KROOMBIT TOURIST PARK - BILOELA
MARBLE WATERHOLE AREA

By Paul Blake

NOTE – The Marble Waterhole area is within a National Park and no fossils should be taken, moved or destroyed.

GEOLOGY OF THE MARBLE WATERHOLE AREA.

This Rocks & Landscape Note is written as a companion to the SELF-GUIDED GEOLOGICAL WALK written by Mark Hayward on the Lochenbar Formation, which was deposited during the Late Devonian, about 360 to 375 million years ago. This current note describes the older, Middle Devonian, Marble Waterhole beds that formed about 380 to 390 million years ago, and gives details of the fossil corals preserved in the limestone at Marble Waterhole.

At the time of deposition of the Marble Waterhole beds the geography of Queensland was very different to its present form. The coastline was further to the west and the edge of the continent would have possessed some prominent volcanoes, similar to parts of the modern Andes in South America. The Marble Waterhole beds were formed around part of a chain of volcanoes off the coast of Queensland and would have been similar to the modern geological environments of Indonesia or Japan.

The lavas that were erupted by the volcanoes that formed the Marble Waterhole beds are high in silica. This would have caused the lavas to be very viscous and many of the eruptions at this time would have been explosive. Most of the rocks present within the Marble Waterhole beds are sandstones that are made up of fragments of rock produced during these volcanic explosions. The sandstones contain fragments of lava and feldspar crystals. They also usually contain fragments of quartz crystals.

Despite the obvious dangers of explosive volcanoes nearby, marine life flourished in the oceans that surrounded these volcanic islands. As the animals died, their skeletons built up to form the large outcrops of limestone that occur within the park. The most common organisms that are preserved in the limestones within the Marble Waterhole beds are stromatoporoids, corals, crinoids and brachiopods.

Stromatoporoids are a group of organisms that are now extinct. Based on microscopic examination of the internal features of their skeletons it is assumed that they were similar to sponges. In well-preserved specimens you can occasionally see growth rings. However, if you are looking at a uniform, featureless limestone "blob" within the limestone outcrop then you are most likely looking at a stromatoporoid.

The **corals** will be described in detail below.

Crinoids can be beautiful fossils, and early palaeontologists referred to them as "Sea Lilies" (Fig. 1), but in most cases all you find preserved are their stems, seen as white cylindrical "rods" within the limestone.

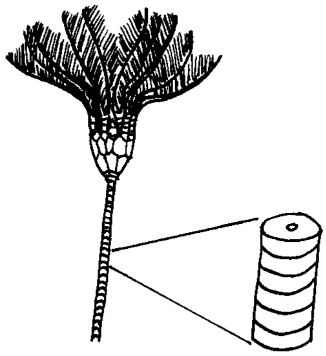

Figure 1: Sketch of a crinoid, with a close-up of its stem.

Brachiopods are shells that look similar to modern bivalves such as clams and mussels. Some brachiopods and crinoids still live on the Great Barrier Reef today, but they are rare.

Study of the geological history of our planet shows that the continents move with time. Towards the end of the Middle Devonian the movements of the continent caused the Marble Waterhole beds and other chains of volcanic islands to collide with the main continent of Australia, putting the coastline in about its current position.

For a short time after this collision the volcanic activity in the area ceased, but several million years later it started again, resulting in the deposition of the Lochenbar Formation.

CORALS OF THE MARBLE WATERHOLE BEDS.

The location of Marble Waterhole in relation to the Tourist Park and the geology can be seen in Figure 2.

Many fossils are visible in the water-polished limestone outcrops at Marble Waterhole. These includes a wide variety of corals belonging to two groups known as Rugose and Tabulate corals. None of these corals survive today, both groups becoming extinct about 250 million years ago. Modern corals are known as Scleractinian corals and these evolved after the extinction of the Rugose and Tabulate corals.

Despite the fact that the fossil corals at Marble Waterhole were different to modern corals, their skeletons were very similar in appearance. Anybody who has been on the Great Barrier Reef, or seen a documentary on corals, will have seen a large variety of coral shapes. Some produce skeletons that are hemispherical, others produce a skeleton that is plate-like in appearance, and others are branching, cylindrical stems (commonly called “stag-horn” corals on the modern reef). Sometimes the coral polyp lives alone, building a skeleton shaped like a cow horn. These are known as “solitary” corals and are rare in the modern world, but were common back in the Devonian.

As the corals grow upwards, the individual polyps build tubes called **corallites**. In some corals (e.g. *Alveolites* (Fig. 3 & 4) and *Endophyllum* (Fig. 19)) the polyps were very close together and the corallites are in contact with each other. In some corals the polyps are spaced far apart and the corallites are connected to each other by small tubes (e.g. *Heliolites porosa* (Fig. 6)) or the corallites remain free of each other (e.g. *Amaraphyllum amoenum* (Fig. 17).

Since the limestones at Marble Waterhole are worn smooth by water, the following illustrations of corals will be drawn as sections through the coral skeletons.

It is hoped that this guide will allow you to identify most of the coral species that you will see. However, even the most thorough study of an area may miss things and it is possible that you will see a type of coral that is not identified in this pamphlet.

Scientific Names

In 1735 Carl Linnaeus invented the system used for naming organisms. All organisms are identified by two words known as the **genus** and the **species**. For example, humans are known as ***Homo sapiens*** our genus is *Homo* and our species is *sapiens*. In fossil corals, the genus can often be easy to determine, but the exact species can sometimes be difficult to figure out. When the exact species cannot be determined “sp.” is used; e.g. in Figure 5 the coral genus is *Thamnopora* but its species is uncertain.

Tabulate corals

Tabulate corals are distinguished by developing colonies of very small corallites. They are also the most numerous corals in the limestones of the Marble Waterhole beds.

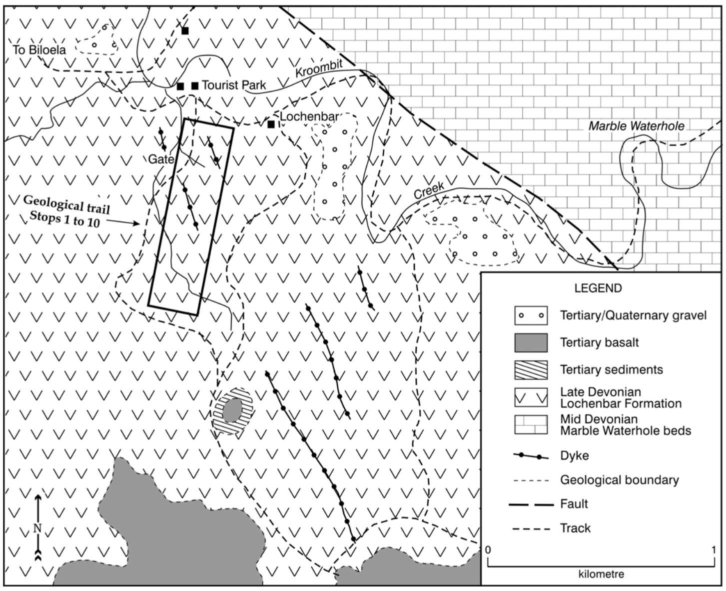

Figure 2: Geology of the Kroombit Tourist Park area including the location of the Marble Waterhole.

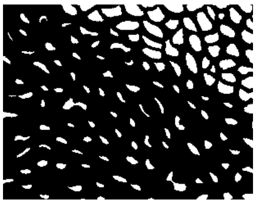

Figure 3: *Alveolites suborbicularis*. This drawing shows only a small part of a colony. The scene depicted is only 8 mm wide on the original specimen.

Amongst the Tabulates there are two species of *Alveolites*. ***Alveolites suborbicularis*** (Fig. 3) built hemispherical to platy shaped colonies that can be up to 150 mm across. This coral had very small, oval to kidney bean-shaped corallites. The walls between the corallites range from being thin (as seen in the top right corner of the sketch) to thick (as can be seen in the bottom left side of Figure 3).

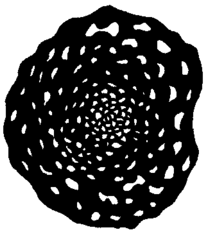

Figure 4: *Alveolites caudatus*. This drawing is a section cut through a cylindrical branch about 10 mm in diameter.

Alveolites caudatus (Fig 4) lived in colonies of branching stems similar to the modern "stag-horn" corals. The corallites are small and have thin walls near the axis of the stem, but became bigger and developed thick walls near the outer edge of the stem.

***Thamnopora* sp.** (Fig. 5) produced a colony that is a branching stem. *Thamnopora* sp. is distinguished from branching *Alveolites* by possessing polygonal corallites. Also, the corallites are larger than those in *Alveolites*.

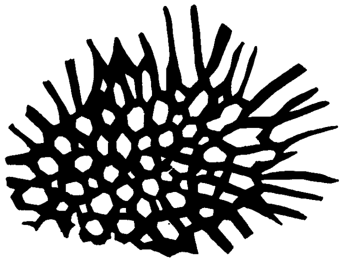

Figure 5: *Thamnopora* sp. This is a sketch through a branch about 20 mm in diameter.

Another common Tabulate coral in the Marble Waterhole beds is known as ***Heliolites porosa*** (Fig. 6). It produces hemi-spherical colonies and is easily distinguished from the other Tabulate corals by possessing thick-walled corallites that are separated from each other by small polygonal tubes. Within each corallite are thin sheets of calcite that project towards the axis of the corallite and look like thin pointy teeth when they can be seen. These are known as **septa**.

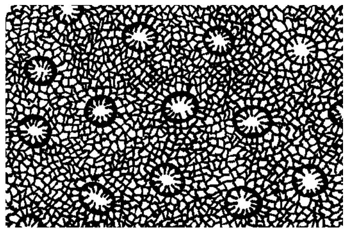

Figure 6: *Heliolites porosa*. The above sketch is a close up view of part of a colony. The sketch above represents a 15 mm wide section of a colony.

Rugose corals

The Rugose corals within the Marble Waterhole beds are very diverse but generally low in numbers. The Rugose corals are distinguished from the Tabulate corals in a number of ways. They usually possessed much bigger corallites. While the corallites of the above Tabulate corals are usually about 1 mm across, Rugose corals often have corallites that are more than 10 mm across. Also, Rugose corals often possess well-developed septa. The coral polyps used the septa to help support their stomach. The bigger a polyp gets, the more it needs septa to support its stomach. This is why the septa are rare in the small polyp Tabulate corals but relatively common in the large polyp Rugose corals.

Also, Rugose corals can live as a single polyp, called a "solitary" coral, or they can form colonies.

***Tryplasma* sp.** (Fig. 7) is a solitary rugose coral distinguished by having very short septa. In some specimens the septa are almost impossible to see. The corallites can range in size from 12 to 24 mm diameter. Several species have been identified in the Marble Waterhole beds, but to the untrained eye they all look much the same.

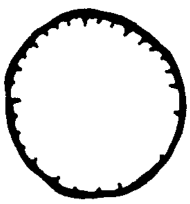

Figure 7: *Tryplasma* sp. This is a sketch of a specimen about 15 mm diameter.

***Calceola* sp.** (Fig. 8) is a very unusual rugose coral. Instead of having a circular corallite, it was semi-circular, and it did not possess septa. They had a lid on top of their skeleton, and if the water conditions became too muddy for them to feed they could pull themselves into their home and close the lid. They are often called "Slipper Corals" by palaeontologists since when you see a whole specimen they look like the pointy tip of a slipper. They have a very thick corallite wall built of white calcite. When you see a section across the corallite it is a white semicircle that look like a "D" up to 50 mm across. When you see a section along the length of the corallite it looks like a large white "V".

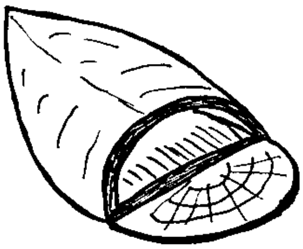

Fig 8: *Calceola* sp. with lid. The sketch is of a specimen about 50 mm across.

There is a large group of corals known as Cystimorphs. These are usually distinguished by having very short to absent septa, and the skeleton is dominated by blister-shaped structures known as **dissepiments**. There are two kinds of cystimorphs known from the Marble Waterhole beds. There is ***Pseudo-microplasma australe*** (Fig. 9) and ***Cystiphylloides* sp.** (Fig. 10).

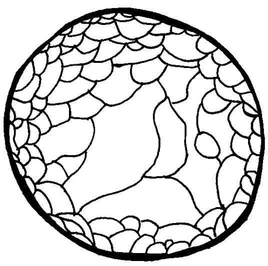

Figure 9: *Pseudomicroplasma australe*. This is a sketch of a specimen about 20 mm in diameter.

The curved structures within the sketched corallites are the dissepiments mentioned above.

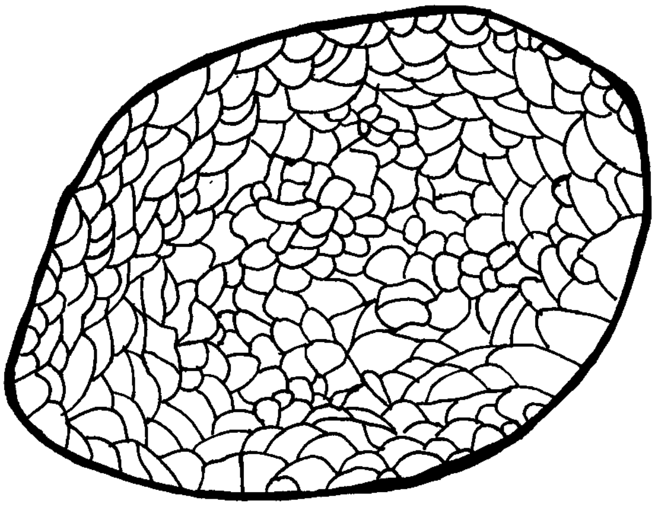

Figure 10: *Cystiphylloides* sp. This is a sketch of a specimen about 70 mm in Diameter.

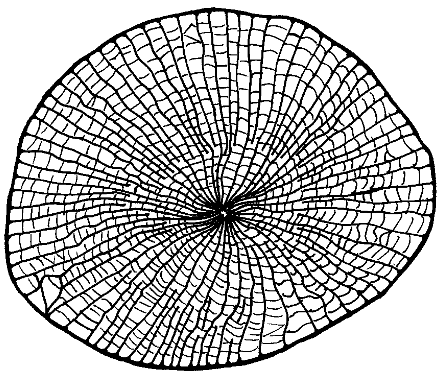

Figure 11: *Acanthophyllum clermontense*. Sketch of a specimen 45 mm diameter.

These two corals look very similar to each other but can be distinguished by their size; *Cystiphylloides* sp. corallites are usually about 60 to 70 mm in diameter and the corallites of *Pseudomicroplama australe* are usually only about 20 mm in diameter.

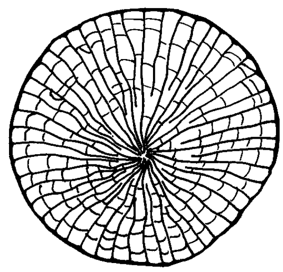

Figure 12: *Grypophyllum jenkinsi*. Sketch of a 20 mm diameter specimen.

Acanthophyllum clermontense (Fig. 11) and ***Grypophyllum jenkinsi*** (Fig. 12) are another pair of closely related corals. Both are solitary, and have very long septa that extend almost all the way from the corallite wall to the axis. They are distinguished from each other by the size of their corallites. *Grypophyllum jenkinsi* has a corallite diameter ranging from 10 to 30 mm and *Acanthophyllum clermontense* has a corallite diameter that is usually slightly more than 40 mm. *Grypophyllum jenkinsi* is one of the most common rugose corals in the Marble Waterhole beds.

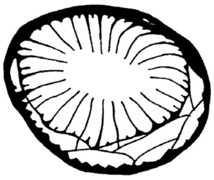

Figure 13: *Tabulophyllum* sp. This is a sketch of a specimen about 15 mm diameter.

***Tabulophyllum* sp.** (Fig. 13) is another solitary Rugose coral. It is distinguished in the Marble Waterhole beds by possessing septa that are long, but do not reach the axis. Also, the blister-like dissepiments near the corallite wall, when present, disrupt the septa and often prevent them from reaching the wall.

A common genus of coral in the Marble Waterhole beds is *Stringophyllum*. This genus, combined with *Grypophyllum jenkinsi*, make up most of the solitary Rugose corals found in the Marble Waterhole beds.

The septa of *Stringophyllum* are arranged bilaterally near the centre of the corallite. Also, the septa break up into upwardly directed spines as they approach the axis. A section through a spine looks like a dot, and the dots that you see near the centres of the two sketches are sections through the septal spines.

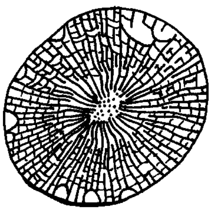

Figure 14: *Stringophyllum quasinormale*. Sketch of a 15 mm diameter specimen.

There are two species of *Stringophyllum* known from the Marble Waterhole beds. These are ***Stringophyllum quasinormale*** (Fig. 14) and ***Stringophyllum bipartatum*** (Fig. 15).

The two different species have different corallite diameters with *S. quasinormale* being 9 to 25 mm in diameter and *S. bipartatum* being 30 to 35 mm in diameter. Also, the septa in *S. bipartatum* are arranged more strongly bilaterally than in *S. quasinormale*.

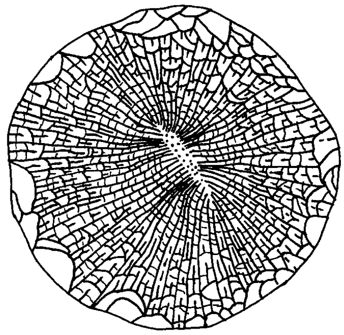

Figure 15: *Stringophyllum bipartatum*. Sketch of a 30 mm diameter specimen.

***Solipetra* sp**. (Fig. 16) is a distant relative of *Stringophyllum*. It is distinctive in that it has very thick septa that start to break up into spines as soon as they leave the corallite wall. Since the spines look like large dots in section the septa have a "string of pearls" look. *Solipetra* is one of the rarest fossil corals known in Australia. Of the three specimens so far found, two are from the Marble Waterholes beds.

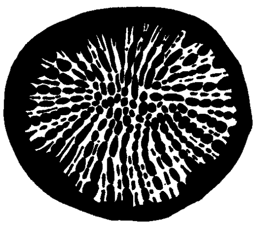

Figure 16: *Solipetra* sp. Sketch of a specimen 15 mm diameter.

All of the rugose corals mentioned so far have been the solitary types. Some colonial rugose corals are known from the Marble Waterhole beds and these will be discussed now.

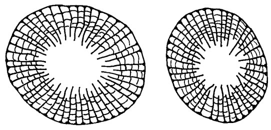

Figure 17: *Amaraphyllum amoenum*. Sketch of two corallites from a colony. The corallites are about 9 mm diameter.

One of the most common colonial rugose corals known from the Marble Waterhole beds is ***Amaraphyllum amoenum*** (Fig. 17). This is one of the corals where, despite the polyps living in a colony, they are not in direct contact with each other. This is different to corals like *Endophyllum* (Fig. 19) where the corallites are all in contact with each other. Colonies of *Amaraphyllum amoenum* can be quite large (over 300 mm across) but most of the ones found in the Marble Waterhole beds are smaller and appear broken, suggesting that they were often damaged in storms during the Devonian. The corallites of *A. amoenum* are usually 6 to 12 mm in diameter.

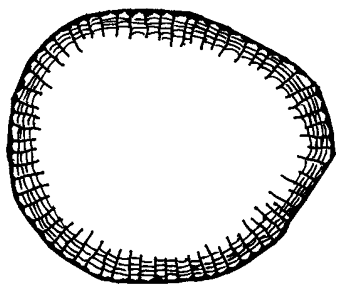

Figure 18: *Disphyllum* sp. This is a sketch of a single corallite from a colony that was over 400 mm across. The corallite sketched here was about 30 mm in diameter.

Another colonial Rugose coral closely related to *Amaraphyllum amoenum* is ***Disphyllum* sp.** (Fig. 18). Some species of *Disphyllum* are so similar to *Amaraphyllum* that you need to examine the microscopic structures within their skeletons to tell them apart. However, the species of *Disphyllum* present within the Marble Waterhole beds is very distinctive in possessing a larger corallite. This species of *Disphyllum* possesses a corallite that ranges from 15 to 30 mm in diameter and has very short septa.

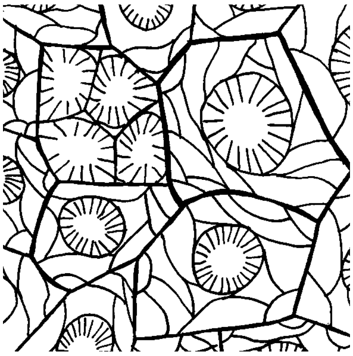

Figure 19: *Endophyllum columna*. The big corallites in this sketch are about 15 mm across. One of the corallites illustrated in the top left hand corner has just undergone asexual reproduction into four juvenile corallites.

Endophyllum columna (Fig. 19) is one of the rugose corals where the corallites are in contact with each other. The corallites range from 5 to 15 mm diameter, and the septa are usually prevented from reaching the corallite wall by dissepiments.

Sanidophyllum davidis (Fig. 20) is another colonial Rugose coral in which the corallites are usually separate from each other. In Figure 20, the small corallites touching the bigger corallites are juveniles that have budded off the mature corallite.

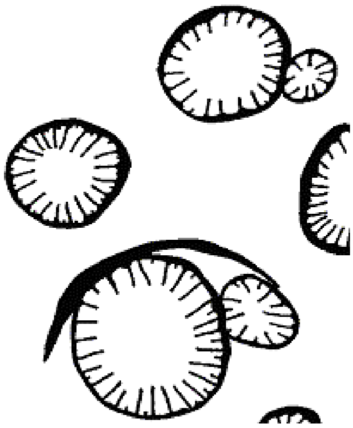

Figure 20: *Sanidophyllum davidis*. The corallites in this sketch range from 10 to 20 mm diameter.

Conclusion

The diversity of life on earth Millions of years ago, as portrayed through palaeontology, is as impressive and interesting as that of today. This pamphlet is just a brief glimpse at one group of organisms preserved in the limestones at Marble Waterhole.

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