### THE MINERAL INDUSTRY OF

# **NEW ZEALAND**

### By Travis Q. Lyday<sup>1</sup>

The New Zealand mining industry is centered primarily on coal and gold, mineral commodities with long traditions in the country. The mineral industry in New Zealand began with the discovery of gold on the Coromandel Peninsula, North Island, in 1852. Coal mining also began in the 1850's. Since then, a wide range of minerals has been produced.

The existence of extensive iron sand deposits on the west coast of North Island has been known for more than a century, but not until the late 1960's was a steelmaking industry in New Zealand able to use successfully the iron sands and coal from an area near Waikato-North Head. Construction of the Glenbrook steelworks was completed in 1970.

Serious exploration for oil and gas began in the late 1950's, resulting in the discovery of several natural gas fields to date. The Kapuni Field was discovered in 1959 and began production in 1970, supplying gas to North Island Government distribution centers and industrial customers. The much larger Maui offshore gasfield, New Zealand's largest, was discovered in 1969. Its production has been used primarily for electricity generation and as a premium fuel.

New Zealand's extractive mineral industry constitutes only a small segment of the economy, contributing on the order of 1% to 2% to the country's gross domestic product (GDP), estimated at \$52 billion.<sup>2</sup> The mineral processing sector provides an estimated 4% to 5% to the GDP, based to a significant extent on imported alumina, crude oil, and fertilizer, increasing the value of the mineral industry output to about 5% to 6% of GDP. The economy in 1994 recorded an increase in its GDP of 4% compared with that of 1993.

Mining activities in New Zealand during 1994 continued to include coal extraction, both by underground and open pit methods; quarrying of raw materials for use primarily in domestic construction (clays, sand and gravel, and stone) and agricultural industries (limestone and marble); and gold and titaniferous magnetite sand (iron sand) mining.

Gold production was from three large hardrock mining operations, the Golden Cross and Martha Hill operations near Waihi at the base of the Coromandel Peninsula on North Island and the Macraes Mine in the Eastern Otago region of South Island. A fourth mine was under consideration for development at Reefton, Westland, in SouthIsland. Alluvial mining occurred at several sites, especially on South Island. Iron sand was mined by New Zealand Steel Ltd. (NZ Steel) at two sites on North Island, Waikato-North Head and Taharoa. Coal was produced from about 60 mines in both North and South Islands. Mineral production also included natural gas, natural gas liquids, and petroleum condensate.

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.

New Zealand's mining industry was regulated by legislation passed in 1991 by Parliament, namely the Crown Minerals Act and the Resource Management Act. The former prescribes the granting of prospecting, exploration, and mining permits for Crown (Government)-owned minerals, ensuring that the Government receives a return when the mineral resources are developed. The latter applies to all industries, focusing on the effects of any activity on the environment.

The long-term electricity supply arrangements concluded at yearend 1993 with the Government's New Zealand Energy Corp. permitted New Zealand Aluminium Smelters Ltd. (NZAS), operator of the Tiwai Point aluminum smelter at Bluff, Southland, on the southern tip of South Island, to implement a major upgrade at the plant.

The two partners in the NZAS joint venture, Comalco New Zealand Ltd. holding 79.36% and Japan's Sumitomo Chemical Co. Ltd. with 20.64%, decided in June 1994 to proceed with the \$253-million expansion program. The upgrade was to improve the technical capability and competitiveness of the plant and increase production capacity from 280,000 metric tons per year (mt/a) to about 313,000 mt/a by the end of 1996. Part of the production increase was to come from existing potline cells, and part was to come from new cells added to the plant's third potline. Technological improvements were to include upgrading the plant's main air emission discharge systems to reduce gaseous fluoride and particulate emissions.<sup>3</sup> The Tiwai Point smelter, originally commissioned in 1971, uses alumina sourced from Queensland Alumina Ltd.'s Gladstone, Australia, refinery as feed for its 612 production pots in three potlines.<sup>4</sup>

The ore treatment facilities at Macraes Mining Co. Ltd.s (MMC) hardrock gold project in the eastern Otago region of South Island were extensively upgraded during 1994 to increase throughput to 3 million metric tons per year (Mmt/a) from the previous 2.1 Mmt/a. Although the expansion was scheduled for completion in September 1994, problems in achieving the designed mill throughput and gold recovery rates were encountered, persisting into 1995. As a result of the commissioning delay for the plant upgrade, there was a shortfall of approximately 136,000 metric tons (mt) of ore mined and treated than was planned, or about 5% of that budgeted for treatment. Mining operations at the Macraes gold project continued at the original Round Hill pit site and commenced at the adjacent Southern Pit during 1994. Mining from the

Southern Pit was slated to cease in mid-1995 in favor of mining higher-grade ore from the Innes-Mills pit adjacent to it toward the southeast. The interconnected open pit mining operations comprising the Macraes mine site are at Macraes Flat near Palmerston, 60 kilometers (km) north of Dunedin.<sup>5</sup>

MMC was progressing with plans to develop its second gold mine. The new Globe-Progress Mine at Reefton in the Westland region of the west coast of South Island was being planned as an open pit operation, mining and treating 1 Mmt/a of ore to produce between 2,500 kilograms (kg) and 2,800 kg of gold each year over its expected 5-year life. Since the ore was known to extend at depth, MMC also was considering the possibility of subsequent underground development.<sup>6</sup>

A secondary ball mill was commissioned in March 1994 at the Martha Hill gold mine at Waihi on the Coromandd Peninsula of North Island, improving the milling of one throughput to a rate of about 840,000 mt/a, as well as improving the gold recovery rate. The Waihi Gold Mining Co. Ltd managed the mine, which was owned by Amax Gold Mines (New Zealand) Ltd., 33.53%; Welcome Gold Mines Ltd, 33.53%; and Mineral Resources (NZ) Ltd., 32.94%.

L & M Mining Ltd., manager of the Nokomai Joint Venture in northern Southland on South Island, was planning to start a second large opencast mine at its Nokomai River valley project once the necessary permits were finalized. Mining at the first alluvial site was completed successfully in February 1994 and restoration of the area was completed at midyear. Production from the first operation was about 1,500 kg of gold during its 26 months of operation. Mining of the second operation was to be on a similar scale.<sup>8</sup>

Titanomagnetite-bearing iron sand continued to be mined and concentrated at two unique projects along the western coast of North Island by NZ Steel, a wholly owned subsidiary of Australia's BHP Steel Mining Ltd. Titanomagnetite concentrate was produced by dry-mining (bulldozing and bucket wheel excavation) methods at Waikato-North Head, about 50 km south of Auckland, and pumped as a slurry through an 18-km pipeline to NZ Steel's integrated Glenbrook Steelworks. NZ Steel used both wet- (suction dredging) and dry-mining methods to produce an iron sand concentrate at its Taharoa project, about 100 km farther south. The Taharoa concentrate, averaging about 40% titanomagnetite by weight, was exported exclusively to Japan in specially fitted slurry ore carriers loaded at a mooring buoy connected to shore by a 3-km slurry pipeline. The product was used as a steelmaking additive and as a refractory in blast furnace operations.9

A fire at the 22-year old floating mining plant on May 9, 1994, stopped the production of iron sand concentrate at the Taharoa project until August when the plant was recommissioned. <sup>10</sup>

Pacific Steel Ltd., utilizing the electric arc furnace method, remained New Zealand's second steelmaker, producing exclusively long products (rod and bar).

The Ministry of Commerce approved in May the granting of four exploration permits to Austrac Titanium Ltd., a wholly owned subsidiary of Australia's Austrac Gold NL, and Japan's Nissho Iwai Corp. The permits were for the ilmenite sands tenements and leases held by the joint venture at its Westport

titanium project on the northwest coast of South Island. Austpac Titanium, holding 70%, and Nissho Iwai, 30%, also were developing proprietary technology designed to beneficiate refractory ilmenite. Mining feasibility and environmental studies were underway at yearend. 11

The Maui gas-condensate field off the coast of North Island remained the country's largest, supplying about one-third of the country's total energy needs. <sup>12</sup> Gas production from the Maui operation was piped to the onshore Oaonui gas treatment plant where it was sold to the Crown under a long-term contract effective until 2009. The Government, in turn, sold the gas to the Electricity Corp. of New Zealand, which burned a substantial amount in the generation of electricity; Methanex NZ Ltd., which owned the synthetic gasoline and methanol manufacturing plants; and the Natural Gas Corp. Ltd., which operated the wholesale natural gas distribution system. These interests each received about one-third of Maui's gas production. The condensate production also was piped to the Oaonui plant, where it was stabilized before shipment to Port Taranaki for export to Australian refineries. <sup>13</sup>

The communications and transportation infrastructure of New Zealand is well developed. Of the 4,716 km of Governmentowned railroads, 113 km is electrified. The 92,648-km road network includes 49,547 km paved and 43,101 km gravel or crushed stone. Principal airports with permanent-surface runways total 39 out of an aggregate of 108 serving the country. Inland waterways, of which there are 1,609 km, are of little importance to the transportation industry. International shipping ports include Auckland, Christchurch, Dunedin, Tauranga, and Wellington. The merchant marine fleet includes three petroleum-oils-lubricants and one liquefied gas tankers and six bulk ore freighters. Pipelines consist of 1,000 km for natural gas, 160 km for refined oil products, and 150 km for liquefied petroleum gas. New Zealand had an electric power generating capacity of 8,000 megawatts and produced power at the approximate level of 9,250 kilowatt hours per capita.<sup>14</sup>

<sup>&</sup>lt;sup>1</sup>Text prepared July 1995.

<sup>&</sup>lt;sup>2</sup>Where necessary, the values have been converted from New Zealand dollars (NZ\$) to U.S. dollars at the rate of NZ\$1.58=US\$1.00.

<sup>&</sup>lt;sup>3</sup>Mining Journal (London). V. 323, No. 8283, July 8, 1994, pp. 20-21.

<sup>&</sup>lt;sup>4</sup>Resource Information Unit Ltd. New Zealand Resources Review 1994. 1994, p. 5, Subiaco, Western Australia.

<sup>&</sup>lt;sup>5</sup>Macraes Mining Co. Ltd. 1994 Annual Report. 60 pp.

<sup>&</sup>lt;sup>6</sup>Mining Journal (London). V. 323, No. 8297, Oct. 14, 1994, p. 273.

<sup>&</sup>lt;sup>7</sup>Australian Journal of Mining (Richmond North, Victoria). V. 9, No. 93, June 1994, p. 49.

<sup>8</sup>\_\_\_\_\_. V. 9, No. 96, Sept. 1994, p. 52.

<sup>&</sup>lt;sup>9</sup>Work cited in footnote 4, pp. 6-7.

<sup>&</sup>lt;sup>10</sup>New Zealand Mining (Wellington). V. 15, Nov. 1994, p. 6.

<sup>&</sup>lt;sup>11</sup>Resource Information Unit Ltd. Register of Australian Mining, 1994/1995. 1994, p. 368, Subiaco, Western Australia.

<sup>&</sup>lt;sup>12</sup>Oil and Gas Journal (Tulsa, Oklahoma). V. 92, No. 52, Dec. 26, 1994, p. 63.

<sup>&</sup>lt;sup>13</sup>Work cited in footnote 4, pp. 32-33.

<sup>&</sup>lt;sup>14</sup>U.S. Central Intelligence Agency, Washington, DC: The World Factbook 1994, pp. 286-287.

### **Other Sources of Information**

Ministry of Commerce P.O. Box 1473 Wellington, New Zealand Telephone: +64 4 472 0030 Fax: +64 4 499 0968 New Zealand Minerals Industry Association P.O. Box 27314 Wellington, New Zealand Telephone: +64 6 385 1141

# TABLE 1 NEW ZEALAND: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

1990	1991	1992	1993	1994 e
• • • • • • •			/	
				271,000 3
				6,700 3
				277,000 3
4,630	6,760	10,500	11,200 r/	12,000
	2,060	2,000	2,000	2,000
2,300			2,390 r/	1,100
		1,300		600
				563 3
		759	853 r/	766 3
	5,000	5,000	3,000 r/	3,000
4,910	11,400	22,400	25,800 r/	30,000
750 e/	576	579	600 e/	700
				1,500
25,400	21,300	27,500	26,500 r/	28,000
65,600	121,000	55,900	130,000 r/	120,000
100,000	90,000	100,000	100,000	100,000
70,000 e/	70,000	68,200	77,800	78,000
				1,500
101,000	52,600			70,000
				80,000
00,000	00,000	00,000	00,000	00,000
100 000	99 100	71 900	48 600 r/	50,000
				700,000
				14,000
				5,000
4,120	3,490	3,040	4,940 1/	3,000
12 900	11 600	12 000 r/	0.670 r/	10,000
				1,000
1,000	1,000	1,000	1,000	1,000
1.050	046	1 210	1 600/	1.500
		,		1,500
				1,500
				400
				600
				23,000
				35,000
		1,510		2,000
2,690	451		6,600 r/	6,000
10,000	10,000	10,000	10,000	10,000
	734	907 r/	975 r/	1,000
1,760	1,780	1,900 r/	1,930 r/	1,900
170	170	180	184 r/	200
2,580	2,680	2,980 r/	3,090 r/	3,100
	· · · · · · · · · · · · · · · · · · ·	*	· · · · · · · · · · · · · · · · · · ·	,
2,000	2,000	1,000	1,000	1,000
				7,000
	9.000			8,000
		,	ŕ	11,400
4.050	6,290	6,710	6,030 r/	6,000
4,850				
4,850 3,750		5,100 r/	4,900 r/	4,900
4,850 3,750	5,800	5,100 r/	4,900 r/	4,900
3,750	5,800			-
4,850 3,750 1,150 300		5,100 r/ 1,400 400	4,900 r/ 1,500 500	1,500 500
	1,300 549 719 5,000 4,910 750 e/  1,390 25,400 65,600 100,000 70,000 e/ 1,970 101,000 80,000 12,100 4,120 13,800 1,000 1,050 1,360 353 411 20,200 29,700 2,160 2,690 10,000 652 1,760 170	4,800         4,700           265,000         263,000           4,630         6,760            2,060           2,300         2,270           1,300         1,300           549         594           719         806           5,000         5,000           4,910         11,400           750 e/         576           1,390            25,400         21,300           65,600         121,000           100,000         90,000           70,000 e/         70,000           1,970         1,670           101,000         52,600           80,000         80,000           100,000         99,100           445,000         494,000           12,100         10,500           4,120         3,490           13,800         11,600           1,050         946           1,360         1,390           353         364           411         407           20,200         13,600           29,700         17,900           2,160         5,240	4,800         4,700         6,700           265,000         263,000         250,000           4,630         6,760         10,500            2,060         2,000           2,300         2,270         2,930           1,300         1,300         1,300           549         594         384           719         806         759           5,000         5,000         5,000           4,910         11,400         22,400           750 e/         576         579           1,390             25,400         21,300         27,500           65,600         121,000         55,900           100,000         90,000         100,000           70,000 e/         70,000         68,200           1,970         1,670         2,000           101,000         52,600         112,000           80,000         80,000         80,000           100,000         99,100         71,900           445,000         494,000         428,000           12,100         10,500         12,500           4,120         3,490         3,840 </td <td>4,800         4,700         6,700         6,700 r/           265,000         263,000         250,000         284,000 r/           4,630         6,760         10,500         11,200 r/            2,060         2,000         2,000           2,300         2,270         2,930         2,390 r/           1,300         1,300         1,300         1,300           549         594         384         406           719         806         759         853 r/           5,000         5,000         3,000 r/         3,000 r/           4,910         11,400         22,400         25,800 r/           750 e/         576         579         600 e/           1,390           1,610 r/           25,400         21,300         27,500         26,500 r/           65,600         121,000         55,900         130,000 r/           100,000         90,000         100,000         100,000           70,000 e/         70,000         68,200         77,800           1,970         1,670         2,000         814 r/           101,000         52,600         112,000         69,200 r/</td>	4,800         4,700         6,700         6,700 r/           265,000         263,000         250,000         284,000 r/           4,630         6,760         10,500         11,200 r/            2,060         2,000         2,000           2,300         2,270         2,930         2,390 r/           1,300         1,300         1,300         1,300           549         594         384         406           719         806         759         853 r/           5,000         5,000         3,000 r/         3,000 r/           4,910         11,400         22,400         25,800 r/           750 e/         576         579         600 e/           1,390           1,610 r/           25,400         21,300         27,500         26,500 r/           65,600         121,000         55,900         130,000 r/           100,000         90,000         100,000         100,000           70,000 e/         70,000         68,200         77,800           1,970         1,670         2,000         814 r/           101,000         52,600         112,000         69,200 r/

See footnotes at end of table.

#### TABLE 1--Continued NEW ZEALAND: PRODUCTION OF MINERAL COMMODITIES 1/2/

(Metric tons unless otherwise specified)

Commodity		1990	1991	1992	1993	1994 e/
Peat	ATED MATERIALSContinued cubic meters	86,400	94,400	58,600	101,000	110,000
Petroleum:						
Crude	thousand 42-gallon barrels	14,100	15,300	13,800	15,000 r/	16,400 3/
Refinery products:						
Gasoline	do.	15,000	13,500	12,500 e/	14,000 e/	14,000
Distillate fuel oil	do.	10,200	10,600	10,500 e/	10,500 e/	11,000
Residual fuel oil	do.	2,560	2,560	2,800 e/	2,500 e/	3,000
Other	do.	2,920	2,920	3,000 e/	3,000 e/	3,000
Refinery fuel and losses	do.	1,830	1,830	1,800 e/	2,000 e/	2,000
Total	do.	32,500	31,400	30,600 e/	32,000 e/	33,000

e/ Estimated. r/ Revised. XX Not Applicable.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Table includes data available through July 7, 1995.

<sup>3/</sup> Reported figure.

<sup>4/</sup> Not used for manufacture of iron; reportedly consumed for gas purification, preparation of stock licks, and manufacture of brick. Because of these uses, iron content is not reported.