LEEUWIN-NATURALISTE NATIONAL PARK AND SCOTT NATIONAL PARK

GEOLOGY

LANDFORM

The landform of the Leeuwin-Naturaliste National Park and of Scott National Park is in part dependent on the type of rocks that are present and on their structure.

The Leeuwin-Naturaliste National Park extends southward from Cape Naturaliste 96km to Cape Leeuwin, and is located mostly on what is known as the Leeuwin-Naturaliste Ridge. It is composed mostly of Precambrian hard, crystalline rocks (commonly called granite, but more correctly termed Granulite), capped by limestone and in places sand dunes.

The ridge is bounded on its eastern side by a fault in the earth's surface known as the Dunsborough Fault, the line of which runs north-south more or less parallel to the Bussell Highway.

Between the Dunsborough Fault and the higher ground east of Busselton, is a down-faulted block, filled with sediment and known as the southern part of the Perth Basin.

The coast between Cape Naturaliste and Cape Leeuwin is rugged with small sandy bays between rocky headlands. These headlands are composed of hard rocks which are the most resistant to erosion.

At Augusta, the Blackwood River discharges to the ocean through Hardy Inlet. The Inlet appears to be aligned generally north-south along the position of the Dunsborough Fault. Eastward of the Inlet is the Scott Coastal Plain comprising a low-lying swampy region with some sand dunes.

Within the Leeuwin-Naturaliste National Park three main episodes of geological events can be seen.

1. PRECAMBRIAN

The first sequence is of ancient Precambrian granulite and granite gneiss which forms the headlands of the coast and which underlie elsewhere on the Ridge the softer limestone. The granulite, which is sugar-like in texture is related to the granite rocks which comprise much of the southern part of Western Australia. Granite gneiss is a rock where the minerals look platy and appear to be drawn-out into fine bands. This rock is more common toward Cape Leeuwin.

These rocks form the Yilgarn Block of Western Australia and have ages ranging from 2,000 million to 650 million years before the present.

The word Precambrian means rocks older than the Cambrian Period which commenced some 600 million years ago, and which represents the time when shell secreting organisms became prolific in the oceans of the world. From the Cambrian period onward, fossils of the hard-parts of animals, found in sediments, record the evolution of life on earth.

The time before the Cambrian is known as the Proterozoic Era, which extended back to 2,500 million years before the present. This age was characterised by considerable volcanic activity over much of the earth and it is when the most primitive life-forms started to appear. These were mostly blue-green algae and jelly-fish like animals.

1. *Conspicuously bedded aeolian limestone near Bunkers Bay. Thick, hard layers of heavily calcified limestone are interbedded with softer, poorly cemented limestone; the latter has eroded away, leaving distinct gaps between the layers.*

2. *Gneiss boulders on the coast near Bunkers Bay. These rocks represent the old gneiss land surface before the aeolian limestone was laid down on top. These were cemented together by the limestone which later formed.*

The epoch of time before the Proterozoic was the Archaean, thousands of millions of years in length during which time the shape and crust of the earth were formed.

Many of the rocks older than the Cambrian period are hard and crystalline and appear to have developed deep within the earth from the solidification of magna.

These rocks are usually called Igneous because they have formed through the melting and reconstitution of the upper layers of the crust, in places of high temperature and high pressure.

The granitic rocks of the South West of Western Australia (which are mostly of Archaean Age), including the similar ones in the Leeuwin-Naturaliste National Park developed this way during the early stages of the earth's evolution.

The age of the original rocks comprising the Leeuwin-Naturaliste Ridge is not known, but it is thought that about 670 million years ago, there was a period when they were affected by a new violent phase of high temperature and pressure.

This activity which is known as tectonism caused the older rock, which may have been granite, to buckle, to take on complex shapes, and to change its composition of minerals. The process of transforming rocks into new types is called metamorphism.

Many of the headlands where this "new" rock is now exposed, show that it is folded and layered. This means that the rocks have been pushed into contortions and elbow like shapes, with the elbow pointing in a northerly direction. Additionally, if the rocks are viewed from the side they tend to appear to be made up in layers.

Furthermore, during this period of intense movement, some of the older rocks remained only partly changed and are included with the granulite material.

Where they are present, they are known as xenoliths. Also there are bands of very much darker rock which are made up of different minerals from the other paler ones and these dark rocks may also be xenoliths. Often they are aligned along the common trend direction, north-south.

Some bands of this darker material which is comprised of the minerals hornblende and plagioclase, are very long and are more easily eroded by the effects of wind, rain and sea action than the harder granite-like rock. In places therefore, it can be seen that the bands have been cut through by the sea.

Many of these bands run parallel to the present coast and also to the Dunsborough Fault. The erosion of them has allowed some islands to develop. The best example of this is at Canal Rocks, south of Yallingup.

The age of 670 million years before the present, for the tectonic event is calculated by measuring relative amounts of radioactivity in some of the minerals making up the granulite, and comparing the data with the known time it takes for the radioactive elements to break down.

2. TAMALA LIMESTONE

Capping the Precambrian rocks is a limestone formation known as the Tamala Limestone. Until recently, this rock which is common from Shark Bay around to the South Coast, was known as the "Coastal Limestone." The sequence is very much younger than the underlying granulite and granite gneiss.

The Tamala Limestone is thought to be of late Pleistocene age, probably younger than 100,000 years before the present. The formation which only occurs near the coast, is at its thickest on the Leeuwin-Naturaliste Ridge, where it is well exposed in a number of localities, particularly at Cowaramup Bay and Hamelin Bay.

The Tamala Limestone consists of fragments of shells and variable amounts of quartz sand. The calcareous or lime material from the shells has formed a cement binding the material into a rock. It is apparent from large-scale cross-bedding that the rock was laid originally as a series of sand dunes. Erosion of the formation in places, has cut cross-sections through these ancient dunes, exposing the layered structure that is to be expected from successive deposits of sand and shells blown-up by the wind from the shore.

It can often be seen that there have been a series of dunes developed one on top of the other, sometimes with a break in deposition between one layer and the next. Where this has occurred, erosion may have cut-away or truncated the top of the existing dune before the next one was laid-down. As a result, the successive strata appear to be crossing, and the structure in consequence, is called cross-bedding.

The limestone is very easily dissolved by moving water and caves have occurred particularly in the thicker sections of the formation.

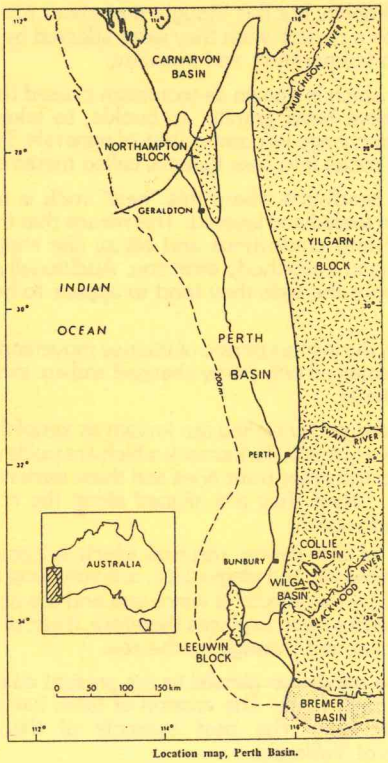
The Leeuwin-Naturaliste Ridge is noted for its caves which contain not only magnificient structures (like stalactites and stalagmites) but also skeletons of extinct animals.

The fauna in Mammoth Cave includes the skeletons of many animals now extinct in Western Australia. The fauna includes a wombat, a marsupial lion, the Tasmanian Tiger and the koala, among others.

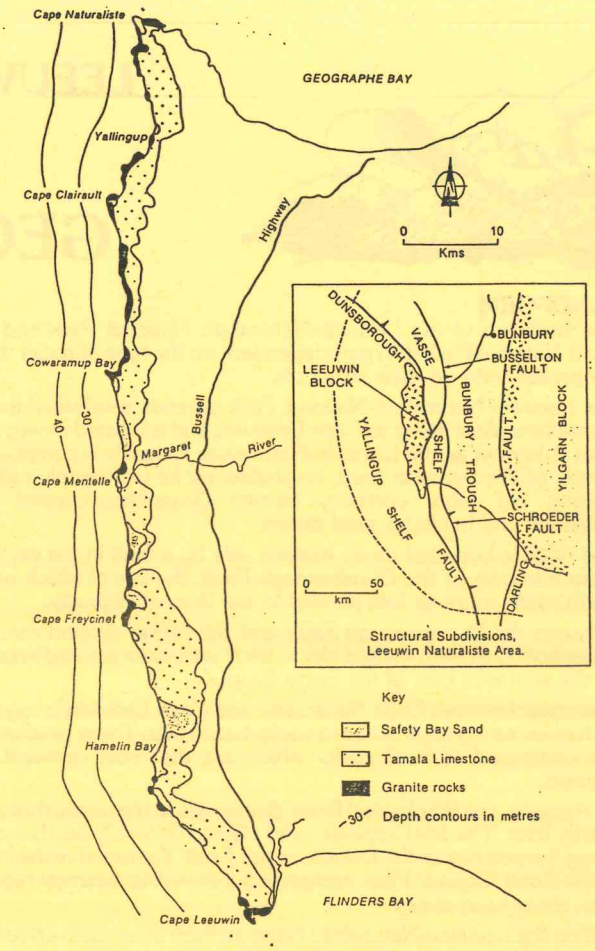
The age of this material has been dated at 37,000 years old.

The Tamala Limestone occurs up to 6km inland from the coast. Further east it underlies more recent soil horizons, but it probably did not persist beyond the Dunsborough Fault.

The flatter parts of the Leeuwin-Naturaliste Ridge are capped with thin laterite or iron-stone (gravel), which is also very common eastward as a topping on the sediments of the Perth Basin.



Location map, Perth Basin.



Source: Geological Survey of W.A. Bulletin 124.

Geology of the Leeuwin- Naturaliste Area

A younger and thicker form of laterite occurs in the Scott River area. Sometimes this material is known as sponge iron-ore, as it is relatively rich in iron oxide (up to 54.6 per cent iron).

3. HOLOCENE

The Holocene is the most recent age of rock formation, from 10,000 years ago to the present.

On the Leeuwin-Naturaliste Ridge it is represented by sand dune systems, many of which have not yet consolidated into rock.

The dunes are of calcareous sand that are still mobile in places, although fixed by vegetation, in other localities. The largest dune mass is the Boranup Sand Patch near Augusta.

The Scott Coastal Plain is characterised by swamp deposits of clay and silt. Some of the swamps are being choked by mobile sand dunes and by material brought down by the Blackwood River. This has caused the drainage pattern of the land to change. As a result the shape of Swan lake and the Deadwater east of Hardy Inlet have altered a number of times since the 1830s. Additionally, the position of the mouth of Hardy Inlet has changed frequently, even over the last few decades.

ADDITIONAL READING:

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