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FOSSILIFEROUS LIMESTONES FROM THE CAPE
RANGE ANTICLINE, CARNARVON BASIN, WESTERN AUSTRALIA

by

Irene Crespin

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Two collections of limestones from the east and west flanks of the Cape Range Anticline have been submitted by West Australian Petroleum Pty.Ltd. for micropalaeontological examination. One collection, forwarded on October 10th 1955, consisted of thirteen specimens, and a second collection, forwarded on November 28th 1955, of fifteen specimens. Although sixteen specimens were listed as belonging to the second collection in the letter from the Company dated 15/12/55, only fifteen were received for examination.

The limestones are representative of the following formations in the Cape Range area - Vlaming Sandstone, Pilgrammunna Formation, Trealla Limestone, Tulki Limestone and Mandu Calcarenite. A summary of the results of the examination is as follows:

Formation	Collection A (10/10/55)	Collection B (28/11/55)
Vlaming Sandstone	CRH.8	
Pilgrammunna Formation	CRG.2, CRH.9,10,11,12,13	
Trealla Limestone (Basal)	CRH.1	CRH.17,18,19,20, CRH.116
Tulki Limestone	CRH.3,5,6,7 CRP.20	CRH.22,23,24,25,26, 27,28. CRM.3,4
Mandu Calcarenite (Upper)		CRH.21

The microfaunal content of the limestones in each collection is given below.

Collection A (10/10/55).

The following samples are included in this collection: CRH.1,3,5,6,7,8,9,10,11,12,13, CRG.2 and CRP.20. The samples are described under the different formational headings to which they are referred.

1. Vlaming Sandstone. The only sample referred to this formation is CRH.8, which was collected on the outcrop margin of the west flank of the Cape Range Anticline. The rock is a conglomerate in which the pebbles are cemented in a calcareous sandstone. One pebble consisted of a dense silicified rock containing a few minute indeterminate fossils. Such a rock has not been recognised previously in the area. Another pebble is a recrystallised limestone in which nearly all traces of organisms have disappeared. A third pebble is a calcareous sandstone with calcareous algae and fragments of Marginopora which are characteristic of rocks of the Pilgrammunna Formation. A few minute foraminifera, probably tests of "Rotalia" beccarii are present in the calcareous sandstone

matrix. The age of the rock is most probably Pleistocene.

2. Pilgrammunna Formation. The following samples are referred to this formation: CRC.2, CRH.9,10,11,12 and 13. They all come from the outcrop margin of the west flank of the Cape Range Anticline. The rock is a calcareous sandstone which contains fragments of calcareous algae and a few foraminifera, many of the tests being ironstained.

Foraminifera:

Amphistegina sp.
Elphidium sp.
Globigerina sp.
Rotorbinella cf. cycloclypeus (Howchin & Parr)
Indeterminate miliolids and small rotalines.

The Pilgrammunna Formation is regarded as the probable sandy equivalent of the Trealla Limestone the age of which is referable to "f₁-f₂" Stage.

3. Trealla Limestone. One specimen CRH.1, from the west flank of the anticline, is referred to the basal part of the Trealla Limestone. It is a crystalline limestone in which the structure of the majority of foraminiferal tests has almost completely disappeared. Marginopora vertebralis is moderately common and a few miliolids are also present. The lithology in hand specimen is not quite typical of the Trealla but the abundance of Marginopora indicates that the rock belongs to that formation.

4. Tulki Limestone. Five samples, CRH.3,5,6, and 7 and CRP.20 are referred to this formation and all are from the west flank of the anticline. Because of the interesting foraminiferal assemblages in each of these samples, they are discussed in detail.

CRH.3 is a crystalline limestone with numerous tests of Lepidocyclina, Katacycloclypeus and Miogypsina. The following species have been recognised;

Austrotrillina howchini (Schlumberger)
Austrotrillina cf. striata Todd and Post
Amphistegina sp.
Elphidium cf. hispidulum Cushman
Flosculinella bontangensis (Rutten)
Gypsina globulus Reuss
Gypsina howchini Chapman
Katacycloclypeus annulatus (Martin)
Lepidocyclina omphalus Tan
Lepidocyclina cf. stratifera Tan
Lepidocyclina (Nephrolepidina) inflata Provale
Lepidocyclina sp.
Miogypsina excentrica Tan
Miogypsina mamillata Hanzawa
Miogypsina cf. kotoi Tan
Operculina cf. victoriensis Chapman and Parr
Rotalia cf. tectoria Todd and Post
Rotorbinella cf. cycloclypeus (Howchin and Parr)

Limestones with the above assemblage of foraminifera have not previously been found in the Cape Range or Rough Range Structures. This assemblage is characterised by numerous tests of Lepidocyclina omphalus and Katacycloclypeus annulatus as well as three species of Miogypsina. Lepidocyclina omphalus belongs to the group of stratified Lepidocyclinae and was described by Tan Sin Hok from west Java. The association there is similar to that found in the limestone from Cape Range and Tan remarked that the association of Miogypsina, Katacycloclypeus and Lepidocyclina omphalus together with species of Trybliolepidina in Java was only known from beds later than those containing Eulepidina. Miogypsina mamillata was described by Hanzawa from "f₁" stage beds in Taiwan. It has not previously been found in the Cape Range limestones. It

is from "f₁" stage deposits on the island of Saipan.

Katacycloclypeus annulatus is characteristic of lower "f" stage deposits. It was previously recorded from Cape Range in a limestone 2 miles S.87°E. from the mouth of Mandu Mandu Creek. On the island of Lau, Fiji, it was found associated with one of the stratified Lepidocyclina, L. stratifera.

CRH.5 is a chalky limestone with poorly preserved foraminifera.

Foraminifera:

Amphistegina sp.
Austrotrillina howchini (Schlumberger)
Cycloclypeus indopacificus Tan
Lepidocyclina spp. (small and poorly preserved)
Operculina cf. victoriensis Chapman and Parr

The chalky lithology of this rock suggests that it should be referred to the upper part of the Mandu Calcarenite rather than the Tulki Limestone. The faunal assemblage does not help in solving this problem. However, it is included in the Tulki as its position on the locality map indicates that it comes from an area mapped as Tulki Limestone.

CRH.6 is a crystalline limestone with numerous tests of Miogypsina.

Foraminifera:

Katacycloclypeus annulatus (Martin)
Lepidocyclina sumatrensis Douville
Lepidocyclina sp.
Miogypsina excentrica Tan
Miogypsina mamillata Hanzawa
Miogypsina polymorpha Rutten
Operculina cf. victoriensis Chapman and Parr
Rotalia cf. tectoria Todd and Post

A feature of this limestone is the numerous tests of the genus Miogypsina, especially M. excentrica. This species has been found elsewhere in the Cape Range; excellently preserved specimens were present in a limestone of the Tulki Formation 3½ miles S.19°E from Yardie Creek Homestead.

CRH.7 is a crystalline limestone containing numerous fronds of calcareous algae including Halimeda, and numerous foraminifera.

Foraminifera:

Austrotrillina howchini (Schlumberger)
Austrotrillina striata Todd and Post
Amphistegina sp.
Cycloclypeus indopacificus Tan
Elphidium cf. hispidulum Cushman
Florescuella bontangensis (Rutten)
Gypsina howchini Chapman
Globigerina sp.
Lepidocyclina sumatrensis Douville
Lepidocyclina spp.
Orbulina universa d'Orb.
Rotorbinella cf. cycloclypeus (Howchin & Parr)
Rotalia cf. tectoria Todd and Post
Sorites cf. martini Verbeek
Miliolids indeterminate

Some good examples of Austrotrillina striata are present in this limestone. The species was described by Todd and Post from cuttings from one of the deep holes drilled on Bikini Atoll. They referred the age of the beds to "e" stage. It seems that the

form occurs in the Cape Range limestones at a slightly higher stratigraphical horizon for the Tulki Limestone is regarded as "f₁" stage in age. The presence of some tests of Orbulina universa supports a middle Tertiary age for this rock.

CRP.20 is a dense foraminiferal limestone with numerous fronds of calcareous algae including Halimeda, and foraminifera.

Foraminifera:

Acervulina inhaerens Schultz
Amphistegina sp.
Flosculinella sp.
Gypsina globulus Reuss
Lepidocyclina spp. (small)
Orbulina universa d'Orb.
Operculina cf. victoriensis Chapman and Parr

The foraminifera, though mostly poorly preserved, indicate that the general assemblage belongs to that found in rocks of the Tulki Limestone.

Collection B (28/11/55)

The following samples are included in this collection: CRH.17,18,19,20,21,22,23,24,25,26,27,28, CRH.116, CRM.3 and 4. Rocks representing the Trealla limestone, Tulki Limestone and the upper part of the Mandu Calcarenite are present in the collection.

1. Trealla Limestone. The following samples are referred to the basal part of this formation - CRH.17,18,19, 20, and CRH.116. All are crystalline limestones with the characteristic assemblage of calcareous algae and foraminifera. CRH.20 has rather a chalky matrix but the foraminifera are typically Trealla. The characteristic assemblage of foraminifera is as follows:

Austrotrillina howchini (Schlumberger)
Amphistegina sp.
Flosculinella bontangensis (Rutten)
Gypsina globulus Reuss
Lepidocyclina cf. sunatrensis Douville
Marginopora cf. vertebralis (Q. & G.)
Operculina sp.
Rotorbinella cf. cycloclypeus (Howchin & Parr)
Valvulina sp.
Miliolids

2. Tulki Limestone. CRH.22,23,24,25,26,27,28 and CRM.3 and 4 are included in the Tulki Limestone. The rocks consist of crystalline limestones in which many of the fronds of calcareous algae and tests of foraminifera are either outlined or infilled with iron. CRH.26 and 27 contain a rich fauna of Lepidocyclina and Cycloclypeus. CRM.3 and 4 are pink crystalline limestones in which tests of the larger foraminifera are rare, the matrix consisting almost entirely of minute fragments of foraminiferal tests.

The general assemblage of species in these limestones is as follows:

Amphistegina sp.
Austrotrillina howchini (Schlumberger)
Cycloclypeus indopacificus (forms A and B.) /Tan
Rhipidium cf. hispidulum Cushman
Gypsina globulus Reuss
Gypsina howchini Chapman
Lepidocyclina (Nephrolepidina) angulosa (Provale)
Lepidocyclina (Nephrolepidina) borneensis (Provale)
Lepidocyclina (Nephrolepidina) verbeeki (B. & H.)
Lepidocyclina (Trybliolepidina) cf. pilifera Scheffer
Lepidocyclina cf. stratifera Tan
Lepidocyclina (Nephrolepidina) ferrerei (Provale)

Miogypsina polymorpha Rutten

Miogypsina sp.

Operculina victoriensis Chapman & Parr

Rotorbinella cf. cycloclypeus (Howchin & Parr)

3. Mandu Calcarenite. It is extremely difficult to place CRH.21 which is on the west flank of the Cape Range Structure, in its correct formation. The rock in hand specimen has affinities with the Tulki Limestone, but when thin sectioned the groundmass is chalky. Brown glauconite replaces many of the foraminiferal tests. Foraminifera are abundant, with tests of Lepidocyclina, Cycloclypeus and Miogypsina being amongst the commonest. These forms were very common in the outcrops of the upper part of the Mandu Calcarenite exposed in Mandu Mandu Creek about $4\frac{1}{2}$ miles to the south-west. There seems little doubt that the upper part of the Mandu Calcarenite is equivalent in age to the lower part of the Tulki Limestone. Although the Lepidocyclinae are so common in this sample it has been difficult to determine some of them specifically. Thin sections of the rock have been cut in all possible directions in the attempt to secure horizontal sections of the tests. A list of species determined is as follows:

Amphistegina sp.

Cycloclypeus indopacificus Tan

Gypsina globulus Reuss

Lepidocyclina (Nephrolepidina) ferreroi (Provale)

Lepidocyclina (Trybliolepidina) umbilicata Scheffen

Lepidocyclina sp. (stratified form)

Lepidocyclina stratifera Tan

Miogypsina polymorpha Rutten

Miogypsina thecidaeformis Tutten

Operculina victoriensis Chapman and Parr.