



2014 Minerals Yearbook

ZAMBIA

THE MINERAL INDUSTRY OF ZAMBIA

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Copper and cobalt mining and refining were the dominant components of Zambia's mineral industry in 2014. Zambia ranked sixth in the world in the production of mined cobalt and eighth in the production of mined copper. Zambia also was an internationally significant producer of semiprecious gemstones (Brininstool, 2016; Shedd, 2016).

Minerals in the National Economy

In 2014, Zambia's gross domestic product (GDP) (at constant 2005 prices) increased by 6% compared with a revised 6.7% in 2013. The value of the mining and quarrying sector, which accounted for 9.7% of real GDP compared with a revised 10.4% in 2013, decreased by 1.4% compared with a revised increase of 5.9% in 2013. Operational challenges at mines were reported as the cause of the decline. The value of the construction sector accounted for 12.7% of Zambia's real GDP compared with a revised 12.4% in 2013. The Bank of Zambia attributed the construction sector's expansion to various public infrastructure projects and growth in commercial and residential construction. The value of the manufacturing sector accounted for 7.6% of real GDP compared with 7.9% in 2013; the sector grew by 2.3% compared with 4.5% in the previous year (Bank of Zambia, 2015, p. 29–32).

Government Policies and Programs

The mining sector is regulated primarily by Act No. 7 of 2008 (the Mines and Mineral Development Act of 2008). Uranium exploration and mining are regulated by the Mines and Minerals Development (Prospecting, Mining and Milling of Uranium Ores and Other Radioactive Mineral Ores) Regulations of 2008.

The Income Tax Act (Chapter 323 of the Laws of Zambia), the Income Tax (Amendment) Act No. 7 of 2014, the Mines and Minerals Development Act of 2008, and the Mines and Minerals Development (Amendment) Act of 2014 address capital allowances, mineral royalties, mining development agreements, and variable profit taxes. Investment in most types of mineral operations are covered by the Zambia Development Agency Act of 2006, although minerals produced for the construction industry, such as clay, sand, and most types of stone, are excluded. The Engineering Institution of Zambia Act of 2010 requires that the Engineering Institution of Zambia register and regulate the conduct of professional engineers. The Environmental Protection and Pollution Control Act of 1990, and its 1999 amendment, address environmental issues, including those associated with the mining industry. The environmental laws are administered by the Zambian Environmental Management Agency (ZEMA). Petroleum exploration and production are regulated by Act No. 10 of 2008 [the Petroleum (Exploration and Production) Act of 2008].

In December 2014, the Government issued amendments to the Income Tax Act of 2008 and the Mines and Minerals

Development Act of 2008, which were to become effective in January 2015. The Income Tax (Amendment) Act No. 7 of 2014 set a 30% tax on income from mineral processing, purchased mineral processing, and mining of industrial minerals. The amendment also eliminated the corporate income tax. The Mines and Minerals Development (Amendment) Act No. 11 of 2014 set mining royalties for open and underground mining operations at 8% and 20%, respectively. The amendment set mining royalties for industrial minerals at 6%.

Production

Data on estimated mineral production are in table 1. Notable increases in production were estimated for amethyst, beryl, cement, manganese (content of ore), and crushed aggregate. Notable decreases in production were estimated for refined cobalt and copper. In 2014, copper metal production data published by the Bank of Zambia were similar to production estimates published by the International Copper Study Group and the U.S. Geological Survey (Bank of Zambia, 2015, p. 137; International Copper Study Group, 2015, p. 12).

Structure of the Mineral Industry

Many of the country's large copper mining and processing operations are located in the Copperbelt Province in north-central Zambia. The Government retains minority interest in most of the large copper projects through its holding company Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH). The mining sector is administered by the Geological Survey Department, the Mines Development Department, and the Mines Safety Department of the Ministry of Mines and Minerals Development. The Ministry of Commerce, Trade and Industry oversees the industrial manufacturing sector. Data on the capacity and ownership of selected mineral operations are in table 2.

Much of the mineral industry's electrical power was distributed by Copperbelt Energy Corp. Plc (CEC), which was owned by the Zambian Energy Corporation Ltd. of Ireland (52% equity) and ZCCM-IH (20%). CEC purchased the majority of its power from ZESCO Ltd., which was a Government parastatal company. ZESCO's 2,200 megawatts (MW) of generating capacity were predominantly hydroelectric facilities and several small isolated diesel-fueled power stations (Copperbelt Energy Corp. Plc., 2015, p. 23; ZESCO Ltd., 2015).

In 2014, the CEC reported electrical supply improvements to the mining sector. Total energy sales to the mining sector decreased by 2% to 4,210 gigawatt-hours (GWh) compared with 4,270 GWh in 2013. ZESCO completed the 360-MW Kariba North Bank Hydropower Extension project in early 2014. ZESCO's 120 MW Itezhi-Tezhi Hydro Power project was scheduled for completion in late October 2015. Maamba Collieries Limited (MCL), a subsidiary

of Nava Bharat Ventures Ltd. of Singapore (65%) and ZCCM-IH (35%), continued construction of a 300-MW coal powerplant, which was expected to be completed by yearend 2015. MCL's plan to increase the capacity of the plant to 600 MW remained dependent on the region's future electricity demand. In September, ZESCO signed a power purchase agreement with Emco. The Government also continued plans to develop the 750-MW Kafue Gorge Lower Hydro Power project. ZESCO planned to build transmission lines to Tanzania and to upgrade transmission lines to Botswana and Namibia. The CEC planned to double transmission capacity to the Democratic Republic of the Congo [Congo (Kinshasa)]. In 2014, the 41,000-barrel Mpika fuel storage depot was commissioned. The Solwezi and Mongu depots were expected to be completed in 2015 (Maamba Collieries, Ltd., 2014; National Assembly of Zambia, 2014; Nava Bharat Ventures Ltd., 2014a, p. 15–16; 2014b, p. 2; Odendaal, 2014; Bank of Zambia, 2015, p. 32; Copperbelt Energy Corporation Plc, 2015, p. 11, 13, 15).

In February 2014, North West Rail Co. (NWR) of Zambia and Grindrod Ltd. of South Africa announced plans to complete a bankable feasibility study for the construction of a railway linking Zambia's Copperbelt mines to Angola's Port of Lobito. The first phase of the rail construction was expected to connect with the existing railway at Chingola through Solwezi to Lumwana. The second phase of construction would connect Lumwana to the existing Benguela line in Angola. The Benguela line would connect to Angola's Port of Lobito. In 2006, NWR was granted a sole license for the construction and operation of a railway (Ng'andu Consulting Ltd., 2012, p. 32–33; Cokayne, 2014).

In 2013, the Government released \$120 million to Zambia Railway Ltd. (ZRL) for a 3-year rehabilitation program of freight and railways designed to reestablish an inter-mine railway network and to increase freight capacity. The Tanzania-Zambia Railway Authority (TAZARA) planned to increase railway capacities that linked Zambia's Copperbelt Province with the Tanzania's Port of Dar es Salaam (Hill, 2013; Tanzania Daily News, 2013).

Mineral Trade

In 2014, the preliminary values of exports and imports were estimated to be about \$10.2 billion and \$8.6 billion, respectively. Although the value of copper exports increased in 2014, the total value of exports decreased by about \$600 million, or by 5.7%, as exports of cement, cobalt, gold, and lime declined. The value of copper exports was estimated to be about \$7.6 billion in 2014 compared with \$6.9 billion in 2013. Copper exports accounted for an estimated 75% of Zambia's total value of exports. The export volume of cobalt decreased by 22% to 4,560 metric tons (t) in 2014, from 5,880 t in 2013, and accounted for 1.2% of Zambia's total value of exports in 2014. The value of cement and lime exports decreased to \$109 million in 2014 from \$234 million in 2013, or by 53%, owing to increased domestic demand. The value of exports of manganese ores and concentrates decreased to \$12 million in 2014 from \$27 million in 2013, or by 56%. The value of base-metal exports to China declined by 20%. The total value of imports decreased by about \$600 million in 2014, or by 6.5%, owing to decreased

imports of copper and cobalt ores and concentrates from Congo (Kinshasa) (Bank of Zambia, 2015, p. 20–24).

Commodity Review

Metals

Cobalt and Copper.—Lubambe Copper Mine Ltd. continued the first phase of the Lubambe copper mine (formerly the Konkola North Mine) rampup as the main vertical shaft was commissioned in September 2014. The mine continued to modify layout plans and to adjust milling efficiencies to accommodate poor ground conditions that resulted in low milling grades. Improved recoveries were realized at the concentrator plant; offtake agreements were in place to treat Lubambe's full production of concentrate at Konkola Copper Mines (KCM) and Chambishi copper smelter. Copper metal recovered from concentrate reached 25,800 t compared with 22,200 t in 2013. Production at the South Limb and East Limb ore bodies was expected to reach 45,000 metric tons per year (t/yr) of copper contained in concentrate by mid-2015, when the plant was expected to be processing 2.5 million metric tons per year (Mt/yr) of ore with an average grade of 2.3% copper. Additional drilling was completed on the Lubambe extension area south of the present mine development. African Rainbow Minerals Ltd. of South Africa and Vale S.A. of Brazil each held a 40% interest in the Lubambe copper mine, and ZCCM-IH holding the remaining 20% in the joint venture (African Rainbow Minerals Ltd., 2013a, p. 53; 2013b, p. 93; 2014a, p. 7, 12, 87–88, 91; 2014b, p. 71; 2015, p. 64–65).

Four direct (or indirect) subsidiaries of China Nonferrous Metal Mining Corp. Ltd. (CNMC) operated copper facilities in Zambia, including Chambishi Copper Smelter Ltd., CNMC Luanshya Copper Mines PLC, NFC Africa Mining PLC, and Sino-Metals Leach Zambia Ltd. In 2014, NFC Africa produced 28,600 t of copper in concentrate, compared with 28,069 t in 2013, from the Chambishi Main and the Chambishi West Mines. Exploration and development of the southeast Chambishi ore body continued. The southeast ore body project, which was expected to be completed in 2016, was designed to produce 63,000 t/yr of copper in concentrate from 3.3 million metric tons (Mt) of ore. CNMC Luanshya's Baluba Center Mine produced 16,854 t of copper contained in concentrate compared with 16,184 t in 2013. Production increases were the result of the slag copper recovery project that began operating in July 2014. The project, which was designed to process 500,000 t/yr of slag copper grading 1.1% copper to produce 3,500 t/yr of copper contained in concentrate, produced 1,542 t of copper contained in concentrate by yearend. CNMC Luanshya's Muliashi project produced 29,481 t of copper cathode, compared with 21,551 t in 2013, of which 21,703 t and 7,780 t were produced by the agitation-leach and heap-leach systems, respectively. The Muliashi heap-leaching system began initial production in late 2013. The agitation-leach and heap-leach facilities were designed to produce 40,000 t/yr of copper cathode at full capacity (China Nonferrous Metal Mining (Group) Corp. Ltd., 2014, p. 27–30, 34–35, 39; 2015, p. 30, 33, 35–36).

Chambishi Copper produced 222,224 t of anode (blister copper) in 2014, a 10.5% increase from 201,123 t of anode

produced in 2013. Production of blister copper increased as a result of the completion of the second phase expansion of the plant in December 2014, which increased production capacity to 250,000 t/yr of blister copper. Sister company Sino-Metals Leach Zambia Ltd. produced 3,623 t of copper cathode at the Chambishi leach plant in 2014. Sino-Metals Leach's Chambishi processing plant produced 497 t of copper in concentrate, compared with 195 t in 2013, as the company purchased increased volumes of ore. Sino Metal Leach continued the construction of the Mwambashi Mine, located in Kalulushi in the Copperbelt Province, which was expected to produce 600,000 t/yr of ore (China Nonferrous Metal Mining (Group) Corp. Ltd., 2014, p. 30–31, 33; 2015, p. 22, 31, 35–36).

Kansanshi Mining PLC, which was a subsidiary of First Quantum Minerals Ltd. of Canada, mined 26.9 Mt of ore and milled 7.94 Mt of sulfide ore, 9.41 Mt of mixed ore, and 7.98 Mt of oxide ore in 2014 compared with milling 11.1 Mt of sulfide ore, 7.68 Mt of mixed ore, and 6.66 Mt of oxide ore in 2013. The output from the Kansanshi facility in 2014 included 157,365 t of copper contained in concentrate and 102,362 t of copper cathode compared with 106,214 t and 99,834 t, respectively, in 2013. Smelter constraints resulted in increased copper concentrate inventory. Production of copper cathode for third parties, which only occurred in the first quarter of 2014, decreased to 2,560 t compared with 64,675 t in 2013. Total copper production decreased to 262,287 t from 270,724 t in 2013 owing to the lower volume of sulfide ore processed, lower oxide ore grades, and lower oxide plant recoveries (First Quantum Minerals Ltd., 2015, p. 34, 49, 54).

In 2014, Kansanshi continued the development of the Kansanshi smelter. By late December, the company had operationally tested the plant and produced anodes. The smelter was designed to process 1.2 Mt/yr of copper concentrate and to produce 300,000 t/yr of copper metal (First Quantum Minerals Ltd., 2015, p. 43).

In 2014, Konkola Copper Mines plc (KCM), which was a subsidiary of Vedanta Resources plc, produced 191,000 t of copper cathode at the Nkana refinery compared with 200,000 t in 2013. At yearend 2014, mining operations continued to be affected by ongoing maintenance work at Konkola shafts 1 and 4, which were expected to be completed by March and December 2015, respectively. At the Nchanga underground mine, technical interruptions and inadequate equipment availability negatively affected production. Production at the Nchanga smelter was negatively affected by lower grades of concentrate and a 1-month maintenance shutdown. In April, the company's draft Environmental and Social Impact Statement (EIS) for a proposed slag dump received ZEMA approval. The planned slag dump would host slag from the Nchanga smelter, which generated an estimated 420,000 t/yr of granulated slag. The slag dump was expected to have a capacity of about 11 Mt and would span 10 hectares. The current 2.6-Mt-capacity slag dump contained 1.75 Mt of slag (URS Scott Wilson Zambia, 2014, p. vii, 1; Vedanta Resources plc., 2014a, p. 4–5; 2014b, p. 4; 2015, p. 8).

Lumwana Mining Company Ltd., which was owned by Barrick Gold Corp. of Canada, operated the Lumwana copper mine. In 2014, production from Lumwana Mining's

Chimwungo open pit accounted for about 60.5% of the 15.7 Mt of ore that was processed at the Lumwana Mine to produce about 97,100 t of copper contained in concentrate; the Malundwe pit accounted for the remainder of the processed ore. Mining was suspended in 2014 for 80 days owing to the collapse of an ore conveyor. In 2013, the company had produced 118,000 t of copper contained in concentrate. In 2015, the Chimwungo pit was scheduled to provide almost all the mill feed. The processed ore contained cobalt, copper, gold, and uranium mineralization. Uranium contained in the concentrate was controlled by blending the ore to comply with agreed-upon content limits for copper contained in concentrate sold to smelters. In December, the company announced that mining at Lumwana would be suspended for care and maintenance as a result of the new Government's new tax regime. The suspension was planned for the second quarter. Barrick planned an infill drilling program at the Chimwungo pit, which was expected to continue in 2015 (Barrick Gold Corp., 2015, p. 29, 34, 69–73).

In 2014, Mopani Copper Mines plc produced 110,000 t of copper metal compared with 112,000 t of copper metal in 2013. Mopani also produced an additional 75,000 t of blister copper from ore obtained from other companies and traders in 2014. Cobalt was not produced in 2014 as operations at the Nkana cobalt plant continued to be suspended for upgrades. The upgrades were expected to increase capacity to 7,000 t/yr from 2,800 t/yr. The plant was placed on care-and-maintenance status in July 2012 owing to the lack of suitable feed and lower global prices of cobalt. In March, Mopani completed the Mufulira smelter upgrade project. The project improved the capture of the plant's sulfur dioxide emissions to 97% compared with emissions of about 50% prior to a 2007 investment (MetalBulletin, 2013; Glencore plc, 2014; 2015, p. 13).

In 2014, Mopani suspended the development of the 1,277-meter (m)-deep Synclinorium shaft at the Nkana Mine. Shaft completion and the initial hoisting of ore from the Nkana Synclinorium deposit were expected by mid-2015. The shaft was expected to extend the mine's life by 25 to 30 years by providing access to 115 Mt of copper and cobalt ore. The company also suspended the planned development of two shafts at the Mindola and Mufulira Mines (Murray & Roberts Cementation Zambia Ltd., 2013; Kable, 2014).

By yearend 2014, Kalumbila Minerals Ltd., which was a subsidiary of First Quantum, had completed construction activities at the Sentinel project. In 2014, the company had begun commissioning the mine and had produced copper concentrate by late December. Commercial production was expected to begin in August 2015. First Quantum estimated the Sentinel project's mineral resource at 1.03 billion metric tons grading 0.51% copper. The Sentinel Mine was designed to mill and process 55 Mt/yr of ore and was expected to produce about 270,000 t/yr of copper in concentrate (First Quantum Minerals Ltd., 2014, p. 18, 44; 2015, p. 31).

Chambishi Metal plc (a subsidiary of Eurasian Natural Resources Corp. of the United Kingdom), operated the Chambishi cobalt plant, which is located northwest of Ndola. In late 2013, power fluctuations and a transformer failure caused a decline in output. The plant returned to full capacity in March 2014. Chambishi processed sulfide concentrates from mining

operations in the Congo (Kinshasa). Chambishi cobalt plant capacities are listed in table 2. (MetalBulletin 2014a; 2014b; ZCCM Investments Holdings Plc, 2014, p. 22).

In 2014, Jinchuan Group International Resources Co. Ltd. of the Cayman Islands' subsidiary Metorex Group of South Africa operated the Chibuluma South Mine. The mine's production capacity was about 18,000 t/yr of copper contained in concentrate. Concentrate produced at the mine was sold to Chambishi copper smelter. The company continued the development of the Chifupu deposit, which was expected to extend mine life by 7 years (Metorex Group, 2014, p. 5, 7; Jinchuan Group International Resources Co. Ltd., 2015, p. 27).

In December 2014, Blackthorn Resources Ltd. of Australia became a wholly owned subsidiary of Intrepid Mines Ltd. of Australia. The company continued the development of the Kitumba prospect, part of the Mumbwa project. In April, the company submitted an Environmental Impact Statement (EIA) to ZEMA for approval, and was granted a large-scale mining license for a 25-year period. Prefeasibility results suggested the underground mine would have a life of 11 years and a flotation and solvent extraction and electrowinning plant with a targeted capacity of 58,000 t/yr of copper metal. In June, the company had begun an infill drill program at the Kitumba prospect as part of a feasibility study. As of yearend 2014, the company estimated mineral reserves of 31.5 Mt of ore with a grade of 2.04% copper (1% copper cutoff grade) for the Kitumba prospect (Blackthorn Resources Ltd., 2013, p. 1, 6; Intrepid Mines Ltd., 2015, p. 6–7, 14–15).

Mwombeshi Resources Ltd. of Zambia, in which Argonaut Resources NL of Australia's subsidiary Lumwana West Resources Ltd. held 90% interest, continued to explore for copper at the Lumwana West project in the Northwestern Province. In June, Mwombeshi commenced a drill program that was expected to comprise 8,500 m of drilling at four different prospects, including the Nyungu deposit. By yearend 2014, 6,123 m of drilling over 25 holes had been completed, and the company had identified two additional drill targets (Argonaut Resources NL, 2015a, p. 3–5; 2015b, p. 2).

A number of cobalt and copper development and exploration projects in Zambia were discontinued. Enviro Processing Ltd., a wholly owned subsidiary of Berkeley Mineral Resources Plc (BMR) of the United Kingdom, discontinued the development of the Kabwe Copper Processing project. BMR had planned to process purchased copper ore and copper tailings at the plant. In 2014, Caledonia Mining Corp. of Canada discontinued the development of the Nama project (Berkeley Mineral Resources Plc, 2015, p. 13; Caledonia Mining Corp., 2015, p. 19).

Gold.—In 2014, gold output from the Kansanshi facility decreased to about 4,800 kilograms (kg), from the 5,210 kg produced in 2013, owing to lower ore grades and recovery rates. Gold recovery from the residue of the high-pressure leach circuit had increased in recent years (First Quantum Minerals Ltd., 2015, p. 32, 54).

In June 2014, Luiri Gold Ltd. sold its remaining 25% interest in the Luiri Hill gold project to Bamboo Rock Ltd. of South Africa. In 2013, the company had completed a feasibility study, received EIA approval for its proposed open pit mine and processing plant, and started development at the Dunrobin

prospect. The Dunrobin prospect had a measured resource estimate of 978,000 t at a grade of 2.6 grams per metric ton (g/t) gold and indicated and inferred resources of 1.8 Mt at a grade of 1.9 g/t gold (1 g/t cutoff grade) (Luiri Gold Ltd., 2014, p. 4–5; 2015, p. 2).

Lead and Zinc.—In 2014, Enviro Processing Ltd. continued the development of the Kabwe Lead-Zinc Recovery and Copper Processing tailings project. In 2014, the company completed the second Definitive Feasibility Study (DFS) for the beneficiation of the washplant tailings stockpile. The company received ZEMA approval of an EIS for the beneficiation of the washplant tailings stockpile in August 2014. The 573,000-t washplant tailings stockpile was estimated to contain 10.66% zinc and 7.21% lead, totaling about 61,000 t of zinc and 41,000 t of lead. In December, the company planned to review the DFS (Berkeley Mineral Resources Plc, 2015, p. 11).

Manganese.—Manganese ore was produced primarily by small-scale operations near Mansa in Luapula Province and Mkushi in Central Province. In July, Kaboko Mining Ltd. of Australia announced that Resources International Pte. Ltd., a wholly owned subsidiary of Noble Group Limited, suspended financing and an offtake agreement. The company planned to continue mining operations at the Peco manganese mine. In 2013, Kaboko's exploration activities included the Emmanuel project, which included the Brunelli prospect, the Chowa Mine prospect, the Kapumba prospect, the Kanona project, and the Northern Manganese project (formerly the Peco project) near Mansa (Kaboko Mining Ltd., 2014, p. 2).

In June, Zamanco Minerals Ltd. of Australia, discontinued the development of the Serenje manganese project. The company was granted an exploration license in the Mansa area in Luapula Province. Exploration work was expected to begin in mid-2015 (Zamanco Minerals Ltd., 2015).

Nickel.—First Quantum continued development of the Trident project, which included the Enterprise nickel sulfide mine and the Sentinel copper mine. In 2014, the company received environmental approval for mining activities at the Enterprise nickel mine and continued pre-stripping work. First Quantum continued construction of the Enterprise processing facility, a 4-Mt/yr-capacity ore processing facility that was expected to produce 38,000 t/yr of nickel contained in concentrate from ore mined at the Enterprise Mine. The company reported that the processing plant, designed to process copper and nickel ore, would initially process copper ore from the Sentinel Mine. Construction was expected to ramp up as resources were released from the Sentinel project. First Quantum estimated mineral resources of 40.1 Mt at a grade of 1.07% nickel for the Enterprise project. The Enterprise Mine was located 12 kilometers northwest of the Sentinel Mine (First Quantum Minerals Ltd., 2014, p. 44; 2015, p. 31, 44).

In May, Jin Tuo Investments Ltd., which was a subsidiary of the Jinchuan Group Resources Holding Ltd. of China, entered into a lease and royalty agreement with Consolidated Nickel Mines Ltd. (CNM), a wholly owned subsidiary of Consolidated Mining and Investments Ltd. of the United Kingdom, for full operational control of the Munali nickel mine and the adjacent exploration area for a 10-year period. CNM conducted metallurgical tests and developed a mine plan at yearend 2014.

The company initially planned to produce 4,000 t/yr of nickel contained in concentrate. Mining operations were expected to begin in 2016 (Zambian Daily Mail News, 2014; Consolidated Nickel Mines Ltd., 2015).

Industrial Minerals

Cement.—The cement industry continued to expand owing to increased domestic demand and continued growth in infrastructure and residential and commercial construction. In 2014, Dangote Cement Plc of Nigeria continued the construction of the 1.5-Mt/yr Ndola cement plant, located in the Masaiti District near Ndola, which was expected to open in early 2015. The company reported that the plant had reserves of 240 Mt of limestone. Dangote expected the plant to supply the Copper Belt region and to export cement to mining regions in Congo (Kinshasa). The company planned to construct another 1.5-Mt/yr plant at Lusaka after the completion of the Ndola plant (Kalia, 2013; Bank of Zambia, 2015, p. 29, 39; Dangote Cement plc., 2015, p. 19).

In September, Lafarge Cement Zambia plc, a wholly owned subsidiary of Lafarge S.A. of France, commissioned a 6,000-t storage depot at Kasumbalesa, near the border with Congo (Kinshasa). In March, the company announced plans to construct a cement depot in the Chipata District, Eastern Province. The depot was expected to have a 3,000-t storage capacity (Global Cement, 2014; Mulambia, 2014).

Gemstones.—In 2014, small-scale miners held 400 mining exploration licenses that had a dormant status. The Government announced a \$10 million grant for the development of small-scale emerald mines. Kagem Mining Ltd., which was a joint venture of Gemfields PLC of the United Kingdom (75%) and the Government of Zambia (25%), operated the Kagem open pit emerald mine. The company continued activities to expand open pit operations, which were expected to be completed in mid-2015. The underground mining project trail was placed on hold owing to the viability of the open pit operation and current expansion, supported by higher emerald prices. Kagem's increased processing efficiencies resulted from the installation of a new washplant installed in 2013. Kariba Minerals Ltd., owned by Gemfields (50%) and ZCCM-IH (50%), planned to construct a 1-MW photovoltaic plant at the Kariba amethyst mine (Sichalwe, 2014; Gemfields PLC, 2015, p. 6, 15).

Lime.—Neelkanth Lime Ltd. of Tanzania operated the Ndola lime plant. In July 2014, the company operated 27 brick kilns with a combined capacity of about 148,000 t/yr, which had increased from 99,000 t/yr at yearend 2013. The company planned to construct an additional 18,000-t/yr rotary kiln at the plant to produce specialized quicklime for use in the production of pharmaceuticals and food additives. Neelkanth was permitted to construct 34 brick kilns in 2011, and intended to continue construction of the remaining 7 kilns (Neelkanth Lime Ltd., 2013; 2014, p. ix, xi, 2–1).

Handyman Lime Ltd., a joint venture of Astro Holdings of Zambia and Handyman's Paradise Ltd. of Zambia, planned to construct a lime quarry and plant at Ndola. Handyman had submitted an EIA to ZEMA in 2013, and began construction in 2014. The plant was expected to have a capacity of 200,000 t/yr

of quicklime (Global Environmanagement Consultancy, 2013, p. 19; Kunda, 2014).

Sulfur.—In 2014, Chambishi Copper produced 602,787 t of sulfuric acid compared with 523,469 t in 2013. The 15% increase was attributed to the second phase expansion of the Chambishi copper smelter and management improvement. The second phase expansion was completed in December 2013, and had increased the smelter's sulfuric acid production capacity to 600,000 t/yr. In July, First Quantum began commissioning the Kansanshi smelter, which was designed to produce 1 Mt/yr of sulfuric acid as a byproduct of copper metal production. By yearend 2014, the company reported that sections of the plant had been operationally tested (First Quantum Minerals Ltd., 2015, p. 43; China Nonferrous Metal Mining Corp. Ltd., 2015, p. 31, 35).

Mineral Fuels and Related Materials

Coal.—In 2014, Maamba Collieries Ltd., which was owned by Nava Bharat Proprietary Ltd. of Singapore (a subsidiary of Nava Bharat Ventures Ltd. of India) and ZCCM-IH, produced coal from the Siankondobo coalfield in the Gwembe Valley. Maamba's output had increased in recent years owing to a recapitalization effort completed in 2012, including a 2.4-Mt/yr coal-handling and processing plant, increased regional demand, and a stable policy and operating environment. Maamba reported estimated reserves of 140 Mt of high-grade and thermal coal. The company continued construction of its onsite powerplant (Zambian Mining News, 2014; Nava Bharat Ventures Ltd., 2015a, p. 38–39; 2015b).

Uranium.—Denison Mines Zambia Ltd., which was a subsidiary of Denison Mines Corp. of Canada, continued to explore the Mutanga project, which included the Dibwe North, the Dibwe-Mutanga corridor, and the Mutanga East deposits. In 2014, the company awaited results of completed geologic mapping, geochemical sampling, and excavator trenching programs. Technical analysis of the Mutanga project estimated a combined measured and indicated mineral resource of 10.3 Mt at a grade of 340 parts per million U_3O_8 equivalent (Denison Mines Corp., 2014a, p. 11; 2014b).

Outlook

Zambia has many deposits and occurrences of metals and industrial minerals, such as barite, feldspar, graphite, iron ore, kaolin, lead, silica sand, talc, and zinc. The country's mineral industry has been dominated by the copper sector. Internal and external hurdles to the successful diversification of its mineral industry include the availability and diversification of electricity and fuel supplies, cyclical world commodity prices, high transportation costs, and unstable policy environments.

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TABLE 1
ZAMBIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES^{1,2}

(Metric tons unless otherwise specified)

Commodity ³	2010	2011	2012	2013	2014
METALS					
Cobalt:					
Mine output, Co content ⁴	8,648 ^r	7,702 ^r	5,435 ^r	5,919 ^r	5,500
Metal, Co content ⁴	5,026	5,746	5,665	5,000	4,317
Copper: ⁵					
Mine output, Cu content:					
By concentration or cementation	527,000	521,000	517,000	559,000	520,000
Leaching, electrowon	145,000	142,000	178,000	201,000	188,000
Total	672,000	663,000	695,000	760,000	708,000
Metal, smelter, primary, includes low-grade electrowon	535,000	520,000	519,000	520,000	526,000
Refinery, primary:					
Electrowon	158,000	147,000	186,000	241,000	220,000
Other	370,000	369,000 ^r	344,000	327,000	290,000
Total	528,000	516,000	530,000	568,000	510,000
Gold ⁴ kilograms	3,410 ^r	3,490 ^r	4,230 ^r	5,210 ^r	4,800 ⁴
Iron and steel, crude steel	40,000	50,000	50,000	55,000	58,000
Manganese:					
Gross weight	120,000	120,000	120,000	120,000	130,000
Mn content	40,000	40,000	40,000	40,000	45,000
Nickel, Ni content of concentrates ⁴	2,482	2,724	--	--	--
Silver kilograms	6,500	6,500	6,400	6,400	5,900
INDUSTRIAL MINERALS					
Cement ⁴	1,126,728	1,230,000 ^r	1,580,000 ^r	1,810,000 ^r	2,190,000
Gemstones:					
Amethyst kilograms	1,300,000	1,000,000	1,050,000	1,150,000	1,450,000
Beryl million carats	13	7	10	9 ^r	11
Emerald do.	20	14	17	17 ^r	18
Tourmaline kilograms	20,000	20,000	21,000	20,000	19,000
Lime, calcined thousand metric tons	140	50	250 ^r	280 ^r	300
Limestone:					
For cement and lime do.	2,500	2,400	2,600	2,700	2,900
Crushed aggregate do.	800	1,000	1,000	1,050	1,170
Sand and gravel, construction do.	350	360	360	370	375
Sulfur:					
Gross weight:					
Sulfuric acid ⁶	990,000	800,000	950,000	975,000 ^r	1,015,000
Sulfuric acid, 32.6% S content	300,000	240,000	310,000	320,000 ^r	330,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous	95,500 ^r	90,000 ^{r,7}	90,000 ^r	149,000 ^{r,7}	159,000
Petroleum refinery products ^{4,8} thousand 42-gallon barrels					
Liquefied petroleum gas do.	104	104	116	104	105 ^e
Gasoline do.	725	665	759	725	725 ^e
Gas oil ⁹ do.	2,453	2,265	2,573	2,460	2,460 ^e
Kerosene do.	240	224	255	240	240 ^e
Jet kerosene do.	246	230	262	246	245 ^e
Residential fuel oil do.	526	480	546	526	525 ^e
Total do.	4,294	3,968	4,511	4,301	4,300 ^e

^rRevised. do. Ditto. -- Zero.

¹Estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through February 25, 2013.

³In addition to the commodities listed, bismuth, clays, lead, palladium, platinum, and selenium may have been produced, but information was inadequate to make reliable estimates of output.

⁴Reported figure.

⁵Terms used are as defined by the International Copper Study Group.

⁶From the Chambishi and the Nkana acid recovery plants.

⁷Secondary sources reported a production difference of 250,000 metric tons. Unable to confirm owing to inadequate information.

⁸From the International Energy Agency.

⁹Diesel fuel containing more than 0.001% sulfur.

TABLE 2
ZAMBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2014

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bismuth	Chambishi Copper Smelter, Ltd. [China Nonferrous Metal Mining (Group) Company Ltd., 60%, and Yunnan Copper Industry (Group) Co. Ltd., 40%]	Chambishi copper smelter, 75 kilometers northwest of Ndola	NA.
Cement	Lafarge Cement Zambia plc (Pan African Cement Ltd., ¹ 50%, and Financiere Lafarge S.A., ¹ 34%)	Chilanga II plant, about 15 kilometers south of Lusaka	830,000.
Do.	do.	Ndola, Copperbelt Province	450,000.
Do.	Scirocco Enterprises Ltd.	About 18 kilometers southwest of Lusaka	100,000.
Do.	Zambezi Portland Cement Ltd.	Ndola, Copperbelt Province	510,000.
Coal, bituminous	Maamba Collieries Ltd. (Nava Bharat Ventures, Ltd., 65%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH), 35%)	Siankondobo coalfield, 350 kilometers south of Lusaka, Sinazongwe District	400,000.
Do.	Nkandabwe Coal Mine Ltd. (Zambia Consolidated Copper Mine Investments Holdings Plc (ZCCM-IH), 100%)	Kandabwe Mine, ² near Sinazongwe	240,000.
Copper and cobalt:			
Ore and concentrate	Lubambe Copper Mine Ltd. [Joint venture of African Rainbow Minerals Ltd., 40%, Vale S.A., 40%, and Zambia Consolidated Copper Mines Investments Holding Plc (ZCCM-IH), 20%]	Lubambe copper mine, near Chililabombwe	2,500,000 ore, which yields about 45,000 copper in concentrate.
Do.	Jin Tuo Investments Ltd. (Jinchuan Group International Resources Co. Ltd., 100%)	Munali nickel mine, ² about 60 kilometers south of Lusaka	1,200,000 ore, which yields about 1,700 copper and 500 cobalt coproduct.
Do.	Chibuluma Mines plc [Metorex Ltd., ³ 85%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH), 15%]	Chibuluma South Mine, about 12 kilometers west of Kitwe	600,000 ore, which yields about 19,000 copper in concentrate.
Do.	CNMC Luanshya Copper Mines PLC. [NFC Africa Mining plc, 80%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH), 20%]	Baluba Center underground mine	1,500,000 ore.
Do.	do.	Luanshya North Mine, Luanshya	4,500,000 ore.
Do.	do.	Luanshya slag recovery, Luanshya	500,000 slag, which yields 3,500 copper in concentrate.
Do.	Kalumbila Minerals Ltd. (First Quantum Minerals Ltd., 100%)	Sentinel Mine	55,000,000 ore, which yields about 270,000 copper in concentrate.
Do.	Kansanshi Mining plc [Kansanshi Holdings Ltd., ⁴ 80.0%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH), 20%]	Kansanshi Mine, north of Solwezi	12,000,000 sulfide ore, 8,800,000 oxide ore, 8,600,000 mixed ore.
Do.	Konkola Copper Mines plc (KCM) [Vedanta Resources Holding Ltd., 79.42%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH), 20%]	Chingola open pit A and Nchanga open pit, Chingola	4,500,000 ore.
Do.	do.	Nchanga underground mine, Chingola	2,800,000 ore.
Do.	do.	Konkola Mine, Chililabombwe	2,400,000 ore.
Do.	do.	Fitwaola open pit, Chingola	NA.
Do.	do.	Reprocessing material from the TD3a, the TD3b, the TD5, and the TD7 tailings dams, Chingola	NA.
Do.	Lumwana Mining Company Ltd. (Barrick Gold Corp., 100%)	Lumwana Mine (Chimiwungo and Malundwe pits), 20 kilometers west of Chingola	21,000,000 ore.
Do.	Mkushi Copper Joint Venture Ltd. (Seringa Mining Ltd., 51%, and Katanga Resources Ltd., 49%)	Mkushi heap leach	NA.

See footnotes at end of table.

TABLE 2—Continued
ZAMBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2014

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper and cobalt—Continued:			
Ore and concentrate—Continued	Mopani Copper Mines plc [Carlisa Investments Corp., ⁵ 90%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM—IH), 10%]	Nkana Mine, includes the Central, the Mindola North, the Mindola Sub-Vertical, and the South Ore Body shafts for underground operations, and the Area A, the Area E, and the Mindola open pits, Southwest of Kitwe	5,500,000 ore.
Do.	do.	Mufulira Mine	2,500,000 ore.
Do.	NFC Africa Mining plc [China Nonferrous Metal Mining (Group) Company Ltd., 85%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM—IH), 15%]	Chambishi Main Mine, 75 kilometers northwest of Ndola	2,145,000 ore, which yields about 50,000 copper in concentrate.
Do.	do.	Chambishi West Mine, 75 kilometers northwest of Ndola	990,000 ore.
Metal	Chambishi Metals plc [Eurasian Natural Resources Corporation PLC (ENRC), 90%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM—IH), 10%]	Chambishi cobalt plant, 75 kilometers northwest of Ndola	27,000 copper cathode, 5,500 cobalt metal.
Do.	Chambishi Copper Smelter Company, Ltd. [China Nonferrous Metal Mining (Group) Company Ltd., 60%, and Yunnan Copper Industry (Group) Co. Ltd., 40%]	Chambishi copper smelter	250,000 copper anode (blister copper).
Do.	CNMC Luanshya Copper Mines PLC. (NFC Africa Mining plc, 100%)	Muliashi leach plant, Luanshya	40,000 copper cathode.
Do.	First Quantum Mining and Operations Ltd. (First Quantum Minerals Ltd., 100%)	Bwana Mkubwa solvent extraction-electrowinning plant, near Ndola	52,000 copper cathode.
Do.	Kansanshi Mining plc [Kansanshi Holdings Ltd., ⁴ 80%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM—IH), 20%]	Kansanshi high-pressure leach and solvent extraction-electrowinning plant	340,000 copper cathode.
Do.	Konkola Copper Mines plc [Vedanta Resources Finance Ltd., 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM—IH), 20.6%]	Tailings leach plant at Chingola	80,000 copper cathode.
Do.	do.	Nchanga copper smelter, Chingola	311,000 copper anode (blister copper), 3,000 copper-cobalt alloy.
Do.	do.	Nkana copper refinery, Kitwe	300,000 copper cathode.
Do.	Mopani Copper Mines plc [Carlisa Investments Corp., ⁵ 90%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM—IH), 10%]	Mufulira West heap-leach facility	NA.
Do.	do.	Mufulira (ISASMELT) smelter	200,000 copper anode.
Do.	do.	Mufulira refinery	275,000 copper cathode.
Do.	do.	Nkana solvent extraction plant, southwest of Kitwe	15,000 copper cathode.
Do.	do.	Nkana cobalt plant, ² southwest of Kitwe	2,800 cobalt metal.
Do.	Sable Zinc Kabwe Ltd. (Glencore International plc, 100%)	Sable copper leach and electrowinning plant at Kabwe	14,000 copper cathode, 600 cobalt carbonate.
Do.	Sino-Metals Leach Zambia Ltd. [China Nonferrous Metals Mining (Group) Company Ltd., Sino-Africa Mining Investments Ltd., NFC Africa Mining plc, and China Hainan Construction Co. Ltd.]	Chambishi	8,000 copper cathode.

See footnotes at end of table.

TABLE 2—Continued
ZAMBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2014

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gemstones:				
Amethyst		Kariba Minerals Ltd. (Gemfields PLC, 50%, and Zambia Consolidated Mines Investments Holdings Plc (ZCCM–IH), 50%)	Kariba Mine, Mapatizya area, Kolomo District, Southern Province	1,100.
Beryl and emerald	kilograms	Kagem Mining Ltd. (Hagura Mining Ltd., ⁶ 75%, and Government of Zambia, 25%)	Kagem Mine, Ndola District, Copperbelt Province	6,600.
Tourmaline	do.	Artisanal miners	Various locations	NA.
Gold, Au content of ore	do.	Kansanshi Mining plc [Kansanshi Holdings Ltd., 80%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM–IH), 20%]	Kansanshi Mine, north of Solwezi	4,800.
Iron and steel, crude steel		Universal Mining and Chemical Industries Ltd. (Trade Kings Group)	Kafue	100,000.
Lead, metal, secondary		Pagrik Zambia Ltd.	Lusaka	1,000.
Lime, quicklime		Ndola Lime Company Ltd. [Zambia Consolidated Copper Mines Investment Holdings Plc (ZCCM–IH), 100%]	Ndola	300,000. ⁷
Do.		Neelkanth Lime Ltd.	do.	148,000. ⁸
Manganese		Kaboko Mining Ltd.	Peco Mine, Mansa area, Luapula Province	120,000.
Do.		Primarily small-scale miners	Mansa area, Luapula Province and Mkushi area, Central Province	120,000.
Nickel, Ni content of ore		Jin Tuo Investments Ltd (Jinchuan Group International Resources Co. Ltd., 100%)	Munali Mine, ² about 60 kilometers south of Lusaka	10,500.
Petroleum, refined	42-gallon barrels	Indeni Petroleum Refinery Ltd. (Government, 100%)	Indeni refinery at Ndola	8,800,000.
Sulfur:				
Pyrite ore, gross weight		Konkola Copper Mines plc [Vedanta Resources Finance Ltd., 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM–IH), 20.6%]	Nampundwe Mine, ² 48 kilometers west of Lusaka	300,000.
Sulfuric acid		do.	Nchanga acid plant	675,000.
Do.		Chambishi Copper Smelter Company, Ltd. [China Nonferrous Metal Mining (Group) Company Ltd., 60%, and Yunnan Copper Industry (Group) Co. Ltd., 40%]	Chambishi copper smelter, 75 kilometers orthwest of Ndola	600,000.
Do.		First Quantum Minerals Ltd.	Bwana Mkubwa acid plant, ² near Ndola	350,000.

Do., do. Ditto. NA Not available.

¹Subsidiary of Lafarge S.A.

²Operations suspended. Facility on care-and-maintenance status.

³Subsidiary of Jinchuan Group International Resources Co. Ltd.

⁴Subsidiary of First Quantum Minerals Ltd.

⁵A joint venture of Glencore International plc, 81.2%, and First Quantum Minerals Ltd., 18.8%.

⁶Subsidiary of Gemfields PLC.

⁷Plant has the capacity to produce up to 5,000 metric tons of hydrated (slaked) lime from quicklime.

⁸Plant has the capacity to produce up to 73,000 metric tons of hydrated lime from quicklime.