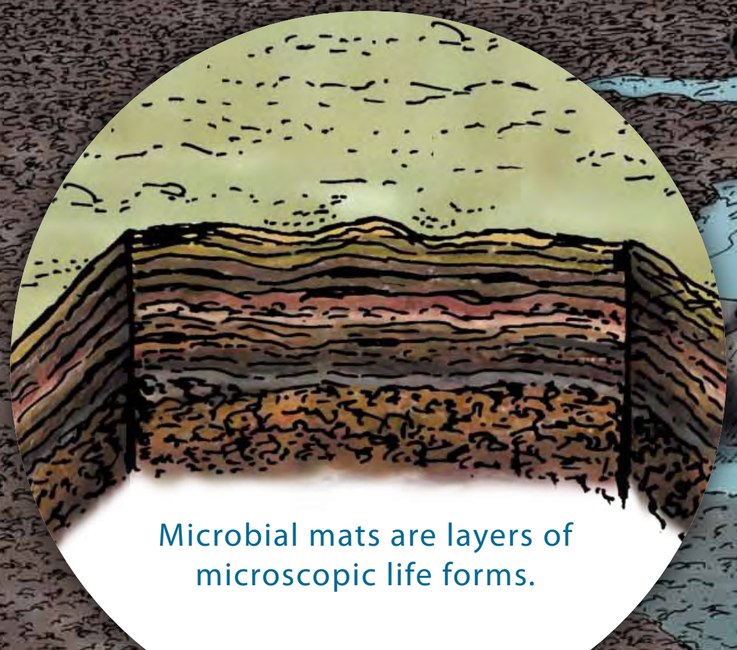
From mat to stromatolite

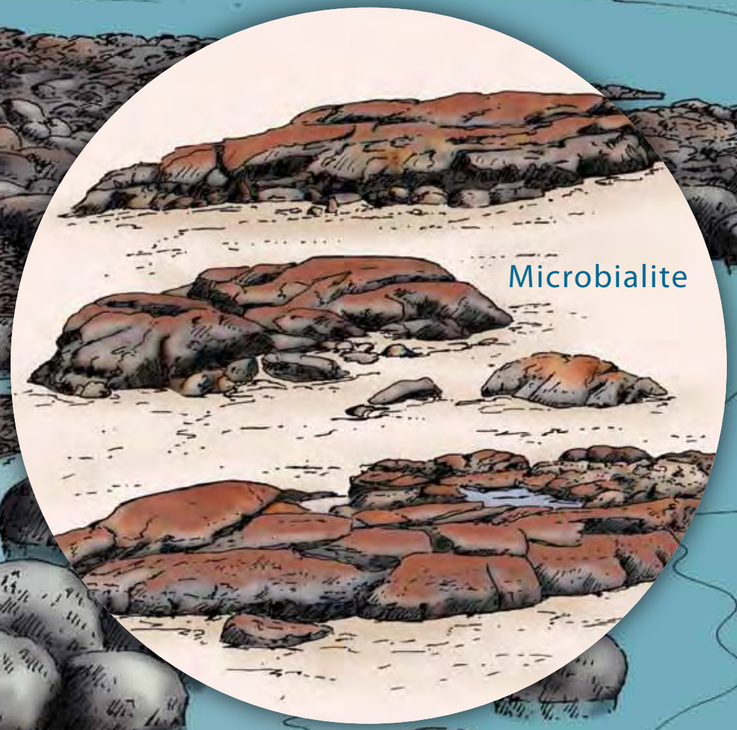
The ground here is alive and growing.

It is covered with microbial mats, communities of microscopic life forms. In certain conditions the communities trap particles and create stone. When this happens, microbial mats become microbialites.

Sometimes microbialites form taller layered structures called stromatolites.



Microbial mats are layers of microscopic life forms.



Microbialite

Stromatolites are tall layered microbialites.

Adapted from PT Visscher et al 2012

Microscopic rainforests

If we could shrink to the size of bacteria we would see these microbial mats quite differently.

We would be able to discover the incredible diversity of bacteria and other microbes in the mats.

With thousands of different species making up just a few millimetres of a microbial mat, it's like a microscopic rainforest.

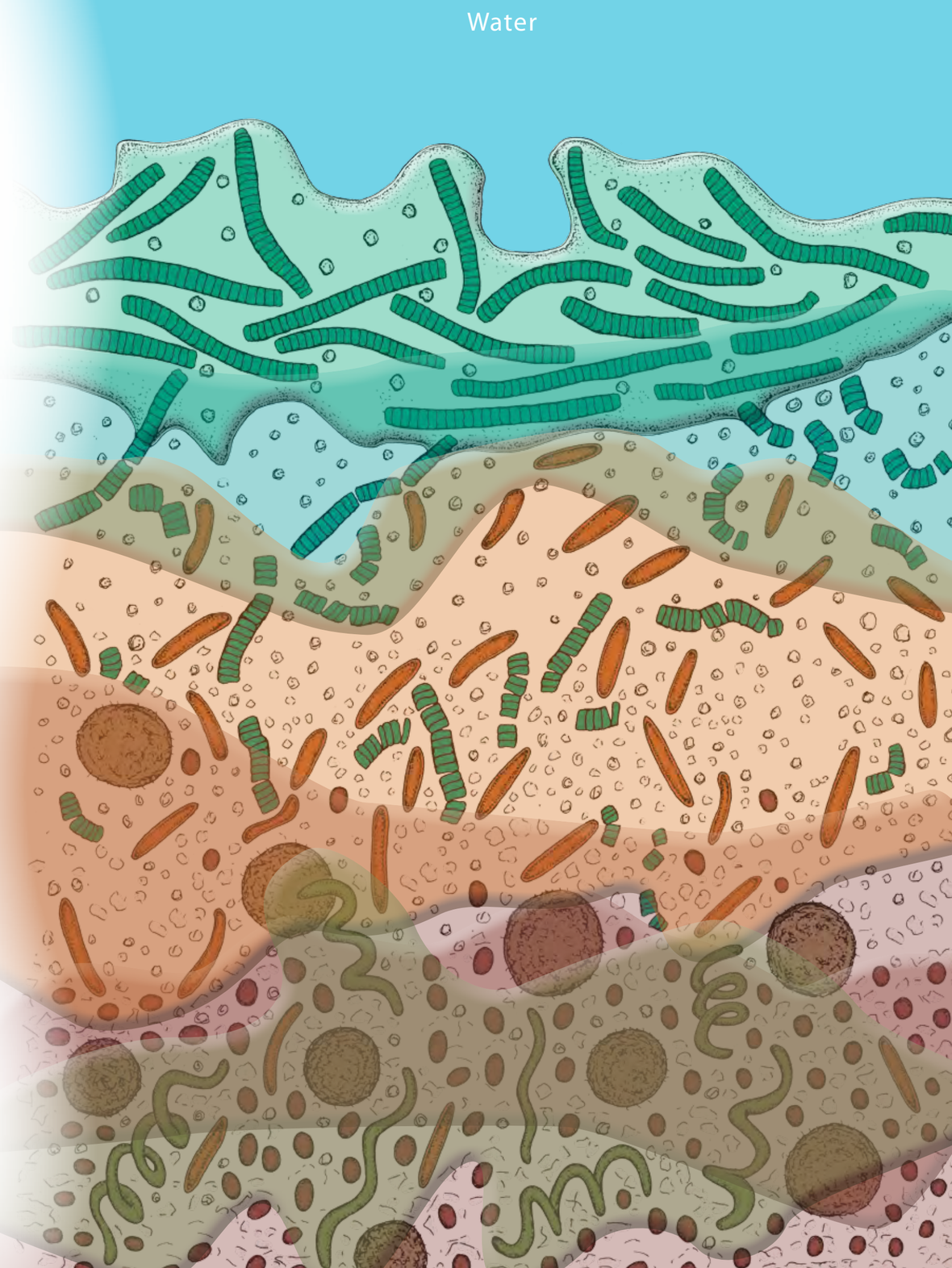
Communities

Thousands of species form communities that work together in microbial mats.

Different communities support each other as they use different elements and create different products.

Fuelled by sunlight, a community of cyanobacteria converts carbon dioxide into organic carbon and free oxygen.

Under and alongside the cyanobacteria, another community uses the carbon and oxygen to create products for a community of fermenters. This community makes smaller products that are used by yet another community and so it continues.



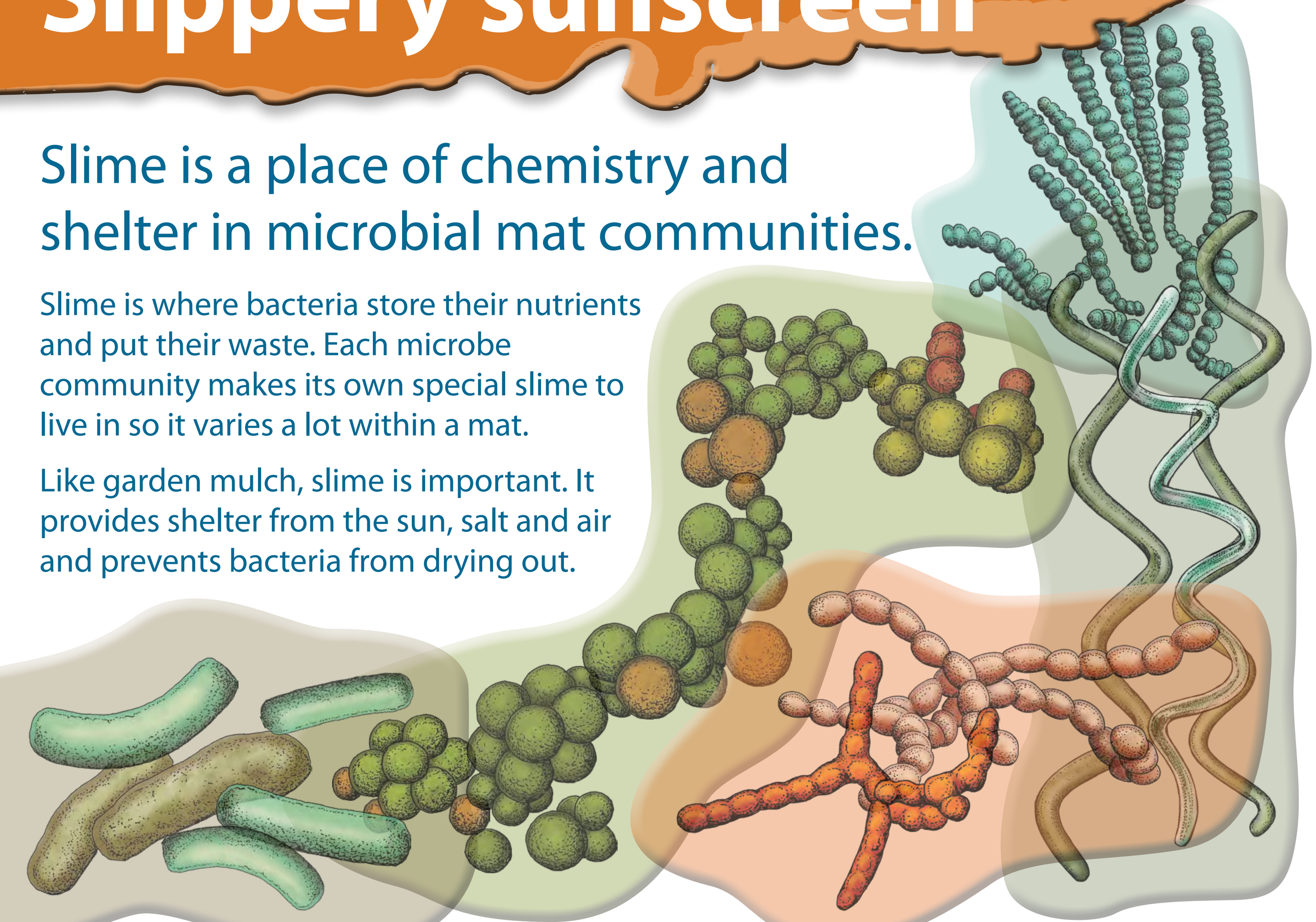
Adapted from PT Visscher et al 2012

Slippery sunscreen

Slime is a place of chemistry and shelter in microbial mat communities.

Slime is where bacteria store their nutrients and put their waste. Each microbe community makes its own special slime to live in so it varies a lot within a mat.

Like garden mulch, slime is important. It provides shelter from the sun, salt and air and prevents bacteria from drying out.

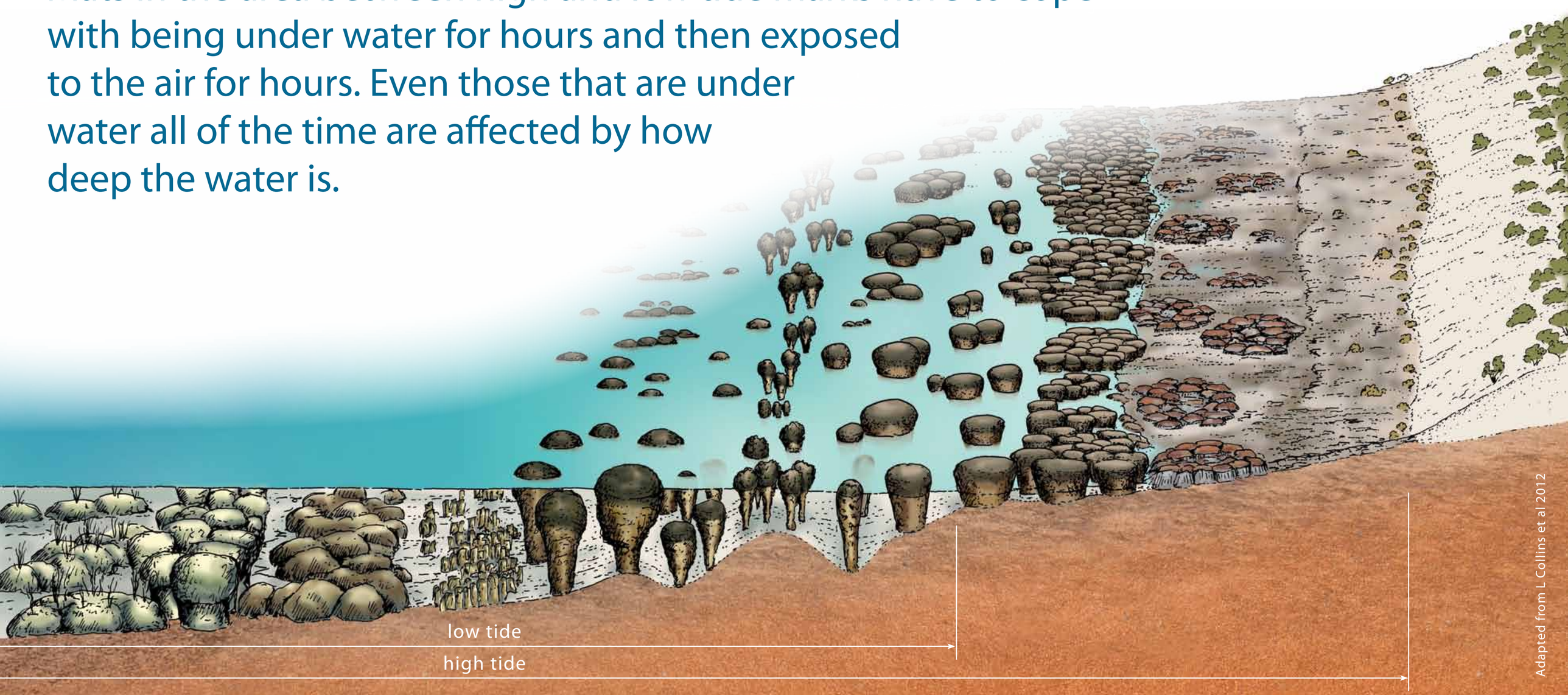


Depth matters

Microbial mats don’t all look alike.

At Hamelin Pool the shape and texture of microbial mats is affected by the depth of the water they are growing in.

Mats in the area between high and low tide marks have to cope with being under water for hours and then exposed to the air for hours. Even those that are under water all of the time are affected by how deep the water is.

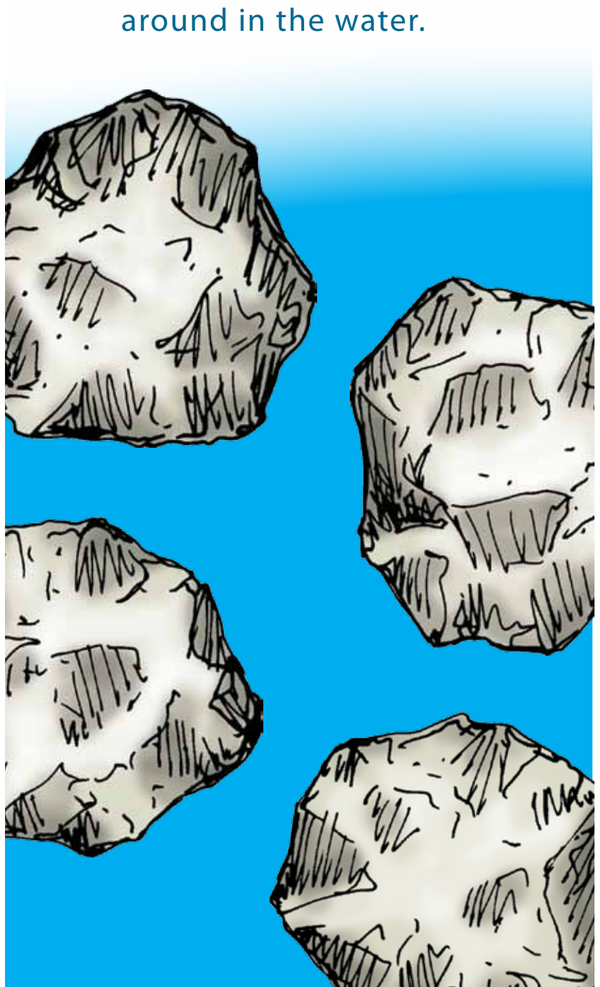


Adapted from L Collins et al 2012

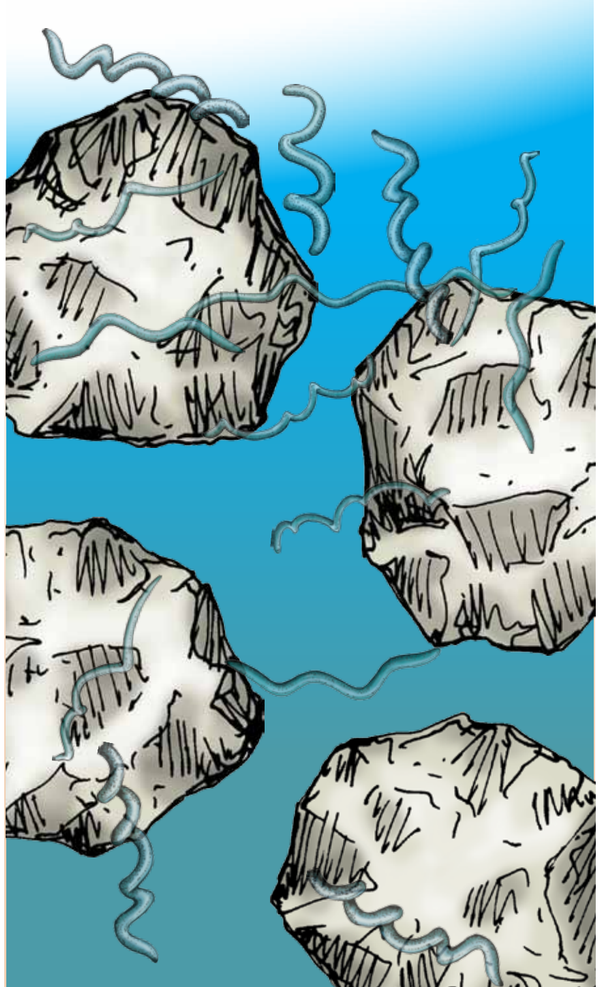
Growing mats

Microbial mats begin when certain bacteria create a stable environment for other bacteria.

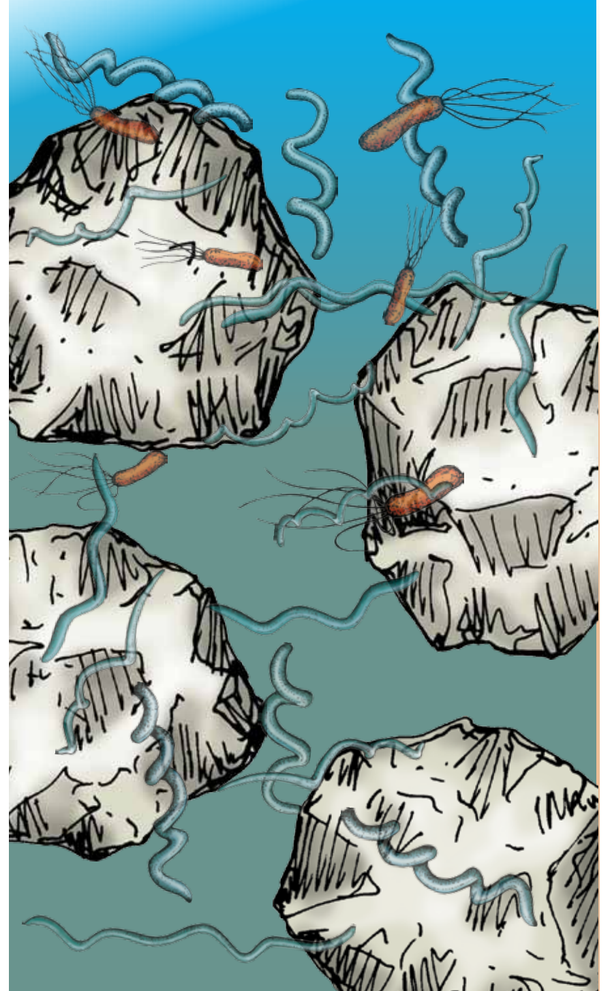
Loose particles float around in the water.



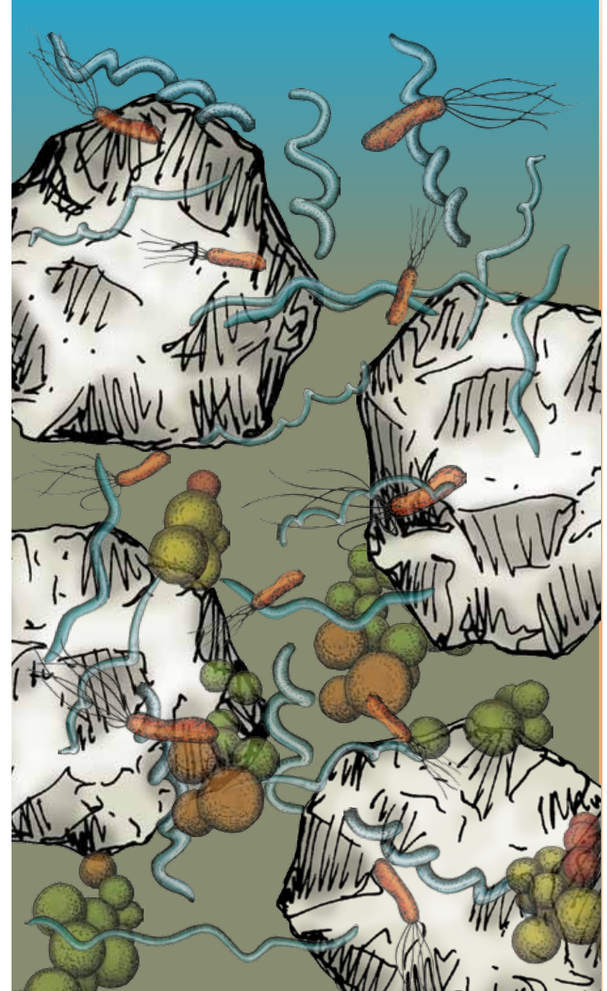
Certain light-loving bacteria start to bind particles together.



Once stabilised, other bacteria become part of the mat.



The new bacteria make it possible for yet more bacteria to live in the growing mat.



Adapted from PT Visscher et al 2012

Earth history

Microbial mats are the Earth's earliest ecosystems.

They have been around for over three billion years, more than 75% of the Earth's geologic history. Over the last two billion years cyanobacteria in microbial mats influenced evolution by breathing oxygen into the atmosphere.

During times of crisis, including the mass extinction ending the age of dinosaurs, microbial mats were among the last to be affected and the first to move into niches left empty by other species.

Extremophiles

Extremophiles live in extreme environments.

In this area the sun's ultraviolet radiation is extreme, Hamelin Pool is almost twice as salty as the sea, and it gets really hot. Also, the area between high and low tides alternates between being exposed to the air and under water.

Few predators and competitors live here to limit the numbers of extremophiles. In fact most plants and animals cannot tolerate such extremes so extremophiles like microbial mat communities have the place mostly to themselves.

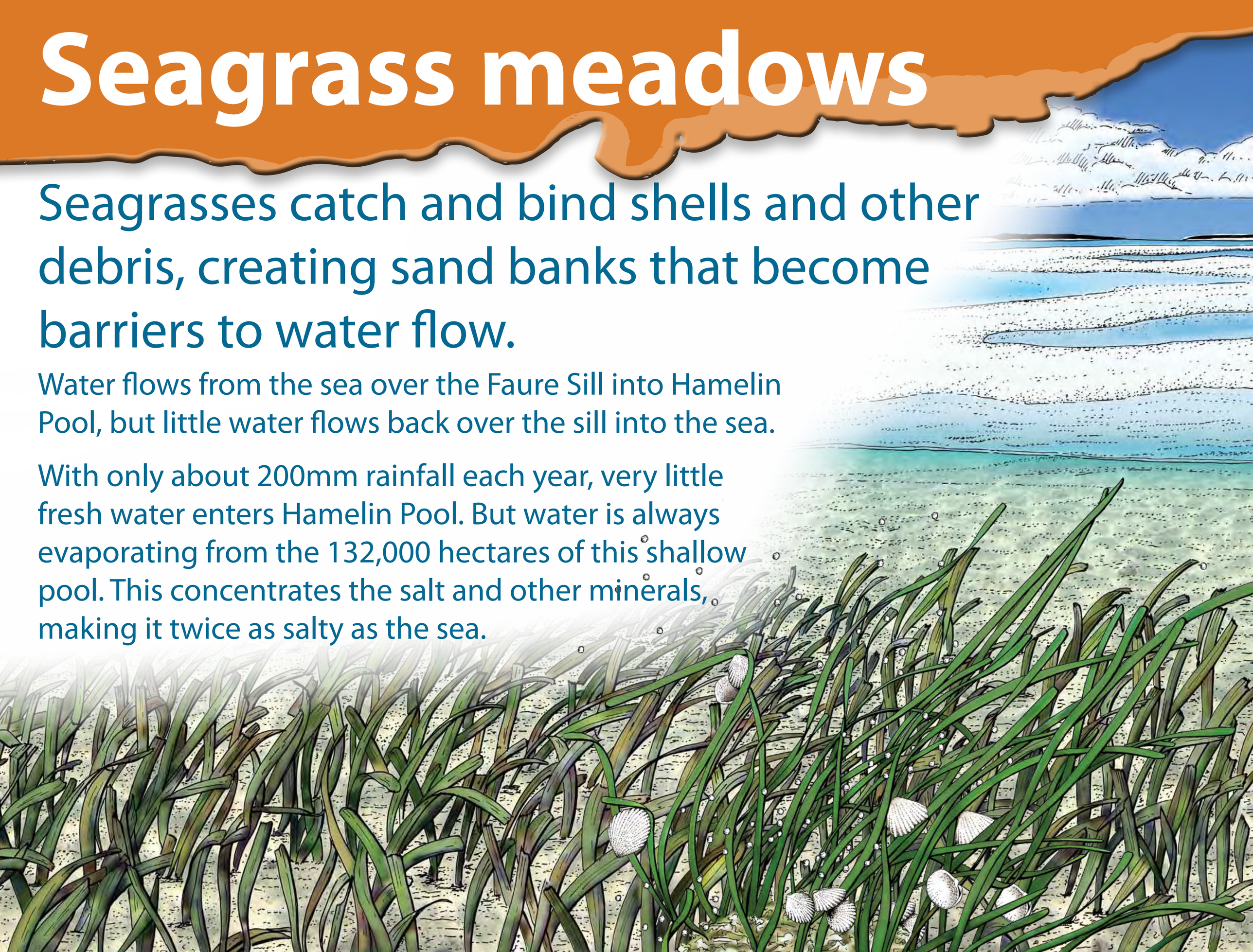
The salinity of Hamelin Pool is 55 to 70 parts per thousand and temperatures can exceed 45°C between December and March.

Seagrass meadows

Seagrasses catch and bind shells and other debris, creating sand banks that become barriers to water flow.

Water flows from the sea over the Faure Sill into Hamelin Pool, but little water flows back over the sill into the sea.

With only about 200mm rainfall each year, very little fresh water enters Hamelin Pool. But water is always evaporating from the 132,000 hectares of this shallow pool. This concentrates the salt and other minerals, making it twice as salty as the sea.



Shell stone

An animal that thrives in the super-salty water here is the fragum cockle.

In this hypersaline water the fragum cockle, *Fragum erugatum*, tends to be much smaller than the same species in regular seawater. But what they lack in size, they make up for in number.

With no competitors or predators, fragum cockles thrive here. There are so many that their shells pile up, compacting and cementing into coquina, a soft limestone rock.

Building blocks

Newcomers used coquina for building.

While Aboriginal people moved around following seasonal resources, European settlers took a different approach and made permanent homes.

From the early to mid 1900s, these shell blocks were a handy building material in this area.

Isolated port

Hamelin Pool was a small, isolated port servicing pastoral stations in the area.

This flagpole was a navigation marker for lighters - small, shallow-draught sailing ships that carried freight, mail and passengers between Hamelin Pool and larger vessels in deeper water.

By the mid 1900s road and rail transport improved so this landing was no longer used.