



# 2007 Minerals Yearbook

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## ZIMBABWE

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# THE MINERAL INDUSTRY OF ZIMBABWE

By Philip M. Mobbs

Zimbabwe's diverse mineral output included about 4% of the world's asbestos production, about 3% each of the world's chromite (much of which is used as a feed material for the ferroalloy plants in Zimbabwe) and vermiculite production, and 2% each of the world's lithium production and platinum-group metals (PGM) production. Hyperinflation, which averaged 10,453% in 2007 compared with a revised average of 1,017% in 2006, affected Zimbabwe's economy and adversely affected mineral production operations. Companies that produced minerals or manufactured mineral-based commodities in Zimbabwe struggled to continue operations (George, 2008; International Monetary Fund, 2008; Ober, 2008; Papp, 2008; Potter, 2008; Virta, 2008).

## Minerals in the National Economy

Nationally, about 40 minerals or mineral-based commodities were produced, chiefly from small- and medium-scale mines. The mining sector accounted for about 4% of the gross domestic product, and minerals and mineral-based commodities were a significant segment of national exports. Despite the general increase in world mineral prices, output of most mineral commodities in Zimbabwe was restrained by frequent electrical power outages; the lack of foreign currency to purchase imported equipment, spare parts, and supplies; and chronic shortages of food, fuel, and skilled manpower (Reuters, 2006; Banya, 2008; Makoshori, 2008).

## Government Policies and Programs

The Ministry of Mines and Mining Development managed the mineral sector in accordance with the Mines and Minerals Act (chapter 21:05) and the Mining (General) Regulations, 1977. The Gold Trade Act of 2006 mandated penalties for unlawful possession or trading of gold. In 2007, the Government amended the Environmental Management Act of 2002. The amendment requires mines that were closed because of illegal activity to submit an environmental impact assessment report before operations may resume.

The Parliament passed the Empowerment and Indigenization Bill, which required that 51% ownership of businesses in Zimbabwe be acquired by eligible Zimbabweans during a several-year period. The bill was expected to be enacted in 2008. The Government also published a draft of the proposed Mines and Minerals Amendment bill, which would require the eventual transfer of 51% ownership interest in strategic energy mining activities, such as coal, to the Government. The Government would receive 25% interest in the company at no cost and purchase the additional 26%. The amendment would also require companies that mined precious metals or stones to divest 51% of their ownership; the Government would receive 25% at no cost, and the other 26% was to be sold to the Government or to eligible indigenous local investors.

The Government's foreign exchange policy and chronically delayed payments from the Reserve Bank of Zimbabwe often adversely affected mining and mineral-based commodity companies that exported production. Because of the rampant inflation, the Government instituted price controls in July to roll back official domestic prices. The price controls adversely affected mineral-based commodity companies, such as brick, cement, coal, and fertilizer companies, that sold their production domestically (Wines, 2007).

## Production

In 2007, the output volume of steel was estimated to have increased owing to the addition of two furnaces at the steel plant of Steelmakers Zimbabwe (Private) Ltd. Production of clays, coal, cobalt, coke, copper ore, indium, magnesite, mica, nitrogen, pig iron, PGM, rhodium, ruthenium, and talc also were estimated to have increased significantly in 2007. According to statistics released by the Kimberley Process, diamond production in Zimbabwe decreased to about 700,000 carats compared with more than 1 million carats in 2006. Production of gold, graphite, nickel ore, phosphate rock, pyrite, silver, sulfur, and vermiculite also were estimated to have decreased significantly in 2007 (Kimberley Process Certification Scheme, 2007, 2008).

## Structure of the Mineral Industry

Ownership of mineral operations in Zimbabwe was dominated by domestic investment and mining companies and international cement and mining companies. State-owned operating companies in the mineral sector included Zimbabwe Mining Development Corp. (ZMDC), which maintained equity interest in the closed copper mining and processing facilities, and in gold mines, many of which were inactive. ZMDC also was assigned the Marange diamond mining operation in eastern Zimbabwe. Subsidiaries of state-owned Industrial Development Corp. of Zimbabwe Ltd. produced industrial minerals and mineral-based commodities, such as clay, fertilizers, glass, phosphate rock, and stone. Zimbabwe Iron and Steel Company (Private) Ltd. (Zisco), in which the Government held majority interest, operated the crude steel plant, and a Zisco subsidiary operated iron ore and limestone mines.

Foreign investment was concentrated in the cement, chromium, coal, diamond, gold, nickel, PGM, and steel sectors. In December, Sinosteel Ltd. of China acquired a 92% interest in Zimasco Consolidated Enterprises Ltd. (ZCE) of Mauritius, which resulted in Sinosteel's control of a 73% interest in the ZCE subsidiary, Zimbabwe Mining and Smelting Company (Private) Ltd. (Zimasco); Zimasco operated chromite mines and a ferrochromium smelter. Zimasco also purchased chromite ore from many small domestic mining operations, which were located on the Great Dyke. Circle Cement Zimbabwe Ltd. changed its name to Lafarge Cement Zimbabwe Ltd.

## Mineral Trade

In accordance with the Minerals Marketing Corp. of Zimbabwe Act [as modified by the Minerals Marketing Corp. (Exemption) Regulations, 1983 and the Precious Stones Trade Act, 1978], state-owned Minerals Marketing Corp. of Zimbabwe (MMCZ) marketed almost all mineral production in Zimbabwe. Gold and silver were required to be sold to Fidelity Printers & Refineries (Private) Ltd. (Fidelity), which was a subsidiary of the Government's Reserve Bank of Zimbabwe. PGM concentrates and smelter matte were shipped to processing facilities in South Africa that were operated by Impala Platinum Holdings Ltd.

## Commodity Review

### Metals

**Gold.**—The Government remained concerned about the significant drop in gold deliveries to Fidelity from the mines, and continued its crackdown on gold smuggling and illegal gold mining operations. It was also concerned that the severe decline in gold output in recent years could affect the gold sales process. That is, to maintain accreditation by the London Bullion Market Association, refineries on the Good Delivery List, such as Fidelity, were required to maintain an annual refining production rate of not less than 10 metric tons of gold. If Fidelity were to be removed from the list, it could negatively affect the Government's international sales of gold by decreasing the number of available gold buyers for Fidelity's products (London Bullion Market Association, The, 2008, p. 3).

Many of the country's small gold mines had been closed for failure to comply with environmental regulations. Many of the larger mines remained adversely affected by the lack of payment for gold delivered to the Government's Fidelity refinery, in addition to numerous operating problems that affected the country's other mining sectors (Moyo, 2007).

**Iron and Steel.**—In December, Steelmakers installed two additional electric arc furnaces at its Redcliff facility. The new furnaces doubled the plant's production capacity to 60,000 metric tons per year of crude steel (New Ziana (Private) Ltd., 2008).

The Government continued to seek investors to fund the rehabilitation of Zisco. Coal shortages in September and December 2006 had adversely affected the steel plant's main blast furnace and resulted in the suspension of furnace operations in early 2007, at which point Zisco primarily reprocessed dump material and sold scrap. Zisco resumed steelmaking operations in April at the rate of about 6,000 metric tons per month. Zisco proposed to reline the Number Four blast furnace and renovate equipment in 2008 (Thondhlana, 2007a, b).

### Industrial Minerals

**Diamond.**—RioZim Ltd., which held a 22% interest in Murowa Diamond (Private) Ltd., reported that production from the Murowa Mine again declined. Output in 2007 was 145,000 carats compared with 240,026 carats in 2006 and 251,152 carats in 2005. The decreases in production were attributed to frequent electrical power cuts, equipment failures that were

caused by the lack of spare parts, and the decrease in the grade of diamond as the open pit mine was deepened. In 2007, a planned \$200 million production capacity expansion program remained on hold pending clarification of the impact of the proposed amendment to the mining law, which could result in the effective loss of 51% of any investment. Without the expansion, RioZim indicated that the mine could close in 2009 or 2010 (Standard, The, 2006; Antwerp Facets News Service, 2007; Banya, 2008).

In 2007, military and police units attempted to remove illegal miners who had overrun the Marange diamond deposit in the Chiadzwa area. In 2006, the Ministry of Mines and Mining Development had revoked the diamond exploration and mining rights for the Marange license area, which had been awarded to African Consolidated Resources plc (ACR) of the United Kingdom. The Ministry subsequently awarded the development rights to the Marange license area to state-owned ZMDC. ACR instituted legal proceedings, contending that it retained the title to the concession. The ongoing dispute between Buby Minerals (Private) Ltd. and River Ranch Ltd. concerning the ownership of the River Ranch Mine in southern Zimbabwe also continued to work its way through the court system (Associated Press, The, 2007; Karombo, 2007b; Mukumbira, 2007).

**Nitrogen and Phosphate Rock.**—In 2006, the Government proposed to nationalize the fertilizer companies in Zimbabwe, which included Sable Chemicals Ltd., Windmill (Private) Ltd., and Zimbabwe Fertilizer Company Ltd. TA Holdings Ltd. of Zimbabwe, however, retained 51% equity interest in Sable. In 2006, a damaged electrical transformer at Sable, which required large amounts of electricity for its operations, resulted in the suspension of ammonium nitrate production for about 6 months. Sable replaced the transformer in 2007, which resulted in a rebound of nitrogenous fertilizer production. Anhydrous ammonia for the Sable facility was imported from South Africa.

Phosphate rock production declined with the suspension of operations in July at the Dorowa Mine, which was owned by state-owned Chemplex Corporation Ltd. The shutdown, which was attributed to the lack of electrical power and foreign exchange to buy imported supplies, also affected Zimbabwe Phosphate Industries Ltd., which produced phosphatic fertilizer. Power and supply shortages also were responsible for the suspension of operations at the Iron Duke pyrite mine in July (Mail & Guardian, 2007).

### Mineral Fuels and Related Materials

**Coal.**—The Chaba open pit and the 3 Main underground mine of Hwange Colliery Co. Ltd.; the Chiredzi Mine, which was operated by Steelmakers; RioZim's Sengwa Mine; and the Tuli Mine of Firmo (Proprietary) Ltd. and the Kutamba Family Trust accounted for most of Zimbabwe's domestic coal production. Coal was produced for electricity generation plants and industrial and metallurgical facilities. In 2007, Signet Mining Ltd. of South Africa entered into a joint venture with Firmo to evaluate the Massaabi coalfield.

**Petroleum.**—In 2007, Venessia Petroleum of Qatar initiated a feasibility study on the construction of a crude oil refinery. The proposed 120,000-barrel-per-day-capacity facility, which would

be located in Harare, would process imported crude oil (Reuters, 2007).

**Uranium.**—The Government declared that “Uranium is a strategic resource and only the Government can mine it” and cancelled the rights to develop the Kanyemba uranium deposit in the Zambezi Valley (Karombo, 2007a). Lowenbrau Mining Services, which was a joint venture of OmegaCorp Ltd. of Australia and domestic investors, had provisionally acquired the development rights in 2006.

## Outlook

According to the International Monetary Fund (2008), Zimbabwe’s rampant inflation, which averaged 10,453% in 2007, reached 108,844% at yearend. The rate is expected to continue to increase rapidly in 2008. The real gross domestic product, which has declined each year since 1999, is not expected to recover quickly.

Zimbabwe has abundant mineral resources and a well-developed (but deteriorated) highway and railroad network. The short-term outlook for the mining sector, however, is not favorable. Escalating local costs and shortages of electrical power, food, fuel, and skilled employees are expected to continue to affect mineral sector operations adversely in the near term. The potential loss of 51% equity interest in mining operations under the proposed Mines and Minerals Amendment is expected to be a negative influence on domestic and international interest in new investment in the Zimbabwe mining industry. The chronic lack of foreign exchange is expected to continue to adversely affect plans for equipment and mine maintenance, mine operations, and proposed mine and plant expansions in the near future, and the massive debt load of the state-owned companies associated with the mineral industry is casting a shadow on their future viability.

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

(Metric tons unless otherwise specified)

Commodity <sup>2</sup>	2003	2004	2005	2006	2007 <sup>c</sup>
<b>METALS</b>					
Chromite, gross weight	637,099	668,391	614,720	700,001	650,000
Cobalt, metal content <sup>3</sup>	79	59	281	26	50
Copper:					
Mine output, concentrate, Cu content	2,767	2,383	2,570	2,581	3,000
Metal, refinery output, refined/cathode, primary <sup>c</sup>	7,200 <sup>r,4</sup>	7,000 <sup>4</sup>	7,000 <sup>4</sup>	7,000 <sup>4</sup>	7,000
Gold kilograms	12,564	21,330	14,024	11,354	6,750 <sup>4</sup>
Iron and steel:					
Mine output, iron ore:					
Gross weight thousand metric tons	367	283	377	104	110
Fe content <sup>c</sup> do.	184	140	185	52	55
Metal:					
Pig iron do.	182	125	129	25 <sup>r,e</sup>	50
Steel, crude do.	152	135	107	24 <sup>r</sup>	100
Ferroalloys:					
Ferrochromium	245,299	193,077	218,143	200,673	200,000
Ferrosilicon chromium	--	1,000	5,000	2,000 <sup>r,e</sup>	2,000
Nickel:					
Mine output, concentrate, Ni content	9,516	9,776	8,556	8,825	7,100
Refinery output, refined metal: <sup>e</sup>					
Refined from domestic materials	9,500	9,700	7,500	5,500	5,000
Toll refined from imported materials <sup>5</sup>	7,300	6,000	5,700	9,000	9,000
Total refined nickel metal	16,800	15,700	13,200	14,500	14,000
Platinum-group metals:					
Palladium kilograms	3,449	3,564	3,879	4,022	4,300
Platinum do.	4,270	4,438	4,834	4,998	5,300
Rhodium do.	377	374	404	410	800
Ruthenium do.	322	300	317	317	500
Iridium do.	152	135	141	147	250
Total do.	8,570	8,811	9,575	9,894	11,150
Silver do.	747	3,216	187	500 <sup>c</sup>	250
Tantalum, mine output, Ta content	4	14	--	NA	--
<b>INDUSTRIAL MINERALS</b>					
Asbestos thousand metric tons	147	104	122	97	100
Cement, hydraulic <sup>c</sup> do.	400	500	600	700	700
Clays <sup>6</sup>	--	700 <sup>r,e</sup>	600 <sup>r,e</sup>	300 <sup>r,e</sup>	600
Diamond carats	--	44,454	251,152	1,046,000	695,015 <sup>4</sup>
Feldspar	246	1	--	--	--
Graphite	7,675	10,267	4,298	6,588	5,000
Kyanite	745	210	--	--	--
Lithium minerals, gross weight	12,131	13,710	37,499	30,000 <sup>r,e</sup>	30,000
Magnesite	1,333	749	893	939	2,000
Mica <sup>c</sup>	--	120,000	160,000	130,000	200,000
Nitrogen, N content of ammonia	56,300	47,500	45,000 <sup>c</sup>	10,000 <sup>r,e</sup>	35,000
Perlite <sup>c</sup>	5,000	4,000	4,000	3,000 <sup>r</sup>	3,000
Phosphate rock, marketable concentrate	95,496	83,391	45,705	65,838	30,000
Stone, sand and gravel:					
Granite, black	190,372	8,825	--	1,000 <sup>r,e</sup>	--
Limestone thousand metric tons	922	41	84	50 <sup>c</sup>	50
Silica <sup>7</sup> do.	2,356	70 <sup>r,e</sup>	20 <sup>r,e</sup>	12 <sup>r,e</sup>	--
Sulfur:					
Pyrite:					
Gross weight	93,010	81,795	59,683	39,777	20,000
S content (32.6%)	30,320	26,670	19,500	13,000	6,500
Byproduct acid, metallurgical and coal process gas, S content <sup>e</sup>	2,000	1,900	1,500	1,000	1,000
Total <sup>e</sup>	32,300	28,600	21,000	14,000	7,500

See footnotes at end of table.

TABLE 1—Continued  
ZIMBABWE: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity <sup>2</sup>	2003	2004	2005	2006	2007 <sup>c</sup>	
INDUSTRIAL MINERALS—Continued						
Talc	196	--	--	140	200	
Vermiculite	20,016	27,150	23,045	13,421	10,000	
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous	thousand metric tons	2,872	2,476	2,891	2,107	2,400
Coke, including metallurgical <sup>c</sup>	do.	228	180	200	160	400

<sup>6</sup>Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. <sup>1</sup>Revised. do. Ditto. NA Not available. -- Zero.

<sup>1</sup>Table includes data available through January 30, 2009.

<sup>2</sup>In addition to the commodities listed, secondary aluminum; corundum; such gemstones as amethyst, aquamarine, emerald, iolite, and tourmaline; kaolin; secondary lead; and ores of tin and tungsten may be produced, but information is inadequate to estimate output.

<sup>3</sup>Metal includes metal content of compounds and salts and may include cobalt recovered from nickel-copper matte imported for toll refining.

<sup>4</sup>Reported figure.

<sup>5</sup>Toll-refined data includes part of the output from the Bindura Refinery and all the production from the Empress Refinery, which processes imported nickel matte from Botswana.

<sup>6</sup>Includes fire clay.

<sup>7</sup>Includes rough and ground quartz and silica sand.

TABLE 2  
ZIMBABWE: STRUCTURE OF THE MINERAL INDUSTRY IN 2007

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Asbestos	African Associated Mines (Private) Ltd.	Shabanie Mine, Zvishavane	2,400,000
Do.	do.	Gaths Mine, Mashava	1,400,000
Cement:			
Clinker	Portland Holdings Ltd. (Pretoria Portland Cement Ltd.)	Colleen Bawn, about 115 kilometers southeast of Bulawayo	1,000,000
Portland cement	do.	Bulawayo	800,000
Do.	Lafarge Cement Zimbabwe Ltd. (Lafarge, S.A., 76.4%)	Harare	450,000
Do.	Sino-Zimbabwe Cement	Gweru	300,000
Chromite	Zimbabwe Mining and Smelting Co. (Private) Ltd. (Zimasco) [Zimasco Consolidated Enterprises Ltd. (ZCE)]	Peak Mine, Railway Block Mine, and Iron Ton Mine near Shurugwi; Rhodesdale Mine at Lalapanzi	120,000
Do.	Local cooperatives	Mines on the southern Great Dyke	340,000
Do.	do.	Mines on the northern Great Dyke	230,000
Do.	Zimbabwe Alloys Ltd. [Benscore Investments (Private) Ltd.]	Inyala Mine	60,000
Coal	Hwange Colliery Co. Ltd. (Government, 38%; Edwards Nominees (Private) Ltd., 15.46%; Messina Investments Ltd., 12.6%)	3 Main Mine and Chaba Mine, Hwange	5,000,000
Do.	RioZim Ltd.	Sengwa Colliery, about 200 kilometers northeast of Kadoma	5,000,000
Do.	Steelmakers Zimbabwe (Private) Ltd. (Steelmakers Ltd.)	Chiredzi, about 130 kilometers southeast of Masvingo	1,200,000
Cobalt:			
Ore, cobalt content	Bindura Nickel Corp. Ltd. (Mwana Africa PLC, 53%)	Trojan Mine at Bindura and Shangani Mine, about 100 kilometers northeast of Bulawayo	800
Hydroxide	BSR Ltd. (Bindura Nickel Corp. Ltd., 100%)	Bindura	700
Copper:			
Ore, copper content	Bindura Nickel Corp. Ltd. (Mwana Africa PLC, 53%)	Trojan Mine at Bindura and Shangani Mine, about 100 kilometers northeast of Bulawayo	1,600
Refined	Empress Nickel Refinery (RioZim Ltd.)	Eiffle Flats, near Kadoma	6,000

See footnotes at end of table.

TABLE 2—Continued  
ZIMBABWE: STRUCTURE OF THE MINERAL INDUSTRY IN 2007

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Diamond	carats	Murowa Diamond (Private) Ltd. (Rio Tinto plc, 78%, and RioZim Ltd., 22%)	Murowa Mine, near Zvishavane	252,000
Do.	do.	River Ranch Ltd. <sup>1</sup>	River Ranch Mine, near Beitbridge	NA
Do.	do.	Zimbabwe Mining Development Corp. <sup>1</sup> (ZMDC)	Marange area	100,000 <sup>e, 2, 3</sup>
Gold	kilograms	Mwana Africa PLC	Freda Rebecca Mine, Bindura	2,000 <sup>4</sup>
Do.	do.	RioZim Ltd.	Renco Mine, 75 kilometers south-southeast of Masvingo	1,000
<b>Iron and steel:</b>				
Crude steel		Zimbabwe Iron and Steel Company (Private) Ltd. (Zisco)	Blast furnace at Redcliff, near Gweru	72,000 <sup>5</sup>
Do.		Steelmakers Zimbabwe (Private) Ltd. (Steelmakers Ltd.)	Electric-arc furnace at Redcliff	60,000
Ferroalloys, ferrochromium		Zimbabwe Mining and Smelting Co. (Private) Ltd. (Zimasco) [Zimasco Consolidated Enterprises Ltd. (ZCE)]	Smelter at Kwekwe	180,000
Do.		Zimbabwe Alloys Ltd. [Benscore Investments (Private) Ltd.]	Smelter at Gweru	45,000
Rolled steel		Lancashire Steel (Pvt.) Ltd. [Zimbabwe Iron and Steel Co. (Private) Ltd. (Zisco)]	Wire rod mill at Kwekwe	120,000
Do.		Steelmakers Zimbabwe (Private) Ltd. (Steelmakers Ltd.)	Rolling mill at Redcliff	100,000
<b>Iron:</b>				
Iron ore, gross weight		Buchwa Iron Mining Co. [Zimbabwe Iron and Steel Co. (Private) Ltd. (Zisco)]	Ripple Creek Mine, near Redcliff	600,000
Sponge iron		Steelmakers Zimbabwe (Private) Ltd. (Steelmakers Ltd.)	Masvingo	54,000
Lithium		Bikita Minerals (Private) Ltd.	Bikita Mine, 60 kilometers east of Masvingo	33,000
<b>Nickel:</b>				
Ore		Bindura Nickel Corp. Ltd. (Mwana Africa PLC, 53%)	Trojan Mine at Bindura and Shangani Mine, about 100 kilometers northeast of Bulawayo	80,000
Refined metal		BSR Ltd. (Bindura Nickel Corp. Ltd., 100%)	Bindura	15,600
Do.		Empress Nickel Refinery (RioZim Ltd.)	Eiffle Flats, near Kadoma	9,000
Phosphate		Dorowa Minerals (Private) Ltd. (Chemplex Corp. Ltd., 100%)	Dorowa Mine, 90 kilometers west of Mutare	155,000
<b>Platinum-group metals:</b>				
Ore		Zimbabwe Holdings Ltd. (Impala Platinum Holdings Ltd., 86.9%)	Ngezi Mines	2,200,000
Do.		Mimosa Investments Ltd. (Aquarius Platinum Ltd., 50%, and Impala Platinum Holdings Ltd., 50%)	Mimosa Mine, east of Zvishavane	1,800,000
Do.		Anglo American Platinum Corp. Ltd.	Unki project	1,440,000 <sup>2</sup>
Concentrate		Zimbabwe Holdings Ltd. (Impala Platinum Holdings Ltd., 86.9%)	Selous concentrator	2,180,000
Do.		Mimosa Investments Ltd. (Aquarius Platinum Ltd., 50%, and Impala Platinum Holdings Ltd., 50%)	Mimosa concentrator, east of Zvishavane	1,900,000
Smelter matte		Zimbabwe Holdings Ltd. (Impala Platinum Holdings Ltd., 86.9%)	Selous smelter	72,000
Pyrite		Iron Duke Pyrites (Chemplex Corp. Ltd.)	Iron Duke Mine	NA
Vermiculite		Shawa Vermiculite (Private) Ltd.	Shawa Mine, near Dorowa	39,000
Do.		Dinidza Vermiculite Mining Co. (Private) Ltd.	Dinidza Mine, near Dorowa	10,000

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

<sup>1</sup>Ownership disputed.

<sup>2</sup>Under development or redevelopment.

<sup>3</sup>Significantly more diamond was produced from the area in 2006 during the uncontrolled diamond rush.

<sup>4</sup>Operations suspended.

<sup>5</sup>Nominal capacity 1,000,000 t/yr. Blast furnaces need refurbishment.