Excellence

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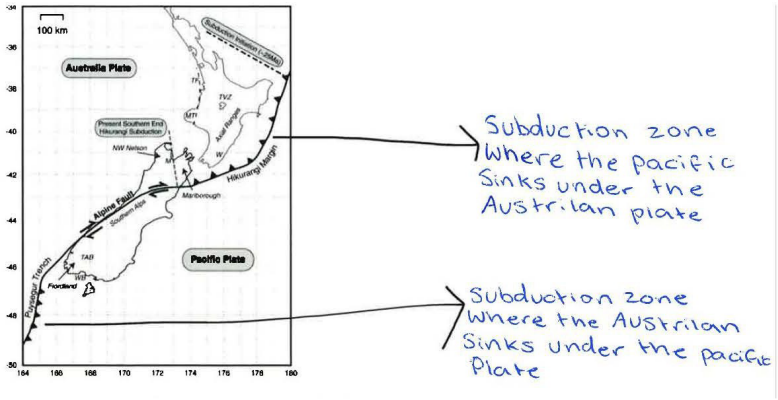
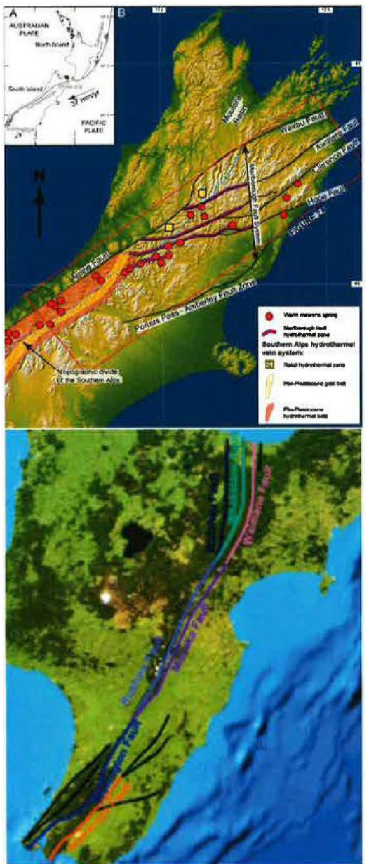
Aotearoa is located between two tectonic plates, the Pacific plate and Australian plate. The spatial pattern that the earthquakes follow is a linear pattern from the southwest of the South Island at Fiordland to East Cape in a Northeast direction in the North Island.

The pattern begins offshore in the Puysegur trench in a subduction zone near Fiordland. (as seen in diagram 1). The linear pattern carries on in a Northeast direction along the Southern Alps where the Alpine Fault is located, then continues into the Marlborough fault system. These form a shallow earthquakes cluster. Continuing Northeast, the plate boundary goes into the Hikurangi trench which is a subduction zone where deep earthquakes occur and the Pacific plate sinks under the Australian plate (diagram 1).

The width of the linear pattern of earthquakes is less in the South Island than the North Island. This is because of the different plate movements at these places. The wider linear pattern stretches across the North Island from the Mt Taranaki to the Hawkes Bay and Coromandel Peninsular, all the way to the coast. The pattern of deeper earthquakes to the Northwest in the North Island is because of the slope of the boundary where subduction occurs between the 2 plates.




An important factor that contributes to the distribution of earthquakes are fault lines. Fault lines are fractures in the earth's crust created by the pressure from the tectonic plates. In Aotearoa fault lines are caused by the pressure of the Australian and Pacific plate colliding together and subducting beneath each other. There are many main fault lines in Aotearoa that contribute to the distribution of earthquakes like Alpine, Marlborough fault system, Wellington, Wairarapa, Hope, Kekerengu, Clarance, Awatere, Wairau faults and they all make up the linear pattern with a general Northeast to Southwest trend. (labelled faults in diagram 2 and 3).

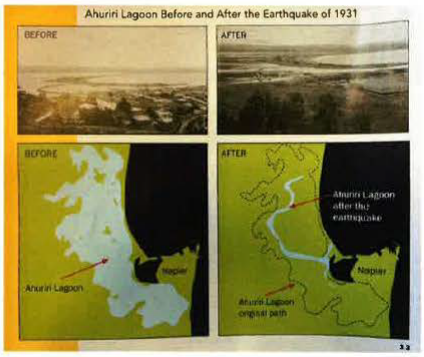


—linear pattern of labeled fautt lines

We see a linear pattern of distribution of earthquakes throughout Aotearoa mainly following the Alpine Fault in the South Island where the 2 tectonic plates meet alongside, there are usually shallow and focus earthquakes. Movements along fault lines occur in different direction where the rocks in the crust get caught and pressure builds up until the rocks break and allow the tectonic plates to move past each other. The pressure is then released as seismic waves (earthquakes). Some examples are Kekerengu fault line 15km deep magnitude 7.8 Nov 14 2016, Wairarapa fault line 33km deep magnitude 7.8 Jan 23 1855, Port Hills fault line 3-5km deep 22 Feb 2011 magnitude 6.3. There are more faults in the Marlborough system and in the southern North Island showing a wider linear pattern of earthquakes. This is likely due to the pressure from the Hikurangi trench off the east coast crushing the land.

Another important factor to the linear pattern of distribution of earthquakes throughout Aotearoa is location. Aotearoa is located on top of a tectonic plate boundary where the Pacific and Australian plate collided. At the narrow part of the linear pattern near the Southern Alps the Australian plate slides to the North and Pacific plate pushes the alps up causing earthquakes along this line. Nearly 95% of earthquakes occur along the tectonic plate boundaries. Parts of Aotearoa are also located in subduction zones where deep earthquakes occur (more than 300km below the surface). Aotearoa's subduction zones are located the Southwest of the South Island (Puysegur trench Fiordland) and under the North Island stretching from the Hikurangi trench. This subduction zone causes a wide linear pattern through south and central N.Z. Aotearoa is located in the Southwest section of the Ring of Fire where 90% of the world's earthquakes happen (ring of fire diagram 4 and 5).

Plants and animals were affected by the impacts from uplifted land, rockfalls and the pollution in rivers which occurred in each of these major earthquakes. Silt from the liquefaction all around Christchurch was washed into rivers (Avon). The sediment from silt covered up the aquatic life many animals were affected (eels, white bait). In the 1931 Hawkes Bay earthquake there was a long term and significant impact because the earthquake caused Ahuriri Lagoon to rise 3 meters. The rise of the land drained all the water changing the habitat for the aquatic life causing thousands of plants and animals to die. In the Kaikoura earthquake 2016 they also experienced "shocking damage". The tectonic forces caused 110km of the coast to be uplifted killing off species, the uplifted land caused the reef to be underwater for only 4 hours a day leaving the marine species to dry up.




→ Befor and after of the Hawkes Bay earthquake causing the lagoon to rise and become land. (turned into air port.)

The effects of the aquatic ecosystem in Christchurch was short term as the rivers were restored. They began in 2013 in the Avon River, where the river was dredged and new aquatic plants were planted in the river bed. The new water entering the Avon was then treated. In Kaikoura and Hawkes Bay the effects were long term because of the change in land and the amount of animal life killed.

Overall, earthquakes in New Zealand, such as those in Christchurch, Kaikoura, and Hawke's Bay, have had profound impacts and significance. The loss of life and destruction of property are significant, leading to human suffering and the need for costly rebuilds. Psychological impacts are severe, with increased rates of PTSD and trauma. Environmental damage, including rockfalls, landslides, and coastal uplift, impacts ecosystems and changes landscapes. Coastal uplift, seen in the 2016 Kaikoura earthquake and the 1931 Hawke's Bay earthquake, raises land from below sea level, affecting marine habitats and biodiversity. The overall significance of these impacts is in the extensive human, economic, and environmental costs as a result of earthquakes, however the human impacts were the worst. These case studies highlight the huge social impacts earthquakes can have, including immediate loss of life, injury, and educational impacts, as well as lasting psychological and economic strains.