

GOLD DEPOSITS

► Introduction

Gold is formed in a wide variety of hydrothermal deposits, which may then be eroded and the gold re-deposited as sedimentary placer deposits. In hydrothermal deposits, gold is most commonly associated with silver and the base metals, copper, lead and zinc. Most of these deposits are quartz veins deposited from hydrothermal fluids in fault zones at medium (mesothermal) or shallow (epithermal) depths in the crust.

Past and present gold production in New Zealand has been from four main geological environments:

- Mesothermal quartz lodes in Paleozoic metagreywacke
- Mesothermal quartz lodes in Mesozoic schist
- Epithermal quartz lodes in Cenozoic volcanic rocks, and
- Placer deposits in Cenozoic gravel and sand

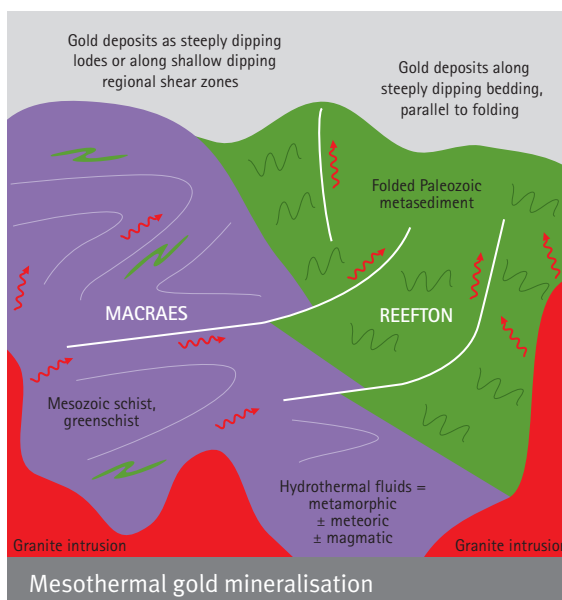
Several other styles of gold mineralisation are represented including porphyry copper and other hydrothermal deposits related to igneous intrusions, and volcanogenic massive sulphide deposits.

► Mesothermal quartz lodes in Paleozoic metagreywacke

Turbidite-hosted mesothermal gold deposits are found in Ordovician rocks at Golden Blocks in Northwest Nelson, at Mokihinui, Lyell, Reefton, Langdons and Mt. Greenland on the West Coast, and at Preservation Inlet in Fiordland, and have accounted for about 8% of New Zealand's total gold production. The deposits consist of quartz veins which were formed in steeply dipping shear and fault structures in Greenland Group greywacke and argillite. The deposits

are metamorphogenic and were probably deposited by hydrothermal fluids released during greenschist facies metamorphism.





The most important deposits of this type in New Zealand are those in the Reefton Goldfield, where over 67 t of gold were produced from 84 mines between 1870 and 1951. The gold quartz lodes are contained within a NNE-trending belt of Greenland Group metasedimentary rocks, some 34 km in length by 10 km in width. The largest known deposits were worked at the Blackwater and Globe-Progress mines. In the Blackwater Mine, the Birthday Reef averaged less than one metre in width but had a strike length of 1070 m, and was mined to a depth of 830 m, to produce 23 t of gold between 1909 and 1951. Quartz lodes at the Globe-Progress mine produced 13 t of gold between 1879 and 1920. Both deposits are currently being further explored.



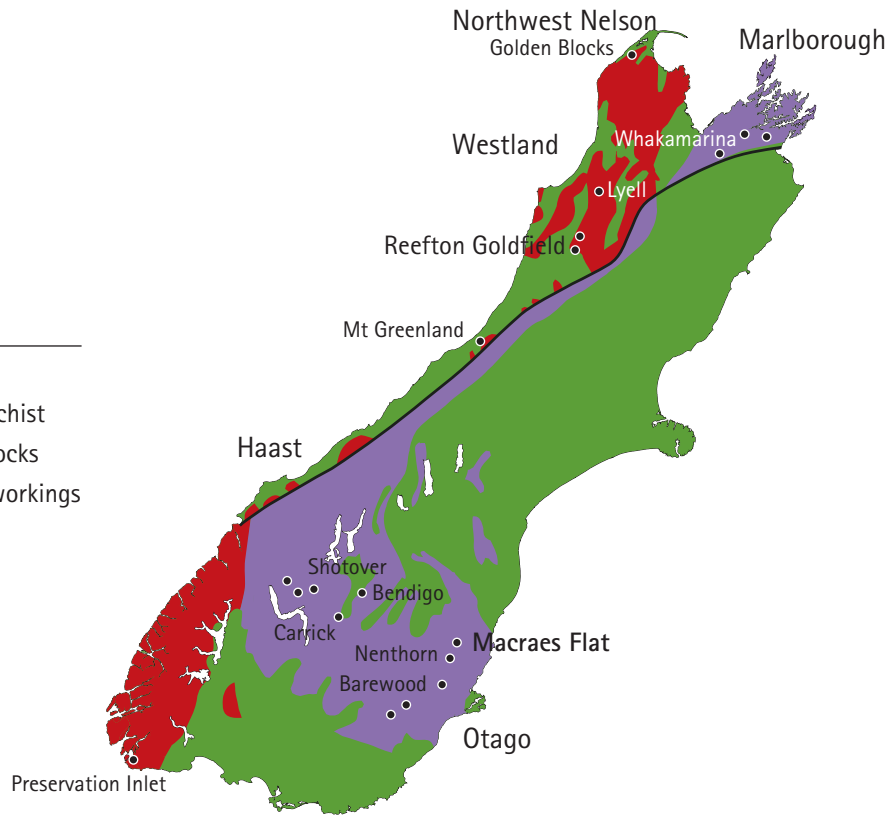
Location



Legend

	Sediments
	Mesozoic schist
	Paleozoic rocks
	Historical workings

Scale



Mesothermal gold provinces

► Mesothermal quartz lodes in Mesozoic schist

Turbidite-hosted mesothermal quartz lode gold deposits are found in the Haast Schist of Otago, Marlborough and Southern Alps. The Otago veins were deposited from low salinity hydrothermal fluids of metamorphic origin. A genetic model for the Otago deposits involves the release of fluid during fault slip episodes, and mineralisation at different levels throughout the more than 100 million year uplift history of the schist belt.

The lodes are typically lensoidal, less than 1 m wide and localised along single or multiple parallel shear zones that generally dip steeply. A notable exception is Macraes Flat, where mineralisation occurs in lode shears, stockworks and disseminated stockworks within the gently dipping Hyde-Macraes Shear Zone. The shear zone is 26 km long, with gold ore produced from a series of pits along the zone. The current mining operation began late in 1990 and the project has now produced more than 1 million ounces

of gold. In 1999 the operation milled 3,545,687 t of ore to produce 3866 kg gold and 240 kg silver at a mill recovery of 75.4%.

Although they accounted for only 2.6% of New Zealand's total pre-1980 gold production, the deposit at Macraes Flat is now New Zealand's largest operating gold mine.



Macraes mine, Otago

► Epithermal quartz lodes in Cenozoic volcanic rocks

Epithermal gold-silver deposits in Northland and in the Hauraki Goldfield were formed in past geothermal systems associated with volcanism that was active in the Miocene - Pliocene, whereas gold is being deposited today in active geothermal systems in the Rotorua-Taupo area, in association with Quaternary volcanism.

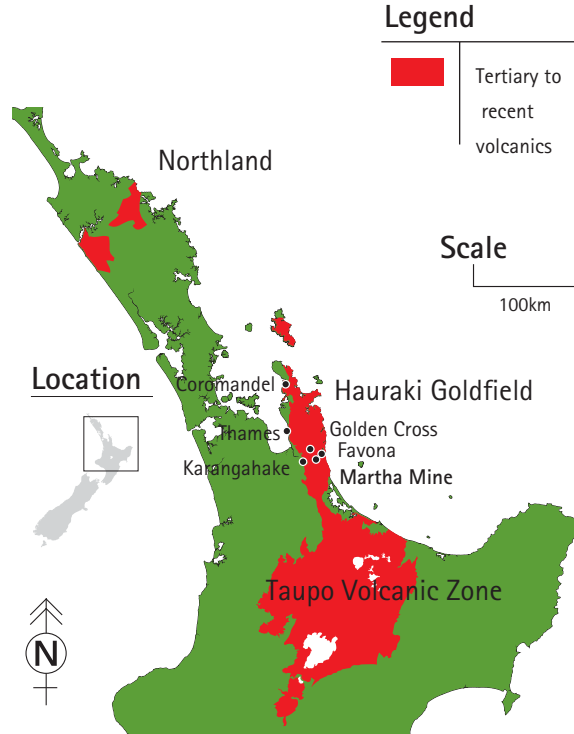
The Hauraki Goldfield contains about 50 known epithermal gold-silver deposits that were deposited by geothermal systems associated with volcanism that was active during the Miocene and Pliocene. About 1360 t of gold-silver bullion were produced between the 1860s and 1952 (about 34% of New Zealand's total gold production), mostly from deposits hosted by andesite and dacite.

The Martha Mine is the largest producer in the Hauraki Goldfield with 1100 t of bullion mined from underground workings between 1878 and 1952. The mine was reopened in 1988, and is the second largest in New Zealand, currently producing about 3 t of gold and 25 t of silver from open pit mining. Four major lodes (Martha, Welcome, Empire and Royal) and numerous smaller veins strike in a northeasterly direction and form a braided vein system over 2.5 km long by 600 m wide extending to a depth of over 600 m.

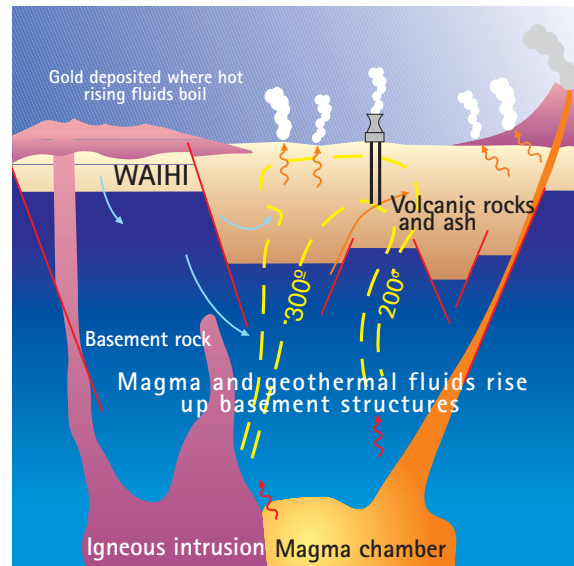
At the Golden Cross deposit, northwest of Waihi, mining of a resource of about 19 t Au began in 1991. By 1993 Golden Cross was New Zealand's biggest mine, producing 3.2 t gold and over 10 t silver, but the mine was closed in 1997.

Small quantities of ore-grade gold-silver mineralisation have been deposited by geothermal fluids in several active geothermal fields of the Taupo Volcanic Zone, including Ohaaki (Broadlands), Rotokawa, Waiotapu and Kawerau. Highly mineralised precipitates have also been found in discharges associated with geothermal exploration and development. Silver-gold mineralisation is also present in fossil geothermal systems in the Taupo Volcanic Zone.

Several hot springs-type epithermal deposits are known in Northland. Small quantities of silver and mercury have been produced at Puhipuhi and mercury at Ngawha. Reconnaissance drilling to intersect feeder quartz veins at Puhipuhi intersected 10 m averaging 5.3 g/t Au and 18.5 g/t Ag. At Te Pene, Te Mata and Puketotara, quartz veins and silicified breccias have geochemically anomalous values gold and silver.



Epithermal gold provinces



Epithermal gold mineralisation



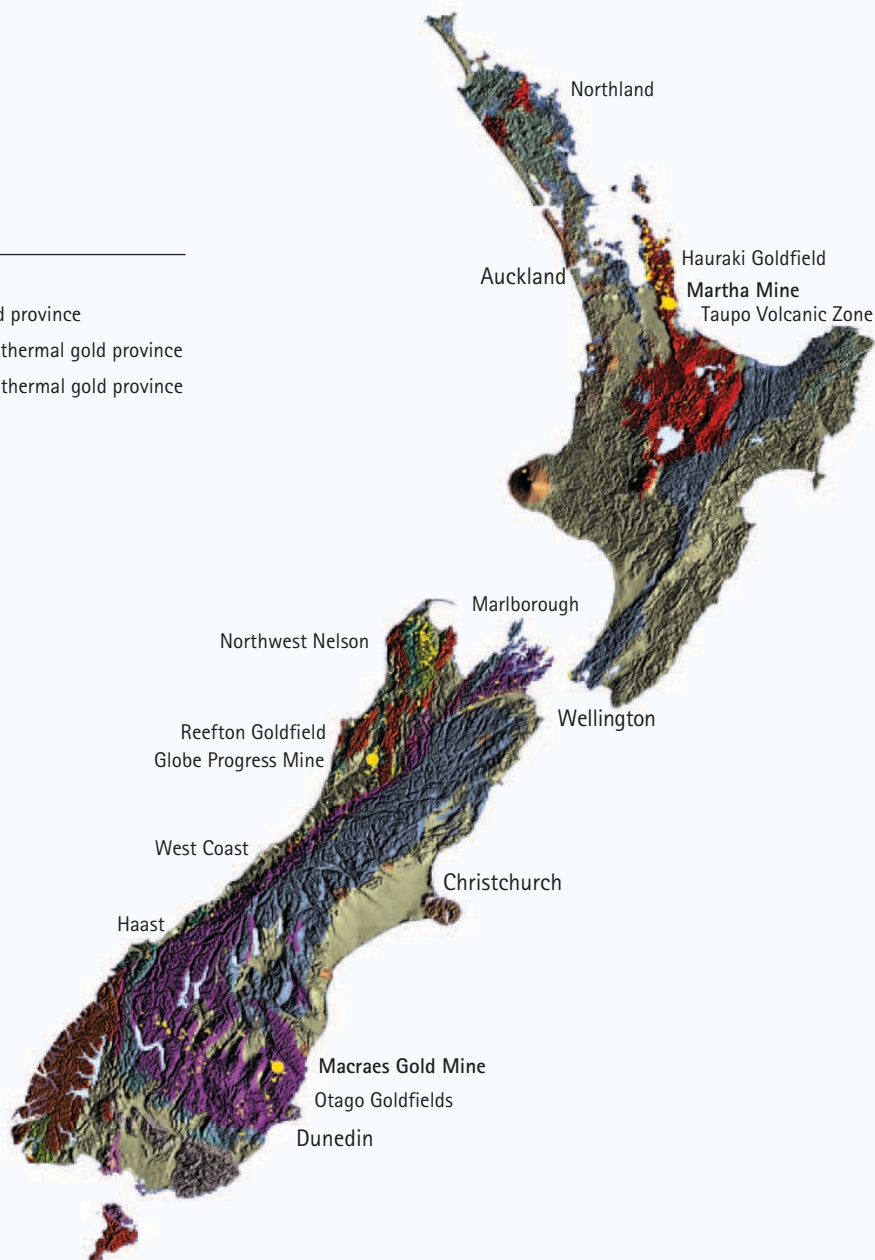
Martha mine, Waihi

Legend

- Gold deposits
- Epithermal gold province
- Mesozoic mesothermal gold province
- ■ Paleozoic mesothermal gold province

Scale

0km 100km 200km



Gold provinces and gold deposits

► Placer deposits

Giant placer gold fields are present in Cenozoic gravel and sand in Westland and Otago-Southland, and smaller placers are found in west Nelson and Marlborough. About 600 t of gold was produced in the past, equivalent to about 54% of New Zealand's total historic production, initially during the gold rushes of the 1860s and 1870s, and later by sluicing and dredging operations. The last of the big river dredges closed operations on the West Coast in 2004. Since 1980 there have been a large number of small and medium scale gold recovery operations using hydraulic excavators and mobile gold recovery plants.

Beach placers are found on the west and south coasts of the South Island in present day beaches, older postglacial beach deposits, and the raised beach deposits of successive marine interglacials which underlie the remnants of coastal terraces. Gold, always very fine, is concentrated with other heavy minerals into lenticular beach placers. Offshore deposits of placer gold occur in places off the Coromandel Peninsula and Hokitika.