



2012 Minerals Yearbook

NEW CALEDONIA [ADVANCE RELEASE]

THE MINERAL INDUSTRY OF NEW CALEDONIA

By Susan Wacaster

New Caledonia is rich in a limited number of mineral resources. The country's economy remained heavily dependent upon nickel and byproduct cobalt production. Other metallic mineral resources included chromite, copper, gold, iron ore, manganese, and silver. The main island, Grande-Terre, is composed of greater than 80,000 square kilometers of late Eocene massive peridotite that represents one of the largest mantle rock complexes in the world. The peridotites, through which supergene alteration brought about widespread nickel concentrations, occupy one-third of the surface of Grande-Terre and include primarily harzburgite-dunite in the south with lesser volumes of lherzolite in the north. Mineral production within this structure is fundamental to the economy of New Caledonia (Direction de l'Industrie, des Mines et de l'Energie de Nouvelle-Calédonie, 2009).

Interest among foreign mining companies in the development of nickel prospects in southern New Caledonia began in the early 1900s when subsidiaries of Inco Ltd. of Canada, which was created as the International Nickel Mining Co. in 1919 and ultimately acquired by Vale Ltd. (formerly Companhia Vale do Rio Doce [CVRD]) of Brazil in 2006, gained control of properties that had been sold or abandoned in the 1920s and 1930s. During World War II, Inco refined nickel matte from New Caledonia at its Sudbury operations on a not-for-profit basis. The Bureau de Recherches Géologiques et Minières (BRGM) (the New Caledonian branch of the French Geological Survey) had been active in New Caledonia since the 1950s. In the 1970s, the BRGM began to inventory mining activities and develop plans for prospecting and exploiting mineral resources. The goal of the project was to diversify the mineral industry, which was based on the extraction primarily of nickel and lesser amounts of chromium and cobalt (Maurizot and Eberle, 1982; Vale S.A., 2013c).

Ore bodies were determined to be concentrated and aligned along tectonic structures in certain mineral provinces. The most significant metallic mineral concentrations were determined to include the central plutono-volcanic units, which contain copper and gold deposits in the form of volcanogenic massive sulfide deposits (VMS); the volcano-sedimentary deposits of the Diahot province to the north, which contain copper, lead, and zinc (and lesser amounts of gold and silver); the East Coast Basalts province and West Coast Basalts province, which host VMS copper and lesser gold deposits; mineral deposits related to major faults, which contain antimony, copper, lead, and tungsten; and mineral occurrences related to granodioritic intrusions, which contain minor deposits of molybdenum, tungsten, and lesser amounts of antimony (Direction de l'Industrie, des Mines et de l'Energie de Nouvelle-Calédonie, 2009).

Production

In 2012, New Caledonia produced 102,400 metric tons (t) of nickel from 6.4 million metric tons (Mt) of saprolite ore and

29,300 t of nickel from 3.3 Mt of laterite ore compared with 100,400 t of nickel from 5.6 Mt of saprolite ore and 30,300 t of nickel from 3.2 Mt of laterite ore in 2011. In 2012, the amount of nickel derived from ferronickel production increased by about 7.5% to 43,030 t. Data on mineral production are in table 1 (Direction de l'Industrie, des Mines et de l'Energie, 2013).

Structure of the Mineral Industry

The country's most recent major mineral industry development was the commissioning in 2010 of Vale of Brazil's Goro nickel and byproduct cobalt operation, the startup of which had been delayed repeatedly, and the development of which involved large cost overruns. Ramping up to commercial production continued throughout early 2012. In 2012, Goro was jointly owned by Vale (74%), Japanese companies Sumitomo Metal Mining Co. Ltd. (11%) and Mitsui & Co. Ltd. (10%), and the Société de Participation Minière du Sud Calédonien S.A.S. (5%).

The Koniambo nickel project was a joint venture between Société Minière du Sud Pacifique (SMSP) (51%) and Xstrata Nickel of Switzerland (49%). In February 2012, Swiss companies Glencore International plc and Xstrata plc announced a potential merger (made final in May 2013) whereby Glencore would acquire the 65.92% of Xstrata that it did not already own, so a change of ownership was expected for the Koniambo project. SMSP continued to be a major nickel ore producer in New Caledonia at its SMSP Laterite Operation (also known as the Sud-Pacifique Mine), which is located northwest of Noumea. The Sud-Pacifique Mine was a joint venture between SMSP (51%) and POSCO of the Republic of Korea (49%) (table 2).

As of yearend 2012, 20 facilities were in place to handle the transport of mineral commodities, including conveyors (5), ports (3), or wharves (12), which had a combined annual gross tonnage capacity of 8.09 Mt. Of those facilities, 17 were used for exports. Six of the facilities were located in the South Province, and the rest were located in the North Province. The individual facilities ranged in capacity from 50,000 t (a wharf in Poum called Tanlé) to 786,000 t (a wharf in Koumac called Karembe). Of the 20 facilities, 17 were for the movement of ore. One port facility, Doniambo, was used for the export of ferronickel and matte, and another, Baie de Prony, was used for the export of nickel oxide (NiO), nickel hydroxide cake (NHC), and cobalt carbonate (CoCa₃). The Doniambo facility had the capacity to handle 206,000 t, and the Baie de Prony facility, 23,000 t. Another port, Vavouto, was ramping up for the export of ferronickel, but the capacity was not yet available. Ownership of the 20 facilities was distributed among eight companies (table 2).

Mineral Trade

In 2012, the total value of exports from New Caledonia decreased by 13.4% compared with that of 2011. Greater than 90% of that value was accounted for by mining and metallurgical products. The economy of New Caledonia was sensitive to the variations in world prices for mineral commodities, and the health of the economy was linked directly to the country's trade in, primarily, cobalt and nickel (Institut de la Statistique et des Études Économique, 2013, p. 17–18).

The value derived from exports of cobalt and nickel products from New Caledonia decreased compared with that of 2011 after having recovered somewhat in 2010 from the global economic slump and resultant price fluctuations that took place in 2008 and 2009. According to the United Nations Commodity Trade Statistics database, New Caledonia exported 4.3 Mt of nickel ore and concentrate valued at \$243 million compared with 4.4 Mt of nickel ore and concentrate valued at about \$302 million in 2011; 20,680 t of NiO and NHC valued at \$79 million compared with 45,100 t and \$127 million, respectively, in 2011; 186,319 t of ferronickel in granular or powder form valued at \$674 million compared with 165,000 t and \$847 million, respectively, in 2011; and about 19,523 t of nickel matte, NiO sinter, and other intermediate products of nickel metallurgy valued at \$203 million compared with 19,700 t and \$271 million, respectively (Direction de l'Industrie des Mines et de l'Énergie, 2013; United Nations Statistics Division, 2013).

About 50% of exports from New Caledonia were typically received by countries in Asia. On a year-on-year basis, exports to New Caledonia's Asian trade partners decreased by 10% in 2012 compared with a 21% increase in 2011 and a 42% increase in 2010. The decrease in 2012 was owing in part to decreased imports from Japan, which had typically been a leading recipient of New Caledonian exports but which was still recovering from the devastating effects of the 2011 Tohoku earthquake. About one-third of the volume of the products Japan typically received from New Caledonia was in the form of cobalt-nickel concentrates. The value of the trade deficit was 64% greater in 2012 than the average value of the trade deficit for the past 10 years. The increased trade deficit was mainly the result of decreased Japanese exports to France, as the financial crisis in the euro area continued to affect international markets negatively (Institut de la Statistique et des Études Économique, 2013, p. 17–18).

Commodity Review

Metals

Nickel and Cobalt.—Negotiations aimed at creating a major mining project in New Caledonia took place in the 1950s and 1960s and resulted in a joint proposal from Inco and Pechiney S.A. of France in 1966 that was rejected by the Government of France. In 1969, Inco and the BRGM joined a French consortium to develop a fully integrated nickel project in southeastern New Caledonia. In July 1970, Inco presented a proposal for a 45,000-t-capacity plant that would use Inco's carbonyl extraction and refining process—the Inco Carbonyl Process for Laterites—at a capital cost of what then would

have been \$500 million. The proposal, however, was rejected by the consortium. Another proposal was made in 1973 based on a reduction and acid-leaching process that would produce 18,000 t/yr of nickel and 1,300 t/yr of cobalt at an expected capital cost of \$275 million. That proposal was based on the Goro ore body, which was then held in trust by the BRGM. The proposal was denied when the French Government split the rights to Goro, with some majority of the rights going to a French company. By that time, Inco had completed 85,000 meters (m) of exploratory drilling, sampled 11,000 t of ore for pilot testing, and spent \$21 million on site investigations (Marcuson and others, 2009).

Subsequent attempts were made by other companies and the BRGM to develop Goro. By 1990, deadlocked negotiations between the BRGM and Dallhold Nickel Management (later known as Queensland Nickel Management) of Australia again caused the project to be put on hold. That same year, Inco acquired the mining licenses for the Goro ore body, completed the purchase from the BRGM, and created Goro Nickel Ltd. as a subsidiary to examine the feasibility of mining and processing laterite ore (Vale S.A., 2013c).

Inco projected that a future Goro mine operation could process about 2.6 million metric tons per year (Mt/yr) of ore to produce 40,000 metric tons per year (t/yr) of NiO, but the project was put on care-and-maintenance status in 1994 because it was considered small in size. The Goro deposit, however, offered a low-cost source of nickel and cobalt, so Inco investigated the use of acid leaching combined with solvent extraction-electrowinning (SX-EW) to process the laterite ore. In 1997, Inco and BRGM announced that they would construct a 12-metric-ton-per day pilot plant. Inco completed a feasibility study that estimated open pit production of 27,000 t/yr of nickel and 2,720 t/yr cobalt for 20 years. The company sought a partner to acquire up to 30% interest to help develop the project. Construction of the pilot plant took place in 1998, and it was commissioned in 1999 on the same site as the future commercial plant, located 58 kilometers east of Noumea in the South Province. Inco had expected to make a decision on building a commercial facility by late 2000, with initial production slated for 3 years after the start of construction (Bacon and Mihaylov, 2002; Vale S.A., 2013c).

By November 2000, Inco had applied for an operating permit and Goro was expected to produce 54,000 t/yr of nickel as a 78% ferronickel alloy and 5,400 t/yr of cobalt in cobalt carbonate. Reserve estimates included 47 Mt grading 1.59% nickel and 0.17% cobalt, with additional resources of 219 Mt grading 1.57% nickel and 0.18% cobalt. Production was expected to begin by late 2004 or early 2005. In 2001, Inco was still in discussions with companies interested in acquiring a stake in the project. Goro was expected to be operating at full capacity by yearend 2006. Inco owned 85% of the project and the BRGM held a 15% share. Inco wanted to sell the BRGM share plus another 15% of its own share to a third party because even with the sale of this 30% interest, Inco would still have needed to raise an estimated \$600 million for project costs. The French Government had already contributed \$350 million by midyear 2001 and it had provided a 15-year tax holiday to be followed by a rate of 50% of the prevailing tax rates for an

additional 5 years. The construction permit for the commercial plant was received by Inco in April 2002 (SNL Metals Economics Group, 2013).

In July 2002, Inco reached an agreement in principle to sell a 25% share of Goro to a Japanese consortium led by Sumitomo Metal Mining. Inco would retain 70% of the project and the Government of New Caledonia would own 5%. By yearend 2002, the capital cost estimates for the development of Goro had increased to \$1.45 billion, which represented a 30% to 40% cost overrun. In 2003, leaders of New Caledonia's indigenous Kanak group announced that they were seeking a role in Inco's development of the Goro project, and Inco announced that the cost overruns were going to delay the project for yet another year. In 2004, Inco completed a final review of the Goro project, which resulted in a \$500 million reduction in the capital cost estimate, and in October approved the \$1.9 billion mine development project. Construction was set to begin in early 2005, and production was projected to commence in September 2007. Goro was expected to reach about 75% of its expanded annual capacity of 60,000 t/yr of nickel within 12 months after commissioning and 90% within 2 years. Cobalt capacity was revised to about 4,650 t/yr (Northern Miner, 2002; ALTA Metallurgical Services, 2003; Guerriere, 2003; Inco Ltd., 2004; Stueck, 2004; Globe and Mail, The, 2005).

In 2005, Inco and the three Provinces of New Caledonia came to an agreement whereby the Provinces would acquire a total 10% interest in Goro. The Provinces formed a company, the Société de Participation Minière du Sud Calédonien (SPMSC) to hold the territory's stake in the project, which would also include the 15% held by the BRGM. In April, Inco announced that Sumitomo Metal Mining and Mitsui had acquired a 21% interest in Goro for \$150 million. By December, Inco reported that increased costs for commodities and construction materials, including fuel and lubricants, would again increase capital costs. In 2006, after incidents of environmental protests, legal proceedings, vandalism, a labor strike, revocation of the project's construction permit, and supply shortages, the estimated capital costs at Goro were increased to \$3 billion and production was delayed until the end of 2008 (Globe and Mail, The, 2005; Mining Journal, 2005; PR Newswire, 2005).

In 2007, Vale [then Companhia Vale do Rio Doce (CVRD)] of Brazil completed a 100% takeover of Inco Ltd. to form CVRD Inco Ltd. The company announced a revised capital cost estimate of \$3.2 billion. The project was still beset by protests and vandalism, including the complete destruction of a \$1.5 million crane. Production was again delayed until the spring of 2009. In April 2009, commissioning of the acid plant was halted after an acid spill into a local waterway. By this time, total capital cost estimates had been increased to \$4.3 billion. Goro was projected to commence operations in 2010 and to reach commercial production by 2013. The project did finally come online in the third quarter of 2010. In 2011, ramping up efforts continued, but the plant's high-pressure acid-leaching technology was difficult to get started. Output increased at Goro in the fourth quarter of 2011 (Companhia Vale do Rio Doce, 2007).

In the first 3 months of 2012, the operation produced 4,000 t of nickel and 385 t of cobalt in intermediate products compared with 5,100 t of nickel and 245 t of cobalt in all of 2011. At full

production, Goro was expected to produce up to 60,000 t/yr of nickel and 4,650 t/yr of cobalt using high-pressure acid leaching to extract the large volumes of low-grade nickel. Proven and probable reserves at Goro included a revised 122.5 Mt of ore grading 1.44% nickel and 0.11% cobalt. By May 2012, however, Vale had suspended sales and purchases after declaring force majeure following an incident at the mine's sulfuric acid plant (Vale S.A., 2013a, p. 7, 9; 2013b, p. 64, 66).

As of December 31, 2011, proven and probable reserves at the Koniambo nickel project included 62.5 Mt grading 2.4% nickel. The project was expected to process 3 Mt/yr of limonite and saprolite ore during a 25-year mine life and to produce 60,000 t/yr of nickel at full production, which was expected to be reached sometime in 2014. In 2009, it was reported that ferronickel would be produced using an updated version of a process used at Xstrata's Falcondo operation called Nickel Smelting Technology. Initially, nickel would be extracted from the saprolite part of the ore body; plans were also in place to extract nickel from the limonite ore using a hydrometallurgical process (Xstrata plc, 2011, p. 36; SNL Metals Economics Group, 2013).

Outlook

New Caledonia is expected to remain a globally significant cobalt and nickel producing country, and output is expected to increase as production is ramped up at the Goro project and operations commence at the Koniambo project. An expansion is planned for Goro, in line with the original plans envisioned by Inco in 1999, for a phased commercial operation that would allow the initial capacity (then expected to be 30,000 t of nickel) to be doubled. The mine was expected to reach full operation in 2013. By the end of the second quarter of 2013, the plant at Goro was operating with two autoclaves. The operation produced a total of about 5,100 t of nickel in NHC and NiO in the first quarter of 2013 and about 3,400 t of nickel in the second quarter, which included 1,800 t contained in NHC and 1,600 t in NiO. Production slumped because of anticipated maintenance of the acid plant. Operations were reportedly normalized by June 2013 (Vale S.A., 2013a, p. 6).

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TABLE 1
NEW CALEDONIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2008	2009	2010	2011	2012
Cement	139,498 ^r	140,173 ^r	161,236 ^r	147,761 ^r	123,668
Nickel:					
Ore:					
Gross weight thousand metric tons	6,172	5,689	8,709	8,835	9,659
Co content	2,110 ^r	2,000 ^r	2,850 ^r	3,240 ^r	3,500
Ni content	102,700	92,500	129,800	130,700	131,700
Ferronickel:					
Gross weight	123,600 ^{r,e}	126,100 ^{r,e}	131,300 ^{r,e}	132,100 ^{r,e}	142,000 ^e
Ni content	37,467	38,230	39,802	40,015	43,030
Nickel matte:					
Gross weight	19,100 ^{r,e}	19,600 ^{r,e}	19,600 ^{r,e}	19,428 ^{r,e}	18,900 ^e
Ni content	13,564	13,902	13,917	13,780	13,417

^eEstimated; estimated data are rounded to no more than three significant digits. ^rRevised.

¹Table includes data available through October 28, 2013.

²In addition to the commodities listed, chromite, copper, crushed stone, gold, iron, manganese, silica sand, and silica are produced, but available information is inadequate to make reliable estimates of output.

TABLE 2
NEW CALEDONIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity ^c
Cobalt, in ore and concentrate, Co content	Société Le Nickel (SLN) [Eramet Group, 56%; Société Territoriale Calédonienne de Participation Industrielle (STCPI), 34%; Nisshin Steel Co., 10%]	Kouaoua, Nepoui-Kopeto, Poum, Thio, and Tiebaghi mining centers	3,000
Do.	Vale S.A., 74%; Sumitomo Metal Mining Co. Ltd., 11%; Mitsui & Co. Ltd., 10%; Société de Participation Minière du Sud Calédonien SAS, 5 %	Goro, 58 kilometers east of Noumea in the South Province	4,650
Nickel			
In ore and concentrate, Ni content	Société Le Nickel (SLN) [Eramet Group, 56%; Société Territoriale Calédonienne de Participation Industrielle (STCPI), 34%; Nisshin Steel Co., 10%]	Kouaoua, Nepoui-Kopeto, Poum Thio, and Tiebaghi mining centers	3,000
Do.	Société Minière du Sud Pacifique, 51%, and POSCO, 49%	SMSP Laterite Operation in the South Province	31,000
Do.	Société des Mines de la Tontouta, 100%	Moneo and Nakety mining centers	6,000
Do.	Other small nickel mining companies, which include Société Minière George Montagnat SA (SMGM)	Tontouta mining center	NA
Do.	Société Le Nickel (SLN) [Eramet Group, 56%; Société Territoriale Calédonienne de Participation Industrielle (STCPI), 34%; Nisshin Steel Co., 10%]	Goro, 58 kilometers east of Noumea in the South Province	60,000
Do.	Vale S.A., 74%; Sumitomo Metal Mining Co. Ltd., 11%; Mitsui & Co. Ltd., 10%; Société de Participation Minière du Sud Calédonien SAS, 5 %	Goro, 58 kilometers east of Noumea in South the Province	1,000
In ferronickel, Ni content	Société Le Nickel (SLN) [Eramet Group, 56%; Société Territoriale Calédonienne de Participation Industrielle (STCPI), 34%; Nisshin Steel Co., 10%]	Doniambo, Noumea	60,000
In nickel matte, Ni content	do.	do.	15,000

^cEstimated. Do., do. Ditto. NA Not available.