Material was also examined from the section at Victoria Pass, Mitchell Righway. Cores and cuttings from bores were also investigated. Samples from the Eulnura Doro, which is situated 15 miles northwest from Gosford, and which was drilled to the depth of 6,293 feet, were examined microscopically during the progress of Grilling, and foreminifers were discovered at various depths, (Reggett and Grospin, 1940). Foreminifers were also present in the Balmain Bore, Gydney, (Raggett and Crespin, 1941) and in Bore J at Goorabin, 55 miles west of Albury (Crespin, 1943).
- (b) Distribution Table. The following table summarises the information available concerning the occurrence and distribution of forminifers in the Upper and Lower Eggine Series of New South Vales. For convenience, letter designations are given to the localities which are listed below the table. The tabulation is based chiefly on the writer's examination of samples from the localities listed, but Chapman's and Newchin's results (4905) are also included. The localities from which their samples were obtained are indicated below.

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## Localities in the Hunter Diver District referred

- a. W.benk of rellwey outting, W. of Minimbah.
- b. Long Point, Hunter River near Singleton.
  c. Box Tree Hill Cutting, Goorangeola Road, N. of
- Singleton. O. McDougall's Hill, Singleton.

- o. Padua Siding. f. Mt. Thorley. Warkworth Road. g. John Brown's Reservoir Section.
- h. Branzton Railway Gutting, W. of Branzton. 1. Postor's Bridge Section.

- J. Pothomna Siding. k. Polan-Bickmond Main Railway Soction.
- 1. Saw Mill, Mulbring Greek. m. Riz's Creek above Muree.
- n. Rothesy to Black Creek.
- o. Warkworth Stock Boute, Loder Dome. p. Bishop's Bridge to Sawyer Gully.
- g. Wollong (Chapman and Howohin).

## Other leadlities referred to the Daner Marine Scries.

- r. Poot of Victoria Pass, Mitchell Highway. s. Kulmura Dore from 3,778 feet down to 4,490 feet. t. Balanin Bore, Sydney, from 4,750 down to 4,760 feet.

#### Horison Unography

u. Bore J. Coorabin at 334 feet.

#### Localitica in the Nunton River District referred to the lover hereine brack.

- A. Top of Parley beds, Perley Road, N.S. of railway otation.
- B. Bailway cutting S. of Farley. C. Holf a mile S.B. of Jackson's Hill, Pokolbin.
- D. Pokolbin (Chapman and Nowehin).
- E. Cranky Corner. F. Harper's Hill.
- G. Leyconfield Section.

## Other legality referred to the Legar Native Series.

H. Kulnura Boro, 4667 feet down to 6,293 feet.

(c) Notes on the Assemblaces. In New South Weles, the most distinctive assemblage of foreminifers is found in the bods at the top of the Lower Harine Series. It is similar to that recognised in the Lower Bosen Series of Queensland. The assemblage is deminated by Galcifornella stamband, the associated species being Trengtlandis op. Series which have a series to be a formed to the control of these forms were described by Chapman and Howchin (1905) from Pokolbin. At the came time these workers described many other specimens from the limestone at Pokolbin, none of which, however, have been discovered elsewhere.

Upper Marine Geries are recognised tentatively.

- (1) The most characteristic assemblage of forminifera is the rocks of the Number River District contains Experimentales actual (abundant), Associated the Resident Re
- (ii) The second assemblage is found in the sediments at the foot of the Victoria Pass, Mitchell Highway, and is present in some of the bods in the Hunter Miver District. The species are Hypers minister asieula, Ameliana Milliana Milliana

The only species restricted to the Upper Marine Series in New South Wales is Trochaming pulvillus Crespin and Papr. This form is fairly well distributed and with further investigation may prove to be of sonal importance.

### 3. Marrania.

Exact for the foreminifera described by Howehin (1694) from the Piper River limestone near Earcola, there has been little investigation of the Permian rocks of Tasmania for micro-faunce, although the extent of the deposits is considerable. Howehin described Calcitornella stephansi from the Piper River limestone. He referred a milicilar form to Delegiosulina? Dismulata (Lon.), but from the figure this is probably a section through Hepitornium schlumbergeri (Howehin). His Hedgasria? radicula (Linne) may be referable to Hedgasria panded, recorded by Chapman and Howehin from a limestone at Pokolbin, New South Fales (1905). A recent excellmation of a thin section of the Piper River Limestone has revealed the presence of Calcitains triangularis. This limestone occurs at the top of the Lower Earline Jeries in Tasmania and the abundance of Castephensi suggests that it is possibly the equivalent of that Jeries in Res South Wales and of the Lower Bowen Series in Queencland.

## b. Western Augtralia.

- (a) Gangral. The list of fossils hereunder is compiled from records of the Commonwealth Pelacontologist based on examination of samples submitted by various companies engaged in the search for oil and from records supplied by Mr. W. J. Parr. The species from the Vandagee bods described by Perr (1940-1941) are given as esperate entries.
- (b) Digitibution Table. The following table sumerises the information available concerning the occurrence and distribution of foraminifora in beds correlated with the Upper and Lower Marine Series of New South Wales. As indicated in the notes following the tabulation, the results of investigations by Parr (1950-41) and by Chapman and Farr (1937) are included, together with the writer's observations.

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## Localities correlated with the Upper Marine Series

## I. Commonwealth Pelgeontological Collection.

a. Junction of Vindabooks Creek and Cascoyne River.

b. Wandagee Station, & mile upstream from Carden Cutozup.
c. Wyndham River, 1 mile below Gap.
d. Gascoyne River, & mile below Hotel.
e. Gascoyne - wone Motor Road Grossing.

f. Hotel, Cascoyne Junction.

g. Loft bank of Greek flowing into Gascoyne River at Loc. 9 (Waterford Loc.).

h. Right bank of Gascoyne River, 2 miles below Bidgomai Homeetesc.

1. 4 mile N.E. of Winnemia.

j. Minilya River, 3 mile upetream from Wandagee Momostoad.

## II. Localities given by Perm (4910-64).

k.(1) Walbia Paddock about 440 chm.due S. of Trig. Stn., Wandegeo Hill.

(11) Coolkilyia Flat approx. 4 mile S. of Homesteed-Carden road and i mile E. of Shod-Outcomp telephone line.

1.(i) S. of Minilya River. (ii) Minilya Road, Coolkilyia Flat, S. limb of syncline N. of Wandagoo Hill.

(111) Burna Burna Paddock, Wandagee Station, on Wandagee-Min Mia Road, about 3 miles in 2310; from Burna Burna Hill.

m.(1) S. side of Minilya River, near Goolkilyia Pool, Wandagee Otn.

(iii) Extreme S.E. corner of Coolkilyia Paddock.

n. Gascoyne River at Jimba Jimba Romestead.

o. About 4 mile W. of Cumdlege Well, Minilya River.

## III. Localitics given by Charman and Parr (4937).

p,(1) 6 miles N.W. of North-West Hill, Kimberley. 3.W. corner of the North-east Structure at Bell'e Ridge, Rimberley.

# Localities correlated with the Lover Marine eries of New

A. Possil Cliff, Irwin River.

8. Pell's Crossing, Cascoyne River. C. 2 miles R.E. of Lyons River Homestead. D. 12 miles S. of Lyons River Homestead.

E. Minginco Homestead, Gaseoyne. F. 5 miles N.B. of Dairy Creek Station. G. 2 miles N. of Carey Downs turnoff, main Byro-Glenburg Road.

H. Grant Hange.

I. Norrima Boro, West Kimberloy Area, from 39 down to 424 feet, 5. Didgemei-Wyndham Gap.
E. Houth of Salt Gully, Callytharra.
L. 4 to 8 miles N. of Arthur Valley, Gascoyne Area.

assemblage is similar to that found in the Lover Marine Series in New South Vales and in the Lower Bowen Series in Queensland. Species restricted to this horizon in Vestern Australia include Transilancia of grandles, Tanianning schlumbergari, Prondicularia vocamanda. Setrotasia conica and Setuitaina triangularia.

A study of the micro-feunal assemblages in the Permian deposits of queensland, New South Wales and Western Australia suggests that the reference (unpublished reports by H. G. Reggatt and F. G. Forman) of the marine deposits met with in the Merrima Bore between 39 feet and 785 feet to the Mooncambah Series may be incorrect. This Series is considered to be the equivalent of the Wandagee bods of the Morth-West Basin. The foraminiferal assemblage noted in samples from the Merrima Bore between the depths of 30 feet and 424 feet consists of Galcitornella atcohensi, Americallis of Francescis, Totrotomia conica, Esdesnia irwinencis, Frankleularia barri, Frankleularia the Kerrima Bore should be correlated with the Kura Kura Kura limestone of the Mest Kimberley area and not with the Nooncambah. The reason for this suggestion will be appreciated by reference to the tabulations given above and to the preceding discussion. From 810 feet down to 4,271 feet, at which dopth drilling was suspended, the bore was in non-fossiliaforous beds and it is suggested that these belong to the Crant Series.

In the Western Australian Strate, which can be correlated with the Upper Narine Series of New South Wales, there are two assemblages, (i) that described by Parr (1940-1944) from the Wandages Series of New South Wales. The assemblage from the Wandages being contains many species of foreminifore new to the Australian Fernian as well as some previously described forms as a second assemblage includes includes and assemblage includes and a

One of the most important micro-faunci discoveries in the Permian rocks of Western Australia is that of the two genera of Fusulinids, Neoschwarzeina and Yorksekina, (Chapman and Parr, 1937). These forms occur in the Eunberley area, in the topmost beds of the Upper Ferruginous Series (Sale, 1938), which is considered to be the equivalent of the highest beds in the Upper Marine Series of New South Tales.

#### 5. Northern Territory.

Rocks of Pormian age were described from the Port Keats Bore by Etheridge Jar. (1907) who recorded and figured Calcifornella dischange from samples obtained between the depths of 554 and 574 feet. The bods are correlated with those at the top of the Lower Barine Series in New South Wales and Tassania, the Lower Bowen Series in Queenuland and with those in Western Australia, which are considered as representing these Series in that State.

#### GONDITIONS DURING GEDINGNIANION OF THE PERMIAN ROCKS.

The foreminiferal assemblages indicated in the tabulations in Section 3. point to differences in climatic and bathymetric conditions under which the Permiss deposits of Australia were laid down.

- 1. The accemblage, which is dominated by <u>Colsitornella Stephensi</u> and which is characteristic of the Lower Harine Ceries and its correlates in all States, <u>uniquests</u> the existence of challow, warm conditions at that time.
- 2. The foreminiferal assemblages in the Upper Marine Series contain many genera which are living in the seas at the present day and an scological study of these forms gives a fairly reliable indication of climatic and bathymetric conditions during the deposition of the bods

comprising the Upper Marine Series. All forms suggest lower temperatures and slightly deeper water conditions than experienced during the deposition of the upper part of the Lower Marine Series.

3. The presence of fusulinide in sediments high in the Permian sequence in Western Australia, suggests the return in that State at least, of warmer and challower water conditions towards the close of that period.

#### MODES ON BOIS OF MISS FOR AUTHORISM. SPECIALS.

The of the most important species, which is wide speech in distribution in the Fermion rocks of Australia, but which, on present sydence is restricted in vertical range, is Calcifornally despheral. Heachin. This calcareous and adherent species was described by sowenin in 1894 from a linestone from the Piper River near Earsola, Tasmania. It is abundant in the Callitherna limestone and Fessil Cliff bods, Vestern Australia. It is common at Pokelbin, Rey South Vales, and is found in sodiments in the Springeure area in Queensland. It is recorded from the Port Keats Bore, Northern Torritory.

(1895) from Fossil Gliff, Irwin River, Jestern Australia. It is not a common form and the only record in the Jastern States is from the Lower Marine Series at Pokolbin, New South Wales.

Gelous to the Company Chapter and Reselin is usually found accordance with Colorogula standard. It was originally described from the Pokerbin Limestone. Although it is found in Vestern Australia and Queencland as well as in New South Wales, it is a comparatively rare species. It is recorded from the Lever Bowen ories in the Opringouse area in Queencland, from localities in the Lever Marine Series in the Hunter River District in New South Wales, from Possil Cliff and from the Gasseyne area in Western Australia.

(1895) from Possil Cliff, Irwin River, Western Australia, is wissly distributed in the Permiss rocks of Australia. In New Youth Wales its vertical range is restricted to the basal portion of the Upper Marine Series and the top of the Lower Marine Series. In the Springeure area, Queenaland, there is one record of E. Moodsand in the Middle Bowen Series, but large tests are common in some of the deposits referred to the Lower Bowen. In Western Australia, it is restricted to the horizon represented by the Possil Cliff bods and the Callytharra limestons.

described by the witer from the Kulmurg Boro in Nov South Welco from the depth of L. 25 feet in sediments referable to the Upper Haring Sories (Sagatt and Greath, 1912). The Daily Other Commences of this species in Nov South Wales are also from the Kulmura Boro between the depths of 1,020 feet and 1,250 feet.

Sediments in the Lover Bowen Bories in Queensland. It is recent in the Norman Boro, West Kimberley area, Western Australia between the depths of 39 feet and 272 feet, where it is associated with a formain-iteral associated with a formain-

are more numerous than those already noted and belong chiefly to aronaccous genera.

The most widely distributed forminiforal opecies in the Persian rocks of Australia is <u>Emargninging activity</u> described by Parr (1960) from the Wandagoe bads near Coolkilyia Fool,

Nandagee Station, Sestern Australia. It soloning is fairly componed nestern Australia in those beds which can be correlated with the Upper Marine Series of New South Valos, but it mans in the lower begins represented by the Callytharra limestone and the Possil Chiff beds. This clongate, tapering foreminiser is very common in both the Upper and Lower Marine Series in the Munter River District. New South Walco. It is also well represented in the Middle and Lower Bowen Series in the Springsure area, Queensland. Parr records specimens of Hagicula up to 20 mm. In length, but the majority of specimens are usually from mentary. In some of the bore samples and in many of the rects from the Manter Niver District, this species is the only foreminister procent.

Amediana multicinetus described by Grespin and Parr (19/0) from beds in the Upper Marine Series in the Easter River District, is a common species in that Series in New South Wales. The only record of its occurrence in the Lower Marine Series is in the Kulmura Bore at depths below 4,667 feet. The species is found in both the Middle and Lower Bowen Series in the Springsure area, and in Western Australia in beds which are referable to both the Upper and Lower Barine Series of New South Wales.

A widely distributed form is Amnolacelited prolocuthi described by Grespin and Parr (1940) from beds in the Upper Harine Series in the Sunter River District. This species is most abundant in the Upper Harine Series, but it is recorded from two localities belonging to the Lower Marine Series. In Queensland, it is present in both the Middle and Lower Bowen Series, but in Sestern Australia, it is known only from the beds which can be correlated with the Upper Barine Series of Bow South Wales.

#### MAKES OF COURSE AMON.

Basing his conclusions partly on evidence derived from the maga-fossils and partly on conditions of sedimentation, feichert (1941) "proposed to correlate in a general way all mestern Australian Series up to and including the Possil Cliff, Callytharra and Mura Series with the Lower Marine Series of New South Wales.... the Irwin River "Upper Marine", the Upper Byro, Cundlego, Sandageo, Nooncanbah, and Upper Perruginous Series with the Upper Marino....". It is believed that this scheme of correlation finds general acceptance in Australia. The study of the micro-fossils from these deposits tends to support this correlation, which can be carried still further, to include queensland, Tassania and Northern Territory. (A Grafting error in Teichert's Correlation Table on p.399 may be noted. In this table it is not made clear that the Parley Stage is part of the Lower Marino Series).

Permian of Australia suggests the following correlations:

- 1. The assemblage dominated by Calcitornella stephonais
  - (a) The Lower Marine Series of New South Wales as developed in the Number River District.
  - (b) The Lower Bowen Series of Queensland as developed in the Springeure area.
  - (c) The Lower Marine Series of Tamania as represented by the Piper River limestone.
  - (8) Callytharra limestone, Foseil Cliff bods and Mura Kura limestone of Western Australia.
  - (a) The Port Rests Bore section, Northern Territory at 554-574 feet.
- 2. The assemblage consisting of Association balkicinetis. The smalled in corein deposits, Israelian sales and assembly a security of the consisting security and an assembly a security of the constant security and a security of the constant secu

- (a) The Upper Marine Series of New South Wales as Goveloped in the Hunter River District; Victoria Page Section, Mitchell Mighway.
- (b) The Middle Bowen Series of Queensland as developed in the Springsure area.
- (c) Cortain Coposits in the Caseoyno River area including the Wandagee Beds in Western Australia.

The above considerations, based on the forarinifera, suggest that beds equivalent in age to the Lower Marine Series
and Upper Marine Series of New South Vales, coour also in Queensland
and Vestern Australia, and that deposits referable to the Lower Marine
Series are present in Tasmania and in a bore in the Morthern Territory.
It is possible that when further research has been carried out on the
Permina rocks of Tasmania, formuniform characteristic of the Upper
Marine Series of New South Vales will be discovered.

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