STORIES IN STONE

ROBBEN ISLAND

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This description of the rocks of Robben Island is based largely on Theron, J. N. & Hill, R. S. 1990. *Geologiese beskrywing van Robbeneiland*. Guidebook for the excursion of the South Western Cape Branch of the Geological Society of South Africa 16 November 1991. Geological Society of South Africa. (Translated from the original Afrikaans and updated by Dr J. Rogers 2001).

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Previous page: Archaeologist David Halkett contemplates sampling slabs of Malmesbury slate wedged from the edge of the outcrop in the historical Van Riebeeck's Quarry at the southern end of Robben Island

ROBBEN ISLAND

Although private tours are not allowed on Robben Island, many of the features described here are visible on Google Earth (north to the right).

Robben Island lies about 7,5 kilometres from Bloubergstrand and 9,5 kilometres from Moullie Point. It is roughly oval in shape with a north/south axis of about 3,4 kilometres and a width of just over 2 kilometres. The maximum height above sea level is about 30 metres. The coastline is predominantly rocky, with the only sandy beach south of the harbour in Murray's Bay. The coastline consists of outcrops of rock of the Tygerberg Formation, a subdivision of the Malmesbury Group. Rocks of the Tygerberg Formation are exposed at Tygerberg, Bloubergstrand, Robben Island, Signal Hill, and from Granger Bay to the famous contact with the granite at Sea Point. These rocks consist of greywacke (gritty), phyllite (shaley), and quartzitic sandstone, with the volcanic layers of the Bloubergstrand Member exposed on the coast at Bloubergstrand. They are Late Precambrian, about 850 to 550 million years old, and were formed by sedimentary deposition and volcanic activity on a growing submarine delta. The surface of the island is covered with sandy limestone and calcrete of the Langebaan Formation, and shelly sand dunes of the Witzand Formation. The Langebaan Formation is Pleistocene, less than 1,6 million years old. It is exposed generally along the West Coast and represents cemented calcareous dunes of various ages. The Witzand Formation is Holocene, less than 10 000 years old, and consists of recent and modern coastal dunes.

The metamorphosed sedimentary rocks of the Tygerberg Formation on Robben Island are similar to the exposures between Green Point and Sea Point, but are less intensely thermally metamorphosed (baked) than the latter, which are closer to the contact with the intrusive granite.

Metamorphosed and highly tilted Malmesbury Group rocks of the Tygerberg Formation near the southern end of Robben Island

The Robben Island rocks consist of alternations of dark grey to greenish greywacke (gritty), siltstone, and phyllitic (micaceous) shale. The layers vary from about 0,5 to 2 metres thick. These rocks contain mainly mica and scattered quartz and feldspar grains.

Between Ladies' Rock and Long Bay the rocks show cross-bedding, ripple marks, graded bedding, loading deformation, and other signs of soft-sediment deformation. There are also a few more massive layers of quartzitic sandstone up to 3 metres thick.

Gently folded surface of Malmesbury slate in Van Riebeeck's Quarry with well-preserved current ripples

Between Minto Hill and the coast at the southern end of the island there is a quarry known locally as Van Riebeeck's quarry. Rock from this quarry was used for some construction at the Castle in Cape Town, including the front portal. Most of the rocks of the island have been folded tightly and generally have a strong cleavage along which they fracture easily.

The cleavage direction tends to be parallel to the axial plane (through the crest) of the folds. This quarry, and another further north at Rangatira Bay, is situated at the crest of a fairly broad anticlinal (up-arching) fold where the rocks are less deformed. This arch is clearly visible at the southwestern end of Van Riebeeck's quarry, where the curved floor displays well-preserved ripple marks and small cross-cutting faults. In both quarries one particular layer, a hard blue slate approximately 1 to 2 metres thick, is more massive and appears to have resisted deformation more strongly. This has been quarried selectively down to the ripple-marked floor.

Drill holes in the Malmesbury slate at Rangatira Bay

The quarrying operations involved drilling lines of holes parallel to the jointing, plugging the holes with an expanding material like wooden pegs that swell when wet, and splitting the rock into large blocks bounded by the bedding planes top and bottom, and by the joint planes at the sides. Some of the split blocks with plugged holes are still visible in situ in Van Riebeeck's quarry. At the Rangatira Bay quarry rows of holes on exposed cleavage surfaces rounded by wave action are visible in the smoothly polished rocks in the intertidal zone outside the protective sea-wall. Evidently quarrying started in the intertidal and moved inland, following the desirable, hard, blue slate.

The distinctive white bands in the slate at Van Riebeeck's Quarry allow this material to be identified in several historical buildings in Cape Town.

At both quarries this horizon contains a distinctive white band showing characteristic contortions and cross-sections of ripples. A similar white band can be seen in the rocks originally forming the uprights of both sides of the entrance to the Castle of Good Hope, and in floor tiles of several old buildings in Cape Town, including the Castle. Microscopic examination of petrographic thin sections to determine the mineralogy has shown that this distinctive material originated from Robben Island.

On a large scale the Malmesbury rocks on Robben Island form a broad open synclinal (trough-like) fold with a N 30° W trend, following the regional structural trend in these rocks in the Western Cape.

Locally the rocks tend to be tightly folded with dips up to 65°, with the exception of the resistant rocks exposed in the two slate quarries. There are a number of north to northwest trending faults with associated brecciated fault zones exposed at various places, between Edmond's Pool and Long Bay, north of Long Bay, at Rangatira Bay, and at the northern-most point of the island.

Long Bay owes its existence to the presence of an eroded dolerite dyke with an approximately east/west trend. Typical spheroidal weathering has created rounded boulders in the intertidal zone. The dolerite, a dark, medium-grained, igneous rock, contains the pyroxene augite and plagioclase feldspar, as well as minor amounts of biotite, olivine, quartz, ilmenite, and magnetite. There are similar dolerite dykes exposed on the Cape Peninsula, possibly Carboniferous to Jurassic (345 to 135 million years ago) in age, but representing at least two intrusive episodes of differing age. Their possible relationship to the well-known Karoo dolerites is unresolved.

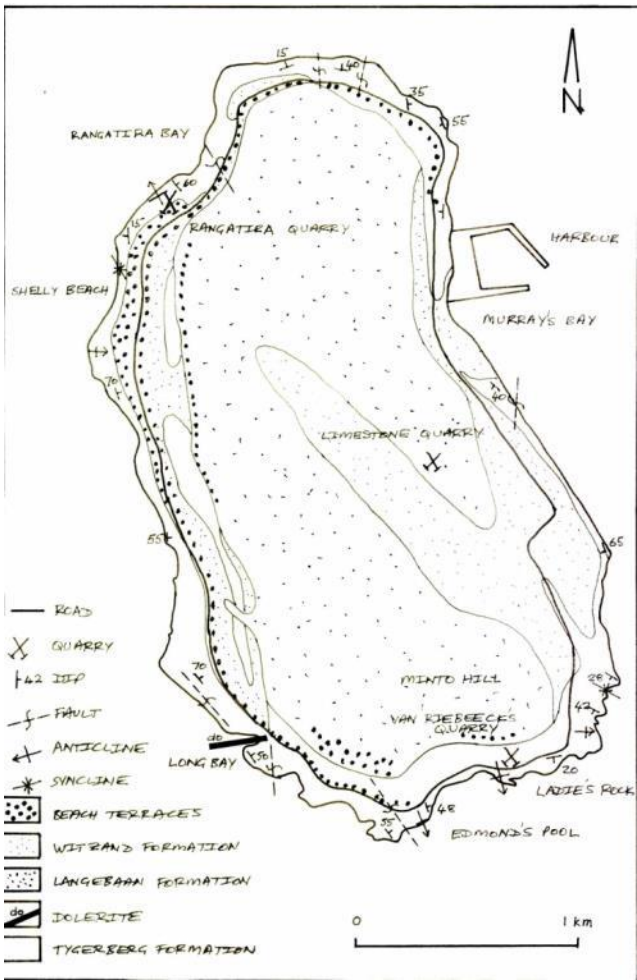
The dark boulders of a weathered dolerite dyke, forming the inlet of Long Bay on the western shore of Robben Island

The interior of the island is blanketed by calcareous sandstone and limestone of the Langebaan Formation, in places overlain by sand. The Langebaan Formation limestone is light grey to cream coloured, is varied in grain size, and contains fragmented shell and visible quartz grains. The degree of consolidation is also variable as can be seen in the old lime quarry near the centre of the island. This quarry is in a consolidated calcareous dune deposited by primarily southerly palaeo-winds. During the Pleistocene, the last 1,6 million years, sea-level varied greatly in response to fluctuations in ice volume at the poles and in mountain glaciers. For instance, at the height of the last glacial period around 17 000 years ago the sea-level around Cape Town was about 130 metres vertically lower than at present and the coast was many tens of kilometres further west. Robben Island was then a low hill, connected to the Blouberg by a ridge (now about 15 metres below sea level), with the Salt and Diep Rivers flowing down a wide valley north of Cape Town. At such times of low sea-level huge amounts of calcareous sand were exposed on the former sea floor and available for wind erosion and redeposition.

The light-coloured, calcareous, but unconsolidated coastal dune sands belong to the Witzand Formation. On the West Coast strong southerly summer winds are responsible for the formation of long tongues of sand moving inland in a north westerly direction where the coast is not protected by cliffs. The dunes at Hout Bay are a familiar example. On Robben Island there is an example north of the sandy beaches of Murray's Bay.

At times during the Pleistocene and Holocene relative sea-level was higher than at present. These relative high stands of the sea left wave-cut platforms and elevated beach terraces at numerous places along the Cape Peninsula and the West Coast. Old beach deposits of indeterminate age occur on Robben Island on wave-cut platforms at about 6 to 9 metres above present mean sea-level between Ladies' Rock and Long Bay, and at Shelly Beach. These terraces are associated with rounded cobbles and gravel, as well as shell deposits, some of which are partially cemented by calcrete. A lower, presumably more recent, terrace occurs at about 3 to 4 metres above present mean sea-level between Edmond's Pool and Rangatira Bay.

The shell deposits exposed at the seaward edge of this terrace were probably deposited by storm waves about 5 000 years ago when relative sea-level was about 2 to 3 metres higher around southern Africa. They were quarried historically to be burned for lime to make cement and whitewash.



Sketch map of Robben Island showing places mentioned in the text

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