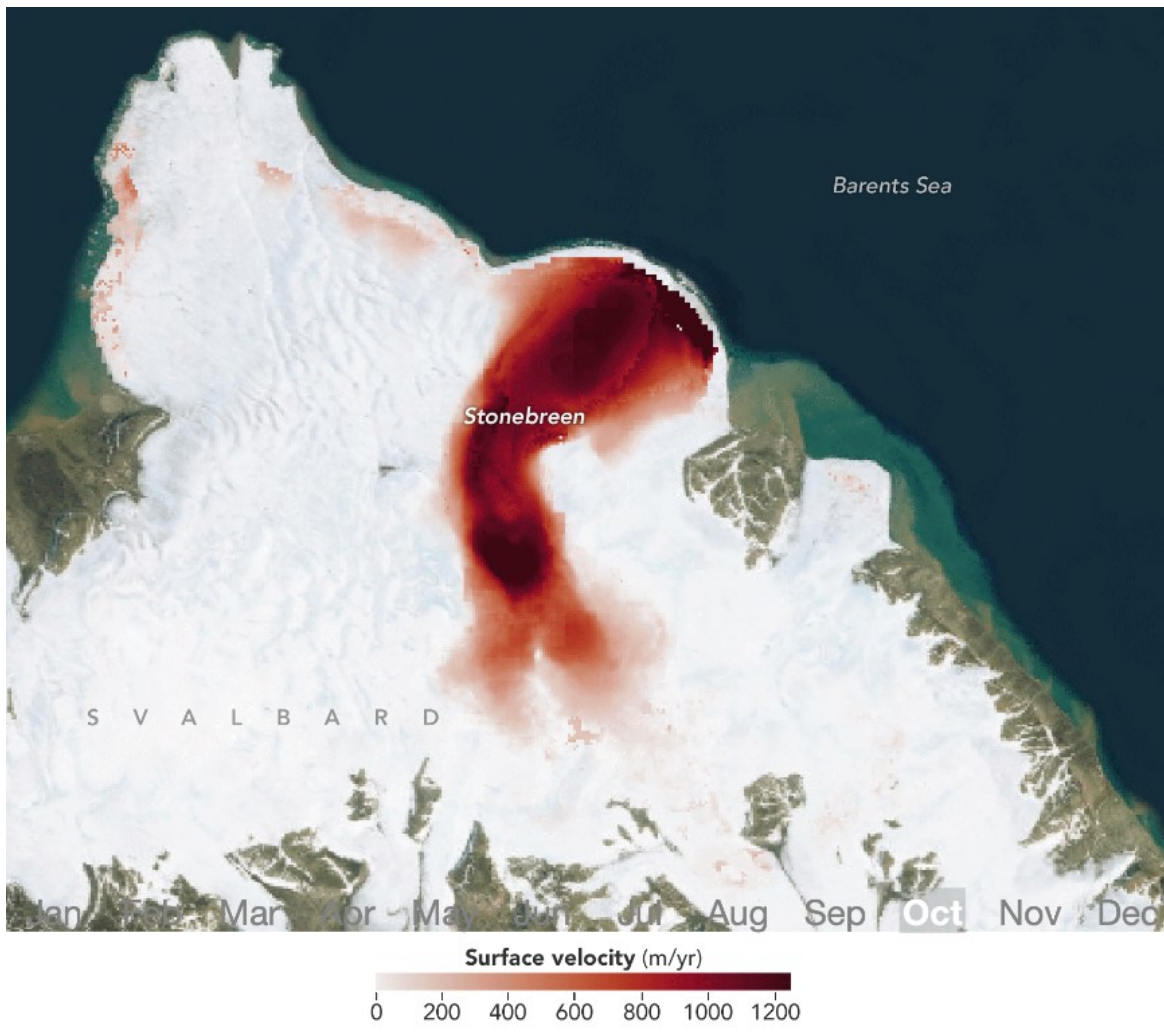


February 16, 2026

## News and notes



**February 13, 2026, Stonebreen Glacier, Svalbard**  
**Credit: NASA's Solar Dynamics Observatory, [public domain](#)**

This week, before going on to discuss the geology and mineral resources of New Zealand, we will first look at some news items I thought were interesting. The picture above is from [NASA's Solar Dynamics Observatory](#)

If you enjoy my blogs, bookmark the site and check on Mondays rather than relying on social media postings which can get lost in the shuffle. For my news items, I try to stick to open access papers.

## Comments

If anyone has comments on any of my postings, please leave a comment on the LinkedIn page for the posting or email me at [raymondreichelt@gmail.com](mailto:raymondreichelt@gmail.com).

## Geopolitics

- Iran:
  - [Iran holds military drill in Hormuz Strait, Tasnim news agency reports.](#)
  - Meanwhile: [Iran Floats Joint Oil Investment With the U.S. Ahead of Nuclear Talks.](#)
  - [US sending second aircraft carrier to Middle East amid rising tensions with Iran, report says;](#)
  - [Confirmed: US Covertly Sent Thousands Of Starlink Terminals Into Iran Amid Unrest.](#)
  - [Five Scenarios for Iran and What They Would Mean for Oil Markets.](#)
- Venezuela:
  - [U.S. Forces Board Another Tanker in Expanding Venezuela Oil Crackdown.](#)
  - [Venezuela Oil Revenue Projected to Hit \\$5 Billion Under U.S. Control.](#)
  - [Venezuela to grant more oil drilling blocks to Chevron, Repsol, Bloomberg News reports.](#)
  - [Venezuela boosts oil output in Orinoco Belt, country's production approaches 1 million bpd, sources say.](#)
- Civil War:
  - ['No Prospect' Of European Governments Preventing CIVIL WAR, Warns British Army Colonel.](#)

## Research and News

- Methane hydrates: [Empirically Based Constitutive Modeling Approach for Methane Hydrate-Bearing Soils.](#)
- More on methane hydrates: [Dissolution and Flow Channeling in Hydrate-Bearing Sediments: Implications for Permeability.](#)
- [Shock origin of the largest ureilitic microdiamond: structural observations and  \$\delta^{13}\text{C}\$  value.](#)
- [Wettability behavior of montmorillonite and pyrophyllite in  \$\text{CO}\_2\$  geological sequestration: Insights from molecular dynamics simulation.](#)
- How Earth's magnetic field has changed over time: [Bayesian Inference of Local Paleosecular Variation From Sparse Paleomagnetic Data.](#)
- [Assessing Pb Isotopic Equilibrium Between Apatite and K-Feldspar.](#)
- [Diagenetic and Hydrothermal Processes Produce Heavy Molybdenum Isotope Signatures in Pelagic Sediments of the North and South Pacific.](#)

- [Hydrothermal alteration of xenotime-\(Y\) and samarskite-\(Y\) in highly fractionated granites: Implications for the formation of ion-adsorption HREE deposits.](#)
- [H<sup>+</sup>-Driven Lattice Gap Impurity Migration in Quartz Polymorphs: A First-Principles Study with Implications for High-Purity Quartz Formation and Purification.](#)
- [Thermochemical measurements on Mg<sub>2</sub>SiO<sub>4</sub> wadsleyite and SiO<sub>2</sub> stishovite and assessment of their self-consistent thermodynamic datasets for Gibbs energy expressions and equations of state.](#)
- [Matrix effects on secondary ion emissions for H and OH from natural spinel-structured oxides: Implications for H<sub>2</sub>O quantification by secondary ion mass spectrometry.](#)
- [Origin of tin-specialized granites constrained from fluid-absent metapelite melting experiments.](#)
- [Holliday et al. \(2023\): Systematic Misrepresentations of Younger Dryas Impact Evidence Undermine the Reliability of their Critique.](#)
- [Magmatic to carbothermal evolution of carbonatites and metasomatism of Damara calcite marble: Osongombo Carbonatite Complex, NW Namibia.](#)

## Planetary Geology

- Video, James Webb Space Telescope: [Transforming Our Understanding of Star Formation.](#)
- [Accumulation of volatiles under salt crusts in the highly evaporative Qaidam basin: Implications for salt crust fluid processes on Mars.](#)
- Meteorite: [H-N budgets and isotopic signatures of Oued Chebeika 002 and CI reservoir heterogeneity.](#)
- [Kinetic Zr isotope fractionation on Mars recorded in ancient Zr-rich minerals.](#)
- [Multiple formation pathways for amino acids in the early Solar System based on carbon and nitrogen isotopes in asteroid Bennu samples.](#)
- [Radar-based observation of a lava tube on Venus; Space.com summary \[here\]\(#\).](#)
- [A laboratory model for Jovian polar vortex crystals.](#)
- [Does the Measured Abundance Suggest a Biological Origin for the Ancient Alkanes Preserved in a Martian Mudstone? SciNews summary \[here\]\(#\).](#)

## Plate Tectonics

- Related to today's posting: [From Collision to Subduction: Thermal-Kinematic Inversions Constrain Plate Boundary Structure and Dip-Slip Activity in Southwestern New Zealand.](#)
- [Numerical Modeling of Purely Active \(Plume-Produced\) Continental Rifting and Break-Up.](#)
- [Sediment-derived deep forearc fluid caused coupled sulfur-Fe<sup>3+</sup>-enrichment in eclogite from the subducted Farallon plate.](#)

- [Self-Consistent Models of Earth's Mantle and Core From Long-Period Seismic and Tidal Constraints.](#)
- [Revised History of Pleistocene Vertical Motions in NE Sicily and Southern Calabria, Italy, From 40Ar/39Ar Dating and Fault Zone Morphology.](#)
- [Differential Mountain-Building in the South Tian Shan Revealed by Multi-Spatiotemporal Foreland Deformation.](#)
- [The Impact of Orogenic Inheritance on Rifted Margin Formation.](#)
- [Coupled thermochemical evolution of the early Earth's solid mantle and basal magma ocean: The role of melting and melt transport.](#)
- [Timing and Style of Tectonic Assembly and Exhumation of the McHugh Complex Within the Chugach-Kodiak Accretionary Wedge, Alaska.](#)
- [Subduction System Response to Ribbon Collision: Implications on the Intra-Plate Force Balance and the Style of Slab Deformation.](#)
- [Was the mantle warmer when Pangea broke up? insights from initial oceanic crustal thickness alongside the rifted margins of the Atlantic and Indian Oceans.](#)

## **Paleontology**

- [Thecate stem medusozoan polyp from the Upper Ordovician of Québec.](#)
- [Orogeny and topography influenced jurassic–cretaceous terrestrial ecosystem evolution in northeastern Asia.](#)
- [First record of a deep-water brachiopod fauna in the Telychian of South China and its paleoecological implications.](#)
- [A sharp-billed stem ibis from the Fossil Butte Member of the Green River Formation.](#)
- [Electron and focused ion beam microscopy of fossilized \*Albertosaurus sarcophagus\* \(Dinosauria: Theropoda\) bone reveals nano to microscale features.](#)
- [Extinction risk related to functional traits in Pliocene to Holocene West Atlantic molluscs.](#)
- [Well-preserved \*Rothpletzella microencruster\* on a brachiopod shell from the Upper Ordovician of Estonia.](#)
- [Mammals of the early Arikarean \(“middle” Oligocene\) Jones Branch Local Fauna, southeastern Mississippi, USA, with notes on two older taxa from the state and the timing of Midcontinent–Gulf Coastal Plain biotic disparity.](#)
- Ediacaran fauna: [Spatial analysis of \*Beltanelliformis\* \(\*Nemiana\*\) in Baltica.](#)

- [Locomotor reassessment of \*Iguanodon\*, \*Ouranosaurus\* and \*Lurdusaurus\* \(Dinosauria, Ornithopoda\) using osteological correlates.](#)
- [Avian features of Archaeopteryx feeding apparatus reflect elevated demands of flight](#); SciNews summary [here](#).

## Ore Deposit and Petroleum Geology

- [REE mineralization in the Saima peralkaline complex \(China\): Constraints from magmatic-hydrothermal processes recorded in apatite Ca-Sr solid solutions.](#)
- [Integrated fractal clustering and inversion of induced polarization data for concealed gold exploration in Kabudan area NE Iran.](#)
- [In-situ geochemical and S-Pb-Sr isotopic constraints on fluid origin and evolution of the Heilongtan-Xiejiagou intrusion-related gold deposit, Tongbai Orogen, central China.](#)
- Australia: [Geological controls on reservoir seismic responses.](#)
- [Cratonic impact on clastic-dominated base metal deposits in continental rifts.](#)

## Mining and Energy

- [Chevron-Led Joint Venture Signs Major Gas Exploration Deal Offshore Greece.](#)
- [New Discovery Bolsters Equinor's North Sea Production Future.](#)
- [Mali renews Canadian mining giant's license for 10 more years after long-standing dispute.](#)
- [Cuba: Massive Fire Erupts At Oil Refinery In Havana Amid Fuel Shortage And US Oil Blockade.](#)
- [Notoriously hazardous South L.A. oil wells finally plugged after decades of community pressure.](#)
- Australia: [80 pc drop in export volumes for BHP's Jimblebar Fines iron ore amid China pressure.](#)
- [U.S. natural gas production to reach record highs in 2026 and 2027.](#)
- [DR Congo turns to AI in new US-backed push to map critical minerals.](#)
- [Oil Prices Drop 3% After IEA Cuts Demand Growth Outlook](#); IEA report [here](#).
- [Company behind proposed sand mining project partnering with U of Manitoba on groundwater monitoring research.](#)
- [Congo's copper exports jump 10% as Chinese firms lead growth.](#)
- [Senegal launches \\$100 million onshore oil and gas plan after revoking licenses from Inactive operators.](#)
- [Nickel Futures Jump As Indonesia Instructs World's Largest Mine To Slash Output.](#)

## Environmental Geology and Hydrogeology

- [Potential impacts of diluted bitumen and conventional crude oil leaks occurring above the water table.](#)
- [U.S. Oil Giants Are Wary of Inheriting Venezuela's Massive Ecological Debt.](#)
- ['A Disaster Waiting to Happen': How the Fracking Boom Put an Oil Field in the Guadalupe River Floodplain.](#)

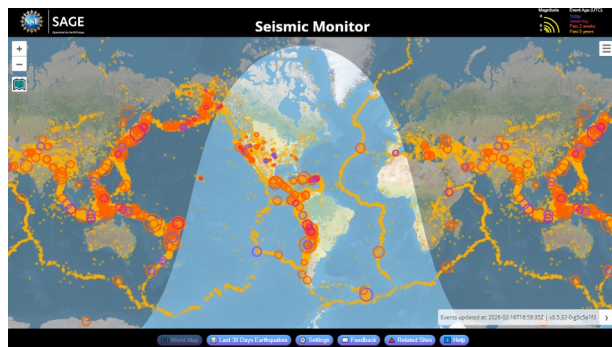
## Glaciers and Climate Change

- [InSAR sensitivity to active layer ground ice content in Adventdalen, Svalbard.](#)
- [Competing processes determine the long-term impact of basal friction parameterizations for Antarctic mass loss.](#)
- [Geochemical characterisation of the Ellsworth-Whitmore Mountains crustal block: a critical piece in the puzzle to unravel ice retreat in West Antarctica.](#)
- [Multichannel Analysis of Surface Waves \(MASW\) for the internal characterisation of the Flüela rock glacier: overcoming the limitations of seismic refraction tomography.](#)
- [Exploring the conditions conducive to convection within the Greenland Ice Sheet.](#)
- [Spatially explicit global assessment of cropland greenhouse gas emissions circa 2020.](#)
- [Glacier surging and surge-related hazards in a changing climate.](#)
- [Detection, attribution, and modeling of climate change: Key open issues; Phys.org summary \[here\]\(#\).](#)

## Bad Science

- [How AI slop is causing a crisis in computer science.](#)
- [Court challenge could chill reporting of research fraud, say whistleblower attorneys.](#)

## Volcanoes, Earthquakes and Geohazards



[Seismic Monitor](#)



[Active Volcano Map](#)

## **Volcanoes**

- [Smithsonian / USGS Weekly Volcanic Activity Report](#).
- United States Geological Survey (USGS) Volcano Observatories:
  - Yellowstone Caldera Chronicles: [A brief history of volcanology: from myths and legends to a modern and interdisciplinary science](#).
  - [Cascades Volcano Observatory Weekly Update](#).
  - Volcano Watch – [Handling the pressure: what gases trapped inside crystals tell us](#).
- [Yellowstone's Valentine Geyser Lovingly Erupts For The First Time In 21 Years](#).
- [Magma Storage Below Sabancaya Volcano \(Southern Peru\) Imaged by Broadband Magnetotellurics](#).
- [Active Volcanoes in Greece You Didn't Know About](#).

## **Earthquakes**

- [Euro-Mediterranean Seismological Centre \(EMSC\)](#).
- [Earthquakes Monitoring Live Worldwide](#).
- [Earthquake dynamics sustained by seismic CO<sub>2</sub>](#).
- [M6.2 earthquake rattles central Chile; USGS summary \[here\]\(#\)](#).
- [Constraining the Seismogenic Fault Geometry of the 1923 M 7.2 Renda Earthquake on the Nonplanar Northwestern Xianshuihe Fault with Dynamic Rupture Simulations](#).
- [Occurrence of major earthquakes is as stochastic as smaller ones](#).
- [The 2023 6.8 Mw Al Haouz Lower Crustal Earthquake Buried in a Thick Crust Within a Thin Lithosphere Beneath the High Atlas Mountain Range \(Morocco\)](#).
- [Environmental Controls on the Near-Surface Seismic Velocity Changes in the South China Coastal Area](#).
- [Possible mechanism of ionospheric anomalies to trigger earthquakes – Electrostatic coupling between the ionosphere and the crust and the resulting electric forces acting within the crust; SciTechDaily summary \[here\]\(#\)](#).

## **Geohazards**

- [Formation process of the gravel-dominated deposit from the 2011 Tohoku-oki tsunami in Ofunato, northeastern Japan, inferred by integrating sedimentology and tsunami modelling](#).

## **Free Geology Books and Other Stuff**

Free geology books can be downloaded from these sites:

- [OreZone Readers and Experts Telegram Channel](#); the Ore Zone channel also shows employment opportunities for geologists.
- [The Groundwater Project](#) has many groundwater geology books for free download together with free online courses, listed [here](#).
- Free [Groundwater Modeling Courses](#) from the HydroGeoCenter.
- From Western Australia: [Carbonatite, lamprophyre and host rocks in the northern Aileron Province](#).
- The Geology of Indonesia: [Volume 1](#) and [Volume 2](#).
- Brett Davis' book on veins in a deforming rock mass: "[The Veining Bible](#)"; also at [this site](#).
- From the Mineralogical Society of America: [Handbook of Mineralogy](#).
- [Systematic geochemical classification of felsic igneous rocks of the Yilgarn Craton](#).

## Upcoming Events

- [March 15-21, 2026, Provincial Engineering and Geoscience Week, Manitoba](#).
- [AGS Annual Conference 2026, 19th Mar 2026, One Great George Street, London, U.K.](#)
- [ISMPP U: Restoring Trust in Science: Storytelling, AI, and Integrity in Scholarly Publishing \(Mar. 26, 2026, 10:00 am ET\)](#).
- [14-15 April 2026: 2026 IAH Ireland Conference – Groundwater 2035, Tullamore, Ireland](#)
- [GAC-MAC 2026 St. John's NL, St. John's Convention Center, May 25-28, 2026](#).
- [PEG2026: 11th International Symposium on Granitic Pegmatites; 16th–19th August 2026, in Perth, Western Australia](#).
- [14-18 September 2026 , IAH 2026, 53rd Congress of the International Association of Hydrogeologists; Budapest Congress Center](#).
- [September 30 - October 3, 2026 SEG 2026 Conference Salt Lake City, United States](#).
- [Society of Petroleum Engineers Distinguished Lecturer Schedule](#).
- [American Geophysical Union List of Upcoming Meetings](#).
- The Geological Society: [Events & Courses](#).

February 16, 2026

## Geology and Mineral Resources – New Zealand

### Introduction



Figure 1 – New Zealand  
Credit: BohwaZ+Αντιγόνη, Free Art License

[New Zealand](#) is an island country of 5,341,730 people in the [South Pacific](#). The country has an area of 263,310 square kilometres and consists of two main islands, [North Island](#) and [South Island](#), together with over [600 smaller islands](#). New Zealand lies east of [Australia](#) across the [Tasman Sea](#) and south of the islands of [New Caledonia](#), [Fiji](#), and [Tonga](#).

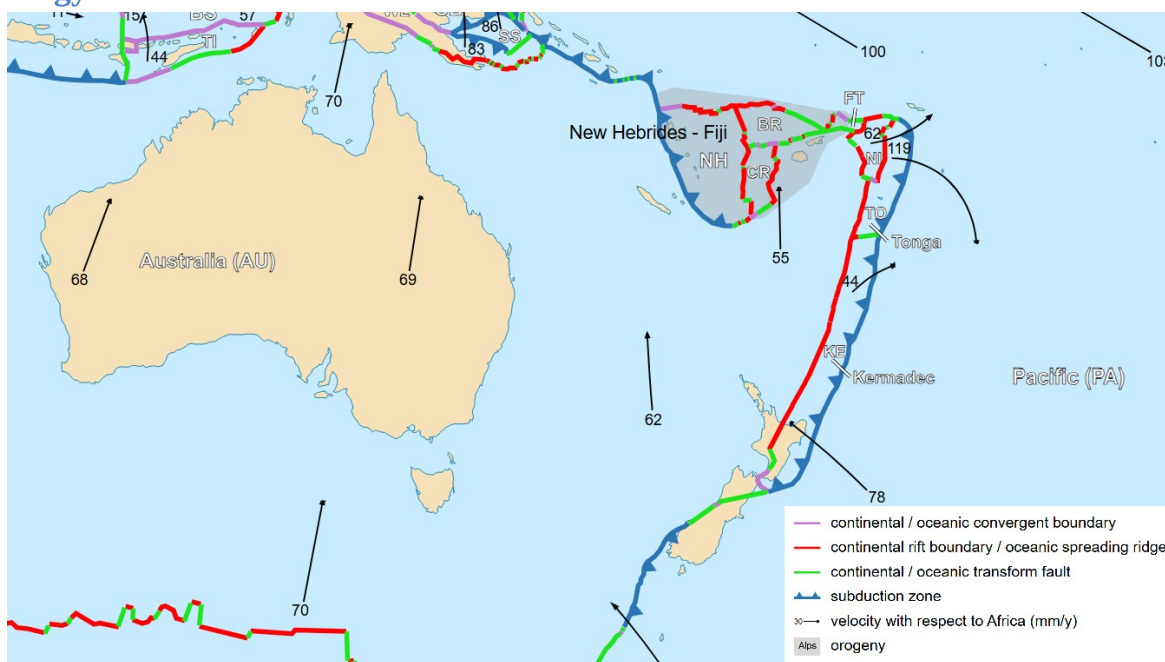
New Zealand is a relatively rich country with a per capita [GDP \(PPP\)](#) of \$55,450 and a very high [Human Development Index](#) of 0.938. An [advanced market economy](#), New Zealand's main industries include agriculture and related food processing industries together with manufacturing industries such as aluminium production, metal fabrication, wood and paper products.

In 2024, the top [exports](#) of New Zealand were dairy products, fruits, beef, sheep and goat meat. The top destinations were China, United States, Australia, Japan, and South Korea. In the latest year, New Zealand was the world's largest exporter of dairy products, rough wood, casein (\$853M), and honey.

In 2024, the top [imports](#) of New Zealand were refined petroleum, cars, gas turbines, telephones, and aerospace products (planes, helicopters, and/or spacecraft). The top origins were China, Australia, United States, South Korea, and Singapore.

For more details on the country, check out the [Wikipedia](#) and [Grokopedia](#) articles on the country.

## Geology

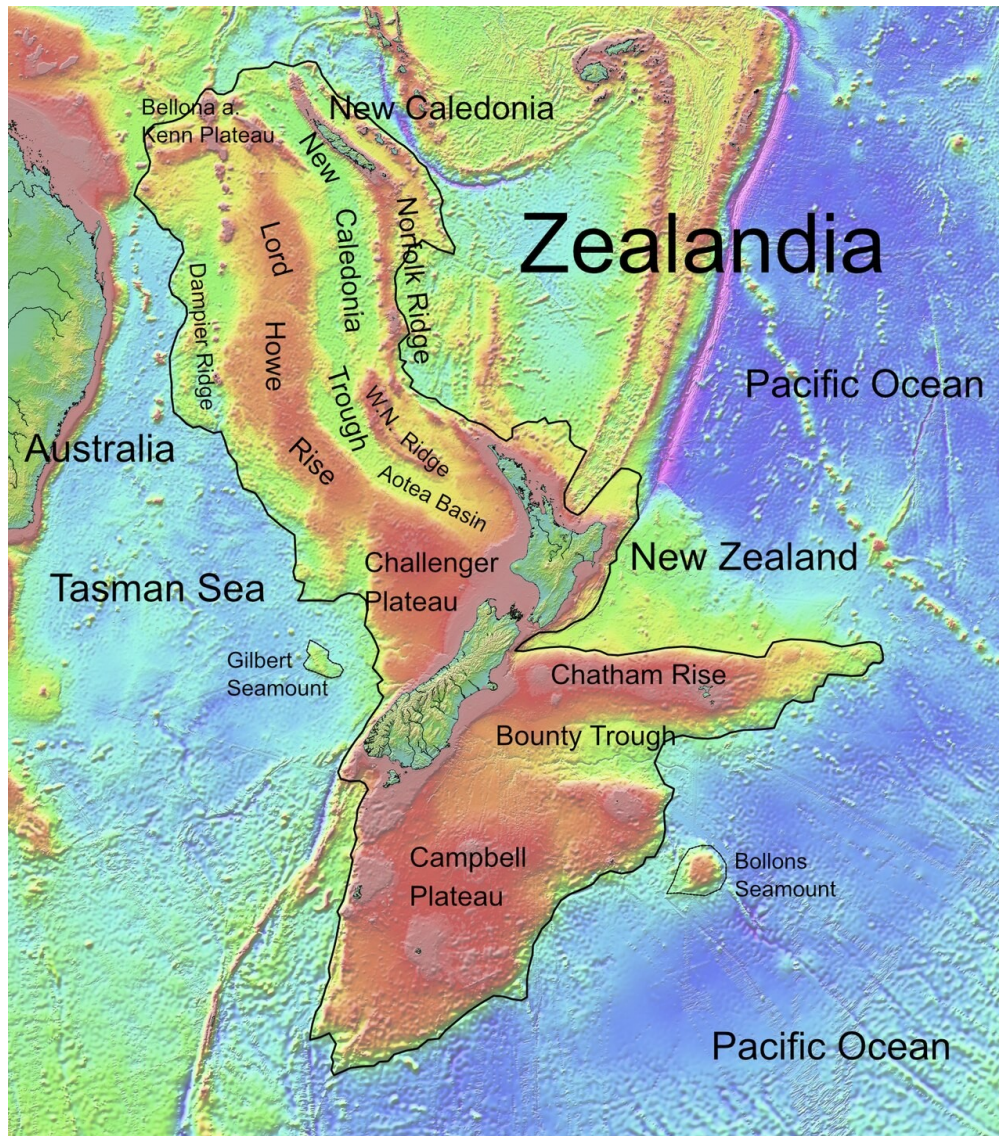


**Figure 2 – Tectonic Framework of New Zealand**

**Credit:** Eric Gaba ([Sting](#)), modified, [Creative Commons Attribution-Share Alike 2.5 Generic](#) license

New Zealand sits on the boundary between the [Pacific Plate](#) and the [Australian Plate](#) with the small [Kermadec Plate](#) being slowly squeezed out between the two larger [tectonic plates](#). The Kermadec Plate is separated from the Australian Plate by [divergent boundary](#) or ocean-spreading ridge. The Pacific Plate is subducting under the Kermadec Plate at a [subduction zone](#). The boundary between the Australian and

Pacific plates is a mix of [transform faults](#) and a subduction zone; in New Zealand this boundary is called the [Alpine Fault](#).



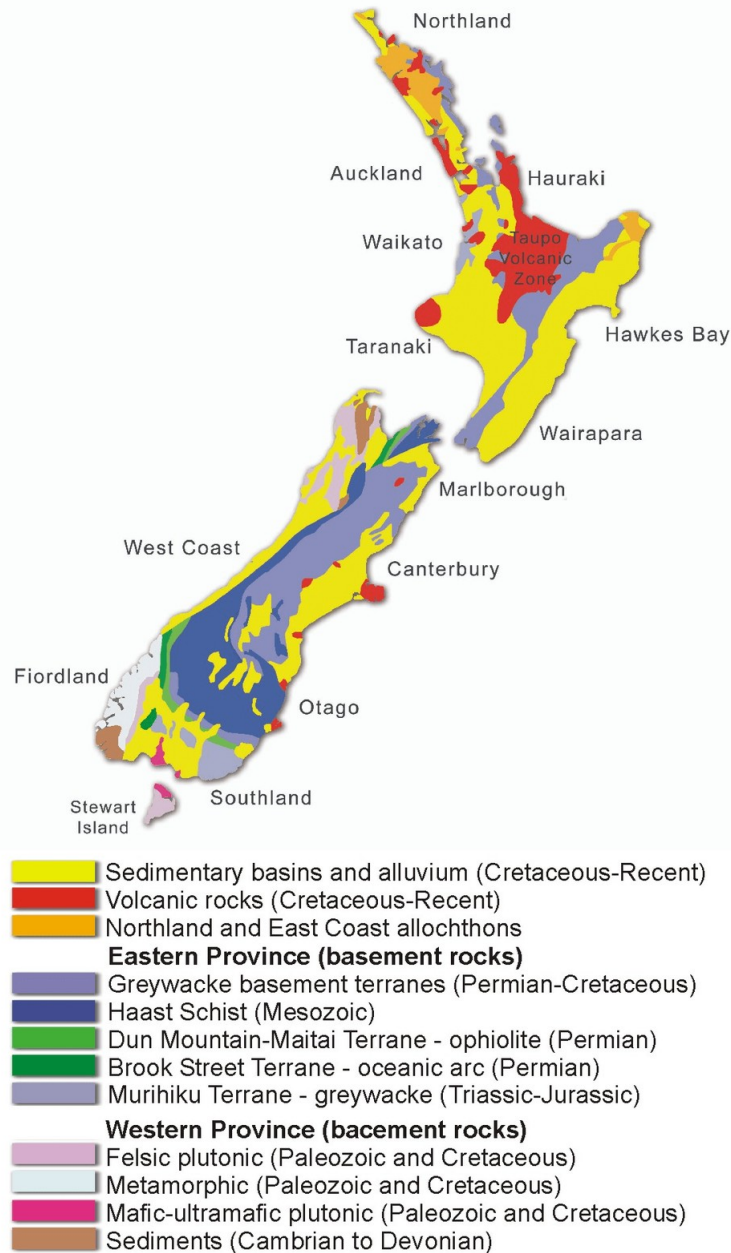
**Figure 3 – Topographic map of Zealandia**

**Credit:** Ulrich Lange, [Creative Commons CC0 1.0 Universal Public Domain Dedication](#) license

Given the presence of subduction zones and divergent boundaries, you might think that New Zealand was a mixture of [island arc volcanism](#) and other volcanoes typical of those tectonic environments, but it is a lot more complex than that. Much of New Zealand is, in fact, the main visible expression of a small continental plate called [Zealandia](#). This [submerged continent](#) is made up of portions of the Pacific Plate, the Kermadec Plate, and a fragment of the ancient supercontinent of [Gondwana](#).

The [geology of New Zealand](#) is fairly complex as the result of all this tectonic activity, activity that [continues to this day](#). Figure 4, below, shows a basic geological map of New Zealand.

## New Zealand Geology



**Figure 4 – New Zealand Geology**

**Credit:** Ulrich Lange, [Creative Commons Attribution 4.0 International](#) license

### **Cambrian**

The oldest [rocks](#) in New Zealand are [Cambrian](#) aged deposits on the northwest part of the South Island, part of ancient Gondwana. These include:

- A sedimentary sequence with [slate](#), [argillite](#), [chert](#), [sandstone](#), [limestone](#), and [conglomerate](#) together with volcanic rock such as [basalt](#), [andesite](#), and [tuff](#) near [Nelson](#);

- A layered igneous complex, of [serpentinised peridotite](#), [gabbro](#), and [diorite](#) in the upper [Takaka River](#) region; and
- Possible Cambrian aged [schist](#) and [gneiss](#) in [Fjordland](#).

### ***Ordovician***

[Ordovician](#) aged [rocks](#) in New Zealand include:

- Limestone and [marble](#) in northwest Nelson, with the marble being particularly well exposed on [Takaka Hill](#), sandstone, argillite, [black shale](#), and white [quartzite](#) bands occur mainly to the west of the limestone.
- Alternating hard sandstone and argillite extend down the west coast of South Island as far as [Milford Sound](#).

### ***Silurian***

[Silurian](#) aged [rocks](#) occur in the Nelson region, on [Stewart Island](#) and probably in Fjordland. These are predominantly quartzite, with minor argillite and limestone, some of which have been metamorphosed into schist, gneiss and [amphibolite](#).

### ***Devonian***

[Devonian](#) aged [rocks](#) are present in the Nelson region, near [Reefton](#), on Stewart Island and probably in Fjordland. Many of the igneous intrusions in the South Island, from the Nelson region down to Stewart Island, are of Devonian age.

- The Devonian aged sedimentary sequences include [calcareous mudstone](#), sandstone, and conglomerate in the northwest Nelson area together with quartzite, limestone, and mudstone near Reefton;
- Devonian aged igneous rocks include large [granite](#) and [granodiorite](#) intrusions such as the [Karamea Batholith](#) in the northwest of the South Island, and also as smaller intrusions further south. South of [Riwaka](#) in the Nelson area, there is a [basic](#) complex of gabbro, peridotite, and diorite.

### ***Carboniferous***

[Carboniferous](#) aged [rocks](#) in New Zealand include deposits within a unit often simply called [greywacke](#) and consists of hard grey sandstone and darker coloured mudstone. These deposits are found near [Canterbury](#). Interbedded marble and chert occur near [Otago](#). Carboniferous aged granite, granodiorite, and gneiss are found on Stewart Island.

### ***The Greywacke***

Greywacke rock occurs on both North and South Islands and range in age from the Carboniferous to the [Early Cretaceous](#). The dominant rock types are hard grey sandstone and darker coloured mudstone. Greywacke rocks are commonly extremely deformed, fractured, and veined, and mudstone in particular is commonly very sheared.

- On North Island the greywacke is found within the [Torlesse](#) and [Waipapa](#) terranes. Within these terranes, the [Tararua](#), [Ruahine](#), and [Kaimanawa](#) ranges appear to be mainly [Triassic](#) to [Jurassic](#) in

age while the [Wairarapa](#) and [Raukumara](#) greywacke ranges to the east and northeast are younger, Jurassic to Early Cretaceous.

- On South Island the greywacke is found within the [Torlesse](#) and Caples terranes. These include the metamorphic rocks of the [Kaimanawa Mountains](#), and the schists near [Marlborough](#) and Otago.

### *Permian*

[Permian](#) aged [rocks](#) in New Zealand include sedimentary and igneous rocks.

- Sedimentary rocks of Permian age are present in the north of the South Island and in a broad band extending from northwestern Otago through [Southland](#). These are generally derived from the erosion of volcanic rocks and include conglomerate, sandstone, mudstone and limestone.
- Volcanic rocks occur in the [Takitimu Mountains](#) and consist of basalt, andesite, [porphyry](#), [volcanic breccia](#), tuff, with minor interbedded sediments.

### *Triassic*

Triassic aged [rocks](#) occur on both the South Island (i.e., Nelson and Southland) and in the west of the North Island, from northern [Taranaki](#) to the [Waikato River](#). Triassic rocks of the greywacke belt occur in Otago, Canterbury, Marlborough, the axial ranges of the North Island and [Northland](#). Generally, the Triassic rocks are generally conglomerate, sandstone, and mudstone.

### *Jurassic*

Jurassic aged [rocks](#) are widespread in Southland, and in the Waikato area. There are also smaller areas near the [Pyke River](#) in northwestern Otago and in Nelson. They are well represented. Jurassic rocks of the greywacke belt occur in north Canterbury, Marlborough, Wairarapa to [East Cape](#) and Northland. In general, the Jurassic aged rocks are mainly sandstone, mudstone, and conglomerate with bands of tuff.

### *Cretaceous*

[Cretaceous](#) aged sedimentary [rocks](#) in New Zealand are widespread, and are exposed in Northland, East Cape, Wairarapa, Marlborough, [Westland](#), Canterbury and Otago. As well, granite occurs in many places in the South Island and volcanic rocks are widespread in Northland, East Cape, Marlborough and parts of Canterbury.

### *Paleogene*

[Paleogene](#) aged [rocks](#) in New Zealand include those from the [Paleocene](#), the [Eocene](#) and [Oligocene](#) epochs.

- Paleocene and Eocene deposits are mainly sedimentary with a few volcanic rocks being confined to north Otago. These include: marine [greensand](#), siliceous mudstone and chert, minor limestone, and sandstone in Northland; marine conglomerate, greensand, and limestone in south Westland; a distinctive white limestone is present in north Canterbury, Marlborough, and southern Wairarapa; [bentonite](#) mudstone in Wairarapa, [Hawkes Bay](#), and some areas of Northland; and the [Oamaru Diatomite](#); Coal has been found in drill holes at [Kapuni](#) as well as in the area from Taranaki to the Waikato River and near [Whangarei](#).

- Eocene aged basalt, [pillow lava](#) and tuff of are also found in north Otago especially at Oamaru.
- Oligocene deposits are most found in the northwest of the South Island, the north and west of the North Island and in Southland and Otago. These rocks are mainly sedimentary, predominantly limestone, calcareous [siltstone](#) and [glauconitic sandstone](#). Oligocene volcanic rocks are found in Canterbury and north Otago.

### *Neogene*

The [Neogene Period](#) include those of the [Miocene](#) and [Pliocene](#) epochs.

- Miocene aged sediments in New Zealand are marine in origin, particularly in the North Island. The most typical rocks are sequences of alternating sandstone and mudstone. Volcanic activity levels were high during the Miocene and deposited tuff, andesite, basalt, [dacite](#) and volcanic breccia.
- Pliocene deposits in New Zealand include sediments on the South Island, mudstone, sandstone, limestone, shell beds, and [coquina](#); while the North Island Pliocene deposits are mostly volcanic rocks, andesite, volcanic breccia, basalt, [rhyolite](#), and dacite.

### *Quaternary*

The current period in Earth's history, the [Quaternary](#), is represented in New Zealand by the sand dune deposits of Northland, the huge [volcanic plateau of central North Island](#), the alluvial plains of Hawkes Bay, Wairarapa, Canterbury and Southland, and the glacial deposits of the South Island high country.

### **Paleontology**

New Zealand has compiled an extensive [paleontological database](#), so if this interests you, troll through the collection. Also, earlier this year, [new finds from the Quaternary](#) were uncovered in the [Moa Eggshell Cave](#), near [Waitomo Caves](#), North Island.

Here are a few examples:

### *Prognathodon*



**Figure 5 - Prognathodon**

**Credit: Ghedoghedo, [Creative Commons Attribution 4.0 International](#) license**

[Prognathodon](#) was a genus of marine lizards belonging to the [mosasaur](#) family that lived from the [Campanian](#) to the [Maastrichtian](#) epochs of the Cretaceous Period. A species of this genus, [Prognathodon overtoni](#) was found in 1989 by J. Wiffen.

### *Flemingites*



Figure 6 – *Flemingites*

Credit: [乌拉跨氮](#), [Creative Commons Attribution-Share Alike 3.0 Unported license](#)

[Flemingites](#) was a genus of ammonoid from the [Olenekian](#) Epoch of the [Lower Triassic](#) characterized by with spiral ridges on the shell. [Bernhard Kummel](#) found examples of this genus in western Southland, New Zealand in 1958.

### *Trilobites*



Figure 7 – Trilobite Fossils from the Valley of Trilobites

Credit: J.H. Robinson, [University of Otago Geology Museum](#)  
[Creative Commons Attribution 4.0 International license](#)

Some of the oldest fossils from New Zealand came from the [Valley of Trilobites](#) in [Cobb Valley](#). Originally [discovered in 1948](#), the fossils are fully described in: Cooper RA. 1979. *Lower Palaeozoic rocks of New Zealand*. Journal of the Royal Society of New Zealand 9:29–84; Mason A, Watters B. 1999. The Discovery of the New Zealand Cambrian. Geological Society of New Zealand Newsletter 118: 15–20.

## Mineral Resources

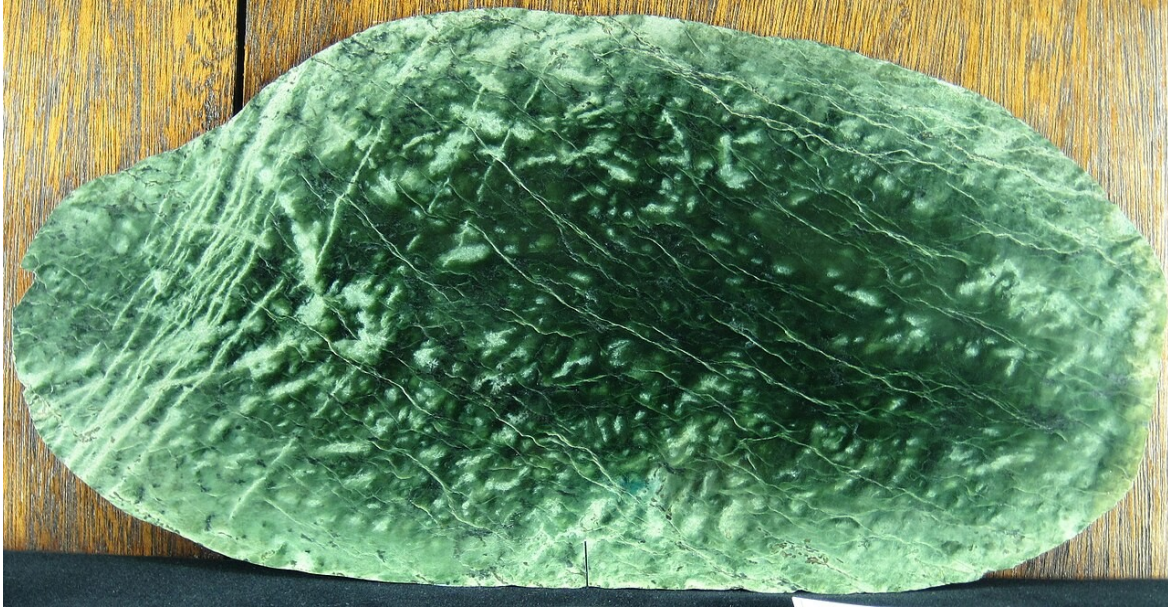


Figure 8 - Nephrite jade from the [Pounamu Ultramafic Belt](#), South Island, New Zealand  
Credit: [James St. John, Creative Commons Attribution 2.0 Generic](#) license

According to the most recent [USGS Minerals Yearbook on New Zealand](#), the country's mineral industry includes the production of metallic minerals, industrial minerals, and fuel minerals – coal, petroleum and natural gas. The most current production statistics from the USGS are [here](#).

### *Metallic Minerals*

Metallic mineral operations include:

- The [Oceana Gold Corp.](#) mines gold at two operations in New Zealand: the [Macraes Operation](#) on the South Island and the [Waihi Operation](#) on the North Island, silver is also produced at the Waihi operation.
- [New Zealand Steel](#) mines [iron sand](#) ore at the [Waikato North Head Mine Site](#); [Taharoa Ironsands Limited](#) mines iron sand at [Taharoa](#).

### *Industrial Minerals*

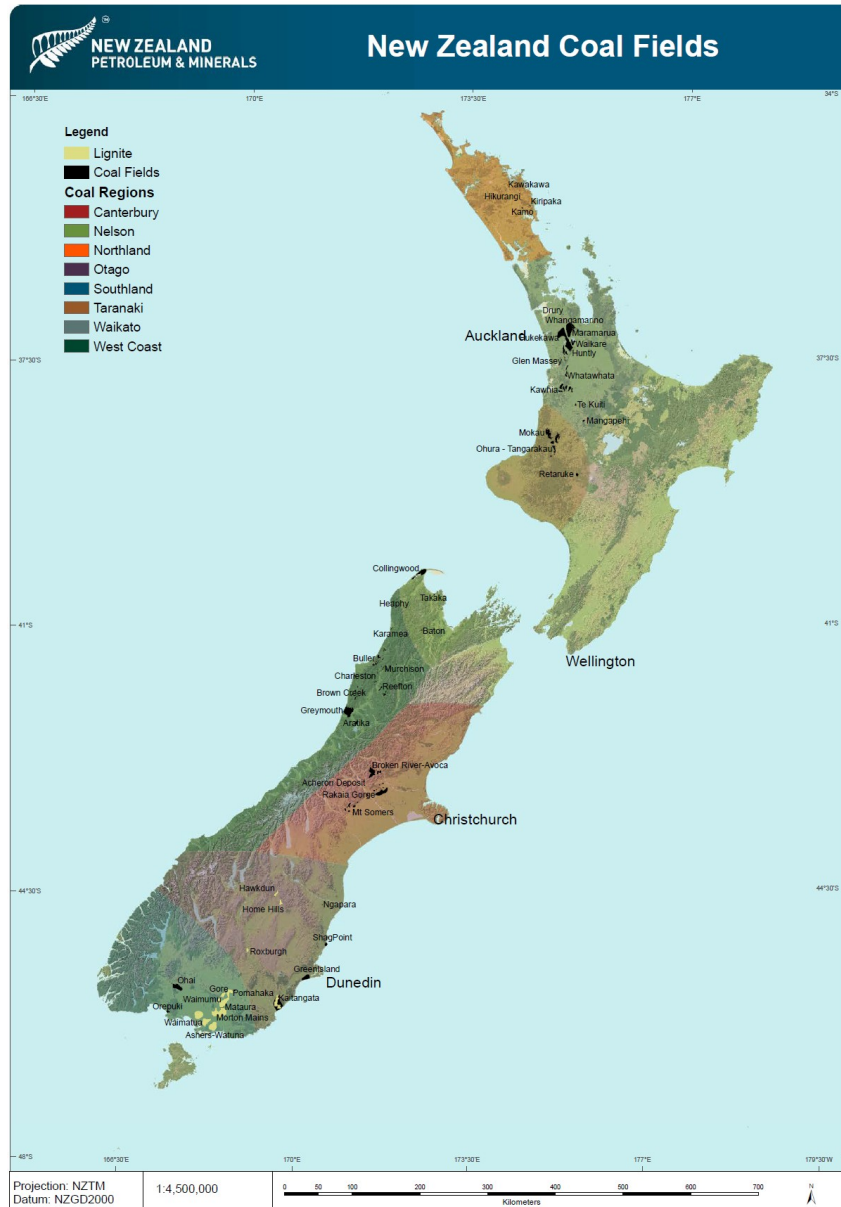
Industrial mineral production in New Zealand includes:

- Cement production by [Golden Bay Cement](#) at [Whangarei](#).
- [Jade deposits on South Island](#).

- Kaolin clay produced by [Imerys Ceramics New Zealand Ltd](#) at the Mahimahi Quarry, [Kaeo, Northland](#).
- [Blue Pacific Minerals](#) quarries [perlite](#) and [zeolite](#) at Ngakuru
- [Dominion Salt](#) produces sea salt at [Marlborough](#).

**Coal**

The major [New Zealand coalfields](#) are located in the Waikato, the West Coast, Otago and Southland. As at the end of 2024 there were [12 operating coal mines in New Zealand](#).



**Figure 9 – New Zealand coal Fields**  
**Credit: [Ministry of Business, Innovation and Employment](#), [Crown Copyright](#)**

## Oil and Natural Gas

Figure 10, below shows the locations of the [18 sedimentary basins](#) that have potential for or are currently producing oil and natural gas deposits. For more information read the booklets on New Zealand petroleum basins:

- [NZ Petroleum Basins - Part One \[PDF 7MB\]](#)
- [NZ Petroleum Basins - Part Two \[PDF 5.5MB\]](#).



**Figure 10 - Map of New Zealand's Petroleum Basins**

**Credit: [Ministry of Business, Innovation and Employment](#), [Crown Copyright](#)**

## Geothermal

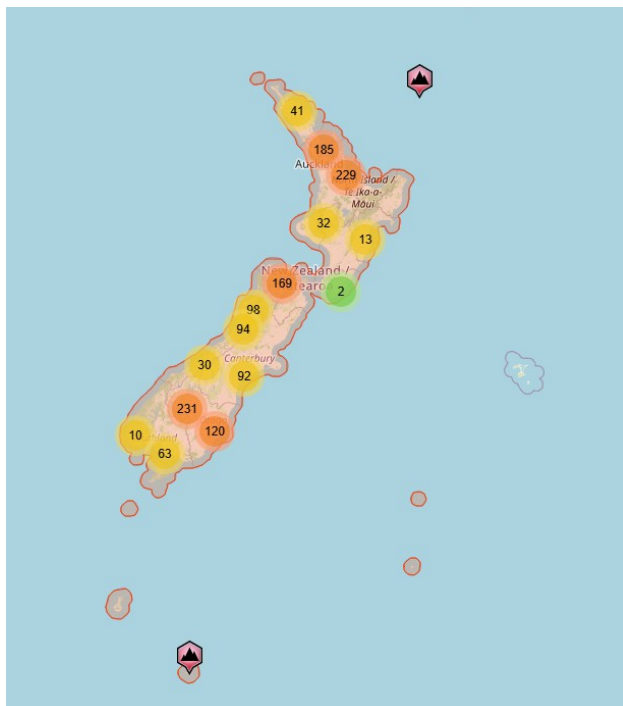


**Figure 11 - Wairakei Geothermal Power Plant**

**Credit: [W. Bulach](#), [Creative Commons Attribution 4.0 International](#) license**

Not covered in the USGS summary of the mineral industry in New Zealand is geothermal energy. With its active volcanism, New Zealand has an abundance of potential and developed geothermal energy. [In 2017](#), electricity generation from geothermal accounted for over 17% of New Zealand's total electricity supply. A comprehensive summary of geothermal energy production and potential in New Zealand can be found [here](#).

Figure 12, below, links to an interactive mineral occurrence map of New Zealand from [Mindat.org](#).



**Figure 12 – Interactive Mineral Occurrence Map of New Zealand** **Credit: [Mindat.org](#)**

## Summary



**Figure 13 - Lake Clearwater, Canterbury, New Zealand**  
**Credit: [Michal Klajban, Creative Commons Attribution 4.0 International license](#)**

There are many opportunities for mineral development in New Zealand, especially in the off-shore oil and gas industry. Geothermal developments are also a promising opportunity. As well, here is a recent news item that points to opportunities in hydrogen production:

- [Natural hydrogen can make decarbonising industry cheaper – NZ’s turbulent geology could give it an edge](#)

I last visited New Zealand in 1988, with my then girlfriend. During that visit we decided to make our relationship a permanent thing, so I have pleasant memories of the place (we’re still married). It’s a wonderful place to visit and I encourage people to do so.

## Standard Caveat

### [J. Robert Oppenheimer on freedom and scientific inquiry](#)

The purpose of my weblog postings is to spark people's curiosity in geology. Don't entirely believe me until you've done your own research and checked the evidence. If I have sparked your curiosity in the subject of this posting, follow up with some of the links provided here. If you want to, go out into the field and examine some rocks on your own with the help of a good field guide. Follow the evidence and make up your own mind.

In science, the only authority is the evidence.