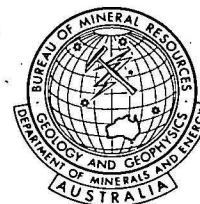


copy 3

BMR PUBLICATIONS COMPACTUS
(LENDING SECTION)

Cancelled
Restriction until after publication.
Manuscript submitted for publication
to: J. PAL, 200, INDIA



DEPARTMENT OF MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD 1975/120

019718*

A PERMIAN COLD WATER MARINE FAUNA IN THE GRANT FORMATION OF THE CANNING BASIN, WESTERN AUSTRALIA

by



J.M. Dickins*, R.R. Towner* and R.W.A. Crowe⁺

* Bureau of Mineral Resources, Geology & Geophysics,
Canberra, Australia. ⁺ Geological Survey of Western
Australia, Perth, Australia. Published by
permission of the Director of the Bureau and the
Director of the Survey.

The information contained in this report has been obtained by the Department of Minerals and Energy as part of the policy of the Australian Government to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus or statement without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

BMR
Record
1975/120
c.3

RECORD 1975/120

A PERMIAN COLD WATER MARINE FAUNA IN THE GRANT FORMATION
OF THE CANNING BASIN, WESTERN AUSTRALIA

by

J.M. Dickins*, R.R. Towner* and R.W.A. Crowe⁺

* Bureau of Mineral Resources, Geology & Geophysics,
Canberra, Australia. ⁺ Geological Survey of Western
Australia, Perth, Australia. Published by
permission of the Director of the Bureau and the
Director of the Survey.

ABSTRACT

A Permian marine fauna is recorded from a member in the top part of the Grant Formation of the Canning Basin, Western Australia. The member contains varves and tillitic beds with faceted and striated clasts. Eleven species of pelecypods, gastropods, brachiopods, bryozoans, and crinoids are identified. The sediments and Deltopecten lyonsensis and Calceolispongidae sp. nov. indicate cold water and the two species indicate correlation with the upper part of the Lyons Group of the Carnarvon Basin, Western Australia. The age is late Sakmarian.

INTRODUCTION

Although glacially derived material has been known in the Grant Formation for a considerable time (Blatchford, 1927, p.20), a study of its surface stratigraphical relations has only recently begun as part of the Canning Basin Project, undertaken jointly by Geological Survey of Western Australia and the Bureau of Mineral Resources, Geology & Geophysics. During the work on the NOONKANBAH 1:250 000 Sheet area in the 1974 field season the Grant Formation was examined in detail and the marine fossils were discovered by R.R. Towner and G.E. Wilford of the Bureau of Mineral Resources in the glacial Wye Worry Member (Crowe & Towner, 1976) of the Grant Formation (Locality No. N1206, Lat $18^{\circ}39'36''S$; Long $124^{\circ}58'36''E$; 10.3 km at 063° from Mount Tuckfield). Although marine fossils have been recorded from the Grant Formation (see Veevers & Wells, 1961, p.71) this discovery represents the first well authenticated occurrence where the stratigraphical level is known with some degree of assurance.

GEOLOGY

The Grant Formation (originally defined by Guppy, Lindner, Rattigan & Casey, 1952) contains glaciogene rocks. It consists of sandstone, conglomerate, siltstone, shale, tillite, and minor varved shale. From subsurface information, three subdivisions of the formation have been made: a basal sandstone unit, a middle shale unit, and an upper sandstone unit (Young & O'Shaughnessy, 1973). Only the upper sandstone unit is exposed on NOONKANBAH 1:250 000 Sheet area, and as a result of field mapping during 1974, two further subdivisions were made within the upper sandstone unit (Crowe & Towner, 1976).

The subdivision includes:

Millajiddee Member: uppermost sandstone unit in the Grant Formation.

Wye Worry Member: siltstone-shale-sandstone sequence containing
tillite.

The sandstone below the Wye Worry Member which makes up the major part of the upper sandstone unit has been mapped as 'Grant Formation undivided'.

Grant Formation undivided

On the surface, the undivided Grant Formation is composed of medium to coarse-grained quartz wacke, feldspathic wacke, and minor quartz arenite. It conformably overlies the middle shale unit and is conformable or disconformable below the Wye Worry Member.

Wye Worry Member

The Wye Worry Member consists mainly of sandy siltstone, shale with calcareous concretions, and striated and faceted glacial dropstones. Excellent examples are figured by Blatchford (1927, figs. 17, 18). Varves of graded silt and clay are present near the base of the member. The member contains lenses of tillitic conglomerate and it is sandy towards the top. Marine macrofossils were found in the middle part of the member in the western St George Range. The member ranges in thickness from 25 m in central St George Range to at least 95 m in eastern St George Range. The member probably overlies the undivided Grant Formation disconformably. It is overlain in most places by the Millajiddee Member but in the southwestern St George Range and at Mt Thorlan it is unconformably overlain by the Nura Nura Member of the Poole Sandstone.

Millajiddee Member

The Millajiddee Member is composed mainly of sandstone and minor siltstone and conglomerate. Most of the member is fine-grained with a medium to coarse-grained part present in the middle of the member. The bedding is poorly defined. Large and small-scale cross-bedding is common and the upper part of the unit is slumped in many areas. The member varies in thickness but may be up to 100 m thick. The contact with the underlying Wye Worry Member is gradational while its contact with the Nura Nura Member is an angular

unconformity although the angular relation is not always apparent.

The Grant Formation is overlain by the Poole Sandstone. At its base is found the Nura Nura Member with a relatively diverse fauna of marine invertebrates (Thomas & Dickens, 1954; Thomas, 1958; Dickens, 1963). The Nura Nura Member overlies the Grant Formation with erosional discordance and in places rests directly on the Wye Worry Member, the Millajiddee Member of the Grant Formation being absent from the sequence.

PALAEONTOLOGY

Identifications

Pelecypods

Eurydesma? sp. ind.

Deltopecten lyonsensis Dickens 1957

Etheripecten cf. tenuicollis (Dana) 1847

Streblopteria sp.

Gastropods

Keeneia? sp. ind.

Brachiopods

Unidentifiable dielasmatis and spiriferids

Bryozoans

Fenestella sp.

Crinoids

Calceolispongidae sp. nov.

Remarks

Deltopecten lyonsensis is represented by numerous pieces of shell which unfortunately do not allow an altogether satisfactory reconstruction of the shape. The ribbing, however, allows little doubt on the presence of D. lyonsensis.

Fenestella sp. is well represented in the collection. The specimens resemble F. affluensa Bretnall 1926 (see Crockford, 1944) but the fenestrules are not as high as in this species.

Calceolispongidae sp. nov. is represented by a single second brachial plate and possibly stem ossicles. The second brachial can be matched with plates from T27 from the upper part of the Lyons Group of the Carnarvon Basin (see Dickins & Thomas, 1959, pp. 72, 78).

Correlation and age

The species most important for indicating the age of this fauna are Deltopecten lyonsensis which ranges through the Lyons Group of the Carnarvon Basin and Calceolispongidae sp. nov. which is found in the top part of the Group. The age can, therefore, be regarded as Sakmarian (Lower Permian) on the basis of relation to the Lyons Group. As Calceolispongidae sp. nov. is recorded only from the top part of the Group, possibly the fauna is late Sakmarian (Sakmarian is used here in its original broad sense for that part of the Permian sequence which has sometimes later been referred to as Asselian and Sakmarian stages).

The Sakmarian age of the Lyons Group and its correlatives has been discussed by Dickins & Thomas (1959). Evidence tending to confirm this age has been considered by Glenister & Furnish (1961), Dickins (1963), Armstrong, Dear & Runnegar (1967), and Glenister, Windle & Furnish (1973).

Environment

Heavy-shelled pelecypods such as Eurydesma and Deltopecten are regarded as having lived in relatively shallow water, and frequently they are associated with coarse sediments (Dickins, 1957). At this locality, however, the Deltopecten shells are found with fenestillids, whose delicate structure would indicate growth out of reach of turbulence. Some mixture after death is then suggested by this assemblage. The fauna was apparently incorporated and buried in sediment below effective wave base or in shallow water protected from waves.

The occurrence of Eurydesma in cold water has been discussed elsewhere (Dickins, 1957, 1961) and the present fauna confirms the association of the 'Eurydesma fauna' with cold water deposits. The cold water character of the fauna is particularly indicated by Deltopecten lyonsensis and Calceolispongidae sp. nov. Species of Eurydesma and Keeneia would also indicate cold water if their presence is confirmed.

REFERENCES

- ARMSTRONG, J.D., DEAR, J.F., and RUNNEGAR, B., 1967 - Permian ammonoids from eastern Australia. J. geol. Soc. Aust., 14(1), 87-97.
- BLATCHFORD, T., 1927 - The geology of portion of the Kimberley Division with special reference to the Fitzroy Basin and the possibility of the occurrence of mineral oil. Bull. geol. Surv. W. Aust., 93.
- CROCKFORD, Joan, M., 1944 - A revision of some previously described species of Bryozoa from the Upper Palaeozoic of Western Australia. Proc. Roy. Soc. W. Aust., 28(9), 187-189.
- CROME, R.W.A., and TOWNER, R.R., 1976 - New stratigraphic nomenclature, Noonkanbah 1:250 000 Sheet. West. Australia. Geol. Surv. Ann. Rep. 1975.
- DICKINS, J.M., 1957 - Lower Permian pelecypods and gastropods from the Carnarvon Basin, Western Australia. Bur. Miner. Resour. Aust. Bull. 41.
- DICKINS, J.M., 1961 - Eurydesma and Peruvispira from the Dwyka Beds of South Africa. Palaeontology, 4(1), 138-148.
- DICKINS, J.M., 1963 - Permian pelecypods and gastropods from Western Australia. Bur. Miner. Resour. Aust. Bull. 63.
- DICKINS, J.M., and THOMAS, G.A., 1959 - The marine fauna of the Lyons Group and the Carrandibby Shale of the Carnarvon Basin, Western Australia. Bur. Miner. Resour. Aust. Rep. 38, 65-96.

GLENISTER, B.F., and FURNISH, W.M., 1961 - The Permian ammonoids of Australia.
J. Paleont., 35(4), 673-736.

GLENISTER, B.F., WINDLE, D.L., Jr., and FURNISH, W.M., 1973 - Australasian
Metalegoceratidae (Lower Permian ammonoids). J. Paleont., 47(6),
1031-1043.

GUPPY, D.J., LINDNER, A.W., RATTIGAN, J.H., and CASEY, J.N., 1952 - The
stratigraphy of the Mesozoic and Permian. Sediments of the Desert
Basin, Western Australia. 19ieme Cong. geol. int., Alger. Symp. on
Gondwanaland, 107-114.

THOMAS, G.A., 1958 - The Permian Orthotetacea of Western Australia.
Bur. Miner. 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.

VEEVERS, J.J., and WELLS, A.T., 1961 - The geology of the Canning Basin,
Western Australia. Bur. Miner. Resour. Aust. Bull. 60.

YOUNG, R.J.B., and O'SHAUGHNESSY, F.R., 1973 - Mount Hardmann No. 1, Well
Completion Report, Canning Basin, West Australian Petroleum. Bur.
Miner. Resour. Aust. Petrol. Search Subsidy Acts Rep. (unpubl.).