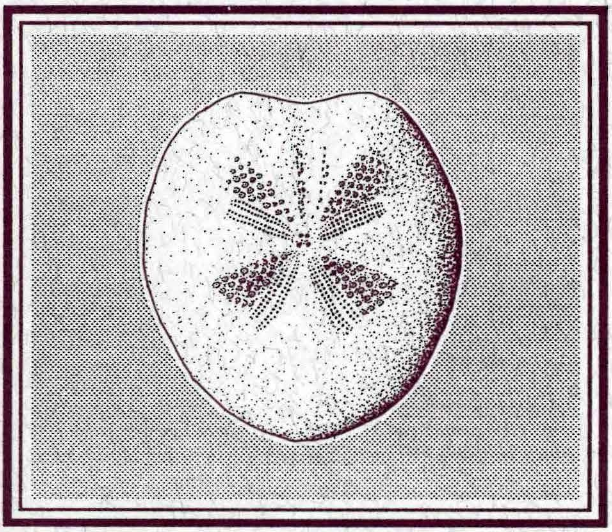
A GUIDE TO THE FOSSILS OF THE ALBANY REGION



by

K. J. McNamara

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Cover drawing of the echinoid *Gillechinus cudmorei*

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INTRODUCTION

This is the third in a series of guides to the fossils of Western Australia. The aim of these guides is to provide illustrations and simple descriptions of some of the more commonly found fossils in Western Australia. Whereas full descriptions are to be found in scientific journals that are generally not readily accessible to the general public for the other two guides, few of the fossils of the Pallinup Siltstone or the Nanarup Limestone have ever been formally described. Consequently, this guide will present a general overview of the main types of fossils that are most commonly found.

A few points should be considered before you go fossil collecting. Firstly, once you have decided on the place from where you are going to collect fossils, find out the name and address of the landowner of the property. Always get the landowner's permission before collecting fossils. And remember to leave the site as you found it (apart from the few fossils which you might remove). At many localities fossils weather out naturally from the rocks. 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. Protective goggles can be a help when attacking hard rocks.

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. 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 provenance has little or no scientific value. Place the wrapped specimens in bags. Linen are the best, but 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 into the Western Australian Museum where Museum staff will help you to identify it.

PALLINUP SILTSTONE AND NANARUP LIMESTONE

Forty million years ago the Albany region of Western Australia looked very different from what it does today. Much of the current low-lying areas were submerged beneath the sea, and only hills, such as Mt Melville, the Porongorups and Stirling Range poked up above the water as islands. Evidence of the life that inhabited this warm sea can be seen from the fossilised remains of marine animals found in rocks that formed from sediments laid down in this sea.

Around Albany, and extending east to the Fitzgerald River region, fossils, including sponges, clams, sea urchins and leaves of plants, can be found in the pale coloured and lightweight **Pallinup Siltstone**. This rock is known as a spongolite and is formed largely of tiny spicules derived from the breakdown of the millions of sponges that must have carpeted the seafloor. The Pallinup Siltstone reaches up to 60 m thick in the Albany region and would have been deposited in relatively deep, quiet marine conditions. The Pallinup Siltstone overlies the Werrilup Formation, which in the Nornalup and Denmark areas is represented by sandstones, clay, and lignite. Immediately east of Albany, between Nanarup and Manypeaks the Werrilup Formation is represented by a richly fossiliferous limestone called the Nanarup Limestone.

The **Nanarup Limestone** represents deposition of thin beds of limestone, never more than 12 m thick, in very shallow water, where the ancient Precambrian granites and gneisses that make up much of the high ground around Albany rose up close to the surface of the sea as shoals. Here the warm water gently washed backwards and forwards over sediment teeming with life: clams, sea urchins, starfish, sea lilies, brachiopods, corals and crabs. The broken remains of the hard parts of these animals built up as the coarse-grained Nanarup Limestone, and within and upon this sand complex animal and plant communities lived.

When the Pallinup Siltstone and Nanarup Limestone were being deposited 40 million years ago, Australia was much farther south than it is today and nestled up against Antarctica, the two great land masses being separated by a narrow, shallow sea (see p. 12). Studying the fossils from the Pallinup Siltstone and Nanarup Limestone provides us not only with an insight into ancient Australian marine life, but also reveals information about the rich marine life that inhabited the seas around Antarctica.The fossils show that although situated in sub-Antarctic waters, the Albany region, and much of Antarctica itself, was much warmer than today.

These fossils allow us to glimpse through a window into the distant past. Studies on the fossils are allowing interpretations of past oceanic currents and land positions to be made. Future work on the fauna will tell us more about the climate of this part of Australia long ago, and help us to put into perspective the nature of changing global climates.

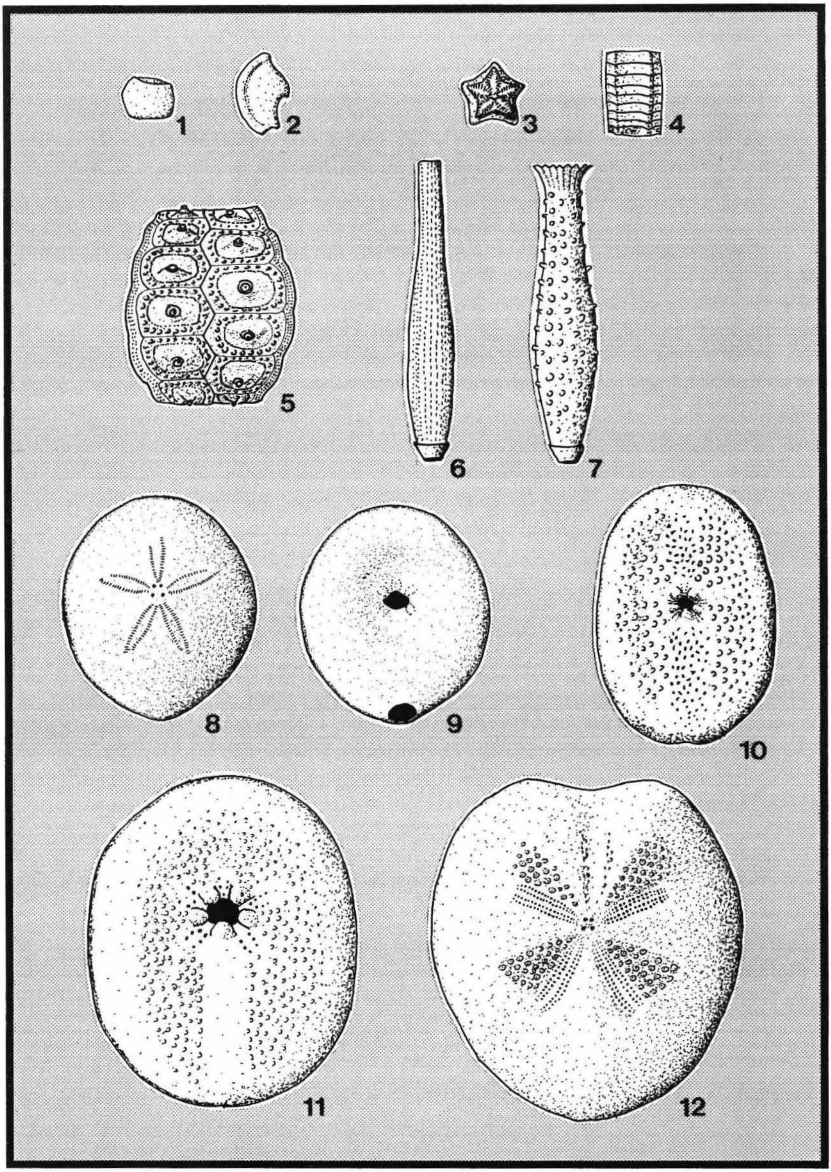
SEA URCHINS AND THEIR ALLIES

The most frequently found fossils in the Nanarup Limestone are the remains of the great group of marine animals known as echinoderms. This includes **sea urchins (echinoids), starfish (asteroids), brittlestars (ophiuroids)** and **sea lilies (crinoids)**. Being made up of many individual plates, firmly secured during life, but often weakly attached after death, echinoderms are often found fossilised as individual plates. Often the plates are sufficiently distinctive to allow identification to be made of the animal from which they came. Although less common, echinoids can be locally abundant in the Pallinup Siltstone, but they occur as internal and external moulds, the shell having been dissolved away.

Starfish (1,2) are never found whole, only as isolated, vaguely cubic to orange segment-shaped plates a few millimetres across, called ossicles. **Sea lilies** too generally fall apart after death. The stems of **isocrinoid** sea lilies (3,4) are star-shaped and very distinctive. Although usually found as isolated plates (3), partially complete columns are sometimes found (4).

The most common element of the echinoderm fauna are the **sea urchins** (5-12). These occur as two types: **regular** and **irregular**. Regular urchins are the familiar urchins seen grazing on rock platforms today - generally spherical bodies and a mass of large, sharp spines. In the Pallinup Siltstone and Nanarup Limestone, regular echinoids are dominated by the **cidaroids (slate pencil urchins)** (5-7). The body (test) is rarely found complete, but consists of 5 columns of tiny plates, each pierced with paired holes, alternating with 5 broad columns of large plates upon which single large tubercles occur (5). To these tubercles were attached stout spines, sometimes long and thin with tiny thorns (6), or thick and flared at the end (7). The dominant cidaroid is ***Goniocidaris***.

Irregular urchins burrow into the sediment. In the Nanarup Limestone cassiduloid urchins are the dominant forms, in particular ***Echinolampas posterocrassa*** (8,9). This egg-shaped urchin has five "petals" on its upper surface (8) and a central mouth and posterior anus on its lower surface (9). Other cassiduloids include the narrow ***Eurhodia australis*** (10) and the large (50mm) ***Australanthus longianus*** (11), with its large mouth surrounded by five stout processess called bourrelets. Heart urchins are generally rarer, the only one to occur with any frequency, particularly in muddier limestones near Manypeaks, being the large (70mm) ***Gillechinus cudmorei*** (12), which has a few larger tubercles on its upper surface and occurs in both the Pallinup Siltstone and Nanarup Limestone. Sand dollars were very rare at this time, but a minute form, just 3 mm long and called *Fossulaster* has recently been discovered in the Nanarup Limestone. This urchin is the earliest form found in Australia that brooded its young in a depression on the surface of the test.



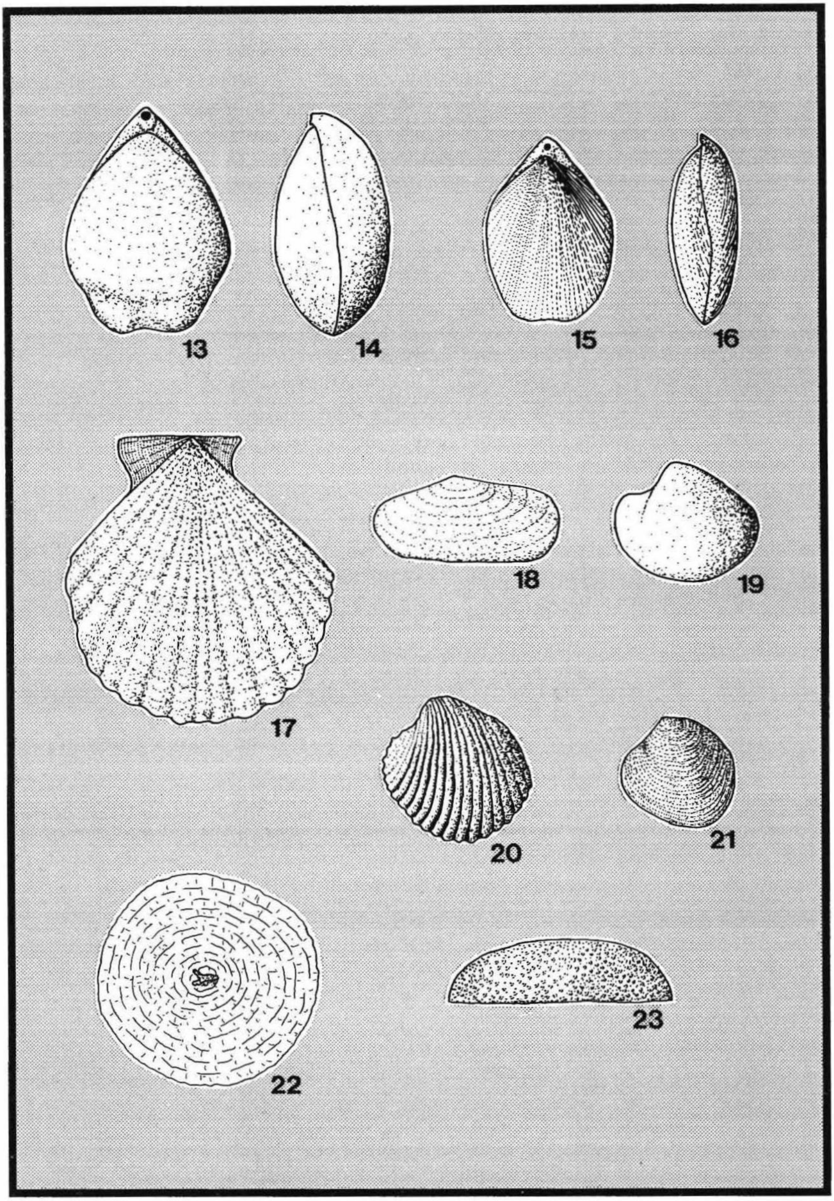
Sea Urchins and their allies

BRACHIOPODS, BIVALVES AND BRYOZOANS

Representatives of these three groups of invertebrates are often found in the Nanarup Limestone, while only bivalves occur commonly in the Pallinup Siltstone. **Brachiopods** (13-16) are animals with two shells, each of dissimilar size, but bilaterally symmetrical down their midline. In the Nanarup Limestone some individuals reach up to about 70mm in length, but most rarely exceed 20mm in length. The two main forms to occur are both **terebratulids**. One, ***Gryphus labiatus*** (13,14), has a smooth shell, the other, ***Cancellothyris* sp.** (15,16) has a shell with fine, closely spaced ribs. These forms also occur in the Tortachilla Limestone, which outcrops in coastal sections south of Adelaide in South Australia. This unit is of the same age as the Nanarup Limestone, and many fossil species are shared between the two limestones. At the pointed end of the shell (the umbo), the brachiopods usually have a hole into which a thick, fleshy stalk, the pedicle, attached during life. This anchored the shell into the sand, or onto a stable base, such as a rock or other large shell.

Bivalves (clams) (17-21) differ from brachiopods in having shells usually of the same size and shape, but which are not bilaterally symmetrical. The most common form in the Nanarup Limestone is a scallop called ***Chlamys*** (17). Reaching up to 60mm in length, the shells of these animals have often been partly dissolved away. In addition to the presence of a few stout ribs, these bivalves are characterised by the possession of "ears" on the shell. Most bivalves occur as internal moulds (18-19) and external moulds, but none have been formally described. Bivalves are far more common in the Pallinup Siltstone, with 23 species having been recorded. Common forms include ***Glans (Fasciculicardia) latissima*** (20) and ***Salaputium communis*** (21). The bivalves, like other fossils, in the Pallinup Siltstone are usually preserved as moulds. External moulds of the outer surface of the shell, showing the ornament, are important in identifying species. Occasionally, complete shells occur, the original shells having been replaced by silica.

Many of the sand grains in the Nanarup Limestone are made of the broken fragments of small, stick-like colonial animals called **bryozoans.** Resembling corals, in consisting of a colony of tiny animals that live together in a structure made from calcium carbonate, bryozoans are actually more closely related to brachiopods. One group of bryozoans that are fossilised whole are a group called **lunulitid bryozoans** (22,23). They consist of a circular base plate from which countless individuals radiated to form a domed hemisphere. The basal plate initially started to grow on either a grain of sand or fragment of shell, and this original anchoring structure can usually be seen nestled into the centre of the basal disk. Some of these bryozoan colonies grew quite large, up to 50 mm in diameter. These bryozoans indicate high energy conditions in the region that they lived, because such structures would have been very stable.



Brachiopods, Bivalves and Bryozoans

CRABS, SHARKS, SNAILS AND NAUTILOIDS

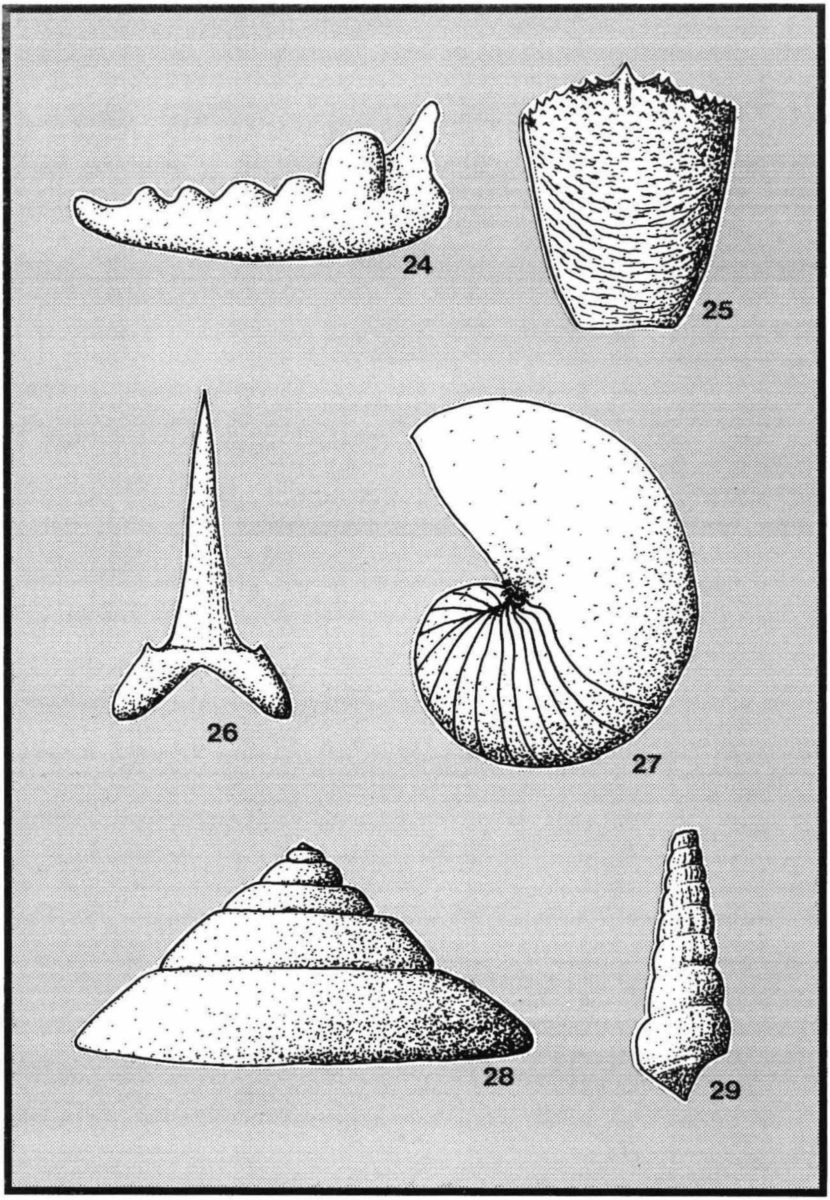
Many of the animals that have been discussed either burrowed into the sand or silt, such as the heart urchins, or were sedentary animals, fixed to one spot for most of their life, such as the brachiopods. But many other groups of animals in the Pallinup and Nanarup seas were much more active. Some were soft bodied and so did not get fossilised. They were either eaten immediately after death, or broken down by bacteria, or smashed to pieces by the ever turbulent waves. However, some groups possessed sufficiently resilient hard parts to be fossilised, giving us an indication of some of the other animal groups that lived in this region 40 million years ago.

Crab (24,25) remains are quite rare in the Nanarup Limestone and absent from the Pallinup Siltstone. Generally only tough claws are found, such as those of **xanthid crabs** (24). These are likely to have come from crabs that fed on many of the sedentary animals, like clams and brachiopods. Some also probably fed on the sea urchins. Many urchins are found incomplete, probably because they were attacked by crabs and broken before fossilisation. A recent exciting find from the Nanarup Limestone is of the shell of a spanner crab called ***Lophoranina*** (25). This is only the second specimen to turn up in Australia, the other having been found recently in the north-west near Exmouth Gulf. This crab had a world wide distribution but appears to have lived in Australia slightly more recently than it did in other parts of the world.

Fish remains are represented in the Nanarup Limestone by **shark teeth** such as ***Striatolamia striata*** (26). Although not common, they are usually well preserved and indicate quite a rich shark fauna, similar in appearance to today's sharks, cruising over the Nanarup sea. These shark teeth represent the only examples of sharks of this age found in Western Australia.

Another free-swimming animal that occasionally turns up in both the Pallinup Siltstone and the Nanarup Limestone is the **nautilus**. Closely related to the living nautilus, these animals belong to the group called cephalopods, which includes the octopus and squid. One form has been found in the Nanarup Limestone, called ***Cimomia felix*** (27). It is represented by the moulds of the coiled shells and can exceed 100 mm in diameter. This species occurs more commonly in the Pallinup Siltstone. Another species to occur in the Pallinup Siltstone is *Aturia clarkei*. This species can reach up to 200 mm in diameter. It differs from *Cimomia felix* in having a much more convoluted suture line.

Snails (gastropods) are uncommon in the Nanarup Limestone, but a rich and diverse, but as yet undescribed, fauna occurs in the Pallinup Siltstone. Most spectacular is the 120 mm ***Perotrochus*** (28), but many small, often high-spired forms, such as ***Jetwoodsia nullarborica*** (29) also occur.



Crabs, sharks, snails and nautiloids

SPONGES AND PLANTS

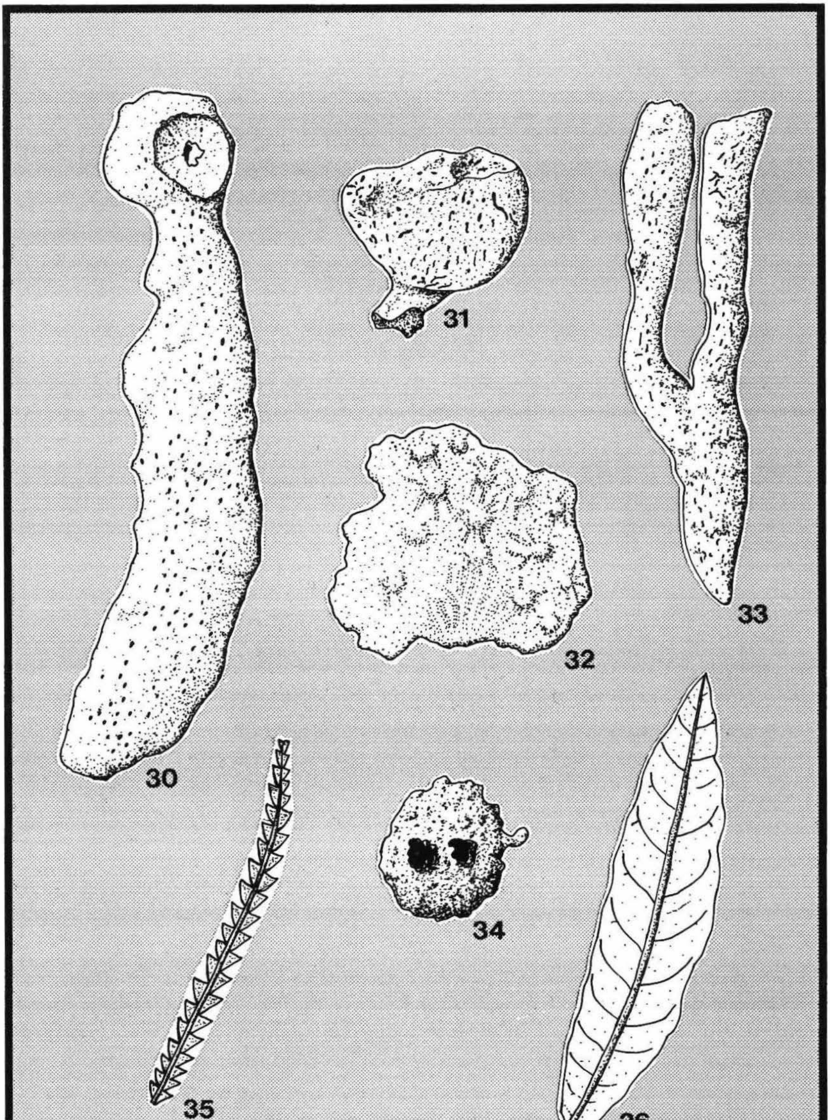
Sponges (30-34) are undoubtably the most common fossils in the Pallinup Siltstone. A wide range of forms have been found and 32 different species recorded. Indeed it has been said that the siliceous sponges of the Pallinup Siltstone are the most diverse in terms of number and variety of any deposit in the world. Some of the sponges are cylindrical, such as ***Corallistes australis*** (30), or globular, like ***"Caminus" parvistoma*** (31). Others are flattened, such as ***"Discodermia" tabelliformis*** (32), or branching, such as ***"Thamnospongia glabra*** (33). From the range and numbers present in the Pallinup Siltstone, it seems likely that the Pallinup sea floor would have been carpeted by millions of sponges.

While these form the major component of the Pallinup Siltsone, sponges were much less common in the shallower, warmer waters of the Nanarup Limestone. They are represented by a spherical form, ***Caminus nitidus*** (34), which when weathered can look deceptively like some of the urchins. However, these sponges lack the characteristic five fold pattern seen on the urchins, and have a few irregularly distributed siphon holes on their surface.

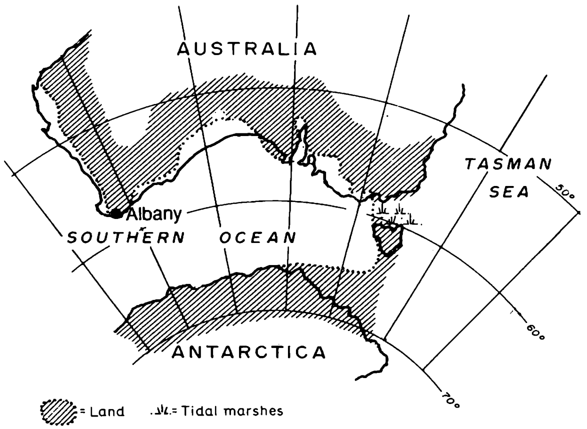
The Pallinup Siltstone is an unusual deposit insomuch as it contains not only fossils of marine animals, but also fossils of **land plants** (35-36). This is important in terms of our understanding of the evolution of the Western Australian flora, because comparison can be made between the Pallinup plant fossils, whose age has been accurately determined using the marine fossils, and other fossil plant bearing deposits on the Darling Range. The plant fossils in the Pallinup Siltstone consist of leaves, wood and even occasional fruits. Around the base of the Porongorups large trunks of fossilised wood occur, washed off the Porongorup "Island" into the Pallinup sea 40 million years ago. A common wood type is banksia wood.

Although this fossil flora has not been studied, the leaves in the Pallinup Siltstone provide evidence that the nearby land surface was clothed in a forest of diverse tree species, including some elements similar to today's flora, such as **banksias** (35), casuarinas and a range of **dicotyledenous trees** (36). Leaves probably attributable to the Southern Antarctic Beech, *Nothofagus*, also occur. This tree indicates that the vegetation was probably temperate rain forest.

Although no land plants have been found in the Nanarup Limestone, the Werillup Formation, of which it is a part, has yielded lignified fossil wood and undescribed fossil banksia fruits west of Walpole. Along with banksia fruits described from the Kennedy Range, these are the earliest evidence for banksias in Australia.



Sponges and plants



Southerly position of Australia close to Antarctica 40 million years ago (based on Foster & Philip 1978, text-fig. 6)

FURTHER READING

Darragh, T.A. & Kendrick, G.W. 1980. Eocene bivalves from the Pallinup Siltstone near Walpole, Western Australia. *Journal of the Royal Society of Western Australia* **63**:5-20.

de Laubenfels, M.W. 1953. Fossil sponges of Western Australia. *Journal of the Royal Society of Western Australia* **37**:105-117.

Chapman, F. & Crespin, I. 1934. The palaeontology of the Plantagenet Beds of Western Australia. *Journal of the Royal Society of Western Australia* **20**:103-136.

Cockbain, A.E. 1968a. The stratigraphy of the Plantagenet Group, Western Australia. *Annual Report, Geological Survey of W.A. 1967*:61-63.

Cockbain, A.E. 1968b. The nautiloid *Cimomia* in the Plantagenet group, Western Australia. *Annual Report, Geological Survey of W.A. 1967*:61-63.

Foster, R.J. & Philip, G.M. 1978. Tertiary holasteroid echinoids from Australia and New Zealand. *Palaeontology* **21**:791-822.

McNamara, K.J. 1985. The spatangoid echinoid *Linthia* from the Late Eocene of southern Australia. *Transactions of the Royal Society of South Australia* **109**:161-165.

McNamara, K.J. & Philip, G.M. 1980. Tertiary species of *Echinolampas* (Echinoidea) from southern Australia. *Memoirs of the National Museum of Victoria* **41**:1-14.

McNamara, K.J., Philip, G.M. & Kruse, P.D. 1986. Tertiary brissid echinoids of southern Australia. *Alcheringa* **10**:55-84.

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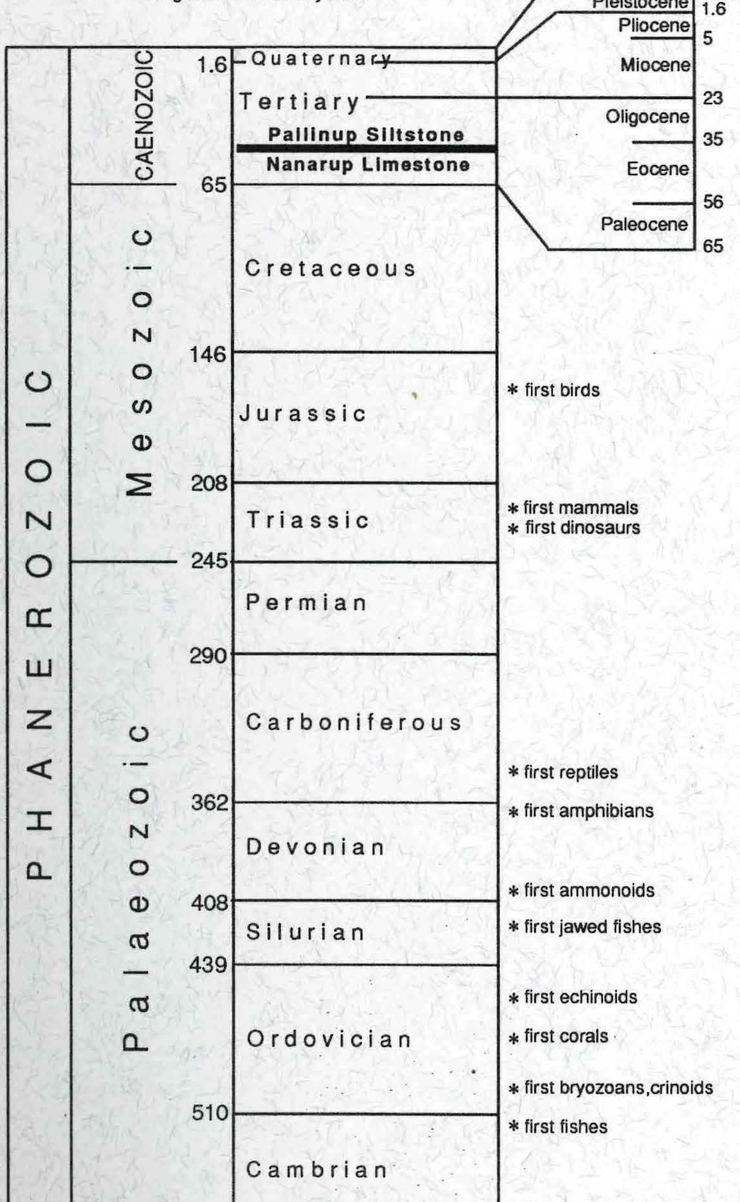
GEOLOGICAL TIME SCAL E

Ages in millions of years



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