



# 2012 Minerals Yearbook

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## ZAMBIA

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# THE MINERAL INDUSTRY OF ZAMBIA

By Philip M. Mobbs

Copper mining and refining were the dominant components of Zambia's mineral industry. In 2012, Zambia was estimated to rank seventh in the world in the production of copper ore and ninth in the production of cobalt ore. Zambia also was an internationally significant producer of semiprecious gemstones (Edelstein, 2013; Shedd, 2013).

## Minerals in the National Economy

In 2012, the construction sector accounted for 12.9% of Zambia's real gross domestic product (GDP) (at constant 1994 prices) compared with 12% in 2011. The value of activity in the mining and quarrying sector decreased to 7.1% of Zambia's real GDP in 2012 compared with a revised 8.8% in 2011. The Bank of Zambia attributed the mining and quarrying sector's lower contribution to the GDP in part to reduced production from lower grade copper ore and a decrease in world copper prices (Bank of Zambia, 2013, p. 33, 36).

The value of copper exports was estimated to be about \$6.3 billion in 2012, when copper exports accounted for an estimated 68% of Zambia's merchandise exports. The value of exports of cobalt was estimated to be \$235 million (2.5% of the preliminary value of Zambia's exports in 2012). The value of imports of petroleum was estimated to be about \$931 million in 2012, when oil accounted for about 12% of Zambia's imports. The preliminary value of imports of fertilizer decreased to \$304 million from \$330 million in 2011 (Bank of Zambia, 2013, p. 24).

## 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. In April, the Government resumed issuing mining and prospecting licenses, which had been suspended in October 2011 so that the Government could audit the outstanding permits.

The Income Tax Act (Chapter 323 of the Laws of Zambia), the Income Tax (Amendment) Act of 2008, the Income Tax (Amendment) Act No. 27 of 2009, and the Mines and Minerals Development Act of 2008, address capital allowances, mineral royalties, mining development agreements, the variable profits tax, and the windfall tax. 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. Petroleum exploration and production are regulated by Act No. 10 of 2008 [the Petroleum (Exploration and Production) Act of 2008].

## Production

Data on estimated Zambian mineral production are in table 1. Notable increases in production were estimated for copper recovered and refined by electrowinning, gold, lime, refined petroleum products, and sulfur. Cobalt and copper metal production data published by the Bank of Zambia were significantly higher than production estimates published by the Cobalt Development Institute and the International Copper Study Group.

## Structure of the Mineral Industry

Many of the country's large copper mining and processing operations are located in 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.

## Commodity Review

### Metals

**Bismuth.**—Chambishi Copper Smelter Company Ltd., which was a subsidiary of China Nonferrous Metal Mining (Group) Corporation Ltd. (CNMC), completed building a bismuth recovery system as part of phase 2 of the Chambishi smelter expansion project. Testing of the bismuth circuit, which processed material that was recovered from converter gases, began late in 2012 [China Nonferrous Metal Mining (Group) Corporation Ltd., 2013].

**Cobalt and Copper.**—Ore from development of the underground Lubambe Copper Mine (formerly the Konkola North Mine) was stockpiled until October, when the mine's concentrator was commissioned. By yearend, 3,214 metric tons (t) of copper in concentrate was produced. Production 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. Lubambe's copper concentrate was to be toll smelted and refined in Zambia by a third party. ZCCM-IH exercised its right to acquire up to 20% interest in the mining operation, of which 5% was free-carried interest. The joint venture of African Rainbow Minerals Ltd. of South Africa and Vale S.A. of Brazil held the remaining 80% interest in the Lubambe copper mine (African Rainbow Minerals Ltd., 2012, p. 12; 2013, p. 70).

Four direct (or indirect) subsidiaries of CNMC operated copper facilities in Zambia, including Chambishi Copper, CNMC Luanshya Copper Mines PLC, NFC Africa Mining plc, and Sino-Metals Leach Zambia Ltd. In 2012, NFC Africa produced 26,178 t of copper in concentrate from the Chambishi Main and the Chambishi West Mines and started the development of the southeast Chambishi ore body. The southeast ore body project was designed to produce 62,600 t/yr of copper in concentrate. CNMC Luanshya, which commissioned the Mulyashi open pit copper mine and the agitation-leach facility of the Mulyashi leach plant in 2012, produced 10,383 t of copper cathode by yearend. The company started loading ore on the Mulyashi heap-leach pads; initial production from the heap leach facility was expected to begin in 2013. The agitation-leach and heap-leach facilities were designed to produce 40,000 t/yr of copper cathode at full capacity. At the Baluba Center Mine, CNMC Luanshya produced 17,485 t of copper in concentrate [ZCCM Investments Holding Plc, 2012, p. 15; China Nonferrous Metal Mining (Group) Corporation Ltd., 2013].

In 2012, Chambishi Copper completed a slag flotation project to recover copper from slag and continued the phase 2 expansion of the Chambishi copper smelter, which would increase the smelter's capacity to 250,000 t/yr of copper anode. Chambishi Copper produced 175,280 t of anode (blister copper) in 2012. Sister-company Sino-Metals Leach Zambia Ltd. produced 5,206 t of copper cathode at the Chambishi leach plant in 2012. Sino-Metals Leach's Chambishi processing plant produced 986 t of copper in concentrate in 2012 [China Nonferrous Metal Mining (Group) Corporation Ltd., 2013].

Kansanshi Mining plc, which was a subsidiary of First Quantum Minerals Ltd. of Canada, mined 30.4 million metric tons (Mt) of ore and milled 9.25 Mt of sulfide ore, 8.56 Mt of mixed ore, and 6.2 Mt of oxide ore in 2012 compared with milling about 8.86 Mt of sulfide ore, about 8.38 Mt of mixed ore, and 6.07 Mt of oxide ore in 2011. The Kansanshi solvent extraction-electrowinning plant produced 169,202 t of cathode, of which about 57% was recovered from ore produced by First Quantum. The output from the Kansanshi facility in 2012 also included 92,149 t of copper contained in concentrate compared with 230,295 t of copper contained in concentrate in 2011 (First Quantum Minerals Ltd., 2013, p. 41).

The increase in sulfide ore was attributed to ongoing pit development. Although the mixed ore processing circuit was reconfigured in 2012 to a processing capacity of 6.5 Mt/yr, mixed ore throughput exceeded capacity owing to optimization of the processing circuit and improved plant utilization. The capacity of the Kansanshi oxide ore processing circuit was expanded to 7.2 Mt/yr from 6.1 Mt/yr (First Quantum Minerals Ltd., 2013, p. 27–28).

In 2012, First Quantum continued work on the project to expand the Kansanshi facility's total copper production capacity to 400,000 t/yr by 2015. The increase in total copper output would include both copper cathode and copper in concentrate. First Quantum also continued exploration drilling programs at Kansanshi and an infill drilling program at the Sentinel project (First Quantum Minerals Ltd., 2012a, p. 9).

In 2012, Konkola Copper Mines plc (KCM) produced 209,000 t of copper cathode compared with 201,000 t in 2011. Of KCM's total cathode output, about 76% was derived from copper ore produced by the company. Toll smelting decreased owing to the restricted availability of appropriate third party concentrate. KCM commissioned the Nchanga East Mill II concentrator in January and, later in 2012, the 3-Mt/yr-capacity Nchanga West II concentrator's flotation circuit. Work continued on the Nchanga West concentrator's mill and on the Konkola Deep Mine project, where the initial hoisting of ore was expected to begin in mid-2013 (Konkola Copper Mines plc, 2012; Vedanta Resources plc, 2012a, p. 3; 2012b, p. 4; 2013, p. 5–6).

Lumwana Mining Company Ltd., which was owned by Barrick Gold Corp. of Canada, operated the Lumwana copper mine. In 2012, Lumwana Mining completed an exploration and infill drill program, which included 237,277 meters (m) of diamond drilling and 49,029 m of reverse-circulation drilling, and prepared a new life-of-mine plan for the mine. The new plan resulted in the determination that development of the newly documented mineralization at Lumwana would be uneconomic with Barrick's expected operating costs and 2012–13 market prices for copper, owing to the increased amount of waste stripping that would be required to reach the deposit. Subsequently, Barrick took an after-tax asset impairment charge of \$3.0 billion and wrote off \$800,000 million from the copper business unit's goodwill. Much of the new mineralization, however, would become economic with higher international copper prices (Barrick Gold Corp., 2013, p. 75–76).

In 2012, Lumwana Mining started production from the Chimiwungo open pit, which accounted for about 25% of the 20.8 Mt of ore that was milled and processed at the Lumwana Mine, to produce about 81,200 t of copper contained in concentrate; the remainder of the ore mined from the Lumwana Mine came from the Malundwe pit. The ore contained cobalt, copper, gold, and uranium mineralization. Uranium in the copper concentrate was controlled by blending the ore and by ore grade control, so that the copper concentrate sold to smelters complied with agreed-to content limits. The Chimiwungo pit was scheduled to provide about 66% of the mill feed in 2013 (Barrick Gold Corp., 2013, p. 75, 77).

The Mkushi Copper Joint Venture Ltd. was owned by the joint venture of Seringa Mining Ltd. (51% equity interest), which was a subsidiary of Zambia Mining Ltd. of the British Virgin Islands, and Katanga Resources Ltd. (49% interest), which was a subsidiary of Elephant Copper Ltd. The Ratel Group of the British Virgin Islands owned Zambia Mining. Elephant Copper acquired Katanga Resources from African Eagle Resources plc of the United Kingdom in December. In 2012, copper ore was loaded on a small heap-leach pad at the Mkushi copper project and a sulfuric acid leach was started. Precipitation of copper

from the heap-leach solution was expected to begin in mid-2013 (RTG Mining Inc., 2013, p. 2–3).

In 2012, Mopani Copper Mines plc produced 99,000 t of copper (which included blister copper and copper contained in concentrate) and about 100 t of cobalt (contained in concentrate and hydroxide) compared with 101,400 t of copper and about 600 t of cobalt in 2011. Mopani also produced 88,100 t of blister copper and about 200 t of cobalt in hydroxide from ore obtained from other companies and traders in 2012. The reduction in cobalt was attributed to the suspension of operations at the Nkana cobalt plant, which was placed on care-and-maintenance status in July owing to the lack of suitable feed and decreased world cobalt prices (Glencore International plc, 2013, p. 4, 9, 14; Wangwe, 2013).

In 2012, sinking of the 7-m-diameter 1,277-m-deep Synclinorium shaft started at the Nkana Mine. Shaft completion and initial hoisting of ore from the Nkana Synclinorium deposit was expected to begin by mid-2015. Mopani continued the refurbishment of the Mufulira smelter, which would reduce the smelter's emissions significantly. More than 97% of the smelter's sulfur dioxide emissions was expected to be captured after the renovation compared with about 50% of the smelter's sulfur dioxide emissions prior to the investment. The smelter rehabilitation was scheduled to be completed by late 2013 (House of Commons, 2012; Glencore International plc, 2013, p. 4; Murray & Roberts Cementation Zambia Ltd., 2013).

A number of cobalt and copper development and exploration projects in Zambia were ongoing. In 2012, Blackthorn Resources Ltd. of Australia completed a scoping study of the development of the Kitumba prospect as an open pit mine. Blackthorn also completed a drill program of about 14,000 m at the Mumbwa project, which included 19 holes at the Kitumba prospect and 3 holes at the Kakozhi prospect (Blackthorn Resources Ltd., 2013a, p. 5; 2013b, p. 6).

Caledonia Mining Corp. of Canada completed a 20-hole 10,903-m diamond drill program on the Nama cobalt and copper prospect. In 2012, Caledonia announced that it had reached an agreement with the Zambian Mines Development Department to start cobalt mining at Nama, to submit a feasibility study and program of operations for copper production, and to submit an updated estimate of the Nama project's copper-sulfide mineral reserves and resources by June 30, 2013. Caledonia planned to mine and mill about 30,000 metric tons per month of ore initially, and to produce a cobalt oxide concentrate. Caledonia also agreed to begin copper production in early 2015 (Caledonia Mining Corp., 2013, p. 18–19).

In June, Chrysalis Resources Ltd. completed the acquisition of 100% equity interest in Zambia Copper Proprietary Ltd. and 99.9% equity interest in Sedgwick Resource Ltd., which was a subsidiary of Zambia Copper. Sedgwick held exploration rights to the Kabwima North and South copper projects and the Shikila copper project in northern Zambia, and the Bulala Hills and the Mwongo copper projects in central Zambia.

First Quantum released a mineral resource estimate of 1,027 Mt of ore at a grade of 0.51% copper for the Sentinel project. Kalumbia Minerals Ltd., which was a subsidiary of First Quantum, continued construction of the \$2 billion Sentinel Mine, which was expected to be completed in 2014. The

Sentinel Mine was designed to mill and process 55 Mt/yr of ore (First Quantum Minerals Ltd., 2013, p. 32–33).

Mwombezhi Resources Ltd. of Zambia, in which Argonaut Resources NL of Australia's subsidiary Lumwana West Resources Ltd. was earning interest, continued to explore for copper in Northwestern Province. Mwombezhi completed a 9-hole 2,100-m drilling program on the Nyungu Central prospect, a 4-hole 10-m drill program on the Nyungu North and Far North prospects, and a 10-hole 1,728-m drill program on the Nyungu South prospect (Argonaut Resources NL, 2013, p. 2–3).

Zambezi Resources Ltd. of Bermuda announced an updated mineral resource estimate (indicated and inferred) of 46 Mt of ore with a grade of 0.67% copper (0.3% Cu cutoff grade) for the Kangaluwi project, which included the Chisawa, the Kalulu, and the Kangaluwi copper prospects. In September, however, the Zambia Environmental Management Agency rejected the environmental impact study for the Kangaluwi project that was submitted by Mwembeshi Resources Ltd., which was a subsidiary of Zambezi Resources, owing to the project's location in Lower Zambezi National Park. Zambezi Resources appealed the decision (Zambezi Resources Ltd., 2013a, p. 7–8; 2013b).

Other copper sector activity included that of First Quantum, which formed a joint venture with Mimosa Resources Ltd. of Zambia to develop the Fishtie copper project. In 2012, the acquisition of Metorex Ltd. of South Africa, which operated the underground Chibuluma copper mine, by the Jinchuan Group Ltd. of China was completed, and Glencore International completed the acquisition of Sable Zinc Kabwe Ltd. from Metorex Ltd. Sable operated a copper leach and electrowinning plant at Kabwe. Mukuba Resources Ltd. of Canada terminated its option to acquire 85% interest in the Nyimba copper project from Lukusashi Mining Ltd. of Zambia.

**Gold.**—Gold recovery by Kansanshi Mining from the residue of the high-pressure leach circuit had increased in recent years. New gravity concentrators were installed in 2010. The output from the Kansanshi facility included about 4,200 kilograms (kg) of gold in 2012 compared with about 3,500 kg of gold in 2011 (First Quantum Minerals Ltd., 2013, p. 41).

On the Luri Hill gold project, Luri Gold Ltd. of Australia completed a scoping study for the development of the Dunrobin prospect and started a scoping study for the development of the Matala prospect. Luri Gold also announced an initial measured resource estimate for the Dunrobin prospect of 978,000 t of ore at a grade of 2.6 grams per metric ton (g/t) gold and indicated and inferred resources of 1.8 Mt of ore at a grade of 1.9 g/t gold (1 g/t cutoff grade) (Luri Gold Ltd., 2012a, b).

**Lead and Zinc.**—Enviro Processing Ltd. and Enviro Props Ltd., which were Zambian subsidiaries of Berkeley Mineral Resources Plc of the United Kingdom, acquired the Kabwe area surface and underground assets of Alberg Mining and Mineral Exploration Ltd. and Silverlining Ltd. The Kabwe area surface assets included a 2.6-Mt central leachplant stockpile, which was estimated to contain 8.81% lead and 3.88% zinc; a 573,000-t washplant stockpile, which was estimated to contain 10.66% zinc and 7.21% lead; Imperial smelter slag and Waelz furnace slag stockpiles; and pyrite tailings. In 2012, Berkeley and Yunnan Xiangyun Feilong Nonferrous Metal Co. of China signed a memorandum of agreement to form a joint venture

to recover lead and zinc from the Kabwe stockpiles (Berkeley Mineral Resources Plc, 2013).

**Manganese.**—Manganese ore was produced primarily by small-scale operations near Mansa in Luapula Province and Mkushi in Central Province. Kaboko Mining Ltd. continued exploration at the Emmanuel project, which included the Brunelli prospect, the Chowa Mine prospect, and the Kapumba prospect; the Kanona project; and the Northern Manganese project (formerly the Peco project) near Mansa. Zamanco Minerals Ltd. of Australia (formerly Atticus Resources Ltd.) completed the acquisition of Zamanco Holdings Ltd. of Mauritius, which held interest in two Zambian companies—Zamanco Minerals Ltd. (100% equity interest) and Zamanone Mining Ltd. (75% interest). In 2012, Zamanco continued work on the Serenje manganese project.

**Nickel.**—First Quantum continued exploration of the Trident project, which included the Enterprise nickel sulfide prospect and the Sentinel copper prospect. In 2012, First Quantum completed drilling of about 110,000 m in an ongoing drill program. First Quantum planned to develop a 4-Mt/yr-capacity ore processing facility at the Sentinel copper plant to process nickel ore from the Enterprise Mine, which initially was expected to produce 38,000 t/yr of nickel in concentrate. The nickel processing plant also was designed to be able to switch to processing copper ore from the Sentinel Mine (First Quantum Minerals Ltd., 2012b; 2013, p. 33).

### *Industrial Minerals*

**Gemstones.**—Kagem Mining Ltd., which was a joint venture of Hagura Mining Ltd. (75%) and the Government of Zambia (25%), operated the Kagem open pit emerald mine, and continued an underground emerald trial mining program. Gemfields PLC of the United Kingdom, which owned Hagura, reported that Kagem began a bulk sampling program in 2012 in the Fibolele exploration area (Gemfields PLC, 2013).

**Rare Earths.**—In 2012, Southern Crown Resources Ltd. of Australia divested its interest in Rare Earth International (REI), which it had acquired in 2011, owing in part to land-tenure uncertainties that resulted from the discovery in 2011 that a portion of the Nkombwa project license also had been awarded to another party. The suspension of the issuance of new mining and prospecting licenses by the Government affected the speedy clarification of the license issue. Galileo Resources Plc of the United Kingdom subsequently secured an option to acquire REI's interest in the joint-venture project to explore the Nkombwa Hill carbonatite for rare earths with Fisherman Mining Ltd., which was a subsidiary of African Consolidated Resources plc of the United Kingdom. In 2012, Galileo funded a sampling program on the project (Southern Crown Resources Ltd., 2012, p. 2–3; Galileo Resources Plc., 2013a; 2013b, p. 5).

**Sulfur.**—In 2012, Chambishi Copper continued the phase 2 expansion of the Chambishi copper smelter, which would increase the smelter's sulfuric acid production capacity by 600,000 t/yr. Also in 2012, Outotec Oyj of Finland was contracted by Kansanshi Mining to build a gas-cleaning system to process smelter off-gases and to build an associated 1-Mt/yr-capacity sulfuric acid plant. The facilities were to be

located at Kansanshi Mining's new copper smelter at Solwezi [Outotec Oyj, 2012; China Nonferrous Metal Mining (Group) Corporation Ltd., 2013; First Quantum Minerals Ltd., 2013, p. 32].

### *Mineral Fuels and Related Materials*

**Coal.**—Maamba Collieries Ltd., which was owned by a consortium of Nava Bharat Proprietary Ltd. of Singapore (which was a subsidiary of Nava Bharat Ventures Ltd. of India) and ZCCM-IH, started to sell coal in 2012 and was stockpiling low-grade coal for an onsite coal-fired powerplant, which was under construction. Rehabilitation of Maamba's facilities began in 2010.

In August, the death of the mine manager of Collum Coal Mining Industries Ltd. during an employee riot resulted in the suspension of operations at the Kandabwe Mine. The miners allegedly were protesting the failure of the mine to implement Zambia's new minimum wage law (Dixon, 2012).

**Uranium.**—Denison Mines Zambia Ltd., which was a subsidiary of Denison Mines Corp. of Canada, completed a 137-hole 18,160-m drill program on the Mutanga project, which included the Dibwe North, the Dibwe-Mutanga corridor, and the Mutanga East deposits. Denison also announced an updated resource estimate for the Dibwe East prospect. The inferred mineral resource estimate of the Mutanga project (which included the Dibwe, the Dibwe East, the Mutanga, the Mutanga East, the Mutanga extension, and the Mutanga West deposits) was increased to 68.5 Mt of ore at a grade of 279 parts per million uranium oxide equivalent ( $eU_3O_8$ ). The Mutanga project also had measured and indicated mineral resources of 10.3 Mt of ore at a grade of 345 parts per million  $eU_3O_8$  (Denison Mines Corp., 2012; 2013, p. 11).

### **Outlook**

Historically, Zambia's mineral industry has been dominated by the copper sector, although Zambia has many deposits and occurrences of other metals and industrial minerals, such as barite, feldspar, graphite, iron ore, kaolin, lead, silica sand, talc, and zinc. Landlocked Zambia faces several internal and external obstacles to successful diversification of its mineral production, which includes the availability of electrical energy and fuel supplies, cyclical world commodity prices, and high transportation costs.

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TABLE 1  
ZAMBIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES<sup>1,2</sup>

(Metric tons unless otherwise specified)

Commodity <sup>3</sup>	2008	2009	2010	2011	2012
<b>METALS</b>					
<b>Cobalt:</b>					
Mine output, Co content	7,000	4,900	6,200 <sup>r</sup>	5,400 <sup>r</sup>	5,300
Metal, Co content <sup>4</sup>	4,049	1,506 <sup>r</sup>	5,026 <sup>r</sup>	5,746 <sup>r</sup>	5,665
<b>Copper:<sup>5</sup></b>					
<b>Mine output, Cu content:</b>					
By concentration or cementation	372,000	557,000	540,000	524,000	515,000
Leaching, electrowon	162,000	141,000	146,000	144,000	175,000
Total	534,000	698,000	686,000	668,000	690,000
Metal, smelter, primary, includes low-grade electrowon	232,000	334,000	490,000	511,000	515,000
<b>Refinery, primary:</b>					
Electrowon	175,000	145,000	160,000	146,000	190,000
Other	240,000	269,000	370,000	370,000	340,000
Total	415,000	414,000	530,000	516,000	530,000
Gold kilograms	1,930	3,300 <sup>r</sup>	3,600 <sup>r</sup>	3,800 <sup>r</sup>	4,500
Iron and steel, crude steel	--	10,000	40,000	50,000	50,000
Lead, metal, secondary	1,000	1,000	1,000	1,000	1,000
<b>Manganese:</b>					
Gross weight	55,000	40,000	120,000	120,000	120,000
Mn content	17,000	13,000	40,000	40,000	40,000
Nickel, Ni content of concentrates	750	280	2,482 <sup>r,4</sup>	2,724 <sup>r,4</sup>	--
Silver kilograms	4,000	6,000	6,500	6,500	6,400
<b>INDUSTRIAL MINERALS</b>					
Cement	560,000	880,000	1,126,728 <sup>4</sup>	1,200,000	1,200,000
<b>Clays:</b>					
Brick	3,000	3,000	3,100	3,100	3,100
Building, not further specified	30,000	30,000	31,000	31,000	31,000
China and ball	200	200	200	200	200
<b>Gemstones:</b>					
Amethyst kilograms	900,000 <sup>r</sup>	1,400,000 <sup>r</sup>	1,300,000 <sup>r</sup>	1,000,000 <sup>r</sup>	1,050,000
Beryl million carats	12 <sup>r</sup>	6 <sup>r</sup>	13 <sup>r</sup>	7 <sup>r</sup>	10
Emerald do.	16 <sup>r</sup>	11 <sup>r</sup>	20 <sup>r</sup>	14 <sup>r</sup>	17
Tourmaline kilograms	15,000 <sup>r</sup>	21,000 <sup>r</sup>	20,000 <sup>r</sup>	20,000 <sup>r</sup>	21,000
Lime, calcined thousand metric tons	135	130	140	50 <sup>r</sup>	200
<b>Limestone:</b>					
For cement and lime do.	1,300	2,000	2,500	2,400 <sup>r</sup>	2,600
Crushed aggregate do.	700	750	800	1,000	1,000
Sand and gravel, construction do.	300	320	350	360	360
<b>Sulfur:</b>					
<b>Gross weight:</b>					
Pyrite concentrate	290,000	100,000	--	--	--
Sulfuric acid <sup>6</sup>	40,000	600,000	990,000	800,000	950,000
<b>Sulfur content:</b>					
Pyrite concentrate (42% S)	123,000	42,000	--	--	--
Sulfuric acid (32.6% S)	13,000	200,000	300,000	240,000	310,000
Total, S content	140,000	240,000	300,000	240,000	310,000
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Coal, bituminous	220,000	200,000	200,000	220,000	200,000
Petroleum, refinery products thousand 42-gallon barrels	3,500	10,000 <sup>r</sup>	5,000 <sup>r</sup>	5,000 <sup>r</sup>	6,000

<sup>1</sup>Revised. do. Ditto. -- Zero.

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

<sup>2</sup>Table includes data available through July 26, 2013.

<sup>3</sup>In addition to the commodities listed, bismuth, palladium, platinum, and selenium may be produced, but information is inadequate to estimate output.

<sup>4</sup>Reported figure.

<sup>5</sup>Terms used are as defined by the International Copper Study Group.

<sup>6</sup>From the Chambishi and the Nkana acid recovery plants.

TABLE 2  
ZAMBIA: 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
Bismuth	Chambishi Copper Smelting Company, Ltd. [China Nonferrous Metal Mining (Group) Company Ltd., 60%, and Yunnan Copper Industry (Group) Co. Ltd., 40%]	Chambishi copper smelter	NA.
Cement	Lafarge Cement Zambia plc (Pan African Cement Ltd., <sup>1</sup> 50%, and Financiere Lafarge S.A., <sup>1</sup> 34%)	Chilanga II plant, about 15 kilometers south of Lusaka	830,000.
Do.	do.	Ndola plant	450,000.
Do.	do.	Chilanga I plant, about 15 kilometers south of Lusaka	200,000.
Do.	Scirococo Enterprises Ltd.	About 18 kilometers southwest of Lusaka	100,000.
Do.	Zambezi Portland Cement Ltd.	Ndola	330,000.
Coal, bituminous	Maamba Collieries Ltd. (Nava Bharat consortium, 65%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 35%)	350 kilometers south of Lusaka in the Kanzie and the Izuma Basins	360,000.
Do.	Collum Coal Mining Industries Ltd.	Kandabwe Mine, <sup>2</sup> near Sinazongwe	240,000.
<b>Copper and cobalt:</b>			
Ore and concentrate	Joint venture of African Rainbow Minerals Ltd., 40%, Vale S.A., 40%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH), 20%	Lubambe Copper Mine	2,500,000 ore, which yields about 45,000 copper in concentrate.
Do.	Albidon Ltd.	Munali nickel mine, <sup>2</sup> 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., <sup>3</sup> 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 18,000 copper in concentrate.
Do.	CNMC Luanshya Copper Mines PLC. (NFC Africa Mining plc, 100%)	Baluba Center underground mine	1,500,000 ore.
Do.	do.	Mulyashi North Mine	4,500,000 ore.
Do.	Kansanshi Mining plc [Kansanshi Holdings Ltd., <sup>4</sup> 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH), 20.6%]	Kansanshi Mine, north of Solwezi	12,000,000 sulfide ore, 7,200,000 oxide ore, 6,500,000 mixed ore.
Do.	Konkola Copper Mines plc (KCM) [Vedanta Resources plc., 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH), 20.6%]	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)	21,000,000 ore.
Do.	Mkushi Copper Joint Venture Ltd. (Seringa Mining Ltd., 51%, and Katanga Resources Ltd., 49%)	Mkushi heap leach	NA.
Do.	Mopani Copper Mines plc [Carlisa Investments Corp., <sup>5</sup> 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	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	2,145,000 ore, which yields about 50,000 copper in concentrate.
Do.	do.	Chambishi West Mine	990,000 ore.

See footnotes at end of table.



TABLE 2—Continued  
ZAMBIA: 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
<b>Copper and cobalt—Continued:</b>			
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	27,000 copper cathode, 3,400 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	150,000 copper anode (blister copper).
Do.	CNMC Luanshya Copper Mines PLC. (NFC Africa Mining plc, 100%)	Mulyashi leach plant	40,000 copper cathode.
Do.	First Quantum Mining and Operations Ltd. (First Quantum Minerals Ltd., 100%)	Bwana Mkubwa solvent extraction-electrowinning plant	52,000 copper cathode.
Do.	Kansanshi Mining plc [Kansanshi Holdings Ltd., <sup>4</sup> 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH), 20.6%]	Kansanshi high-pressure leach and solvent extraction-electrowinning plant	250,000 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., <sup>5</sup> 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	15,000 copper cathode.
Do.	do.	Nkana cobalt plant <sup>2</sup>	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.
<b>Gemstones:</b>			
Amethyst	Gemfields PLC and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH)	Kariba Mine, Mapatizya area, Kolomo District, Southern Province	800.
Beryl and emerald	kilograms Kagem Mining Ltd. (Hagura Mining Ltd., 75%, and Government of Zambia, 25%)	Kagem Mine, Ndola District, Copperbelt Province	6,600.
Tourmaline	carats Artisanal miners	Various locations	NA.
Gold, Au content of ore	kilograms Kansanshi Mining plc [Kansanshi Holdings Ltd., <sup>2</sup> 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc (ZCCM-IH), 20.6%]	Kansanshi Mine	3,200.
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. <sup>6</sup>
Manganese	Primarily small-scale miners	Mansa area, Luapula Province and Mkushi area, Central Province	120,000.
Nickel, Ni content of ore	Albidon Zambia Ltd. (Albidon Ltd., 100%)	Munali Mine, <sup>2</sup> about 60 kilometers south of Lusaka	10,500.
Petroleum, refined	42-gallon barrels Indeni Petroleum Refinery Ltd. (Government, 100%)	Indeni refinery at Ndola	10,000,000.

See footnotes at end of table.

TABLE 2—Continued  
ZAMBIA: 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
<b>Sulfur:</b>			
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, <sup>2</sup> 48 kilometers west of Lusaka	300,000.
Sulfuric acid	do.	Nchanga acid plant	675,000.
Do.	First Quantum Minerals Ltd.	Bwana Mkubwa acid plant, near Ndola	350,000.

Do., do. Ditto. NA Not available.

<sup>1</sup>Subsidiary of Lafarge S.A.

<sup>2</sup>Operations suspended. Facility on care-and-maintenance status.

<sup>3</sup>Metorex Ltd. is a subsidiary of Jinchuan Group Ltd.

<sup>4</sup>Subsidiary of First Quantum Minerals Ltd.

<sup>5</sup>Carlisa Investments Corp. is a joint venture of Glencore International plc, 81.2%, and First Quantum Minerals Ltd., 18.8%.

<sup>6</sup>Plant has the capacity to produce up to 5,000 metric tons of hydrated lime (slaked) from quicklime.