# **NEW ZEALAND**

### By Travis Q. Lyday

New Zealand's wide variety of economic minerals reflects its diverse geologic and dynamic tectonic history. In 1999, mining activities in New Zealand included extracting coal by underground and open cast methods; mining gold, silver, and titanomagnetite sand (ironsand); and quarrying raw materials for use primarily in the domestic construction (clays, sand and gravel, and stone) and agricultural (limestone and marble) industries. Natural gas, natural gas liquids, and crude petroleum also were produced during the year.

Although the extractive minerals industry (rocks and minerals, coal, natural gas, and petroleum) in New Zealand constituted a small segment of the economy, it contributed an estimated 3% to 4% to the gross domestic product (GDP) of the country. The mineral-processing sector, which consisted chiefly of the production of primary aluminum, concrete, manufactured fertilizer, refined petroleum products, and crude steel mostly produced from imported raw materials, provided an estimated 4% to 5% to the GDP, thus increasing the value of the country's mineral industry to about 7% to 9% of the GDP. New Zealand's mining industry was a \$500 million sector that employed about 12,000 people (Mineral Resources of New Zealand, 2000b).

Minerals owned by the New Zealand crown [a term inherited from the United Kingdom and interpreted as being the state] were regulated by legislation passed by Parliament, namely the New Zealand Crown Minerals Act 1991 and the Crown Minerals Amendment Act (No. 2), which was passed in 1997. Crownowned minerals included all naturally occurring gold, silver, and petroleum and substantial amounts of coal and other metallic and nonmetallic minerals and aggregates (Mineral Resources of New Zealand, 2000c).

#### **Commodity Review**

**Gold and Silver.**—Gold and silver were produced from two large hardrock mining operations—the Macraes open cut 55 kilometers (km) north of Dunedin in the Eastern Otago region of South Island and the Martha Hill open cut at Waihi 120 km southeast of Auckland at the base of the Coromandel Peninsula, North Island. Numerous smaller scale alluvial gold mining operations were on South Island; these included dredging along the Arahura River 10 km northeast of Hokitika, the Glenore dredge operation 6 km west of Milton, the Grey River dredge 20 km north of Greymouth, and the Ross open cut 25 km southwest of Hokitika. Nearly all New Zealand's known gold mines and prospects were first identified and exploited in the years during and following the gold rushes of the 19<sup>th</sup> century (Resource Information Unit, 2000, p. 18).

The Macraes Mine, New Zealand's largest gold mine and wholly owned by Australia's Gold and Resource Developments NL, was developed in 1990 on the Round Hill deposit 5 km north of the town of Macraes. Oxide ore was reclaimed from stockpiles and processed from yearend 1998 to May 1999, when sulfide ore processing resumed. In November 1997, a technology licensing agreement was signed with U.S.-based Newmont Gold Co. that enabled the use of the patented pressure oxidation process (POX) on Macraes' refractory ores and lifting gold recovery from 70% to about 84% (Mining Journal, 2000). The POX plant was commissioned on September 22, 1999, and almost immediately achieved design throughput and carbon-in- leach recoveries. Additionally, part of the Macraes expansion was an upgrade in the flotation recovery circuit, which followed the startup of a second ball mill in late July (Resource Information Unit, 2000, p. 49-50).

The underground Martha Hill Mine produced about 171,100 kilograms (kg) (5.5 million troy ounces) of gold and 1,150,800 kg (37 million troy ounces) of silver between its beginnings in the 1880's and its closure in 1952 (Resource Information Unit, 2000, p. 50). Using open cut methods, the mine was reopened in 1987 by joint-venture partners Normandy Mining Ltd. (67.06%) and Otter Gold Mines Ltd. (32.94%). First gold was poured in May 1988. The Martha Mine has produced about 23,950 kg (770,000 troy ounces) of gold and 130,650 kg (4.2 million ounces) of silver since its reopening (New Zealand Mining, 1999c). In December 1998. New Zealand's Environment Court ruled in favor of a \$30 million expansion of the mine from 2,644 kilograms per year (kg/yr) (85,000 troy ounces per year) to 3,421 kg/yr (110,000 troy ounces per year). This should extend mine life to at least 2007 (Mining Magazine, 1999). Major construction work, which included upgrades of the crushing plant, the overland conveyor, and the process plant, was completed by yearend 1999, and production was ramping up toward the new production targets (Mineral Resources of New Zealand, 2000a).

**Iron and Steel.**—Iron ore in the form of titanomagnetitebearing ironsand was mined and concentrated at two projects along the western coast of North Island by BHP New Zealand Steel Ltd. (NZ Steel), which was a wholly owned subsidiary of Australia's BHP Steel Mining Ltd. Titanomagnetite concentrate was produced by dry-mining (bulldozing and bucketwheel excavation) methods at Waikato-North Head 30 km south of Auckland and pumped as a slurry through an 18-km-long highpressure pipeline to NZ Steel's integrated Glenbrook Steelworks for direct reduction steelmaking. NZ Steel had an exclusive license with the Government to mine ironsand for a period of 100 years beginning in 1996. NZ Steel used wet- (suction dredging) and dry-mining methods to produce an ironsand concentrate at its Taharoa project 120 km farther south. The Taharoa concentrate was pumped via twin 3-km-long slurry pipelines onto stockpiles near the ship-loading plant at the port of Taharoa where it was shipped to China and Japan. The Taharoa site was leased by its Maori owners to NZ Steel for a period of 70 years beginning in 1968 (Resources Information Unit, 2000, p. 80).

**Platinum.**—Following the first-ever discovery of primary platiniferous drill core intersections in New Zealand toward yearend 1998, junior platinum explorers entered 1999 with cautious enthusiasm. Although interest was stirred in a number of areas on the South Island, the main focus during 1999 was near Invercargill in Southland where Canadian-based Anzex Resources Ltd. explored the Longwood Range and found platinum and palladium in association with mafic and ultramafic rocks. The igneous complex of the Longwoods showed distinct similarities to the Bushveld Complex in South Africa and to Stillwater in the United States (Resource Information Unit, 2000, p. 21)

**Industrial Minerals.**—New Zealand had a large number of industrial minerals operations in 1999. Although most produced aggregates (gravel, sand, crushed stone, and other materials used mainly in construction), significant amounts of amorphous silica, high-grade silica sand, bentonite, diatomite, dolomite, halloysite, lime and limestone, perlite, pumice, zeolite, and a variety of brick clays were also produced (New Zealand Mining, 1999b).

Coal.—Coal was produced from about 60 mines in more than 40 separate coalfields on North Island and South Island. The estimated resource of almost 9 billion metric tons of potentially recoverable coal was 82% lignite, mainly in Southland and Otago on South Island; 14% subbituminous, mainly in Waikato, North Island; and 4% high-value bituminous coal, mainly in Westland, South Island (New Zealand Mining, 1999a). Production was dominated by Solid Energy New Zealand Ltd., which was a state-owned enterprise operated on a competitive, commercial basis that produced about 70% of production (Asian Mining Yearbook, 1999, p. 93). The single largest domestic consumer of coal was the direct reduction steelworks at Glenbrook. Demand for coal used for the generation of electricity at thermal powerplants has declined to nil except during emergencies, such as prolonged drought (Crown Minerals, March 26, 2000, Coal resources of New Zealand, accessed July 21, 2000, at URL http://www.med.govt.nz/ crown minerals/resdata/reviews/coalres.html).

Natural Gas and Oil.—Gas and oil seeps were known throughout the country long before the first European settlers arrived (Crown Minerals, February 15, 2000, Petroleum— Current activity and production, accessed March 14, 2000, at URL http://www.med.govt.nz/crown\_minerals/petroleum. html). The Taranaki Basin has been the main focus for hydrocarbon exploration and production. The first well was drilled in 1865 near New Plymouth, and petroleum has been produced continuously from the basin since about 1900. The modern era of exploration and production in New Zealand began in 1959 with the discovery of the Kapuni gas condensate field on the Taranaki Peninsula. In 1969, the country's third offshore well discovered the giant Maui gas condensate field off the coast of North Island. More than 70% of New Zealand's production was derived from the Maui and Kapuni Fields (Crown Minerals, April 11, 2000, Overview of New Zealand's petroleum systems, accessed July 21, 2000, at URL http://www.med.govt.nz/crown\_minerals/petroleum\_info/pet\_syst/overview.html).

New Zealand's downstream mineral industry consisted of two steel mills; an aluminum smelter; aluminum, copper, and brass extrusion plants; and an oil refinery, all of which primarily used imported raw materials. There were also three cement companies, each with a single plant.

The transportation infrastructure of New Zealand was well developed. International shipping ports included Auckland, Christchurch, Dunedin, Tauranga, and Wellington. The 14-ship merchant marine fleet included 1 liquefied gas tanker and 3 petroleum-oil-lubricant tankers. Pipelines included 1,000 km for natural gas, 160 km for refined petroleum products, and 150 km for liquefied petroleum gas (U.S. Central Intelligence Agency, 1999, World factbook—New Zealand, accessed October 27, 1999, at URL http://www.odci.gov/cia/publications/factbook geos/nz.html).

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#### **Major Source of Information**

Crown Minerals, Ministry of Commerce 33 Bowen St., Commerce Bldg. P.O. Box 1473 Wellington, New Zealand Telephone: (++64 4) 472 0030 Fax: (++64 4) 499 0968 E-mail: crown.minerals@moc.govt.nz URL: http://www.crownminerals.govt.nz

## TABLE 1 NEW ZEALAND: PRODUCTION OF MINERAL COMMODITIES 1/

#### (Metric tons unless otherwise specified)

Commodity	1995	1996	1997	1998 e/	1999 e/
METALS					
Aluminum metal, smelter:		202.220	210.224	207.000	200.000
Primary Secondary (	273,296	283,329	310,324	307,000	300,000
Secondary e/	8,200	8,300	8,000	8,600	7,700
Total e/	281,496	291,629	318,324	315,600	307,700
Gold, mine output, Au content kilogram	<u>s</u> 12,132	11,879	11,359	8,200 r/	7,600
Iron and steel:	- 2202	2 224	2 479	2 120 - / 2/	2 280 2/
Iron sand (titaniferous magnetite), gross weight thousand ton		2,334	2,478	2,120 r/2/	2,280 2/
Pig iron de		619 r/2/	534	609 r/2/ 756 r/2/	620 2/ 744 2/
Steel, crude do		680	680		
Lead, refinery output, secondary e/	6,000	6,000	6,000 31.684	6,000	6,000
Silver, mine out put, Ag content INDUSTRIAL MINERALS	27,794	29,611	51,084	31,500	31,600
Cement, hydraulic		974	976	950	900
	930 8/	974	970	930	900
Clays: Bentonite	3,699	13,734	12,802	14,000	15,000
	13,662	26,325	21,874	26,000	25,000
Kaolin (pottery) For brick and tile		26,323 27,159	21,874 33,396	28,000	30,000
Diatomaceous earth 3/	XX	16	33,390 20 e/	27,000	20
Marble	100,000 1,139	20,916 2/ 1,500	20,196 2/ 1,500 e/	20,000 1,500	20,000 1,500
Nitrogen, N content of ammonis		1,300 67,700 r/	79,600 e/	93,700 r/ 2/	1,300
Perlite 4/		67,700 f/ 1,880	79,600 e/ 4,960	93,700 f/ 2/ 5,000	5,000
	77,054	90,571	4,960	190,000	3,000 190,000
Pumice Salt e/	50,000	90,371 67,000	67,000	65,000	65,000
Sand and gravel:		67,000	67,000	63,000	63,000
		23,867	25 021	25 000	25,000
Silica sand (glass sand) Other industrial sand	31,052	23,867 508,950	25,931 463,438	25,000 500,000	25,000
	627,671 s 16,100		403,438 15,000 e/	15,000	15,000
For roads and ballast thousand ton	_ ′	15,566	,	<i>'</i>	,
For building aggregate do Stone:	<u>5,126</u>	8,069	8,000 e/	8,000	8,000
Dolomite		21,718	20,000 e/	20,000	20,000
Limestone and marl:	14,212	21,718	20,000 e/	20,000	20,000
For agriculture thousand ton	s 1,300	1,457	1,316	1,500	1,500
For cement do	_ `	1,437	1,510	1,500	1,500
For other industrial uses do		461	460 e/	450	450
For roads 5/ e/		530 2/	400 e/ 550	550	430 550
Seprentine do		15,714	15,000 e/	15,000	15,000
Dimension	25,080	27,242	28,000 e/	15,000	15,000
Rock for harbor work thousand ton		1,500 e/	28,000 e/ 1,500 e/	1,500	1,500
MINERAL FUELS AND RELATED MATERIALS	5 1,527	1,500 6/	1,500 6/	1,500	1,500
Carbon dioxide, liquefied e/	10,000	10.000	10,000	10,000	10,000
Coal:	10,000	10,000	10,000	10,000	10,000
Bituminous thousand ton	s 1,570	1,672	1,500	1,000 r/ 2/	1,140
Subbituminous do		1,559	1,951	1,300 r/ 2/	1,140
Lignite do		249	213	1,500 f/ 2/ 150 r/ 2/	1,490
Total do		3,480	3,664	2,450 r/ 2/	2,790 2/
Coke:		5,460	3,004	2,430 1/ 2/	2,790 2/
Coke oven Gashouse					
Total					
	9,000 e/				
Gas: e/ Manufactured (from converte) the user d cubic motor	11 500	11 500	11 500	11.000	11,000
Manufactured (from gasworks) thousand cubic meter	<u>s</u> 11,500	11,500	11,500	11,000	11,000
Natural: Cross production million subia motor	4 000 2/	1 000 2/	1 000	1 000	5 000
Gross production million cubic meter		4,800 2/	4,800	4,800	5,000
Marketed production de	9. 4,000	3,900	3,900	3,900	4,050
Natural gas liquids: e/	1.500	1 500	1 500	1 500	2 000
Liquefied petroleum gas thousand 42-gallon barrel		1,500	1,500	1,500	2,000
Natural gasoline do		500	500	500	700
Total do		2,000	2,000	2,000	2,700
Peat	107,703	109,982	107,041	110,000	110,000

See footnotes at end of table.

#### TABLE 1--Continued NEW ZEALAND: PRODUCTION OF MINERAL COMMODITIES 1/

#### (Metric tons unless otherwise specified)

Commodity		1995	1996	1997	1998 e/	1999 e/
MINERAL FULES AND RELATED MATERIALSContinued						
Petroleum:						
Crude	million 42-gallon barells	11,880	15,848	21,016	21,000	21,000
Refinery products:						
Gasoline	do.	13,505	12,634	13,219	14,000	14,000
Distillate fuel oil	do.	11,680	10,852	12,038	11,000	11,000
Residual fuel oil	do.	2,555	2,967	3,250	3,000	3,000
Other	do.	2,920	6,735	7,380	3,000	3,000
Refinery fuel and losses e/	do.	(6/)	2,000	2,000	2,000	2,000
Total e/	do.	30,660	35,188	37,887	33,000	33,000

e/ Estimated. r/ Revised. XX Not applicable. -- Zero. 1/ Table includes data available through July 10, 2000.

2/Reported figure.

3/ Not delineated prior to 1996.

4/ Includes zeolite beginning in 1995.

5/ Includes dolomite beginning in 1996.

6/ Refinery and fuel losses for 1995, 1,825 million 42-gallon barrels, are included in the output of the individual petroleum products.