



2012 Minerals Yearbook

SOUTH AFRICA

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 2012, South Africa's estimated share of world mined platinum production amounted to 72%; refined rhodium, 59%; refined platinum, 57%; kyanite and other materials, 53%; chromium, 46%; mined palladium, 36%; vanadium, 35%; vermiculite, 34%; refined palladium, 29%; zirconium, 28%; manganese, 22%; ilmenite, 17%; rutile, 16%; refined gold, 10%; mined gold, 6%; coal, 4%; fluor spar, 3%; antimony, mined cobalt, iron ore, nickel, silica sand, and silicon metal, 2% each; and aluminum, refined cobalt, ferrosilicon, lead, and phosphate rock, 1% each (Bedinger, 2013; BP p.l.c., 2013, p. 32; Bray, 2013; Carlin, 2013; Cobalt Development Institute, 2013; Corathers, 2013a; 2013b, p. 67.13–67.14; Dolley, 2013; George, 2013; Guberman, 2013; Jasinski, 2013; Johnson Matthey plc, 2013, p. 50, 52, 54, 56; Kuck, 2013; Loferski, 2013a, b; Miller, 2013; Papp, 2013; Polyak, 2013; Shedd, 2013; Tanner, 2013a, b; Tuck, 2013; World Gold Council, 2013, p. 19).

In 2012, South Africa's estimated share of the world's coal consumption was 2.4%, and petroleum products consumption, 0.7%. The country also accounted for 92% of total African coal consumption and 16% of total African petroleum products consumption in 2012 (BP p.l.c., 2013, p. 9, 33).

Minerals in the National Economy

The mineral industry accounted for 8.3% of the gross domestic product (GDP) in 2012 compared with 8.8% in 2011. Crude and processed mineral products accounted for 42% of the value of total exports. About 74% of crude mineral products and 84% of processed mineral products, by value, were exported in 2012. Employment in the mineral industry amounted to 524,632 workers in 2012 compared with a revised 512,878 in 2011 and 415,988 in 2002. In 2012, platinum-group metal (PGM) mining accounted for 37.7% of the mineral industry's employment; gold, 27.1%; coal, 15.9%; iron ore, 4.5%; chromite, 3.8%; diamond, 2.3%; manganese, 1.7%; and other minerals, 7%. In 2002, gold mining accounted for 47.9% of the mineral industry's employment; PGMs, 26.8%; coal, 11.4%; diamond, 3.9%; and chromite, iron ore, and manganese combined, a total of 3.2% (Chamber of Mines of South Africa, 2012, p. 12; 2013, p. 6–7, 12; Martin Kohler, Deputy Director of Statistics, Department of Mineral Resources, written commun., August 7, 2013).

Government Policies and Programs

The Government's Black Economic Empowerment (BEE) program requires that black ownership of mining companies reach 26% by 2014. In September 2010, the Government introduced its new Mining Charter, which allows companies to use the value of their domestic beneficiation activities as credit

for up to 11% of their black ownership requirements. The new Mining Charter requires mining companies 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).

Environment

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. In the eastern part of the Witwatersrand basin, the rising water levels in the mines are expected to reach the environmental critical level (ECL) (which is the highest level in a mine in which groundwater systems are not contaminated) by June 2014. In the central part of the basin, which includes Johannesburg, the ECL is expected to be reached in mid-2013 (Allan, 2013).

Production

In 2012, mined cobalt production increased by 56%; kaolin, 35%; refined cobalt, 28%; antimony, an estimated 20%; anthracite coal, 18%; gypsum, 17%; iron ore, 16%; and direct-reduced iron, an estimated 13%. The output of pyrophyllite decreased by 85%; slate, 55%; silicomanganese, 53%; crude petroleum, 42%; mica, 37%; flint clay, 30%; silicon metal and ferrosilicon, by an estimated 27% each; sulfur and smelted copper, 24% each; refined copper, 23%; vermiculite, 22%; lime and silica sand, 21% each; aluminum and fire clay, 18% each; iridium 17%; mined copper and uranium, 16% each; mined gold, 14%; platinum and phosphate rock, 13% each; rhodium, 12%; and ferrochromium, ruthenium and zircon, 11% each. Refined zinc production was shut down at the end of 2011 (table 1; Martin Kohler, Deputy Director of Statistics, Department of Mineral Resources, written commun., August 7, 2013).

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 iron ore accounted for 64% of national production; that of diamond, 61%; nickel, 42%; manganese, 41%; gold, 30%; and coal, 22% (table 2).

Reserves and Resources

South Africa's estimated share of world reserves of PGMs amounted to 95%; chromite, 43%; zirconium, 29%; vanadium, 25%; manganese, 24%; rutile, 20%; fluor spar, 17%; gold, 12%; and ilmenite, 10%. The country also had substantial reserves of andalusite, antimony, coal, copper, iron ore, lead, nickel, phosphate rock, uranium, vermiculite, and zinc (table 3; Bedinger, 2013; Corathers, 2013a; George, 2013; Loferski, 2013a, b; Miller, 2013; Papp, 2013; Polyak, 2013).

Mineral Trade

In 2012, South Africa's exports of gold amounted to \$8.41 billion; coal, \$6.11 billion; iron ore, \$5.63 billion; platinum, \$5.26 billion; manganese ore, \$1.13 billion; palladium, \$1.07 billion; rhodium, \$625 million; nickel, \$572 million; chromite, \$420 million; copper, \$185 million; iridium, \$114 million; ruthenium, \$53 million; and other crude mineral products, which included diamond, ilmenite, rutile, and zircon, \$1.75 billion. Exports of ferrochromium amounted to \$2.61 billion; manganese metal and alloys, \$720 million; vanadium alloys and other vanadium products, \$266 million; silicon metal and alloys, \$159 million; and other processed mineral products, which included aluminum, \$2.06 billion (Martin Kohler, Deputy Director of Statistics, Department of Mineral Resources, written commun., August 7, 2013).

The percentage of domestic consumption of mineral commodities produced in South Africa varied sharply by commodity. In 2012, ferrochromium exports, by volume, amounted to 90% of domestic production; iron ore, 85%; manganese ore, 84%; PGMs, 83%; vanadium, 78%; manganese alloys and nickel, 77% each; vermiculite, 73%; silicon alloys, 68%; coal, 29%; flint clay, 3%; and lime and silica, less than 1% each (Martin Kohler, Deputy Director of Statistics, Department of Mineral Resources, written commun., August 7, 2013).

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 decreased to 566,000 metric tons (t) in 2012 from 712,000 t in 2011, and production at Bayside increased to 99,000 t from 97,000 t (BHP Billiton Ltd., 2012b, p. 4; 2013, p. 4).

Antimony.—The Consolidated Murchison Mine was South Africa's only producer of antimony. Village Main Reef Ltd. won final approval from the Government for the purchase of the mine in June 2012. Village Main Reef was ramping up production to about 3,900 metric tons per year (t/yr) of antimony. The company was engaged in deepening its three existing mine shafts; further increases in production were likely to result from the mining of near-surface resources. Reserves were estimated to be 993,000 t at a grade of 2.67% antimony in November 2011.

The remaining life of the mine was estimated to be 11 years (Clarke, 2012).

Chromium.—In 2012, chromite production was about 11.31 million metric tons (Mt) compared with 11.87 Mt in 2011 and 6.44 Mt in 2002 because of increased production from the Dwarsrivier Mine and the opening of the Lesedi Mine, the Sky Chrome Mine, and other mines. From 2002 to 2012, employment in chromite mining increased to 16,389 workers from 5,404 (table 1; Chamber of Mines of South Africa, 2012, p. 12, 15; 2013, p. 12).

Xstrata plc of Switzerland and its joint-venture partner Merafe Resources Ltd. mined 2.31 Mt of chromite in 2012. Production at the Thorncliffe Mine was 769,000 t; the Helena Mine, 689,000 t; the Kroondal Mine, 684,000 t; and the Waterval Mine, 102,000 t. The Horizon Mine was reopened in 2012 and produced 70,000 t; Xstrata and Merafe planned to start the rampup to full capacity in the first half of 2013. In 2012, Xstrata and Merafe completed the new Magareng Mine within the Thorncliffe Mine complex; the mine's beneficiation plant was likely to be completed in the first half of 2013. The Magareng Mine, which would provide ore to the Lion ferrochromium plant, had a capacity of 1.2 million metric tons per year (Mt/yr) (Engineering & Mining Journal, 2010; Xstrata plc, 2013, p. 29, 35).

Xstrata and Merafe produced 1.18 Mt of ferrochromium in 2012 compared with 1.29 Mt in 2011. Production at the Wonderkop plant was 355,000 t; the Lion plant, 318,000 t; the Lydenburg plant, 269,000 t; the Boshhoek plant, 154,000 t; and the Rustenburg plant, 79,000 t. In 2012, output was reduced to 66% of capacity because of decreased demand, power buybacks by state-owned utility Eskom, increased power costs, and labor disputes. The companies signed another power buyback agreement that would reduce ferrochromium production by about 100,000 t in the first quarter of 2013. Xstrata and Merafe were engaged in an expansion of the Lion plant's capacity to 720,000 t/yr from 360,000 t/yr. The project was expected to be completed by the end of 2013 (Platinum Weekly, 2012; Xstrata plc, 2013, p. 29, 35).

In October 2012, Xstrata and Merafe completed the construction of the Tswelopele pelletizing and sintering plant, which had a capacity of 600,000 t/yr. By yearend, the plant was operating at full capacity. Tswelopele recovered chromite from the tailings of PGM mining operations (Xstrata plc, 2013, p. 29).

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. 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 Steelport; the plants had a combined capacity of 1.12 Mt/yr (table 2). The company accounted for about 10% of the world's ferrochromium production (Competition Tribunal of South Africa, 2012).

Assmang Ltd. [African Rainbow Minerals Ltd. (ARM), 50%, and Assore Ltd., 50%] operated the Dwarsrivier Mine in

Mpumalanga Province. In 2012, production increased to 1 Mt from 922,000 t in 2011. Output was expected to ramp up to 1.4 Mt/yr in 2012; production plans were constrained by weak demand (African Rainbow Minerals Ltd., 2012a, p. 65, 78; 2012b, p. 58; 2013, p. 58).

Assmang's ferrochromium production at the Machadodorp plant decreased to 73,000 t in 2012 from 228,000 t in 2011. In October 2012, the company completed the conversion of two of its furnaces from ferrochromium to ferromanganese because ferromanganese is 65% as power intensive to produce as ferrochromium. Assmang's ferrochromium production shut down in the second half of 2012 (Ryan's Notes, 2011b; African Rainbow Minerals Ltd., 2012a, p. 67–68, 78; 2012b, p. 58; 2013, p. 58).

ARM and its joint-venture partner MMC Norilsk Nickel of Russia operated the Nkomati Chrome Mine. In 2012, sales decreased to 266,000 t from 666,000 t in 2011 (African Rainbow Minerals Ltd., 2012a, p. 62; 2012b, p. 64; 2013, p. 64).

International Ferro Metals Ltd. (IFM) operated the Lesedi and the Sky Chrome Mines and the Buffelsfontein ferrochromium plant in North West Province. In 2012, IFM produced 177,359 t of ferrochromium; production was constrained by power buybacks by Eskom in the second quarter. Also in the second quarter, the Sky Chrome Mine was producing at a rate of 600,000 t/yr of run-of-mine ore. IFM planned to increase output at Sky Chrome to 840,000 t/yr in the third quarter, as reserves of the Lesedi Mine were depleted (Ryan's Notes, 2012e, f; 2013).

ASA Metals (Pty) Ltd. (Sinosteel Corp. of China, 60%, and Limpopo Economic Development Enterprise, 40%) operated a chromite mine and a ferrochromium plant with capacities of 800,000 t/yr and 400,000 t/yr, respectively. In early 2012, ASA Metals agreed to shut down 33% of its ferrochromium capacity for 6 months because of a power buyback agreement with Eskom. Total production losses were expected to be as much as 60,000 t of ferrochromium (Ryan's Notes, 2012b).

Hernic Ferrochrome (Pty) Ltd. (a subsidiary of Mitsubishi Corp. of Japan) operated the Bokfontein Mine, which had a capacity of 1.5 Mt/yr, and a ferrochromium plant with a capacity of 420,000 t/yr (table 2). After a partial shutdown in April and May 2012 because of a power buyback agreement with Eskom, Hernic restored ferrochromium production to full capacity. The company subsequently signed another power buyback agreement that would shut down 40% of ferrochromium capacity from the beginning of December to the end of March 2013 (Platinum Weekly, 2012; Ryan's Notes, 2012c).

In September 2012, Tharisa Minerals (Pty) Ltd. had nearly completed its new processing plant that would increase chromite concentrate capacity at the Tharisa Mine to 1.92 Mt/yr from 420,000 t/yr. Tharisa Minerals planned to ramp up to full capacity by the end of 2013 (Projects in Progress, 2012b).

Ruukki Group Oyj of Finland mined chromite at the Mecklenburg and the Stellite Mines and produced ferroalloys at the Mogale Alloys plant. In November 2012, Ruukki agreed to shut down its ferrochromium production for 3 months because of a power buyback agreement with Eskom (Metal Bulletin, 2012).

PGM producers also mined chromite as a coproduct of PGM 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. UG2 ore had a much lower production cost than the Lower Group 6 (LG6) chromite ore mined by ferrochromium producers. Lonmin plc of the United Kingdom's sales of chromite were 1.23 Mt in 2012. In April, Anglo American Platinum Ltd. (Amplats) started supplying UG2 ore to IFM at the rate of 180,000 t/yr for use in its ferrochromium plant. Amplats had estimated reserves of about 640 Mt of UG2 ore. Eastern Platinum Ltd. (Eastplats) of Canada sold 230,508 t of chromite from its Crocodile River Mine in 2012 (Lonmin plc, 2012, p. 154; 2013; Ryan's Notes, 2012e, h; Eastern Platinum Ltd., 2013).

Most companies that produced chromite from UG2 ore exported their production. In 2011, chromite exports by volume were 30% of national chromite production compared with 7% in 2006. The increase in exports was partially attributable to higher production from UG2 ore. China received most South African chromite exports. In 2012, ferrochromium producers encouraged the Government to enact a tax of \$100 per metric ton on exports of chromite ore because exports of low-cost UG2 ore to China resulted in a cost advantage for Chinese ferrochromium producers. PGM producers opposed the tax because the tax would be particularly costly for UG2 exporters. UG2 ore had a grade of about 10% Cr₂O₃, which was much lower than the grades in LG6 ore and therefore had a much lower value than LG6 ore (Chamber of Mines of South Africa, 2012, p. 15; Ryan's Notes, 2012a, h).

Copper.—Palabora Mining Co. Ltd. (Rio Tinto Ltd. of Australia, 57.7%, and Anglo American plc of the United Kingdom, 16.8%) operated the Palabora Mine. Anglo American and Rio Tinto finalized plans to sell their interest in the mine in 2013. In 2012, the output of copper in concentrate at Palabora decreased to 49,063 t from 69,143 t in 2011. Smelted copper production decreased to 40,576 t from 59,438 t, and refined copper production decreased to 41,724 t from 63,787 t. Palabora Mining was engaged in a study on extending the life of the mine from 2015 to 2030 (Palabora Mining Co. Ltd., 2013, p. 17, 23, 146–148).

Gold.—The long-term decline in the country's gold output continued in 2012, with national gold mine production decreasing to 154,178 kilograms (kg) from a revised 180,293 kg in 2011 and about 398,500 kg in 2002. From 2002 to 2012, employment in gold mining decreased to 142,201 workers from 199,378. During the same period, South Africa's share of world gold production decreased to about 6% from 15%. Decreased production was primarily attributable to mine depths as great as 4 kilometers (km), which led to difficult geologic conditions, high ore haulage and refrigeration costs, and low labor productivity (table 1; Chamber of Mines of South Africa, 2012, p. 12, 25–26; 2013, p. 12; du Venage, 2013).

Gold Fields Ltd. of South Africa mined gold at the Beatrix Mine, the KDC Mine (formerly the Driefontein and the Kloof Mines), and the South Deep Mine, which were underground mines. In 2012, production at the KDC Mine amounted to 29,078 kg; the Beatrix Mine, 8,981 kg; and the South Deep Mine, 8,411 kg. Production losses at KDC from labor disputes and an underground fire were about 3,600 kg and 900 kg, respectively. In November, Gold Fields announced plans

to spin off Beatrix and KDC into a separate company called Sibanye Gold Ltd. (Gold Fields Ltd., 2013, p. 11, 13–17).

Gold Fields planned to increase output at South Deep to between 9,500 and 10,000 kg in 2013 and to nearly 22,000 kilograms per year (kg/yr) by 2016. The estimated mine life at South Deep was more than 80 years. Total production at Beatrix and KDC was expected to decrease to about 31,000 kg/yr by 2018 and 25,000 kg/yr by 2022. Reserves at the Driefontein section of the KDC Mine were likely to be depleted by 2024; at Beatrix, by 2026; and at the Kloof section of the KDC Mine, by 2027 (du Venage, 2013; Gold Fields Ltd., 2013, p. 15).

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 decreased to about 37,700 kg in 2012 from 50,500 kg in 2011. Production at the Mponeng Mine was about 12,600 kg in 2012; the Tau Tona Mine, 5,900 kg; the Kopanang Mine, 5,100 kg; the Moab Khotsoeng Mine, 5,000 kg; the surface mining operations in the Vaal River and West Wits areas, 4,500 kg; the Great Noligwa Mine, 2,600 kg; and the Savuka Mine, 1,200 kg. About 12,800 kg of output was lost because of a labor dispute and other factors, including difficult geologic conditions, lower ore grades, and seismic activity (AngloGold Ashanti Ltd., 2013, p. 39, 42).

In July 2012, AngloGold Ashanti completed the purchase of First Uranium (Pty) Ltd., which operated the Mine Waste Solutions (MWS) tailings retreatment project. MWS produced at the rate of nearly 2,000 kg/yr of gold; AngloGold Ashanti planned to increase production to about 3,400 kg/yr in 2013 and 2014 (AngloGold Ashanti Ltd., 2013, p. 11, 13, 39).

AngloGold Ashanti planned to produce between 41,400 and 44,400 kg of gold from all of its South African operations in 2013. The company expected its production to decrease to about 37,000 kg by 2016 without the development of new technology to mechanize its current operations and to increase the depths of its mines to as much as 5 km. The remaining life of AngloGold Ashanti's mines was estimated to be between 20 and 30 years; the company hoped to increase the life of its mines by between 50 and 100 years and recover an additional 2,200 t of gold (England, 2012; AngloGold Ashanti Ltd., 2013, p. 102).

Harmony Gold Mining Company Ltd. produced a total of 36,799 kg of gold from numerous mines in 2012; the company planned to increase its South African gold production to about 49,000 kg/yr by 2016. The company planned to increase production at the Doornkop Mine to about 6,100 kg/yr by 2016 from 3,187 kg in 2012. The Phakisa Mine produced 2,724 kg in 2012; full output was expected to be about 5,900 kg/yr. At the Kusasalethu Mine, production was likely to increase to about 8,900 kg/yr from 4,814 kg in 2012. The remaining life of the Kusasalethu Mine was estimated to be about 25 years; Phakisa, 21 years; and Doornkop, 16 years (Harmony Gold Mining Company Ltd., 2012, p. 14–15; 2013, p. 18, 46–47).

Harmony planned to maintain combined production at the Target 1 and Target 3 Mines at about 5,500 kg/yr. The company planned to maintain production of about 6,000 kg/yr at the Tshepong Mine; about 4,400 kg/yr at the Masimong Mine; about 3,600 kg/yr at the Bambanani Mine; and at about 2,100 kg/yr at

the Unisel Mine. In 2012, Harmony agreed to sell the Evander Mine to Pan African Resources plc of the United Kingdom (Harmony Gold Mining Company Ltd., 2013, p. 20).

Gold One International Ltd. produced 7,519 kg of gold in 2012 compared with 3,831 kg in 2011. The Cooke 1–3 Underground operations produced 3,062 kg in 2012; the Modder East Mine, 3,047 kg; and the Randfontein surface operations, 1,146 kg. Gold One purchased the Ezulwini Mine from First Uranium Corp. of Canada in 2012 (Gold One International Ltd., 2013, p. 7, 10, 12, 14).

Gold One planned to increase total production at the Cooke 1–3 Underground operations (which would include gold production from new uranium recovery operations), and at the Ezulwini, the Modder East, and the Randfontein surface operations to more than 12,000 kg in 2013 and to about 16,000 kg/yr from 2015 through 2020. At the Cooke 1–3 Underground operations, planned output was about 5,000 kg in 2014 and 7,000 kg/yr starting in 2016. Production at Modder East was expected to increase to about 5,000 kg/yr from 2013 through 2015 and subsequently to decrease to about 3,000 kg/yr from 2017 through 2019. Production at the Randfontein surface operations was likely to increase to more than 3,000 kg/yr by 2017, and at Ezulwini, to about 2,000 kg/yr by 2014. Gold One also planned to complete a feasibility study on the Ventersburg project in 2013 (Gold One International Ltd., 2013, p. 16, 25).

Village Main Reef produced a total of 5,068 kg of gold at the Buffelsfontein, the Consolidated Murchison, and the Tau Lekoa Mines in 2012. The company also produced 1,048 kg of gold at the Blyvoor Mine in the last 7 months of 2012 after purchasing the mine from DRDGold Ltd. (Village Main Reef Ltd., 2012; 2013, p. 1).

In 2012, DRDGold produced 4,417 kg of gold at the Ergo tailings retreatment operations, which are located near Johannesburg. Production increased in the second half of 2012 as greater volumes of tailings were processed. DRDGold also produced 1,181 kg of gold at the Blyvoor Mine in the first 5 months of 2012 (DRDGold Ltd., 2013).

Pan African Resources mined gold at the rate of about 3,000 kg/yr from the Barberton Mine. The company planned to increase the mine's capacity to about 3,600 kg/yr with a new tailings retreatment plant, which was expected to start production in June 2013. The estimated life of the Barberton Mine was 17 years (Cornish, 2013).

In 2012, Witwatersrand Consolidated Gold Resources Ltd. (Wits Gold) completed its prefeasibility study on a new mine at the DBM project. Reserves at DBM were estimated to be 23.5 Mt at a grade of 4.1 grams per metric ton gold. Depending on the results of a feasibility study that Wits Gold planned to complete in the second half of 2013, the company could start mining 47 months after the commencement of shaft sinking. Production was likely to be 6,200 kg/yr during the estimated 18-year life of the mine; peak output was planned to be nearly 7,700 kg in the ninth year of mining (Barradas, 2012).

Taung Gold International Ltd. of China planned to complete its feasibility study on the first phase of reopening the Evander Mine and the prefeasibility study on the second phase in mid-2012. The company planned to complete the feasibility study on the third phase by the end of March 2013.

Taung also planned to start a prefeasibility study on reopening the Jeannette Mine by the end of 2012. Depending on the results of the studies, mining was expected to restart at Evander 30 months after the start of the dewatering of the flooded mine shafts. Mining at Jeannette was likely to start by mid-2017. Planned production was about 11,800 kg/yr at Jeannette and 8,100 kg/yr at Evander; the estimated life of the mines was 30 years each. The projects also depended on securing financing. In June 2012, trading of Taung's stock was suspended (Lanham, 2012; Taung Gold International Ltd., 2012).

Rand Refinery (Pty) 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. In fiscal year 2012, Rand Refinery's production was more than 440,000 kg compared with 476,229 kg in fiscal year 2011 and 390,441 kg in fiscal year 2007. The company sourced 58% of its gold from foreign gold producers in 2011 compared with 34% in 2007 (Rand Refinery (Pty) Ltd., 2011, p. 43; 2013).

Iron Ore and Iron and Steel.—In 2012, iron ore production was about 67.1 Mt compared with 58.1 Mt in 2011 and 36.5 Mt in 2002 because of increased production from the Palabora and the Sishen Mines and the opening of the Khumani and the Kolomela Mines. From 2002 to 2012, employment in iron ore mining increased to 23,380 workers from 5,389 (Chamber of Mines of South Africa, 2012, p. 12, 16; 2013, p. 12, 16).

Kumba Iron Ore Ltd.'s iron ore production increased to 43 Mt in 2012 from 41.3 Mt in 2011. In 2012, the Sishen Mine produced 33.7 Mt; the Kolomela Mine, 8.5 Mt; and the Thabazimbi Mine, 0.8 Mt. The loss of about 5 Mt of output from a labor dispute at Sishen was more than offset by the rampup towards full capacity at Kolomela. The remaining life of Kolomela was estimated to be 29 years; Sishen, 18 years; and Thabazimbi, 6 years (Kumba Iron Ore Ltd., 2013, p. 3–4, 19, 46).

Production at Kolomela was expected to increase to reach the mine's full capacity of 9 Mt/yr in 2013. Kumba was engaged in a prefeasibility study on a capacity expansion to 15 Mt/yr. Depending on the results of the study, production from the Kolomela expansion project could start in 2017 and reach full capacity by 2019 (Kumba Iron Ore Ltd., 2013, p. 46–47).

Kumba planned to complete a feasibility study on the Phoenix project by 2015, which could extend the life of the Thabazimbi Mine by 20 years and produce 3.4 Mt/yr of iron ore starting in 2019. The company also planned to complete a prefeasibility study on the new Zandriverspoort project by 2015; this project could start production in 2019 and eventually ramp up to 6 Mt/yr. Kumba planned to increase the capacity of the Sishen Mine by 0.73 Mt/yr in 2013 and was engaged in studies on projects that could increase the mine's capacity by an additional 10 Mt/yr by 2019 (Kumba Iron Ore Ltd., 2013, p. 47–49).

Assmang produced iron ore at the Beeshoek and the Khumani Mines. In 2012, production at Beeshoek and Khumani increased to 15 Mt from 11.5 Mt in 2011. Assmang was ramping up its production at Khumani to 16 Mt/yr from 10 Mt/yr by mid-2013. Assmang started mining at the East Pit at Beeshoek, which increased production and was likely to prolong the mine's life by 20 years (African Rainbow Minerals Ltd., 2012a, p. 67, 70, 75; 2012b, p. 58; 2013, p. 58).

In 2012, Palabora Mining produced 5.28 Mt of magnetite at Palabora for domestic and international markets compared with 3.43 Mt in 2011. The company planned to commission a new drying plant that would increase its magnetite production capacity to 6 Mt/yr in the first quarter of 2013. Palabora Mining and the Government-owned Industrial Development Corp. were building a pilot pig iron plant at Palabora (Palabora Mining Co. Ltd., 2013, p. 21, 50, 146).

Evrz Highveld Steel and Vanadium Corp. Ltd. (a subsidiary of Evraz Group S.A. of Luxembourg) mined 1.78 Mt of magnetite from the Mapochs Mine in 2012 compared with 1.9 Mt in 2011. Iron ore from Mapochs was consumed in Highveld's steel mill at Witbank; the company's production of crude steel was 571,787 t in 2012 compared with 670,880 t in 2011. Highveld planned to increase its crude steel production to more than 760,000 t in 2013 (Evrz Highveld Steel and Vanadium Ltd., 2013, p. 16, 19).

Lead and Zinc.—The Black Mountain Mine produced copper, lead, and zinc. Lead mine production decreased by nearly 4%, and zinc mine production increased by about 1%. At the end of 2011, Exxaro Resources Ltd. shut down the Zincor refinery, which produced 73,000 t of refined zinc in 2011. Vedanta Resources plc of the United Kingdom planned to start production at the Gamsberg Mine by April 2015; the mine's full capacity of 475,000 t/yr was expected to be reached in 2017. The estimated life of the Gamsberg Mine was 16 years. Vedanta also planned to start production at a new zinc refinery with a capacity of 400,000 t/yr in 2016; the startup date of the refinery would depend on such factors as financing (Pitso, 2012).

Magnesium, Silicon, Titanium, and Zirconium.—Grupo FerroAtlántica was South Africa's only producer of silicon metal; the company also produced ferrosilicon. In December 2012, Grupo FerroAtlántica announced a partial shutdown of production for as much as 5 months starting at the beginning of 2013. Output losses were expected to be about 15,000 t of silicon metal (Ryan's Notes, 2012d).

Richards Bay Minerals (RBM) (BHP Billiton Ltd., 37%; Rio Tinto plc, 37%; Blue Horizon Investments, 24%; and RBM permanent employees, 2%) of the United Kingdom was South Africa's leading producer of ilmenite, rutile, and zircon. In 2011, RBM's titanium slag production increased to 1.02 Mt from 968,000 t in 2010; zircon, to 265,000 t from 220,000 t; and rutile, to 101,000 t from 85,000 t. BHP Billiton sold its share in RBM to Rio Tinto in September 2012 (BHP Billiton Ltd., 2012a, p. 28, 42).

From January 1 through June 15, 2012, Exxaro's KZN Sands project 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. The Namakwa Sands project produced at the rate of about 400,000 t/yr of ilmenite, 120,000 t/yr of zircon, and 39,000 t/yr of rutile. KZN Sands was likely to shut down at the end of 2012 because of resource depletion at the Hillendale Mine. In early 2012, the Government issued environmental and water permits for the construction of the Fairbreeze Mine, which would replace Hillendale. The new mine was expected to start production in the second half of 2014 and to have a capacity of 500,000 t/yr of ilmenite and 60,000 t/yr of zircon. Tronox Ltd. of the United States purchased a 74% share in the KZN Sands and the

Namakwa Sands projects in June 2012 and Exxaro purchased a 44.65% share in Tronox by yearend (Maphango, 2012; Exxaro Resources Ltd., 2013, p. 6–7).

Mineral Commodities Ltd. of Australia planned to start mining at the Tormin project in Western Cape Province in the first half of 2013. Output was expected to be about 38,200 t/yr of zircon and 4,800 t/yr of rutile; the estimated life of the mine was between 3 and 5 years (Maphango, 2012).

Rare Metal Industries (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., was considering the development of a new plant to produce 25,000 t/yr of magnesium, 15,000 t/yr of titanium, 10,000 t/yr of zirconium dioxide, 5,000 t/yr of silicon dioxide, 3,000 t/yr of silicon metal, 2,400 t/yr of ferrotitanium, and 2,000 t/yr of zirconium metal. The estimated cost of the plant was about \$2.1 billion (Buthelezi, 2012, p. 41–42).

Manganese.—In 2012, manganese ore production was about 8.94 Mt compared with 8.65 Mt in 2011 and 3.36 Mt in 2002 because of increased production from the Mamatwan, the Nchwaning, and the Wessels Mines and the opening of the Kalahari Mine. From 2002 to 2012, employment in manganese mining increased to 8,726 workers from 2,581 (Chamber of Mines of South Africa, 2012, p. 12, 18; 2013, p. 12, 18).

Assmang produced manganese ore at the Gloria and the Nchwaning Mines. Output at Gloria and Nchwaning decreased to about 3.09 Mt in 2012 from 3.44 Mt in 2011 because of safety stoppages and difficult geologic conditions. In late 2012, Assmang approved the expansion of Nchwaning's capacity to 4 Mt/yr from 3 Mt/yr. The company planned to complete its feasibility study on a further increase to 5 Mt/yr by mid-2013 (African Rainbow Minerals Ltd., 2012a, p. 65, 67, 77; 2012b, p. 58; 2013, p. 58–60).

In 2012, Assmang increased output to 357,000 t of ferromanganese from 311,000 t in 2011. The company increased its ferromanganese capacity by converting two of its furnaces at Machadodorp from ferrochromium to ferromanganese. Assmang's ferromanganese production was expected to increase further in 2013 because of the conversion (African Rainbow Minerals Ltd., 2012a, p. 65, 67, 77; 2012b, p. 58; 2013, p. 58).

Samancor 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 2012, Samancor's production of manganese ore increased to 3.66 Mt from 3.01 Mt in 2011. 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; Samancor Manganese was engaged in a feasibility study on the second phase in 2012. The estimated life of the Mamatwan Mine was 46 years, and the Wessels Mine, 21 years (BHP Billiton Ltd., 2012a, p. 34–35; 2012b, p. 4; 2013, p. 4).

In 2012, Samancor Manganese produced 340,000 t of manganese alloys at its Meyerton plant compared with 479,000 t in 2011. The plant had the capacity to produce 490,000 t/yr of ferromanganese and 120,000 t/yr of silicomanganese. The production of silicomanganese, which was more energy-intensive than ferromanganese, was shut down in January 2012.

Samancor Manganese was building a new ferromanganese furnace at Meyerton with a capacity of about 130,000 t/yr (BHP Billiton Ltd., 2012a, p. 34–35; 2012b, p. 4; 2013, p. 4).

Renova Group of Russia was engaged in a joint-venture project with Majestic Silver Trading (which was a BEE company) to mine the Kalahari manganese ore deposit. Manganese from the Kalahari deposit was consumed by Transalloys (Pty) Ltd. (a subsidiary of Renova) in the production of silicomanganese. Renova and its partners produced 2.16 Mt of lumpy ore at a grade of 37% manganese in 2011; the companies planned to increase output to 2.7 Mt/yr in 2012 (Ryan's Notes, 2011a; Tex Report, The, 2012b).

Transalloys produced 155,000 t of silicomanganese in 2011; the company increased its capacity to 180,000 t/yr from 165,000 t/yr in 2012. In early 2012, Transalloys' plant was not producing because the silicomanganese price of \$1,000 per metric ton was below production costs. By late November, the company was producing at full capacity. Transalloys was considering a further expansion of its capacity to 360,000 t/yr; high power costs could prevent approval of the project (Ryan's Notes, 2012d, j).

Ruukki Group Oyj of Finland's silicomanganese capacity at its Mogale plant was about 60,000 t/yr. The company was operating at about 50% of capacity in early 2012 because of problems with transformers. In mid-November, Ruukki closed one of its silicomanganese furnaces as part of a power buyback agreement with Eskom. In September, Manganese Metal Co. (MMC) was producing refined manganese metal at a rate of nearly 30,000 t/yr (Metal Bulletin, 2012; Ryan's Notes, 2012g, i).

ArcelorMittal of Luxembourg was engaged in a joint venture with IDC and Kalagadi Manganese (Pty) Ltd. (Kalahari Resources Ltd., 80%) to develop Kalagadi's manganese resources. ArcelorMittal and Kalahari (which was a BEE company) planned to start production at a new underground mine at Hotazel. Output was expected to be 3 Mt/yr of manganese ore; the companies had nearly completed a plant to beneficiate the mine's output into 2.4 Mt/yr of sintered ore by the end of 2012. About 1.7 Mt/yr of the mine's sintered output was likely to be exported. ArcelorMittal and Kalahari also planned to build a new ferromanganese plant at Coega with a capacity of 320,000 t/yr by 2015; the plant was expected to consume about 700,000 t/yr of the mine's sintered output. In late 2012, ArcelorMittal sold its 50% share in Kalagadi Manganese (Ryan's Notes, 2010, 2011a; Mining Journal, 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 held 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, 2013).

Asia Minerals Ltd. (AML) of Hong Kong planned to start large-scale production from a new mine at its Kudumane manganese project by the end of 2012. Production at full capacity was likely to be 2 Mt/yr of ore at a grade of between 37% and 38% manganese and 900,000 t/yr of ore at a grade of 42% manganese. By 2014, AML planned to complete a plant

at the minesite that would produce sintered ore at a grade of between 44% and 45% manganese (Tex Report, The, 2012a, b).

Nickel.—Most of South Africa's nickel mine production was a coproduct of PGM mining. Amplats produced 17,700 t of refined nickel in 2012 compared with 20,300 t in 2011. About 14,900 t was attributable to the company's PGM mining operations compared with 17,000 t in 2011. Impala Platinum Holdings Ltd. (Implats) produced 15,200 t of refined nickel in 2012, of which 4,100 t was attributable to the company's PGM mining operations (Impala Platinum Holdings Ltd., 2012, p. 76, 86, 93; 2013; Anglo American Platinum Ltd., 2013, p. 87).

ARM produced 19,248 of nickel at the Nkomati Mine in 2012 compared with 11,228 t in 2011. The company completed the expansion of its capacity to 20,500 t/yr from 5,000 t/yr in late 2012. ARM also expected to produce 10,000 t/yr of copper and 300 t/yr of cobalt at full capacity (African Rainbow Minerals Ltd., 2012a, p. 62–63; 2012b, p. 63; 2013, p. 64–65).

Platinum-Group Metals.—In 2012, platinum-group metal (PGM) mine production was 254,338 kg compared with 288,850 kg in 2011 and about 221,000 kg in 2002. From 2002 to 2012, the share of platinum in PGM production by volume decreased to 51% from 62%. During the same period, employment in PGM mining increased to 197,847 workers from 111,419 (table 1; Chamber of Mines of South Africa, 2012, p. 12, 31; 2013, p. 12).

Nearly 19,000 kg of platinum production was lost because of labor disputes in 2012; production losses for iridium, palladium, rhodium, and ruthenium were also substantial. Amplats lost about 9,300 kg of platinum production to labor disputes between mid-September and mid-November; Implats, nearly 4,700 kg during a 6-week period in the first quarter of 2012; and Lonmin, about 3,400 kg during a 6-week period in the third quarter of 2012. During the Lonmin dispute, 34 people were killed when police fired on striking workers on August 16. An additional 10 were killed in disputes between workers (Freeman, 2012; Maylie, 2012; Johnson Matthey plc, 2013, p. 17).

In 2012, Amplats produced 144,300 kg of refined PGMs compared with 148,800 kg in 2011. About 122,100 kg was attributable to mining operations of Amplats and its joint-venture partners in 2012, of which platinum accounted for 61,010 kg; palladium, 37,231 kg; rhodium, 8,572 kg; and other PGMs, about 12,700 kg (Anglo American Platinum Ltd., 2013, p. 87, 91–108).

In 2012, PGM production at Amplats' Mogalakwena Mine amounted to 21,026 kg; the Kroondal Mine, 13,580 kg; the Tumela Mine, 13,309 kg; the Union Mine, 12,979 kg; the Modikwa Mine, 9,539 kg; the Dishaba Mine, 8,473 kg; the Khuseleka Mine, 7,875 kg; the Mototolo Mine, 7,857 kg; the Batholope Mine, 7,614 kg; and the Khomanai Mine, 5,819 kg. From 2008 to 2012, output at Mogalakwena increased by 76% and output at Tumela and Union decreased by 27% each. Amplats' production target for 2013 was between 65,000 and 71,500 kg of refined platinum, which included toll refining (Anglo American Platinum Ltd., 2013, p. 91–108; Johnson Matthey plc, 2013, p. 15).

Bokoni Platinum Mines (Pty) Ltd. [Amplats, 62%, and Atlatsa Holdings Investments (Pty) Ltd., 26%] produced 3,196 kg of PGMs in 2012 compared with 3,534 kg in 2011. In 2012, the company moved its expansion plans to increase

production by 3,100 kg/yr up from 2020 to 2016 (van Vuuren, 2012; Atlatsa Resources Corp., 2013, p. 17).

Royal Bafokeng Platinum Ltd. (RBPlat) operated the Bafokeng-Rasimone Platinum Mine. Sales of PGMs were 9,046 kg in 2012, including 5,433 kg of platinum. RBPlat was building a new mine at the Styldrift project in 2012; the company planned to start production in the third quarter of 2015 and to ramp up to full capacity by the third 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. 27, 49–50).

In 2012, Implats produced 95,640 kg of refined PGMs compared with 109,900 kg in 2011. About 45,200 kg was attributable to Implats' mining operations, of which platinum accounted for about 21,700 kg; palladium, 13,200 kg; rhodium, 3,100 kg; and other PGMs, about 7,300 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., 2012, p. 57, 76, 86, 93; 2013).

The Impala Mines near Rustenburg in North West Province produced 39,557 kg of PGMs in 2012, of which 19,530 kg was platinum and 10,980 kg was palladium. Implats planned to increase platinum production to about 29,500 kg/yr by 2017 by sinking three new mine shafts (Impala Platinum Holdings Ltd., 2012, p. 76, 78–79; 2013; Johnson Matthey plc, 2013, p. 17).

In 2012, platinum output at Marula was about 2,160 kg, and palladium, about 2,230 kg. Implats planned to produce about 2,200 kg of platinum at Marula in 2013 and to increase output subsequently to 2,800 kg/yr (Impala Platinum Holdings Ltd., 2012, p. 84, 86; 2013).

ARM and Implats operated the Two Rivers Mine; output increased to 10,465 kg of PGMs in 2012 from 9,874 kg in 2011. Production was expected to be maintained at about 10,000 kg/yr of PGMs (African Rainbow Minerals Ltd., 2012a, p. 51, 61; 2012b, p. 63; 2013, p. 64–65).

Implats also planned to restart development of the Leeuwkop Mine, which was suspended during the worldwide financial crisis. The company planned to produce 4,500 kg/yr of platinum from UG2 ore; mining was expected to start in 2021 (Johnson Matthey plc, 2013, p. 15–16).

In 2012, Lonmin produced 41,504 kg of refined PGMs compared with 44,542 kg in 2011. Lonmin's mining operations produced 38,641 kg of PGMs in 2012, of which platinum accounted for 21,107 kg; palladium, 9,639 kg; ruthenium, 4,213 kg; rhodium, 2,776 kg; and iridium, 907 kg. Most of the mine production was attributable to the Marikana Mine. Lonmin planned to sell about 20,500 kg of platinum in its 2013 fiscal year (which ran from the beginning of October 2012 to the end of September 2013) and to subsequently increase production and sales to more than 23,000 kg/yr in fiscal year 2014 and fiscal year 2015 (Lonmin plc, 2012, p. 153–154; 2013; Johnson Matthey plc, 2013, p. 16).

Northam Platinum Ltd. operated the Zondereinde Mine; PGM production at Zondereinde increased to nearly 9,400 kg in 2012 from 8,700 kg in 2011. The company started underground operations at the Booyensdal Mine in 2012; the concentrator was likely to be commissioned in 2013. Northam planned to

produce about 5,000 kg/yr of PGMs at Booyssendal (Butler, 2011, p. 18–19; Johnson Matthey plc, 2013, p. 16).

Aquarius Platinum Ltd. operated the Everest Mine and had joint-venture agreements with Amplats for the Kroondal and the Marikana Mines. In 2012, platinum output at Everest decreased to 560 kg from more than 1,700 kg in 2011 because of difficult geologic conditions and low ore grades. Aquarius placed Everest on care-and-maintenance status in June 2012 (Johnson Matthey plc, 2013, p. 19).

Eastplats mined about 2,700 kg of PGMs at the Crocodile River Mine in 2012, of which more than 1,300 kg was platinum. In 2012, platinum production decreased by about 7% because of low PGM prices. Eastplats put the development of the new Mareesburg Mine on hold in mid-2012 (Eastern Platinum Ltd., 2013; Johnson Matthey plc, 2013, p. 18).

In late 2012, ARM and Norilsk completed the expansion of the Nkomati nickel mine. The companies planned to produce about 3,400 kg/yr of PGMs at Nkomati. Output increased to 2,883 kg in 2012 from 2,135 kg in 2011, of which about 2,000 kg was palladium and 750 kg was platinum (African Rainbow Minerals Ltd., 2012a, p. 62–63; 2012b, p. 63; 2013, p. 64–65; Johnson Matthey plc, 2013, p. 19).

Platmin Ltd. of Canada produced PGMs at the rate of nearly 2,700 kg/yr at Pilanesberg in the first 9 months of 2012 compared with 2,000 kg/yr during the same period in 2011. Mining was constrained by low ore grades and recovery rates (Johnson Matthey plc, 2013, p. 16, 18).

In 2012, Xstrata produced about 1,000 kg of PGMs at the Eland Mine compared with about 1,800 kg in 2010. Production decreased because of the transition from open pit to underground mining and labor disputes in October. Xstrata planned to increase PGM production to about 9,300 kg/yr by 2018 (Butler, 2011, p. 18–19; 2012, p. 16; Xstrata plc, 2013, p. 30, 35).

Platinum Australia Pty Ltd. (PLA) of Australia produced about 1,000 kg of PGMs at the Smokey Hills Mine in 2011; Smokey Hills was shut down in June 2012 because of low PGM prices and a lack of financing. In late 2012, Jubilee Platinum plc was considering a merger with PLA. Jubilee planned to reopen Smokey Hills in the second half of 2013 and to ramp up output to about 1,900 kg/yr starting in 2014 (Butler, 2012, p. 18; Johnson Matthey plc, 2013, p. 18).

Tharisa Minerals had the capacity to produce 1,200 kg/yr of PGM at the Tharisa Mine. In September 2012, the company had nearly completed an expansion of its capacity to nearly 4,900 kg/yr. Tharisa Minerals planned to ramp up PGM production to full capacity by the end of 2013. In 2012, Sylvania Platinum Ltd. produced nearly 1,300 kg of PGM from its five chromite tailings retreatment plants compared with about 1,500 kg in 2011 because of decreased grades (Projects in Progress, 2012b; Johnson Matthey plc, 2013, p. 18).

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 PGMs (not including ruthenium or iridium) at a new mine. Initial production at WBJV was likely to be in mid-2014; the estimated life of the mine was 20 years (Esterhuizen, 2012).

In 2012, Wesizwe was engaged in the development of the Bakubung Mine, which was expected to produce about 10,900 kg/yr of PGMs. The first module of the concentrator was expected to be commissioned in 2020; Wesizwe planned to reach full capacity at Bakubung in 2023 (Johnson Matthey plc, 2013, p. 18).

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 2012, the content of V_2O_5 in vanadium slag was 10,710 t at Mapochs; output was constrained by labor disputes. Highveld planned to increase production to about 15,500 t of V_2O_5 in 2013 (Evraz Highveld Steel and Vanadium Ltd., 2013, p. 16).

Vanchem Vanadium Products (Pty) Ltd. (a subsidiary of Duferco of Switzerland) purchased fine ore from the Mapochs Mine for processing into ferrovanadium and other products. From the beginning of October 2011 to the end of September 2012, Vanchem's output of contained vanadium was 4,516 t.

Xstrata produced V_2O_5 and ferrovanadium at the Rhovan Mine and smelter in Brits. In 2012, production of V_2O_5 at Rhovan amounted to 9,631 t, and ferrovanadium, 4,144 t (Xstrata plc, 2013, p. 35).

Industrial Minerals

Cement.—South Africa had four cement producers with a total capacity of 17.2 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).

By the end of 2013, Sephaku Cement (Pty) Ltd. (Dangote Industries Ltd. of Nigeria, 64%) planned to complete its new Aganang and Delmas cement plants in North West and Mpumalanga Provinces, respectively. The capacity at the Delmas plant was expected to be 1.4 Mt/yr and, at Aganang, 1.2 Mt/yr (International Cement Review, 2012).

Diamond.—In 2012, diamond production was 7.25 million carats compared with a revised 7.11 million carats in 2011 and 10.91 million carats in 2002 because of decreased production at the Cullinan, the Finsch, and the Venetia Mines. From 2002 to 2012, employment in diamond mining decreased to 12,176 workers from 16,346 (table 1; Chamber of Mines of South Africa, 2012, p. 12, 24; 2013, p. 12).

De Beers Group accounted for the majority of South Africa's rough diamond production. In 2012, the company's output decreased to 4.43 million carats from 5.44 million carats in 2011 because of shortages of equipment and skilled labor and the sale of the Finsch Mine. The Venetia Mine produced nearly 3.07 million carats in 2012; the Kimberley Surface Mining Operations, 755,000 carats; and the Voorspoed Mine,

611,000 carats. In 2012, De Beers approved the construction of an underground mine at Venetia that would extend the mine's life from 2021 to 2042. The company planned to produce 800,000 carats per year at Voorspoed. The remaining lives of the Kimberley Surface Mining Operations and the Voorspoed Mine were estimated to be 11 years each. Anglo American purchased CHL Holdings Ltd.'s 40% share in De Beers in 2012 (De Beers Group, 2013, p. 23; Mining Journal, 2013).

In 2012, diamond production at the Finsch Mine by Petra Diamonds Ltd. amounted to 1.3 million carats; the Cullinan Mine, 832,504 carats; the Kimberley Underground Mine, 92,975 carats; and the Koffiefontein Mine, 37,108 carats. The Helam, the Sedibeng, and the Star Mines were put on care-and-maintenance status in 2012. Petra planned to ramp up production at Cullinan to 2.4 million carats per year in 2019 and at Finsch to 1.9 million carats per year by 2018. 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, 2013; Petra Diamonds Ltd., 2013, p. 10–15).

Trans Hex Group produced 61,204 carats from alluvial operations on the lower Orange River in 2012 and Rockwell Diamonds Ltd. produced about 16,000 carats from alluvial operations on the middle Orange River. Namaqua Diamonds Ltd. mined about 30,000 carats from alluvial deposits in North West Province (Janse, 2013).

By October 2012, Diamcor Mining Inc. of Canada had commissioned its processing plant at the Krone-Endorda Mine, which was adjacent to the Venetia Mine. Diamcor planned to start large-scale production by late 2012 or early 2013. Initial output was expected to be 120,000 carats per year; the company hoped to identify additional resources that would increase the life of the mine to 15 years from between 7 and 10 years. Depending on the discovery of additional resources, production could increase to 240,000 carats per year. DiamondCorp plc of the United Kingdom planned to reopen the Lace Mine in 2013 (Caulfield, 2012; Janse, 2013).

Fluorspar.—Minerales y Productos Derivados S.A. (Minersa) of Spain held an 85% share in the Vergenoeg Mine, which was South Africa's only active fluorspar mine at the end of 2012. In 2009, Minersa started the expansion of Vergenoeg's capacity to 300,000 t/yr from 180,000 t/yr. By October 2012, capacity had reached 250,000 t/yr (Hodge, 2012).

Fluormin plc acquired a 63% share in Sallies Ltd., which held the Witkop Mines. Sallies restarted mining operations at Witkop, which had a capacity of 140,000 t/yr of acid-grade fluorspar, in March 2011. The mine was placed 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 (Fluormin plc, 2012; Hodge, 2012).

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 (AlF₃). National consumption of AlF₃ was estimated to be about 28,000 t/yr, all of which was imported (Sephaku Fluoride Ltd., 2013, p. 4, 18, 21).

As of March 2012, Eurasian Natural Resources Corp. plc of the United Kingdom planned to conduct a feasibility study on the development of a new mine at the Doornhoek project. Depending on the results of the study, production at Doornhoek could be about 240,000 t/yr of acid-grade fluorspar (Hodge, 2012).

Kyanite and Related Minerals.—South Africa was the world's leading producer of andalusite. 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. The company planned to increase capacity to 290,000 t/yr by mid-2014 through debottlenecking programs at the Krugerspost and the Thabazimbi Mines and the opening of the Segorong Mine. Expansion plans were subsequently revised to a combined capacity of 250,000 t/yr (Feytis, 2011; Carmichael and Lismore-Scott, 2013).

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 2012, phosphate rock production decreased to 2.24 Mt from nearly 2.57 Mt in 2011. Foskor planned to increase its capacity to 4 Mt/yr from 2.8 Mt/yr by 2016; the company also planned to increase the capacity of its phosphoric acid and granular fertilizer plants to 1 Mt/yr each. By 2017, Foskor 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. The company planned to reopen Sasol Ltd.'s phosphoric acid plant, which had a capacity of 300,000 t/yr of P₂O₅ (Muravha, 2012).

Rare-Earth Elements and Thorium.—The Steenkampskraal Mine in Western Cape Province produced rare-earth elements from monazite from 1953 to 1963; Great Western Minerals Group Ltd. (GWMG) of Canada planned to reopen the mine in the first quarter of 2013. 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. GWMG also planned to process thorium from the monazite and store it until demand increased (Great Western Minerals Group Ltd., 2013, p. 18, 22).

In December 2011, Frontier Rare Earths Ltd. of Luxembourg signed a joint-venture agreement with Korea Resources Group (Kores) to develop the Zandkopsdrift rare-earths project.

Frontier planned to complete a prefeasibility study on a new mine at Zandkopsdrift in 2013 and a feasibility study in 2014. Depending on the results of the studies, Frontier and Kores could start mining at the Zandkopsdrift monazite deposit by late 2015. The mine's production would be processed at a rare-earths separation plant at Saldhanha with a capacity of 20,000 t/yr of rare-earth oxides (Frontier Rare Earths Ltd., 2013, p. 32, 43).

Vermiculite.—South Africa was the world's leading producer of vermiculite. In 2012, Palabora Mining's production at the Palabora Mine decreased by 22% because of 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. The life of the mine was estimated to be 24 years with production at the full capacity of 200,000 t/yr. Palabora Mining hoped to identify additional reserves; the company was engaged in a study on increasing production to between 300,000 t/yr and 400,000 t/yr (Elliott, 2012; Palabora Mining Co. Ltd., 2013, p. 51, 149).

Wollastonite.—Namaqua Wollastonite (Pty) Ltd., which was South Africa's last remaining producer of wollastonite, shut down its mining operations in 1999. The company restarted mining at Magata in Northern Cape Province in 2010. Namaqua's long-term production target was 12,000 t/yr for export to Europe and the United States. Wollastonite from Magata was likely to be used as a substitute for asbestos (Patel, 2012).

Mineral Fuels and Related Materials

Coal.—In 2012, coal production was about 258.6 Mt compared with a revised 250.7 Mt in 2011 and 220.3 Mt in 2002. From 2002 to 2012, employment in coal mining increased to 83,240 workers from 47,469 (table 1; Chamber of Mines of South Africa; 2012, p. 12, 19; 2013, p. 12).

Anglo American's coal production was 57.1 Mt in 2012, which was nearly unchanged from that of 2011. The New Vaal Mine produced 17.6 Mt in 2012; the Kriel Mine, 8.1 Mt; the Isibonelo Mine, 5.4 Mt; the Zibulo Mine, 5.03 Mt; the Goedehoop Mine, 4.86 Mt; the Landau Mine, 4.27 Mt; the Kleinkopje Mine, 3.77 Mt; the New Denmark Mine, 3.4 Mt; the Greenside Mine, 2.88 Mt; and the Mafube Mine, 1.8 Mt. Anglo American was considering the development of the New Largo Mine and the Elders project, which could produce 11 Mt/yr and 3.1 Mt/yr of coal, respectively (Anglo American plc, 2013, p. 17, 231).

In 2012, Exxaro mined 40 Mt of coal compared with 42 Mt in 2011. The Grootegeluk Mine produced 17.5 Mt in 2012; the Matla Mine, 10.9 Mt; the Leeuwpan Mine, 3.84 Mt; the North Block Complex, 2.72 Mt; and the Arnot Mine, 2.08 Mt. Exxaro completed the expansion of the Grootegeluk Mine's capacity by 14.6 Mt/yr in 2012; full production was expected by 2016 (Exxaro Resources Ltd., 2013, p. 6, 30).

By 2013, Exxaro planned to complete feasibility studies on the development of the new Belfast and Thabametsi Mines. Depending on the results of the studies, production at full capacity could be 19.8 Mt/yr at Thabametsi and between 3 and 5 Mt/yr at Belfast. Mining could start at Thabametsi in 2015 and ramp up to the full capacity of 19.8 Mt/yr by 2025. At Belfast,

the planned starting date of 2014 could be postponed because of delays in completing the feasibility study (Exxaro Resources Ltd., 2012, p. 34, 37; 2013, p. 30).

In fiscal year 2012, Sasol Ltd.'s salable coal production increased to 38.4 Mt from 37.3 Mt in fiscal year 2011; output increased at four of the company's mines. Total production was 40 Mt, of which the Syferfontein Mine accounted for 10 Mt; the Middelbult Mine, 7.4 Mt; the Bosjesspruit Mine, 7.3 Mt; the Brandspruit Mine, 7.1 Mt; the Twistdraai Mine, 6.3 Mt; and the Sigma Mine, 1.9 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., 2012, p. 43, 45).

BHP Billiton Energy Coal South Africa Ltd. (BECSA) produced coal at the Khutala, the Klipspruit, and the Middelburg Mines in Mpumalanga Province. In 2012, BECSA produced 32.6 Mt of coal compared with 33.9 Mt in 2011. The Middelburg Mine accounted for 15.3 Mt of sales in 2012; Khutala, 10.5 Mt; and Klipspruit, 8.05 Mt (BHP Billiton Ltd., 2012b, p. 4; 2013, p. 4; Chamber of Mines of South Africa, 2013, p. 20).

In 2012, Xstrata's coal production amounted to about 20.7 Mt. The Goedgevonden Mine produced 7.67 Mt; the Impunzi Division, 5.8 Mt; the Tweefontein Underground Mine, 4.41 Mt; and the Tweefontein Opencast Mine, 2.81 Mt. Xstrata and ARM reached full capacity at Goedgevonden in 2012. The companies started a prefeasibility study on an expansion and planned to complete a feasibility study by late 2014. Xstrata was engaged in an expansion of the Tweefontein Opencast Mine's capacity to 7 Mt/yr from 4 Mt/yr; the project was likely to be completed in 2015. The Mpumalanga Division was sold at the end of 2011 (African Rainbow Minerals Ltd., 2012a, p. 79; Xstrata plc, 2013, p. 23–24, 32).

Optimum Coal Holdings (Pty) Ltd. operated the Optimum and the Koornfontein Mines, which produced a total of 13.6 Mt in 2012. Sales from Koornfontein were 2.94 Mt in 2012. Optimum planned to produce an additional 1.9 Mt/yr of salable coal from the Koornfontein 4 Seam project; construction was expected to start in 2013. The company was also engaged in feasibility studies on the Remhoogte, the Schoonoord, and the TNC projects. Depending on the results of the studies, TNC and Schoonoord could produce 3.5 Mt/yr and 1.3 Mt/yr, respectively, of run-of-mine coal starting in 2015. Remhoogte could produce 2.5 Mt/yr of salable coal starting in 2016. Glencore International plc of Switzerland purchased a 64.13% interest in Optimum in 2012 (Optimum Coal Holdings (Pty) Ltd., 2011, p. 35–36; Glencore International plc, 2012, p. 20; 2013, p. 6–7; Chamber of Mines of South Africa, 2013, p. 20).

Shanduka Coal (Pty) Ltd. (Shanduka Group, 50.01%, and Glencore, 49.99%) operated the Graspan, the Middelburg Townlands, and the Springlake Mines, which together produced 6.46 Mt of salable coal in 2012. The company planned to complete feasibility studies on new mines at the Argent and the Springboklaagte projects by April 2013. Depending on the results of the studies, Springboklaagte and Argent could produce 3.6 Mt/yr and 2 Mt/yr, respectively, of run-of-mine coal starting in 2015 (Glencore International plc, 2012, p. 20; 2013, p. 6–7).

Umcebo Mining Ltd. (Glencore, 43.66%) produced 7 Mt from the Kleinfontein, the Klippan, and the Middelkraal Mines in 2012. In December, Umcebo started mining at the Wonderfontein Mine; output was likely to be about 2.7 Mt/yr of salable coal (ResearchViews, 2011; Glencore International plc, 2013, p. 6).

Total Coal South Africa (Pty) Ltd.'s (TCSA) sales from the Dorstfontein West Mine and the Dorstfontein East Mine combined were 2.08 Mt; the Forzando North Mine and the Forzando South Mine combined, 1.54 Mt; and the Tumelo Mine, about 420,000 t. TCSA planned to produce 1.8 Mt/yr of salable coal at the Dorstfontein East Mine. The lives of the Dorstfontein East, the Forzando North, and the Forzando South Mines was estimated to be more than 20 years each. The Dorstfontein West and the Tumelo Mines were expected to be shut down in 2014 (Chamber of Mines of South Africa, 2013, p. 20).

In 2012, sales from Coal of Africa Ltd.'s Vuna and Woestalleen Mines were 2.52 Mt; the Mooiplaats Mine, about 743,000 t; and the Vele Mine, 136,000 t. The company started mining at Vele in 2012; production was expected to reach 1 Mt/yr by mid-2013. Coal of Africa hoped to increase production eventually to 1.5 Mt/yr and then to 2.5 Mt/yr in the second phase of the project (Naidoo, 2012; Chamber of Mines of South Africa, 2013, p. 20).

Kangra Group (Pty) Ltd. (Shanduka Group, 30%) sold 3.18 Mt of coal from the Savmore Mine in 2012. The company was engaged in a feasibility study on a new mine at the Kusipongo project, which could produce 4 Mt/yr of run-of-mine coal starting in 2015, depending on the results of the study (Glencore International plc, 2012, p. 20; Chamber of Mines of South Africa, 2013, p. 20).

In September 2012, Keaton Energy Holdings Ltd. was producing coal at the Vanggatfontein Mine at a rate of 2 Mt/yr, and at the Vaalkranz Mine at a rate of nearly 380,000 t/yr. Keaton planned to increase its output to about 5 Mt/yr between late 2015 and late 2017. The company completed a feasibility study on a new mine at the Braakfontein project with favorable results, and Keaton was also engaged in a feasibility study on a new mine at the Sterkfontein project (Wait, 2012).

In 2012, Continental Coal Ltd.'s sales from the Vlakvarkfontein Mine were about 1.09 Mt, and from the Ferreira Mine, about 482,000 t. Continental planned to sell 200,000 t of coal from the new Penumbra Mine in fiscal year 2013 and 500,000 t in fiscal year 2014. The company also planned to make an investment decision on the De Wittekrans project in 2013; the project could produce 2.4 Mt/yr of salable coal during its estimated 33-year life (Chamber of Mines of South Africa, 2013, p. 20; Continental Coal Ltd., 2013).

Wescoal Holdings Ltd. operated the Khanyisa Mine, which was expected to be depleted by mid-2013. The company planned to start mining at the new Intabane Mine in February 2013 and at the new Elandspruit Mine in late 2013 or early 2014. By 2016, Wescoal planned to produce a combined 4 Mt/yr at Elandspruit and Intabane (Hoeane, 2012; Kolver, 2012).

Universal Coal plc of the United Kingdom planned to start development at the Kangala project in 2013 and mining in 2014 pending an agreement with Eskom. Production was expected to be 2 Mt/yr (Universal Coal plc, 2012, p. 2).

Resource Generation Ltd. (Resgen) of Australia planned to start construction on its new Boikarabelo Mine in early 2013 and to start mining in 2015. Production was likely to be 4 Mt in 2015, 5 Mt in 2016, and 6 Mt in 2017. In the first phase of the project, about 3 Mt/yr of thermal coal would be consumed domestically and 3 Mt/yr would be exported. By 2019 or 2020, production was expected to increase to between 18 and 20 Mt/yr of salable coal. Reserves at Boikarabelo were estimated to be 744 Mt (Williams, 2012).

Petroleum.—South Africa had four petroleum refineries with a combined capacity of about 508,000 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. The refinery was likely to be completed in 2017 (Quinlan, 2012).

Uranium.—AngloGold Ashanti and First Uranium mined uranium as a coproduct of gold. From 2002 to 2012, national uranium production decreased by 45% because of decreased gold production. In 2012, AngloGold Ashanti's production of uranium oxide (U_3O_8) from its Kopanang and surface mining operations was 549 t compared with 626 t in 2011. With the purchase of First Uranium's Mine Waste Solutions 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 (AngloGold Ashanti Ltd., 2012; 2013, p. 38–39; Chamber of Mines of South Africa, 2013, p. 39).

Gold One was engaged in a feasibility study on the Cooke Uranium project, which would recover uranium from the Cooke Tailings Dam and the Cooke 1–3 Underground operations. Depending on the results of the study, uranium production could start by 2015. Gold One planned to produce about 1,100 t/yr of U_3O_8 from 2016 through 2022 and about 650 t/yr from 2023 through 2026 (Gold One International Ltd., 2012, p. 21–22, 24).

Outlook

Numerous producers are planning new mines and plants and capacity expansions of existing operations for andalusite, antimony, cement, chromite, coal, diamond, ferrochromium, ferromanganese, fluorspar, gold, ilmenite, iron ore, magnesium metal, manganese ore, PGMs, phosphate rock and fertilizers, rare-earth elements, rutile, titanium metal, uranium, vermiculite, wollastonite, zinc, zircon, 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.

In 2011, the cost of power for South Africa's ferrochromium producers was estimated to be \$0.22 per pound of ferrochromium smelted compared with \$0.27 per pound in China. By 2015, the cost of power was expected to be \$0.39 per pound in South Africa and \$0.32 per pound in China. Total South African ferrochromium production costs were likely to increase to \$1.30 per pound in 2015 from \$0.98 per pound in 2011, and Chinese costs, to \$1.19 per pound from \$1.03 per pound (Merafe Resources Ltd., 2012).

Increases in coal, iron ore, and manganese exports depend upon increased capacity on the rail network. Transnet planned to spend about \$37 billion on expanding its railways between 2012 and 2019. The capacity of railways 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 11.7 Mt/yr from 4.7 Mt/yr (Transnet, 2012, p. 7–8).

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TABLE 1
 SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2008	2009	2010	2011	2012
METALS					
Aluminum metal, primary	811,000	809,000	807,000	809,000	665,000
Antimony concentrate, Sb content	3,983	2,673	3,239 ^r	3,175 ^r	3,800 ^e
Chromium, gross weight:					
44% to 48% chromic oxide	2,135	1,296	808	1,070	1,073
Less than 44% chromic oxide	7,547	6,265	10,063	10,795	10,237
Total	9,682	7,561	10,871	11,865	11,310
Cobalt:					
Mine output, Co content ^e	590	610	1,800	1,600 ^r	2,500
Refinery output	244	238	840	862	1,102
Copper:					
Mine, Cu content	108,700	107,600	102,600	96,600	81,000
Metal:					
Smelter	94,800	86,900	75,900	82,400	62,300
Refined, primary	92,972	89,453	81,129	86,166	66,416
Gold:					
Mine	212,571	197,628	188,702	180,293 ^r	154,178
Refined ²	402,839 ^r	389,596 ^r	385,244 ^r	476,229 ^r	440,000 ^e
Iron and steel:					
Ore and concentrate:					
Gross weight	48,983	55,313	58,709	58,057 ^r	67,100
Fe content (62% to 65%)	30,800	34,800	36,900	36,500	42,000 ^e
Metal:					
Direct-reduced iron	1,178	1,340	1,120	1,414	1,493
Pig iron	5,138	4,444	5,429	4,604	4,599
Ferroalloys, electric arc furnace:					
Chromium ferroalloys	3,269	2,346	3,607	3,426	3,063
Ferromanganese	434 ^r	239	460	535 ^r	510 ^e
Ferrosilicon	135	110	128 ^r	124 ^r	91 ^e
Ferrovandium ^e	19	14	19	19	18
Silicomanganese ³	237	135	274	314	149
Silicon metal	52	39	46 ^r	59 ^r	43 ^e
Total ^c	4,210	2,880	4,530	4,480 ^r	3,870
Steel:					
Crude	8,246	7,484	7,617	7,546	6,938
Stainless	528	547	478	460 ^e	420 ^e
Lead:					
Concentrate, Pb content	46,440	49,149	50,625	54,460	52,489
Refined, secondary	62,000	58,000	51,000 ^r	56,000 ^r	55,000 ^e

See footnotes at end of table.

TABLE 1—Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2008	2009	2010	2011	2012	
METALS—Continued						
Manganese:						
Ore and concentrate, gross weight:						
Metallurgical:						
More than 48% manganese	thousand metric tons	712	--	847	128	200
45% to 48% manganese	do.	2,897	2,121	1,683	2,742	2,711
40% to 45% manganese	do.	1,192	498	843	1,181	1,187
30% to 40% manganese	do.	1,996	1,949	3,783	4,584	4,833
Total	do.	6,797	4,568	7,156	8,636	8,931
Chemical, 35% to 65% manganese dioxide	do.	9	11	15	16	12
Grand total	do.	6,806	4,579	7,172	8,652	8,943
Metal, electrolytic ^e	do.	20	11	20	29 ⁴	30 ⁴
Nickel:						
Mine output, concentrate, Ni content		31,675	34,605	39,960	43,321	45,945
Metal, electrolytic		29,400	34,200	34,700	35,900	32,900
Platinum-group metals:						
Mine:						
Iridium	kilograms	6,415	6,378	6,445	6,813	5,665
Palladium	do.	75,537	75,117	82,222	82,731	74,738
Platinum	do.	146,141	140,819	147,790	148,008	128,590
Rhodium	do.	19,348	20,007	20,001	20,332	17,810
Ruthenium	do.	28,236	29,071	30,846	30,966	27,535
Total	do.	275,677	271,393	287,304	288,850	254,338
Refined:						
Palladium	do.	80,640	86,610	94,990	89,640	84,800
Platinum	do.	149,900	149,500	156,600	155,900	141,700
Rhodium	do.	20,000	21,600	21,400	21,300	19,300
Other ⁵	do.	32,900	34,600	37,600	36,400	32,400
Total	do.	283,400	292,300	310,600	303,200	278,200
Silver, mine	do.	75,199	77,780	79,315	73,180	67,304
Titanium:						
Ilmenite concentrate ^e	thousand metric tons	1,900	1,900	1,700	2,000	2,100
Rutile concentrate	do.	134 ^r	136	130	149 ^r	150 ^e
Total ^e	do.	2,030	2,220	1,840	2,130	2,250
Titaniferous slag	do.	1,252 ^r	1,084 ^r	1,252 ^r	1,346 ^r	1,400 ^e
Uranium, U ₃ O ₈ content		654	629	682	656	551
Vanadium, vanadium metal content		20,295	14,353	22,606	21,652	19,957
Zinc:						
Concentrate, Zn content		29,002	28,159	36,142	36,629	37,034
Metal, smelter, primary		87,000	87,000	90,000	73,000	--
Zirconium concentrate (baddeleyite and zircon)		404,000 ^r	372,000 ^r	381,000	428,000 ^r	380,000 ^e
INDUSTRIAL MINERALS						
Andalusite		216,667	165,217	189,185 ^r	186,242 ^r	200,000 ^e
Cementitious products:						
Cement, finished product, sales	thousand metric tons	13,473	11,784	10,870	11,234	11,560
Granulated slag, fly ash, and others, sales	do.	1,396	1,200 ^e	1,100 ^e	1,200 ^e	1,200 ^e
Total	do.	14,869	13,000 ^e	12,000 ^e	12,400 ^e	12,800 ^e
Clays:						
Attapulgit		69,876	54,418	85,336	14,448	15,580
Bentonite		44,067	40,340	54,311	120,417	120,566
Brick clay, local sales	thousand metric tons	9,706	8,763	6,923	7,658	7,179
Fire clay		138,100	120,162	551,612	785,641	643,285
Flint clay, raw and calcined		47,290	37,227	39,690	29,968	21,065
Kaolin		39,197	31,048	29,929	15,220	20,499

See footnotes at end of table.

TABLE 1—Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2008	2009	2010	2011	2012
INDUSTRIAL MINERALS—Continued					
Diamond, natural:					
Gem ^c thousand carats	5,200	2,500	3,600	2,800	2,900
Industrial ^c do.	7,700	3,600	5,400	4,300	4,300
Total do.	12,895	6,113	8,868	7,112 ^r	7,245
Feldspar	105,815	101,394	94,307	101,559	94,458
Fluorspar:					
Acid-grade ^c	281,000	196,000	150,000	225,000	210,000 ^r
Metallurgical-grade ^c	18,000	8,000	10,000	15,000	15,000 ^r
Total	299,000	204,000	160,000	240,000	225,000 ^e
Gypsum, crude	571,343	597,571	513,310	476,118	558,242
Industrial or glass sand (silica) thousand metric tons	3,342	2,306	2,905	2,722	2,151
Lime do.	1,563	1,368	1,291	1,539	1,209
Magnesite, crude	83,900	47,600	27,700 ^r	31,900 ^r	31,000 ^e
Mica, scrap and ground	426	572	904	633	400
Nitrogen, N content of ammonia ^c	510,000	510,000	470,000	470,000	470,000
Perlite	NA ^r	NA ^r	NA ^r	NA ^r	NA
Phosphate rock:					
Gross weight thousand metric tons	2,287	2,237	2,494	2,565	2,242
Phosphorus pentoxide content do.	858	839	935	962	841
Pigments, mineral, natural:					
Ochers	39	--	--	--	--
Oxides	--	183	244	266	--
Total	39	183	244	266	--
Salt	429,888	408,422	394,493	381,177	399,135
Sodium sulfate, natural	38,717	43,835	37,369	38,290	36,435
Stone, n.e.s.: ⁶					
Dimension:					
Granite and norite	457,965	334,589	272,531	227,154	187,475
Slate	25,538	25,841	48,114	53,643	23,938
Crushed and broken:					
Limestone and dolomite thousand metric tons	23,481	18,568	17,927	16,980	17,269
Shale:					
For cement do.	418	462	388	404	422
Other do.	814	975	570	655	549
Total do.	1,232	1,437	958	1,059	971
Aggregate and sand, n.e.s. ⁶ do.	58,608	53,604	52,356	52,286	53,374
Sulfur:					
S content of pyrite do.	61	60	30	--	-- ^e
Byproduct:					
Metallurgy do.	187	185	141 ^r	174 ^r	133 ^e
Petroleum do.	323	291	205 ^r	163 ^r	124 ^e
Total do.	571	536	376 ^r	336 ^r	257
Talc and related materials:					
Talc	5,145	4,718	3,150	4,453	4,765
Pyrophyllite (wonderstone)	80,704	114,889	122,511	121,368	18,734
Vermiculite	199,764	193,334	199,285	170,571	132,886
Wollastonite	--	--	--	2,400 ^e	2,400 ^e

See footnotes at end of table.

TABLE 1—Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	2008	2009	2010	2011	2012	
MINERAL FUELS AND RELATED MATERIALS						
Coal (salable product):						
Anthracite	thousand metric tons	2,207	1,658	2,074	2,554	3,005
Bituminous	do.	250,492	240,880	252,448	248,153 ^r	255,571
Total	do.	252,699	250,538	254,522	250,707 ^r	258,576
Natural gas	million cubic meters	1,623 ^r	1,368 ^r	1,718 ^r	1,516 ^r	1,313
Petroleum: ⁷						
Crude	thousand 42-gallon barrels	1,976	1,070	1,358	591	343
Refinery products:						
Liquefied petroleum gases	do.	3,387 ^r	2,726 ^r	3,086 ^r	3,666 ^r	3,600 ^e
Natural gas liquids	do.	1,529	1,529	1,456	1,456	1,400 ^e
Gasoline	do.	52,528 ^r	48,766 ^r	49,773 ^r	53,236 ^r	52,000 ^e
Jet fuel	do.	12,529 ^r	11,681 ^r	10,951 ^r	12,410 ^r	12,000 ^e
Kerosene	do.	3,077 ^r	3,092 ^r	2,644 ^r	2,806 ^r	2,800 ^e
Distillate fuel oil	do.	45,275 ^r	40,329 ^r	50,265 ^r	56,450 ^r	56,000 ^e
Residual fuel oil	do.	20,746 ^r	14,525 ^r	15,205 ^r	14,399 ^r	14,000 ^e
Other, includes lubricants and greases ^e	do.	15,000	14,500	14,500	14,500	14,000
Total ^{e, 8}	do.	154,000 ^r	137,000 ^r	148,000 ^r	159,000 ^r	156,000

^eEstimated; estimated data are rounded to no more than three significant figures; may not add to totals shown. ^rRevised. do. Ditto. NA Not available. -- Zero.

¹Table includes data available through January 10, 2014.

²Data are for the Rand Refinery (Pty) Ltd. fiscal year ending September 30 of the year listed.

³Reported by the International Manganese Institute.

⁴Reported figure.

⁵May include small amounts of gold.

⁶Not elsewhere specified.

⁷In addition, Sasol Ltd. produced about 67 million barrels per year of synthetic liquid petroleum fuels from coal.

⁸Excludes refinery fuel and losses.

TABLE 2
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(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	715.
Do.	do.	Bayside smelter at Richards Bay	95.
Andalusite	Samrec Pty. Ltd. [Imerys (Pty) Ltd., 100%]	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 Mine, 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, Port Elizabeth, Riebeeck, and Slurry plants	8,000.
Do.	Alpha Ltd. [AfriSam Consortium (Pty) Ltd., 48.5%]	Dudfield, Rooderport, 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	1,600.
Chromite	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	1,500.
Do.	Tharisa Minerals (Pty) Ltd.	Tharisa Mine	1,920.
Do.	Hernic Ferrochrome (Pty) Ltd. (Mitsubishi Corp., 51%)	Bokfontein Mine	1,500.
Do.	Assmang 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	1,400. ^c
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	520. ^c
Do.	Bayer (Pty) Ltd.	Rustenburg Chrome Mine	450.
Do.	Anglo American Platinum Ltd. (Amplats) (Anglo American plc, 74.1%)	Bathopele, Dishaba, Khomanani, Khuseleka, Mogalakwena, Siphumelele, Thembelani, Union, and other mines	430. ^c
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.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(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%)	Grootegeluk Mine in Limpopo Province	33,400.
Do.	do.	Matla Mine in Mpumalanga Province	14,000.
Do.	do.	Arnot Mine in Mpumalanga Province	5,000.
Do.	do.	North Block Complex in Mpumalanga Province	3,300.
Do.	do.	Leeuwpans Mine in Mpumalanga Province	3,000.
Do.	do.	New Clydesdale Mine in Mpumalanga Province	1,400.
Do.	do.	Tshikondeni Mine in Limpopo Province	316.
Do.	Exxaro Resources Ltd. (BEE Holdco, 52.3%), 50%, and Anglo American plc, 50%	Mafube Mine	4,200.
Do.	Sasol Ltd.	Syferfontein Mine	9,700.
Do.	do.	Middelbult Mine	8,500.
Do.	do.	Brandspruit Mine	8,400.
Do.	do.	Bosjesspruit Mine	8,200.
Do.	do.	Twistdraai Mine	6,400.
Do.	do.	Sigma Mine	2,000.
Do.	BHP Billiton Energy Coal South Africa Ltd. (BECSA)	Middelburg Mine in Mpumalanga Province	18,500.
Do.	do.	Khutala underground mine	15,100.
Do.	do.	Klipspruit Mine in Mpumalanga Province	8,000.
Do.	Xstrata plc, 79.8%	Impunzi Division at Witbank	9,400.
Do.	Xstrata plc, 74%	Goedgevonden Mine at Witbank	7,000.
Do.	do.	Tweefontein Division at Witbank	6,200.
Do.	Optimum Coal Holdings (Pty) Ltd.	Optimum Mine	13,500.
Do.	do.	Koornfontein Mines	5,200.
Do.	Umcebo Mining Ltd. (Glencore International plc, 43.66%)	Kleinfontein, Klippan, and Middelkraal Mines	6,400. ^c
Do.	do.	Wonderfontein Mine	2,700.
Do.	Shanduka Coal (Pty) Ltd. (Shanduka Group, 50.01%, and Glencore International plc, 49.99%)	Graspan, Middelburg Townlands, and Springlake Mines	7,000.
Do.	Total Coal South Africa (Pty) Ltd.	Dorstfontein West and Dorstfontein East Mines	2,100. ^c
Do.	do.	Forzando North and Forzando South Mines	1,600. ^c
Do.	do.	Tumelo Mine	450. ^c
Do.	Coal of Africa Ltd.	Vuna and Woestalleen Mines	2,500.
Do.	do.	Mooiplaats Mine	2,000.
Do.	do.	Vele Mine	1,000.
Do.	Kangra Group (Pty) Ltd. (Shanduka Group, 30%)	Savmore Mine	3,200. ^c
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.	Kuyasa Mining (Pty) Ltd.	Delmas Mine	2,000.
Do.	Continental Coal Ltd.	Vlakovarkfontein Mines	1,100. ^c
Do.	do.	Ferreira Mine	500. ^c
Do.	do.	Penumbra Mine	500.
Copper:			
Mine	Palabora Mining Co. Ltd. (Rio Tinto Ltd., 57.7%, and Anglo American plc, 16.8%)	Palabora Mines at Phalaborwa	65. ²
Do.	Anglo American Platinum Ltd. (Amplats)	Bathopele, Dishaba, Khomanani, Khuseleka, Mogalakwena, Siphumelele, Thembelani, Union, and other mines	13. ²
Do.	Nkomati Joint Venture	Nkomati Mine in Mpumalanga Province	10.
Do.	Impala Platinum Holdings Ltd. (Implats)	Impala Mines	7. ²
Do.	Black Mountain Mineral Development Co. (Pty) Ltd. (Vedanta Resources plc, 74%)	Black Mountain Mine near Aggeneys in Northern Cape Province	6. ²

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners		Location of main facilities	Annual capacity
Copper—Continued:				
Smelter	Palabora Mining Co. Ltd.		Smelter at Phalaborwa	110. ²
Do.	Anglo American Platinum Ltd. (Amplats)		Rustenburg Smelter	11. ²
Do.	Impala Platinum Holdings 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 Holdings 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	1,400.
Do.	do.	do.	Cullinan Mine	870.
Do.	do.	do.	Helam, Sedibeng, and Star Mines ¹	175.
Do.	do.	do.	Kimberley underground mines, Kimberley	100. ^c
Do.	do.	do.	Koffiefontein Mine in Free State Province	35.
Do.	do.	Diamcor Mining Inc.	Krone-Endorda Mine	120.
Fluorspar		Vergenoeg Mining Corp. (Pty) Ltd. [Minerales y Productos Derivados S.A. (Minersa), 85%]	Vergenoeg Mine at Rust de Winter	250.
Do.		Witkop Fluorspar Mine (Pty) Ltd. (subsidiary of Sallies Ltd.)	Witkop Mine at Zeerust ¹	140.
Do.		do.	Buffalo Mine at Mookgopong ¹	60.
Gold:				
Mine	kilograms	AngloGold Ashanti Ltd. (Anglo American plc, 41.8%)	Among which, Vaal River operations:	
			Kopanang Mine	32,100.
Do.	do.	do.	Great Noligwa Mine	14,600.
Do.	do.	do.	Moab Khotsong Mine	11,000.
Do.	do.	do.	Surface operations	5,100. ^c
Do.	do.	do.	West Wits operations:	
			Mponeng Mine	17,000.
Do.	do.	do.	Tau Tona Mine	16,000.
Do.	do.	do.	Savuka Mine	12,000.
Do.	do.	do.	Mine Waste Solutions (MWS) project	3,400.
Do.	do.	Gold Fields Ltd.	KDC Mine	36,900.
Do.	do.	do.	Beatrix Mine	12,800.
Do.	do.	do.	South Deep Mine	9,200.
Do.	do.	Harmony Gold Mining Co. Ltd.	Kusasaletu Mine	8,900.
Do.	do.	do.	Doornkop Mine	6,100.
Do.	do.	do.	Tshepong Mine	6,000.
Do.	do.	do.	Phakisa Mine	5,900.
Do.	do.	do.	Target 1 and Target 3 Mines	5,500.
Do.	do.	do.	Masimong Mine	4,400.
Do.	do.	do.	Bambanani Mine	3,600.
Do.	do.	do.	Evander Mine	3,000. ^c
Do.	do.	do.	Joel Mine	2,500.
Do.	do.	do.	Unisel Mine	2,100.
Do.	do.	do.	Surface operations	1,800.
Do.	do.	do.	Kalgold Mine	1,200.
Do.	do.	Gold One International Ltd.	Modder East Mine	4,700.
Do.	do.	do.	Cooke 1–3 Underground operations	3,700.
Do.	do.	do.	Randfontein surface operations	1,200. ^c

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(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	Village Main Reef Ltd.	Buffelsfontein and Tau Lekoa Mines	5,100. ^e
Do.	do.	do.	Blyvoor Mine	2,300. ^e
Do.	do.	Great Basin Gold Ltd.	Burnstone Mine ¹	7,900.
Do.	do.	DRDGold Ltd.	East Rand Proprietary Mine	4,500. ^e
Do.	do.	Pan African Resources plc	Barberton Mine	3,000.
Do.	do.	Central Rand Gold Ltd.	Central Rand Goldfield near Johannesburg	1,200.
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	41,000.
Do.	do.	do.	Kolomela Mine	9,000.
Do.	do.	do.	Thabazimbi Mine at Thabazimbi	2,700.
Do.		Assmang Ltd.	Khumani Mine	16,000.
Do.	do.	do.	Beeshoek Mine near Postmasburg	4,000.
Do.		Palabora Mining Co. Ltd.	Palabora Mines at Phalaborwa	5,300. ^e
Do.		Ervaz 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.		Xstrata plc	Rhovan Mine at Brits	400.
Ferroalloys		Xstrata plc, 79.5%, and Merafe Resources Ltd., 20.5%	Wonderkop plant at Marikana	553 ferrochromium.
Do.	do.	do.	Rustenburg plant at Rustenburg	430 ferrochromium.
Do.		Xstrata plc, 69.6%, and Merafe Resources Ltd., 30.4%	Lydenburg plant at Lydenburg	396 ferrochromium.
Do.		Xstrata plc, 79.5%, and Merafe Resources Ltd., 20.5%	Lion plant at Steelpoort	360 ferrochromium.
Do.	do.	do.	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.		Assmang Ltd.	Machadodorp plant in Mpumalanga Province	190 ferrochromium; 100 ferromanganese.
Do.		International Ferro Metals Ltd.	Plant in North West Province	267 ferrochromium.
Do.		Tata Steel Ltd.	Richards Bay	151 ferrochromium.
Do.		Samancor Manganese (Pty) Ltd. (BHP Billiton Ltd., 60%, and Anglo American plc, 40%)	Plant at Meyerton	490 ferromanganese; 135 silicomanganese. ¹
Do.		Assmang Ltd.	Cato Ridge plant in KwaZulu Natal Province	300 ferromanganese.
Do.		Renova Group	Plant at Witbank	48 ferromanganese; 180 silicomanganese.
Do.		Silicon Technology Pty Ltd.	NA	55 ferrosilicon.
Do.		Grupo Ferroatlantica	Rand Carbide plant	35 ^e ferrosilicon.
Do.	metric tons	Vanchem Vanadium Products (Pty) Ltd.	Plant at Witbank	12,500 ferrovandium.
Do.	do.	Xstrata plc	Rhovan plant at Brits	6,000 ferrovandium.
Do.	do.	Vametco Minerals Corp.	Smelter near Brits	4,800 ferrovandium.
Do.		Ruukki Group Oyj	Mogale plant	110 ferroalloys.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(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	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.	
Do.	Evraz Highveld Steel and Vanadium Corp. 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.	Kuilsrivier plant, Cape Town	260 crude steel; 250 billet.	
Do.	Duferco Steel Processing Ltd.	Cold-rolled slab steel plant at Saldanha Bay	240 rolled steel.	
Lead	Black Mountain Mineral Development Co. (Pty) Ltd.	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	Assmang Ltd.	Nchwaning Mine near Black Rock	3,000 ore.	
Do.	do.	Gloria Mine near Black Rock	600 ore.	
Do.	Samancor Manganese (Pty) Ltd.	Mamatwan Mine near Hotazel	3,500 ore.	
Do.	do.	Wessels Mine near Hotazel	1,000 ore.	
Do.	Renova Group	Kalahari Mine	2,700 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 Holdings Ltd. (Implats)	Impala Mines	6 mine. ^e	
Do.	do.	Base Metals Refinery	23 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 Ltd.)	Foskor Mine and plant at Phalaborwa	2,800 phosphate rock.
Phosphoric acid		Farmers World Limpopo (Pty) Ltd.	Plant at Phalaborwa ¹	325.
Platinum-group metals	kilograms	Anglo American Platinum Ltd. (Amplats)	Bathopele, Khomanani, Khuseleka, Siphumelele and Thembelani Mines	24,000 platinum; 11,900 palladium; 3,100 rhodium; 5,500 iridium and ruthenium.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(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	Anglo American Platinum Ltd. (Amplats)	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. (Amplats), 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. (Amplats), 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. (Amplats), 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. (Amplats), 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-Masanya	10,600 platinum; 10,900 palladium; 700 rhodium; 760 iridium and ruthenium.
Do.	do.	Anglo American Platinum Ltd. (Amplats), 50%, and XK Platinum Partnership, 50%	Mototolo Mine at Steelpoort	4,100 platinum; 2,400 palladium; 630 rhodium; 1,300 iridium and ruthenium.
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 ruthenium.
Do.	do.	Impala Platinum Holdings 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.
Do.	do.	do.	Marula Mine at Bothashoek	2,200 platinum; 2,300 palladium; 630 ruthenium; 460 rhodium; 180 iridium.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(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 Holdings Ltd. (Implats)	Smelter near Phokeng	81,000 platinum; 45,600 ^e palladium; 12,300 ^e ruthenium; 9,900 ^e rhodium; 5,300 ^e iridium.
Do.	do.	do.	Precious metals refinery, near Springs in Gauteng Province	71,500 platinum metal; 40,400 palladium metal; 10,900 ruthenium metal; 8,700 rhodium metal, 4,700 iridium metal.
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. (Amplats), 22.5%, and Mvelaphanda Resources Ltd., 21.9%]	Zondereinde Mine near Northam	9,400 platinum; 4,600 palladium; 1,100 rhodium.
Do.	do.	Marikana Platinum Mine [Anglo American Platinum Ltd. (Amplats), 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.	Xstrata plc, 74%	Eland Mine at Brits	7,500 platinum-group metals.
Do.	do.	Bokoni Platinum Mines (Pty) Ltd. [Anglo American Platinum Ltd. (Amplats), 62%, and Atlatsa Holdings Investments (Pty) Ltd., 26%]	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. (Implats), 45%]	Two Rivers Platinum Mine near Steelpoort	4,600 platinum; 2,700 palladium; 1,300 ruthenium; 780 rhodium; 310 iridium.
Do.	do.	Eastern Platinum Ltd. (Eastplats)	Crocodile River Mine at Arbourfell	3,100 platinum; 1,300 palladium; 950 ruthenium; 520 rhodium; 220 iridium.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(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	Nkomati Joint Venture	Nkomati Mine in Mpumalanga Province	3,400 platinum-group metals.
Do.	do.	Platinum Australia Pty Ltd. (PLA)	Smokey Hills Mine ¹	3,000 platinum-group metals.
Pyrophyllite		Idwala Industrial Minerals (Benoni)	Ottsdal Mine in North West Province	15.
Do.		Wonderstone Ltd. (The Associated Ore & Metals Corp. Ltd.)	Pyrophyllite (wonderstone) mine, North West Province	NA.
Do.		G&W Base and Industrial Minerals Pty. Ltd.	Piet Retief Mine	NA.
Silicon		Grupo Ferroatlantica	Polokwane plant, near Pietersburg	55 silicon metal.
Silver	metric tons	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.
Titanium:				
Titanium concentrates		Richards Bay Minerals (RBM) (Rio Tinto plc, 74%; and Horizon Investments, 24%)	Open cast operations, near Richards Bay	1,280 ilmenite; [°] 125 rutile. [°]
Do.		Tronox Ltd., 74%	Namakwa Mine near Brand-se-Baai and mineral separation plant at Koekenaap	540 ilmenite; 31 rutile.
Do.		do.	KZN Sands Mine near Richards Bay	550 ilmenite; 30 rutile.
Titanium slag		Richards Bay Minerals (RBM)	Smelter at Richards Bay	1,050 titanium slag; 110 rutile.
Do.		Tronox Ltd., 74%	Empangeni smelter near Richards Bay	220 titanium slag.
Do.		do.	Smelter at Vredenberg, Saldanha Bay area	160 titanium slag.
Do.		Evraz Highveld Steel and Vanadium Corp. Ltd.	Steel plant at Witbank	48 titanium slag. [°]
Uranium oxide	metric tons	AngloGold Ashanti Ltd.	Vaal Rivers operation, near Klerksdorp	3,000.
Do.	do.	Gold One	Ezulwini Mine	100. [°]
Vanadium pentoxide	do.	Evraz Highveld Steel and Vanadium Corp. Ltd.	Mapochs Mine near Lydenburg	17,500.
Do.	do.	do.	Plant at Witbank	10,800.
Do.	do.	Xstrata plc, 74%	Rhovan Mine at Brits	10,000.
Do.		Vanchem Vanadium Products Pty Ltd.	Plant at Witbank	5,000. [°]
Do.	do.	Vametco Minerals Corp.	Krokodilkraal 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. [°]
Zinc		Zinc Corp. of South Africa Ltd. (Exxaro Resources 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.

[°]Estimated. Do., do. Ditto. NA Not available.

¹Not operating at the end of 2012.

²Data from International Copper Study Group.

TABLE 3
SOUTH AFRICA: RESERVE BASE OF MAJOR MINERALS IN 2012¹

(Million metric tons unless otherwise specified)

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

¹Metallic minerals are contained metal.

²Includes 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.