How Did Timaru's Coastline Form?

Waitarakao Washdyke Lagoon

- We are on a tectonic plate sliding under the West Coast. Lava flowed here 2.5 million years ago.
- Powerful ice carved rocks into dust and wind blew the dust (Loess) from the mountains to Timaru.
- Rivers carry rocks, gravel, silt and sand from the mountains to the sea.
- The power of the sea is moving rocks, gravel and sand North, up the East Coast

Looking up Timaru's Coastline from an aeroplane. Shaped by earthquakes, lava, loess, rivers, the sea and people.

Photography by Geoff Cloake

New Zealand has a big fault line. Over 50 million years, Timaru has been sliding down the fault line, and Auckland has been sliding up. There are two techtonic plates that are touching. The Pacific Plate is pushing under the Tasman Plate. At times the land was under the sea, which is why there are fossils at Pareora.

Waitarakao
Washdyke Lagoon

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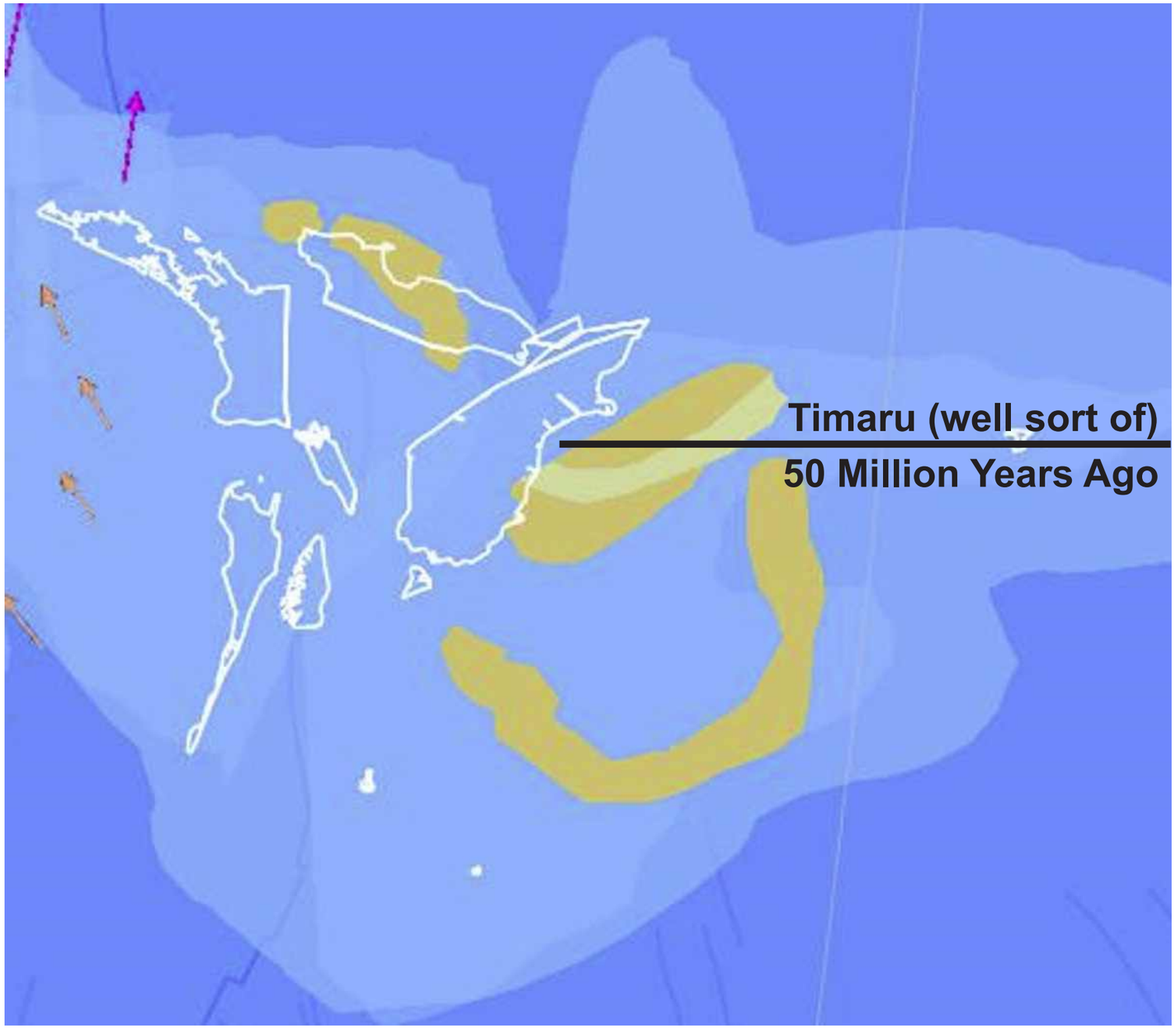

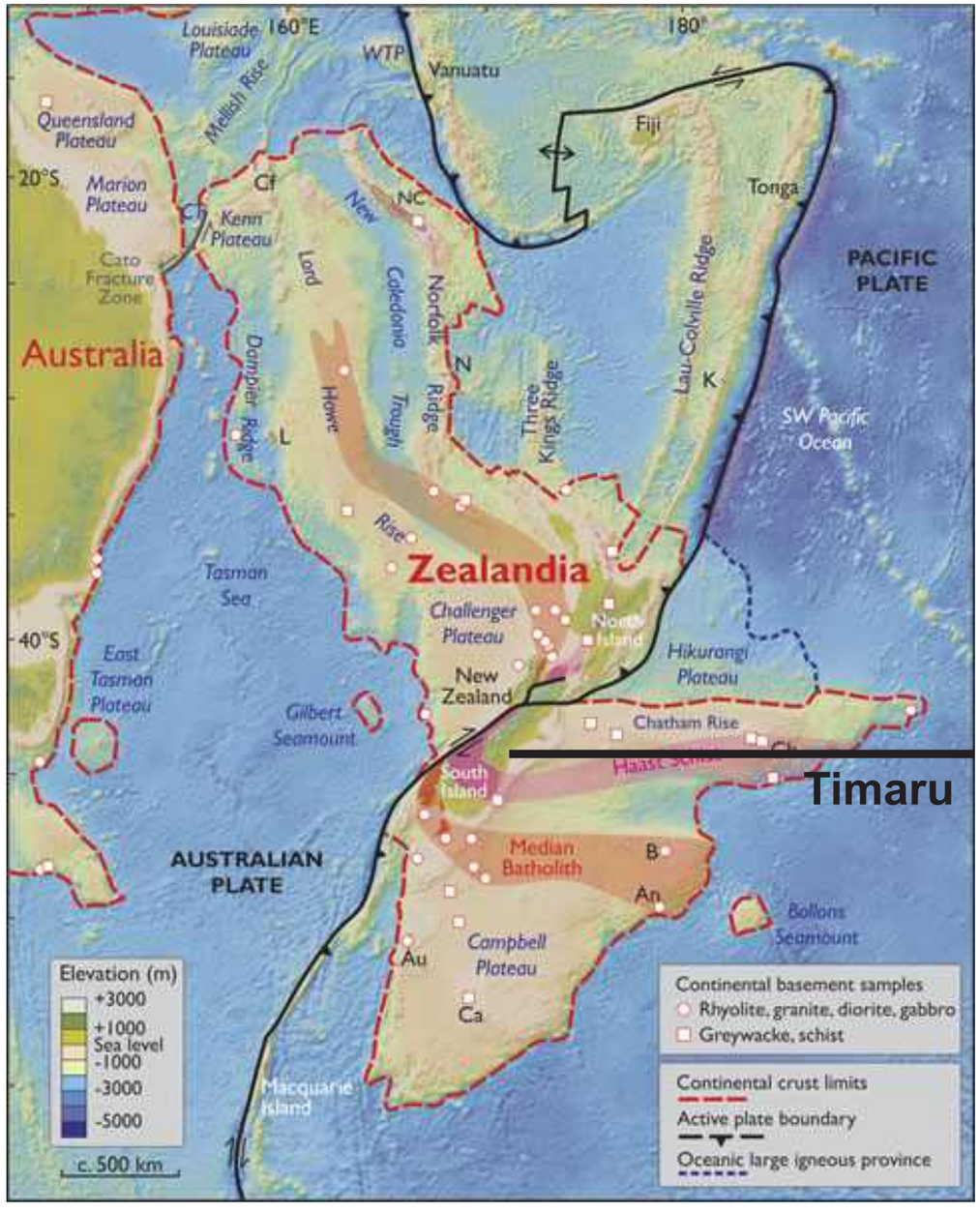

Marine deposits covered Zealandia

Illustration by Geoff Cloake

Today, 94% of Zealandia is submerged NZ and islands are the highest points.

Gondwana was a supercontinent that existed hundreds of millions of years ago, made up of what are now South America, Africa, Antarctica, Australia, the Indian subcontinent, and New Zealand.

Waitarakao Washdyke Lagoon

- **180 million years ago** – Gondwana began to break apart into separate landmasses.
- **85 million years ago** – New Zealand split from the eastern edge of Gondwana (Australia and Antarctica) as part of the landmass Zealandia.
- **After 85 million years ago** – Most of Zealandia submerged, but New Zealand remained above water.
- **Over the last few million years** – Ongoing tectonic activity formed mountains (such as the Southern Alps) and caused frequent earthquakes and volcanic eruptions.
- **2.6 million to 12,000 years ago** (Pleistocene Epoch) – Ice ages brought repeated advances and retreats of glaciers, shaping New Zealand's valleys, fiords, and landscapes, especially in the South Island.

NZ split away from Gondwanaland 85 M years ago

Fun Fact: The tuatara comes from a reptile lineage over 225 million years old! When New Zealand broke away from Gondwana around 85 million years ago, tuatara ancestors were likely already aboard. As most of Zealandia sank, New Zealand stayed above sea level—giving tuatara a safe haven. They survived in isolation, through mountain building, volcanic eruptions, and ice ages, making them a true living fossil that's seen it all!

New Zealand has a big fault line, we know it in Timaru as the Alpine Fault. Over 50 million years, Timaru has been sliding down the fault line, and Nelson has been sliding up. There are two techtonic plates that are crashing into each other. The Pacific Plate is pushing under the Tasman Plate. At times some of New Zealand was under the sea. See if you can find 50 million year old fossils at Pareora River, Evans Crossing.

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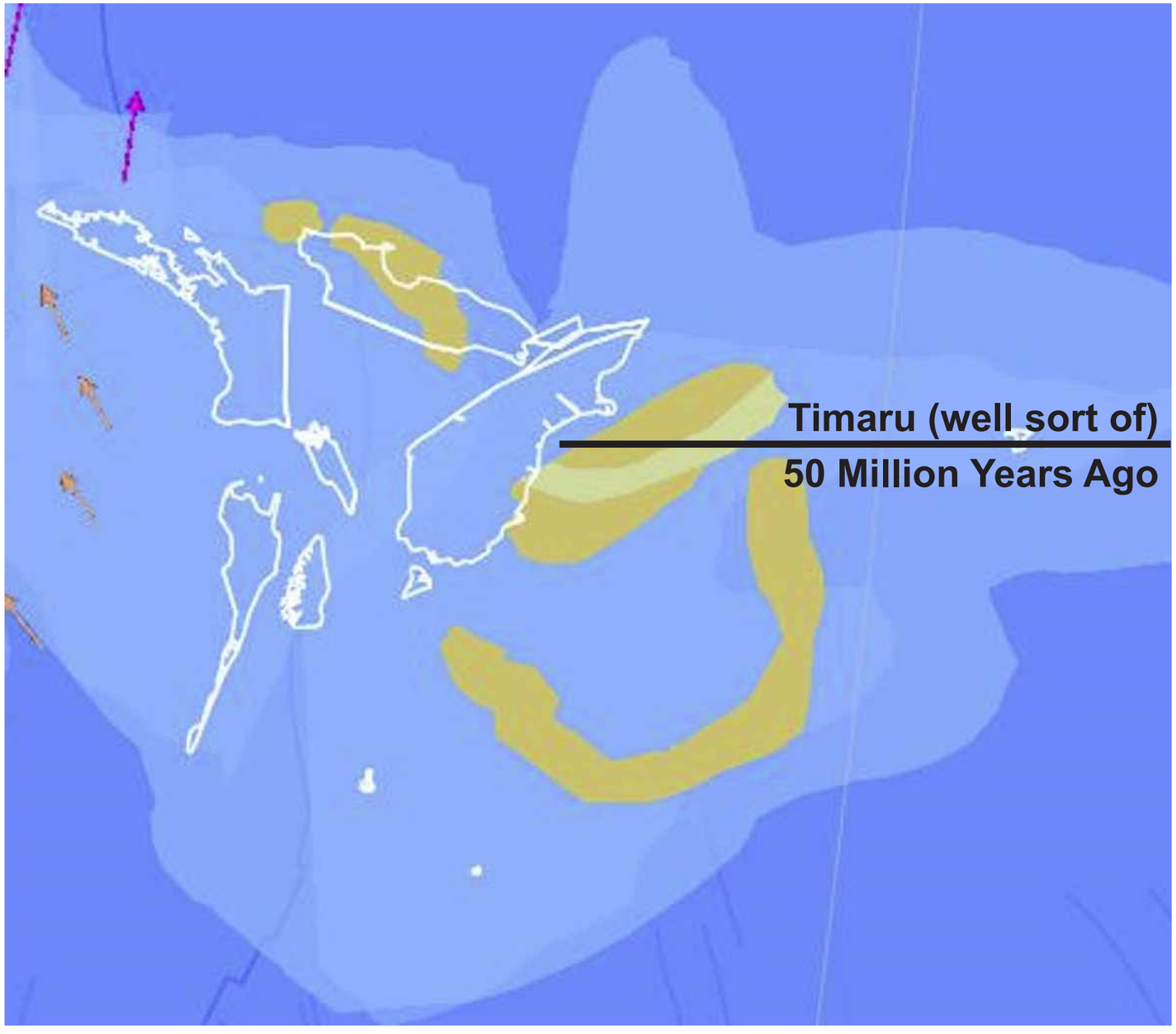

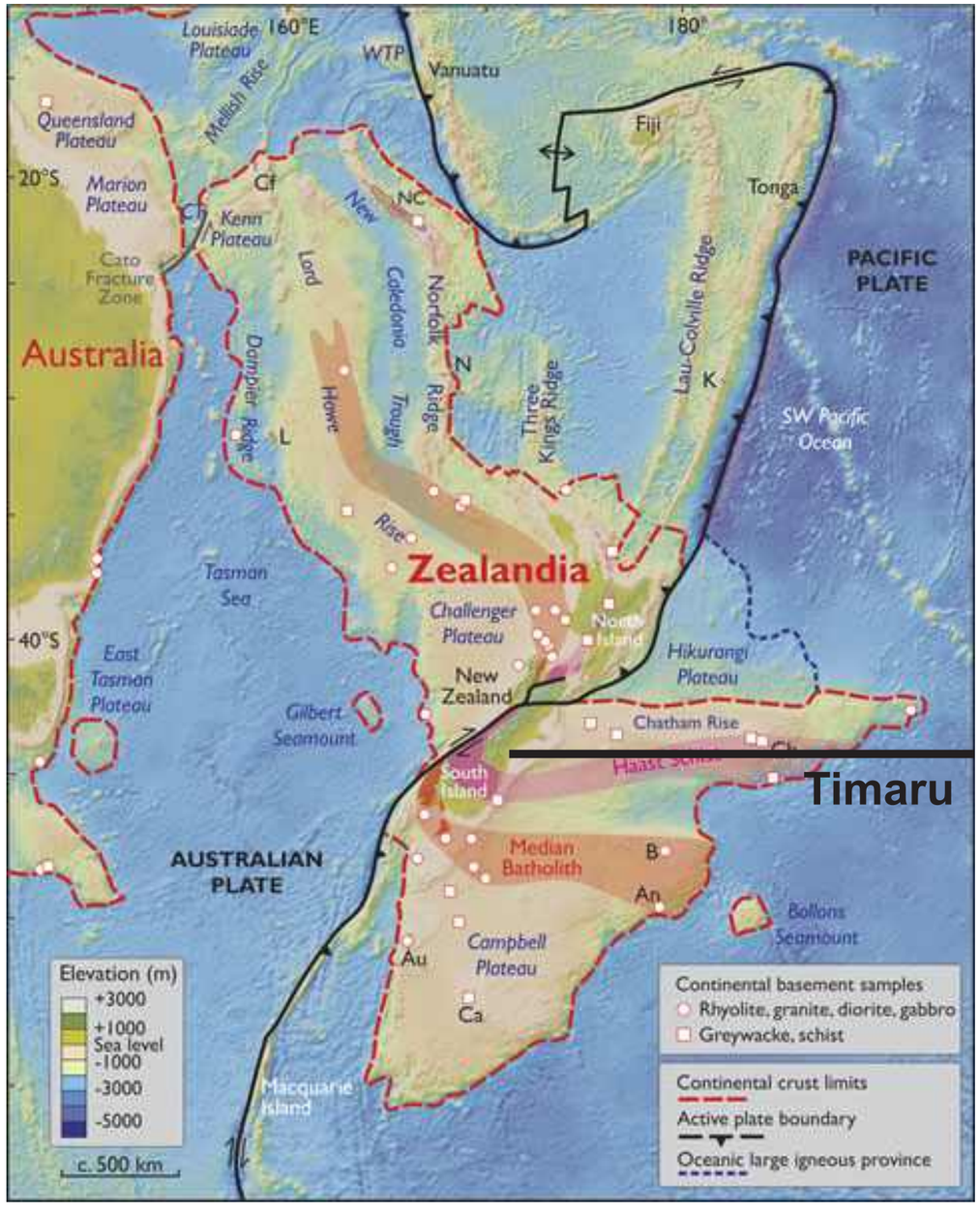

Marine deposits covered Zealandia

Illustration by Geoff Cloake

Today, 94% of Zealandia is submerged NZ and islands are the highest points.

Fiery Volcanoes. Around 2.5 million years ago, lava flowed slowly from volcanic eruptions at Waipouri Mt Horrible. This lava flowed like fingers down to where the coastline is today, it cooled and formed the basalt rock and reefs we see around Timaru.

Some rock has flowed into place. Other rock has been quarried and placed to build the port and protect the coastline from erosion

These volcanic rocks help protect the coast from erosion.

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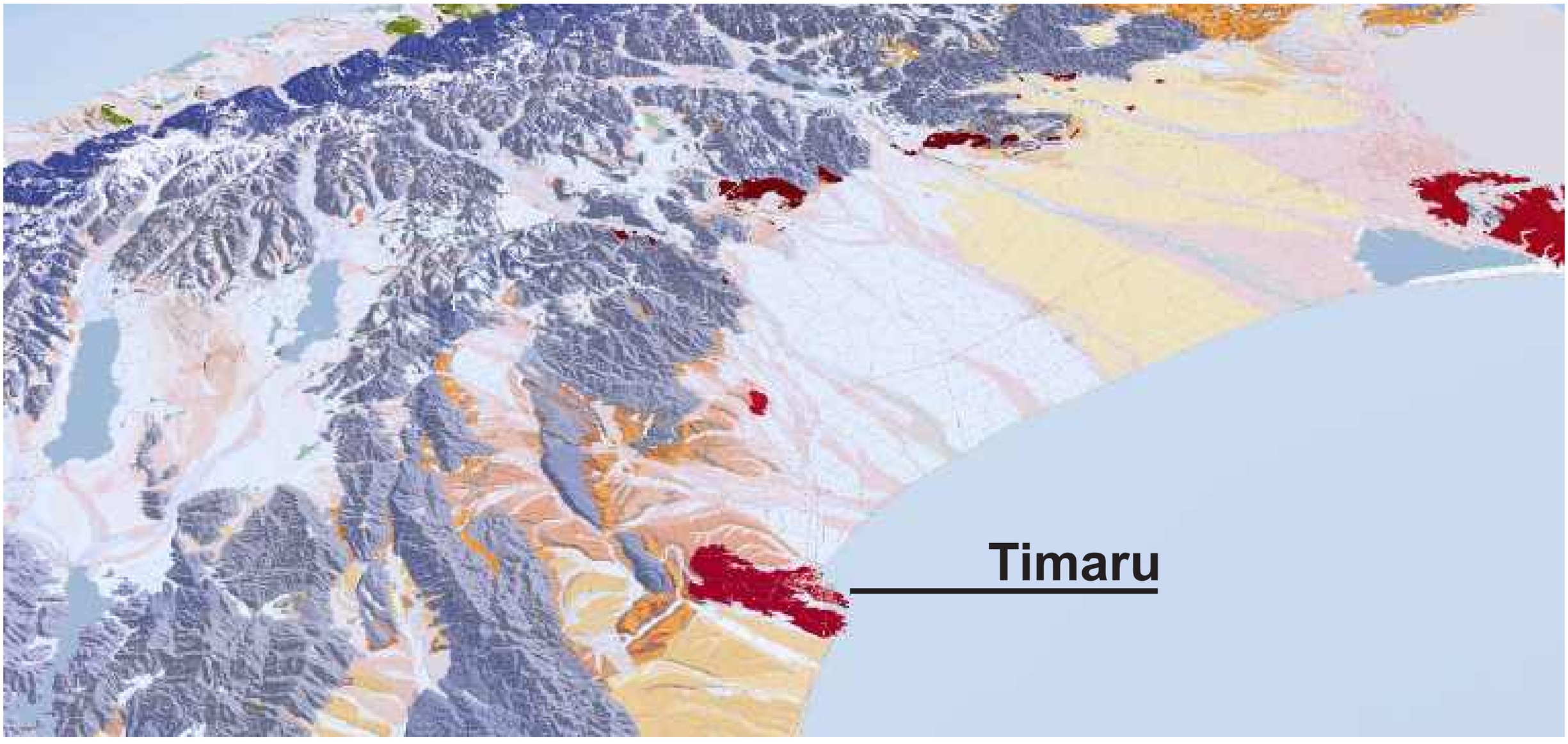
The lava flowed from Waipouri Mt Horrible. The shore was not here at the time.



This is the most recent volcanic activity in the South Island. Mt Horrible is extinct.

Diagram showing the lava in the Mid South Island

Illustration by Geoff Cloake

The lava flowed like fingers.
Cooled Lava is known as Basalt. Nicknamed (Bluestone).
Rock was quarried for construction and erosion protection.

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Is there lava under your house?

Diagram showing the lava in Timaru
Illustration by Geoff Cloake

Waipouri Mt Horrible is a really flat volcano. A vulcanologist said Mt Horrible can be "confidently considered extinct."

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The Pareora River runs below Waipouri Mt Horrible

Diagram showing the lava in Timaru

Illustration by Geoff Cloake

Power of Ice and Wind. During the Ice Ages, huge glaciers carved out valleys and carried rocks and dust. Strong winds blew dust, called loess, which built up in thick layers over the land over thousands of years. John Hardcastle, a Timaru geologist, wrote an internationally important scientific paper on the loess cliffs at Caroline Bay, and how it shows layers of dust giving us a record of climate change.

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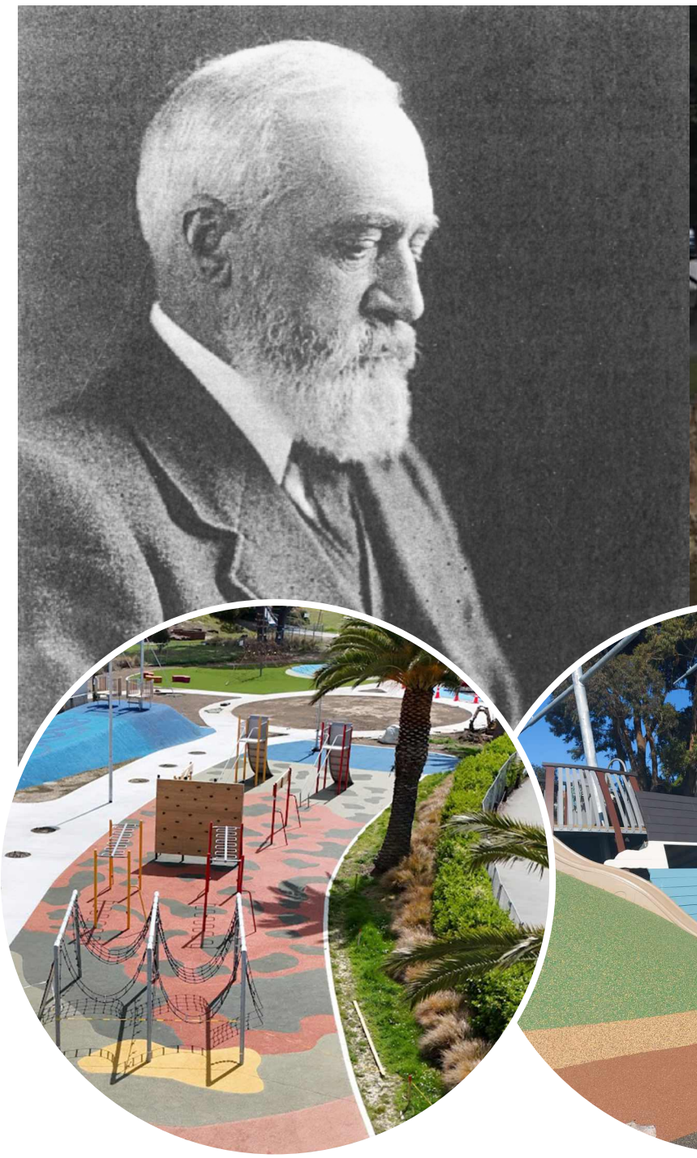
Powerful Ice and Wind blew dust here from the glacial carvings back at the mountains.



Can you see the layers in the loess cliffs and the lava at the Caroline Bay Playground?

Dashing Rocks Cliffs looking to Waitarakao reef.

Photography by South Canterbury Drone Photography

Waitarakao
Washdyke Lagoon

In Canterbury, as in the rest of New Zealand, the ice ages occurred during the Pleistocene Epoch, which spanned from about 2.6 million to 12,000 years ago. Multiple glacial periods occurred during this time, with glaciers advancing and retreating repeatedly. In Canterbury, the Southern Alps were heavily glaciated, and braided rivers like the Waimakariri and Rakaia spread the vast amounts of glacial gravel across the Canterbury Plains.

While lowland Canterbury wasn't covered in ice, it was affected by cold, dry winds, the spread of loess (fine dust), and massive gravel outwash fans from melting glaciers.

Can you see the layers in the loess cliffs?
Can you see the lava that has cooled into rock?

Dashing Rocks Cliffs looking to Waitarakao reef.
Photography by Geoff Cloake

Braided rivers from the Southern Alps carry greywacke and other ancient rocks, worn down by uplift and erosion, across the Canterbury Plains to the coast. These sediments help build beaches like Caroline Bay and shape the coastal landforms.

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Wide braied rivers carried rock, stones, gravel and sand from the mountains to the sea.

Can you find the braided river at Caroline Bay Playground that carrys rocks and gravel from the mountains to the sea??

Braided river in South Canterbury
Photography by Geoff Cloake

New Zealand has some cool looking rocks! These were found at Pareora River.

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Rivers help move rocks, sand and silt to the sea

Photography by Geoff Cloake

The sea moved the rocks from the river mouth up the East Coast. The waves push and roll the rocks, making them smoother and smaller.

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Fun Fact: Waves on NZ's east coast often travel from Antarctic storms, arriving with powerful energy that shapes beaches and drives gravel north along the shore.

Tuhawaiki (Jacks) Point

Photography by Geoff Cloake

As the rocks move north of the river mouth they get smaller and smaller.

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Greywacke rocks move up the coastline by the sea

Photography by Geoff Cloake

This is what a river looks like in a flood. Can you see where the river has broken out in places and flowed over farmland towards the sea.

Waitarakao Washdyke Lagoon

Flooding

Photography by Ross Brodie

Waves pounding Dashing Rocks reef and loess cliffs have eroded the landscape—20 years ago, you could walk across a natural arch that has since collapsed into the sea.

This is a striking example of how natural forces and human changes can accelerate coastal erosion and reshape the shoreline over time.

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Sea eroding the loess cliff.
Photography by Geoff Cloake

The reef at Waitarakao Washdyke Lagoon is an important habitat for marine life.

Mahika kai / Mahinga Kai (to work the food) is about the traditional ways of growing, gathering, and safeguarding food. Our reefs were abundant in marine life and an important food source for Māori.

Waitarakao Washdyke Lagoon

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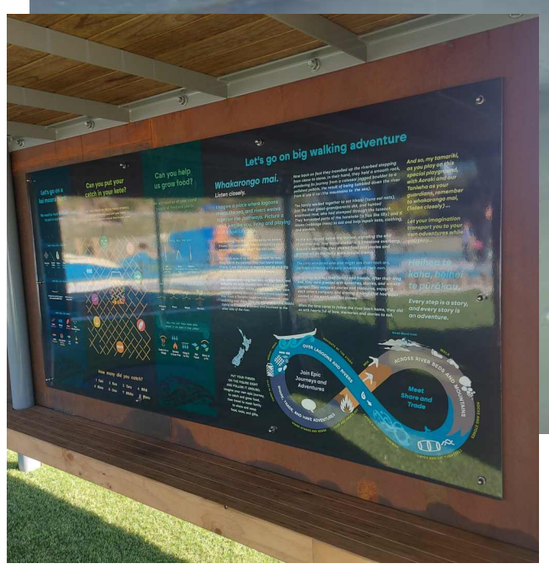

Can you find the Mahika Kai sign at the playground and pretend to go on a seafood hunt?

This basalt reef is a habitat

Photography by Geoff Cloake

Waitarakao Washdyke Lagoon

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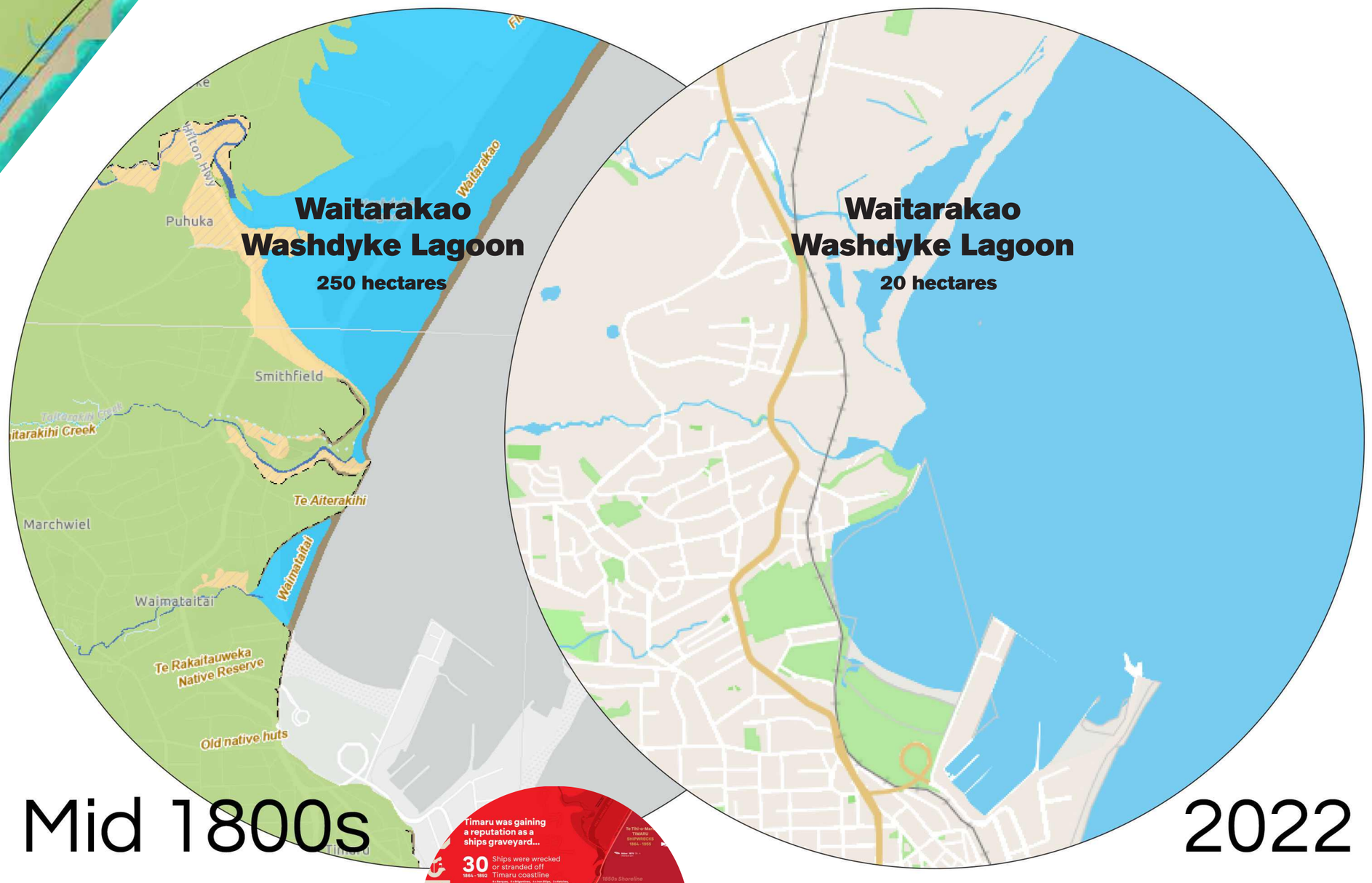

Mid 1800s

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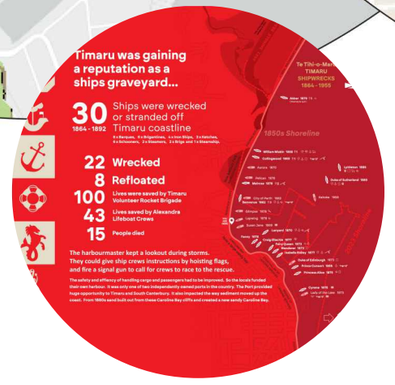

Can you see how much the coast line has changed over 150 years? Investigate the Caroline Bay mouse wheel sign to study the coastline map.

Coastline Changes over 150 years.

Illustration by Roselyn Fauth

Nothing is permanent in geological time

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Washdyke Lagoon

Our land is continually changing. There are changes that are happening to our coastline and mountains beyond our control like earthquakes, volcanoes, erosion, and sea levels.
People can also change our land by impacting the climates tempreture, building cities, cutting down forests, farming, making roads, changing waterways, building ports and even damming the rivers..

Can you find these?

Greywacke

Can you find a greywacke rocks? Chances are, it could have once been in Australia when NZ was on the edge of Gondwanaland... it could be 110-120 million years old!

Our land broke away and moved to where we are now on the contenent Zealandia. We are still moving and changing. Greywacke is a basement rock that makes up the main ranges of NZ.

Basalt

Can you find basalt in Timaru? This rock used to be hot lava that flowed from Waipouri Mt Horrible towards what is now the coast... *(The sea wasn't this close to Timaru then).*

Timaru's Basalt (Bluestone) is around 2.5 million years old. The reefs are natural. The port and rock placed for erosion control was constructed from quarried basalt.

Timaru Bricks

Can you find a brick made in Timaru? Timaru's bricks were made from dust blown from the mountains to Timaru when glacial ice ground and carved rocks.

The brick could have been made in last 160 years... The dust from the glaciers Pleistocene Epoch, spanned from about 2.6 million to 12,000 years ago. Imagine how old the dust could be in these bricks?

Humans have impacted Timaru's coastline through engineering, land use, and changes to natural sediment flow, have also contributed to the changing coastline.

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Can you find evidence of human impact?

Challenge 1: Trapped Gravel

Can you find where the port has trapped gravel and impacted the shape of Caroline Bay? The waves used to reach the Bay Hill cliffs.

Hint: Look for markers along the palm tree lined paths that show where the mean tide mark has been over the years.

Challenge 2: Coastal Erosion

Can you spot areas where the coastline is eroding because less gravel is reaching it?

Hint: Compare old and new maps to see the change at the South Canterbury Musuem and on this website: www.canterburymaps.govt.nz

Challenge 3: Disrupted Rivers

Can you find where river control or stopbanks might have stopped gravel from reaching the beach?

Hint: Look near the Opihi or Pareora rivers for evidence on how the rivers have changed. Can you spy dams?

Challenge 4: Built Barriers

Can you see how roads, rail lines, or buildings have changed the natural shape of the coast or lagoon?

Hint: Walk around Waitarakao and notice where the water or wetlands seem blocked or narrowed.

Humans have also impacted Timaru's coastline through engineering, land use, and changes to natural sediment flow, have also contributed to the changing coastline.

Waitarakao
Washdyke Lagoon

Why is Waitarakao (Washdyke Lagoon) important?

Natural Protection

Waitarakao acts as a natural buffer between the land and sea. It helps:

- Absorb storm surges and waves
- Reduce coastal flooding
- Trap sediment and protect nearby land and infrastructure

Habitat for Wildlife

The lagoon is a rich habitat for birds, fish, and insects:

- It's part of an internationally recognised wetland system
- Provides feeding and nesting areas for migratory and native birds, including threatened species

Water Purification

Wetlands like Waitarakao help clean water by:

- Filtering out pollutants and nutrients
- Improving water quality before it reaches the ocean

Cultural and Historical Value

Waitarakao holds deep cultural significance for Ngāi Tahu, with a long history of mahinga kai (traditional food gathering) and occupation.

- It's also part of Timaru's early European history, shaping land use and settlement patterns.

Why is it important to learn about the past?

Waitarakao
Washdyke Lagoon

It helps us understand how places have changed, why certain problems exist today, and how we can make better decisions for the future.

In the case of Timaru's coast, learning about the past (like natural river patterns, harbour construction, and erosion) can show us how human actions and natural forces have shaped the land.

This knowledge helps communities protect beaches, restore habitats, and plan wisely for challenges like changing sea levels, erosion, and flooding.

Together, we can care for our coast.

By understanding how nature works and making small positive choices, we can help care, for special places like Waitarakao Washdyke Lagoon

Protect and Restore Wetlands

Wetlands like Waitarakao Lagoon act as natural buffers—protecting the coast, filtering water, and providing habitat.

We can help by planting natives, reducing pollution, and keeping waterways clear.

Learn and Share

The more people know about the coast's history and how it works, the better we can care for it.

Share stories, join beach cleanups, and support community and school projects that focus on coastal protection.