TE PĀTAKA O RĀKAIHAUTŪ BANKS PENINSULA GEOPARK
STORIES FROM THE LANDSCAPE

Formation of Whakaraupō / Lyttelton Harbour

- Volcanism
- Erosion
- Return of volcanism
- Sea level
- Ongoing processes

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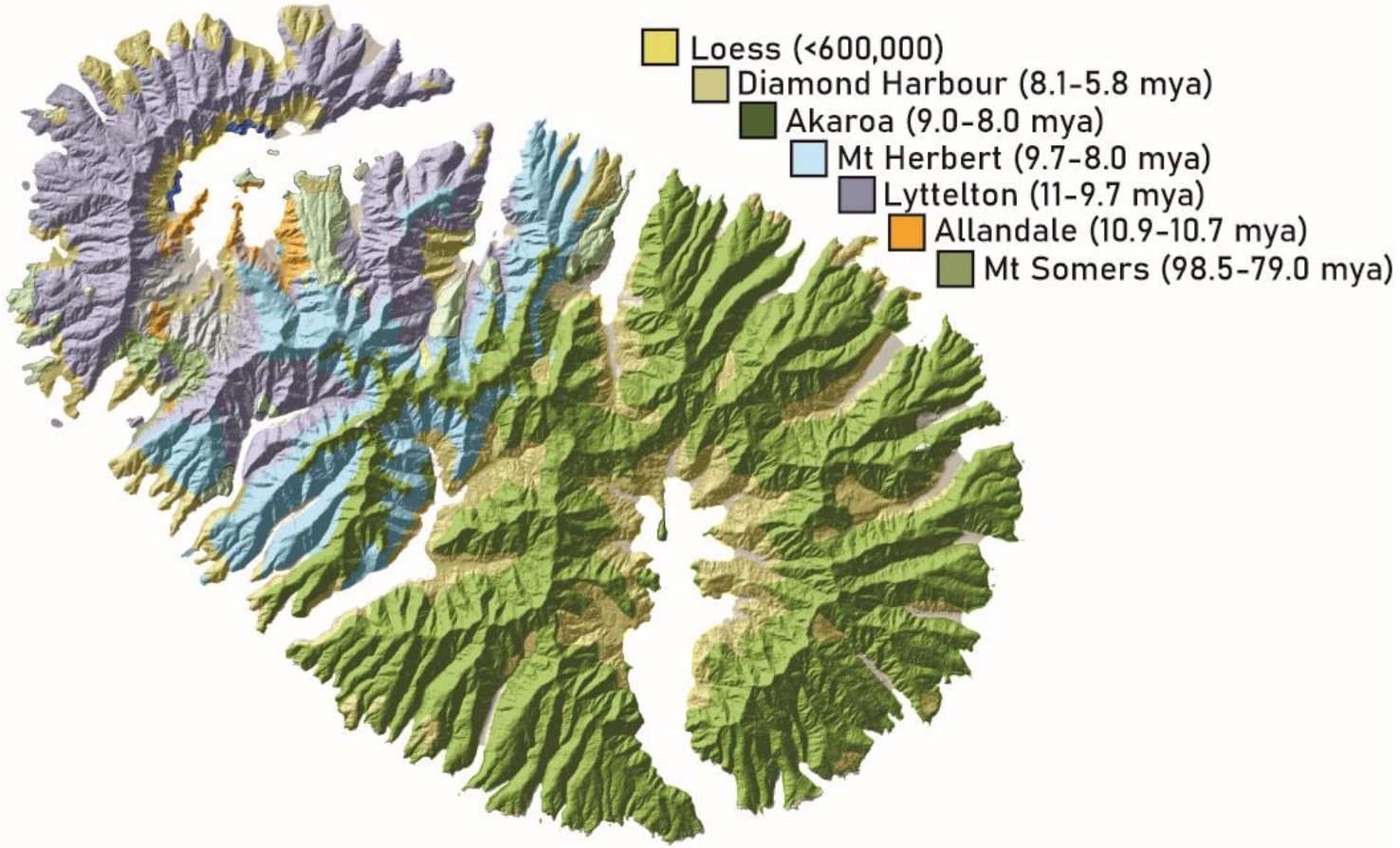
Significance

Todays eroded remnants of the Whakaraupō / Lyttelton Volcanic Complex, formed by volcanic eruptions between 11 and 9.7 million years ago.



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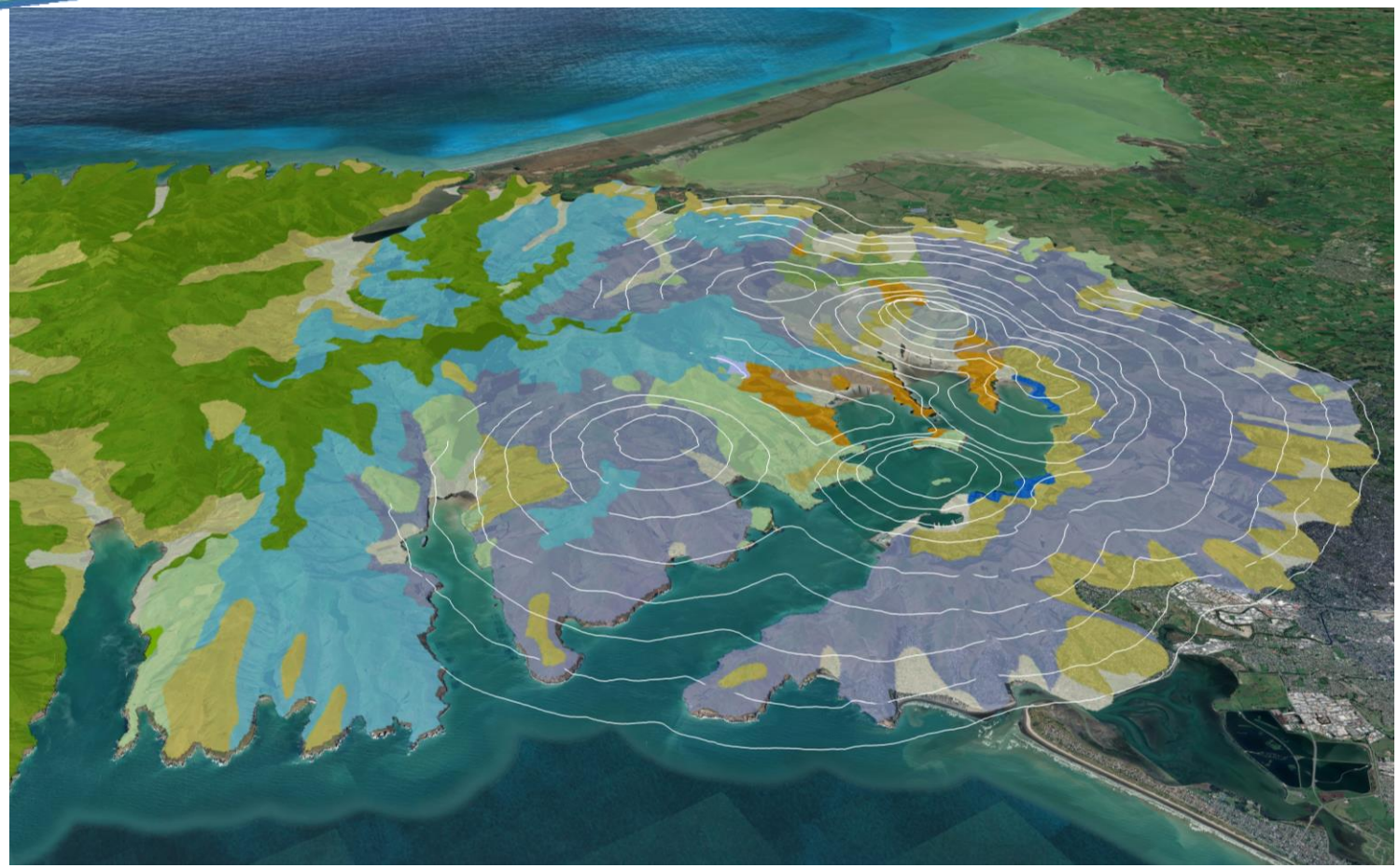
Volcanic Complex

The volcanoes that formed this volcanic complex reached heights of 1500m, almost three times the height of the present day eroded crater rim.



Projected Whakaraupō / Lyttelton Volcanic Complex (Adapted from Hampton 2010).

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Whakaraupō Valley

The narrow entrance to Whakaraupō / Lyttelton Harbour was once a valley between volcanic cones extending up to the summit region.

For two million years Whakaraupō valley progressively ate into the flanks of the volcano towards the central crater region, forming the expansive upper harbour, and became the main drainage network.

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Volcanic Sequences

Livingstone Bay dyke, Awaroa / Godley Head exposures.

Today, the volcanic sequences, (layers of lava flows, ash horizons, scoria cones, and intrusive dykes), are exposed along the cliff sequences of Awaroa / Godley Head and between Te Pohue / Camp Bay and Te Piaka / Adderley Head, of Whakaraupō / Lyttelton Harbour.

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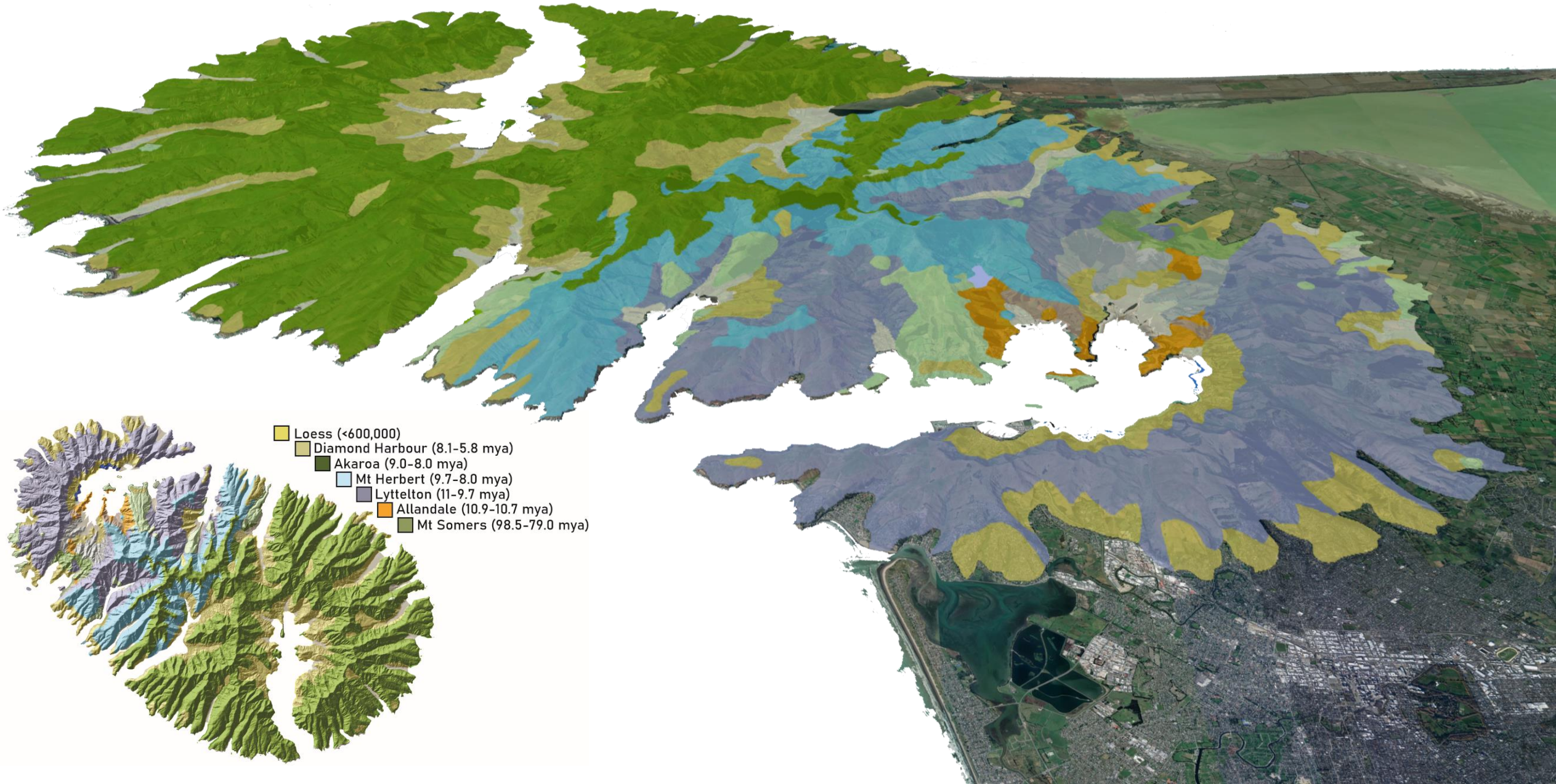
Whakaraupō Valley

As the volcanoes of Whakaraupō / Lyttelton eroded, volcanism shifted eastward, erupting Te Ahu Patiki / Mt Herbert and the Akaroa Volcanic Complex. Volcanism returned to this side of the Peninsula around 8 million years ago, erupting into the eroding crater of Whakaraupō.

By then Whakaraupō had enlarged, with erosion working deep into the heart of the volcano, removing rock, exposing the internal plumbing network (volcanic dykes) that once brought magma to the surface.


Loess (<600,000)
Diamond Harbour (8.1-5.8 mya)
Akaroa (9.0-8.0 mya)
Mt Herbert (9.7-8.0 mya)
Lyttelton (11-9.7 mya)
Allandale (10.9-10.7 mya)
Mt Somers (98.5-79.0 mya)

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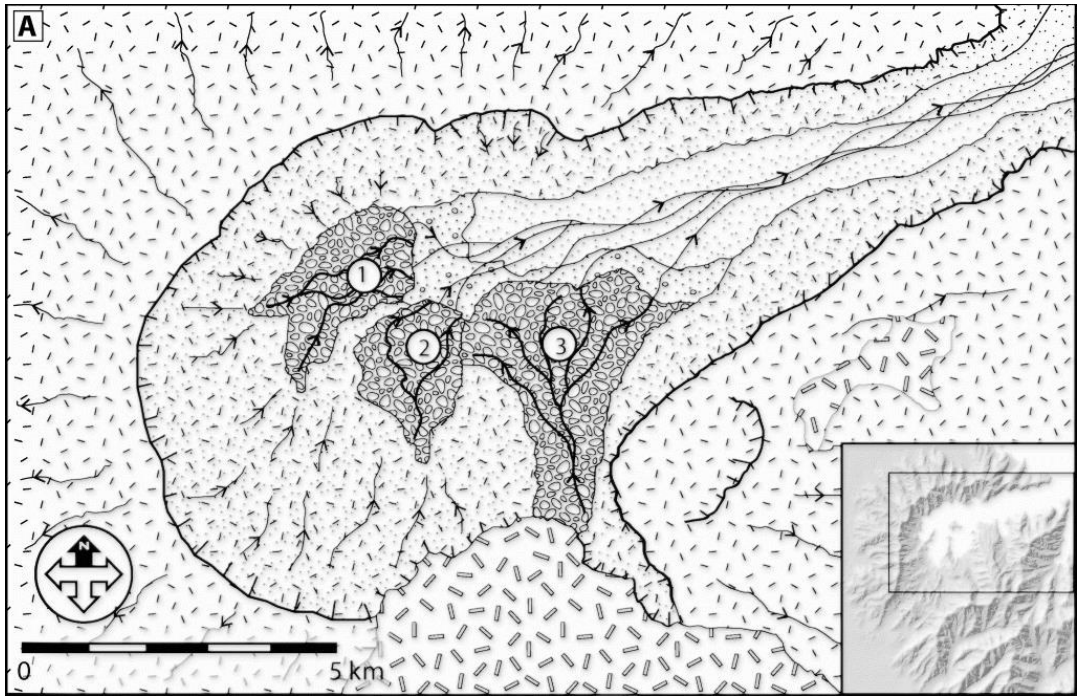

Drainage network of the eroding Whakaraupō (from Hampton, Cole and Bell 2012).

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Whakaraupō Valley

This was a landscape not dissimilar to today, a broad open crater with local high points, but had large braided rivers draining out to Te Moana-nui-a-Kiwa / Pacific Ocean via the deeply cut Whakaraupō valley.

Ōtamahua / Quail Island was only a collection of low hills, and the rhyolite and sandstone ridgelines (now headlands) of Kaitangita /Mansons Peninsula and Moepuke / Potts Peninsula framed the drainages from the upper crater. It was in this landscape that volcanism returned.

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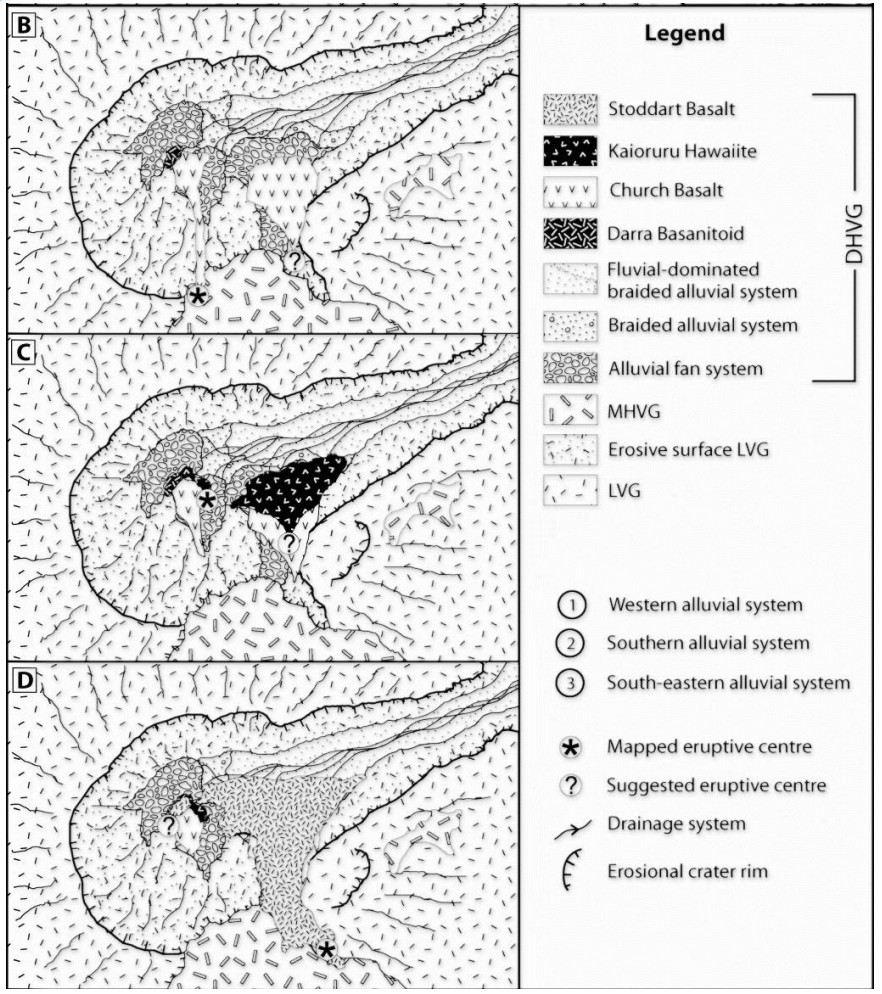
Crater Eruptions

Eruptions began around 8 million years ago and lasted until 5.8 million years ago, and changed the shape of the harbour, forming the iconic landscapes of Ōtamahua / Quail Island, Te Waipapa / Diamond Harbour, Purau, Ripapa, Inainatu / Pile Bay and Kamautaurua /Kamautaurua Island.

The largest of the eruptions flowed from an area beneath the summit of Te Ahu Patiki / Mt Herbert into Whakaraupō.



Eruptions within the eroding Whakaraupō (from Hampton, Cole and Bell 2012).

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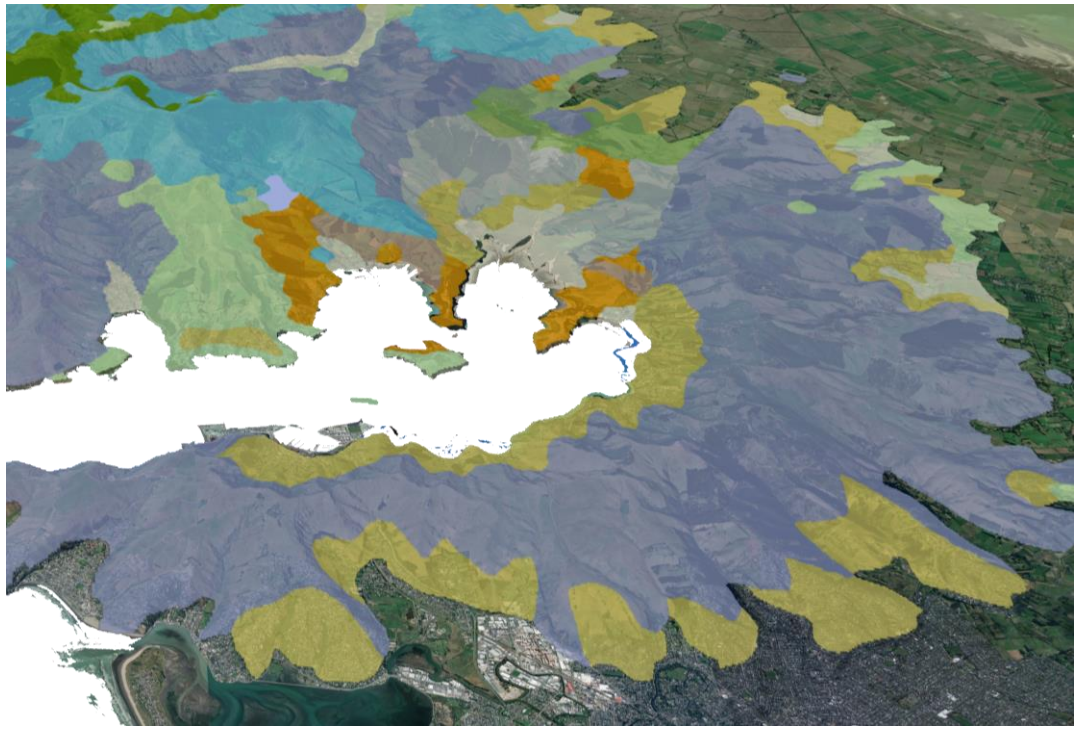
STORIES FROM THE LANDSCAPE

Lava Flows

A sequence of lava flows descended from the slopes above, into the eroded Whakaraupō, forming a tongue of lava that, extended to Inainatu / Pile Bay and across to Kamautaurua /Kamautaurua Island.

This lava sequence over the last millions of years have been eroded, the crater carved deeper, and the connection of the lava flows lost.



Light green represents the lava flows that entered Whakaraupō


Google Earth

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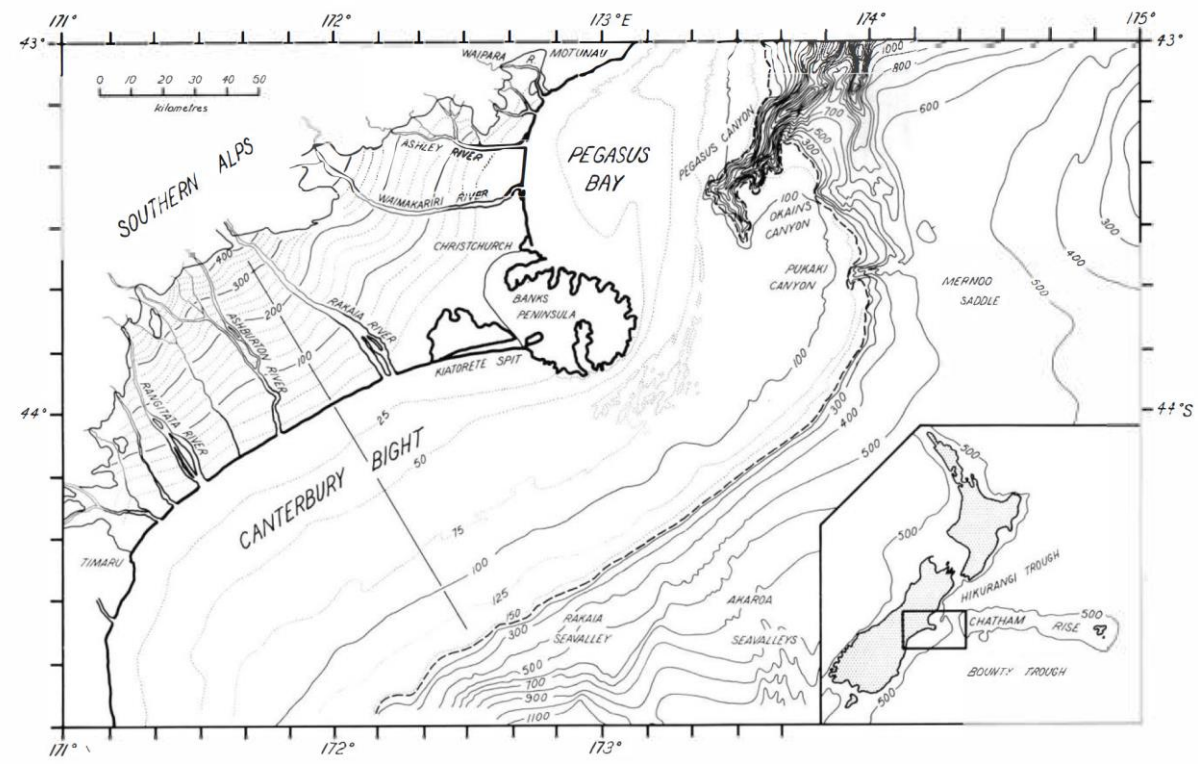
Sea Level

Over millennia sea level has risen and fallen, driven by natural periods of glaciations and warmth.

During glaciations sea levels dropped to 150m below present day – the edge of the continental shelf.



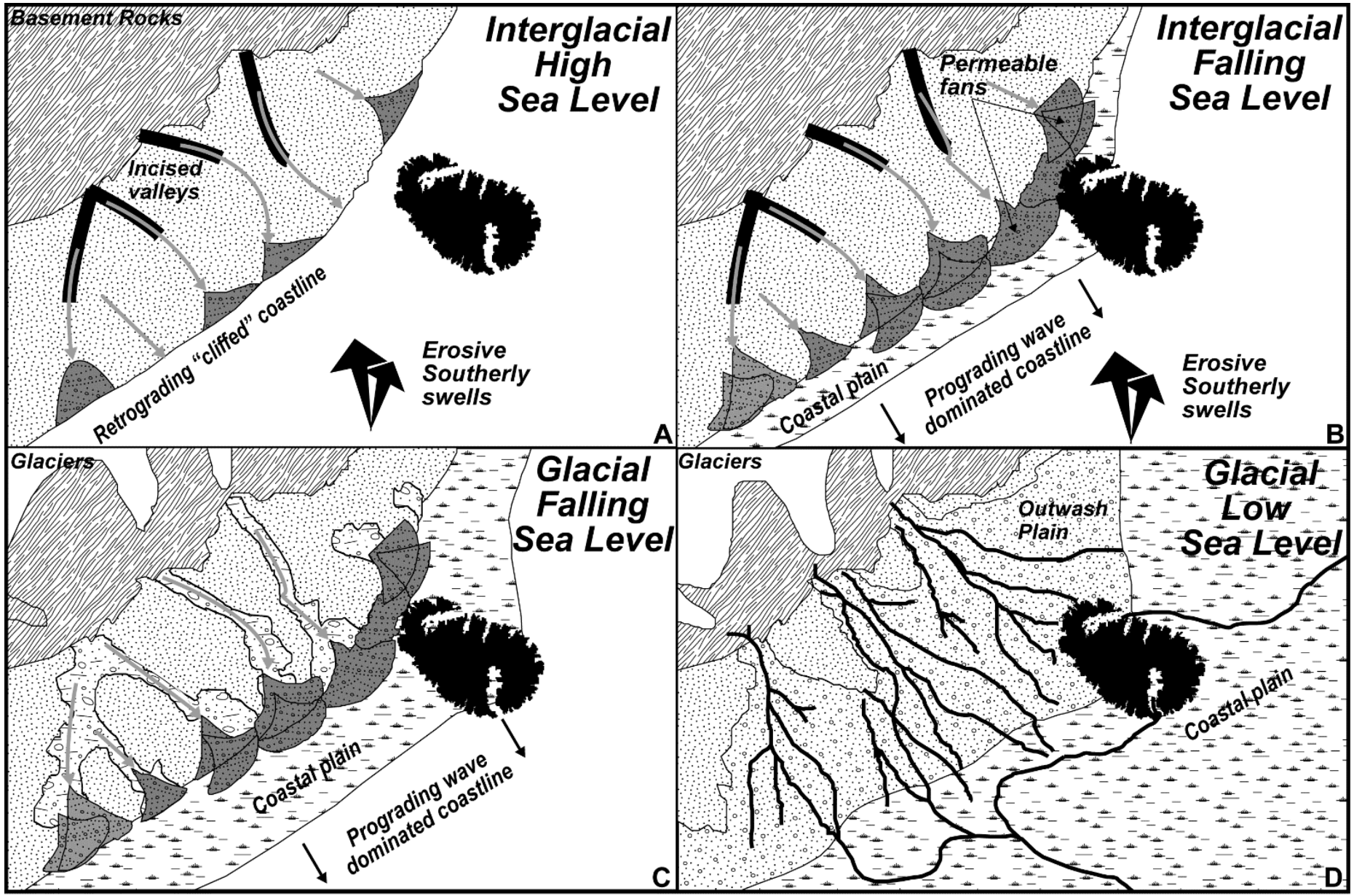
Dashed line indicates edge of continental shelf.

TE PĀTAKA O RĀKAIHAUTŪ BANKS PENINSULA GEOPARK
STORIES FROM THE LANDSCAPE

Sea Level

During cold periods, today's bays and harbours would have been valleys, with rivers draining out along a broad coastal plain, and Te Pātaka o Rākaihautū / Banks Peninsula would have been connected to the mainland, no longer an island.

During warmer periods sea level rose, and the raenga kūiti / peninsula became a moutere /island again.


Basement Rocks
Interglacial
High
Sea Level
Incised
valleys
Retrograding "cliffed" coastline
Erosive
Southerly
swells
A
Interglacial
Falling
Sea Level
Permeable
fans
Coastal plain
Prograding wave
dominated coastline
Erosive
Southerly
swells
B
Glaciers
Glacial
Falling
Sea Level
Coastal plain
Prograding wave
dominated coastline
C
Glaciers
Outwash
Plain
Glacial
Low
Sea Level
Coastal plain
D

TE PĀTAKA O RĀKAIHAUTŪ BANKS PENINSULA GEOPARK
STORIES FROM THE LANDSCAPE

Formation of the Plains

With the rise of Kā Tiritiri o te Moana / Southern Alps, their erosion, transportation and deposition of sediment by the braided rivers of Rangitata, Rakaia, Waikirikiri (Selwyn), Waimakariri, and Rakahuri / Ashley, the Kā Pākihi-whakatekateka-a-Waitaha / Canterbury Plains were formed.

TE PĀTAKA O RĀKAIHAUTŪ BANKS PENINSULA GEOPARK
STORIES FROM THE LANDSCAPE

Loess

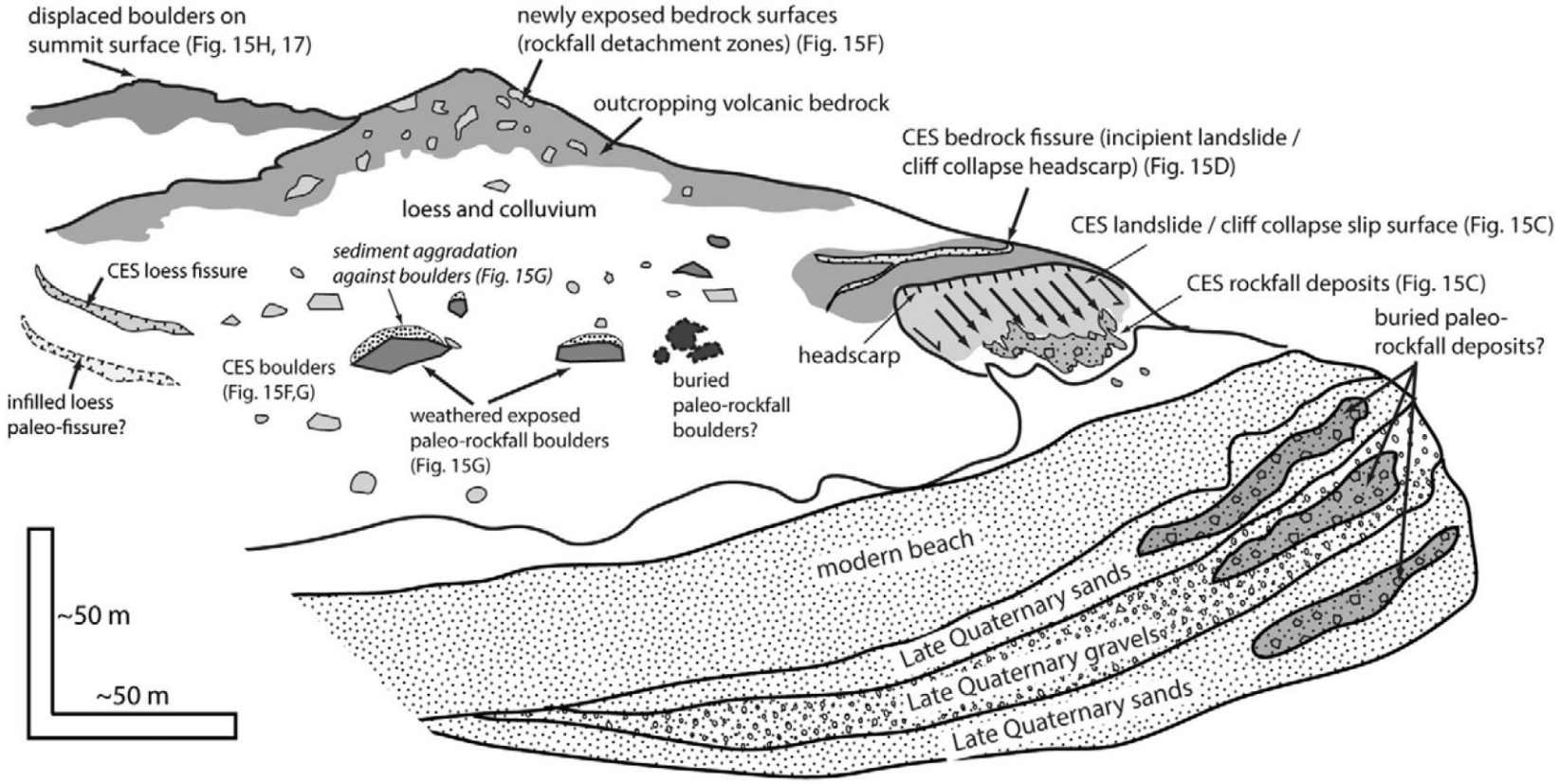
Parera / north-westerly winds across the braided rivers and plains picked up fine sediment, which fell out on the topography of Te Pātaka o Rākaihautū / Banks Peninsula.

This formed a mantling of clay-rich layers on the eroding volcanic landscape known as loess.

TE PĀTAKA O RĀKAIHAUTŪ BANKS PENINSULA GEOPARK
STORIES FROM THE LANDSCAPE

Rūamoko

Every now and again Rūaumoko becomes restless and shakes this landscape, causing rocks to fall, cliffs to collapse, and the ground to liquify.



Earthquake impacts on landscape (From Quigley et al 2016)

TE PĀTAKA O RĀKAIHAUTŪ BANKS PENINSULA GEOPARK
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Coastal Features

Today, the raenga kūiti / peninsula is connected to the mainland by the Kā Pākihi-whakatekateka-a-Waitaha / Canterbury Plains.

Gravels of the Rangitata and Rakaia Rivers have pushed up against the peninsula, forming Kaitorete, a barrier spit, enclosing Te Waihora / Lake Ellesmere.

TE PĀTAKA O RĀKAIHAUTŪ BANKS PENINSULA GEOPARK

STORIES FROM THE LANDSCAPE

Swirling Sands

The sand from these braided rivers swirl around the peninsula, pushed by coastal currents. Swirling eddies deposit these sands into the open eastern bays forming sandy beaches.

To the North, sand from the Waimakariri flows southward towards Whakaraupō, forming the beaches of Waimari, Brighton, and Matuku-takotako / Sumner, enclosing the Ihutai / Avon Heathcote Estuary by the Te Kōrero Karoro / South Brighton Spit.