Processes at the Headland at Muriwai

Thousands of years ago when sea levels dropped over years at the Southern end of Muriwai, the sedimentary rock and sandstone was exposed to the air. Rock from volcanic activity mixed with the sedimentary rock; this is called Breccia – a mixture of all rock. An example of this is at Maori Bay.
Coastal Erosion operates at different rates and different times. Limestone rock is eroded slower than sedimentary rock. The cliff at Muriwai made of sedimentary rock was eroded back to expose 'Fisherman's Rock' - the shore platform which, made of limestone – tended to erode back slower than the cliff.

The Otakamiro headland is composed of Manukau Breccias, conglomerates of moderate hardness, some softer sandstone strata and quite resistant volcanic intrusions.

At Muriwai, the cliff's conglomerate rock is broken down by the crystallising salt spray to create a powdery surface that looks like a layer of dust on the rock. The wetting and drying processes means the rock surface shrinks and expands. The cliffs in many places show smooth concave shapes and a 'visor' overhang.

Motutara Stack was built up by geological processes. It was eroded away from Otakamiro point by wave erosion and weathering.

Muriwai beach experiences high wave energy due to the large fetch (2000km) across the Tasman Sea. The strength and duration of the wind tend to be high, therefore creating waves with 300,000 to 500,000 joules of energy per square metre of wave front.

The prevailing wind direction is from the south west and blows over 11 knots 42% of the time.

The waves reach Otakamiro Point before the rest of the beach as it juts out into the sea. Energy is focused here as the waves refract around the headland, attacking it from 3 sides.

Just above high water level on Motutara Stack is where most of the wetting and drying occurs. Wetting and drying of the rock causes it to expand and contract and over time, the rock is weakened leaving it vulnerable to wave erosion.

As waves hit Motutara Stack with enormous force, air is trapped and compressed into the small cracks and weaknesses in the joints of the manukau breccias. As the wave retreats the air expands explosively and rock fragments shatter off. This continues to work on the weaknesses in the rock and eventually caves were formed in the area between the current stack and the headland. This was an area of less resistant rock.

Corrosive action occurred in the caves and at the base of the headland. This process resulted in undercutting. Notches are clear evidence of corrosion. Over time the notch widened and land above it became unstable and collapse. Caves were enlarged through continued hydraulic action and corrosion. The cave eventually was eroded through the headland to the other side forming an arch which later collapsed.

Wave attack erodes the softer rock and attacks the cliff leaving the more resistant rock. As the width of the platform increases, the waves become shallower and less able to attack the cliff leaving a platform.