

# Muriwai's pillow rocks tell of ancient undersea eruptions



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## ON THE ROCKS

**M**URIWAI, on Auckland's west coast, attracts thousands of visitors each year. They once came primarily for beach activities, such as surfing and digging for their quota of oheroa.

Nowadays more are attracted to the cliffs at the south end of the beach, where they come to abseil, to hang-glide, or to observe the swelling gannet colony.

The cliffs themselves attract their own brand of visitor, who comes to marvel at the spectacular rock formations called pillow lavas. Since they were first recognised and documented in the 1930s by an Auckland University geologist, the late Professor Bartrum, a steady stream of New Zealand and overseas geologists has come to Muriwai to see some of the best examples anywhere in the world of these ancient undersea lava flows.

The rocks that form the cliffs south of Muriwai accumulated 16 to 17 million years ago on the seafloor on the lower north-eastern slopes of the large, active Waitakere Volcano.

Twenty kilometres or so to the west, the top of the Waitakere Volcano stuck out above the ocean waves as one or more periodically erupting is-

lands. Since then, the Muriwai area has been uplifted above sea level and most of the Waitakere Volcano out to the west has been eroded away.

Seventeen million years ago, the Muriwai area was 1000m to 2000m deep, with layers of sand, mud and ash accumulating on the sea floor. These sediments were largely derived from eruptions and erosion of the Waitakere Volcano. Occasionally a large underwater lahar of volcanic cobbles, pebbles, grit and mud would sweep down the undersea slopes of the volcano and deposit a layer of coarser debris over the seafloor in the Muriwai vicinity.

On several occasions, molten hot lava came up feeder pipes from the Waitakere magma chambers deep within the crust and spewed out as lava flows onto the seafloor in the Muriwai area.

**U**NDER the sea, viscous lava often produces a kind of flow distinctly different from any that forms on land. They have steep fronts and sides and are composed of hundreds of elongate, interconnecting lobes, 0.2 to 3 metres in diameter and elliptical or circular in cross-section. These branching, finger-like lobes are fed by larger tubes, 50m or more in diameter.

These flows are known as pillow lavas because of their appearance when seen exposed in cliffs like those at Muriwai. In cross-section each lobe (or pillow) appears as a subcircular packet of cooled lava with a distinctive pattern of radiating joints, enclosed within a black, glassy skin.

This structure develops when the hot lava is extruded into cold sea water. The outside of each lobe is rapidly quenched, forming a black, glassy skin around the molten lava which confines the

lava within the narrow lobes as it flows along. The skin sometimes breaks and another lobe may branch off. Later, as the lava inside the lobe slowly cools to form rock, it contracts and the distinctive radiating joints are formed.

The main pillow lava flow at Muriwai is seen high in the cliff above Maori Bay, the small beach just to the south of the gannet colony. Here it is seen as an eroded cross-section through a flow that was possibly several kilometres long. It consists of several large, solidified tube feeders, 30m to 50m in diameter, each with a giant fan of radiating cooling joints.

These large tubes are surrounded and separated by a mass of smaller lava lobes. The tubes and surrounding lobes together flowed across the seafloor and built up the pillow lava flow over a period of perhaps several weeks.

The large internal tube feeders acted as conduits for the molten lava which was fed to the small lava lobes along the advancing front.

In several places we can see that more fluid lava broke through the front of the flow and spread out as a thin sheet over the surrounding seafloor before being buried by still further pillow lava lobes.

The car park above Maori Bay is located in an old quarry. In the 1950s to 1970s the Waitemata City Council quarried deeply into one of the large tube feeders for road metal. The fan of radiating joints can be viewed in the old quarry face together with some of the smaller surrounding pillow lobes.

A local Maori Bay Preservation Committee fought for many years to have quarrying stopped. They eventually succeeded in the 1970s and the internationally important pillow lavas were added to Muriwai Regional Park for protection.

### Pillow lava flow in cliffs north of Muriwai

