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The Mineral Industry of South Africa

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The Republic of South Africa remained one of the world's leading mining and mineral-processing countries. In 2013, South Africa's estimated share of world mined platinum production amounted to 72%; refined rhodium, 56%; refined platinum, 55%; chromium, 48%; kyanite and related minerals, 47%; mined palladium, 37%; vermiculite, 36%; vanadium, 27%; manganese, 25%; refined palladium, 23%; refined gold, 9%; mined gold, 6%; coal, 4%; mined cobalt and fluorspar, 3% each; aluminum, iron ore, and nickel, 2% each; bentonite, refined cobalt, ferrosilicon and silicon metal combined, phosphate rock, and silica sand, 1% each. South Africa also played a globally significant role in the production of ilmenite, rutile, and zircon (BP p.l.c, 2014, p. 32; Cobalt Development Institute, 2014; CPM Group, 2014, p. 7, 109, 175; World Gold Council, 2014, p. 17; Bray, 2015; Corathers, 2015a, b; Dolley, 2015; George, 2015; Jasinski, 2015; Kuck, 2015; Loferski, 2015; McRae, 2015; Papp, 2015; Polyak, 2015; Shedd, 2015; Tanner, 2015a, b; Tuck, 2015).

In 2013, South Africa's estimated share of the world's consumption of coal was 2.3%, and that of petroleum products, 0.6%. The country also accounted for 92% of total African coal consumption and 16% of total African petroleum products consumption in 2013 (BP p.l.c., 2014, p. 9, 33).

Minerals in the National Economy

The mineral industry accounted for 8.3% of the gross domestic product (GDP) in 2013 compared with a revised 8.6% in 2012. Employment in the mineral industry amounted to 510,099 workers in 2013 compared with 524,632 in 2012 and 435,628 in 2003. In 2013, platinum-group metal (PGM) mining accounted for 37.5% of the mineral industry's employment; gold, 25.8%; coal, 17.2%; iron ore, 4.1%; chromite, 3.6%; diamond, 2.7%; manganese, 1.9%; and other minerals, 7.2%. In 2003, gold mining accounted for 45.6% of the mineral industry's employment; PGMs, 29.3%; coal, 10.8%; diamond, 4.1%; and chromite, iron ore, and manganese combined, a total of 3.3% (Chamber of Mines of South Africa, 2013, p. 12; 2015, p. 14; Martin Kohler, Deputy Director of Statistics, Department of Minerals and Energy of the Republic of South Africa, written commun., October 28, 2014).

Government Policies and Programs

The Government's Black Economic Empowerment (BEE) program requires that black ownership of mining companies reach 26% by 2014. Companies are allowed to use the value of their domestic beneficiation activities as credit for up to 11% of their black ownership requirements. Companies are required to purchase 70% of their services, 50% of their consumable goods, and 40% of their capital goods from BEE entities by 2014. Companies are also required to report progress annually on the development of near-mine communities, the sustainability of growth and development, and mineral beneficiation (Creamer, 2010).

Government-owned utility Eskom engaged in power buybacks from producers of ferrochromium, ferrosilicon, and silicon metal in 2012 and early 2013; Eskom paid the producers to shut down some of their capacity to prevent power shortages. In March 2013, the National Energy Regulator of South Africa forbade Eskom to engage in further power buybacks after June 1, 2013 (Ryan's Notes, 2013a).

In September 2012, the Government announced that its moratorium on exploration for natural gas in shale formations in the Karoo region had been lifted. As of September 2013, no exploration licenses for shale gas had been granted because the Government had not yet signed off on a legal justification for ending the moratorium (Bain, 2013).

In the Witwatersrand basin, acid mine drainage from gold mining operations threatened to contaminate water supplies in Gauteng Province with increased levels of toxic heavy metals and radioactive particles. The acid mine drainage was the result of leaching from tailings piles and from abandoned deep underground mines that filled with water that became acidic. South Africa had about 6,000 abandoned mines and 270 tailings dams in the Witwatersrand basin that contained about 6 billion metric tons of pyrite. The oxidation of pyrite led to acid mine drainage. The tailings dams also contained an estimated 430,000 metric tons (t) of uranium. In the eastern part of the Witwatersrand basin, the rising water levels in the mines are expected to reach the environmental critical level (which is the highest level in a mine in which groundwater systems are not contaminated) by November 2014 (Kolver, 2013).

In Mpumalanga Province, acid mine drainage from coal mines led to contaminated water supplies and the loss of agricultural capacity. The high sulfur content and shallowness of South Africa's coal mines contributed to problems with acid mine drainage (Kolver, 2013).

Production

In 2013, feldspar production increased by 103%; bentonite, by 47%; attapulgite, by 41%; shale, by 34%; granite and norite, by 26%; aluminum and smelted copper, by 24% each; manganese, by 23%; refined copper, by 22%; chromite, by 21%; anthracite coal and salt, by 20% each; refined cobalt, by 17%; sodium sulfate and uranium, by 14% each; diamond, by 13%; aggregate and sand and mined cobalt, by 12% each; and mined nickel, by 11%. The output of crude petroleum decreased by 59%; rutile, by an estimated 55%; zirconium, by an estimated 48%; silicon metal, by an estimated 40%; natural gas, by 29%; mica, by 23%; antimony and fluorspar, by an estimated 22% each; fire clay, by 21%; mined lead and slate, by 20%; mined zinc by 19%; titaniferous slag, by an estimated 12%; and silicomanganese, by 10% (table 1; Martin Kohler, Deputy Director of Statistics, Department of Minerals and Energy of the Republic of South Africa, written commun., October 28, 2014).

Structure of the Mineral Industry

Most of the South African mineral industry was privately owned. The production of diamond and gold, which were produced mostly by artisanal miners in many African countries, was dominated by large-scale producers in South Africa. The leading producer's share of total output varied sharply by commodity; the leading producer of silver accounted for about 73% of national production; that of iron ore, 59%; diamond, 58%; nickel, 45%; manganese, 33%; gold, 28%; and coal, 22% (tables 1 and 2).

Mineral Trade

In 2013, South Africa's exports of iron ore amounted to $5.71 billion; platinum, $5.51 billion; gold, $5.36 billion; coal, $5.16 billion; palladium, $1.31 billion; manganese ore, $1.29 billion; chromite, $587 million; nickel, $572 million; rhodium, $505 million; diamond, $477 million; copper, $175 million; iridium, $110 million; ruthenium, $71 million; and other crude mineral products, which included ilmenite, rutile, and zircon, $1.08 billion. Exports of ferrochromium amounted to $2.55 billion; manganese alloys, $491 million; vanadium alloys and other vanadium products, $265 million; silicon metal and alloys, $131 million; and other processed mineral products, which included aluminum, antimony trioxide, phosphoric acid, and titanium slag, $2.15 billion. Crude and processed mineral products accounted for 37% of the value of total exports. About 73% of crude mineral products and 84% of processed mineral products, by value, were exported in 2013 (Martin Kohler, Deputy Director of Statistics, Department of Minerals and Energy of the Republic of South Africa, written commun., October 28, 2014).

The percentage of domestic consumption of mineral commodities produced in South Africa varied sharply by commodity. In 2013, gold exports, by amount, were 94% of total sales; PGMs, 90%; ferrochromium, 89%; manganese alloys and vanadium, 88% each; iron ore, 86%; nickel, 82%; silicon alloys, 54%; diamond, 52%; chromite, 33%; copper, 32%; coal, 29%; granite, 24%; flint clay, 6%; and lime and silica, less than 1% each (Martin Kohler, Deputy Director of Statistics, Department of Minerals and Energy of the Republic of South Africa, written commun., October 28, 2014).

Commodity Review

Metals

Aluminum.—South Africa produced primary aluminum from alumina imported from Guinea. BHP Billiton Ltd. of Australia operated the Bayside and the Hillside primary aluminum smelters at Richards Bay. Production at Hillside increased to 726,000 t in 2013 from 566,000 t in 2012, and production at Bayside decreased to 96,000 t from 99,000 t (BHP Billiton Ltd., 2013b, p. 4; 2014, p. 24).

Antimony.—The Consolidated Murchison Mine was South Africa's only producer of antimony. In 2012, Village Main Reef was ramping up production at Consolidated Murchison to about 3,900 metric tons per year (t/yr) of antimony. The company was engaged in deepening its three existing underground mine shafts; further increases in production were likely to result from the mining of near-surface resources. In the second half of 2013, output declined sharply because of a labor dispute in July (Clarke, 2012; Village Main Reef, 2013, 2014, p. 1).

Chromium.—In 2013, chromite production was about 13.65 million metric tons (Mt) compared with 11.32 Mt in 2012 and 7.41 Mt in 2003. From 2003 to 2013, employment in chromite mining increased to 18,359 workers from 5,784 (table 1; Chamber of Mines of South Africa, 2013, p. 12, 15; 2015, p. 14).

Xstrata plc of Switzerland and its joint-venture partner Merafe Resources Ltd. operated the Helena, the Kroondal, the Magareng, the Thorncliffe, and the Waterval Mines, which had a capacity of 4.52 million metric tons per year (Mt/yr). In 2013, the Magareng Mine was commissioned and the Horizon Mine was put on care-and-maintenance status. Xstrata merged with Glencore International AG of Switzerland in May; the new company was known as Glencore Xstrata plc (Merafe Resources Ltd., 2014, p. 18).

Glencore Xstrata and Merafe operated the Boshoek, the Lion, the Lydernburg, the Rustenburg, and the Wonderkop ferrochromium plants, which had a total capacity of 1.98 Mt/yr at the beginning of 2013. The companies produced 1.56 Mt of ferrochromium in 2013 compared with 1.18 Mt in 2012. Increased production was partially attributable to improved operating results from the furnace; the commissioning of the Tswelopele pelletizing plant in 2012 led to more efficient use of chromite ore. The companies signed a power buyback agreement with Eskom that reduced output by about 130,000 t in 2013. Xstrata and Merafe completed an expansion of the Lion plant's capacity to 720,000 t/yr from 360,000 t/yr in 2013 (Glencore Xstrata plc, 2014, p. 57, 60; Markram, 2014).

Samancor Chrome Ltd. (International Mineral Resources BV of the Netherlands, 70%) produced chromite at the Eastern Chrome Mines in Mpumalanga Province and the Western Chrome Mines in North West Province. The company accounted for about 30% of South Africa's chromite production in 2012. The majority of Samancor Chrome's output was consumed in its ferrochromium plants (Competition Tribunal of South Africa, 2012).

Samancor Chrome operated the Ferrometals plant in Witbank, the Middelburg plant in Middelburg, and the Tubatse plant in Steelpoort; the plants had a combined capacity of 1.11 Mt/yr (table 2). The company accounted for about 10% of the world's ferrochromium production in 2012. In early 2013, Samancor agreed to a power buyback agreement with Eskom that reduced ferrochromium output by an estimated 63,000 t (Competition Tribunal of South Africa, 2012; Oryx Stainless Group, 2013).

Assmang (Pty) Ltd. [African Rainbow Minerals Ltd. (ARM), 50%, and Assore Ltd., 50%] operated the Dwarsrivier Mine in Mpumalanga. In 2013, chromite production increased to 1.03 Mt from 1 Mt in 2012. Chromite sales were expected to increase in 2014 (African Rainbow Minerals Ltd., 2013a, p. 75, 81; 2013b, p. 58; 2014, p. 59).

Assmang's ferrochromium production at the Machadodorp plant decreased to 23,000 t in 2013 from 73,000 t in 2012. The company converted its remaining ferrochromium furnaces at Machadodorp to ferromanganese by mid-2013 (African Rainbow Minerals Ltd., 2013a, p. 71, 78, 81; 2013b, p. 58; 2014, p. 59).

ARM and its joint-venture partner MMC Norilsk Nickel of Russia operated the Nkomati chromite mine. Sales remained unchanged at 266,000 t; ARM planned to increase sales to 340,000 t in 2014. Chromite sales were expected to start from the Two Rivers Mine by 2014 and to reach about 250,000 t/yr by 2015 depending on the results of a feasibility study (African Rainbow Minerals Ltd., 2013a, p. 55–56, 60; 2013b, p. 64; 2014, p. 65–66).

International Ferro Metals Ltd. (IFM) of Australia operated the Lesedi and the Sky Chrome Mines and the Buffelsfontein ferrochromium plant in North West Province. In 2013, IFM produced 190,095 t of ferrochromium compared with 177,359 t in 2012. Output at the Sky Chrome Mine decreased to 182,000 t in 2013 from 585,000 t in 2012. The Lesedi Mine produced 421,000 t of chromite in 2012. Mining at Lesedi, which shut down in 2012, was likely to resume in the second quarter of 2014 and to reach full capacity in the third quarter (Tex Report, The, 2014c).

Hernic Ferrochrome (Pty) Ltd. (a subsidiary of Mitsubishi Corp. of Japan) operated the Bokone Mines, which had a capacity of 1.5 Mt/yr, and a ferrochromium plant with a capacity of 420,000 t/yr (table 2). The company signed a power buyback agreement that shut down 40% of ferrochromium capacity from the beginning of December 2012 to the end of March 2013. By early June 2013, Hernic was operating three of its four furnaces (Platinum Weekly, 2012; Davies, 2013).

ASA Metals (Pty) Ltd. (Sinosteel Corp. of China, 60%, and Limpopo Economic Development Enterprise, 40%) operated the Dilokong chromite mine near Burgersfort and a ferrochromium plant near Pietersburg with capacities of 800,000 t/yr and 400,000 t/yr, respectively. In early 2013, ASA Metals agreed to shut down three of its four ferrochromium furnaces because of a power buyback agreement with Eskom. By early June, the company had restarted one of its furnaces (Davies, 2013).

In 2012, Tharisa Minerals (Pty) Ltd. of Cyprus completed its new processing plant that increased chromite concentrate capacity at the Tharisa Mine to 1.92 Mt/yr from 420,000 t/yr. Between October 2012 and March 2013, Tharisa produced 564,000 t of chromite. The company planned to produce between 1.15 Mt and 1.3 Mt in fiscal year 2014 and to reach steady-state production of 1.85 Mt/yr in fiscal year 2016 (Projects in Progress, 2012b; Tharisa Minerals (Pty) Ltd., 2014a, b).

In mid-2013, Afarak Group Oyj of Finland (formerly Ruukki Group Oyj) was producing run-of-mine chromite at the rate of 300,000 t/yr at the Mecklenburg Mine. Afarak planned to maintain its output levels through the end of 2014; the company was considering the possibility of engaging subsequently in underground mining. Chromite from Mecklenburg was used to supply Afarak's Mogale Alloys plant, which had a combined capacity of 110,000 t/yr of ferrochromium and silicomanganese (Ryan's Notes, 2013b; Markram, 2014).

In January 2013, Tata Steel (KZN) (Pty) Ltd. shut down production at its ferrochromium plant as part of a power buyback agreement with Eskom. Tata's plant had a capacity of 150,000 t/yr; the company was operating one of its two furnaces in early June and planned to restart the second furnace (Davies, 2013; Metal Bulletin, 2013).

FerroChrome Furnaces (Pty) Ltd. was building a new ferrochromium plant in Rustenburg with an initial capacity of 300,000 t/yr. The company planned to increase capacity to 420,000 t/yr by the end of 2016 (Markram, 2014).

PGM producers also mined chromite as a coproduct of mining of Upper Group 2 (UG2) ore in the Bushveld Complex. Production of chromite from UG2 ore had increased in recent years because of the declining profitability of PGM mining resulting from increased labor, power, and other costs. UG2 ore had a much lower production cost than the Lower Group 6 (LG6) chromite ore mined by ferrochromium producers because chromite was a coproduct of PGM mining. Technological advances have allowed ferrochromium producers to use UG2 ore, which had a grade of about 10% Cr_2O_3 that was much lower than the grades in LG6 ore. National capacity of UG2 ore was estimated to be 4.71 Mt/yr in 2012, which was an increase of nearly 35% from 2011 (Ryan's Notes, 2012; d'Harambure, 2013).

Most companies that produced chromite from UG2 ore exported their production to China. UG2 exports, by tonnage, were an estimated 40% of national chromite exports in 2013. Many producers of LG6 ore continued to mine while their ferrochromium plants were partially shut down by power buyback agreements with Eskom and exported their output to China (Markram, 2014).

Lonmin plc of the United Kingdom's sales of chromite were 1.5 Mt in 2013. Anglo American Platinum Ltd. (Amplats) produced 399,500 t of chromite from UG2 ore in 2013 compared with 352,400 t in 2012. Eastern Platinum Ltd. (Eastplats) of Canada sold 81,698 t of chromite from its Crocodile River Mine in 2013 (Lonmin plc, 2013, p. 172; 2014; Anglo American Platinum Ltd., 2014, p. 141; Eastern Platinum Ltd., 2014, p. 6).

ChromTech Holdings planned to start construction on a new ferrochromium plant that would use UG2 ore in 2014. The plant would have an initial capacity of between 68,000 and 70,000 t/yr (Markram, 2014).

Copper.—Palabora Mining Co. Ltd. operated the Palabora Mine, which was the leading producer of copper in South Africa. In 2013, the output of copper in concentrate at Palabora decreased to 41,428 t from 49,063 t in 2012. Smelted copper production at Palabora's smelter increased to 50,872 t in 2013 from 40,576 t in 2012, and refined copper production increased to 50,677 t from 41,724 t. In 2013, Palabora Mining decided to proceed with a feasibility study of extending the life of the mine, which was expected to end in 2015. Rio Tinto Ltd. of Australia and Anglo American plc of the United Kingdom sold their interest in the mine in 2013 (Palabora Mining Co. Ltd., 2014, p. 8, 11, 117–120).

Gold.—The long-term decline in the country's gold output reversed at least temporarily in 2013, with national gold mine production at 159,724 kilograms (kg) compared with a revised 155,286 kg in 2012 and about 375,800 kg in 2003. From 2003 to 2013, employment in gold mining decreased to 131,591 workers from 198,465. During the same period, South Africa's share of world gold production decreased to about 5% from 14%. Decreased production was primarily attributable to mine depths as great as 4 kilometers, which led to difficult mining

conditions, high ore haulage and refrigeration costs, and low labor productivity (table 1; Chamber of Mines of South Africa, 2013, p. 12, 26; 2015, p. 14; du Venage, 2013b).

Gold Fields Ltd. of South Africa mined gold at the Beatrix, the Driefontein, the Kloof, and the South Deep Mines, which were underground mines. The South Deep Mine produced nearly 9,400 kg in 2013 compared with 8,400 kg in 2012. Gold Fields planned to increase output at South Deep to between 20,200 and 21,700 kilograms per year (kg/yr) by the end of 2017. In February, Gold Fields spun off Beatrix, Driefontein, and Kloof into a separate company called Sibanye Gold Ltd. (Gold Fields Ltd., 2014, p. 10, 21).

Production at Driefontein increased to 18,775 kg in 2013 from 13,728 kg in 2012; at Kloof, to 15,977 kg from 15,350 kg; and at Beatrix, to 9,722 kg from 8,981 kg. In Sibanye's original mining plan, production at Beatrix, Driefontein, and Kloof was expected to decrease to about 31,000 kg/yr by 2018, 25,000 kg/yr by 2022, and 19,000 kg/yr by 2024. Reserves at Driefontein were likely to be depleted by 2024; at Beatrix, by 2026; and at Kloof, by 2027. With the development of the West Rand Tailings Retreatment project and other projects, Sibanye planned to maintain production at nearly 44,000 kg/yr through 2022 and to continue mining operations until 2036 (du Venage, 2013b; Sibanye Gold Ltd., 2014, p. 17–18, 25).

AngloGold Ashanti Ltd. operated numerous mines in the Vaal River area near Klerksdorp and the West Wits area near Carletonville. The company's gold production increased to about 40,500 kg in 2013 from 37,700 kg in 2012. Production at the Mponeng Mine was about 11,000 kg in 2013; the surface mining operations in the Vaal River and West Wits areas, 7,500 kg; the Tau Tona Mine, 7,300 kg; the Moab Khotsong Mine, 6,600 kg; the Kopanang Mine, 5,500 kg; and the Great Noligwa Mine, 2,600 kg. The Savuka Mine was merged with the Tau Tona Mine in 2013. Decreased output from Mponeng in 2013 was more than offset by increased output from Kopanang, and Moab Khotsong and the acquisition of Mine Waste Solutions. AngloGold Ashanti planned to produce between 37,000 and 40,000 kg of gold from all its South African operations in 2014 (AngloGold Ashanti Ltd., 2014, p. 44, 68).

Harmony Gold Mining Company Ltd. produced a total of 32,547 kg of gold in 2013. The Target 1 and Target 3 Mines produced a combined 5,702 kg; the Tshepong Mine, 3,855 kg; the surface mining operations, 3,397 kg; the Doornkop Mine, 3,393 kg; the Kusasalethu Mine, 3,149 kg; the Masimong Mine, 3,080 kg; the Joel Mine, 2,819 kg; the Phakisa Mine, 2,528 kg; the Bambanani Mine, 2,232 kg; the Unisel Mine, 1,839 kg; and the Steyn 2 Mine, 553 kg. By 2016, Harmony planned to increase production at Kusasalethu to about 8,900 kg/yr; at Doornkop, to about 6,100 kg/yr; and at Phakisa, to about 5,900 kg/yr (Harmony Gold Mining Company Ltd., 2013a, p. 6–9; 2013b, p. 18; 2014, p. 42–43).

Harmony planned to maintain combined production at the Target 1 and Target 3 Mines at about 6,100 kg/yr; about 4,500 kg/yr at Tshepong; about 3,900 kg/yr at Masimong; about 3,000 kg/yr each at Bambanani and the surface mining operations; about 2,600 kg/yr at Joel; and about 1,900 kg/yr at Unisel. In 2013, Harmony sold the Evander Mine to Pan African Resources plc of the United Kingdom (Harmony Gold Mining Company Ltd., 2014, p. 21).

Gold One International Ltd. produced 8,562 kg of gold in 2013 compared with 7,519 kg in 2012. The Cooke Underground operations produced 4,183 kg in 2013; the Modder East Mine, 3,235 kg; and the Randfontein Surface operations, 1,144 kg. In August 2013, Gold One signed an agreement with Sibanye. In return for a 17% share in Sibanye, Gold One allowed Sibanye to take over the Cooke Underground and the Randfontein Surface operations. From 2014 to 2018, total production at the Cooke Underground and the Randfontein Surface operations was likely to be about 7,800 kg/yr (Gold One International Ltd., 2013, p. 7, 11, 13, 23–24; 2014; Sibanye Gold Ltd., 2014, p. 20).

At the end of 2013, Gold One and Sibanye were engaged in a feasibility study on producing gold from the West Rand Tailings Retreatment project. Depending on the results of the study, the companies could produce nearly 5,600 kg/yr of gold from retreating tailings. Full capacity would be reached during a 3- to 5-year period (Cornish, 2013g; Sibanye Gold Ltd., 2014, p. 74).

Village Main Reef produced a total of 4,872 kg of gold at the Buffelsfontein, the Blyvoor, the Consolidated Murchison, and the Tau Lekoa Mines in 2013. The company placed Buffelsfontein on care-and-maintenance status and Blyvoor in provisional liquidation in 2013 (Village Main Reef, 2013; 2014, p. 1, 12).

In 2013, DRDGold Ltd. produced 4,360 kg of gold at the Ergo tailings retreatment operations, which are located near Johannesburg. The company opened a new processing plant that was expected to increase gold recovery by between 16% and 20% (Mining Review Africa, 2013; DRDGold Ltd., 2014).

In June 2013, Pan African Resources increased the capacity of the Barberton Mine to about 3,600 kg/yr from 3,000 kg/yr because of the completion of the Barberton Tailings Retreatment Project (BRTP). The estimated life of BRTP was 6 years; Pan African hoped to extend the life of the project to between 13 and 15 years. The estimated life of the Barberton Mine was more than 15 years (Cornish, 2013e).

Pan African also purchased the Evander gold mine from Harmony Gold. Production at Evander was about 3,100 kg/yr; the estimated life of the mine was 15 years. Pan African planned to make a decision on reprocessing tailings at Evander by mid-2014 (Cornish, 2013d).

In 2013, Witswatersrand Consolidated Gold Resources Ltd. (Wits Gold) was engaged in a feasibility study on a new mine at the DBM project. Depending on the results of the study, construction could start in 2014 and mining in 2018. Production was likely to be 6,200 kg/yr over the estimated 18-year life of the mine; peak output was planned to be nearly 7,700 kg in the ninth year of mining. In July, Wits Gold made an offer to purchase the Burnstone Mine from Great Basin Gold Ltd. (GBG) of Canada. Burnstone was on care-on-maintenance status in 2013; production was expected to be about 5,000 kg/yr during the estimated 16-year life of the mine under GBG's mining plan. In December, Sibanye announced plans to purchase Wits Gold (Cornish, 2013a; Engineering & Mining Journal, 2014).

Rand Refinery Ltd. (AngloGold Ashanti, 53%; Gold Fields, 33%; DRDGold, 10%; and Avgold Ltd. and Western Areas Ltd., 2% each) refined most of the newly mined gold in South Africa.

The company produced at the rate of about 440,000 kg/yr. Rand Refinery sourced the majority of its gold from foreign gold producers (Rand Refinery Ltd., 2013).

Iron Ore and Iron and Steel.—In 2013, iron ore production was about 71.5 Mt compared with 67.1 Mt in 2012 and 38.1 Mt in 2003 because of increased production from the Palabora and the Sishen Mines and the opening of the Khumani and the Kolomela Mines. From 2003 to 2013, employment in iron ore mining increased to 21,145 workers from 5,961 (Chamber of Mines of South Africa, 2013, p. 12, 16; 2015, p. 14).

Kumba Iron Ore Ltd.'s iron ore production decreased to 42.3 Mt in 2013 from 43 Mt in 2012. In 2013, the Sishen Mine produced 30.9 Mt; the Kolomela Mine, 10.8 Mt; and the Thabazimbi Mine, 0.6 Mt. Output decreased at Sishen because of geologic constraints and safety stoppages. At Kolomela, production exceeded the original target of 9 Mt. The remaining life of Kolomela was estimated to be 25 years, and Sishen, 19 years (Kumba Iron Ore Ltd., 2014, p. 4, 7, 10).

In 2013, Kumba revised its plan for steady state production at Sishen to 37 Mt/yr from 41 Mt/yr. The company planned to reach 37 Mt/yr at Sishen by 2016. Kumba was conducting a feasibility study on an expansion of Sishen's capacity by 0.8 Mt/yr and a prefeasibility study on an additional expansion by 2 Mt/yr (Kumba Iron Ore Ltd., 2014, p. 61, 78).

Steady-state production at Kolomela was revised to 10 Mt/yr from 9 Mt/yr in 2013; Kumba was engaged in a prefeasibility study on a capacity expansion to 15 Mt/yr in 2013. Depending on the results of the study, Kumba planned to start a feasibility study in 2015. The company was also engaged in a feasibility study on Project Infinity, which could extend the life of the Thabazimbi Mine through at least 2023 and increase production to 2 Mt/yr (Kumba Iron Ore Ltd., 2014, p. 40, 76, 78).

Assmang produced iron ore at the Beeshoek and the Khumani Mines. In 2013, production at Beeshoek and Khumani increased to 16 Mt from 15 Mt in 2012. Assmang started mining at the East Pit at Beeshoek; the development of the East Pit was expected to prolong the mine's life until 2018 (African Rainbow Minerals Ltd., 2013a, p. 74, 79; 2013b, p. 58; 2014, p. 59).

In 2013, Palabora Mining produced 6.52 Mt of magnetite at Palabora compared with 5.28 Mt in 2012. Increased production was attributable to improvements in logistics. The company was engaged in an expansion of its capacity to 9 Mt/yr (Palabora Mining Co. Ltd., 2013, p. 2, 8).

Evraz Highveld Steel and Vanadium Ltd. (a subsidiary of Evraz Group S.A. of Luxembourg) mined 2.08 Mt of magnetite from the Mapochs Mine in 2013 compared with 1.78 Mt in 2012. Iron ore from Mapochs was consumed in Highveld's steel mill at Witbank; the company's crude steel output was 638,912 t in 2013 compared with 620,035 t in 2012. Highveld planned to increase its steel output to nearly 820,000 t in 2014 (Evraz Highveld Steel and Vanadium Ltd., 2014, p. 15, 18).

Cape Town Iron & Steel Works (Pty) Ltd. (Cisco) announced plans to reopen its electric arc furnace (EAF) in Cape Town by August or early September 2013. Cisco planned to produce 300,000 t/yr by late 2013 and to increase output to 400,000 t/yr by 2014. About 280,000 t/yr would be consumed domestically and 120,000 t/yr would be exported. By 2016, Cisco also planned to open a new EAF with a capacity of 600,000 t/yr in Johannesburg (Christie, 2013).

Lead, Silver, and Zinc.—The Black Mountain Mine, which was operated by Vedanta Resources plc of the United Kingdom, produced copper, lead, silver, and zinc. Lead mine production decreased by 20%, and zinc mine production, by nearly 19% in 2013. The mine produced about 50,000 kg/yr of silver; the remainder of South Africa's silver production was attributable to gold and PGM mines. Vedanta was considering the development of the Gamsberg Mine. Depending on the results of a feasibility study, the mine could produce 400,000 t/yr of zinc from the Gamsberg North deposit during an estimated 20-year life (Vedanta Resources plc, 2013, p. 10).

Manganese.—In 2013, manganese ore production was about 10.96 Mt compared with 8.94 Mt in 2012 and 3.55 Mt in 2003 because of increased production from the Mamatwan, the Nchwaning, and the Wessels Mines and the opening of the Kalahari, the Kudumane, and the Tshipi Borwa Mines. From 2003 to 2013, employment in manganese mining increased to 9,866 workers from 2,623 (Chamber of Mines of South Africa, 2013, p. 12, 17; 2015, p. 14).

Assmang produced manganese ore at the Gloria and the Nchwaning Mines. Output at Gloria and Nchwaning increased to about 3.44 Mt in 2013 from 3.09 Mt in 2012. In 2013, the company approved an expansion of Nchwaning's capacity to 4 Mt/yr from 3 Mt/yr (African Rainbow Minerals Ltd., 2013a, p. 74, 80; 2013b, p. 58–60; 2014, p. 59, 61).

In 2013, Assmang decreased output to 327,000 t of ferromanganese at its Cato Ridge and Machadodorp from 357,000 t in 2012. The company converted its remaining ferrochromium furnaces at Machadodorp to ferromanganese. Assmang also shut down inefficient ferromanganese furnaces at Cato Ridge and Machadodorp (African Rainbow Minerals Ltd., 2013a, p. 71, 80; 2013b, p. 58; 2014, p. 59).

Hotazel Manganese (Pty) Ltd. (BHP Billiton, 44.4%, and Anglo American, 29.6%) operated the Mamatwan open pit mine and the Wessels underground mine near Hotazel in Northern Cape Province. In 2013, Hotazel's production of manganese ore decreased to 3.61 Mt from 3.66 Mt in 2012. The company planned a two-phase project to increase ore production at Wessels to 1.5 Mt/yr from 1 Mt/yr. The first phase was expected to be completed by mid-2014; Hotazel was engaged in a feasibility study on the second phase in 2013. The estimated life of the Wessels Mine was 48 years, and the Mamatwan Mine, 20 years (BHP Billiton Ltd., 2013a, p. 41–42; 2013b, p. 4; 2014, p. 24).

In 2013, Samancor Manganese (Pty) Ltd. (BHP Billiton, 44.4%, and Anglo American, 29.6%) produced 370,000 t of manganese alloys at its Meyerton plant compared with 340,000 t in 2012. The plant, which had the capacity to produce 500,000 t/yr of ferromanganese, consumed more than 25% of the ore mined at Mamatwan and Wessels. The production of silicomanganese, which was more energy-intensive than ferromanganese, shut down in January 2012 (BHP Billiton Ltd., 2013a, p. 41; 2013b, p. 4; 2014, p. 24).

In 2012, United Manganese of Kalahari (Pty) Ltd. (UMK) (Majestic Silver Trading 40 (Pty) Ltd., 51%, and Renova Group of Russia, 49%) mined more than 2.7 Mt at the Kalahari

manganese ore deposit. UMK was producing at the rate of 3 Mt/yr in mid-2013; the company planned to increase output to 4 Mt/yr. Plans to increase production could be constrained by the rail network (Ryan's Notes, 2013f, h).

Manganese from the Kalahari deposit was consumed by Transalloys (Pty) Ltd. (a subsidiary of Renova) in the production of silicomanganese. In March 2013, Renova signed an agreement with Majestic Silver Trading to increase the capacity at Transalloys to 360,000 t/yr of silicomanganese from 180,000 t/yr by 2015. Majestic Silver Trading also would acquire a share in Transalloys (Renova Group, 2013).

BEE company Ntsimbitntle Mining (Pty) Ltd. held a 50.1% share in Tshipi e Ntle Manganese Mining (Pty) Ltd., and Jupiter Mines Ltd. of Australia, a 49.9% share. In December 2012, Jupiter and Ntsimbitntle started the export of ore from the new Tshipi Borwa Mine, which was adjacent to the Mamatwan Mine. The mine was expected to reach its full capacity of 2.4 Mt/yr of ore at a grade of 37% manganese in 2014 (Mining Journal, 2013a).

Kalagadi Manganese (Pty) Ltd. (ArcelorMittal of Luxembourg, 50%; Kalahari Resources (Pty) Ltd., 40%; and IDC, 10%) planned to start production at a new underground mine at Hotazel in the first half of 2014. Output was expected to be 3 Mt/yr of manganese ore at a grade of 38%; Kalagadi completed a plant to beneficiate the mine's output into 2.4 Mt/yr of sintered ore in 2013. The sintering plant, which had a capacity of 3.7 Mt/yr, started to process at least 400,000 t of ore processed from other South African producers before production started at the mine. Kalagadi was also considering the purchase of ore to fill the plant's excess capacity after the mine reached its full capacity (Ryan's Notes, 2013f, g; Williams, 2013).

About 1.7 Mt/yr of the mine's sintered output was likely to be exported. Kalagadi also planned to build a new ferromanganese plant at Coega with a capacity of 320,000 t/yr by early 2015; the plant was expected to consume about 700,000 t/yr of the mine's sintered output. Kalahari (which was a BEE company) planned to buy ArcelorMittal's 50% share in Kalagadi (Williams, 2013).

Asia Minerals Ltd. (AML) of Hong Kong started exports from its new Kudumane Mine in April 2013. The company planned to produce 1.5 Mt of manganese ore in 2013, 2.5 Mt in 2014, and 3 Mt in 2015. Production at full capacity was likely to be about 2 Mt/yr of ore at a grade of between 37% and 38% manganese and 1 Mt/yr of ore at a grade of 42% manganese. Mining of the lower grade ore started in 2013, and mining of the higher grade ore was planned for 2014. By 2015, AML planned to complete a plant that would produce sintered ore at a grade of between 44% and 45% manganese (Tex Report, The, 2012; Letaba, 2013).

Afarak planned to convert one of its unused silicomanganese furnaces at Mogale to ferrochromium by the third quarter of 2014 because the company had its own supply of chromite but not manganese ore. The furnace had a capacity of nearly 17,000 t/yr. In early 2013, Manganese Metal Co. (MMC) was producing refined manganese metal at a rate of 30,000 t/yr (Ryan's Notes, 2013e).

In November 2013, Globe Speciality Metals Inc. of the United States purchased Silicon Technology Ltd., which held a ferrosilicon plant with a capacity of 45,000 t/yr. The plant was not operating in late 2013; Globe planned to restart production in the second half of 2014 (Ryan's Notes, 2013d).

In mid-2012, Lehating Mining (Pty) Ltd. completed a feasibility study on its new Lehating Mine with favorable results. The company submitted its mining license application and its environmental impact assessment in October 2012 and August 2013, respectively. Lehating Mining expected to receive its mining license in 2014. In late 2013, the company was seeking financing for its mine, which was likely to cost about $150 million. Mining could start in 2017 depending on successfully obtaining financing; output was planned to be 600,000 t/yr of ore at a grade of more than 44% manganese over the estimated 14-year life of the mine (Cornish, 2013c).

Nickel.—The majority of South Africa's nickel mine production was a coproduct of PGM mining. Anglo American Platinum Ltd. (Amplats) produced 16,800 t of refined nickel in 2013 compared with 17,700 t in 2012; the company also produced 5,800 t of nickel in matte. About 18,300 t of nickel was mined at the company's PGM mining operations in 2013. Impala Platinum Holdings Ltd. (Implats) produced 16,400 t of refined nickel in 2013, of which about 4,100 t was attributable to the company's PGM mining operations (Impala Platinum Holdings Ltd., 2013, p. 59, 66, 76; 2014; Anglo American Platinum Ltd., 2014, p. 141, 145–160).

ARM and Norilsk produced 23,821 t of nickel at the Nkomati Mine in 2013 compared with 19,248 t in 2012 as the mine ramped up to full capacity. The company planned to maintain production at about 20,500 t/yr (African Rainbow Minerals Ltd., 2013a, p. 5, 64; 2013b, p. 64–65; 2014, p. 65).

Platinum-Group Metals.—In 2013, platinum-group metal (PGM) mine production was 264,188 kg compared with 254,338 kg in 2012 and about 233,100 kg in 2003. From 2003 to 2013, the share of platinum in PGM production, by amount, decreased to 52% from 62%. During the same period, employment in PGM mining increased to 191,261 workers from 127,672 (table 1; Chamber of Mines of South Africa, 2013, p. 12, 33; 2015, p. 14).

In 2013, Amplats produced 142,000 kg of refined PGMs compared with 144,300 kg in 2012. About 117,300 kg was attributable to mining operations of Amplats and its joint-venture partners in 2013, of which platinum accounted for 61,339 kg; palladium, 36,404 kg; rhodium, 7,968 kg; and other PGMs, about 11,600 kg (Anglo American Platinum Ltd., 2014, p. 141, 145–160).

In 2013, PGM production at Amplats' Mogalakwena Mine amounted to 22,151 kg; the Kroondal Mine, 15,816 kg; the Tumela Mine, 12,665 kg; the Union Mine, 10,031 kg; the Modikwa Platinum Mine, 9,602 kg; the Mototolo Mine, 8,093 kg; the Khuseleka Mine, 8,015 kg; the Dishaba Mine, 7,723 kg; the Batholope Mine, 6,961 kg; and the Khomanai Mine, 3,592 kg. The Khomanai Mine was put on care-and-maintenance status in August 2013. From 2009 to 2013, output at Mogalakwena increased by 41% and output at Union and Tumela decreased by 41% and 25%, respectively. Production at the mines managed by Amplats was likely to remain unchanged in 2014 (Anglo American Platinum Ltd., 2014, p. 80, 145–160).

Atlatsa Resources Corp. operated the Bokoni Mine, which produced PGMs at the rate of about 5,300 kg/yr. Atlatsa and

Amplats planned to increase production to about 7,800 kg/yr by 2019. The estimated life of the mine was more than 95 years (Atlatsa Resources Corp., 2014).

Royal Bafokeng Platinum Ltd. (RBPlat) operated the Bafokeng Rasimone Platinum Mine. Sales of PGMs were 9,396 kg in 2013, including 5,641 kg of platinum. RBPlat was building a new mine at the Styldrift project; the company planned to start mining in the third quarter of 2015 and to ramp up to full capacity by the second quarter of 2018. Production of platinum at Styldrift was likely to be 6,800 kg/yr, and palladium, rhodium, and gold, a total of 3,100 kg/yr (Projects in Progress, 2012a; Royal Bafokeng Platinum Ltd., 2013, p. 49–50; 2014, p. 62).

In 2013, Implats produced 93,808 kg of refined PGMs compared with 95,640 kg in 2012. About 49,200 kg was attributable to Implats' South African mining operations, of which platinum accounted for about 25,100 kg; palladium, 13,300 kg; rhodium, 3,700 kg; and other PGMs, about 7,100 kg. The remainder was attributable to the Two Rivers joint venture with ARM, company operations in Zimbabwe, recycling, and toll refining (Impala Platinum Holdings Ltd., 2013, p. 59, 66, 76, 87–88; 2014).

The Impala Mines near Rustenburg in North West Province produced 42,930 kg of PGMs in 2013, of which 22,740 kg was platinum and 10,820 kg was palladium. In 2013, platinum output at Marula was about 2,390 kg, and palladium, about 2,440 kg. Implats planned to increase platinum production at the Impala Mines to about 26,400 kg/yr by 2018 by sinking new mine shafts. The company also planned to increase platinum production at Marula to 2,600 kg/yr by 2018 (Impala Platinum Holdings Ltd., 2013, p. 59, 66, 69, 76–77; 2014).

ARM and Implats operated the Two Rivers Mine; output increased to 11,335 kg of PGMs in 2013 from 10,465 kg in 2012. Production was expected to be maintained at about 10,900 kg/yr of PGMs (African Rainbow Minerals Ltd., 2013a, p. 55, 63; 2013b, p. 64–65; 2014, p. 64).

In 2013, Lonmin produced 45,082 kg of refined PGMs compared with 41,391 kg in 2012. Lonmin's mining operations produced 42,914 kg of PGMs in 2013, of which platinum accounted for 23,033 kg; palladium, 10,638 kg; ruthenium, 4,933 kg; rhodium, 3,214 kg; and iridium, 1,097 kg. Most of the mine production was attributable to the Marikana Mine. Lonmin planned to maintain sales at more than 23,000 kg/yr of platinum (Lonmin plc, 2013, p. 170–171; 2014).

Northam Platinum Ltd. operated the Booysendal and the Zondereinde Mines. In 2013, Booysendal and Zondereinde produced a total of about 6,400 kg of platinum, 3,000 kg of palladium, and 810 kg of rhodium. Northam started mining at Booysendal in 2013; the company produced about 5,700 kg of platinum, 2,800 kg of palladium, and 740 kg of rhodium at Zondereinde in 2012. Booysendal's planned production at full capacity was about 5,000 kg/yr of PGMs (CPM Group, 2014, p. 15, 114–115, 181).

In late 2012, ARM and Norilsk completed the expansion of the Nkomati nickel mine. Output increased to 4,251 kg of PGM in 2013 from 2,883 kg in 2012 (African Rainbow Minerals Ltd., 2013a, p. 64; 2013b, p. 64–65; 2014, p. 65).

Platmin Ltd. of Canada produced about 2,300 kg of platinum, 810 kg of palladium, and 180 kg of rhodium at Pilanesberg in 2013 compared with about 1,600 kg of platinum, 590 kg of palladium, and 160 kg of rhodium in 2012. In 2014, palladium and platinum production was expected to increase by about 50% (CPM Group, 2014, p. 15, 115, 181).

In 2013, Glencore Xstrata produced 1,369 kg of PGMs at the Eland Mine, which was an increase of 37% from 2012. Production increased because of the rampup of output from the Western decline area (Glencore Xstrata plc, 2014, p. 60).

In 2013, Tharisa completed its new processing plant that increased PGM capacity at the Tharisa Mine to nearly 4,900 kg/yr from 1,200 kg/yr. Between October 2012 and March 2013, Tharisa produced 870 kg of PGMs. The company planned to produce between 2,500 kg and 2,800 kg in fiscal year 2014 and to reach steady-state production of 4,500 kg/yr in fiscal year 2016. In 2013, Sylvania Platinum Ltd. produced about 780 kg of platinum, 500 kg of palladium, and 280 kg of rhodium from its chromite tailings retreatment plants (Projects in Progress, 2012b; CPM Group, 2014, p. 15, 115, 181; Tharisa Minerals (Pty) Ltd., 2014a, b).

Eastplats sold 851 kg of PGMs from the Crocodile River Mine in 2013 compared with 2,682 kg in 2012. Sales of platinum decreased to 431 kg in 2013 from 1,348 kg in 2012, and sales of palladium, to 183 kg from 591 kg. Eastplats put the Crocodile River Mine on care-and-maintenance status in August 2013 (Eastern Platinum Ltd., 2014, p. 2, 6).

Platinum Group Metals Ltd. of Canada was engaged in the development of the Western Bushveld Joint Venture (WBJV) project. The company and its joint-venture partner Wesizwe Platinum Ltd. planned to produce nearly 8,600 kg/yr of PGM (not including ruthenium or iridium) at a new mine. Initial production at WBJV was planned for mid-2015; the estimated life of the mine was more than 20 years. Wesizwe decided not to fund its share of the operations in October 2013; the project could be delayed as a result (Mining Journal, 2013b).

In 2013, Wesizwe was engaged in the development of the Bakubung Mine, which was expected to produce about 10,900 kg/yr of PGM. Production was likely to start in 2017 or 2018; the estimated life of the mine was more than 30 years. Wesizwe also was considering the development of its own smelter for the Bakubung Mine (du Venage, 2013a).

Selenium and Tellurium.—Implats and its partners produced about 9,000 kg/yr of selenium and 4,000 kg/yr of tellurium from their PGM mining operations. In the first half of 2013, sales of anode slimes from Palabora Mining's copper operations were running at the rate of more than 130,000 kg/yr. The average selenium and tellurium content of the anode slimes was 4% and 2%, respectively (Palabora Mining Company Ltd., 2013, p. 8; [undated]; Paul Finney, Group Executive—Refining, Impala Platinum Ltd., written commun., March 8, 2013).

Silicon, Titanium, and Zirconium.—Grupo Ferroatlantica S.A. was South Africa's only producer of silicon metal; the company also produced ferrosilicon. In the first quarter of 2013, Grupo Ferroatlantica shut down 60% of its capacity at its Polokwane and Rand Carbide plants as part of a power buyback agreement with Eskom. The company shut down all production in April and May; total production losses were estimated to be 22,000 t of silicon metal and 8,000 t of ferrosilicon (Ryan's Notes, 2013c).

Richards Bay Minerals (RBM) (Rio Tinto plc of the United Kingdom, 74%; Blue Horizon Investments, 24%; and RBM permanent employees, 2%) was South Africa's leading producer of ilmenite, rutile, and zircon; the company also processed ilmenite to titanium slag. In 2012 (the latest year for which data were available), RBM's titanium slag production decreased to 880,800 t from 1.04 Mt in 2011, and rutile production, to 97,500 t from 100,400 t. Zircon production remained nearly unchanged at 263,700 t in 2012. RBM put its rutile and zircon operations on hold in early 2013; the company resumed limited zircon production in the second quarter because of improving market conditions (Rio Tinto plc, 2013, p. 7).

From January 1 through June 15, 2012, Tronox Ltd. of the United States' (Exxaro Resources Ltd., 44.65%) KZN Sands project in Kwa Zulu Natal Province produced at the rate of about 320,000 t/yr of ilmenite, 20,000 t/yr of zircon, and 15,000 t/yr of rutile. In 2013, output at KZN Sands was 291,000 t of ilmenite, 10,000 t of zircon, and 6,000 t of rutile. KZN Sands shut down in December as reserves were depleted at the Hillendale Mine. From January 1 through June 15, 2012, the Namakwa Sands project in Western Cape Province produced at the rate of about 400,000 t/yr of ilmenite, 120,000 t/yr of zircon, and 40,000 t/yr of rutile. In 2013, output at Namakwa Sands was 459,000 t of ilmenite, 111,000 t of zircon, and 27,000 t of rutile (Exxaro Resources Ltd., 2013, p. 6–7; Tronox Ltd., 2014, p. 1, 27).

Tronox planned to start production at the Fairbreeze Mine in Kwa-Zulu Natal Province, which would replace Hillendale, in the second half of 2015. The company planned to produce 600,000 t/yr of ilmenite, 60,000 t/yr of zircon, and 30,000 t/yr of rutile over Fairbreeze's estimated 15-year life. At the end of 2013, development was on hold because of an appeal to the Government's decision to grant a water use permit to Tronox. The appeal was based on environmental concerns (Tronox Ltd., 2014, p. 2, 8, 29);

In the third quarter of 2013, Mineral Commodities Ltd. of Australia started construction on the Tormin Mine in Western Cape Province. The company planned to start production by yearend. Output was expected to be about 100,000 t/yr of ilmenite, 38,200 t/yr of zircon, and 5,700 t/yr of rutile; the estimated life of the mine was 5 years (Maphango, 2014).

Most of the titanium slag produced in South Africa was exported before additional processing. Huntsman International LLC of the United States operated a titanium dioxide (TiO_2) pigment plant at Umbogintwini with a capacity of 25,000 t/yr. In May 2013, Nyanza Light Metals Ltd. (Arkein Industrial Holdings Ltd. of Mauritius, 80%, and Highveld, 20%) completed a prefeasibility study on a new TiO_2 pigment plant with favorable results. Nyanza planned to complete a feasibility study by early 2015. Depending on the results of the study, the company could produce 50,000 t/yr of TiO_2 pigment starting in the third quarter of 2016. Pigment would be produced using titanium-rich wastes from Highveld's iron ore and vanadium mining operations (Hughes and Ollett, 2013).

Rare Metal Industries (RMI), which was a joint venture of the Government-owned companies Industrial Development Corp. (IDC) and National Empowerment Fund, Magnesium & Metals of Russia, and TJTI (Pty) Ltd., planned to start a feasibility study in November 2013 on a new silicon, titanium, and zirconium plant. Planned production was 15,000 t/yr of titanium metal, 2,000 t/yr of zirconium metal, and 1,900 t/yr of silicon metal and other silicon products. Depending on the results of the study, RMI could start construction in 2015 and production in late 2017. The estimated cost of the project was about $2 billion (Maphango, 2014).

The Council for Scientific and Industrial Research (CSIR) started producing titanium metal powder at a pilot plant using an experimental production process. By 2017, CSIR hoped to produce 500 t/yr of titanium metal powder from a new plant. Depending on the success of the new plant, a large-scale plant with a capacity of 20,000 t/yr could be opened between 2021 and 2023 (Campbell, 2013).

Vanadium.—Evraz Group S.A. produced vanadium from titaniferous magnetite at the Mapochs and the Vametco Vanadium Mines, which were operated by Highveld and Vametco Minerals Corp., respectively. Highveld produced vanadium slag from the lumpy ore at Mapochs; the slag was sold to Germany for processing into ferrovanadium and to Vametco for processing into other products. In 2013, the content of V_2O_5 in vanadium slag was about 11,800 t at Mapochs; output was constrained by high power costs and unplanned shutdowns for maintenance. Highveld planned to increase production to more than 16,000 t of V_2O_5 in 2014 (Evraz Highveld Steel and Vanadium Ltd., 2014, p. 15, 20).

Vanchem Vanadium Products (Pty) Ltd. (a subsidiary of Duferco Group of Luxembourg) purchased fine ore from the Mapochs Mine for processing into ferrovanadium and other products. From the beginning of October 2012 to the end of September 2013, Vanchem's output of contained vanadium was more than 3,900 t (Duferco Group, 2014, p. 35).

GlencoreXstrata produced V_2O_5 and ferrovanadium at the Rhovan Mine and smelter in Brits. In 2013, production of V_2O_5 at Rhovan increased to about 9,800 t from about 9,600 t in 2012. About 7,000 t of Rhovan's output was processed into ferrovanadium in 2013 (Glencore Xstrata plc, 2014, p. 60).

In 2013, Ironveld plc of the United Kingdom completed a prefeasibility study with favorable results on a new mine at its Ironveld Pig Iron project, which is located on the Northern Limb of the Bushveld Complex. Ironveld planned to mine 2.4 Mt/yr of magnetite, which would be processed at the company's new smelters into 1 Mt/yr of pig iron and 9,670 t/yr of ferrovanadium. Large-scale production was planned to start in 2019 depending on successful results of its feasibility study; the company planned initial production of 46,000 t/yr of pig iron and 445 t/yr of ferrovanadium from a smaller smelter starting in 2015 (Ratshomo, 2014).

Industrial Minerals

Cement.—South Africa had four cement producers with a total capacity of 17.9 Mt/yr. Pretoria Portland Cement Co. (Pty) Ltd. had six plants with a combined capacity of 8 Mt/yr; the company planned to increase the capacity of its De Hoek and Riebeck plants by 50% by 2016. AfriSam Consortium (Pty) Ltd., which had a combined capacity of 4.6 Mt/yr at its Dudfield, Roodeport, and Ulco plants, planned to complete a new plant at Coega with a capacity of 740,000 t/yr by 2015 (Turner, 2013).

In late 2013, Sephaku Cement (Pty) Ltd. (Dangote Industries Ltd. of Nigeria, 64%) had completed 95% of the construction on its new clinker grinding plant near Delmas in Mpumalanga Province. Sephaku Cement planned to start production in early 2014. The company also planned to start production at its new Aganang integrated cement plant in Lichtenburg in North West Province by mid-2014. The cement production capacity at the Delmas plant was expected to be 1.4 Mt/yr, and at Aganang, 1.2 Mt/yr (Edwin and Fourie, 2014; International Cement Review, 2014).

Osho Ventures Group of the United Arab Emirates planned to start construction on two new clinker grinding plants near Port Elizabeth and Richards Bay in February 2014. The plants would have a capacity of 600,000 t/yr each of cement; completion was scheduled for the end of 2014 (International Cement Review, 2013).

Diamond.—In 2013, diamond production was 8.17 million carats compared with 7.25 million carats in 2012 and 12.6 million carats in 2003 because of decreased production at the Cullian, the Finsch, and the Venetia Mines. From 2003 to 2013, employment in diamond mining decreased to 13,547 workers from 17,949 (table 1; Chamber of Mines of South Africa, 2013, p. 12, 14; 2015, p. 14).

De Beers Group accounted for the majority of South Africa's rough diamond production. In 2013, the company's total output from the Kimberley Surface Mining Operations, the Venetia Mine, and the Voorspoed Mine increased to 4.72 million carats from 4.43 million carats in 2012. De Beers planned to build an underground mine at Venetia that would extend the life of the project by at least 24 years. Production from the new mine would start in 2021 and reach the full capacity of 4 million carats per year in 2024. The estimated cost of the new mine was about $2.1 billion. The Voorspoed Mine was expected to produce 800,000 carats per year until the expiration of its mining license in late 2023. Production at the Kimberley Surface Mining Operations was also expected to continue until 2023 (Mining Journal, 2013b; Janse, 2014).

In 2013, diamond production at the Finsch Mine by Petra Diamonds Ltd. amounted to 1.74 million carats; the Cullinan Mine, 921,549 carats; the Kimberley Underground Mine, 119,532 carats; the Helam Mine, 45,241 carats; and the Koffiefontein Mine, 44,272 carats. The Sedibeng and the Star Mines remained on care-and-maintenance status in 2013. Petra planned to ramp up production at Cullinan to 2.2 million carats per year in 2019 and at Finsch, to 1.9 million carats per year. The company also planned to increase production at the Kimberley Underground and the Koffiefontein Mines to 135,000 carats per year and 100,000 carats per year, respectively, in 2016. The estimated remaining life of the Cullinan and the Finsch Mines was 18 years each; the Koffiefontein Mine, 13 years; and the Kimberley Underground Mine, 10 years (Mining Journal, 2013a; Petra Diamonds Ltd., 2014, p. 9–15).

Trans Hex Group produced 61,204 carats from alluvial operations on the lower Orange River in 2013 and Rockwell Diamonds Ltd. produced about 20,000 carats from alluvial operations on the middle Orange River. Mwana Africa plc of the United Kingdom recovered about 15,000 carats from tailings at its Marsfontein kimberlite mine (Janse, 2014).

DiamondCorp plc of the United Kingdom planned to reopen the Lace Mine in 2014 and to reach the full capacity of 500,000 carats per year in the second half of 2015. Reserves at the Lace Mine were estimated to be 13.5 million carats (Janse, 2014).

Fluorspar.—Minerales Y Productos Derivados SA (Minersa) of Spain held an 85% share in the Vergenoeg Mine, which was South Africa's only active fluorspar mine at the end of 2013. Vergenoeg's capacity of acid-grade fluorspar had reached 250,000 t/yr by March 2013; minimal changes to the processing plant's design could increase capacity to 300,000 t/yr. Minersa also increased metal-grade fluorspar powder and briquet capacity to 30,000 t/yr (Modiselle, 2014b).

Fluormin plc placed the Witkop Mine on care-and-maintenance status in October 2012 in spite of cost reductions and improved performance; world market prices for fluorspar were lower than costs. The company sold the Buffalo Mine, which had been on care-and-maintenance status since 2008, to Rooiberg Stone (Pty.) Ltd. in February 2013. Rooiberg started processing the Buffalo Mine's stockpiles to produce aggregates (Modiselle, 2014b).

Sephaku Fluoride Ltd. (SepFluor) planned to start production at the Nokeng fluorspar project by the fourth quarter of 2014. In the first 9 years of the project, SepFluor planned to produce 185,000 t/yr of acid-grade fluorspar from the Plattekop deposit. Production was expected to decrease subsequently to 130,000 t/yr as mining shifted to the Outwash Fan deposit. SepFluor also planned to build a new processing plant that would consume 130,000 t/yr of fluorspar and 156,000 t/yr of sulfuric acid in the production of 60,000 t/yr of hydrogen fluoride (HF). About 42,600 t/yr of HF was expected to be consumed in the production of 60,000 t/yr of aluminum fluoride (AlF_3). National consumption of AlF_3 was estimated to be about 28,000 t/yr, all of which was imported (Sephaku Fluoride Ltd., 2013, p. 4, 18, 21).

Kyanite, Andalusite, and Related Minerals.—South Africa was the world's leading producer of andalusite. In 2012, national production decreased to 163,801 t from 186,242 t in 2011 because of commissioning problems at processing plants, decreased domestic demand from ferroalloy and iron and steel producers, and decreased export demand because of economic conditions in Europe (Modiselle, 2014a).

At the start of 2013, Imerys South Africa (Pty) Ltd. (a subsidiary of Imerys Group of France) operated the Annesley, the Havercroft, the Krugerspost, and the Thabazimbi (Rhino) Mines, which had a combined capacity of 225,000 t/yr. By mid-2014, the company planned to increase capacity to 290,000 t/yr through debottlenecking programs at Krugerspost and Thabazimbi and opening the Segorong Mine. Expansion plans were subsequently revised to a combined capacity of 250,000 t/yr; expenditures were much higher than initially planned. Imerys closed the Havercroft Mine in February and started operations at the Segorong Mine, which had a capacity of 55,000 t/yr, in March (Feytis, 2011; Carmichael and Lismore-Scott, 2013; Modiselle, 2014a).

In mid-2010, Andalusite Resources (Pty) Ltd. increased the capacity at its Maroeloesfontein Mine to 70,000 t/yr from 40,000 t/yr. The company planned a further increase in

capacity to between 80,000 t/yr and 100,000 t/yr by the end of 2012; expansion plans were revised subsequently to 120,000 t/yr by 2015. The life of the Maroeloesfontein Mine was estimated to be about 60 years (Feytis, 2011; Carmichael and Lismore-Scott, 2013).

Phosphate Rock.—Foskor (Pty) Ltd. was South Africa's only producer of phosphate rock. In 2013, phosphate rock production decreased to 2.13 Mt from 2.24 Mt in 2012; lower output was attributable to problems with ore crushing facilities and unusually heavy rainfall. Foskor consumed about 70% of its phosphate rock in the production of phosphoric acid, which was used to produce fertilizers. Between 15% and 20% of Foskor's output was exported to Japan, the Netherlands, and New Zealand and the remainder was sold to domestic consumers. The company planned to start further downstream processing of its fertilizer output to NPK fertilizers (which contained nitrogen, phosphorus, and potassium). Farmers World Limpopo (Pty) Ltd. also produced fertilizers and operated the phosphoric acid plant formerly held by Sasol Ltd. (Muravha, 2014).

Rare Earths.—In 2013, Great Western Minerals Group Ltd. (GWMG) of Canada completed a preliminary economic assessment on reopening the Steenkampskraal Mine in Western Cape Province with favorable results. GWMG and Ganzhou Qiandong of China planned to build a rare-earths separation plant that would process rare-earth chlorides from Steenkampskraal to about 5,000 t/yr of rare-earth oxides. Mining could start within 24 months of obtaining the necessary financing; rare-earth oxide production was expected to start within 12 months of rare-earth chloride production (Engineering & Mining Journal, 2013).

In March 2013, Galileo Resources plc of the United Kingdom completed a preliminary economic assessment of a a new mine at its Glenover Rare Earth project with favorable results. Galileo could produce about 7,000 t/yr of rare-earth oxides during an estimated 24-year mine life. The company was also considering the production of ammonium sulfate, phosphate products, and scandium from mine-processing waste streams (Galileo Resources plc, 2013).

Frontier Rare Earths Ltd. of Luxembourg and Korea Resources Group (Kores) planned to complete a prefeasibility study on a new mine at the Zandkopsdrift rare-earths project in 2014. The companies planned to complete a feasibility study between 9 and 12 months after the completion of the prefeasibility study. Depending on the results of the studies, Frontier and Kores could start mining at Zandkopsdrift by 2017. The mine's production would be processed at a rare-earths separation plant at Saldhanha Bay with a capacity of 20,000 t/yr of rare-earth oxides (Frontier Rare Earths Ltd., 2014).

Vermiculite.—South Africa was the world's leading producer of vermiculite. In 2013, Palabora Mining's production at the Palabora Mine decreased by 4%. In recent years, decreased output was attributable to reduced demand and increased competition in the European and North American markets. Vermiculite from the Palabora Mine was increasingly fine grained and superfine grained because of decreased grades and recovery rates. Palabora Mining planned to increase production to 150,000 t/yr by late 2015. The remaining life of the mine was estimated to be 24 years with output at the capacity of 200,000 t/yr (Elliott, 2012; Torrisi and Patel, 2014).

Mineral Fuels and Related Materials

Coal.—In 2013, coal production was about 256.3 Mt compared with a revised 259 Mt in 2012 and 237.9 Mt in 2003. From 2003 to 2013, employment in coal mining increased to 87,768 workers from 47,239 (table 1; Chamber of Mines of South Africa, 2013, p. 12, 19; 2015, p. 14).

Anglo American's coal production was 56.6 Mt in 2013 compared with 57.1 Mt in 2012. The New Vaal Mine produced 17.1 Mt in 2013; the Kriel Mine, 8.1 Mt; the Isibonelo Mine, 5.07 Mt; the Zibulo Mine, 4.87 Mt; the Goedehoop Mine, 4.68 Mt; the Landau Mine, 4.08 Mt; the Kleinkopje Mine, 4 Mt; the New Denmark Mine, 3.59 Mt; the Greenside Mine, 3.27 Mt; and the Mafube Mine, 1.83 Mt. Anglo American was engaged in a feasibility study on the New Largo Mine, which could produce 11 Mt/yr of thermal coal (Anglo American plc, 2014, p. 67, 252).

In 2013, Exxaro's coal production was about 38.8 Mt compared with 40 Mt in 2012. Output at the Grootegeluk Mine was 17.8 Mt in 2013; the Matla Mine, 10.1 Mt; the Leeuwpan Mine, 3.8 Mt; the North Block Complex, 2.67 Mt; the Arnot Mine, 1.63 Mt; the New Clydesdale Mine, 419,000 t; and the Tshikondeni Mine, 343,000 t. Exxaro had completed 96% of the expansion of Grootegeluk's capacity by 14.6 Mt/yr in 2012; Grootegeluk was expected to produce 36 Mt/yr by 2017 (Chamber of Mines of South Africa, 2013, p. 20; 2015, p. 22; Tex Report, The 2014b).

In fiscal year 2013, Sasol Ltd.'s salable coal production increased to 38.6 Mt from 38.4 Mt in fiscal year 2012. Total production was 40.1 Mt, of which the Syferfontein Mine accounted for 9.6 Mt; the Bosjesspruit Mine, 8 Mt; the Middelbult Mine, 7.4 Mt; the Brandspruit Mine, 7.3 Mt; the Twistdraai Mine, 6.1 Mt; and the Sigma Mine, 1.7 Mt. Sasol planned to complete the new Impumelelo Mine to replace the Brandspruit Mine in the second half of 2014 and the new Shondoni Mine to replace the Middelbult Mine in the second half of 2015 (Sasol Ltd., 2013, p. 37, 39).

BHP Billiton Energy Coal South Africa Ltd. (BESCA) produced coal at the Khutala, the Klipspruit, the Middelburg, and the Wolverkrans Mines in Mpumalanga Province. In 2013, BESCA produced 30.2 Mt of coal compared with 32.6 Mt in 2012. The remaining life of the Middelburg Mine was estimated to be 24 years; Wolverkrans, 22 years; and Khutala and Klipspruit, 7 years each (BHP Billiton Ltd., 2013a, p. 37; 2013b, p. 4; 2014, p. 23).

Glencore Xstrata operated the Goedgevonden Complex, the Tweefontein Complex, and the iMpunzi Complex, which had capacities of 8 Mt/yr, 7 Mt/yr, and 6.3 Mt/yr, respectively. In late 2013, Glencore Xstrata had completed 58% of the construction on an expansion of the Tweefontein Complex's capacity to 14 Mt/yr of salable coal from 7 Mt/yr; the project was likely to be completed in 2015 (Glencore Xstrata plc, 2013, p. 9, 11–12, 16–17).

Optimum Coal Holdings (Pty) Ltd. (Glencore Xstrata, 67.6%) operated the Optimum Complex and the Koornfontein Complex, which had capacities of 11 Mt/yr and 2.8 Mt/yr of salable coal, respectively. The company was considering the possibility of starting mines at the Koornfontein OC and the Schoonoord projects. The Koornfontein OC project could produce 3.3 Mt/yr of run-of-mine coal starting in 2019, and the Schoonoord project,

1.6 Mt/yr of run-of-mine coal starting in 2020 (Glencore Xstrata plc, 2013, p. 10, 15–16).

Shanduka Coal (Pty) Ltd. (Shanduka Group, 50.01%, and Glencore Xstrata, 49.99%) operated the Middelburg Complex, which had a capacity of 6.5 Mt/yr of salable coal. The company was engaged in a feasibility study on a new mine at the Argent project. Depending on the results of the study, Argent could start production in the second quarter of 2015 and ramp up to its full capacity of 1.5 Mt/yr of salable thermal coal by the end of 2015. Shanduka Coal was also considering a new mine at the Springboklaagte project, which could produce 2.4 Mt/yr of run-of-mine coal starting in 2019 (Glencore Xstrata plc, 2013, p. 13, 16, 19).

Umcebo Mining Ltd. (Glencore Xstrata, 43.66%) operated the Kleinfontein, the Klippan, and the Middelkraal Mines, which had a total capacity of 7 Mt/yr of salable coal. The company planned to start processing coal from the new Wonderfontein Mine in the second quarter of 2014 and to ramp up to the mine's full capacity of 2.5 Mt/yr by the end of 2014. The life of the Wonderfontein Mine was estimated to be 14 years, and the Kleinfontein, the Klippan, and the Middelkraal Mines, 3 years(Glencore Xtrata plc, 2013, p. 14, 16).

Total Coal South Africa (Pty) Ltd.'s (TCSA) operated the Dorstfontein West, the Dorstfontein East, the Forzando North, the Forzando South, and the Tumelo Mines. In 2013, sales from TCSA's mines were 4.26 Mt compared with 4.04 Mt in 2012 (Chamber of Mines of South Africa, 2013, p. 20; 2015, p. 22).

Kangra Group (Pty) Ltd. [Shanduka Resources (Pty) Ltd., 30%] produced about 3 Mt/yr of salable coal from the Savmore Mine, which had an estimated remaining life of between 3 and 5 years. The company was considering the development of the Kusipongo project to extend Savmore's life by between 10 and 20 years. Kusipongo could produce between 3.6 and 3.8 Mt/yr of run-of-mine coal; construction was planned to start in 2014 (Environmental Resources Management Southern Africa (Pty) Ltd., 2013, p. 1.1, 3.8–3.9).

Keaton Energy Holdings Ltd. was producing salable coal at the Vaalkranz and the Vanggatfontein Mines at the rate of 2.5 Mt/yr in 2013, most of which was produced at Vanggatfontein. The company planned to increase output to about 5 Mt/yr by 2017 by developing the Braakfontein project, which was expected to produce 1.1 Mt/yr, and by acquiring Xceed Resources Ltd. of Australia (Keaton Energy Holdings Ltd., 2013, p. 15; Kotze, 2013).

Keaton planned to complete the acquisition of Xceed, which held the Moabsvelden thermal coal project, in February 2014. Depending on the results of a feasibility study, Keaton could start mining at Moabsvelden in the first quarter of 2015. Production was likely to be about 1.4 Mt/yr at full capacity (Kotze, 2013).

In 2013, Continental Coal Ltd.'s sales from the Vlakvarkfontein Mine were about 1.38 Mt, and from the Ferreira and the Penumbra Mines, about 565,000 t. Continental planned to produce at Penumbra's full capacity of 760,000 t/yr of run-of-mine coal by late November. The company also planned to start mining at the new De Wittekrans Mine by late 2014. Production at De Wittekrans was expected to be 800,000 t/yr of run-of-mine coal in the first phase before increasing to 3.6 Mt/yr (Moodley, 2013; Chamber of Mines of South Africa, 2015, p. 22).

Wescoal Holdings Ltd. operated the Khanyisa Mine, which was expected to be depleted by mid-2015. The company also started mining at the new Intibane Mine in June 2013; total production at Intibane and Khanyisa was 1.31 Mt in fiscal year 2013. By 2014, Wescoal planned to start production at the new Elandspruit Mine. Wescoal planned to supply a total of 3.2 Mt/yr of coal from its operations (Sidler, 2013).

In 2013, sales from Coal of Africa Ltd.'s Woestalleen Complex were about 901,000 t, the Mooiplaats Mine, 327,000 t; and the Vele Mine, 62,000 t. Mooiplaats and Woestalleen were placed on care-and-maintenance status in 2013. Output at the Vele Mine decreased sharply in the fourth quarter of 2013 as Coal of Africa focused on the construction of a new processing plant. The company planned to start production at the new plant at Vele in mid-2015 and to produce 1.1 Mt/yr of salable coal (Tex Report, The, 2014a; Chamber of Mines of South Africa, 2015, p. 22).

Coal of Africa also planned to start construction of the Makhado project at the Southpansberg coalfield in Limpopo Province in 2014; production was expected to start in mid-2016. The company planned to produce 3.2 Mt/yr of thermal coal and 2.6 Mt/yr of coking coal during the estimated 16-year life of the mine (Cornish, 2013b).

Universal Coal plc of the United Kingdom was engaged in the construction of its new Kangala Mine in 2013. The mine was likely to be commissioned in February 2014; Universal planned to supply 2 Mt/yr of coal to Eskom and 100,000 t/yr to the export market. The estimated life of the first pit at Kangala was 8 years; the company was also considering a second contiguous pit with an estimated 8-year life. Universal also planned to develop the Roodekop project, which would produce 1 Mt/yr of run-of-mine thermal coal. The development of Roodekop depended on a water use license that was expected to be granted in the first half of 2014 (Cornish, 2013f).

Resource Generation Ltd. (Resgen) of Australia planned to start production at its new Boikarabelo Mine in 2015. In the first stage of the project, production was likely to be 6 Mt/yr of thermal coal, of which about 3 Mt/yr would be consumed domestically and 3 Mt/yr would be exported (Tex Report, The, 2013).

Petroleum.—South Africa had four petroleum refineries with a combined capacity of about 485,000 barrels per day (bbl/d). PetroSA, which was a Government-owned company, planned to build a new refinery at Coega with a capacity of 400,000 bbl/d. As of September 2013, it was unclear when the refinery would be completed (Quinlan, 2013).

Uranium.—AngloGold Ashanti mined uranium as a coproduct with gold. From 2003 to 2013, national uranium production decreased by 32% because of decreased gold production. In 2013, AngloGold Ashanti's production of uranium oxide (U_3O_8) from its Vaal River and surface mining operations was 626 t compared with 549 t in 2012. With the purchase of First Uranium's Mine Waste Solutions (MWS) operations, AngloGold Ashanti acquired resources of 352 Mt at a grade of 0.008% U_3O_8. The company planned to complete the uranium circuit at the MWS processing plant in 2014, which would allow its total production to increase to between 1,400 and 2,000 t/yr of U_3O_8. The estimated life of the MWS

operations was more than 30 years (table 1; AngloGold Ashanti Ltd., 2012, 2014, p. 37; Chamber of Mines of South Africa, 2013, p. 39).

From 2014 to 2018, Sibanye planned to produce a total of about 230 t/yr of U_3O_8 from the Cooke Underground and the Randfontein Surface operations. At the end of 2013, Gold One and Sibanye were engaged in a feasibility study on producing uranium from the West Rand Tailings Retreatment project. Depending on the results of the study, the companies could produce nearly 1,600 t/yr of U_3O_8 from retreating tailings. Full capacity would be reached during a 3- to 5-year period (Cornish, 2013g; Sibanye Gold Ltd., 2014, p. 74).

DRDGold was considering the possibility of producing nearly 140 t/yr of U_3O_8 at the Ergo tailings retreatment operations. Harmony was also considering uranium production from its gold operatons (Mining Review Africa, 2013).

Reserves and Resources

South Africa's estimated share of world reserves of PGMs amounted to 95%; chromite, 42%; manganese, 26%; vanadium, 23%; rutile and zirconium, 18% each; fluorspar, 17%; gold, 11%; ilmenite, 9%; and nickel, 5%. The country also had substantial reserves of andalusite, antimony, coal, copper, iron ore, lead, phosphate rock, uranium, vermiculite, and zinc (table 3; Bedinger, 2015a, b; Corathers, 2015a; George, 2015; Kuck, 2015; Loferski, 2015; McRae, 2015; Papp, 2015; Polyak, 2015).

Outlook

Numerous producers are planning new mines and plants and capacity expansions of existing operations for andalusite, antimony, cement, chromite, coal, diamond, ferrochromium, ferromanganese, ferrovanadium, fluorspar, gold, iron ore, manganese ore, pig iron, PGMs, phosphate fertilizers, rare-earth elements, silicomanganese, titanium metal, uranium, vanadium, zinc, and zirconium metal. Power shortages could constrain mining and mineral processing expansions until Eskom's new coal-fired Kusile and Medupi power stations are commissioned, particularly in power-intensive industries, such as ferrochromium.

Eskom planned to start operations at Medupi in the second half of 2014, and at Kusile by the end of 2014. Initial capacity at Kusile and Medupi would be 800 megawatts (MW) and 794 MW, respectively. Eskom planned to increase capacity in increments to 4,800 MW at Kusile and 4,764 MW at Medupi by 2018 (Mail & Guardian, 2013).

Increases in coal, iron ore, and manganese exports depend upon increased rail network capacity. Transnet planned to spend about $37 billion on expanding its railways between 2012 and 2019. The railway capacity dedicated to coal exports was expected to increase in increments to 98 Mt/yr in mid-2019 from 68 Mt/yr in 2012. During the same period, Transnet planned to increase the capacity of the iron ore railways to 83 Mt/yr from 53 Mt/yr, and railways for transporting manganese ore, to 12 Mt/yr from 5.5 Mt/yr (Mining Journal, 2013a; Barradas, 2014).

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TABLE 1
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2009	2010	2011	2012	2013
METALS						
Aluminum metal, primary		809,000	807,000	809,000	665,000	822,000
Antimony concentrate, Sb content		2,673	3,239	3,175	3,066 r	2,400 e
Chromium, gross weight:						
44% to 48% chromic oxide	thousand metric tons	1,296	808	1,070	1,073	1,608
Less than 44% chromic oxide	do.	6,265	10,063	10,795	10,244 r	12,037
Total	do.	7,561	10,871	11,865	11,317 r	13,645
Cobalt:						
Mine output, Co content[e]		610	1,800	1,600	2,500	2,800
Refinery output		238	840	862	1,102	1,294
Copper:						
Mine, Cu content		107,600	102,600	96,600	81,000	77,000
Metal:						
Smelter		86,900	75,900	82,400	62,300	77,500
Refined, primary		89,453	81,129	86,166	66,416	80,821
Gold:						
Mine	kilograms	197,628	188,702	180,293	155,286 r	159,724
Refined[2]	do.	389,596	385,244	476,229	440,000 e	440,000 e
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand metric tons	55,313	58,709	58,057	67,100	71,543
Fe content (62% to 65%)	do.	34,800	36,900	36,500	42,000 e	42,500 e
Metal:						
Direct-reduced iron	do.	1,340	1,120	1,414	1,493	1,400
Pig iron	do.	4,444	5,429	4,604	4,599	4,900
Ferroalloys, electric arc furnace:						
Chromium ferroalloys	do.	2,346	3,607	3,426	3,063	3,219
Ferromanganese	do.	275 r	473 r	714 r	706 r	697
Ferrosilicon	do.	110	128	126 r	83 r	78 e
Ferrovanadium[e]	do.	14	19	19	18	18
Silicomanganese[3]	do.	135	274	314	149	134 [4]
Silicon metal	do.	39	46	59	53 r	32 e
Total[e]	do.	2,920 r	4,550 r	4,660 r	4,070 r	4,180
Steel:						
Crude	do.	7,484	7,617	7,546	6,938	7,200 e
Stainless		547	478	444 r	505 r	493
Lead:						
Concentrate, Pb content		49,149	50,625	54,460	52,489	41,848
Refined, secondary		58,000	51,000	56,000	54,000 r	54,000 e
Manganese:						
Ore and concentrate, gross weight:						
Metallurgical:						
More than 48% manganese	thousand metric tons	--	847	128	200	--
45% to 48% manganese	do.	2,121	1,683	2,742	2,711	3,057
40% to 45% manganese	do.	498	843	1,181	1,187	1,319
30% to 40% manganese	do.	1,949	3,783	4,584	4,833	6,581
Total	do.	4,568	7,156	8,636	8,931	10,957
Chemical, 35% to 65% manganese dioxide	do.	11	15	16	12	1
Grand total	do.	4,579	7,172	8,652	8,943	10,958
Metal, electrolytic[e]	do.	11	20	29 [4]	30 [4]	30 e
Nickel:						
Mine output, concentrate, Ni content		34,605	39,960	43,321	45,945	51,208
Metal, electrolytic		34,200	34,700	35,900	32,900	33,200
Platinum-group metals:						
Mine:						
Iridium	kilograms	6,378	6,445	6,813	5,665	5,680
Platinum	do.	140,819	147,790	148,008	128,590	137,024

See footnotes at end of table.

TABLE 1—Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2009	2010	2011	2012	2013
METALS—Continued						
Platinum-group metals:—Continued						
Mine:—Continued						
Palladium	do.	75,117	82,222	82,731	74,738	76,008
Rhodium	do.	20,007	20,001	20,332	17,810	18,129
Ruthenium	do.	29,071	30,846	30,966	27,535	27,347
Total	do.	271,393	287,304	288,850	254,338	264,188
Refined:[5]						
Platinum	do.	149,500	156,600	155,900	141,700	144,700
Palladium	do.	86,610	94,990	89,640	84,800	82,300
Rhodium	do.	21,600	21,400	21,300	19,300	18,600
Other[1]	do.	34,600	37,600	36,400	32,400	32,100
Total	do.	292,300	310,600	303,200	278,200	277,700
Selenium, Se content of anode slimes[e]	do.	14,000	16,000	18,000	14,000	14,000
Silver, mine	do.	77,780	79,315	73,180	67,304	68,777
Tellurium, Te content of anode slimes[e]	do.	6,000	7,500	8,500	6,500	6,500
Titanium:						
Ilmenite concentrate[e]	thousand metric tons	2,000 [r]	2,100 [r]	2,300 [r]	2,200 [r]	2,100
Rutile concentrate	do.	136	130	149	150 [e]	67
Total[e]	do.	2,140 [r]	2,230 [r]	2,450 [r]	2,350 [r]	2,170
Titaniferous slag	do.	1,084	1,210 [r]	1,367 [r]	1,300 [r, e]	1,150
Vanadium, vanadium metal content		14,353	22,606	21,652	19,957	21,397
Zinc:						
Concentrate, Zn content		28,159	36,142	36,629	37,034	30,145
Metal, smelter, primary		87,000	90,000	73,000	--	--
Zirconium concentrate (baddeleyite and zircon)		372,000	383,000 [r]	427,000 [r]	400,000 [r, e]	210,000 [e]
INDUSTRIAL MINERALS						
Andalusite		165,217	189,185	186,242	163,801 [r]	180,000 [e]
Cementitious products:						
Cement, finished product, sales	thousand metric tons	11,784	10,870	11,234	11,560	12,200
Granulated slag, fly ash, and others, sales[e]	do.	1,200	1,100	1,200	1,200	1,300
Total[e]	do.	13,000	12,000	12,400	12,800	13,500
Clays:						
Attapulgite		54,418	85,336	14,448	15,019 [r]	21,233
Bentonite		40,340	54,311	120,417	120,592 [r]	177,187
Brick clay, local sales	thousand metric tons	8,763	6,923	7,658	7,227 [r]	6,897
Fire clay		120,162	551,612	785,641	643,285	506,019
Flint clay, raw and calcined		37,227	39,690	29,968	21,065	22,984
Kaolin		31,048	29,929	15,220	20,791 [r]	22,295
Diamond, natural:						
Gem[e]	thousand carats	2,500	3,600	2,800	2,900	3,300
Industrial[e]	do.	3,600	5,300 [r]	4,300	4,400 [r]	4,900
Total	do.	6,113	8,868	7,112	7,250 [r]	8,168
Feldspar		101,394	94,307	101,559	94,458	191,443
Fluorspar:						
Acid-grade[e]		196,000	150,000	225,000	210,000	165,000
Metallurgical-grade[e]		8,000	10,000	15,000	15,000	10,000
Total		204,000	160,000	240,000	225,000 [e]	175,000 [e]
Gypsum, crude		597,571	513,310	476,118	558,242	559,443
Industrial or glass sand (silica)	thousand metric tons	2,306	2,905	2,722	2,155 [r]	2,198
Lime	do.	1,368	1,291	1,539	1,209	1,187
Magnesite, crude		47,600	27,700	31,900	31,000 [e]	31,000 [e]
Mica, scrap and ground		572	904	633	400	309
Nitrogen, N content of ammonia[e]		510,000	470,000	470,000	550,000 [r]	600,000

See footnotes at end of table.

TABLE 1—Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2009	2010	2011	2012	2013
INDUSTRIAL MINERALS—Continued						
Phosphate rock:						
Gross weight	thousand metric tons	2,237	2,494	2,565	2,242	2,132
Phosphorus pentoxide content	do.	839	935	962	841	800
Pigments, mineral, natural:						
Ochers		--	--	--	--	-- e
Oxides		183	244	266	--	-- e
Total		183	244	266	--	-- e
Salt		408,422	394,493	381,177	399,135	479,024
Sodium sulfate, natural		43,835	37,369	38,290	36,435	41,428
Stone, n.e.s.:[6]						
Dimension:						
Granite and norite		334,589	272,531	227,154	187,475	236,229
Slate		25,841	48,114	53,643	23,938	19,266
Crushed and broken:						
Limestone and dolomite	thousand metric tons	18,568	17,927	16,980	17,269	17,188
Shale:						
For cement	do.	462	388	404	423 r	464
Other	do.	975	570	655	547 r	837
Total	do.	1,437	958	1,059	970 r	1,301
Aggregate and sand, n.e.s.[6]	do.	53,604	52,356	52,286	54,649 r	61,414
Sulfur:						
S content of pyrite	do.	60	30	--	--	-- e
Byproduct:						
Metallurgy	do.	185	141	174	103 r	110 e
Petroleum	do.	291	205	163	154 r	160 e
Total	do.	536	376	337 r	257	270 e
Talc and related materials:						
Talc		4,718	3,150	4,453	4,765	4,924
Pyrophyllite (wonderstone)		114,889	122,511	121,368	18,734	17,336
Vermiculite		193,334	199,285	170,571	132,886	127,658
Wollastonite		--	--	2,400 e	2,400 e	2,400 e
MINERAL FUELS AND RELATED MATERIALS						
Coal (salable product):						
Anthracite	thousand metric tons	1,658	2,074	2,554	3,005	3,621
Bituminous	do.	248,880 r	252,448	248,153	256,007 r	252,661
Total	do.	250,538	254,522	250,707	259,012 r	256,282
Natural gas	million cubic meters	1,368	1,718	1,516	1,313	927
Petroleum:[7]						
Crude	thousand 42-gallon barrels	1,070	1,358	591	343	139
Refinery products:						
Liquefied petroleum gases	do.	2,726	3,086	3,666	3,422 r	3,400 e
Natural gas liquids	do.	1,529	1,456	1,456	1,019 r	1,000 e
Gasoline	do.	48,766	49,773	53,236	53,295 r	53,000 e
Jet fuel	do.	11,681	10,951	12,410	9,445 r	9,400 e
Kerosene	do.	3,092	2,644	2,806	2,729 r	2,700 e
Distillate fuel oil	do.	40,329	50,265	56,450	57,494 r	58,000 e
Residual fuel oil	do.	14,525	15,205	14,399	19,021 r	19,000 e
Other, includes lubricants and greases[e]	do.	14,500	16,000 r	17,000 r	17,000 r	17,000
Total[e, 8]	do.	137,000	149,000 r	161,000 r	163,000	164,000
Uranium, U_3O_8 content		629	682	656	551	626

[e]Estimated; estimated data are rounded to no more than three significant figures; may not add to totals shown. [r] Revised. do. Ditto. -- Zero.
[1]Table includes data available through February 27, 2015.
[2]Data are for the Rand Refinery (Pty) Ltd. fiscal year ending September 30 of the year listed.
[3]Reported by the International Manganese Institute.
[4]Reported figure.

TABLE 1—Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

[5]May include small amounts of gold.
[6]Not elsewhere specified.
[7]In addition, Sasol Ltd. produced about 67 million barrels per year of synthetic liquid petroleum fuels from coal.
[8]Excludes refinery fuel and losses.
Source: Mineral Economics Directorate, South Africa Department of Minerals and Energy.

TABLE 2
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	BHP Billiton Ltd.	Hillside smelter at Richards Bay	726.
Do.	do.	Bayside smelter at Richards Bay	97.
Andalusite	Imerys South Africa (Pty) Ltd. (subsidiary of Imerys Group)	Annesley and Havercroft Mines at Penge, Krugerspost Mine near Lydenburg, and Thabazimbi Mine near Thabazimbi	225.
Do.	Andalusite Resources (Pty) Ltd. [African Mineral Trading and Exploration (Pty) Ltd.]	Maroeloesfontein, near Thabazimbi, Northern Province	70.
Antimony metric tons	Consolidated Murchison Ltd. (Village Main Reef Ltd., 74%)	Cons Murch Mine near Gravelotte	7,000 antimony in concentrate.
Cement	Pretoria Portland Cement Co. (Pty) Ltd. (Barloworld Trust Co. Ltd., 68%)	De Hoek, Dwaalboom, Hercules, Jupiter, Riebeeck, and Slurry plants	8,000.
Do.	AfriSam Consortium (Pty) Ltd.	Dudfield, Roodepoort, and Ulco plants	4,600.
Do.	Lafarge South Africa Ltd. (Lafarge S.A.)	Lichtenburg plant in North West Province	3,600.
Do.	Natal Portland Cement Co. (Pty) Ltd. (Cimentos de Portugal SGPS, S.A., 98%)	Simumu plant	1,700.
Chromite	Glencore Xstrata plc, 79.5%, and Merafe Resources Ltd., 20.5%	Thorncliffe Mine at Steelpoort	995.
Do.	do.	Kroondal Mine at Rustenburg	850.
Do.	do.	Helena Mine at Steelpoort	825.
Do.	do.	Waterval Mine	650.
Do.	do.	Horizon Mine at Pilansberg	260.
Do.	Samancor Chrome Ltd. (International Mineral Resources BV, 70%)	Eastern Chrome Mines in Steelpoort Valley, Mpumalanga Province	2,000.
Do.	do.	Western Chrome Mines in Northern Province	1,500.
Do.	Tharisa Minerals (Pty) Ltd.	Tharisa Mine	1,920.
Do.	Hernic Ferrochrome (Pty) Ltd. (Mitsubishi Corp., 51%)	Bokone Mines	1,500.
Do.	Assmang (Pty) Ltd. (African Rainbow Minerals Ltd., 50%, and Assore Ltd., 50%)	Dwarsrivier Mine in Mpumalanga Province	1,400.
Do.	International Ferro Metals Ltd.	Lesedi Mines[1]	1,320.
Do.	do.	Sky Chrome Mine	840 run-of-mine.
Do.	Lonmin plc	Marikana Mines (Eastern Platinum, Karee, and Western Platinum) and Pandora Mine	1,500.[e]
Do.	Nkomati Joint Venture (African Rainbow Minerals Ltd., 50%, and MMC Norilsk Nickel, 50%)	Nkomati Chrome Mine in Mpumalanga Province	1,000.
Do.	Dilokong Chrome Mine (Pty) Ltd. [ASA Metals (Pty) Ltd., 100%]	Dilokong Mine, near Burgersfort in Mpumalanga Province	800.
Do.	Eastern Platinum Ltd. (Eastplats)	Crocodile River Mine at Arbourfell[1]	520.[e]
Do.	Bayer (Pty) Ltd.	Rustenburg Chrome Mine	450.
Do.	Anglo American Platinum Ltd. (Anglo American plc, 74.1%) (Amplats)	Bathopele, Dishaba, Khomanani, Khuseleka, Mogalakwena, Siphumelele, Thembelani, Union, and other mines	430.[e]
Do.	Afarak Group Oyj	Mecklenburg Mine	300 run-of-mine.
Coal	Anglo Coal Ltd. (Anglo American plc, 100%)	New Vaal Mine	18,000.
Do.	Anglo Coal Ltd., 73%	Kriel Mine	10,000.
Do.	do.	Zibulo Mine	8,000.
Do.	Anglo Coal Ltd.	Goedehoop Mine	7,500.
Do.	do.	Isibonelo Mine	5,000.
Do.	do.	New Denmark Mine	5,000.
Do.	do.	Kleinkopje Mine	4,500.
Do.	do.	Landau Mine	4,200.
Do.	do.	Greenside Mine	3,100.
Do.	Exxaro Resources Ltd. (BEE Holdco, 52.3%)	Grootegeluk Mine in Limpopo Province	18,800
Do.	do.	Matla Mine in Mpumalanga Province	14,000.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal—Continued	Exxaro Resources Ltd. (BEE Holdco, 52.3%)	Arnot Mine in Mpumalanga Province	5,000.
Do.	do.	Leeuwpan Mine in Mpumalanga Province	3,800.[e]
Do.	do.	North Block Mine in Mpumalanga Province	3,300.
Do.	do.	New Clydesdale Mine in Mpumalanga Province	1,400.
Do.	do.	Tshikondeni Mine in Limpopo Province	350.[e]
Do.	Exxaro Resources Ltd., 50%, and Anglo American plc, 50%	Mafube Mine North Block Mine in Mpumalanga Province	4,200.
Do.	Sasol Ltd.	Syferfontein Mine	9,600.
Do.	do.	Middelbult Mine	8,300.
Do.	do.	Bosjesspruit Mine	7,500.
Do.	do.	Brandspruit Mine	6,600.
Do.	do.	Twistdraai Mine	6,100.
Do.	do.	Sigma Mine	2,200.
Do.	BHP Billiton Energy Coal South Africa Ltd.	Middelburg and Wolverkrans Mines	41,400.
Do.	do.	Khutala underground mine	19,500.
Do.	do.	Klipspruit Mine	16,000.
Do.	Glencore Xstrata plc, 74%	Goedgevonden Complex at Witbank	8,000.
Do.	Glencore Xstrata plc, 79.8%	Tweefontein Complex at Witbank	7,000.
Do.	do.	Impunzi Complex at Witbank	6,300.
Do.	Optimum Coal Holdings (Pty) Ltd. (Glencore Xstrata plc, 67.6%)	Optimum Complex	11,000.
Do.	do.	Koornfontein Complex	2,800.
Do.	Umcebo Mining Ltd. (Glencore Xstrata plc, 43.66%)	Kleinfontein, Klippan, and Middelkraal Mines	7,000.
Do.	do.	Wonderfontein Mine	2,500.
Do.	Shanduka Coal (Pty) Ltd. (Shanduka Resources (Pty) Ltd., 50.01%, and Glencore Xstrata plc, 49.99%)	Middelburg Complex	6,500.
Do.	Coal of Africa Ltd.	Woestalleen Complex[1]	2,500.
Do.	do.	Mooiplaats Mine[1]	2,000.
Do.	do.	Vele Mine	1,000.
Do.	Total Coal SA (Pty) Ltd.	Dorstfontein West and Dorstfontein East Mines	2,100.[e]
Do.	do.	Forzando North and Forzando South Mines	1,600.[e]
Do.	do.	Tumelo Mine	450.[e]
Do.	Kangra Group Pty. Ltd. (Shanduka Resources (Pty) Ltd., 30%)	Savmore Mine	3,000.
Do.	Keaton Energy Holdings Ltd.	Vanggatfontein Mine	2,640.
Do.	do.	Vaalkranz Mine	360.
Do.	Imbawula Group	Mpumalanga Division (Spitzkop and Tselentis Mines) at Breyten and Ermelo	2,800.
Do.	Continental Coal Ltd.	Vlakvarkfontein Mines	1,400.[e]
Do.	do.	Ferreira Mine	500.[e]
Do.	do.	Penumbra Mine	500.
Do.	Kuyasa Mining (Pty) Ltd.	Delmas Mine	2,000.
Do.	Wescoal Holdings Ltd.	Khanyisa Mine	1,000
Do.	do.	Intibane Mine	1,000
Copper:			
Mine	Palabora Mining Co. Ltd.	Palabora Mines at Phalaborwa	65.[2]
Do.	Anglo American Platinum Ltd. (Amplats) (Anglo American plc, 78%)	Bathopele, Dishaba, Khomanani, Khuseleka, Mogalakwena, Siphumelele, Thembelani, Union, and other mines	65.[2]
Do.	Nkomati Joint Venture	Nkomati Mine in Mpumalanga Province	10.
Do.	Impala Platinum Ltd. (Implats)	Impala Mines	7.[2]

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper:—Continued				
Mine—Continued		Black Mountain Mineral Development Co. (Pty) Ltd. (Vedanta Resources plc, 74%)	Black Mountain Mine near Aggeneys in Northern Cape Province	6.[2]
Smelter		Palabora Mining Co. Ltd.	Smelter at Phalaborwa	110.[2]
Do.		Anglo American Platinum Ltd. (Amplats)	Rustenburg Smelter	11.[2]
Do.		Impala Platinum Ltd. (Implats)	Smelter near Phokeng	7.[2]
Refined		Palabora Mining Co. Ltd.	Refinery at Phalaborwa	140.[2]
Do.		Anglo American Platinum Ltd. (Amplats)	Rustenburg Base Metal Refiners	13.[2]
Do.		Lonmin plc	Base Metals Refinery and scrap plant	9.[2]
Do.		Impala Platinum Ltd. (Implats)	Base Metals Refinery	7.[2]
Diamond	thousand carats	De Beers Consolidated Mines Ltd. (Anglo American plc, 85%)	Venetia Mine in Northern Province	7,500.
Do.	do.	do.	Kimberley surface mines, Kimberley	1,500.
Do.	do.	do.	Voorspoed Mine	800.
Do.	do.	Petra Diamonds Ltd.	Finsch Mine, 100 kilometers west of Kimberley	1,800.[e]
Do.	do.	do.	Cullinan Mine	950.[e]
Do.	do.	do.	Helam, Sedibeng, and Star Mines[1]	175.
Do.	do.	do.	Kimberley underground mines, Kimberley	130.[e]
Do.	do.	do.	Koffiefontein Mine in Free State Province	50.[e]
Do.	do.	Diamcor Mining Inc.	Krone-Endorda Mine	120.
Fluorspar		Vergenoeg Mining Corp. (Pty) Ltd. [Minerales Y Productos Derivados SA, 85%]	Vergenoeg Mine at Rust de Winter	250.
Do.		Witkop Fluorspar Mine (Pty) Ltd. (subsidiary of Sallies Ltd.)	Witkop Mine at Zeerust[1]	140.
Gold:				
Mine		AngloGold Ashanti Ltd. (Anglo American plc, 41.8%)	Vaal River operations:	
Do.	kilograms	do.	Kopanang Mine	32,100 gold.
Do.	do.	do.	Great Noligwa Mine	14,600 gold.
Do.	do.	do.	Moab Khotsong Mine	11,000 gold.
Do.	do.	do.	Surface operations	5,100 gold.[e]
Do.	do.	do.	West Wits operations:	
Do.	do.	do.	Mponeng Mine	17,000 gold.
Do.	do.	do.	Tau Tona Mine	16,000 gold.
Do.	do.	do.	Savuka Mine	12,000 gold.
Do.	do.	do.	Mine Waste Solutions Project (MWS)	3,400 gold.
Do.	do.	Sibanye Gold Ltd.	Driefontein and Kloof Mines	36,900 gold.
Do.	do.	do.	Beatrix Mine	12,800 gold.
Do.	do.	Harmony Gold Mining Co. Ltd.	Kusasalethu Mine	8,900 gold.
Do.	do.	do.	Doornkop Mine	6,100 gold.
Do.	do.	do.	Tshepong Mine	6,000 gold.
Do.	do.	do.	Phakisa Mine	5,900 gold.
Do.	do.	do.	Target 1 and Target 3 Mines	5,800 gold.[e]
Do.	do.	do.	Masimong Mine	4,400 gold.
Do.	do.	do.	Bambanani Mine	3,600 gold.
Do.	do.	do.	Surface operations	3,500 gold.[e]
Do.	do.	do.	Joel Mine	3,000 gold.[e]
Do.	do.	do.	Unisel Mine	2,100 gold.
Do.	do.	do.	Kalgold Mine	1,200 gold.
Do.	do.	Gold One International Ltd.	Modder East Mine	4,700 gold.
Do.	do.	do.	Cooke Underground Mine	4,200 gold.[e]
Do.	do.	do.	Randfontein Surface Mine	1,200 gold.[e]
Do.	do.	Gold Fields Ltd.	South Deep Mine	9,200 gold.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gold:—Continued				
Mine—Continued	kilograms	Great Basin Gold Ltd.	Burnstone Mine[1]	7,900 gold.
Do.	do.	Village Main Reef Ltd.	Buffelsfontein and Tau Lekoa Mines	5,100 gold.[e]
Do.	do.	do.	Blyvoor Mine	2,300 gold.[e]
Do.	do.	Pan African Resources plc	Barberton Mine	3,600 gold.
Do.	do.	do.	Evander Mine	3,100 gold.[e]
Do.	do.	DRDGold Ltd.	East Rand Proprietary Mine	4,500 gold.[e]
Refined	metric tons	Rand Refinery Ltd. (AngloGold Ashanti Ltd., 53%, and Gold Fields Ltd., 33%)	Germiston, Gauteng Province	1,000.
Iron and steel:				
Iron ore		Kumba Iron Ore Ltd.	Sishen Mine at Sishen	37,000.
Do.		do.	Kolomela Mine	10,000.
Do.		do.	Thabazimbi Mine at Thabazimbi	2,700.
Do.		Assmang (Pty) Ltd.	Khumani Mine	16,000.
Do.		do.	Beeshoek Mine near Postmasburg	4,000.
Do.		Palabora Mining Co. Ltd.	Palabora Mines at Phalaborwa	6,000.
Do.		Highveld Steel and Vanadium Corp. Ltd. (Ervaz Group S.A., 79%)	Mapochs Mine at Roossenekal	2,700.
Do.		Vametco Minerals Corp. (Ervaz Group S.A., 81%)	Vametco Vanadium Mine and plant near Brits	1,100
Do.		Glencore Xstrata plc	Rhovan Mine at Brits	400.
Ferroalloys		Glencore Xstrata plc, 79.5%, and Merafe Resources Ltd., 20.5%	Lion plant at Steelpoort	720 ferrochromium.
Do.		do.	Wonderkop plant at Marikana	553 ferrochromium.
Do.		do.	Rustenburg plant at Rustenburg	430 ferrochromium.
Do.		Glencore Xstrata plc, 69.6%, and Merafe Resources Ltd., 30.4%	Lydenburg plant at Lydenburg	396 ferrochromium.
Do.		Glencore Xstrata plc, 79.5%, and Merafe Resources Ltd., 20.5%	Boshoek plant at Boshoek	240 ferrochromium.
Do.		Samancor Chrome Ltd.	Plants at Middelburg, Steelpoort, and Witbank	1,110 ferrochromium.
Do.		Hernic Ferrochrome (Pty) Ltd.	Plant at Brits	420 ferrochromium.
Do.		ASA Metals (Pty) Ltd. (Sinosteel, 60%, and Limpopo Economic Development Enterprise, 40%)	Plant near Pietersburg, Northern Province	400 ferrochromium.
Do.		International Ferro Metals Ltd.	Plant in North West Province	267 ferrochromium.
Do.		Tata Steel (KZN) (Pty) Ltd.	Richards Bay	150 ferrochromium.
Do.		Assmang (Pty) Ltd.	Cato Ridge plant in KwaZulu Natal Province	300 ferromanganese.
Do.		do.	Machadodorp plant in Mpumalanga Province	290 ferromanganese
Do.		Samancor Manganese (Pty) Ltd. (BHP Billiton Ltd., 44.4%, and Anglo American plc, 29.6%)	Plant at Meyerton	500 ferromanganese.
Do.		Renova Group	Plant at Witbank	50 ferromanganese;[1] 180 silicomanganese.
Do.		Globe Speciality Metals Inc.	Plant at Ballengeich	45 ferrosilicon.
Do.		Grupo Ferroatlantica	Rand Carbide plant	35[e] ferrosilicon.
Do.	metric tons	Vanchem Vanadium Products (Pty) Ltd.	Plant at Witbank	12,500 ferrovanadium.
Do.	do.	Glencore Xstrata plc	Rhovan plant at Brits	6,000 ferrovanadium.
Do.	do.	Vametco Minerals Corp.	Smelter near Brits	4,800 ferrovanadium.
Do.		Afarak Group Oyj	Mogale plant	110 ferroalloys.
Steel		ArcelorMittal South Africa Ltd.	Vanderbijlpark plant	4,400 crude steel.
Do.		do.	Newcastle and Vereeniging plants	2,200 crude steel.
Do.		do.	Saldanha plant	1,200 crude steel.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel:—Continued				
Steel—Continued		Evraz Highveld Steel and Vanadium Ltd.	Witbank	1,000 iron; 1,000 crude steel.
Do.		Columbus Stainless (Pty) Ltd. (Acerinox SA, 76%)	Stainless steel plant at Middelburg	750 crude steel.
Do.		Scaw Metals Group	Germiston plant, Johannesburg	600 crude steel.
Do.		Davsteel Division (Cape Gate Pty. Ltd.)	Vanderbijlpark plant, Gauteng	485 crude steel; 460 rolled steel.
Do.		Cape Town Iron & Steel Works (Pty) Ltd. (Cisco)	Kuilsrivier plant, Cape Town	300 crude steel; 300 billet.
Do.		Duferco Steel Processing Ltd.	Cold-rolled slab steel plant at Saldanha Bay	240 rolled steel.
Lead		Vedanta Resources plc	Black Mountain Mine near Aggeneys in Northern Cape Province	55 lead in concentrate.
Lime		PPC Lime Ltd. (subsidiary of Pretoria Portland Cement Company Ltd.)	Plant at Lime Acres	1,200.
Do.		Idwala Lime (Idwala Industrial Holdings)	Plant at Daniëlskuil	1,000.
Do.		Inca Lime (Pty) Ltd. (subsidiary of Inca Mining (Pty) Ltd.)	Plant at Immerpan, Limpopo Province	100.
Manganese		Hotazel Manganese Mines (Pty) Ltd. (BHP Billiton, 44.4% and Anglo American plc, 29.6%)	Mamatwan Mine near Hotazel	3,500 ore.
Do.		do.	Wessels Mine near Hotazel	1,000 ore.
Do.		United Manganese of Kalahari (Pty) Ltd. (UMK) (Majestic Silver Trading 40 (Pty) Ltd., 51%, and Renova Group of Russia, 49%)	Kalahari Mine	4,000 ore.
Do.		Assmang (Pty) Ltd.	Nchwaning Mine near Black Rock	3,000 ore.
Do.		do.	Gloria Mine near Black Rock	600 ore.
Do.		Asia Minerals Ltd. (AML)	Kudumane Mine	3,000 ore.
Do.		Tshipi e Ntle Manganese Mining (Pty) Ltd. (Ntsimbitntle Mining (Pty) Ltd., 50.1%, and Jupiter Mines Ltd., 49.9%)	Tshipi Borwa Mine	2,400 ore.
Do.		Metmin (Metorex Pty. Ltd., 100%)	Open pit mine in North West Province	24 manganese dioxide.
Do.		Manganese Metal Co. Pty. Ltd. [Samancor Manganese (Pty) Ltd., 51%]	Electrolytic plant at Nelspruit	30 manganese metal.
Nickel		Anglo American Platinum Ltd. (Amplats)	Bathopele, Dishaba, Khomanani, Khuseleka, Mogalakwena, Siphumelele, Thembelani, Union, and other mines	33 mine.[e]
Do.		do.	Rustenburg Base Metal Refiners	33 refined.
Do.		Nkomati Joint Venture	Nkomati Mine in Mpumalanga Province	21 mine.
Do.		Impala Platinum Ltd.	Impala Mines	6 mine.[e]
Do.		do.	Base Metals Refinery	16 refined.[e]
Do.		Lonmin plc	Marikana and Pandora Mines	4 mine.[e]
Do.		do.	Base Metals Refinery	5 sulfate.[e]
Nitrogen, ammonia		Sasol Ltd.	Plants at Sasolburg and Secunda	660.
Petroleum:				
Crude	thousand 42-gallon barrels	Petroleum Oil and Gas Corporation of South Africa	Oribi and Oryx fields	730.
Refined	do.	South African Petroleum Refineries (Shell SA Energy, 50%, and BP Southern Africa, 50%)	Sapref refinery in Durban	61,700.
Do.	do.	Engen Ltd. (62%)	Engen refinery in Durban	43,100.
Do.	do.	Caltex Oil SA (Pty) Ltd.	Chevref refinery in Cape Town	40,200.
Do.	do.	National Petroleum Refiners of South Africa Pty. Ltd. (Sasol Ltd., 63.6%)	Natref refinery in Sasolburg	32,000.
Phosphate rock		Phosphate Development Corp. Ltd. [Foskor (Pty) Ltd.]	Foskor Mine and plant at Phalaborwa	2,800 phosphate rock.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Phosphoric acid		Farmers World Limpopo (Pty) Ltd.	Plant at Phalaborwa	325.
Platinum-group metals	kilograms	Anglo American Platinum Ltd.	Bathopele, Khomanani, Khuseleka, Siphumelele and Thembelani Mines	24,000 platinum; 11,900 palladium; 3,100 rhodium; 5,500 iridium and ruthenium.
Do.	do.	do.	Dishaba and Tumela Mines at Northam	16,000 platinum; 7,300 palladium; 2,400 rhodium; 4,200 iridium and ruthenium.
Do.	do.	Anglo American Platinum Ltd., 85%	Union Mine at Swartklip	10,700 platinum; 4,600 palladium; 1,800 rhodium; 3,100 iridium and ruthenium.
Do.	do.	Bafokeng Rasimone Platinum Mine (Royal Bafokeng Nation, 67%, and Anglo American Platinum Ltd., 33%)	Bafokeng Rasimone Platinum Mine at Rasimone	5,900 platinum; 2,400 palladium; 790 ruthenium; 460 rhodium; 150 iridium.
Do.	do.	Kroondal Platinum Mines (Anglo American Platinum Ltd., 50%, and Aquarius Platinum Ltd., 50%)	Kroondal Mine	7,800 platinum; 3,800 palladium; 2,300 ruthenium; 1,500 rhodium; 550 iridium.
Do.	do.	Modikwa Platinum Mine (Anglo American Platinum Ltd., 50%, and African Rainbow Minerals, 50%)	Modikwa Mine at Makgemeng	4,200 platinum; 4,000 palladium; 1,200 ruthenium; 820 rhodium; 310 iridium.
Do.	do.	Anglo American Platinum Ltd. (Amplats)	Mogalakwena Mine at Ga-Masenya	10,600 platinum; 10,900 palladium; 700 rhodium; 760 iridium and ruthernium.
Do.	do.	Anglo American Platinum Ltd., 50%, and XK Platinum Partnership, 50%	Mototolo Mine at Steelpoort	4,100 platinum; 2,400 palladium; 630 rhodium; 1,300 iridium and ruthernium.
Do.	do.	Anglo American Platinum Ltd. (Amplats)	Polokwane smelter at Polokwane, Mortimer smelter at Swartklip, and Waterval smelter	85,000 platinum; 48,000 palladium; 12,000 rhodium.
Do.	do.	do.	Precious Metals Refinery	81,000 platinum; 45,700 palladium; 10,800 rhodium; 18,800 iridium and ruthernium.
Do.	do.	Impala Platinum Ltd. (Implats)	Impala Mines, near Phokeng in North West Province	29,500 platinum; 16,000 palladium; 6,600 ruthenium; 4,000 rhodium; 1,600 iridium.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Platinum-group metals—Continued	kilograms	Impala Platinum Ltd. (Implats)	Marula Mine at Bothashoek	2,200 platinum; 2,300 palladium; 630 ruthenium; 460 rhodium; 180 iridium.
Do.	do.	do.	Smelter near Phokeng	81,000 platinum; 52,600 palladium; 11,600 rhodium; 17,000 gold, iridium, and ruthenium.
Do.	do.	do.	Precious metals refinery, near Springs in Guateng Province	71,500 platinum metal; 46,400 palladium metal; 10,200 rhodium metal; 15,000 gold, iridium, and ruthenium.
Do.	do.	Lonmin plc	Marikana and Pandora Mines	24,900 platinum; 11,600 palladium; 5,300 ruthenium; 3,400 rhodium; 1,100 iridium.
Do.	do.	do.	Precious Metals Refinery at Western Platinum	31,000 platinum metal; 14,600 palladium metal; 7,000 ruthenium metal; 4,300 rhodium metal; 1,400 iridium metal.
Do.	do.	Northam Platinum Ltd. (Anglo American Platinum Ltd., 22.5%, and Mvelaphanda Resources Ltd., 21.9%)	Zondereinde Mine near Northam	9,400 platinum; 4,600 palladium; 1,100 rhodium.
Do.	do.	do.	Booysendal Mine	2,900 platinum; 1,600 palladium; 470 rhodium.
Do.	do.	Marikana Platinum Mine (Anglo American Platinum Ltd., 50%, and Aquarius Platinum Ltd., 50%)	Marikana Mine	2,700 platinum; 1,300 palladium; 760 ruthenium; 480 rhodium; 210 iridium.
Do.	do.	Aquarius Platinum Ltd.	Everest Platinum Mine at Lydenburg[1]	3,800 platinum; 2,100 palladium; 1,100 ruthenium; 640 rhodium; 230 iridium.
Do.	do.	do.	Blue Ridge Mine[1]	3,900 platinum-group metals.
Do.	do.	Platmin Ltd.	Pilanesberg Mine	5,400 platinum; 1,700 palladium; 490 rhodium.
Do.	do.	Glencore Xstrata plc, 74%	Eland Mine at Brits	7,500 platinum-group metals.
Do.	do.	Atlatsa Resource Corp., 51%, and Anglo American Platinum Ltd., 49%	Bokoni Mine at Sefateng	4,100 platinum; 2,700 palladium; 470 rhodium.
Do.	do.	Two Rivers Platinum Mine (Pty) Ltd. (African Rainbow Minerals Ltd., 55%, and Impala Platinum Holdings Ltd., 45%)	Two Rivers Platinum Mine near Steelpoort	4,600 platinum; 2,700 palladium; 1,300 ruthenium; 780 rhodium; 310 iridium.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Platinum-group metals—Continued	kilograms	Eastern Platinum Ltd. (Eastplats)	Crocodile River Mine at Arbourfell[1]	3,100 platinum; 1,300 palladium; 950 ruthenium; 520 rhodium; 220 iridium.
Do.	do.	Tharisa Minerals (Pty) Ltd.	Tharisa Mine	2,700 platinum; 710 palladium; 530 ruthenium; 360 rhodium; 170 iridium.
Do.	do.	Nkomati Joint Venture	Nkomati Mine in Mpumalanga Province	4,300 platinum-group metals.
Do.	do.	Platinum Australia Pty Ltd. (PLA)	Smokey Hills Mine[1]	3,000 platinum-group metals.
Do.	do.	Sylvania Platinum Ltd.	Sylvania Dump Operations	1,600 platinum-group metals.
Pyrophyllite		Idwala Industrial Minerals (Benoni)	Ottsdal Mine in North West Province	15.
Do.		Wonderstone Ltd. (The Associated Ore & Metals Corp. Ltd.)	Pyrophylite (wonderstone) mine, North West Province	NA.
Do.		G&W Base and Industrial Minerals Pty. Ltd.	Piet Retief Mine	NA.
Selenium	kilograms	Impala Platinum Ltd. (Implats)	Impala and Marula Mines	12,000.[e]
Do.	do.	Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	10,000.[e]
Silicon		Grupo Ferroatlantica	Polokwane plant, near Pietersburg	55 silicon metal.
Silver:				
Mine	metric tons	Vedanta Resources plc	Black Mountain Mine	50 mined silver.
Refined	do.	Rand Refinery Ltd.	Germiston, Gauteng Province	200 refined silver.
Sulfur		Sasol Synthetic Fuels (Pty) Ltd.	Plant at Secunda	180.
Do.		South African Petroleum Refineries	Plant at Durban	63.
Do.		Engen Petroleum Ltd.	do.	47.
Do.		National Petroleum Refiners of South Africa (Pty) Ltd.	Plant at Sasolburg	44.
Do.		Caltex Oil SA (Pty) Ltd.	Plant at Cape Town	30.
Synthetic fuels	thousand 42-gallon barrels	Sasol Synthetic Fuels (Pty) Ltd.	Coal to oil plant at Secunda	58,400.
Do.	do.	Petroleum Oil and Gas Corporation of South Africa	Natural gas to petroleum products plant at Mossel Bay	16,400.
Tellurium	kilograms	Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	5,300.[e]
Do.	do.	Impala Platinum Ltd. (Implats)	Impala and Marula Mines	5,000.[e]
Titanium:				
Titanium concentrates		Richards Bay Minerals (RBM) (Rio Tinto plc, 74%; Horizon Investments, 24%)	Open cast operations, near Richards Bay	2,000 ilmenite;[e] 100 rutile.[e]
Do.		Tronox Ltd., 74% (Exxaro Resources Ltd., 44.65%)	KZN Sands Mine near Richards Bay[1]	550 ilmenite; 30 rutile.
Do.		do.	Namakwa Mine near Brand-se-Baai and mineral separation plant at Koekenaap	540 ilmenite; 31 rutile.
Titanium slag		Richards Bay Minerals (RBM)	Smelter at Richards Bay	1,050 titanium slag
Do.		Tronox Ltd., 74%	Empangeni smelter near Richards Bay	220 titanium slag.
Do.		Tronox Ltd., 74%	Smelter at Vredenberg, Saldanha Bay area	190 titanium slag.
Do.		Evraz Highveld Steel and Vanadium Ltd.	Steel plant at Witbank	48 titanium slag.[e]
Uranium oxide	metric tons	AngloGold Ashanti Ltd.	Vaal Rivers operation, near Klerksdorp	3,000.
Do.	do.	First Uranium Corp.	Ezulwini Mine	100.[e]
Vanadium pentoxide	do.	Highveld Steel and Vanadium Ltd. (Ervaz Group S.A., 79%)	Mapochs Mine near Lydenburg	17,500.
Do.	do.	do.	Plant at Witbank	10,800.
Do.	do.	Glencore Xstrata plc, 74%	Rhovan Mine at Brits	10,000.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2013

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Vanadium pentoxide—Continued	metric tons	Vanchem Vanadium Products Pty Ltd.	Plant at Witbank	5,000.[e]
Do.	do.	Vametco Minerals Corp.	Vametco Mine and plant near Brits	3,800.
Vermiculite		Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	200.
Wollastonite	metric tons	Namaqua Wollastonite (Pty) Ltd.	Magata Mine	2,400.[e]
Zinc		Zinc Corp. of South Africa Ltd. (Lebonix (Pty) Ltd., 100%)	Struisbult Springszinc refinery at Springs, southeast of Johannesburg[1]	110 refined zinc; 170 sulfuric acid.
Do.		Black Mountain Mineral Development Co. (Pty) Ltd.	Black Mountain Mine near Aggeneys in Northern Cape Province	40 zinc in concentrate.
Zirconium		Richards Bay Minerals (RBM)	Open cast mines near Richards Bay	300 zircon in concentrate.
Do.		Tronox Ltd., 74%	Namakwa Mine near Brand-se-Baai and mineral separation plant at Koekenaap	135 zircon in concentrate.
Do.		do.	Hillendale Mine near Richards Bay, KwaZulu Natal Province	60 zircon in concentrate.

[e]Estimated. Do., do. Ditto. NA Not available.
[1]Not operating at the end of 2013.
[2]Data from International Copper Study Group.

TABLE 3
SOUTH AFRICA: RESERVES OF MAJOR MINERALS IN 2013[1]

(Million metric tons unless otherwise specified)

Commodity		Reserves
Andalusite[2]		51
Antimony	thousand metric tons	21
Chromium, ore		3,100
Coal, recoverable		30,156
Copper		11
Fluorspar		41
Gold	thousand metric tons	6
Iron ore		650
Lead	thousand metric tons	300
Manganese, ore		150
Nickel	thousand metric tons	3,700
Phosphate rock		1,500
Platinum-group metals	thousand metric tons	63
Titanium minerals		71
Vanadium	thousand metric tons	3,640
Vermiculite		14
Zinc		14
Zirconium		14

[1]Metallic minerals are contained metal.

[2]Includes aluminosilicate and sillimanite.

Source: Mnguni, Mildred, 2013, General review, in South Africa's Mineral Industry 2012/2013: Johannesburg, South Africa, Department of Mineral Resources of the Republic of South Africa, p. 1–36.