Shark Bay World Heritage Notes

ACT NOW FOR THE FUTURE
Department of Environment and Conservation
SHARK BAY world heritage

ENVIRONMENT AND CONSERVATION DISTRICT OFFICE, DENHAM, WESTERN AUSTRALIA

WHAT ARE STROMATOLITES?

The Short Answer
Stromatolites are considered to be 'living fossils'.

The Long Answer

- Stromatolites represent the oldest forms of life on earth
- They are made of the same kind of cyanobacteria that appeared on the planet some 3.5 billion years ago
- Cyanobacteria were among the first living organisms to evolve on Earth
- Colonies of cyanobacteria bond together and secrete a sticky gel that traps drifting shells, sand and other sediments
- Slowly the colony build up layers of this sediment with accumulates and forms extensive mats or hardens to form stromatolites
- The outer layer of a stromatolite is a thin strip of living active cyanobacteria
- Stromatolite colonies release oxygen into the atmosphere and have therefore played a paramount part in the evolutionary history on Earth
- Shark Bay is one of only two places in the world where living marine stromatolites still exist.

The micro-organisms that live on the margins of Hamelin Pool are invisible to human eyes. These organisms are able to form cohesive carpets extending for tens of square kilometres over intertidal and shallow subtidal environments. The 'microbial mats' are actually communities of diverse inhabitants with over 3 000 million individuals per square metre.

Some of these communities are able, as a by-product of recycling nutrients, to construct protective towers up to 1.5 metres high – up to ten million times larger than the organisms that build them. Stromatolites grow very slowly – about five centimetres in 100 years and a metre-high stromatolite would be about 2 000 years old.

Bottom-dwelling communities dominated by microbes are only established in places where larger organisms are unable to survive. Stromatolites are now able to develop only in environments where biotic diversity is limited, allowing the slow-growing structures to gain a foothold. These conditions are satisfied in Hamelin Pool around the shallow margins, to a depth of about four metres. Microbial communities do not grow at depths of more than 4m because of the lack of sunlight. The warm, shallow waters at the southern end of Hamelin Pool favour the growth of micro-organisms, particularly cyanobacteria, which is the simplest single-cell life form known.

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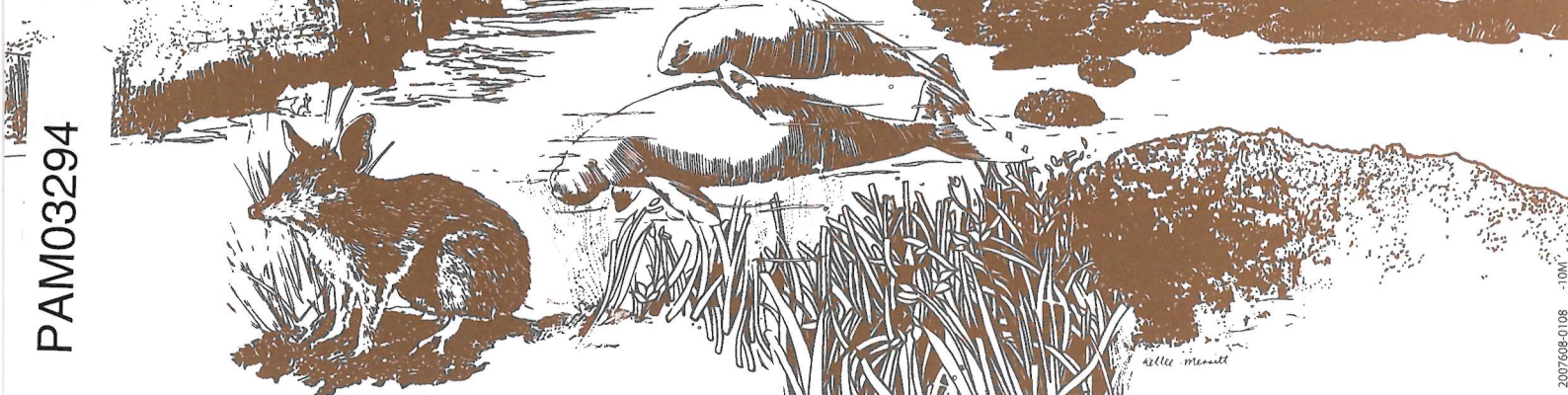

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As the cyanobacteria need sunlight to grow, and they have the ability to move towards light, their growth keeps pace with the accumulating sediment and Hamelin Pool stromatolites grow in this way.

Sedimentation from seagrass banks around the Fauré Sill have restricted the flow of water into Hamelin Pool and as a result, salinity has increased to almost twice that of normal sea water - to a point where many living organisms, and the microbes major competitors and predators, can not survive in the hypersaline conditions. A combination of extreme salinity, limited water circulation and the occurrence of calcium carbonate, allow stromatolites to grow in Hamelin Pool.

As long as the current pattern of seawater exchange across the Sill is maintained, stromatolites will continue much as they are today. If the inflow of water is further restricted, the waters of Hamelin Pool will become even more salty and stromatolites will colonise deeper waters. However, if the Fauré Sill is breached, with a full exchange of normal sea water, then seagrass and perhaps corals would displace the stromatolites.

While the stromatolites are the result of an ecological strategy that dates back almost to the origins of life, most of the organisms forming the communities in Hamelin Pool are not themselves primitive, but are modern organisms. Some microbes are, however, similar to very ancient forms. For example, the cyanobacterium which dominates one widespread type of intertidal mat in Hamelin Pool is thought to have descended from a similar form that flourished 1 900 million years ago. Thus, it represents one of the longest continuous biological lineages known.

The Hamelin Pool stromatolites remain the most abundant and diverse examples of growing marine stromatolites in the world today. They date back only for the past 2 000 years or so, and are therefore one of Australia's newest ecosystems. Nevertheless, they provide a unique look at what life was like at the dawn of evolution.

The discovery of stromatolites at Hamelin Pool has helped science understand the significance of micro-organisms in the environment, helped unravel the history of life on earth, and helped establish a view of survival of life that depends upon interaction rather than competition.

Hamelin Pool's stromatolites are internationally renowned as the most extensive examples on earth of living marine stromatolites and their presence was a major factor in Shark Bay being listed as a World Heritage Area.