



# 2015 Minerals Yearbook

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**CONGO (KINSHASA) [ADVANCE RELEASE]**

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# THE MINERAL INDUSTRY OF CONGO (KINSHASA)

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The Democratic Republic of the Congo [DRC or Congo (Kinshasa)] played a globally significant role in the world's production of cobalt, copper, diamond, gold, tantalum, and tin. In 2015, the country's share of the world's mined cobalt production amounted to 50%; tantalum, 32%; diamond, 13%; copper, 5%; refined cobalt, 3%; tin, 2%; and gold, 1%. Congo (Kinshasa) accounted for about 49% of the world's cobalt reserves. Crude petroleum production also played a significant role in the domestic economy. The country was not a globally significant consumer of minerals or mineral fuels (Cobalt Development Institute, 2016; Republique Democratique du Congo Ministere des Mines, 2016, p. 33; Anderson, 2017; Brininstool, 2017; George, 2017; Olson, 2017a, b; Papp, 2017; Shedd, 2017).

## Minerals in the National Economy

The mining and mineral processing sector accounted for an estimated 22.1% of the gross domestic product (GDP) in 2014, and the manufacturing sector, 15.6%. The value of output in the mining sector increased by 19.4% in 2014 compared with 10.1% in 2013 (Banque Centrale du Congo, undated, p. 39–40).

More than 800,000 artisanal miners were estimated to be employed in diamond mining in Congo (Kinshasa) in 2014. Between 2013 and 2015, a survey of 1,615 mine sites was conducted in Katanga, Maniema, Nord-Kivu, and Sud-Kivu Provinces and the Ituri Province (formerly the Ituri Interim Administration of Orientale Province) by the International Peace Information Service (IPIS). Gold mining was reported to employ about 193,000 miners; tin mining, about 32,000 miners; niobium and tantalum mining, about 15,500 miners; diamond, about 4,100 miners; tourmaline, about 3,900 miners; and tungsten, about 1,800 miners. Niobium, tantalum, tin, and tungsten mining employed a total of about 42,800 miners; some mines produced at least two different commodities (Krawitz, 2014; Weyns and others, 2016, p. 15–16).

## Government Policies and Programs

The mining sector was governed by law No. 007/2012 of July 11, 2002, which replaced law No. 81–013 of April 2, 1981. The revised mining code encourages private sector development of the mineral industry; the principal role of the Government is to encourage and regulate the development of the industry. Mining rights are vested with the Government. At the end of 2015, the petroleum sector still was governed by law No. 81–013 of April 2, 1981, and law No. 86–008 dated December 27, 1986.

In 2015, the Government was considering a new mining code that would increase its free-carried and non-dilutable share in mining projects to 10% from 5%. The proposed mining code would increase the corporate tax rate to 35% from 30% and introduce a 50% windfall profits tax. Royalty rates on cobalt

and copper would increase to 3.5% from 2%; on gold and other precious metals, to 3.5% from 2.5%; and on diamonds and other gemstones, to 6% from 4%. At yearend, the proposed mining code had not been adopted by the Congolese Parliament (Kavanagh, 2015).

In April 2013, the Government issued a decree that banned the export of cobalt and copper concentrates to promote domestic downstream processing of cobalt and copper. Companies were given a moratorium to comply with the ban; the moratorium was scheduled to expire at the end of 2015. In December 2015, the Government extended the moratorium until the end of 2016 because power shortages limited downstream processing of concentrates (Thomson Reuters, 2016).

Congo (Kinshasa) was a signatory to the Kimberley Process, which is a certification system that became effective on January 1, 2003, to reduce the trade in conflict diamond. In 2015, an association of small-scale miners was engaged in programs to reduce illegal exports of diamond in accordance with the Kimberley Process (Chamber of Mines, 2016, p. 6).

In July 2010, the U.S. Congress passed the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act), which contains provisions concerning the use of minerals to finance military operations in eastern Congo (Kinshasa). The U.S. Securities and Exchange Commission (SEC) issued regulations in final form in accordance with the Dodd-Frank Act in August 2012 (U.S. Securities and Exchange Commission, 2012, p. 56274–56275).

Under the regulations, all companies registered with the SEC that sold products containing gold, tantalum, tin, or tungsten were required to disclose whether these minerals originated from Congo (Kinshasa) or countries that share an international boundary with Congo (Kinshasa). Companies that sold products containing gold, tantalum, tin, or tungsten that originated in Congo (Kinshasa) or adjoining countries were also required to submit annual reports to the SEC describing the due diligence measures taken to determine the source and custody of such minerals and to provide a description of the products manufactured or contracted to be manufactured that are not conflict-free. The reports also were required to be published on the companies' Web sites (U.S. Securities and Exchange Commission, 2012, p. 56274).

In April 2014, a panel of the U.S. Court of Appeals for the District of Columbia Circuit mostly upheld the SEC's authority to implement the regulations in Section 1502 of the Dodd-Frank Act. The panel ruled that the regulations requiring companies to describe certain products as having been "not found to be DRC conflict free" were unconstitutional on First Amendment grounds. Subsequently, the full DC Circuit Court of Appeals overruled part of the panel's ruling that struck down the disputed Section 1502 regulations. On November 18, 2014, the panel agreed to rehear arguments regarding First Amendment issues in the case. In August 2015, the panel ruled again that the

regulations were unconstitutional (Browning, 2015; Seitzinger and Ruane, 2015).

In March 2011, the government of Katanga Province and the International Tin Research Institute (ITRI) started the ITRI Tin Supply Chain Initiative (iTSCI), which is a traceability mechanism for domestically produced tantalum, tin, and tungsten to meet end users' requirements under the Dodd-Frank Act and Organisation for Economic Co-operation and Development due diligence guidelines. By the end of June 2015, 243 mine sites were covered by iTSCI in Katanga Province, of which 155 were active (International Tin Research Institute, 2015b, p. 3).

In Maniema Province, 185 mine sites were covered by iTSCI at the end of June 2015, of which 161 were active. Mine sites were covered in the Kailo, Lubutu, Pangi, and Punia Territories. In Sud-Kivu Province, 53 mine sites were covered at yearend, of which 50 were active. Mine sites were covered in the Idjwi, Kalehe, Mwenga, Uvira, and Walungu Territories. In Nord-Kivu Province, 46 mine sites were covered at yearend, of which 35 were active. Mine sites were covered in the Lubero, Masisi, and Walikale Territories (International Tin Research Institute, 2015b, p. 3).

Between 2013 and 2015, armed groups were reported to be present at 64% of artisanal and small-scale gold mines and 21% of tantalum, tin, and tungsten mines in eastern Congo (Kinshasa). Armed groups present at mines included military units of Congo (Kinshasa), Mai-Mai militia, and various rebel groups. Armed groups reportedly engaged in illegal taxation of miners at 42% of the 1,615 mine sites surveyed between 2013 and 2015 and practiced forced labor at 5% of the mine sites (Weyns and others, 2016, p. 4, 21).

## Production

In 2015, production of tungsten increased by an estimated 75%; cement, by 21%; and gold, by an estimated 19%. Between 2011 and 2015, gold output increased by an estimated 208%; refined copper, by 143%; mined copper, by an estimated 88%; niobium, by an estimated 44%; and tantalum, by an estimated 35%. Silver production decreased by 63% in 2015; black copper, by an estimated 40%; niobium, by an estimated 24%; tantalum, by an estimated 22%; tourmaline, by an estimated 20%; tin, by an estimated 18%; and lead, by 15% (table 1).

## Structure of the Mineral Industry

La Générale des Carrières et des Mines (Gécamines), which was a state-owned company, produced cobalt and copper. Other cobalt and copper mining companies were privately owned; Gécamines held shares of between 5% and 40% in numerous operations. Private companies held majority shares in the cement producers; Gécamines held a 49.73% share in Ciment et Matériaux du Katanga. The Government held an 80% share in the large-scale diamond producer Société Minière de Bakwanga (MIBA).

Artisanal and small-scale miners accounted for most Congolese output of diamond, niobium, tantalum, tin, and tungsten. Artisanal and small-scale miners also played a significant role in the country's cobalt and gold mine production.

Before the Kibali Mine's first full year of production in 2014, artisanal and small-scale miners accounted for most domestic gold output. In IPIS' survey, gold was produced in Ituri, Katanga, Maniema, Nord-Kivu, and Sud-Kivu Provinces at a minimum of 1,220 mines; niobium, tantalum, tin, and tungsten, at a minimum of 390 mines; and tourmaline, at a minimum of 9 mines. Capacity, location, ownership, and production information were not readily available for many artisanal and small-scale operations (International Peace Information Service and SaveActMine, 2016, p. 18; Weyns and others, 2016, p. 15–16, 32, 38).

## Mineral Trade

Total reported exports were valued at \$12.3 billion in 2014, and imports, \$12 billion. Copper accounted for 61% of the total value of Congolese exports; cobalt, 19%; gold, 7%; crude petroleum, 6%; and diamond, 2%. Other mineral exports included germanium, niobium, tantalum, tin, tourmaline, and tungsten. Cobalt was exported to countries including China and Finland; copper, to countries including China and the United States; gold, to countries including the United Arab Emirates; and tin, to countries including Malaysia. Minerals fuels accounted for about 7% of total imports in 2014 (Banque Centrale du Congo, undated, p. 119–121).

In 2015, the share of Congolese copper and cobalt production that was refined prior to export was 88% and 5%, respectively. Additional cobalt and copper mine production was exported after processing to intermediate products, such as cobalt carbonate, cobalt hydroxide, and black copper. The lower levels of domestic cobalt refining could be attributable to power shortages. Most or all Congolese diamond, niobium, tantalum, tin, and tungsten production was exported prior to downstream processing (table 1).

## Commodity Review

### Metals

**Cobalt, Copper, Germanium, and Silver.**—Mutanda Mining SPRL (Glencore plc of Switzerland, 69%, and Fleurette Properties Ltd., 31%) operated a copper solvent extraction and electrowinning (SX-EW) plant at the Mutanda Mine with a nameplate capacity of 200,000 metric tons per year (t/yr). The capacity of cobalt in hydroxide was 23,000 t/yr. In 2015, output at Mutanda was 216,100 metric tons (t) of copper, of which 210,400 t was refined. In 2014, production was 197,100 t of copper, of which 196,300 t was refined. Cobalt output in concentrate and hydroxide increased to about 16,500 t in 2015 from 14,400 t in 2014 (Kibawa, 2015, 2016; Glencore plc, 2016, p. 12).

In 2015, output at the Tenke Fungurume Mine was 203,964 t of refined copper and 16,014 t of contained cobalt in hydroxide compared with 202,648 t of refined copper and 13,334 t of contained cobalt in 2014. Production exceeded the mine's rated capacity of 225,000 t/yr of refined copper; the rated capacity of cobalt in cobalt hydroxide was 16,000 t/yr. In 2016, sales volumes were expected to be nearly 225,000 t of refined copper and 15,900 t of contained cobalt. Tenke Fungurume was a

joint venture of Freeport McMoran Copper & Gold Inc. of the United States (56%), Lundin Mining Corp. of Canada (24%), and Gécamines (20%) (Lundin Mining Corp., 2016, p. 25).

Katanga Mining Ltd. of Switzerland produced copper and cobalt at the KOV open pit mine, the KTO underground mines, and the Lulu refinery. In the first nine months of 2015, production was 106,816 t of refined copper and 2,901 t of cobalt metal compared with 157,016 t of refined copper and 2,784 t of cobalt metal in 2014. Copper ore grades decreased in 2015. In September, Katanga placed its processing operations on care-and-maintenance status and sharply reduced mining operations during the construction phase of its Whole Ore Leach project (Katanga Mining Ltd., 2016, p. 1, 4, 7–8).

Boss Mining SPRL [Eurasian Resources Group (ERG) of Luxembourg, 70%, and Gécamines, 30%] produced copper and cobalt at the Mukondo Mountain Mine and the Luita SX-EW plant. Refined copper production at Luita decreased to 28,660 t in 2015 from 31,518 t in 2014; the company also produced copper in concentrate. Cobalt production decreased to an estimated 3,500 t in 2015 from 8,500 t in 2014 as oxide ore reserves were depleted; mining from sulfide ores also decreased. In 2016, cobalt production was expected to decrease to between 1,500 and 2,000 t. The mine's sulfide ore reserves were likely to be depleted by 2017 (Kibawa, 2015, 2016; Darton Commodities Ltd., 2016, p. 12, 17).

ERG produced 33,300 t of copper in concentrate at the Frontier Mine in 2013; production increased by an estimated 28% in 2014 and an additional 5% in 2015. Output was expected to increase subsequently to 80,000 t/yr (Bahamin, 2013; Eurasian Natural Resources Corp. Ltd., 2014, p. 14; Kibawa, 2014, 2015, 2016).

MMG Ltd. of China operated the Kinsevere Mine and SX-EW plant. The company produced 80,169 t of refined copper at Kinsevere in 2015 compared with 69,624 t in 2014; output exceeded the production target of between 73,000 and 78,000 t. MMG planned to produce between 75,000 and 80,000 t of refined copper at Kinsevere in 2016 (MMG Ltd., 2016, p. 2, 6).

Ruashi Mining SPRL (Jinchuan Group of China, 75%) produced cobalt and copper from the Ruashi Mine; refined copper and cobalt hydroxide were produced at the company's SX-EW plant. In 2015, production was 35,066 t of refined copper and 4,344 t of contained cobalt compared with 37,170 t of refined copper and 3,885 t of contained cobalt in 2014. Reduced copper output was attributable to power supply interruptions. Cobalt production increased because of higher cobalt ore grades. At yearend, reserves were estimated to be 8.9 million metric tons (Mt) at grades of 2.3% copper and 0.4% cobalt (Jinchuan Group International Resources Co. Ltd., 2016, p. 10, 18).

In 2015, Jinchuan was engaged in reopening the Kinsenda Mine. The company completed the processing plant in 2015; the beginning of production was delayed from 2015 to 2017 because of flooding of the underground mine works. Planned production was 24,000 t/yr of copper in concentrate. Jinchuan spent \$100 million on reopening Kinsenda in 2015, most of which was attributable to mine and power station construction. Reserves at Kinsenda were estimated to be 6.1 Mt at a grade of 4.8% copper (Jinchuan Group International Resources Co. Ltd., 2016, p. 12, 18).

In 2014, Jinchuan completed a feasibility study of a new mine and SX-EW plant at the Musonoi project with favorable results. Jinchuan planned to produce 31,000 t/yr of refined copper and 10,000 t/yr of contained cobalt in hydroxide depending on its scheduled approval of the project in 2016. Resources at Musonoi were estimated to be 31.7 Mt at grades of 2.8% copper and 0.9% cobalt. The life of the mine could be more than 20 years (Jarvis, 2015; Jinchuan Group International Resources Co. Ltd., 2016, p. 13, 16).

The joint venture of Tiger Resources Ltd. of Australia (60%) and Gécamines (40%) mined copper at the Kipoi Central deposit; output amounted to 29,779 t in 2014. The companies produced 16,222 t of copper in concentrate before shutting down the heavy-media separation plant in September 2014. Operations started at a new SX-EW plant in May 2014; production of refined copper was 13,557 t by yearend 2014. Tiger and Gécamines produced 26,151 t of refined copper in 2015, which exceeded the 2015 production target by 5%. Planned production was between 26,000 and 28,000 t in 2016. Debottlenecking operations to increase capacity to 32,500 t/yr from 25,000 t/yr were likely to be completed by November 2016. The companies planned to reach full capacity in 2017; the estimated remaining life was 16 years (Tiger Resources Ltd., 2016, p. 6, 9, 15, 38).

Gécamines operated the Kamfundwa, Kamoya Central, Kamoya South, Kilamusembu, and Shangalowe Mines. The company's total copper production was about 19,000 t in 2015 compared with 16,000 t in 2014. Refined copper production increased to 15,347 t in 2015 from 11,559 t in 2014, and cobalt metal, to 240 t from 75 t. By June 2016, Gécamines planned to increase its copper production to 60,000 t/yr (Agence Congolaise de Presse, 2015b; Kibawa, 2015, 2016).

Gécamines also operated the Luswishi Mine, which produced about 2,100 t of cobalt in 2014. Production declined sharply in 2015. Congo Dong Fang International Mining SPRL (CDM) of China purchased one of Luswishi's mining licenses from Gécamines in June (Kibawa, 2015, 2016; Darton Commodities Ltd., 2016, p. 8, 19).

Gécamines and joint-venture partner Enterprise Generale Malta Forrest SPRL (EGMF) produced cobalt and copper at La Société pour le Traitement du Terril de Lubumbashi's (STL's) Big Hill tailings treatment plant in Lubumbashi. STL's capacity was about 5,500 t/yr of cobalt and 3,500 t/yr of copper. Cobalt production was 5,076 t between September 2013 and August 2014 and remained nearly unchanged in 2015. STL also produced germanium at the estimated rate of 21 t/yr in 2014 and 2015 (Construire L'avenir, 2014; Kibawa, 2015, 2016).

Chemaf SPRL (a subsidiary of Shalina Resources Ltd. of the United Arab Emirates) produced copper and cobalt at the Etoile Mine and the Usoke Avenue copper SX-EW and cobalt carbonate plants. In 2014, Chemaf produced 15,223 t of refined copper compared with 19,124 t in 2013. Output of cobalt in carbonate and hydroxide increased to 2,006 t in 2014 from 1,170 t in 2013. In 2015, copper and cobalt production increased by 60% and 18%, respectively. By mid-2016, Chemaf planned to increase refined copper capacity to 50,000 t/yr from 31,500 t/yr, and cobalt capacity, to 6,200 t/yr from 2,400 t/yr (Shalina Resources Ltd., 2015a, b; Kibawa, 2016).

Mawson West Ltd. of Australia operated the Dikulushi Mine near Lake Mweru in Katanga Province. In 2015, Mawson West produced 256 t of copper and 340 kilograms (kg) of silver compared with 3,026 t of copper and 6,492 kg of silver in 2014. The company placed Dikulushi on care-and-maintenance status in early 2015 (Mawson West Ltd., 2016, p. 6–7).

Mawson West started mining at the Kapulo project in the first quarter of 2015. By yearend, the company produced 13,790 t of copper and 2,072 kg of silver in concentrate. Mawson West planned to produce more than 19,400 t/yr of copper in concentrate at Kapulo (Mawson West Ltd., 2016, p. 6–7).

In November 2015, Sicominex (China Railway Group Ltd. and Sinohydro Corp., 68%; Gécamines and Société Immobilière du Congo, 32%) started production at its cobalt and copper mining operations. Production was delayed by power shortages and the need to pump water out of mining pits. China Railway Group and Sinohydro pledged to build infrastructure with a value of \$3 billion in return for their stake in Sicominex. Initial planned copper production at the Mashamba West and Dikulwe deposits was 125,000 t/yr (Inside Mining, 2016).

Black copper, which is an intermediate product that has a copper content of between 80% and 98%, was produced by numerous companies in Katanga Province. Some companies produced black copper from concentrate produced at their own mines and others sourced concentrate from artisanal miners. In 2015, CDM produced more than 17,000 t of copper in black copper; Rubamin SPRL (a subsidiary of Rubamin Ltd. of India), about 9,600 t; and Huachin Mining (HK) Ltd. of Hong Kong, about 3,200 t (Kibawa, 2016).

CDM, Congo International Mining Corp. (CIMCO), La Minière de Kalumbwe Myunga (MKM), Société Minière du Katanga SPRL (Somika) of India, Shituru Mining Corp. SPRL, and other companies operated small copper refineries. Shituru Mining's production of refined copper increased to 32,232 t in 2015 from 30,437 t in 2014, and Somika's, to 13,808 t from 12,114 t. CNMC-Mabende Metal Leach SPRL started operations in 2014; the company produced 18,015 t in 2015 compared with 12,870 t in 2014. MKM's production decreased to 21,984 t in 2015 from 25,118 t in 2014; Compagnie Minière de Luisha's, to 10,309 t from 12,400 t; CIMCO's, to 10,551 t from 11,392 t; and CDM's to 9,717 t from 11,447 t (Kibawa, 2015, 2016).

In 2015, CDM mined about 5,600 t of cobalt in concentrate and hydroxide compared with 4,200 t in 2014. Metals Mines produced about 2,100 t of cobalt in 2015, and Feza Mining SPRL and Somika, about 1,100 t each. Most of Feza's production was processed at the company's smelter to an intermediate product that contained cobalt and copper (Kibawa, 2015, 2016).

At the end of 2015, Ivanhoe Mines Ltd. of Canada was engaged in a prefeasibility study of a new mine at its Kamoia project. The company completed a new preliminary economic assessment (PEA) in November 2013. Under the PEA, Ivanhoe planned to produce about 100,000 t/yr of copper in concentrate in the first phase of mining. Ivanhoe planned to start the second phase after 5 years of mining; output was likely to be 300,000 t/yr of blister copper. Capital costs in the first phase of the project were estimated to be \$1.4 billion. Indicated resources were estimated

to be 739 Mt at a grade of 2.67% copper; and inferred resources, 227 Mt at a grade of 1.96% copper (Modern Mining, 2016).

**Gold.**—Artisanal and small-scale miners produced gold in Ituri, Nord-Kivu, and Sud-Kivu Provinces in eastern Congo (Kinshasa). Most of the gold exports from artisanal production were undeclared. In 2014, production by artisanal miners in eastern Congo (Kinshasa) was estimated to be between 8,000 and 10,000 kilograms per year (kg/yr) of gold (Spittaels and others, 2014, p. 12).

In 2014, artisanal gold mining in Sud-Kivu Province employed nearly 58,000 workers; Nord-Kivu Province, 44,000 workers; Katanga Province, 19,000 workers; and Maniema Province, 7,100 workers. Artisanal gold miners also operated throughout Ituri Province. In early 2014, gold mining in Djugu Territory employed 28,000 workers; Mambasa Territory, more than 8,000 workers; Irumu Territory, 6,300 workers; and Aru and Mahagi Territories, a total of 5,300 workers. Mining operations in Aru, Djugu, and Mahagi Territories were free from interference by armed groups. In Irumu and Mambasa Territories, Congolese military units interfered with mining operations (Spittaels and others, 2014, p. 20; Organisation for Economic Co-operation and Development, 2015, p. 14).

AngloGold Ashanti Ltd. of South Africa and Randgold Resources Ltd. of the United Kingdom started operations at the Kibali Mine in 2013. The companies produced 19,991 kg of gold in 2015 compared with 16,380 kg in 2014. Planned production was about 19,000 kg/yr in 2016 and 2017 and about 23,000 kg/yr starting in 2018. The estimated remaining life of the mine was 16 years. Reserves at Kibali were estimated to be 80 Mt at a grade of 4.1 grams per metric ton (g/t) gold (Randgold Resources Ltd., 2016, p. 65, 67–68).

Banro Corp. of Canada operated the Twangiza Mine in Sud-Kivu Province; the company produced 4,216 kg of gold in 2015 compared with 3,054 kg of gold in 2014. In 2015, Banro's processing plant was operating at 101% of its rated capacity. Output was expected to be between 3,400 and 3,700 kg in 2016. Reserves at Twangiza were estimated to be 27.7 Mt at a grade of 2.05 g/t gold (Banro Corp., 2016a, p. 9–10; 2016b).

Banro started mining ore at the new Namoya Mine in Sud-Kivu Province in late December 2013. The company produced 569 kg of gold at Namoya in 2014 and 1,488 kg in 2015. Planned output was between 3,100 and 3,400 kg for 2016. Reserves at Namoya were estimated to be 20.9 Mt at a grade of 2.02 g/t gold. Banro also estimated that resources at the Lugushwa project were 88.1 Mt at a grade of 1.55 g/t gold; resources at the Kamituga project were estimated to be 7.26 Mt at a grade of 4.07 g/t gold. The company engaged in limited exploration at Kamituga and Lugushwa in 2015 (Banro Corp., 2016a, p. 9, 12–13; 2016b).

Semi-industrial gold mining operations in rivers in Ituri Province were estimated to produce an additional 2,000 kg/yr of gold. Chinese companies involved in semi-industrial mining included Coomid, Fametal, and Gold Dragon Resources (Spittaels and others, 2014, p. 12, 21).

In November 2015, Armadale Capital plc of the United Kingdom was engaged in a feasibility study of a new mine at its Mpokoto project. Depending on the results of the

study, the company could start mining in 2016. Production was likely to be nearly 800 kg/yr of gold during the estimated 9-year life of the mine. Resources were estimated to be 21 t of contained gold; Armadale Capital hoped to increase resources to at least 31 t (Armadale Capital plc, 2015).

**Niobium (Columbium) and Tantalum.**—National production of columbite-tantalite decreased to 992 t in 2015 from 1,324 t in 2014. Decreased output was attributable to lower columbite-tantalite prices. In the first half of 2014, mineral processing facilities in Katanga Province were producing columbite-tantalite at the rate of nearly 500 t/yr. Most niobium and tantalum in Katanga Province was produced from mixed cassiterite and columbite-tantalite ore. In the first half of 2014, mines in Malemba Nkulu Territory accounted for 67% of mixed cassiterite and columbite-tantalite production; Manono Territory, 29%; and Nyunzu Territory, 4%. Miners in Dilolo Territory produced columbite-tantalite at the rate of more than 30 t/yr in the first half of 2014. Production increased in the Malemba Nkulu, Manono, and Nyunzu Territories in the first half of 2014 (International Tin Research Institute, 2015a; Chamber of Mines, 2016, p. 4, 8).

Niobium and tantalum were also contained in cassiterite. Based on historical production of niobium and tantalum from slag at smelters in Congo (Kinshasa), the estimated tantalum and niobium content of cassiterite in 2015 was 130 t and 90 t, respectively. In 2014, the estimated tantalum and niobium content of cassiterite in 2014 was 160 t and 110 t, respectively (World Mining, 1979; Ellis, 1981).

**Tin.**—Artisanal and small-scale miners produced cassiterite in Katanga, Maniema, Nord-Kivu, and Sud-Kivu Provinces. Production of cassiterite decreased to 8,827 t in 2015 from 10,756 t in 2014. Reduced output was attributable to the discovery of tin deposits in Asia, decreased demand from China, and lower tin prices on world markets (Chamber of Mines, 2016, p. 4, 7).

In the first half of 2014, mineral processing facilities in Katanga Province were producing cassiterite at the rate of about 3,900 t/yr. The Mitwaba Territory accounted for about 900 t/yr of cassiterite output in Katanga Province in the first half of 2014; the Malemba Nkulu Territory, about 870 t/yr; the Lubudi Territory, about 500 t/yr; and the Bukama/Luena Territory, about 370 t/yr. Cassiterite was also produced from mixed cassiterite and columbite-tantalite ores in Katanga Province. Production increased in the Lubudi, Malemba Nkulu, and Mitwaba Territories in the first half of 2014. In Maniema Province, mines in Pangi Territory were producing at the rate of more than 1,400 t/yr in the first half of 2014, and the Punia Territory, nearly 300 t/yr (International Tin Research Institute, 2015a).

Mining Mineral Resources (MMR), which was a subsidiary of Somika, purchased cassiterite, columbite-tantalite, and wolframite from artisanal miners. In 2012, MMR and joint-venture partner Malaysia Smelting Corporation Berhad of Malaysia completed a new tin smelter in Lubumbashi with a capacity of 3,600 t/yr. At the end of 2015, production had not started because of a lack of power supplies. African Smelting Group SPRL completed a new smelter at Sake in Nord-Kivu Province in 2013. It was unclear whether the plant operated in 2015 (Malaysia Smelting Corporation Berhad, 2014, p. 22; 2016, p. 126).

Alphamin Resources Corp. of Mauritius was considering the development of a new mine at the Mpama North deposit, which was part of the Bisie project in Nord-Kivu Province. Depending on the results of a feasibility study that Alphamin planned to complete by the end of 2015, mining could start at Mpama North by 2017. Planned production was about 13,500 t/yr of tin concentrate for the first 3 years of mining. Starting in 2020, Alphamin planned to produce about 15,000 t/yr of tin metal from a new smelter at Mpama North. Production of tin metal was likely to decrease to about 11,800 t/yr starting in 2024. At yearend, the feasibility study had not been completed (Alphamin Resources Corp., 2014; 2015, p. 9–10).

**Tungsten.**—In recent years, wolframite was mined in Katanga, Nord-Kivu, and Sud-Kivu Provinces. National production of wolframite increased to 44 t in 2015 from 25 t in 2014. Output remained far below the levels reached between 2005 and 2009 despite higher tungsten prices (Chamber of Mines, 2016, p. 8).

### *Industrial Minerals*

**Cement.**—National cement production increased to 398,749 t in 2015 from 329,505 t in 2014, but remained below the production levels between 2011 and 2013. HeidelbergCement AG of Germany held an 85% share each in Interlacs and Cimenterie du Lukala, which had operating plants with a combined capacity of about 470,000 t/yr. Forspak International of China's plant had a capacity of 300,000 t/yr at Dolosie (Banque Centrale du Congo, 2016, p. 4).

Lucky Cement Ltd. of Pakistan and Groupe Rawji were engaged in a joint venture to build the new Nyuma Ya Akiba plant with a capacity of 1.26 million metric tons per year (Mt/yr). The companies planned to complete the plant at Songololo in Bas-Congo Province by the first quarter of 2017. PPC Ltd. of South Africa and Barnet Group planned to complete a new plant with a capacity of 1 Mt/yr in Bas-Congo Province by the fourth quarter of 2016 (International Cement Review, 2014; 2015a, b).

**Diamond.**—Artisanal and small-scale miners accounted for most Congolese output of diamond. In 2015, artisanal and small-scale diamond production was 14.2 million carats compared with nearly 14.7 million carats in 2014. Miners in Kasai-Oriental Province produced 12.1 million carats in 2015; miners in Kasai-Occidental Province, 1.91 million carats; miners in Bandundu Province, about 132,000 carats; and miners in Orientale Province, about 103,000 carats (Banque Centrale du Congo, 2016, p. 2; Republique Democratique du Congo Ministere des Mines, 2016, p. 16).

Societe Anhui-Congo d'Investissement Minier SPRL (SACIM) (Anhui Foreign Economic Construction Group of China, 50%, and Government-owned Société Congolaise d'Investissement Minier, 50%) produced diamond at the Tshibwe Mine in Kasai-Oriental Province. In 2015, SACIM produced about 1.19 million carats. The company planned to increase its output to 6 million carats per year. Resources were estimated to be about 159 million carats (Republique Democratique du Congo Ministere des Mines, 2016, p. 17; undated, p. 12, 14).

MIBA mined mostly industrial and near-gem-quality diamond at Mbuji-Mayi in Kasai-Oriental Province. In 2015, the company produced 273,300 carats from its alluvial deposits. Production increased in November because of the purchase of new mining equipment. MIBA planned to increase production to 900,000 carats per year because of the new equipment. Société Minière de Lupatapata started diamond production in November; the company produced 28,099 carats by yearend (Agence Congolaise de Presse, 2015a; République Democratique du Congo Ministère des Mines, 2016, p. 17).

**Gemstones.**—Artisanal miners produced amethyst and tourmaline at Rwangara and Shakubangwa in Nord-Kivu Province. In the first half of 2015, the miners produced tourmaline at an estimated rate of 48 t/yr compared with 74 t/yr in the last 5 months of 2014. Production decreased significantly in February 2015; further decreases in August were attributable to low tourmaline prices and difficult mining conditions. Amethyst production was sporadic. Tourmaline also was mined in Sud-Kivu Province (International Peace Information Service and SaveActMine, 2016, p. 22, 24).

### **Mineral Fuels**

**Coal.**—Gécamines reopened the Luena Mine in 2011 and produced small amounts of coal. In early 2014, the company was engaged in a feasibility study on a new coal-fired power station with a capacity of 500 megawatts. Depending on the results of the study, construction could start in 2015 and power generation, in 2017. As of yearend, the status of the project was unclear (Crowley and Kavanagh, 2014).

### **Outlook**

Cobalt and copper output in Congo (Kinshasa) are expected to increase in the near future. At least eight companies planned to increase copper mining, and at least four planned to increase cobalt mining. Additionally, at least five companies planned to increase their refined copper production. Gold production is also likely to increase between 2016 and 2018 because of higher output at the Kibali and the Namoya Mines and the opening of the Mpokoto project. The Bisie project could increase tin mining starting in 2017 and restart tin refining in 2020. The opening of new plants is expected to result in increased cement production between 2016 and 2019. Diamond mining could also increase because of the expansion at Tshibwe and the rampup at Mbuji-Mayi.

The development of these projects depends heavily upon political and economic stability and favorable conditions in world markets. The outlook for gold, niobium, tantalum, tin, and tungsten is particularly dependent upon political stability because of continued civil unrest in eastern Congo (Kinshasa) and upon international concerns about the reported use of minerals to finance military operations. Niobium, tantalum, tin, and tungsten also could be limited by numerous factors including high transportation costs from Maniema Province and delays in awarding mining licenses (Chamber of Mines, 2016, p. 9).

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TABLE 1  
CONGO (KINSHASA): PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity <sup>2</sup>	2011	2012	2013	2014	2015
METALS					
Cobalt:					
Mine output, Co content <sup>e,3</sup>	59,000	52,000	56,000	61,000 <sup>r</sup>	64,000
Metal, Co content <sup>4</sup>	3,103	3,021	2,777 <sup>r</sup>	2,859	3,075
Copper:					
Mine output, Cu content <sup>e</sup>	530,000	660,000	970,000	1,029,800 <sup>5</sup>	995,805 <sup>5</sup>
Black:					
Gross weight	73,112	64,797	72,955	63,646	38,854
Cu content <sup>e</sup>	68,000	60,000	68,000	58,000	35,000
Refined	362,000	473,000	684,937	877,966 <sup>r</sup>	878,018
Germanium, mine output, Ge content <sup>e</sup>	kilograms	21,000	15,000	18,000	21,000
Gold, mine output, Au content <sup>e</sup>	do.	12,000	14,000	17,000	31,000
Lead, mine output, Pb content	416	95	621	764	653
Niobium (columbium) and tantalum:					
Cassiterite concentrate:					
Gross weight	9,267	8,018	7,567	10,756	8,827
Nb content <sup>e</sup>	90	80	70	110	90
Ta content <sup>e</sup>	140	120	110	160	130
Columbite-tantalite concentrate:					
Gross weight	536 <sup>6</sup>	586 <sup>6</sup>	697	1,324	992
Nb content <sup>e</sup>	90	100	120 <sup>r</sup>	230 <sup>r</sup>	170
Ta content <sup>e</sup>	120	130	160 <sup>r</sup>	290 <sup>r</sup>	220
Silver, mine output, Ag content	kilograms	10,080	12,342	60,431	6,492
Tin, mine output, cassiterite concentrate:					
Gross weight	9,267 <sup>6</sup>	8,018 <sup>6</sup>	7,567	10,756	8,827
Sn content <sup>e</sup>	5,600	4,800	4,500 <sup>r</sup>	6,500	5,300
Tungsten, mine output, concentrate:					
Gross weight	87 <sup>6</sup>	71 <sup>6</sup>	115	25	44
W content <sup>e</sup>	41	35	55	12	21
Zinc, mine output, Zn content	14,944 <sup>r</sup>	11,571 <sup>r</sup>	12,806	14,584	14,193
INDUSTRIAL MINERALS					
Cement, hydraulic	457,761	413,181 <sup>r</sup>	446,610	329,505	398,749
Diamond: <sup>7</sup>					
Artisanal	thousand carats	17,601	19,154	16,653	14,689 <sup>r</sup>
Large-scale	do.	998 <sup>r</sup>	569	246 <sup>r</sup>	244 <sup>r</sup>
Total	do.	18,599 <sup>r</sup>	19,723 <sup>r</sup>	16,899 <sup>r</sup>	14,933 <sup>r</sup>
Gemstones, tourmaline		NA	NA	NA	35 <sup>e</sup>
Stone, crushed		700,300	356,900 <sup>r</sup>	361,200 <sup>r</sup>	285,100 <sup>r</sup>
Sulfuric acid <sup>e</sup>		1,200,000	1,600,000	2,300,000	3,000,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous		1,469	3,870	4,000 <sup>e</sup>	4,000 <sup>e</sup>
Petroleum, crude	thousand 42-gallon barrels	8,558	8,545	8,351	8,362 <sup>r</sup>

<sup>e</sup>Estimated; estimated data are rounded to no more than three significant digits. <sup>r</sup>Revised. do. Ditto. NA Not available.

<sup>1</sup>Table includes data available through January 13, 2017.

<sup>2</sup>In addition to the commodities listed, crude construction materials, including brick clay, are produced, but available information is inadequate to make reliable estimates of output.

<sup>3</sup>Includes mine production and reprocessed tailings.

<sup>4</sup>Salable refined production only; excludes white alloy and matte.

<sup>5</sup>Reported figure.

<sup>6</sup>Reported exports.

<sup>7</sup>An estimated 20% of total diamond is gem quality; the majority of production is from artisanal mining.

TABLE 2  
CONGO (KINSHASA): STRUCTURE OF THE MINERAL INDUSTRY IN 2015

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Cimenterie de Lukala (HeidelbergCement AG, 85%)	Lukala plant near Kinshasa	420,000.
Do.	Cimenterie Nationale SARL (Nova Cimangola, 58%)	Kimpese plant, 40 kilometers south of Kinshasa <sup>1</sup>	300,000.
Do.	Forspak International	Plant at Dolosie	300,000.
Do.	Ciment et Matériaux du Katanga [Entreprise Malta Forrest SPRL (EGMF), 50.27%, and La Générale des Carrières et des Mines (Gécamines), 49.73%]	Lubudi plant, between Likasi and Kolwezi, Katanga Province	87,000.
Do.	Interlacs (HeidelbergCement AG, 85%)	Kabimba plant near Lubumbashi	50,000.
Coal	La Générale des Carrières et des Mines (Gécamines)	Luena Mine in Katanga Province	NA.
Copper and cobalt:			
Mine	Katanga Mining Ltd. [Glencore International AG, 75.2%, and La Générale des Carrières et des Mines (Gécamines), 24.8%]	KOV and KTO Mines <sup>1</sup>	250,000 <sup>c</sup> copper; 8,000 <sup>c</sup> cobalt.
Do.	Tenke Fungurume Mining SARL [Freeport McMoran Copper & Gold Inc., 56%; Lundin Mining Corp., 24%; La Générale des Carrières et des Mines (Gécamines), 20%]	Tenke Fungurume Mine	225,000 copper in ore; 16,000 cobalt in ore.
Do.	Mutanda Mining SPRL (Glencore plc, 69%, and Fleurette Properties Ltd., 31%)	Mutanda Mine	200,000 <sup>c</sup> copper; 23,000 <sup>c</sup> cobalt.
Do.	Eurasian Resources Group (ERG)	Frontier Mine	80,000 copper.
Do.	Boss Mining SPRL [Eurasian Resources Group (ERG), 70%, and La Générale des Carrières et des Mines (Gécamines), 30%]	Mukondo Mountain Mine	40,000 <sup>c</sup> copper; 10,000 <sup>c</sup> cobalt.
Do.	Eurasian Resources Group (ERG)	Comide Mine	30,000 <sup>c</sup> copper.
Do.	MMG Ltd.	Kinsevere Mine	80,000 copper.
Do.	La Générale des Carrières et des Mines (Gécamines)	Kamfundwa, Kamoya Central, Kamoya South, Kilamusembu, and Shangalowe Mines	50,000 <sup>c</sup> copper; 2,500 <sup>c</sup> cobalt.
Do.	Compagnie Minière du Sud Katanga [subsidiary of La Générale des Carrières et des Mines (Gécamines)]	Luiswishi Mine near Lubumbashi <sup>1</sup>	10,000 copper; 4,000 cobalt.
Do.	Congo Dong Fang International Mining SPRL	do.	45,000 <sup>c</sup> copper; 4,400 <sup>c</sup> cobalt.
Do.	Ruashi Mining SPRL [Metorex Group, 75% (subsidiary of Jinchuan Group)]	Ruashi Mine	38,000 copper; 5,000 cobalt.
Do.	Chemaf SPRL (subsidiary of Shalina Resources Ltd.)	Etoile Mine	31,500 <sup>c</sup> copper; 2,400 <sup>c</sup> cobalt.
Do.	Shituru Mining Corp. SPRL	Mines in Katanga Province	30,000 <sup>c</sup> copper.
Do.	Tiger Resources Ltd., 60%, and La Générale des Carrières et des Mines (Gécamines), 40%	Kipoi Mine	25,000 copper.
Do.	Société Minière du Katanga SPRL (Somika)	do.	20,000 <sup>c</sup> copper; 2,400 cobalt.
Do.	Anvil Mining Congo SARL (Mawson West Ltd., 90%)	Dikulushi Mine <sup>1</sup>	20,000 copper.
Do.	do.	Kapulo Mine	19,400 copper.
Do.	La Société pour le Traitement du Terril de Lubumbashi (STL) [Entreprise Générale Malta Forrest SPRL (EGMF), 70%, and La Générale des Carrières et des Mines (Gécamines), 30%]	Big Hill tailings treatment plant at Lubumbashi	3,500 copper; 5,500 cobalt.

See footnotes at end of table.

TABLE 2—Continued  
 CONGO (KINSHASA): STRUCTURE OF THE MINERAL INDUSTRY IN 2015

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners		Location of main facilities	Annual capacity
Copper and cobalt—Continued:				
Mine	Metals Mines		Mines in Katanga Province	2,000 <sup>c</sup> cobalt.
Do.	Feza Mining SPRL		do.	1,000 <sup>c</sup> cobalt.
Black copper <sup>2</sup>	Congo Dong Fang International Mining SPRL		Plant in Lubumbashi	30,000 <sup>c</sup> copper.
Do.	Rubamin SPRL		Plant in Likasi	20,000 copper.
Do.	Société Minière du Katanga SPRL (Somika)		Plant near Lubumbashi <sup>1</sup>	10,000 copper.
Do.	Huachin Metal Leach		Plant in Katanga Province	7,000 <sup>c</sup> copper.
Refined <sup>2</sup>	Katanga Mining Ltd.		Luilu plant <sup>1</sup>	300,000 copper; 8,000 cobalt.
Do.	Tenke Fungurume Mining SARL		Tenke Fungurume plant	225,000 copper.
Do.	Mutanda Mining SPRL		Mutanda plant	200,000 copper.
Do.	MMG Ltd.		Kinsevere plant	80,000 <sup>c</sup> copper.
Do.	Boss Mining SPRL		Luita plant near Lubumbashi	40,000 copper.
Do.	Ruashi Mining SPRL		Ruashi plant	38,000 copper.
Do.	Chemaf SPRL		Usoke Avenue plant in Lubumbashi	31,500 copper.
Do.	Congo International Mining Corp.		Plant in Katanga Province	30,000 copper.
Do.	Shituru Mining Corp. SPRL		do.	30,000 copper.
Do.	La Minière de Kalumbwe Myunga (MKM)		do.	26,000 <sup>c</sup> copper.
Do.	Tiger Resources Ltd., 60%, and La Générale des Carrières et des Mines (Gécamines), 40%		Plant near Kipoi Mine	25,000 copper.
Do.	La Générale des Carrières et des Mines (Gécamines)		Shituru plant	21,600 copper.
Do.	do.		Fonderie Electrique de Panda cobalt plant	1,200 cobalt.
Do.	CNMC-Mabende Metal Leach SPRL		Plant at Lwisha	20,000 copper.
Do.	Compagnie Minière de Luisha		Plant in Katanga Province	13,000 <sup>c</sup> copper.
Do.	Société Minière du Katanga SPRL (Somika)		Plant near Lubumbashi	12,000 copper.
Diamond	carats	Artisanal miners	Mines in Kasai-Oriental Province	13,000,000. <sup>c</sup>
Do.	do.	do.	Mines in Kasai-Occidental Province	2,000,000. <sup>c</sup>
Do.	do.	do.	Mines in Bandundu Province	140,000. <sup>c</sup>
Do.	do.	do.	Mines in Orientale Province	110,000. <sup>c</sup>
Do.	do.	Societe Anhui-Congo d'Investissment Minier SPRL (SACIM) [Anhui Foreign Economic Construction Group, 50%, and Société Congolaise d'Investissment Minier, 50%]	Mine at Tshibwe	6,000,000.
Do.	do.	Société Minière de Bakwanga (MIBA) [Government, 80%, and Sibeka Group, 20% (which was owned by Mwana Africa plc)]	Mines at Mbuji-Mayi in Kasai-Oriental Province	900,000.
Do.	do.	Société Minière de Lupatapata	Mine at Kansenga	240,000. <sup>c</sup>
Gemstones	Artisanal and small-scale miners		Mines at Rwangara and Shakubangwa in Nord-Kivu Province	48 tourmaline. <sup>c</sup>
Germanium	kilograms	La Société pour le Traitement du Terril de Lubumbashi (STL)	Big Hill tailings treatment plant at Lubumbashi	20,000.
Gold	do.	Artisanal and small-scale miners	Mines in various locations, including:	10,000. <sup>c</sup>
Do.	do.	do.	Ituri Province	NA.
Do.	do.	do.	Katanga Province	NA.
Do.	do.	do.	Maniema Province	NA.
Do.	do.	do.	Nord-Kivu Province	NA.
Do.	do.	do.	Sud-Kivu Province	NA.
Do.	do.	Coomid, Fametal, and Gold Dragon Resources	Ituri Province	2,000. <sup>c</sup>
Do.	do.	AngloGold Ashanti, 45%, and Randgold Resources Ltd., 45%	Kibali Mine in Ituri Province	30,000.
Do.	do.	Banro Corp.	Namoya Mine in Maniema Province	4,200.
Do.	do.	do.	Twangiza Mine in Sud-Kivu Province	3,300.

See footnotes at end of table.

TABLE 2—Continued  
 CONGO (KINSHASA): STRUCTURE OF THE MINERAL INDUSTRY IN 2015

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Niobium (columbium) and tantalum		Société Minière du Kivu (Simikivu) [GfE Metalle und Materialien GmbH of Germany, 70%]	Lueshe Mine <sup>1</sup>	1,440 pyrochlore.
Do.		Artisanal and small-scale miners	Mines in Malemba Nkulu Territory	310 <sup>c</sup> columbite- tantalite.
Do.		do.	Mines in Manono Territory	140 <sup>c</sup> columbite- tantalite.
Do.		do.	Mines in Dilolo Territory	35 <sup>c</sup> columbite- tantalite.
Do.		do.	Mines in Nyunzu Territory	20 <sup>c</sup> columbite- tantalite.
Petroleum, crude	thousand 42-gallon barrels	Perenco REP (subsidiary of Perenco plc) and Congolaise des Hydrocarbures SARL	Kifuku, Kinkasi, Liawenda, Makelekese, Muanda, Nsiamfuma, and Tschienne onshore wells	5,480.
Do.	do.	Muanda International Oil Co. (subsidiary of Perenco plc), 50%; Teikoku Oil Co. Ltd., 32.3%; ODS Ltd., 17.7%	Mibale, Motoba, and Tshiala offshore wells	3,650.
Silver	kilograms	Anvil Congo Mining SARL	Dikulushi Mine <sup>1</sup>	60,000.
Do.	do.	do.	Kapulo Mine	3,000 <sup>c</sup> .
Stone, crushed		Chemaf SPRL	Kilimasimba quarry near Lubumbashi	440,000.
Sulfuric acid		La Générale des Carrières et des Mines (Gécamines)	Sulfuric acid plants at Kolwezi and Shituru	NA.
Do.		Chemaf SPRL	Plant in Lubumbashi	36,000.
Tin:				
Mine		Artisanal and small-scale miners	Mines in Panji Territory	1,500 <sup>c</sup> cassiterite.
Do.		do.	Mines in Malemba Nkulu Territory	1,400 <sup>c</sup> cassiterite.
Do.		do.	Mines in Mitwaba Territory	900 <sup>c</sup> cassiterite.
Do.		do.	Mines in Manono Territory	600 <sup>c</sup> cassiterite.
Do.		do.	Mines in Lubudi Territory	500 <sup>c</sup> cassiterite.
Do.		do.	Mines in Bukama/Luena Territory	400 <sup>c</sup> cassiterite.
Do.		do.	Mines in Kalehe Territory	350 <sup>c</sup> cassiterite.
Do.		do.	Mines in Punia Territory	300 <sup>c</sup> cassiterite.
Refined		Malaysia Smelting Corporation Berhad and Mining Mineral Resources	Plant at Lubumbashi <sup>1</sup>	3,600.
Do.		African Smelting Group SPRL	Plant at Sake in Nord-Kivu Province <sup>1</sup>	NA.
Tungsten		Artisanal and small-scale miners	Mines in Bukama/Luena Territory	160 <sup>c</sup> wolframite.
Zinc		La Société pour le Traitement du Terril de Lubumbashi (STL)	Big Hill tailings treatment plant at Lubumbashi	15,000 zinc in zinc oxide.

<sup>c</sup>Estimated. Do., do. Ditto. NA Not available.

<sup>1</sup>Not operating at the end of 2015.

<sup>2</sup>Largest facilities listed; also several more small producers.