MICRO-ORGANISMS

STROMATOLITES - LIVING FOSSILS

Claire Hall

Stromatolites are rock-like structures built by micro-organisms. These micro-organisms, mainly blue-green algae (cyanobacteria) and various green unicellular algae, form mats covering large areas of lake shores, marine intertidal and shallow subtidal environments. In ancient times, stromatolites formed extensive reef-like structures on the edges of lakes and seas. The stromatolites we see today could be described as 'living fossils' - a biological link to these ancient life forms.

ancient history

The unremarkable appearance of stromatolites belies their importance in understanding the origins of life on earth. Geologists had long been puzzled by fossil stromatolites and the discovery in 1956 of living stromatolites at Hamelin Pool, Shark Bay, helped scientists to understand the significance of micro-organisms in the environment. Scientists have been able to study both the fossil record and the living representative of an ancient life form.

The oldest known fossil stromatolites in the world, discovered near the mining centre of North Pole in the Pilbara, are about 3,500 million years (my) old. They were the dominant form of life until about 650 my ago, forming extensive reef tracts like modern coral reefs.

The oxygen they produced was important to the formation of iron ore deposits such as those in the Hamersley Range in the Pilbara, and started the oxygenation of the atmosphere. Increasing levels of oxygen in the atmosphere and oceans enabled the first oxygen-breathing animals to evolve. Stromatolites declined as it became more efficient for microbes to exist in faster growing organisms such as corals, or in the digestive tracts of ruminant animals.

stromatolites or thrombolites

Today, marine subtidal stromatolite-dominated ecosystems exist only at Hamelin Pool and in the Bahamas. Hamelin Pool is twice as salty as sea-water and sea-grasses and other marine life cannot survive there, resulting in minimal competition for the micro-organisms that form the stromatolites.

Non-marine stromatolites (thrombolites) exist in a number of lakes throughout the world. The best examples in WA occur in Lake Richmond (Rockingham), Lakes Clifton and Preston (Yalgorup National Park, south of Mandurah), Lake Thetis (Cervantes), and Pink Lake (Esperance).

Externally, stromatolites and thrombolites may look similar, but in cross-section stromatolites have a layered appearance and thrombolites have a clotted structure composed of carbonate cement.

Although they are invisible to the naked eye, the micro-organisms form communities of diverse inhabitants numbering over 3000 million individuals per square metre. By a combination of trapping, binding and precipitation of sediment, the stromatolites construct mats that provide protection from erosion and allow a stable microbial community to develop and thrive.

Stromatolites will only form when the micro-organisms grow slightly faster than the rate at which sediment is deposited, and the mats must be able to keep pace with destructive grazing by other organisms. Growth is very slow at only 0.5 mm a year and the height of the structure varies depending on water depth, reaching a maximum

Thrombolite community at Lake Clifton may be formed by micro-organisms precipitating calcium carbonate from upwellings of fresh groundwater as they photosynthesise.

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stromatolites

height of about 1.5 metres in the shallow sub-tidal zone. Stromatolites can form club, column or loaf shaped structures.

future for stromatolites

If we are to retain these 'living fossils' and maintain one of the longest continuous biological lineages, some careful management will be needed. They may appear rock-like but they are very fragile and can be damaged by being walked on. Observation walkways have been constructed at Hamelin Pool and Lake Clifton to minimise any impact from visitors.

The Lake Richmond thrombolite community has been classified as a Threatened Ecological Community. It's proximity to an urban environment makes it vulnerable to excess nutrients in groundwater which could cause algal blooms that smother the thrombolites. A wide buffer zone of vegetation around all lakes containing thrombolites is important for maintaining the quality of ground water. The Hamelin Pool stromatolites could be affected by climate change. If the inflow of seawater is restricted, Hamelin Pool will dry out, but if sea levels rise and normal sea water flows in, then seagrasses and corals could displace the stromatolites.

By visiting these unique life forms you can imagine what life was like when the earth began.

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Stop press!

New study of ancient Pilbara stromatolites

Further studies of the Pilbara's ancient rocks have revealed even more information about ancient stromatolites. A new paper states that organisms flourished on a broad peritidal platform 3,430 my ago, rapidly taking hold and creating a reef-like build-up in shallow waters as surfaces became submerged.

Read: Abigail Allwood et al. "Stromatolite reef from the Early Archaean era of Australia". Nature. Vol 44/18, 714-718, June 2006.