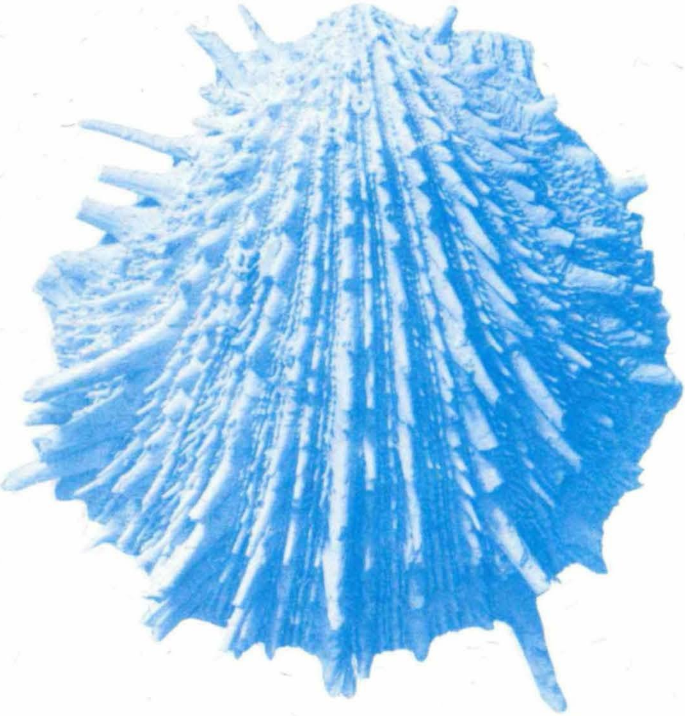
A GUIDE TO THE FOSSILS OF THE ROE PLAINS



by

G. W. Kendrick, K. J. McNamara & K. Brimmell

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A Guide to the Fossils of the Albany Region - *K. J. McNamara*

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Cover drawing of the bivalve *Spondylus spondyloides*

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1997

Dept of Earth & Planetary Sciences, W. A. Museum, Perth

INTRODUCTION

This is the fourth in a series of guides to the fossils of Western Australia. These guides provide illustrations and simple descriptions of some of the more commonly found fossils in Western Australia. Full descriptions are to be found in scientific journals that are often not readily accessible to the general public. Some of the most important references are provided on page 12.

A few points should be considered before you go fossil collecting. Firstly, once you have decided on the place from where you want to collect fossils, find out the name and address of the landowner of the property. Always get the landowner's permission before collecting fossils. Remember to leave the site as you found it (apart from the few fossils which you might remove). At many localities fossils like petrified wood weather out of the rocks naturally. All you have to do is pick them up. At other sites the fossils will be embedded within hard rock. To extract these a good hammer and some cold chisels are essential. Take care when hammering rocks that pieces of rock don't go into your eyes or those of bystanders. Protective goggles should be used when attacking hard rocks. Fossickers should also remember that the collection of fossils within national parks and reserves is illegal and that a special license is required for the export of fossils.

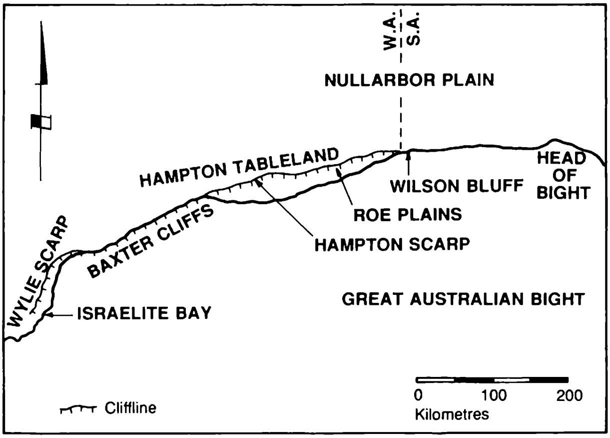
Good fossil collecting consists of the three '**R**'s': 1, **R**estraint; 2, w**R**apping; 3, **R**ecording. Collect judiciously and avoid unnecessary destruction in the process of collecting. Avoid trying to collect the 'uncollectable'. Don't collect everything you see. Leave a few for other people! Once collected, your fossils need to be carefully wrapped. After all, they have lain undisturbed for many millions of years and may be a little fragile. Plant fossils often show fine imprints of vein patterns or even comprise a thin film of carbon representing the original compressed leaf matter. As such they are often more delicate and more easily damaged than animal fossils which commonly consist of more robust shell or bone material. Tissues, newspapers, or old telephone books are all useful wrapping material. It is imperative that you record details of the locality from which each specimen was collected, along with the date and name of the collector, on a piece of paper. Wrap this with the specimen. Remember, a fossil without details of its origin has little or no scientific value. Place the wrapped specimens in boxes or bags. Linen are best but sturdy plastic bags will do. However, if damp specimens are collected do not leave them too long in plastic bags or mould will grow. In addition to recording information on labels, record the same information in a notebook or diary. Record the level in the rock face from which you have collected. Annotated field sketches or photographs are useful for this purpose. If you find a fossil that is not illustrated in this guide bring it in to the Western Australian Museum where Museum staff will help you to identify it.

AN ANCIENT SEA CLIFF

For those who are travelling along the Eyre Highway, across the vast distances of the Nullarbor Plain, the change of scenery at Madura and Eucla is a welcome relief. Here the road descends from the elevated Hampton Tableland to the lowlands of the Roe Plains. The line of cliffs along the northern side of the Madura-Eucla section of the Highway provides a scenic contrast with the otherwise rather featureless landscapes of the Tableland country.

Approaching Eucla from the west, the inland cliff of the Hampton Scarp, which has paralleled the road since Madura, merges with the high sea cliff at Wilson Bluff, a few kilometres to the east. This cliff actually continues into South Australia as far as the Head of the Bight, a further 200 km to the east. A perusal of maps of the country westward from Madura shows the same inland cliffline of the Hampton Scarp leading into the Baxter Cliffs from Twilight Cove to near Point Culver. The same cliffline, this time inland, continues further westward to beyond Israelite Bay, where it is known as the Wylie Scarp. Viewed overall, this cliffline, or scarp, extends more or less continuously either along the modern coast or inland for about 800 km, around the western part of the Great Australian Bight (Figure 1). Being formed of limestone, it constitutes the largest and most spectacular karst-erosional feature of its kind in Australia.

The nature and origin of this great cliffline was recognized as early as 1879 by Professor Ralph Tate of Adelaide. He concluded (Tate 1879) that it was an emergent sea cliff formed by coastal erosion, a view confirmed by later geological studies (Ludbrook 1958; Lowry 1970). Because the cliffline must be younger than the limestone into which it has been cut, the age of the cliff can be deduced by considering the ages of the limestones. Studies of the fossils that occur within them has established a clear picture of their age.

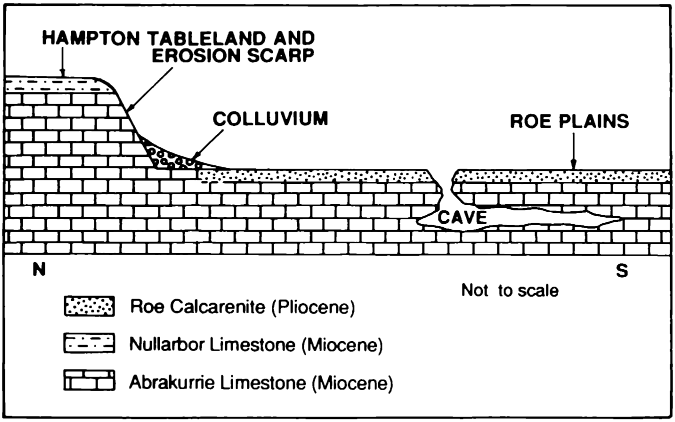


ROCKS OF THE SOUTHERN NULLARBOR

The oldest (and lowest) rocks exposed along the great Hampton–Baxter–Wylie cliffline are pale, chalky limestones of Middle to Late Eocene age (about 40 million years old) known as the Wilson Bluff Limestone.The deposition of these marine sediments represents the first major incursion of the sea between Australia and Antarctica, heralding the final breakup of Gondwana, and the beginning of Australia's northward flight. The most common fossils within the limestione are bryozoans and echinoids (sea urchins). Very similar fossils occur in limestones of comparable age from near Albany in the west to Adelaide in the east. Large silica nodules are preserved in this formation. They were mined by the Aboriginal Mirning people of the region and used for making sharp-edged stone tools.

The Wilson Bluff Limestone is overlain by the cream-coloured, fossil-rich Abrakurrie Limestone of Early Miocene age (about 20 million years old) . Fossils echinoderms, in particular sea urchins and fragmented starfishes, are common as fossils. They are useful in dating, because similar fossils occur in Early Miocene rocks in the Murray Basin in South Australia.It is within this formation that most of the caves of the region have their principal development.

Overlying theAbrakurrie Limestone is a thin, hard, greyish-brown deposit of Middle Miocene age (about 15 million years old) known as the Nullarbor Limestone. The shells of the fossils preserved in this limestone have dissolved away, leaving just moulds and casts. This, with various calcrete deposits (products of weathering), forms most of the surface rock of the Nullarbor Plain, though in southern areas this has been eroded away to expose the Abrakurrie Limestone at the surface.



Each of these three marine limestones (Wilson Bluff, Abrakurrie and Nullarbor) has a distinctive colour, texture and fossils and is readily recognisable. Full descriptions and distributions of these rocks are given by Lowry (1970). In view of the ages of these limestones it can be deduced that the age of the great cliff line around the western Australian Bight should be younger than the youngest limestone exposed by it, that is younger than the 15 million-year-old Nullarbor Limestone.

Further evidence for the age of the great cliff line has been found by studying the deposits on the Roe Plains at the foot of the Hampton Scarp between Eucla and Twilight Cove. Only two caves, Madura and Nurina Caves, are at present known on the Roe Plains. Visitors to these will have noticed the layer of pinkish-brown, shell-rich sandy limestone at the surface around the entrances of these caves. This formation, known as the Roe Calcarenite, is confined to the Roe Plains and, though present over an extensive area, is usually no more than a few metres thick. It rests on a flat erosion surface of hard, cream-coloured Abrakurrie Limestone, in which both Madura and Nurina Caves have their principal development. The Roe Calcarenite represents a more recent incursion of the sea onto the land.

A depiction of the probable field relationships of the limestones of the Hampton Scarp and Roe Plains and their karst features is shown on page 4. From this it can be seen that the sea in which the Roe Calcarenite was deposited was probably that which formed, at the same time, the inland cliff of the Hampton Scarp. This then delineated the shoreline along this particular part of the coast. If we can establish the geological age of the Roe Calcarenite then a likely age for the Hampton Scarp can be obtained, and possibly for other parts of the great cliff line around the Western Bight.

The Roe Calcarenite lies at or near the surface of the entire Roe Plains over some 300 km in an east-west direction and up to 40 km wide. Once, the only open sections through the deposit were the natural ones at Madura and Nurina Caves but excavations for road fill and other construction work have opened up more and informative sections. One of these is the large Main Roads quarry 16 km south of Madura, from which the entire thickness of the Roe Calcarenite has been removed and used for road foundations on the Eyre Highway as far away as Cocklebiddy. This material is extremely rich in well-preserved fossils which show clearly that at one time, the Roe Plains lay beneath the seas of the continental shelf. From the study of these fossils the age of the formationtion and also the probable age of the Hampton Scarp can be established. Comparison of the fossils with the same or closely related species in the region can help build up a picture of changing ocean currents and global temperatures over the last few million years.

FOSSILS OF THE ROE CALCARENITE

Mollusc shells are the most common fossils in the Roe Calcarenite. Many other groups of marine invertebrates, such as foraminifers, bryozoans, corals, brachiopods, annelids, arthropods and echinoderms are also present, as well as occasional fish remains and calcareous algae. A very common fossil is the large discoidal foraminifer *Marginopora*, of warm temperate-tropical affinity. Today species of *Marginopora* live in shallow waters attached to seagrasses such as the strap-weed *Posidonia*.

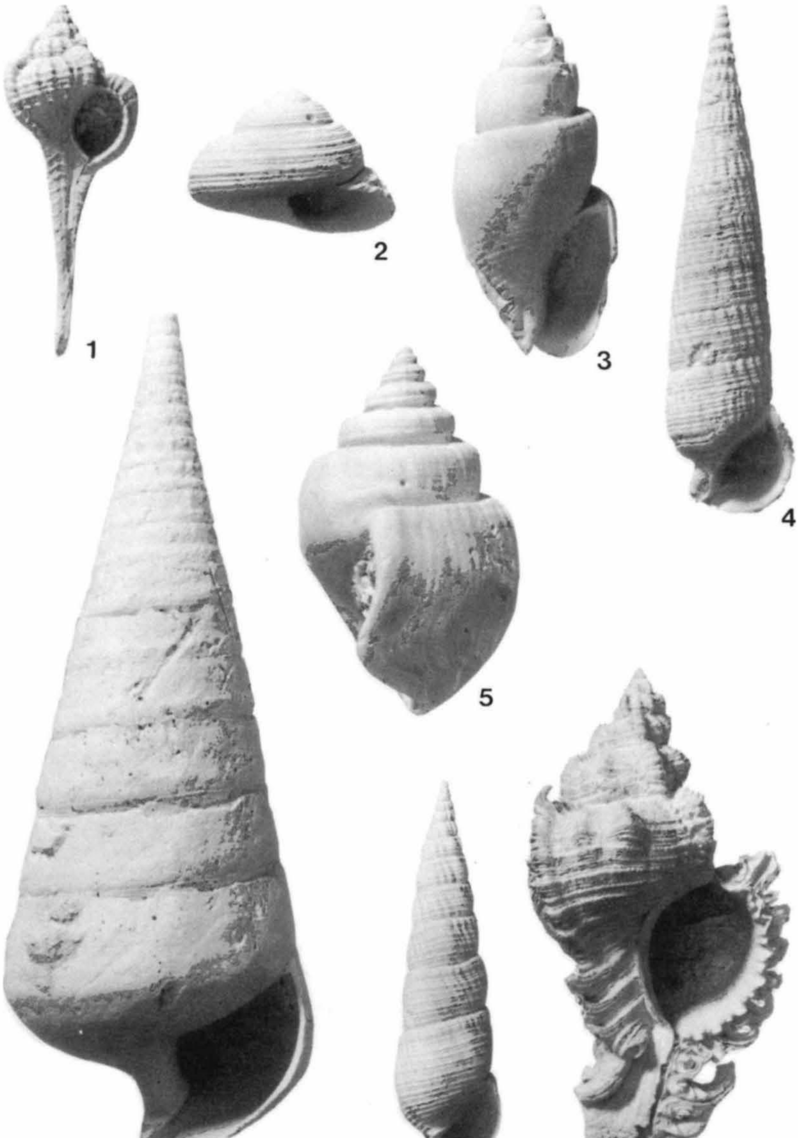
Also common in the Roe Calcarenite is the bryozoan *Densipora*, which lives exclusively around the wiry stems of the seagrass *Amphibolis*. Another common group of fossils is a diverse assemblage of herbivorous gastropods, all of which prefer shallow, well-lit, inshore waters where plant foods grow thickly. From these and other fossils, it is clear that the Roe Calcarenite was laid down on the shallow, inshore continental shelf, in well-circulated waters of normal marine salinity. Sea temperatures would have been a little warmer than at present and with a sandy substrate on which flourished a rich growth of seagrasses and other vegetation.

A pioneering study of the molluscs fossils from the Roe Calcarenite by the late Dr N.H. Ludbrook of Adelaide recognised a total of 265 species and subspecies, of which 31 were then new to science (Ludbrook 1978). The fauna was found to comprise both living and extinct species, of which the former were estimated at 65 to 70% of the total.

From this traditional, analytical method of assessing the geological age of Cenozoic fossil faunas, established by the great 19th Century English geologist Charles Lyell, a mentor of Charles Darwin, it was concluded that the Roe Calcarenite was of Early Pleistocene age, that is, up to about 1.6 million years old.

In more recent years, extensive collecting of the fossils of the Roe Calcarenite has been carried out during several expeditions by palaeontologists from the Western Australian Museum. These new collections have greatly enlarged the known fauna and led to a re-consideration of its geological age. The age is now thought to be older than hitherto suspected, lying somewere within the Pliocene Epoch, that is from between 1.6 and 5 million years old. As the new fossils are studied, the age of the Roe Calcarenite is likely to be more accurately refined.

A selection of some of the common and distinctive fossil species from the Roe Calcarenite is shown in Figures 1 to 33. A list of the names of these fossils is given on page 11.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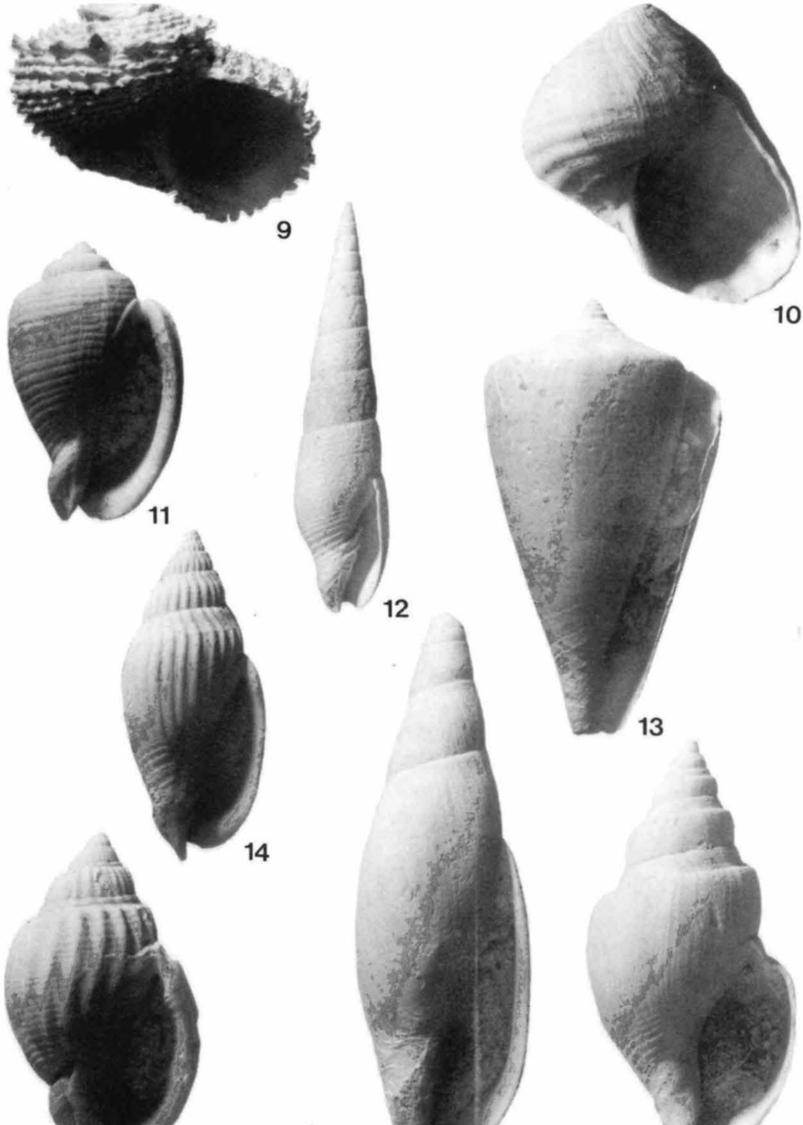
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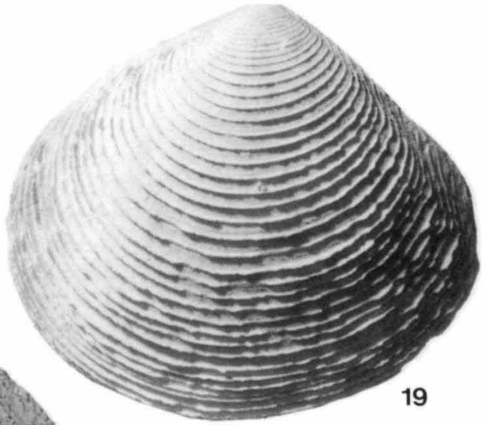
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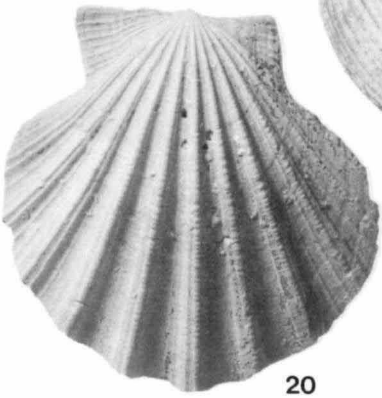
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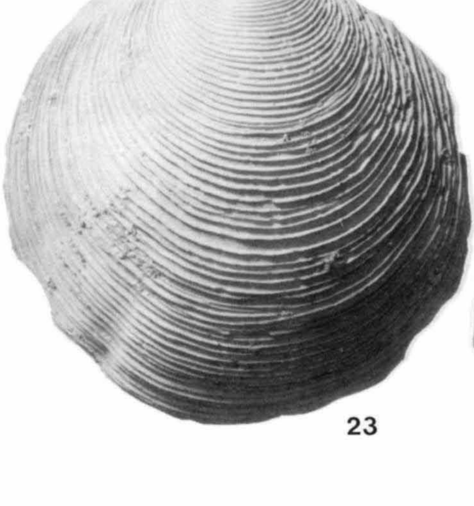
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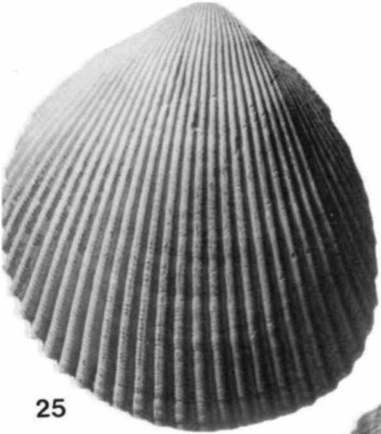
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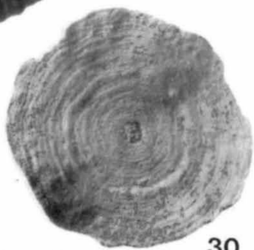
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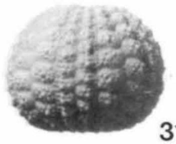
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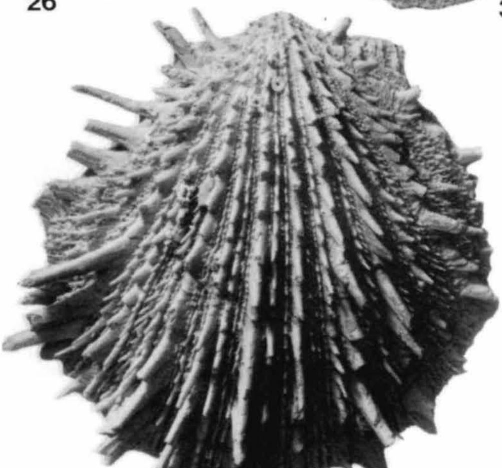
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SELECTED ROE CALCARENITE FOSSILS

Gastropods

1 *Murex (Haustellum) darraghi* Ludbrook, x1
2 *Monilea euclensis* Ludbrook, x1
3 *Zemira (Eburnopsis) intermedia* Ludbrook, x1
4 *Thericium (Chavanicerithium) westraliense* Ludbrook, x1
5 *Tylospira pagodiformis* Ludbrook, x1
6 *Campanile symbolicum* Iredale, x0.6
7 *Diastoma melanioides* Reeve, x1
8 *Chicoreus lundeliusae* Ludbrook, x0.75
9 *Angaia tyria* (Reeve), x1
10 *Hartungia dennanti chavani* Ludbrook, x1
11 *Austroharpa spiralistriata* Ludbrook, x1
12 *Mira (Eumitra) coxi* (Ludbrook), x1
13 *Conus petasus* Ludbrook, x1
14 *Lyria gracilicostata* Ludbrook, x1
15 *Semicassis adcocki* (Sowerby), x1
16 *Ericusa subtilis* (Ludbrook), x1
17 *Liratomina adelaidensis* (Powell), x1

Bivalves

18 *Placamen placidum* (Philippi), x1
19 *Tellina (Pseudarcopagia) basedowi* Tate, x0.75
20 *Equichlamys bifrons* (Lamarck), x1
21 *Tucetona lowryi* Ludbrook, x1
22 *Nuculana (Scaeoleda)* sp., x1
23 *Miltha hamptonensis* Ludbrook, x0.75
24 *Tawera gallinula* Ludbrook, x1
25 *Acrosterigma cygnorum* (Deshayes), x1
26 *Neotrigonia uniphora* (Gray), x1
27 *Spondylus spondyloides* (Tate), x0.75

Bryozoan

28 *Densipora* sp., x1

Brachiopod

29 *Neothyris* sp., x1

Foraminifer

30 *Marginopora* sp., x1

Echinoids

31 *Microcyphus annulatus* Mortensen, 1.5
32 *Amblyneustes* sp., x1
33 *Peronella ova* McNamara, x1

FURTHER READING

Foster, R.J. and Philip, G.M. 1980. Some Australian Late Cainozoic echinoids. *Proceedings of the Royal Society of Victoria* **91**: 155-160.

Kendrick, G.W., Wyrwoll, K.-H. and Szabo, B.J. 1991. Pliocene-Pleistocene coastal events and history along the western margin of Australia.

Lowry, D.C. 1970. Geology of the western part of the Eucla Basin. *Western Australian Geological Survey Bulletin* **122**.

Ludbrook, N.H. 1958. The stratigraphic sequence in the western portion of the Eucla Basin. *Journal of the Royal Society of Western Australia* **41**:108-114.

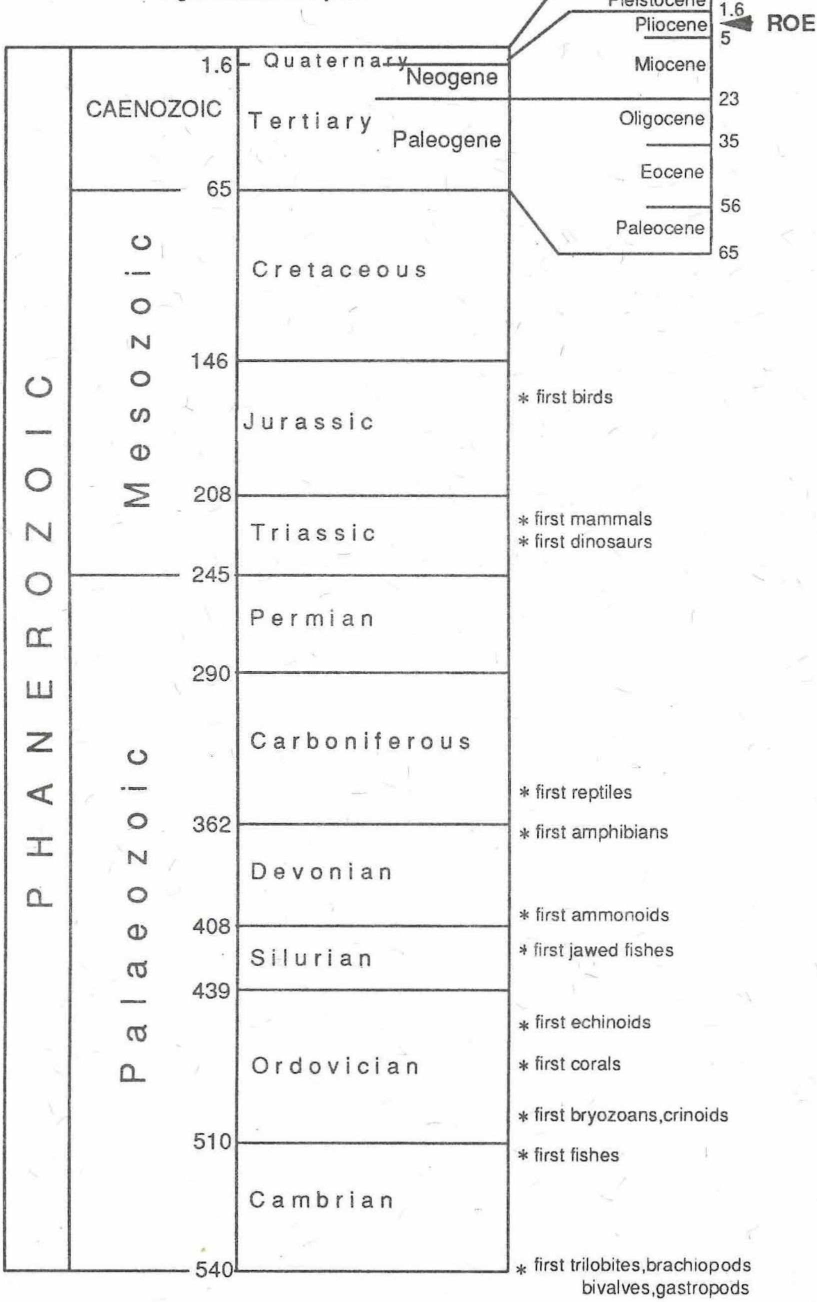
Ludbrook, N.H. 1978. Quaternary molluscs of the western part of the Eucla Basin. *Western Australian Geological Survey Bulletin* **125**.

McNamara, K.J. 1996. Plio-Peistocene *Peronella* (Echinoidea: Clypeasteroida) from Western Australia. *Records of the Western Australian Museum* **18**: 193-202.

Tate, R. 1879. The natural history of the country around the head of the Great Australian Bight. *Transactions of the Royal Society of South Australia* **2**:94-128.

GEOLOGICAL TIME SCALE

Ages in millions of years



About the Authors

George Kendrick is a Research Associate in the Department of Earth & Planetary Sciences at the Western Australian Museum. His main research interests lie in Tertiary and Cretaceous molluscs, with particular emphasis on Western Australia.
Ken McNamara is Senior Curator of Invertebrate Palaeontology in the Department of Earth & Planetary Sciences at the Western Australian Museum. His main research interests lie in Tertiary echinoids, trilobites and evolutionary theory.
Kris Brimmell, who prepared the illustrations, is Technical Officer in the Department of Earth & Planetary Sciences at the Western Australian Museum.

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