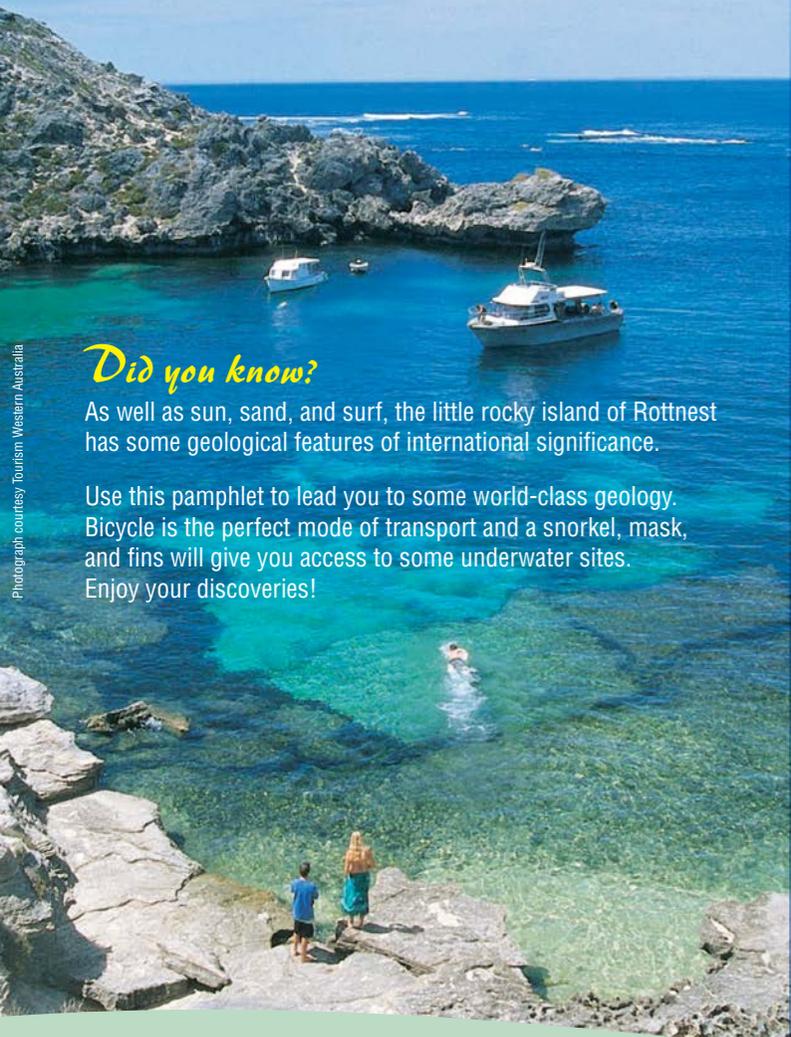


ROTTNEST ISLAND

a geology guide

Photograph courtesy Tourism Western Australia



About Rottnest Island

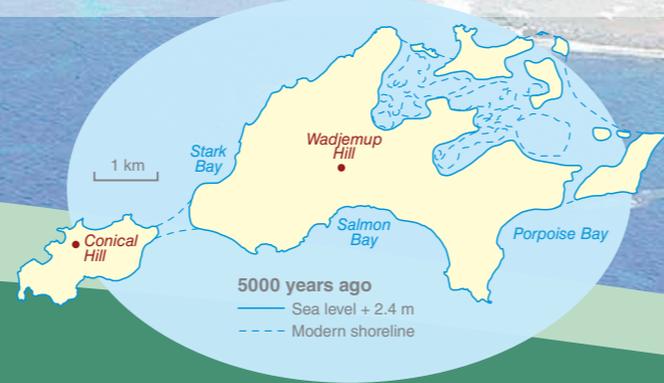
Rottnest Island tells the story of sea-level change over the last 140 000 years — when the sea was both higher and lower. Most of the island is Tamala Limestone, formed from coastal wind-blown sand dunes that built up when sea level was 130 metres below today's level, and the coast was 12 kilometres west of the island. Today the coast is 20 km to the east! From the lighthouse at Wadjemup Hill you can see younger, high-relief, steep-sided limestone dunes sitting on top of older, low-relief limestone dunes.

This side of the pamphlet tells you about some of the island geology. Turn over the page to see where you can view these geological features

Sea-level change

Higher level shoreline platforms and notches are conspicuous around the salt lakes, at about 2.4 m, 1.1 m, and 0.5 m above current sea level. They are now visible because the sea stayed at the same level for long enough to allow erosion to cut a platform, a notch, and an overhanging visor (see sketch). When the upper level platform formed, Rottnest Island was an archipelago made up of 10 smaller islands as shown on the map below (the present-day lakes were under the sea).

Sites to visit: Causeway, Mount Herschel



Coral reefs — new and old

There is a modern coral reef at Pocillopora Reef, offshore from Parker Point. *Pocillopora damicornis* is the dominant coral of 25 species. About 125 000 years ago, a similar coral reef grew at what is now Fairbridge Bluff. This fossil coral reef — named the Rottnest Limestone — is more than 3 m thick and is dominated by branching and platy forms of *Acropora* (now rare in modern reefs). There are also fossil brain and tubular corals, gastropods, and bivalves. The reef is heavily encrusted with coralline algae, which also form the reef framework. For the reef to grow here sea level must have been at least 3 m higher than at present.

Sites to visit: Pocillopora Reef, Fairbridge Bluff

Shoreline features

Rocky shoreline platforms are conspicuous features around the island coast. The platforms have been cut horizontally into the Tamala Limestone by a combination of wave action, saltwater weathering, and erosion by marine organisms. On the outer platform are distinct, rocky terraces called 'paddy-field' terraces. Irregular-shaped polygons with narrow borders of brown seaweed are due to the grazing habits of herbivorous reef fish. Where the rocky platform meets a cliff there is an undercut shoreline notch and overhanging visor (see sketch below) or a gently sloping, rocky ramp. Above both, there may be a narrow storm bench containing rocks and boulders flung up by the waves.

Sites to visit: West End, Radar Reef, Wilson Bay, The Basin



Stromatolites

Some of the best evidence for early life on Earth comes from fossil stromatolites that existed 3.43 billion years ago — which makes them nearly as old as the Earth itself! Stromatolites still live today. The floors and margins of the salt lakes have veneers of microbial mats that in places form living stromatolites. On the north side of Government House Lake the stromatolites grow in water up to 3 m deep, and are 10 cm high, sometimes 20 cm high, with growth rates of about 1.5 mm per year. Fossil stromatolites along the shoreline at the western end of Serpentine Lake are about 2000 to 3000 years old.

Sites to visit: Government House Lake, Serpentine Lake (see main map)

Salt lakes and swamps

You will notice that Rottnest's salt lakes are elongated to subcircular in shape (see background map). They formed from coalescing elliptical features thought to be the surface expression of dolines. The dolines formed when the large cave systems collapsed when sea level was much lower and rainwater and groundwater dissolved the roof limestone. When the sea level rose again, the dolines became lakes and were filled with sand and silt. The lake system is oriented from northwest to southeast, which reflects major subsurface faults. Eight small swamps on Rottnest Island are mostly in depressions between sand dunes in the central part of the island. Study of pollen samples from Barker Swamp enables the story of the environmental and climatic history of Rottnest Island over the past 7500 years to be pieced together.

Sites to visit: Government House Lake, Serpentine Lake, and Herschel Lake (see main map)





○ West End

What you will see: shoreline features with notch and visor, storm bench, algal polygons

The West End is an ideal place to see well-developed shoreline features. At Cape Vlamingh the inshore part of the wide shoreline platform is covered by algal polygons. A narrow storm bench at the foot of the cliff is partly covered by large blocks of limestone broken off and flung up by storm waves. Such a deposit is called a tempestite. At adjacent Fish Hook Bay there is a narrow storm bench above a shoreline notch and overhanging visor (see sketch over page).

○ Radar Reef

See: storm bench, shoreline ramp, algal polygons

Where the shoreline platform meets the limestone cliff there is a gently sloping shoreline ramp backed by a storm bench (see sketch over page) with an extensive deposit of tempestite. The limestone ramp has two zones: the seaward zone (area of maximum swash) is hackly and extremely rough (it hurts to walk on it with bare feet!) as it is created by saltwater erosion of the limestone; the landward zone has smooth, well-rounded features caused by deepening and widening of cracks in the limestone. Blue-green algae cover the landward zone. Algal polygons are a distinctive feature too.



Note: The map on this page highlights nine sites to visit to see some of the island's geological treasures

○ South Point

See: Tamala Limestone with cross-bedding

Just north of South Point, at the end of the track into Strickland Bay, the limestone cliff has been eroded to expose a cross-section of Tamala Limestone with convincing evidence that it formed from windblown (eolian) dunes of lime, quartz sand, and shells. These criss-cross layers formed as the sand dune migrated across the area from north to south. Here the layers are exceptionally well preserved.



○ Wilson Bay

See: 'paddy-field' terraces, algal polygons

'Paddy-field' terraces are a distinctive feature here. The rims are about 70 cm above the general level of the platform, and the waves cascade water from one terrace to another.

As well, algal polygons are beautifully developed (see West End photograph) on the inshore part of the shoreline platform — irregular pentagons and hexagons are outlined by the growth of brown seaweed. The shapes appear to remain unchanged over a long time and are due to the grazing habits of herbivorous reef fish, particularly Western Buffalo Bream. The fish graze up to a common boundary but do not invade a neighbouring polygon.

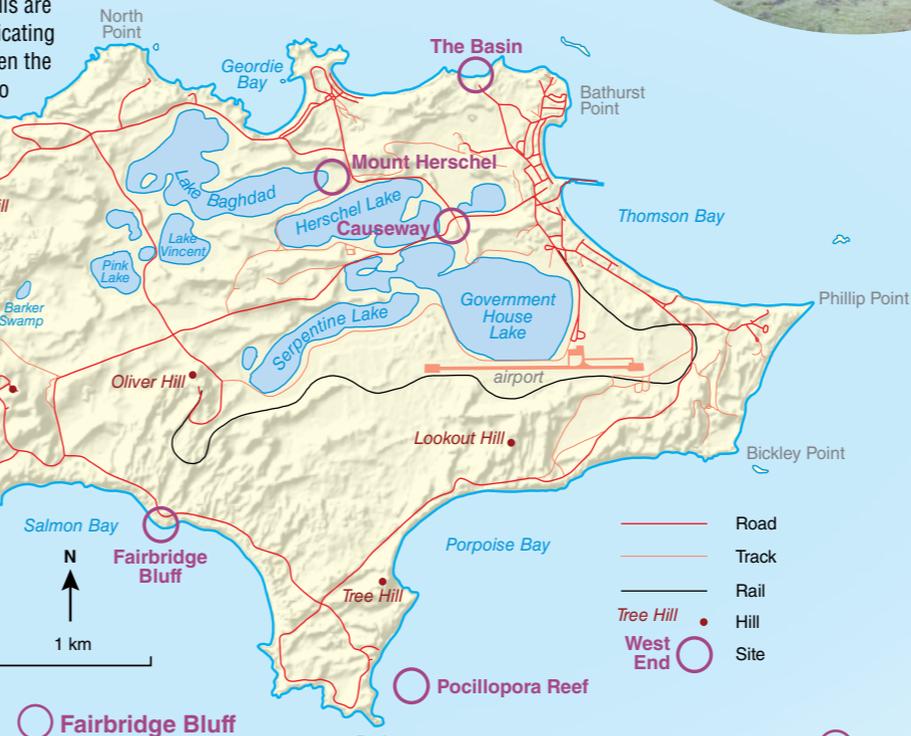


○ Mount Herschel

See: shell deposits

The Herschel Limestone, made up of shell deposits, is exposed in the quarry below Mount Herschel. The lower layer formed between 4800 and 5900 years ago when sea level was up to 2.4 m higher than today. This layer contains closed pairs of shells, suggesting the shells accumulated in a quiet-water environment in sea-grass meadows.

In the upper shell deposit almost all shells are singles, orientated convex upwards, indicating there were relatively strong currents when the shells were deposited as a beach 2200 to 3100 years ago when sea level was about one metre higher than today.



○ Fairbridge Bluff

See: ancient coral reef, gastropods in shelly limestones

The Rottnest Limestone fossil coral reef extends for about 200 m along the shoreline. You can see staghorn and platy varieties of the coral *Acropora*, and large colonies of brain coral. Shelly limestones are intimately associated with the reef, and contain abundant gastropods, especially the thick-shelled genus *Turbo*. Coralline algae encrust many corals and form the framework of the reef. The reef is 125 000 years old, and is now visible onshore as sea level has dropped.



○ The Basin

See: shoreline platform, notches and visors (see sketch over page)

The shoreline platform is very evident. It has a prominent raised rim on its outer edge where it is more strongly cemented by lime. As the rest of the platform is eroded the raised rim remains (see photo). You can count three shoreline notches and overhanging visors; each notch has its own fauna of molluscs, depending on their ability to withstand the waves and sea spray, and tidal exposure to the air.



○ Causeway

See: elevated shoreline platform with notch (sketch over page)

Three elevated shoreline platforms and notches are at the eastern end of the Causeway between Herschel and Government House Lakes. The upper platform is well preserved (cut when the sea level was about 2.4 m higher), but does not have a well-defined notch. You can see a thin encrusting layer of worm tubes on the limestone. The middle and lowest level notches are prominent as double notches. The lowest notch has a platform, cut when sea level was about 0.5 m above present level.



○ Pocillopora Reef

See offshore: Cauliflower Coral, brain coral

Pocillopora Reef extends offshore for about 500 m to the northeast from the cliffs at Parker Point, and can be accessed from the east side of the promontory or from the beach. The dominant species *Pocillopora damicornis* (Cauliflower Coral) is a hard coral that forms large colonies. There are 24 other species including brain, flowerpot, star, and mound corals. Pocillopora Reef is the southernmost coral reef along Western Australia's coast and was built by coral larvae that were probably swept south by the warm Leeuwin Current.

