



# 2010 Minerals Yearbook

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BOTSWANA [ADVANCE RELEASE]

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# THE MINERAL INDUSTRY OF BOTSWANA

By Harold R. Newman

Botswana's mineral resources include base metals, coal, diamond, salt, and soda ash; however, mineral exploration in Botswana is difficult. Botswana's mineral resources were formed during several geologic periods. The geology of most of the country is poorly understood owing to extensive cover by recent sediments, and available information was based mainly on drilling and geophysical surveys. Unexploited mineral resources include asbestos, chromium, feldspar, graphite, gypsum, iron, and manganese that are located mostly in remote areas and (or) beneath a thick sequence of Kalahari sands.

Mineral exploration and mining in Botswana are regulated by the Department of Geological Survey and the Department of Mines under the Ministry of Minerals, Energy and Water Resources (MMEWR). The Department of Geological Survey's role is to gather, collate, assess, and disseminate information related to the groundwater, rocks, and mineral resources of the country. The Department of Mines, in partnership with stakeholders, provides administrative services, sets policies, develops programs, and drafts legislation for mineral exploitation and works to prevent mining occupational diseases and injuries and to minimize degradation of the environment (Ministry of Minerals, Energy and Water Resources, 2010b).

## Minerals in the National Economy

All mineral rights in Botswana are vested in the state. The MMEWR is responsible for ensuring that the mineral resources are investigated and exploited in an efficient and timely manner for the benefit of the national economy. The Mines and Minerals Act 1999 is comparable to modern mineral legislation in other countries and was favorably received by the mineral industry (Ministry of Minerals, Energy and Water Resources, 2010a).

Mineral production was a significant factor contributing to Botswana's economic growth. The country was a leading producer of diamond and accounted for about 32% of world diamond production in terms of volume (Olson, 2011). Diamond extraction was the main contributor to the country's economy in recent years, accounting for more than one-third of the gross domestic product, almost all the country's export earnings, and about one-half of Government revenue in 2010. By law, diamond revenues provide the funds for every child in Botswana to receive a free education up to the age of 14 (Trading Economics, 2010).

## Production

Following an overall decrease in production in 2009, mineral production in Botswana rebounded for most mineral commodities in 2010 owing to the global economic recovery. Mineral production was the main reason behind Botswana's economic growth. In 2010, Tati Nickel Mining Co. (Pty.) Ltd. (a subsidiary of OJSC MMC Norilsk Nickel of Russia) produced

an estimated 28,000 metric tons (t) of nickel, 14,000 t of copper, and 340 t of cobalt from its nickel-copper-cobalt mining and processing operations at Selebi-Phikwe. Bamangwato Concessions Ltd. (BCL) of Botswana processed copper-nickel concentrate from its Selebi-Phikwe Mines. BCL also toll-smelted concentrate from Tati Nickel's Phoenix open pit mine. IMAGOLD Corp. produced an estimated 1,800 kilograms (kg) of gold in 2010 compared with 1,626 kg in 2009. Diamond production increased significantly to about 21 million carats in 2010 compared with 17.7 million carats in 2009. Almost all the country's rough diamond output was by Debswana Diamond Co. (Pty) Ltd., which was a 50-50 joint partnership of the De Beers Group of South Africa and the Government. Production of semiprecious stones totaled about 30,000 kg. The semiprecious stones were mainly varieties of agate and carnelian, and production was not reported separately. Botswana Ash (Pty.) Ltd. produced salt and soda ash. Coal production in 2010 increased by more than 5.7% (table 1).

## Structure of the Mineral Industry

The Government maintained an equity position in most of the major mining companies; however, the mineral industry operated mainly on a privately owned free-market basis. In addition to these major operations, a number of medium- and small-scale mines produced agates, aggregates, clay, and dimension stone. Production, capacity, and ownership information was not readily available for these operations. Major commodities and the companies that produced those commodities are listed in table 2.

## Commodity Review

### Metals

**Copper.**—African Copper plc of the United Kingdom announced that it was continuing to make improvements in 2010 to the plant at the Mowana Mine. After the equipment breakdowns at the primary and secondary crushers, African Copper installed mobile crushing units in 2009 to bypass the primary and secondary crushers. The mine had been placed on care-and-maintenance status in early 2009 owing to the decrease in commodity prices, and production was restarted in August 2009. The company planned to install a new washing plant to screen and wash out the fine fraction of the ore before it enters the primary crusher ore stockpile as well as a dense-media separation plant in 2011 (de Bruyn, 2010b).

African Copper announced that the environmental impact assessment and development permit had been approved for its Thakadu copper-silver deposit, which would allow mining to start. The deposit is located 70 kilometers (km) from the company's Mowana Mine. Estimated inferred resources at

yearend 2010 were 10.2 million metric tons (Mt) grading 1.2% copper. With mining commencing at the Thakadu deposit, Africa Copper's focus was expected to shift to the Makala deposit as the next deposit to be developed in close proximity to the Thakadu deposit (African Copper plc, 2010).

Botswana Metals Ltd. of Australia, which was a company that was focused mainly on exploration for base metals, diamond, and precious metals, identified an area of supergene copper-silver mineralization in a weathered zone at its Airstrip prospect. Highlights included 18 meters (m) grading 1.78% copper and 28.9 grams per metric ton (g/t) silver, including 5 m grading 4.2% copper and 92.5 g/t silver, and 9 m grading 2.7% copper and 54.7g/t silver. Botswana Metals was planning an additional 10,000 m of drilling in 2011 at the Airstrip, Dibete, and Mabilele sites to further define the supergene copper-silver mineralization and determine the areal extent of the zone (Botswana Metals Ltd., 2010).

Discovery Minerals Ltd. of Australia, which was developing the Boseto copper project in northwestern Botswana, announced an upgraded mineral resource capacity for the project from an estimated 2 million metric tons per year (Mt/yr) to an estimated 3 Mt/yr. This significant addition was based on drilling undertaken in 2009 and early 2010. The extent of the resource addition meant that Discovery could evaluate increasing the planned rate of processing of the open pit ore and extend the life of the mine to at least 10 years. Discovery had a license for the Boseto project along with 14 prospecting licenses on the Kalahari Copper Belt (Discovery Minerals Ltd., 2010a).

Hana Mining Ltd. of Canada had identified significant copper and silver ore deposits across an area of about 2,200 square kilometers (km<sup>2</sup>) through its Ghanzi project. The project consisted of five license blocks that contained sediment-hosted copper-silver mineralization along a 600-km cumulative strike length. The project is located within the Ghanzi-Chobe Fold Thrust Belt, which is a 140-km-wide zone of deformed metavolcanics and metasediments. This belt, which is also referred to as the Kalahari Copper Belt, formed part of the late Proterozoic Pan African Mobile Belt that runs for more than 1,000 km across Botswana and southwest into Namibia, and hosts numerous copper-silver deposits. The characteristic mineralogy of the deposits consists of a near-surface oxide zone containing chalcocite, chrysocolla, malachite, and trace azurite; a transitional zone containing both oxide and sulfide copper minerals; and a deeper sulfide zone of bornite, chalcocite, chalcopyrite, and minor copper minerals. Silver is a significant ore constituent, occurring as intergrowths within copper sulfides. Estimated indicated reserves at the Ghanzi deposit were 37.4 Mt grading 0.93% copper and 13.4 g/t silver, and the reported estimated inferred reserves were 423.9 Mt grading 0.60% copper and 6.3 g/t silver and were National Instrument (NI) 143-101 ore reserves definition compliant. There was considerable exploration that could be done on the project as mineralization remained open in all directions and at depth (Hana Mining Ltd., 2010).

**Manganese.**—Discovery announced that it had been granted 16 new prospecting licenses for manganese in an area covering 14,425 km<sup>2</sup>. The area covered was underlain by rocks of the Transvaal Super Group in an extension of the Griqualand West Basin in South Africa known in Botswana as the Kanye

Basin. The licenses were valid for an initial period of 3 years and could be renewed for two additional terms of 2 years each. Exploration in the Kalahari manganese field has historically been challenging because of the thick cover of Kalahari sand, which can be up to 45 m deep. Exploration for manganese deposits in southern Botswana is likely to encounter similar difficulties. An initial work plan to assess the prospectivity of the area was scheduled to commence in midyear 2011 (London Stock Exchange Ltd., 2010).

**Nickel.**—Discovery's Dikoloti nickel project comprised four prospecting licenses covering an area of 612 km<sup>2</sup> that surrounds the three nickel deposits owned by BCL in the Selebi-Phikwe region of northeastern Botswana. The project had an estimated inferred resource of 4.1 Mt grading 0.7% nickel and 0.5% copper. Discovery renewed its leases for a further 2 years and expected to complete another exploration program in 2011 to add to the mineral resources to enable a project life of 10 years (Discovery Minerals Ltd., 2010b).

BCL and Global Initiatives Co. of Botswana signed an agreement to investigate construction of a \$140 million plant to retreat smelter slag and mine tailings at BCL's Selebi-Phikwe Mine. The plant would retreat about 100 Mt of mine tailings and 45 Mt of smelter slag to produce about 150,000 t of cobalt, copper, and nickel. The proposed plant would use Chinese metallurgical technology to treat up to 40,000 metric tons per day (t/d) of combined tailings and slag, and recover at least one-half of the estimated 300,000 t of nickel contained in the resource. Construction and commissioning of the plant was scheduled to be completed by 2012 (Mining Weekly Online, 2010).

### *Industrial Minerals*

**Diamond.**—Botswana is a participant in the Kimberley Process Certification Scheme, which is an association of the Governments of diamond-producing and -importing countries, commercial diamond firms, industry associations, and nongovernmental organizations that have implemented a certification system for the international trade of rough diamond. The Kimberley Process is designed to prevent so-called "blood" or "conflict" diamond from being shipped through legitimate trading channels.

Diamond exports from January through November 2010 (the latest month for which data were available) reached \$2.94 billion. Diamond exports could surpass an earlier forecast of \$3.27 billion for the full year. If diamond exports do reach the 2010 forecasted level, it would be the highest annual income the Government has received from diamond since diamond was discovered in Botswana in 1967. Only 2 years previous, Debswana (which was 50% Government owned) had closed its mines temporarily owing to decreased demand (Antwerp Facets, 2011a).

Debswana was the world's leading diamond producer, by value, with mining operations at Damtshaa, Jwaneng, Letlhakane, and Orapa. The Orapa pipe was the world's second ranked diamond-producing pipe after the Argyle diamond-producing pipe in Australia. The Jwaneng (meaning "a place of small stones") open pit mine was the richest diamond mine in the world when measured by the value of recovered diamond (MBendi Information Services (Pty) Ltd., 2010).

Lucara Diamond Corp. of Canada announced that it had acquired African Diamond plc. Under the terms of the sale, Lucara received all the issued and outstanding shares of African Diamond, including a 100% interest in the AK6 project, which was an advanced, high-value diamond development project located in the Letlhakane/Orapa kimberlite district. The AK6 project was on schedule for commissioning in the fourth quarter of 2011. AK6 was considered to have the potential to become a mine capable of producing 1 million carats per year. Earthwork at the site was well advanced and all major plant terraces were established (Antwerp Facets, 2011c).

The De Beers Group and the Government were planning to extend production at the Jwaneng Mine. The \$3 billion expansion, named Cut-8, would be the largest-ever single capital investment in the mineral sector in Botswana. The expansion would extend the Jwaneng Mine's life by 7 years from 2017 to 2024. The expansion would involve removing 658 Mt of waste material to more than double the mine's depth to 650 m to create a 'super pit'. Cut 8 would not increase the amount of diamond produced annually at Jwaneng but rather would enable Debswana to continue current production levels to 2024 to sustain the mine (Shacinda, 2010).

Debswana announced that it would reopen the Damtshaa Mine in 2012 following a 3-year shutdown. Damtshaa was closed in the wake of the global economic crisis and remained closed, although Debswana's other three mines—Jwaneng, Letlhakane, and Orapa—were reopened in April 2009. The mine was planned to operate at full capacity when reopened. In 2008, Damtshaa had produced more than 500,000 carats of diamond (Antwerp Facets, 2011b).

Lucara Diamond started construction at the BK11 Mine after being granted a 12-year mining license for the project. The BK11 Mine was expected to produce an estimated 1 million carats of diamond during its 10-year mine life. Output would be sold by open tender in Botswana and also outside the country until December 2013 (de Bruyn, 2010a).

Gem Diamonds Ltd. of the United Kingdom announced that it had been granted a license to mine the Gope deposit in the Central Kalahari Game Reserve. The license, which was valid for 25 years, was the first step toward the development of the Gope deposit into a viable producing mine. The Gope deposit was estimated to contain about 20.5 million carats of diamond with an estimated value of \$3.3 billion. The mine was projected to produce more than 1 million carats per year during a 20-year life span when fully operational (Israeli Diamond Industry, The, 2010).

### *Mineral Fuels and Related Materials*

**Coal.**—JSW Energy Ltd. of India offered \$414 million for all the shares in CIC Energy Corp., which was developing the Mmamabula coal deposit and power station, and both companies had approved the transaction. Mmamabula has an estimated resource of 2,800 Mt of coal. The Mmamabula energy project consisted of the development of a 6-Mt/yr mine and the construction of a 1,200-megawatt powerplant. All the energy produced was for export (Mining Journal, 2010).

**Uranium.**—African Energy Resources Ltd. of Australia's Sese uranium project was located in northeastern Botswana about 50 km from Francistown. The Sese project is located in an area of Karoo sediments that form a band about 5 km to 10 km wide and occupy a position between older basement gneisses to the east and younger, flat-lying Kalahari sand cover to the west. Calcrete horizons are locally developed immediately above the Karoo sediments in this part of Botswana. African Energy was awaiting all assay results from the current drilling program before making an assessment of the infill drilling required to support an initial resource estimate for the project area. Infill drilling would commence once seasonal rains eased and drill rig access became viable (African Energy Resources Ltd., 2010).

A-Cap Resources Ltd. of Canada reported that its ongoing exploration at the Letlhakane uranium project had resulted in the discovery of a new zone of near-surface secondary uranium mineralization. The Letlhakane project involved the construction of Botswana's first uranium mine. A previous scoping study reported an estimated resource of 280 Mt grading 158 parts per million uranium oxide ( $U_3O_8$ ) for 44,500 t of contained concentrate. The shallow-lying ore would be extracted using conventional open pit mining equipment. The crushed ore would be stacked on a specially designed leach pad and the  $U_3O_8$  yellowcake material would be recovered by implementing alkaline heap leaching, solvent extraction, and ion exchange. This type of ore mineralization has high grades and good metallurgical recoveries, and is amendable for open pit mining (Wait, 2010).

### **Outlook**

Revenues from diamond operations that were affected by the international financial crisis recovered in 2010 and are expected to remain high. International interest in exploration for diamond, base and precious metals, and uranium is expected to continue. The country's favorable mineral investment climate, low tax rates, and political stability are expected to continue to attract foreign mineral investment. The several international companies with active mineral exploration programs are expected to continue to operate in Botswana. Copper, gold, nickel, and soda ash production and processing are expected to continue to be positive factors to the country's economy. Given the country's extensive coal resources and the projected regional power demand, additional coal-fueled electricity-generating plants are likely to be constructed to supply power to Botswana and the southern African power pool, and additional coal resources are likely to be developed.

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TABLE 1  
BOTSWANA: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity <sup>2</sup>	2006	2007	2008	2009	2010 <sup>e</sup>	
Clay <sup>e</sup>	50,000	50,000	50,000	50,000	50,000	
Coal, bituminous	962,427	828,164	909,511	737,798 <sup>r,3</sup>	780,000	
Cobalt, smelter output, Co content of matte <sup>4</sup>	303	242	337	342 <sup>r,3</sup>	340	
Copper:						
Mine output, Cu content of ore milled	24,255 <sup>5</sup>	24,400 <sup>r</sup>	28,800 <sup>r</sup>	27,700	28,000	
Smelter output, matte, gross weight	64,368	53,947	48,000 <sup>e</sup>	38,000 <sup>3</sup>	38,000	
Smelter output, Cu content of matte <sup>4</sup>	24,255	19,996	23,146	13,600 <sup>3</sup>	14,000	
Diamond <sup>6</sup>	thousand carats	34,293	33,639	32,595	17,734 <sup>r,3</sup>	21,000
Gemstones, semiprecious <sup>7</sup>	kilograms	65,000	48,000 <sup>e</sup>	50,000 <sup>e</sup>	30,000	30,000
Gold <sup>8</sup>	do.	3,020	2,722	3,176	1,626 <sup>r,3</sup>	1,800
Nickel:						
Mine output, Ni content of ore milled	38,000 <sup>e</sup>	27,600 <sup>e</sup>	28,940	28,595	28,000	
Smelter output, matte, gross weight	64,368	53,947	54,000 <sup>e</sup>	54,000	53,000	
Smelter output, Ni content of matte <sup>4</sup>	26,762	22,844	24,000 <sup>e</sup>	29,616 <sup>r,3</sup>	29,000	
Salt <sup>9</sup>	151,595	165,710	170,994	241,114 <sup>r,3</sup>	240,000	
Sand and gravel <sup>10</sup>	thousand cubic meters	4,812	2,866	3,000 <sup>e</sup>	3,000	3,000
Soda ash, natural	255,677	279,625	263,566	215,118 <sup>r,3</sup>	225,000	
Stone, crushed	thousand cubic meters	1,134	1,200 <sup>e</sup>	1,200 <sup>e</sup>	1,200	1,200

<sup>e</sup>Estimated; estimated data are rounded to no more than three significant digits. <sup>r</sup>Revised. do. Ditto.

<sup>1</sup>Table includes data available through May 31, 2011.

<sup>2</sup>In addition to commodities listed, palladium, platinum, and silver were produced, and exported in nickel-copper-cobalt matte; copper and nickel cathodes also were produced at a pilot plant, but information is inadequate to make reliable estimates of output.

<sup>3</sup>Reported figure.

<sup>4</sup>Smelter product was granulated nickel-copper-cobalt matte.

<sup>5</sup>Included some product from direct smelting of ore; that is, ore not reported as milled.

<sup>6</sup>Assumed to contain about 70% gem and near gem.

<sup>7</sup>Principally agate. Reported as sales.

<sup>8</sup>Reported as bullion; historically included silver estimated to be about 2%. Includes artisanal production.

<sup>9</sup>Byproduct of natural soda ash production.

<sup>10</sup>Includes clay (for brick and tile).

TABLE 2  
BOTSWANA: STRUCTURE OF THE MINERAL INDUSTRY IN 2010

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Clay <sup>1</sup>		Lobatse Clay Works (Pty.) Ltd. (Botswana Development Corp. and Interkiln Corp. joint venture)	Lobatse, 70 kilometers south-southwest of Gaborone	50,000. <sup>c</sup>
Do.		Makoro Brick and Tile (Pty.) Ltd.	Makoro, 10 kilometers south of Palapye	20,000. <sup>c</sup>
Coal		Morupule Colliery (Pty) Ltd. (Anglo American Corp. of South Africa Ltd. and related firms, 93.3%)	Morupule, 270 kilometers northwest of Gaborone	1,000,000.
Diamond	thousand carats	Debswana Diamond Co. (Pty.) Ltd. (Government, 50%, and De Beers Centenary AG, 50%)	Jwaneng Mine, 115 kilometers west of Gaborone	12,000.
Do.	do.	do.	Orapa Mine, 375 kilometers north of Gaborone	13,000.
Do.	do.	do.	Lethakane Mine, 350 kilometers north of Gaborone	1,000.
Do.	do.	do.	Damtshaa Mine, 220 kilometers west of Francistown	670.
Do.	do.	Tswapong Mining Co. (Pty.) Ltd. (De Beers Prospecting Botswana Ltd., 85%, and Government, 15%)	Tswapong Mine, 275 kilometers northeast of Gaborone	3.
Gemstones, semiprecious	kilograms	Agate Botswana (Pty.) Ltd.	Processing plant at Pilane, 45 kilometers north of Gaborone	60,000.
Gold	do.	IAMGOLD Corp.	Mupane Mine, near Francistown	3,100.
Nickel-copper-cobalt		Bamangwato Concessions Ltd. (BCL), (Government, 15%, and Botswana RST Ltd., 85%, of which LionOre Mining International Ltd., 12.65%)	Selebi-Phikwe Mines, 350 kilometers northeast of Gaborone	3,000,000 ore matte content (of which 30,000 nickel, 25,000 copper, 400 cobalt).
Do.		Tati Nickel Mining Co. (Pty.) Ltd. (LionOre Mining International Ltd., 85%, and Government, 15%)	Phoenix and Selkirk Mines, 23 kilometers east of Francistown	3,600,000 ore matte content (of which 15,000 nickel, 9,000 copper, 100 cobalt, 960 kilograms palladium, 145 kilograms platinum).
Do.		Masa Precious Stones (Pty.) Ltd.	Bobonong, east of Selebi-Phikwe	4,000.
Salt		Botswana Ash (Pty.) Ltd. (Government, 50%, and Anglo American plc, 50%)	Sua Pan, 450 kilometers north of Gaborone	650,000.
Soda ash		do.	do.	300,000.

<sup>c</sup>Estimated.

<sup>1</sup>For brick and tiles.