2020–2021 Minerals Yearbook

SOUTH AFRICA [ADVANCE RELEASE]

U.S. Department of the Interior
U.S. Geological Survey

September 2025

U.S. Geological Survey, Reston, Virginia: 2025

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment—visit https://www.usgs.gov or call 1–888–392–8545.

For an overview of USGS information products, including maps, imagery, and publications, visit https://store.usgs.gov/ or contact the store at 1–888–275–8747.

The Mineral Industry of South Africa

By Thomas R. Yager

Note: In this chapter, information for 2020 is followed by information for 2021.

In 2020, the Republic of South Africa remained one of the world's top mining and mineral-processing countries. South Africa's estimated share of world mined ruthenium production by volume amounted to 92%; mined rhodium, 85%; mined iridium, 83%; mined platinum, 67%; refined rhodium, an estimated 51%; refined platinum, an estimated 48%; vermiculite 39%, chromium, 36%; manganese ore and mined palladium, 34% each; zircon, 23%; ferrochromium, 22%; refined palladium, 21%; rutile, 14%; ilmenite and industrial garnet, 13% each; diamond, 8% (10%, by value); vanadium, 8%; refined gold, 6%; coal and fluorspar, 4% each; mined gold, 3%; iron ore, 2%; and aluminum, mined cobalt, mined nickel, stainless steel, and zinc, 1% each. In 2020, South Africa also was the world's leading producer of vermiculite and played a globally significant role in the production of kyanite and related materials (Benjamin, 2020; BP p.l.c., 2021, p. 48; Johnson Matthey plc, 2021, p. 22, 27; Merafe Resources Ltd., 2021, p. 11–12; South32 Ltd., 2021; World Gold Council, 2021; Bray, 2022; Gambogi, 2022a, b; Hatfield, 2022; McRae, 2022a, b; Olson, 2022; Polyak, 2022; Schnebele, 2022; Schulte, 2022a, b; Sheaffer, 2022; Simmons, 2022; Shedd, 2022; Tolcin, 2022; Tuck, 2022; Kimberley Process Rough Diamond Statistics, undated; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

In 2020, South Africa's estimated share of the world's coal consumption was 2.3% and petroleum products, 0.6%. The country's shares of total coal and petroleum consumption in Africa in 2020 were 85% and 14%, respectively (BP p.l.c., 2021, p. 23, 49).

Minerals in the National Economy

The mineral industry accounted for 8.4% of South Africa's gross domestic product (GDP) in 2020 compared with 8.3% in 2019 and 9.2% in 2010; the mineral industry's share of the GDP varied widely by Province. The mineral industry's share in the GDP of North West Province was 35.7%; Northern Cape Province, 27.8%; Mpumalanga Province, 23.6%; Free State Province, 8.9%; Gauteng Province, 1.5%; and Eastern Cape Province, 0.2% (Minerals Council South Africa, 2021, p. 12, 17).

Employment in the mineral industry was 452,866 workers in 2020 compared with a revised 462,039 in 2019 and 498,907 in 2010. In 2020, platinum-group-metal (PGM) mining accounted for 36.4% of the mineral industry's employment; gold mining, 20.8%; coal mining, 20.2%; iron ore mining, 4.5%; chromite mining, 4.3%; diamond mining, 3.1%; manganese mining, 2.7%; and mining for other minerals, 8%. In 2010, PGM mining accounted for 36.4% of the mineral industry's employment; gold mining, 31.5%; coal mining, 14.8%; iron ore mining, 3.7%; chromite mining, 2.8%; diamond mining, 2.3%; manganese mining, 1.2%; and mining for other minerals, 7.3% (Minerals Council South Africa, 2021, p. 15).

Government Policies and Programs

Mining of minerals and mineral fuels was governed by the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA), which became effective in May 2004. Section 100(2)(a) of the MPRDA allowed for the establishment of the Mining Charter. The Mining Charter was enacted in 2004 and modified by the Amended Mining Charter of 2010.

Under the Amended Mining Charter of 2010, the Government's Black Economic Empowerment (BEE) program required that black ownership of mining companies reach 26%. Companies were allowed to use the value of their domestic downstream processing as credit for as much as 11% of their black-ownership requirements. Companies were required to purchase 70% of their services, 50% of their consumable goods, and 40% of their capital goods from BEE entities. Companies were also required to report progress annually on downstream processing; the development of near-mine communities; and the economic, environmental, and social sustainability of mining activities in the country (Creamer, 2010).

In June 2017, the Government introduced a new Mining Charter that proposed several changes to BEE requirements. After the Charter went into effect in March 2019, the black-ownership requirement increased to 30%, of which at least 20% was required to be held by BEE entrepreneurs and 5% each by employee-share ownership plans and near-mine communities invested in a trust. The new Charter also reduced the downstream-processing credit to 5%. Mining rights held by companies with a minimum 26% black ownership in March 2019 were recognized as in compliance. Additionally, the requirement to purchase services from South African companies increased to 80% from 70%, and the requirement to purchase goods from them increased to 70% from 50% (Beech and Livingston, 2017; Liedtke, 2018; Bulbulia, 2019).

In the Witwatersrand basin, acid mine drainage from gold-mining operations posed a risk to contaminate water supplies in Gauteng Province with increased levels of toxic heavy metals and radioactive particles. The oxidation of pyrite in and subsequent leaching from tailings piles and deep underground mines resulted in this acid mine drainage. South Africa had about 270 tailings piles in the Witwatersrand basin that contained about 6 billion metric tons of pyrite; acid mine drainage also occurred at abandoned coal mines. The tailing piles also contained an estimated 600,000 metric tons (t) of uranium (Solomons, 2017; Bega, 2021).

In 2020, the Government was involved in an acid mine drainage remediation program that had an estimated cost of

$760 million. Additionally, in 2019, the Government undertook the remediation of abandoned asbestos mines, with the total cost estimated at around $120 million. The overall cost of remediation for other abandoned mines was estimated to be nearly $2.8 billion (Solomons, 2017; Gilliand, 2019; Bega, 2021). The mining industry was regulated by the Department of Mineral Resources. The exploration and production of natural gas and petroleum were regulated by the Petroleum Agency South Africa. Environmental regulations were enforced by the Department of Environmental Affairs. The Department of Mineral Resources issued environmental permits for mining operations; decisions regarding permits could be appealed to the Department of Environmental Affairs.

Production

In 2020, production of zinc increased by 28%; diamond, by 18%; and anthracite, fluorspar, and fuller's earth, by 13% each. Mica production also increased by 225%. Helium production started in 2020. In 2020, production of direct-reduced iron decreased by 73%; flint clay, by 60%; ferromanganese, by 47%; shale for brickmaking, by 46%; mined copper and pig iron, by 45% each; ferrosilicon, by an estimated 43%; refined copper, by 39%; hot-rolled steel, by an estimated 38%; raw steel and silicomanganese, by 37% each; feldspar and sulfur, by 36% each; mined lead, by 35%; silver, by 32%; pyrophyllite, by 31%; phosphate rock (gross weight and P_2O_5 content), by 30%; nickel matte, by an estimated 29%; ferrochromium, gypsum, kaolin, refined nickel, and refined PGMs other than palladium, platinum, and rhodium, by 26% each; chromite, phosphoric acid, sodium sulfate, and vermiculite, by 25% each; iron ore, by 23%; refined gold and refined platinum, by an estimated 21% each; brick clay, mined nickel, and refined petroleum products, by 20% each; bentonite, lime, and uranium, by 19% each; aggregates and mined palladium, by 18% each; refined palladium and refined rhodium, by an estimated 17% each; natural gas and mined platinum, by 16% each; smelted copper, by 15%; cement, industrial garnet, and sand for construction, by 14% each; mined cobalt, refined cobalt, fire clay, mined rhodium, and shale for cement, by 13% each; mined ruthenium and sulfuric acid, by 12% each; andalusite and phosphate fertilizers, by 11% each; and amethyst, by an estimated 10%. Emerald, plastic clay, silicon metal, and talc production shut down in 2019 (Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

In 2020, fluorspar and zinc production increased because of the recent opening of new mines. The production of numerous commodities, including aggregates, andalusite, brick clay, chromite, ferrochromium, iron ore, refined PGMs, and silicomanganese, decreased because of the effects of the coronavirus disease 2019 (COVID-19) pandemic. Data on mineral production are in table 1.

Structure of the Mineral Industry

Most of South Africa's mineral industry is privately owned, except for the Government-owned Petroleum Oil and Gas Corporation, which operates a gas-to-liquids plant and produces natural gas. The production of diamond and gold, which was mostly done by artisanal miners in other countries in Africa, was dominated by large-scale producers in South Africa. Ammonia, primary aluminum, industrial garnet, mined lead, magnesite, manganese metal, stainless steel, vermiculite, and wollastonite were produced by only one domestic company each.
The leading producer of iron ore accounted for about 67% of national production in 2020; mined nickel, 50%; diamond, 44%; mined manganese, 22%; and coal, 19%. The leading producers of other commodities and their share of total output vary widely by commodity. South Africa also had many producers of aggregates, clay and shale, and sand for construction. Capacity, location, ownership, and levels of production were not readily available for most of these operations. Table 2 is a list of major mineral industry facilities.

Reserves and Resources

South Africa's estimated share of world reserves of PGMs was 90%; manganese, 43%; chromite, 35%; vanadium, 15%; fluorspar, 13%; gold, 9%; and zirconium, 8%. The country also had substantial reserves of andalusite, antimony, coal, ilmenite, iron ore, nickel, phosphate rock, rutile, uranium, and vermiculite (table 3; Gambogi, 2022a, b; McRae, 2022a; Polyak, 2022; Schnebele, 2022; Schulte, 2022a, b; Sheaffer, 2022; Simmons, 2022; Tuck, 2022).

Mineral Trade

Crude minerals (which included refined metals other than aluminum and silicon and industrial minerals) accounted for about 32% of the $84.5 billion[1] total value of South Africa's exports in 2020. About 74% of crude minerals, by value, were exported in 2020. South Africa's exports of iron ore were valued at $5.05 billion in 2020; rhodium, $4.31 billion; gold, $4.17 billion; palladium, $3.22 billion; coal, $2.76 billion; platinum, $2.5 billion; manganese ore, $2.11 billion; cobalt, copper, ilmenite, lead, rutile, and zircon, a total of $728 million; chromite, $527 million; diamond, $492 million; nickel, $388 million; zinc, $304 million; iridium, $288 million; industrial minerals, a total of $260 million; and ruthenium, $185 million (Minerals Council South Africa, 2021, p. 13; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 24, 2021).

The percentage of domestic consumption of mineral commodities produced in South Africa varied widely by commodity. In 2020, the percentage of export sales by volume was 91% for iron ore, 88% for manganese, 82% for diamond, 61% for granite, 34% for chromite, 24% for coal, and 1% for lime. All sales of aggregates, clay and shale, feldspar, gypsum, mica, natural gas, sand for construction, and sodium sulfate were domestic (Muravha, 2019; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 24, 2021).

[1]Where here necessary, values have been converted from South African rand (ZAR) to U.S. dollars (US$) at an average exchange rate of ZAR16.5=US$1.00 for 2020.

In 2020, South Africa's imports of mineral products were valued at $9.71 billion; base metals and articles thereof, $3.52 billion; and articles of stone, plaster, cement, asbestos, mica or similar materials, ceramic products, and glass and glassware, $766 million. Total imports were valued at $68.1 billion in 2020 (South African Revenue Service, 2021).

Commodity Review

Metals

Aluminum.—South Africa produced primary aluminum from alumina imported from Australia. South32 Ltd. of Australia operated the Hillside primary aluminum smelter at Richards Bay; production at Hillside remained unchanged at 717,000 t in 2020. The company planned to produce at a rate of nearly 720,000 metric tons per year (t/yr) in the first half of 2021 (South32 Ltd., 2020, 2021).

Chromium.—In 2020, chromite production was about 13.24 million metric tons (Mt) compared with 17.66 Mt in 2019 and 10.87 Mt in 2010. Increased production since 2010 was partially attributable to PGM-mining companies producing chromite as a coproduct. In 2020, ferrochromium production was about 2.7 Mt compared with a revised 3.2 Mt in 2019 and 3.6 Mt in 2010. Ferrochromium output in 2020 was limited by power supply problems and the COVID-19 pandemic (Galane, 2018; Creamer, 2019; Merafe Resources Ltd., 2021, p. 12, Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Samancor Chrome (Pty) Ltd. [International Mineral Resources BV of the Netherlands, 70%, and Batho Barena (Pty) Ltd., 28%] operated the Eastern Chrome Mines in Limpopo Province and the Western Chrome Mines in North West Province. Based on Samancor Chrome's ferrochromium production levels, the company produced chromite at a rate of about 4.3 million metric tons per year (Mt/yr) in April 2019 for its ferrochromium plants. An additional 500,000 t/yr was produced for export. In January 2020, Samancor Chrome announced plans to reduce production by 29%. Production shut down temporarily because of the COVID-19 pandemic [Samancor *C*hrome (Pty) Ltd., 2018; EESTech Inc., 2019; Khaile, 2019a; Davies and others, 2020].

Samancor Chrome operated six ferrochromium plants that had a total capacity of about 2.4 Mt/yr. In April 2019, the company was producing at a rate of more than 1.7 Mt/yr of ferrochromium. Production of ferrochromium reportedly was reduced by severe power shortages in December 2019. In January 2020, Samancor Chrome announced plans to cut ferrochromium production by 20%. Production shut down temporarily because of the COVID-19 pandemic (Creamer, 2016a; EESTech Inc., 2019; Tex Report, The, 2019b, d; Davies and others, 2020).

Glencore plc of Switzerland and its joint-venture partner Merafe Resources Ltd. operated the Boshoek, the Helena, the Kroondal, the Magareng, the Thorncliffe, and the Waterval Mines. Glencore and Merafe produced about 2.56 Mt of chromite for use in their ferrochromium plants in 2020 compared with 3.62 Mt in 2019 (Merafe Resources Ltd., 2021, p. 5, 19).

Glencore and Merafe operated the Boshoek, the Lion, the Lydenburg, the Rustenburg, and the Wonderkop ferrochromium plants, which had a total capacity of 2.34 Mt/yr. The companies produced 1.29 Mt in 2020 compared with 1.81 Mt in 2019. Production shut down in the second quarter of 2020 because of the COVID-19 pandemic; the Lydenburg plant remained on care-and-maintenance status at yearend. Glencore planned to produce 1.7 to 1.8 Mt of ferrochromium in 2021, 1.7 Mt in 2022, and nearly 1.8 Mt each in 2023 (Tex Report, The, 2020b; Glencore plc, 2021a, p. 2, 16, 18).

Sibanye-Stillwater Ltd. operated the Marikana and the Rustenburg PGM mines. The company purchased Lonmin plc of the United Kingdom, which previously operated Marikana, in June 2019. In the second half of 2019, Sibanye-Stillwater produced chromite from Upper Group 2 (UG2) ore in the Bushveld Complex at Marikana and Rustenburg at a rate of 2.45 Mt/yr. In 2020, the company produced a total of nearly 1.81 Mt of chromite at Marikana and Rustenburg (Sibanye-Stillwater Ltd., 2021b).

In its fiscal year 2020 (October 1, 2019, through September 30, 2020), Tharisa Minerals (Pty) Ltd. of Cyprus produced about 1.34 Mt of chromite at the Tharisa Mine compared with 1.29 Mt in fiscal year 2019. Increased output was partially attributable to higher ore grades and recovery rates. Tharisa Minerals planned to produce 1.45 to 1.55 Mt in fiscal year 2021. The company planned to increase production subsequently to a rate of 2 Mt/yr. The remaining life of the open pit was estimated to be 14 years, which could be followed by an underground mine with a life of 40 years [Tharisa Minerals (Pty) Ltd., 2020, p. 2, 7].

Anglo American Platinum Ltd. (Amplats) operated a plant at the Amandelbult Mine that produced chromite from UG2 ore. In 2020, Amplats produced 785,800 t of chromite compared with 908,700 t in 2019 and 859,000 t in 2018. The company also was engaged in the development of a new 288,000-t/yr-capacity chromite recovery plant at the Modikwa Mine. Amplats planned to start production at the new plant by the first quarter of 2021 (Anglo American Platinum Ltd., 2020, p. 103; 2021, p. 12, 54).

In 2020, Northam Platinum Ltd. produced 834,247 t of chromite from UG2 ore at its Booysendaal, Eland, and Zondereinde Mines compared with 865,882 t in 2019. Production at the Booysendaal Mine increased to 473,515 t in 2020 from 450,417 t in 2019 and to 60,703 t from 51,150 t at the Eland Mine. At the Zondereinde Mine, production decreased to 300,029 t from 364,315 t. Northam planned to expand its PGM operations, which could increase its output to 1 Mt/yr (Creamer, 2016b; Northam Platinum Ltd., 2020, p. 22, 27, 33, 37; 2021, p. 36, 41, 47, 52).

African Rainbow Minerals Ltd. (ARM) and its joint-venture partner, MMC Norilsk Nickel of Russia, operated the Nkomati chromite mine. The sale of chromite from Nkomati decreased to 165,000 t in 2020 from 424,000 t in 2019. The sale of chromite from the Two Rivers Mine, which was a joint venture between ARM and Impala Platinum Holdings Ltd. (Implats), decreased to 199,065 t in 2020 from 211,868 t in 2019. The Nkomati Mine was expected to be placed on care-and-maintenance status by the end of March 2021; ARM planned to continue selling nearly 240,000 t/yr of chromite from Two Rivers through at least mid-2023 (African Rainbow Minerals Ltd., 2020a, p. 63, 65, 67; 2020b, p. 11, 13; 2021, p. 12, 14).

Eastern Platinum Ltd. (Eastplats) of Canada recovered chromite from UG2 tailings at the Crocodile River Mine, which is in the North West Province. Eastplats produced 987,003 t of chromite at Crocodile River in 2020; production increased by 68% from that in 2019 (Eastern Platinum Ltd., 2021).

ASA Metals (Pty) Ltd. [Eastern Asia Metals Development of China, 60%, and Limpopo Economic Development Enterprise (LEDA), 40%] operated the Dilokong chromite mine near Burgersfort until March 2016, when the company entered bankruptcy proceedings because of its high-cost mining operation. Cheetah Chrome South Africa (Pty) Ltd. purchased the Dilokong Mine in 2017. As of December 2020, Cheetah was engaged in a legal dispute with LEDA regarding ownership of the mine, which remained on care-and-maintenance status (Creamer, 2016a; Ritchie, 2020).

Richards Bay Alloys (Pty) Ltd. (a subsidiary of Traxis Group) shut down its ferrochromium plant at the end of 2017; the plant remained closed as of late October 2020. The closure of the plant, which had a capacity of 150,000 t/yr, could be attributable to a lack of an integrated supply of chromite. The company did not operate its own chromite mines. Richards Bay Alloys planned to upgrade its plant starting in the first quarter of 2021 and to restart production by the fourth quarter of 2021 (table 2; Creamer, 2016a, 2020).

Cobalt.—ARM and Norilsk produced 708 t of mined cobalt at the Nkomati Mine in 2020 compared with 737 t in 2019 because reserves were depleted. Cobalt also was produced by PGM-mining companies (African Rainbow Minerals Ltd., 2020a, p. 65; 2020b, p. 13; 2021, p. 14).

Copper, Lead, and Zinc.—In 2020, zinc production increased to 160,816 t from 125,157 t in 2019, lead production decreased to 28,048 t from 42,936 t, and copper production decreased to 29,100 t from 52,500 t. The Black Mountain Mine, which was operated by Vedanta Resources Ltd. of the United Kingdom, produced copper, lead, silver, and zinc. Vedanta started the first phase of mining at the Gamsberg open pit mine in Northern Cape Province in late 2018. Gamsberg had a capacity of 250,000 t/yr of zinc in concentrate. The company was producing at a rate of 120,000 t/yr between April and September 2020 compared with 94,000 t/yr in the same period in 2019. At yearend, mining was temporarily shut down because of a collapse of the pit wall (Piper, 2019; Vedanta Resources Ltd., 2020, p. 18, 106; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Vedanta planned to increase production at Gamsberg to 450,000 t/yr of zinc in concentrate in its second phase of mining. The second phase could start as soon as full capacity was reached in the first phase. Vedanta also was considering a third phase of mining, which could increase production to 650,000 t/yr of zinc; the third phase would require the opening of an underground mine. The company was engaged in a feasibility study on a new smelter and refinery at Gamsberg that would produce 250,000 t/yr of zinc metal. The development of the smelter and refinery depended on an additional 200 megawatts (MW) of power. As of the end of 2020, it was unclear when Vedanta would start construction (Kotze, 2018b; Piper, 2019: Ryan, 2019; Frost, 2021).

In June 2019, Orion Minerals Ltd. of Australia completed a feasibility study on restarting mining at the Prieska project in Northern Cape Province. Production shut down at Prieska in 1991. Orion planned to produce 70,000 to 80,000 t/yr of zinc in concentrate and 20,000 to 24,000 t/yr of copper in concentrate during the estimated 10-year life of the mine. In May 2020, the company changed planned production to 70,000 t/yr of zinc and 22,000 t/yr of copper and changed the estimated mine life to 12 years based on a new feasibility study. Depending on the amount of financing, Orion planned to start construction in 2021 and mining in 2023 (Andrews, 2019a; Piper, 2019; Resources Rising Stars, 2020).

Gold.—The long-term decline in South Africa's mined gold output continued in 2020; production decreased to 95,786 kilograms (kg) from 105,185 kg in 2019 and about 188,702 kg in 2010. Decreased output was primarily attributable to mines operating at depths as great as 4 kilometers, which led to difficult geologic conditions, higher ore haulage and refrigeration costs, and low labor productivity. Rand Refinery (Pty) Ltd.'s production of refined gold decreased to an estimated 260,000 kg in its fiscal year 2020 (October 1, 2019, through September 30, 2020) from 385,244 kg in fiscal year 2010 [table 1; Rand Refinery (Pty) Ltd., 2011, p. 43; du Venage, 2013; Galane, 2018; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022].

In every year from 2013 through 2019, input cost inflation in the gold-mining subsector exceeded the average of the mining sector. Power costs accounted for 24% of the intermediate input costs for the gold-mining subsector compared with 11% for the mining sector (Minerals Council South Africa, 2020, p. 7, 34).

At the end of September 2020, AngloGold Ashanti Ltd. of the United Kingdom sold its operations to Harmony Gold Ltd. Harmony produced a total of 32,273 kg of gold from its other operations in South Africa in 2020 compared with 37,382 kg in 2019. In 2020, production of gold at the Tshepong operations was 6,267 kg; at the Moab Khotsong Mine, 6,095 kg; at the surface-mining operations, 4,174 kg; at the Kusasalethu Mine, 3,672 kg; at the Doornkop Mine, 3,302 kg; at the Target 1 Mine, 2,122 kg; at the Bambanani Mine, 1,885 kg; at the Masimong Mine, 1,785 kg; at the Joel Mine, 1,221 kg; at the Kalgold Mine, 1,095 kg; and at the Unisel Mine, 655 kg. Production at the surface operations increased by 51% in 2020 and at Doornkop, by 5%. In 2020, production at Joel decreased by 27%; at Bambanani, by 26%; at Masimong, by 25%; at Tshepong, by 24%; at Moab Khotsong, by 21%; at Kalgold and Kusasalethu, by 13% each; and at Target 1, by 9% (Harmony Gold Mining Company Ltd., 2020a, p. 3, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30; 2020b, p. 8; 2021, p. 4, 8–9).

For Harmony's fiscal year 2021 (July 1, 2020, through June 30, 2021), planned production at the Tshepong operations was 7,700 to 8,000 kg of gold; at Moab Khotsong, 6,900 to 7,100 kg; at Kusasalethu, 3,800 to 4,000 kg; at Doornkop, 3,500 to 3,600 kg; at the surface-mining operations and Target 1, 2,500 to 2,600 kg each; at Bambanani, 2,100 to 2,200 kg; at Masimong, 1,900 to 2,000 kg; at Joel, 1,600 to 1,700 kg; and at Kalgold, 1,200 to 1,300 kg. The remaining life of the Tshepong operations was 20 years; of Doornkop, 16 years; of the surface-mining operations, at least 14 years; of Kalgold, 13 years; of Joel, 10 years; of Moab Khotsong, 8 years; of Target 1, 7 years; of Kusasalethu, 4 years; and of Bambanani, 3 years. Masimong was expected to close by the end of 2021 because of the depletion of its reserves (Harmony Gold Mining Company Ltd., 2020a, p. 3).

Sibanye-Stillwater mined gold at the Beatrix, the Driefontein, and the Kloof Mines, and at the Cooke Operations. In 2020, production increased to 10,948 kg from 10,863 kg in 2019 at the Kloof Mine and to 7,790 kg from 5,154 kg at Driefontein, in spite of reduced capacity utilization in the second quarter caused by the effects of the COVID-19 pandemic. Production decreased to 5,280 kg from 6,118 kg at Beatrix and to 1,172 kg from 1,291 kg at the Cooke Operations. Sibanye-Stillwater also held a 50.1% interest in DRDGold Ltd., which produced gold at the Ergo and the Far West Gold Recovery Operations (FWGR). The Ergo and FWGR Operations produced a total of 5,371 kg in 2020 compared with 5,582 kg in 2019 (Sibanye-Stillwater Ltd., 2021b).

Sibanye-Stillwater planned to increase total production at Beatrix, Driefontein, and Kloof Mines and the Cooke Operations to about 29,000 kg in 2022; output was expected to decrease to about 27,000 kg by 2024. The company was considering reopening the Burnstone Mine, which could produce 3,900 kilograms per year (kg/yr) of gold at full capacity. Average production during the estimated 20-year life of the mine was estimated to be nearly 3,000 kg/yr. As of yearend 2020, Sibanye-Stillwater had not decided whether to reopen Burnstone (Sibanye Gold Ltd., 2018, p. 50; Sibanye-Stillwater Ltd., 2021a, p. 178–179).

In the third quarter of 2020, AngloGold Ashanti was producing gold at a rate of 7,200 kg/yr at the Mponeng Mine and 4,700 kg/yr at the Surface Operations. During the same period in 2019, production was 8,100 kg/yr at Mponeng and 6,000 kg/yr at the Surface Operations (AngloGold Ashanti Ltd., 2020).

Gold Fields Ltd. produced 7,056 kg of gold at the South Deep Mine in 2020 compared with 6,907 kg in 2019. The company estimated that its production was reduced by about 1,000 kg because of the effects of the COVID-19 pandemic. Gold Fields planned to produce about 9,000 kg in 2021. The estimated life of the mine was 75 years (Gold Fields Ltd., 2021, p. 70; Kotze, 2021b).

In its fiscal year 2020 (July 1, 2019, through June 30, 2020), Pan African Resources plc produced 5,242 kg of gold compared with 5,053 kg in fiscal year 2019. Production at the Barberton Mine was 2,119 kg in fiscal year 2020; at the Elikhulu Tailings Retreatment Project (Elikhulu), 1,854 kg; at the Evander Mines' 8 Shaft, 643 kg; and at the Barberton Tailings Retreatment Project (BTRP), 626 kg. The estimated remaining life of the Barberton Mine was 20 years; of the Elikhulu Mine, 12 years; of the BTRP, 6 years; and of the Evander Mines' 8 Shaft, 3 years. Pan African planned to produce a total of 5,900 kg in its fiscal year 2021 (Pan African Resources plc, 2020, p. 6–7, 9).

In 2020, Pan African completed a feasibility study on the Egoli project, which could extend the life of the Evander Mine to 11 years. The company planned to produce 1,900 to 2,200 kg/yr of gold. Production would start 20 months after the project was commenced (Kotze, 2021a).

Village Main Reef Ltd. (a subsidiary of Heaven Sent Capital Group of China) operated the Kopanang and the Tau Lekoa Mines. The company produced about 2,600 kg/yr at Kopanang and 2,300 kg/yr at Tau Lekoa (Village Main Reef Ltd., undated a, b).

Amplats and its joint-venture partners produced about 2,000 kg of gold from their South African PGM-mining operations in 2020 compared with 2,300 kg in 2019. The Mogalakwena Mine, which accounted for 43% of the companies' total PGM production in 2020, produced 86% of the gold (Anglo American Platinum Ltd., 2021, p. 60, 62, 64, 68, 70).

Theta Gold Mines Ltd. of Australia completed a feasibility study on its Theta Hill project in the Sabie-Pilgrim's Rest goldfield in May 2019. The company planned to produce 1,250 kg/yr of gold during an estimated mine life of 5 years. In its revised feasibility study completed in April 2020, Theta Gold increased its planned production to 1,600 kg/yr of gold. Theta Gold planned to start construction of its plant in the first quarter of 2021 and mining in the third quarter of 2021. The company also was considering mining other deposits in the Sabie-Pilgrim's Rest goldfield, which could increase its production to nearly 4,700 kg/yr of gold (Andrews, 2019b; Kotze, 2020).

Rand Refinery (Pty) Ltd. (AngloGold Ashanti, 42.41%; Sibanye-Stillwater, 33.15%; DRDGold, 11.3%; Harmony, 10.38%; Gold Fields, 2.76%; and Avgold Ltd. and Western Areas Ltd., 2% each) refined most of the non-recycled gold in South Africa. The company produced at about 80% of its capacity (410,000 kg/yr of gold) in its fiscal year 2019 compared with 90% in fiscal year 2018. Rand Refinery was producing at a rate of 250,000 to 280,000 kg/yr of gold in March 2020 before the effects of the COVID-19 pandemic temporarily forced a reduction in production to a small fraction of capacity. Decreased production also was attributable to reduced supplies of gold from mines in South Africa and Zimbabwe. Rand Refinery sourced most of its gold from imports from countries in Africa [Rand Refinery (Pty) Ltd., 2019, p. 4, 14–15; Benjamin, 2020].

Iron Ore and Iron and Steel.—In 2020, iron ore production was about 55.6 Mt compared with 72.4 Mt in 2019 and 58.7 Mt in 2010. Decreased production in 2020 was attributable to the effects of the COVID-19 pandemic. From 2010 to 2020, export sales of iron ore increased to 60.2 Mt from 47.5 Mt, whereas domestic sales decreased to 5.79 Mt from 10.6 Mt (Galane, 2018; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Kumba Iron Ore Ltd.'s iron ore production decreased to 37 Mt in 2020 from 42.4 Mt in 2019. Production at the Sishen Mine decreased to 25.4 Mt in 2020 from 29.2 Mt in 2019 and at the Kolomela Mine to 11.6 Mt from 13.2 Mt. The company's exports sales decreased to 39.4 Mt in 2020 from 39.8 Mt in 2019; domestic sales decreased to 352,000 t from 2.18 Mt because of the closure of the Saldanha steel plant. Kumba planned to produce at a rate of 40 to 41 Mt/yr at Kolomela and Sishen in 2021 and 41 to 42 Mt/yr in 2022 and 2023 (Tex Report, The, 2020c; Anglo American plc, 2021, p. 9–10).

Assmang (Pty) Ltd. produced iron ore at the Beeshoek and the Khumani Mines. In 2020, total production decreased to 14.2 Mt from 18.4 Mt in 2019. Sales decreased by about 2 Mt because of the effects of the COVID-19 pandemic in the first half of 2020. The company planned to increase production at Khumani and Beeshoek to 14 Mt/yr and 2.8 Mt/yr, respectively, after mid-2021. About 84% of Assmang's sales were exports between July 2019 and June 2020; most of Khumani's output was exported, whereas most of Beeshoek's was sold domestically. The estimated remaining mine life at Khumani was 20 years and at Beeshoek was 6 years (African Rainbow Minerals Ltd., 2020a, p. 13, 70–71, 79, 81; 2020b, p. 7; 2021, p. 8).

Palabora Mining Company Ltd. produced magnetite from the Palabora Mine. In its fiscal year 2020 (April 1, 2019, through March 31, 2020), Government-owned Transnet SOC Ltd. shipped 10.4 Mt of magnetite on its railways, most of which was attributable to Palabora Mining (Khaile, 2018, p. 20−24; Transnet SOC Ltd., 2020, p. 13).

Afrimat Ltd. operated the Demaneng iron ore mine (formerly the Diro Mine) in Northern Cape Province. In 2020, the company's rail shipments were 805,757 t of iron ore compared with 756,756 t in 2019. Afrimat planned to begin production at the Driehoekspan, Doornpan, and Jenkins Mines promptly upon securing a mining license in 2021. Total sales from the mines were expected to be 1.25 Mt/yr (Afrimat Ltd., 2020, p. 55−56; 2021, p. 31).

In 2020, South Africa's raw steel production decreased to 3.88 Mt from 6.15 Mt in 2019. ArcelorMittal South Africa Ltd.'s production of raw steel decreased to 2.31 Mt in 2020 from 4.41 Mt in 2019 and 5.09 Mt in 2018. The Saldanha plant was placed on care-and-maintenance status in the first quarter of 2020. Other producers of raw steel included Cape Town Iron & Steel Works (Pty) Ltd. and Scaw Metals Group (table 1; ArcelorMittal South Africa Ltd., 2021, p. 2–3).

Manganese.—In 2020, manganese ore production was about 16.2 Mt compared with 17 Mt in 2019 and 7.17 Mt in 2010. Ore grading 30% to 40% manganese accounted for 76% of national production in 2020 compared with 69% in 2019. The long-term increase was attributable to increased production from the Mamatwan, the Nchwaning, and the Wessels Mines and the opening of the Kalahari, the Kudumane, and the Tshipi Borwa Mines (Galane, 2018; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Assmang produced manganese ore at the Gloria and the Nchwaning Mines. Total output decreased to 3.58 Mt in 2020 from 3.71 Mt in 2019. About 530,000 t of export sales were impacted by delays, cancellations, and (or) reduced demand associated with the COVID-19 pandemic during the first half of 2020. Assmang planned to export 4 Mt/yr through mid-2023. The company planned to expand its total capacity to 5 Mt/yr by late 2021 or early 2022, depending on the availability of Transnet's railways. The estimated remaining life of Assmang's manganese mines was more than 30 years (Barradas, 2018; African Rainbow Minerals Ltd., 2020a, p. 13, 80–81; 2020b, p. 8; 2021, p. 9).

Samancor Manganese (Pty) Ltd. (South32 Ltd., 60%) operated the Mamatwan and the Wessels Mines near Hotazel in Northern Cape Province. In 2020, Samancor Manganese's output of manganese ore decreased to 3.21 Mt from 3.58 Mt in 2019. Production was limited by the effects of the COVID-19 pandemic. Ore grades from the company's sales were about 40% manganese in 2019 and 2020. The company's plant at Meyerton produced 32,000 t of manganese alloys in 2020 before shutting down in the second quarter. Samancor Manganese planned to produce ore at a rate of about 3 Mt/yr in the first half of 2021 (South32 Ltd., 2020, 2021).

Jupiter Mines Ltd. of Australia held a 49.9% share in Tshipi e Ntle Manganese Mining (Pty) Ltd., and Ntsimbitntle Mining (Pty) Ltd. held a 38.1% share. In Jupiter's fiscal year 2020 (March 1, 2019, through February 28, 2020), sales from the Tshipi Borwa Mine in Northern Cape Province were 3.41 Mt of manganese ore compared with 3.51 Mt in fiscal year 2019. Between March and November 2019, production was at a rate of about 3.28 Mt/yr. Full production resumed at the start of May 2020 after South Africa's COVID-19 lockdown ended. Lumpy ore mined at Tshipi Borwa had a grade of 36.5% manganese, and fine ore had a grade of 35.5% manganese. The mine had a capacity of 3.6 Mt/yr and an estimated remaining mine life of more than 100 years (Khaile, 2018, p. 28; Jupiter Mines Ltd., 2020, Tex Report, The, 2020h, i).

United Manganese of Kalahari (Pty) Ltd. (UMK) [Majestic Silver Trading 40 (Pty) Ltd., 51%, and Renova Group of Russia, 49%] operated the Russik Mine in Northern Cape Province. The company produced 3 Mt/yr of manganese ore at a grade of 37.5% manganese. In April 2020, UMK temporarily stopped production at the Russik Mine because of the effects of the COVID-19 pandemic (Khaile, 2018, p. 29; Davies and others, 2020).

Manganese ore from the Kalahari deposit was used by Transalloys (Pty) Ltd. (Renova, 23.78%) in the production of silicomanganese. The company had a capacity of 180,000 t/yr; initial planned production for 2020 was 170,000 t of silicomanganese. Transalloys reduced its production target to 120,000 t because of its temporarily closure for the COVID-19 pandemic and low silicomanganese prices on world markets. Production was reduced further by a fire at Transalloys' plant in late August 2020 (table 2; Tex Report, The, 2020e).

Asia Minerals Ltd. (AML) of Hong Kong operated the Kudumane Mine at Farm York. The company produced about 1.6 Mt of manganese ore in 2020 compared with nearly 1.4 Mt in 2019; ore grades were 36% to 37% manganese. AML's total production was limited to 1.6 Mt/yr because of Transnet's limited rail capacity (Tex Report, The, 2017; Nippon Denko Co. Ltd., 2021, p. 15).

In March 2018, Kalagadi Manganese (Pty) Ltd. [Kalagadi Alloys (Pty) Ltd., 44%; Kalahari Resources (Pty) Ltd., 36%; and Industrial Development Corp. (IDC), 20%] started operations at a new underground mine at Hotazel and produced 484,000 t of manganese ore by the end of March 2019. The company was producing at a rate of about 250,000 t/yr in the first quarter of 2019; production was expected to increase to 2.4 Mt/yr by the first quarter of 2020. Kalagadi planned to produce 3 Mt/yr of manganese ore at a grade of nearly 39% manganese upon reaching full capacity (Khaile, 2018, p. 29; Kalagadian, The, 2019).

Kalagadi operated a plant to beneficiate its mine's output into sintered ore at a grade of nearly 47% manganese. In 2019, Transnet signed an agreement with Kalagadi to transport 650,000 t of sintered ore by rail. Kalagadi would supply 1 Mt/yr of sintered ore in subsequent years until reaching the sintering plant's full capacity of 2.4 Mt/yr in 2023. As of late October 2020, it was unclear when the company would reach its targets for ore and sinter production. IDC and Kalagadi were engaged in a legal dispute regarding Kalagadi's reported nonpayment of debt owed to IDC (Khaile, 2018, p. 29; McKay, 2019, 2020a).

In late September 2020, Sitatunga Resources (Pty) Ltd. [a subsidiary of Menar Holding (Pty) Ltd. of Luxembourg] received permission to start strip-mining operations at its East Manganese project near Hotazel. Sitatunga could start mining manganese ore as soon as late March or April 2021; the company planned to start building roads for ore processing and transportation after mining started. Planned production at the open pit mine was about 360,000 t/yr (Tex Report, The, 2020a).

Nickel.—Most of South Africa's nickel production was a coproduct of PGM mining. Amplats produced about 13,900 t of refined nickel in 2020 compared with 23,000 t in 2019. About 17,500 t of nickel was mined at the company's South Africa-based PGM-mining operations in 2020 compared with 18,500 t in 2019; the Mogalakwena Mine's production decreased to 15,500 t from 15,700 t. Implats produced 15,200 t of refined nickel in 2020 compared with 16,100 t in 2019. About 3,300 t was attributable to the company's South Africa-based PGM-mining operations in 2020 compared with 6,300 t in 2019 (Impala Platinum Holdings Ltd., 2020a, p. 117, 121, 129; 2020b, p. 71, 73, 81; 2021, p. 70, 72, 82; Anglo American Platinum Ltd., 2021, p. 54, 60, 62, 64, 68, 70).

ARM and Norilsk produced 11,678 t of nickel at the Nkomati Mine in 2020 compared with 12,971 t in 2019 because reserves were depleted. The mine was expected to close by the end of March 2021 (African Rainbow Minerals Ltd., 2020a, p. 65; 2020b, p. 13; 2021, p. 14).

In September 2018, Thakadu Group started construction of a new nickel sulfate plant at Sibanye-Stillwater's Base Metals Refinery. The company had planned to complete the plant in April 2019 and to start commercial production by June. Thakadu planned to produce as much as 25,000 t/yr of high-purity nickel sulfate from the Base Metals Refinery's crude nickel sulfate. As of the end of 2020, the plant was not completed (Mining Weekly, 2018; Arnoldi, 2021b).

Platinum-Group Metals.—In 2020, total mined PGMs production was 226,473 kg compared with 268,068 kg in 2019 and 287,304 kg in 2010. Total refined PGMs production was estimated to be about 231,000 kg in 2020 compared with 288,000 kg in 2019. In recent years, the share of platinum in PGM-mining companies' earnings decreased and the shares of palladium and rhodium increased. The share of platinum in South Africa's PGM-mine output decreased to 49% in 2020 from 51% in 2010; increased palladium and rhodium prices were a more important factor in the shift in earnings (table 1; Moumakwa, 2012; Minerals Council South Africa, 2021, p. 23; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

In 2020, Amplats produced about 97,800 kg of refined PGMs compared with 156,700 kg in 2019. The company's production of refined platinum was 46,745 kg in 2020; refined palladium, 32,892 kg; refined rhodium, 6,669 kg; and refined iridium and ruthenium, a total of about 11,500 kg. Amplats' production of refined platinum was 78,200 kg in 2019; refined palladium, 50,851 kg; refined rhodium, 10,084 kg; and refined iridium and ruthenium, a total of about 17,500 kg (Anglo American Platinum Ltd., 2021, p. 55).

About 82,200 kg of PGMs were produced by the South Africa-based mining operations of Amplats and its joint-venture partners in 2020, which was a decrease of about 17% compared with that in 2019. Production decreases from the effects of the COVID-19 pandemic were estimated to be about 16,000 kg of PGMs. Of the PGMs produced in 2020, platinum accounted for 38,000 kg; palladium, 29,700 kg; ruthenium, 7,400 kg; rhodium, 5,300 kg; and iridium, 1,800 kg. Production of mined ruthenium decreased by about 22% in 2020; mined rhodium, by 21%; mined iridium, by 20%; mined platinum, by 18%; and mined palladium, by 13% (Anglo American Platinum Ltd., 2021, p. 7, 60, 62, 64, 68, 70).

In 2020, total PGM production at Amplats' Mogalakwena Mine was 35,032 kg; at the Amandelbult Mine, 18,821 kg; at the Kroondal Mine, 14,874 kg; at the Mototolo Mine, 6,899 kg; and at the Modikwa Mine, 6,619 kg. Total PGM production decreased at Amandelbult, by 31%; at Modikwa, by 26%; at Kroondal, by 23%; at Mototolo, by 8%; and at Mogalakwena by 2% (Anglo American Platinum Ltd., 2021, p. 60, 62, 64, 68, 70).

Mogalakwena, which accounted for 43% of Amplats and its joint-venture partners' total mined PGM output in 2020, produced 57% of the companies' palladium, 41% of the platinum, 22% of the rhodium, and 14% each of the iridium and ruthenium. Mogalakwena was in the Northern Limb of the Bushveld Complex, which hosted PGM deposits that tended to be relatively richer in palladium. Amandelbult, which accounted for 23% of the companies' total mined PGM output in 2020, produced 34% each of the iridium and ruthenium, 32% of the rhodium, 25% of the platinum, and 15% of the palladium. Kroondal, which accounted for 18% of the companies' total mined PGM output in 2019, produced 31% of the iridium, 29% of the ruthenium, 25% of the rhodium, 19% of the platinum, and 13% of the palladium. Amandelbult and Kroondal were in the Western Limb and the Eastern Limb of the Bushveld Complex, respectively, which hosted PGM deposits that tended to be relatively richer in iridium, rhodium, and ruthenium (Impala Platinum Holdings Ltd., 2008; Anglo American Platinum Ltd., 2021, p. 60, 62, 64, 68, 70).

Amplats was considering developing the Der Brochen project, which was adjacent to the Mototolo Mine. The Der Brochen project had an estimated mine life of 30 years. Developing Der Brochen could increase total PGM production at Mototolo to more than 8,600 kg/yr by 2025 (Anglo American Platinum Ltd., 2021, p. 64, 156–158, 194).

Amplats also planned to complete a feasibility study on an expansion of the Mogalakwena Mine by the end of 2021. The company expected to make an investment decision on the project by the first quarter of 2022. Depending on the results of the study, total PGM production capacity at Mogalakwena could increase by 9,300 to 18,700 kg/yr after 2023. Amplats and Sibanye-Stillwater were considering the development of the Klipfontein project at Kroondal, which could produce a total of 1,150 kg/yr of PGMs (not including iridium or ruthenium) and gold (Anglo American Platinum Ltd., 2021, p. 12, 152; Sibanye-Stillwater Ltd., 2021a, p. 179, 286).

Implats produced a total of 92,934 kg of refined PGMs and gold in 2020 compared with 86,888 kg in 2019. Platinum accounted for about 45,600 kg in 2020; palladium, 28,000 kg; rhodium, 6,200 kg; and gold, iridium, ruthenium, a total of about 13,200 kg. The company's production of refined platinum in 2019 was about 43,000 kg; refined palladium, 25,800 kg; refined rhodium, 5,800 kg; and gold, iridium, and ruthenium, a total of about 12,300 kg. Implats' South Africa-based mining operations accounted for about 45,000 kg of refined PGM and gold production in 2020; the remaining 47,900 kg was attributable to the Two Rivers Mine, company operations in Zimbabwe, recycling, and toll refining (Impala Platinum Holdings Ltd., 2020a, p. 117, 121, 129; 2020b, p. 71, 73, 81; 2021, p. 70, 72, 82).

The Impala Rustenburg Mine near Rustenburg in North West Province produced a total of about 38,500 kg of PGMs and gold in 2020 compared with 43,800 kg in 2019. Implats' platinum production was about 19,800 kg in 2020; palladium, 9,700 kg; and rhodium, 3,000 kg. Total gold, iridium, and ruthenium was 6,100 kg in 2020, of which ruthenium and iridium accounted for an estimated 69% and 17%, respectively, based on data from prill splits (the relative proportions of PGMs in ore). Palladium production decreased by 17% in 2020; platinum, 13%; and rhodium, 5%. Iridium and ruthenium production decreased by an estimated 3% each. Production decreases were about 4,700 kg of PGMs and gold in the first half of 2020 (Impala Platinum Holdings Ltd., 2008; 2020a, p. 114, 117; 2020b, p. 71; 2021, p. 70).

In 2020, Implats' output of palladium at the Marula Mine was about 2,530 kg; platinum, 2,460 kg; rhodium, 510 kg; and gold, iridium, and ruthenium, a total of 960 kg. Based on prill split data, ruthenium production was estimated to be about 700 kg in 2020 and iridium, about 200 kg. All ore mined at Marula was from the UG2 chromitite layer, which was richer in iridium, palladium, rhodium, and ruthenium than the Merensky reef layer. In 2019, Implats' production at Marula was about 2,730 kg of palladium; platinum, 2,660 kg; rhodium, 550 kg; and gold, iridium, and ruthenium, a total of 1,010 kg. The company planned to produce 6,800 to 8,100 kg of PGMs and gold in fiscal year 2021 (Impala Platinum Holdings Ltd., 2008; 2020a, p. 123, 129; 2020b, p. 73; 2021, p. 72).

Sibanye-Stillwater produced 23,821 kg of PGMs at the Marikana Mine in 2020, of which platinum accounted for 12,598 kg; palladium, 5,702 kg; ruthenium, 2,965 kg; rhodium, 1,767 kg; and iridium, 788 kg. In the second half of 2019, the company produced platinum at a rate of 16,200 kg/yr; palladium, 7,500 kg/yr; ruthenium, 4,000 kg/yr; rhodium, 2,400 kg/yr; and iridium, 1,100 kg/yr. Marikana's production was refined at Sibanye-Stillwater's Precious Metals Refinery at Brakpan (Sibanye-Stillwater Ltd., 2021b).

In 2020, Sibanye-Stillwater produced 19,960 kg of PGMs at the Rustenburg Mine compared with 24,931 kg in 2019. In 2020, the company's production of platinum at Rustenburg was 10,379 kg; palladium, 5,268 kg; ruthenium, 2,324 kg; rhodium, 1,466 kg; and iridium, 523 kg. In 2019, Sibanye-Stillwater's production of platinum at Rustenburg was 12,864 kg; palladium, 6,586 kg; ruthenium, 2,954 kg; rhodium, 1,860 kg; and iridium, 666 kg. Decreased output was partially attributable to lower ore grades (Sibanye-Stillwater Ltd., 2021b).

Sibanye-Stillwater planned to increase its production of PGMs (not including ruthenium or iridium) and gold at its current operation by about 8% by 2024. The company also was considering developing the K4 project at Marikana, which could produce 7,800 kg/yr of PGMs and gold during an estimated 50-year life (Sibanye-Stillwater Ltd., 2021a, p. 178–179, 286).

Northam Platinum Ltd. operated the Booysendal, the Eland, and the Zondereinde Mines; the company sold its production to Heraeus South Africa (Pty) Ltd. for refining. Heraeus' production of refined platinum at Port Elizabeth decreased to 10,367 kg in 2020 from 11,165 kg in 2019, and that of refined palladium remained nearly unchanged at 5,480 kg. Iridium, rhodium, and ruthenium were exported to Germany for refining (Northam Platinum Ltd., 2020, p. 21; 2021, p. 36).

Platinum production in 2020 from the Booysendal, the Eland, and the Zondereinde Mines was 10,598 kg; palladium, 4,963 kg; ruthenium, 2,835 kg; rhodium, 1,647 kg; iridium, 890 kg; and gold, 258 kg. Northam's production in 2019 of platinum was 10,858 kg; palladium, 5,090 kg; ruthenium, 2,661 kg; rhodium, 1,582 kg; iridium, 579 kg; and gold, 207 kg. Total PGM and gold production from Zondereinde decreased to 9,609 kg in 2020 compared with 11,561 kg in 2019. Production increased to 10,508 kg from 9,123 kg at Booysendal and to 1,396 kg from 559 kg at Eland (Northam Platinum Ltd., 2020, p. 21, 32, 37, 41; 2021, p. 36, 41, 47, 52).

Northam planned to increase its production of PGMs (not including ruthenium or iridium) and gold to more than 31,000 kg/yr, of which Booysendal would account for about 15,500 kg/yr; Zondereinde, nearly 11,000 kg/yr; and Eland, about 4,700 kg/yr. The company planned to reach full capacity at the Central UG2 and Central Merensky mining sections within the Booysendal Mine by mid-2023 and mid-2024, respectively. Northam planned to start processing ore from the Kukuma Shaft at Eland by mid-2021. Increased production from Zondereinde would be attributable to the Western extension project. The estimated remaining life of Zondereinde was more than 30 years and that of Booysendal was more than 25 years. In 2020, Northam put its expansion plans on hold temporarily because of the COVID-19 pandemic (Northam Platinum Ltd., 2020, p. 4–5, 44–45; Heiberg, 2021).

Royal Bafokeng Platinum Ltd. (RBPlat) produced PGMs at the Bafokeng Rasimone Platinum Mine (BRPM) and the Styldrift Mine. Production of PGMs (not including ruthenium or iridium) and gold was about 13,000 kg in 2020 compared with 12,500 kg in 2019. At BRPM, total production of PGMs and gold decreased to 7,000 kg in 2020 from 7,500 kg in 2019; platinum increased to 4,480 kg from 4,850 kg. Total production of PGMs and gold at Styldrift increased to 6,070 kg in 2020 from 5,000 kg in 2019; platinum increased to 3,980 kg from 3,270 kg. Based on prill split data, BRPM and Styldrift produced a total of about 3,400 kg of palladium and 650 kg of rhodium in 2020 (Royal Bafokeng Platinum Ltd., 2021, p. 4, 69–70, 114).

RBPlat planned to produce a total of 14,800 to 16,300 kg of PGMs and gold at BRPM and Styldrift in 2021. The company planned to increase production at Styldrift to its full capacity of nearly 10,000 kg/yr by 2021 (Royal Bafokeng Platinum Ltd., 2021, p. 39, 83).

ARM and Implats operated the Two Rivers Mine, the output of which decreased to 8,495 kg of PGMs and gold in 2020 from 9,040 kg in 2019. Platinum accounted for about 47% of Two Rivers' PGM output; palladium, 28%; ruthenium, 13%; rhodium, 8%; iridium, 3%; and gold, 1%. In the second half of 2019, ARM approved an expansion of the concentrator plant capacity that was expected to increase total production to 11,200 kg/yr. The plant could be completed by the first quarter of 2022. The estimated remaining life of the Two Rivers Mine was more than 30 years (African Rainbow Minerals Ltd., 2020a, p. 13, 56, 59, 63; 2020b, p. 11; 2021, p. 12).

ARM and Norilsk produced PGMs at the Nkomati nickel mine. Output increased to 2,874 kg of PGMs in 2020 from 3,057 kg of PGMs in 2019. Based on prill split data, palladium accounted for about 66% of production; platinum, 28%; and rhodium, 4%. The mine was expected to close at the end of March 2021 (Impala Platinum Holdings Ltd., 2008; African Rainbow Minerals Ltd., 2020a, p. 13, 65; 2020b, p. 13; 2021, p. 14).

In 2018, Siyanda Resources (Pty) Ltd. produced platinum at the Siyanda Bakgatla Mine (formerly the Union Mine) in Limpopo Province at a rate of about 5,400 kg/yr. The company's palladium production was estimated to be about 2,500 kg/yr; ruthenium, 1,400 to 1,500 kg/yr; rhodium, 990 kg/yr; and iridium, 360 kg/yr. In fiscal year 2020 (March 1, 2019, through February 28, 2020), total PGM production was 9,597 kg. The Siyanda Bakgatla Mine was expected to continue production until 2030 (Moumakwa and Rakhudu, 2018; Anglo American Platinum Ltd., 2019, p. 56; Arnoldi, 2021a).

In its fiscal year 2020, Tharisa Minerals produced 4,420 kg of PGMs and gold compared with 4,345 kg in fiscal year 2019. Platinum accounted for 55.4% of production by volume in fiscal year 2020; palladium, 16.2%; rhodium, 9.5%; and gold, iridium, and ruthenium, a total of 18.9%. Tharisa Minerals planned to produce 4,800 to 5,100 kg of PGMs and gold in fiscal year 2021. The company planned to increase production subsequently to a rate of 6,200 kg/yr of PGMs and gold [Tharisa Minerals (Pty) Ltd., 2020, p. 2, 7, 37].

Sedibelo Platinum Mines Ltd. produced 4,005 kg of PGMs (not including ruthenium or iridium) and gold at its Pilanesburg Platinum Mines in 2020 compared with 3,960 kg in 2019. Increased production was attributable to higher ore grades and recovery rates. In 2020, the company approved plans to expand its mining operations and to build a new hydrometallurgical processing plant (Sedibelo Platinum Mines Ltd., 2021, p. 2, 7).

Wesizwe Platinum Ltd. was developing the Bakubung Mine in North West Province. As of 2018, the company planned to produce 13,000 kg/yr of PGMs (not including ruthenium or iridium) and gold. Platinum was expected to account for 62.4% of PGM production; palladium, 28%; rhodium, 7.4%; and gold, 2.2%. In March 2019, Wesizwe announced that the initial planned capacity of the mine would be reduced by two-thirds because of low PGM prices; the company could expand capacity after a 5-year mining period based on market conditions. Mining was expected to start in October 2021 (Engineering & Mining Journal, 2015; Cornish, 2018a; Moumakwa, 2019; Arnoldi, 2020b).

Ivanhoe Mines Ltd. of Canada was constructing a new mine at its Platreef project. In the first phase of mining, Ivanhoe had planned to produce 9,500 t/yr of nickel, 5,900 t/yr of copper, and 14,800 kg/yr of PGMs (not including ruthenium or iridium) and gold. The company completed a new feasibility study in 2020; planned production was 15,800 kg/yr of PGMs and gold. Ivanhoe could start mining in 2025 and reach full capacity in 2027 (Engineering & Mining Journal, 2017; McKay, 2020b).

Platinum Group Metals Ltd. of Canada expected to receive a mining license for the Waterberg project in the first quarter of 2020 and to subsequently make a final investment decision on a new mine. Mining could start at Waterberg, which is in the Northern Limb of the Bushveld Complex, in late 2023 depending on the results of the final investment decision. The mine's planned capacity of about 13,000 kg/yr of PGMs (not including ruthenium or iridium) and gold could be reached by 2027. Palladium accounted for 63% of production in a prefeasibility study completed in 2016; platinum, 30%; gold, 6%; and rhodium, 1%. Mining was expected to continue until 2066. As of mid-December 2020, Platinum Group Metals had not received the mining license (Engineering & Mining Journal, 2016, 2019; Mining Weekly, 2020).

Titanium and Zirconium.—Richards Bay Minerals (Pty) Ltd. (RBM) (Rio Tinto plc, 74%; Blue Horizon Investments, 24%; and RBM permanent employees, 2%) of the United Kingdom produced ilmenite, rutile, and zircon at the Zulti North deposits in KwaZulu Natal Province; ilmenite was processed to titanium slag. The company's production decreased in recent years because of factors including lower ore grades and civil unrest that shut down operations during several periods between 2014 and 2016 and in 2018 and 2019. Mining was also limited by the COVID-19 pandemic in 2020 [Richards Bay Minerals (Pty) Ltd., 2017, p. 12; Ramane, 2018; Barradas, 2019; Rio Tinto plc, 2021, p. 186].

RBM's production of titanium slag decreased to 563,264 t in 2019 from 880,844 t in 2012. Based on titanium slag production, ilmenite production was estimated to have decreased to 1.1 Mt from 1.7 Mt. Production of titanium slag and ilmenite decreased by an estimated 10% each in 2020. RBM's titanium slag had a titanium dioxide (TiO_2) content of 85% [Richards Bay Minerals (Pty) Ltd., 2013, p. 10; 2017, p. 8; 2020, p. 4; Rio Tinto plc, 2021, p. 57].

RBM's zircon and rutile production capacity was 250,000 t/yr and 100,000 t/yr, respectively. The company's zircon production decreased to 141,645 t in 2019 from 263,673 t in 2012, and rutile production decreased to 46,176 t from 97,489 t. Production of rutile and zircon decreased by an estimated 10% each in 2020. RBM's rutile had a TiO_2 content of about 94%. Most of the company's rutile and zircon production was exported [Richards Bay Minerals (Pty) Ltd., 2013, p. 10; 2017, p. 8; 2020, p. 4; Ramane, 2018; Rio Tinto plc, 2021, p. 57].

In April 2019, RBM approved the Zulti South project, which could maintain the company's zircon and rutile capacity and extend the life of its operations. Mining was expected to start at Zulti South by late 2021. The company shut down production and stopped construction on Zulti South in December 2019 because of civil unrest resulting from a dispute between RBM and the local community. RBM planned to restart mining in early January 2020 and to evaluate restarting Zulti South. As of the end of 2020, development had not restarted (Barradas, 2019; Thomson Reuters, 2019; Rio Tinto plc, 2021, p. 57).

Mineral Commodities Ltd. (MCL) of Australia operated the Tormin Mine in Western Cape Province. In 2020, the company produced 67,460 t of ilmenite, 6,822 t of zircon, and 1,609 t of rutile compared with 49,937 t of ilmenite, 6,633 t of zircon, and 1,527 t of rutile in 2019. Increased production of ilmenite, rutile, and zircon was attributable to the startup of operations at the Inland Strand and Northern Beach mining areas. MCL planned to produce 130,000 to 160,000 t of ilmenite and a total of 20,000 to 40,000 t of rutile and zircon in 2021. The company planned an expansion that would include a new plant with a capacity of 150,000 t/yr of finished ilmenite by March 2022 (Mineral Commodities Ltd., 2021, p. 3–4, 6–7, 11).

In 2020, Nyanza Light Metals Ltd. (Arkein Group of Companies, 80%) started construction of a new TiO_2 pigment plant in the Richards Bay Industrial Development Zone. The company planned to start production from a small-scale plant by December 2021 and to subsequently produce more than 80,000 t/yr of TiO_2 pigment from a large-scale plant. The small-scale plant would produce until late 2022. Pigment would be produced using titanium-rich wastes from Highveld's iron ore and vanadium-mining operations (Tshethlanyane, 2017; Richards Bay Industrial Development Zone, 2020).

Vanadium.—Glencore produced vanadium pentoxide (V_2O_5) and ferrovanadium at the Rhovan Mine and smelter in Brits. In 2020, production of V_2O_5 at Rhovan decreased to about 8,800 t from 9,200 t in 2019. The estimated remaining life of the Rhovan Mine was 11 to 12 years based on reserves at yearend (Glencore plc, 2021a, p. 16; 2021b, p. 30).

Bushveld Minerals Ltd. of the United Kingdom operated the Vametco Mine and Brits plant. In 2020, the company produced 2,654 t of vanadium content from magnetite ore at Vametco compared with 2,833 t in 2019. Bushveld planned to produce 2,700 to 2,850 t of vanadium content at Vametco in 2021. Depending on the outcome of a feasibility study, the company planned to increase production at Vametco to 4,200 t/yr eventually. Capacity was increased to 3,750 t/yr in June 2018 (Kotze, 2018a; Bushveld Minerals Ltd., 2020, p. 26; 2021).

Bushveld purchased and reopened the Vanchem plant in November 2019; the company produced 990 t of vanadium content in 2020 from stockpiles. The company planned to produce 1,400 t 1,500 t of vanadium content at Vametco in 2021. Bushveld planned to start a feasibility study on mining the Main Magnetite Layer at its Mokopane project in 2021. Depending on the results of the study, Mokopane could be Vanchem's primary source of ore. Bushveld planned to eventually increase production at Vanchem to more than 4,200 t/yr of vanadium content (Bushveld Minerals Ltd., 2020, p. 6, 27; 2021).

In 2020, Bushveld approved a new plant that would produce vanadium electrolytes from vanadium supplied by Vametco and Vanchem. Bushveld's subsidiary Bushveld Electrolyte Co. was expected to start construction of the plant in 2021. Vanadium electrolytes would be used in batteries (Bushveld Minerals Ltd., 2020, p. 4, 6–7; 2021).

Industrial Minerals

Cement.—South Africa had six cement producers that had a total capacity of 20.5 Mt/yr of cement. Pretoria Portland Cement Co. (Pty) Ltd. had a combined cement capacity of 7 Mt/yr; AfriSam Consortium (Pty) Ltd., 4.6 Mt/yr; Lafarge Industries South Africa (Pty) Ltd., 3.2 Mt/yr; Dangote Cement South Africa (Pty) Ltd., 2.9 Mt/yr; Natal Portland Cement Co. (Pty) Ltd., 1.8 Mt/yr; and Mamba Cement Company (Pty) Ltd., 1 Mt/yr (table 2; International Cement Review, 2018).

In 2020, cement sales in South Africa by domestic producers were an estimated 12 Mt compared with 12.7 Mt in 2019 and 13.7 Mt in 2018. In June, South Africa's cement plants were operating far below capacity because of the effects of the COVID-19 pandemic [table 1; Global Cement, 2020; Levitt Kirson Business Services (Pty) Ltd., 2020].

Clay and Shale.—In 2020, South Africa's total sales of brick clay and shale decreased to 4.54 Mt from 5.99 Mt in 2019. Sales decreased for brick clay to 3.77 Mt in 2020 from 4.71 Mt in 2019; shale for use in bricks, to 554,000 t from 1.04 Mt; and shale for use in cement, to 220,000 t from 252,000 t. Decreased sales of brick clay and shale were attributable to the effects of the COVID-19 pandemic. In early 2020, brick clay and shale were produced at as many as 151 mines (Lourens and DeWater, 2020, p. 73, 88–103, 112, 114–116, 120, 128, 131, 133, 136, 152, 154, 158; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Diamond.—In 2020, diamond production was 8.47 million carats compared with 7.18 million carats in 2019 and 8.87 million carats in 2010. Kimberlites accounted for about 94% of diamond production in 2020, and alluvial and marine deposits accounted for 3% each. From 2009 through 2019, employment in the diamond cutting and polishing industry decreased to 250 polishers from 4,500. The decrease was attributable to factors including insufficient supplies of suitable rough diamond, a lack of new companies entering the market, high labor costs, and narrowing margins between rough and polished diamond prices (State Diamond Trader, 2015, p. 24–25, 27–30; Galane, 2018; de Klerk, 2019; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

De Beers Group of Companies produced 3.77 million carats of diamond at the Venetia Mine in 2020 compared with 1.92 million carats in 2019. Increased production was attributable to higher ore grades. At yearend, Venetia's near-surface reserves were approaching depletion (Anglo American plc, 2021, p. 3–4).

In 2020, De Beers was engaged in the construction of the Venetia Underground mine, which would extend the life of the Venetia Mine beyond 2045. Production from Venetia Underground was expected to start by 2022 and to produce 4.5 million carats per year at full capacity (Cornish, 2018b; Schmidt, 2020).

In 2020, Petra Diamonds Ltd. produced 1.7 million carats of diamond at the Cullinan Mine, which was nearly unchanged from 2019. At the Finsch Mine, production decreased to 1.43 million carats in 2020 from 1.72 million carats in 2019, and at the Koffiefontein Mine production decreased to about 60,000 carats from 82,000 carats. Decreased output at Finsch was partially attributable to lower ore grades (Petra Diamonds Ltd., 2020, p. 12–15; 2021, p. 15–18).

Fluorspar.—In 2020, South Africa's production of fluorspar increased to an estimated 287,000 t from 253,000 t (revised) in 2019 and 212,000 t in 2018 because the Nokeng Mine opened. Minerales Y Productos Derivados SA of Spain operated the Vergenoeg Mine. Vergenoeg's capacity of acid-grade fluorspar was 250,000 t/yr, and its capacity of metallurgical-grade fluorspar powder and briquets was 30,000 t/yr (table 1; Modiselle, 2019).

Sephaku Fluoride Ltd. (SepFluor) started operations at its plant at the Nokeng Mine in March 2019 and officially opened the mine in August 2019. Nokeng, which was at Rust de Winter, had a capacity of 180,000 t/yr of acid-grade fluorspar and 30,000 t/yr of metallurgical-grade fluorspar. SepFluor made its first shipment of 10,000 t at a grade of 97% calcium fluoride (CaF_2) in December 2019 (Modiselle, 2019; Roskill Information Services Ltd., 2020).

Eurasian Resources Group (ERG) of the United Kingdom and SA Fluorite (Pty) Ltd. were considering developing the Doornhoek project. The companies planned to complete a feasibility study on a new mine at Doornhoek in 2020. Depending on the results of the study, ERG and SA Fluorite could produce 120,000 to 150,000 t/yr of fluorspar. Mining could start in 2022; Doornhoek was estimated to require fluorspar prices of $200 per metric ton to break even. As of the end of 2020, it was unclear whether the feasibility study was completed (Modiselle, 2019).

Garnet, Industrial.—MCL produced industrial garnet from the Tormin Mine. In 2020, the company produced 153,743 t compared with 179,057 t in 2019. MCL planned to produce 200,000 to 240,000 t of industrial garnet in 2021. The company planned an expansion that included a new plant with a capacity of 250,000 t/yr of finished garnet by March 2022 (Mineral Commodities Ltd., 2021, p. 3–4, 6–7, 11).

Gemstones.—In 2018 and 2019, Magnum Mining & Exploration Ltd. of Australia engaged in trial production at the Gravelotte Mine. The company produced 2 kg/yr of emerald. Between 1929 and 1982, Gravelotte and other nearby mines produced a total of 22,500 kg of emerald. Gravelotte Mine ceased large-scale production in 1986. Gravelotte was the world's leading emerald producer in the 1950s and 1960s. Magnum was considering restarting large-scale mining at Gravelotte at an initial rate of 600 kg/yr; the company planned to complete a final technical and economic study in the first quarter of 2021 (Magnum Mining & Exploration Ltd., 2019, p. 4, 6, 9; 2020, p. 1, 4; 2021, p. 1).

Kyanite and Related Materials.—South Africa was the world's leading producer of andalusite. In 2020, production decreased to an estimated 170,000 t from 190,000 t in 2019. Output was limited by the temporary closure of the Maroeloesfontein Mine in 2019 (table 1; Lassetter, 2020).

Imerys South Africa (Pty) Ltd. (a subsidiary of Imerys Group of France) operated the Annesley, the Segorong, and the Thabazimbi Mines. The company accounted for a substantial majority of domestic andalusite production. Andalusite Resources (Pty) Ltd. operated the Maroeloesfontein Mine, which had a capacity of more than 70,000 t/yr. The estimated remaining life of Maroeloesfontein was about 100 years. In late March 2020, Andalusite Resources and Imerys temporarily shut down their mining operations because of the effects of the COVID-19 pandemic (Ghilotti, 2020; Lassetter, 2020).

Phosphate Rock.—Foskor (Pty) Ltd. was South Africa's leading producer of phosphate rock. In 2020, national phosphate rock production decreased to about 1.28 Mt from 1.83 Mt in 2019 and 2.49 Mt in 2010. In the second quarter of 2019, domestic sales were at a rate of more than 860,000 t/yr and exports were at a rate 440,000 t/yr (Galane, 2018; Muravha, 2019; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Foskor used phosphate rock from its mine at Phalaborwa in the production of phosphoric acid and fertilizers including monoammonium phosphate and diammonium phosphate at its plant in Richards Bay. In its fiscal year 2020 (April 1, 2019, through March 31, 2020), the company produced 287,000 t of phosphoric acid compared with 382,000 t in fiscal year 2019. Fertilizer production decreased to 238,000 t from 266,000 t. Decreased production was attributable to labor disputes and equipment problems. Foskor planned to increase production to an average of 2.2 Mt/yr of phosphate rock, 550,000 t/yr of phosphoric acid, and 400,000 t/yr of fertilizers by fiscal year 2022 [Foskor (Pty) Ltd., 2020, p. 4, 40, 98].

Kropz Elandsfontein (Pty) Ltd. and African Rainbow Capital (Pty) Ltd. planned to restart production at the Elandsfontein Mine, which is in Western Cape Province, in 2020. The companies planned to produce 1 Mt/yr of phosphate rock at a grade of 31% phosphorus pentoxide. The opening of the mine subsequently was delayed until the fourth quarter of 2021 (Muravha, 2019; Arnoldi, 2020a).

Sand, Construction.—In 2020, South Africa's sales of aggregates and sand for construction were 46.2 Mt compared with 59 Mt in 2019. Sales of aggregates decreased to 38.8 Mt in 2020 from 47.2 Mt in 2019, and sand for construction decreased to 10.1 Mt from 11.8 Mt. Decreased sales of aggregates and sand for construction were attributable to the effects of the COVID-19 pandemic. In early 2020, aggregates and construction sand were produced by cement producers and other companies at as many as 655 mines (Lourens and DeWater, 2020, p. 22, 40, 43, 89, 95, 100–101, 103–104, 109, 111, 113–117, 119–166; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Sand, Industrial.—In 2020, South Africa's production of silica sand was about 2.12 Mt compared with 2.27 Mt in 2019. In early 2020, silica sand was produced at as many as 29 mines. Silica sand was used by Consol Glass (Pty) Ltd., Nampak Glass (Pty) Ltd., and other companies in the production of glass (Lourens and DeWater, 2020, p. 78, 110, 117, 119–121, 129, 168; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Stone, Crushed.—In 2020, South Africa's production of limestone decreased to 20.3 Mt from 22.3 Mt in 2019 and 22.8 Mt in 2018. As of early 2020, limestone was produced by cement companies and other producers at as many as 48 mines. Limestone sales for use in cement were 13.5 Mt in 2020; agriculture, 2.27 Mt; metallurgy, 1.27 Mt; and other industries, 1.31 Mt (Lourens and DeWater, 2020, p. 100, 111–116, 139; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Stone, Dimension.—In 2020, South Africa's sales of granite dimension stone were 371,212 t compared with 384,019 t in 2019 and 346,161 t in 2010. About 39% of granite sales were domestic in 2020 compared with 81% in 2010; decreased domestic sales could be attributable to competition with engineered stone products. Granite accounted for about 99% of the volume of national dimension stone sales. As of early 2020, granite was produced at as many as 59 mines; slate, 8 mines; sandstone, 7 mines; and other dimension stone, 4 mines (Galane, 2018; Motsie, 2018; Lourens and DeWater, 2020, p. 103–109; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Sulfur.—South Africa's sulfur production was 575,000 t in 2020 compared with 900,000 t in 2019. Foskor used sulfur in the production of sulfuric acid; the company produced 1.2 Mt in its fiscal year 2020 compared with 1.36 Mt in fiscal year 2019. Output was limited by equipment problems and labor disputes [Foskor (Pty) Ltd., 2020, p. 97; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022].

Vedanta was engaged in a feasibility study on the development of a new zinc smelter and refinery at the Gamsberg Mine. Depending on the results of the study and obtaining reliable power supplies, the refinery could produce nearly 370,000 t/yr of sulfuric acid. As of yearend 2020, it was unclear when Vedanta would start construction (Piper, 2019; Frost, 2021).

Vermiculite.—In 2020, Palabora Mining's production at the Palabora Mine was 118,223 t compared with 158,013 t in 2019 and 141,346 t in 2018. Decreased production in April and May was attributable to the effects of the COVID-19 pandemic. Mining was expected to continue at Palabora until 2045 (Golder Associates Inc., 2019, p. 20; Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Mineral Fuels and Related Materials

Coal.—In 2020, total coal production was about 248 Mt compared with 259 Mt in 2019 and 257 Mt in 2010. Bituminous coal accounted for 97% of South Africa's coal production in 2020. Coal accounted for more than 70% of the power generated in South Africa. In 2019, Eskom Holdings SOC Ltd. purchased 118 Mt of coal for use in its power stations. Coal exports from Richards Bay were 72 Mt in 2019, of which India accounted for 41.6 Mt and Pakistan accounted for 12 Mt. About 40 Mt of coal was used in the production of synthetic fuels (table 1; Galane, 2018; Ryan, 2020; Sasol Ltd., 2020, p. 52).

Exxaro Resources Ltd.'s coal production increased to 47.4 Mt in 2020 from 45.6 Mt in 2019. Output at the Grootegeluk Mine in the Waterberg Coalfield in Limpopo Province increased to 28.8 Mt in 2020 from 27.8 Mt in 2019; metallurgical coal increased to 2.22 Mt from 2.07 Mt. Grootegeluk accounted for most of South Africa's metallurgical coal production. Production at Matla increased to 6.15 Mt in 2020 from 5.99 Mt, and production at Belfast increased to 2.85 Mt from 1.03 Mt. The Mafube Mine produced 3.64 Mt in 2020, of which 50% was attributable to Exxaro. The company planned to produce a total of 47.6 Mt in 2021 and nearly 55 Mt in 2022; metallurgical coal production was expected to increase to 3 Mt in 2021 (table 1; Tex Report, The, 2021a, b).

Exxaro started production at the Leeuwpan life expansion project in the second half of 2018; full production of 2.7 Mt/yr was expected by the first quarter of 2021. The company completed an expansion of the Dorstfontein Mine's capacity by 800,000 t/yr in 2020. Exxaro also was engaged in the expansion of Grootegeluk's capacity by 1.7 Mt/yr in 2020; the expansion could be completed by the first half of 2022. In the third quarter of 2020, Exxaro started construction of an expansion at Matla to 10 Mt/yr from 6 Mt/yr. Exxaro planned to complete the expansion by the second half of 2024 (Exxaro Resources Ltd., 2021, p. 105).

In fiscal year 2020 (July 1, 2019, through June 30, 2020), Sasol Ltd.'s coal production decreased to 36.8 Mt from 37.5 Mt in fiscal year 2019. The Syferfontein Mine accounted for 9.1 Mt; the Shondoni (formerly the Middelbult Mine) and the Twistdraai Mines, 7.5 Mt each; the Impumelelo Mine, 6.2 Mt; the Bosjesspruit Mine, 5.3 Mt; and the Sigma Mine, 1.2 Mt. The Brandspruit Mine shut down in the first half of 2019. Most of Sasol's coal production was used in the company's synthetic fuel operations (Sasol Ltd., 2020, p. 51).

Glencore and ARM operated the Goedgevonden Complex, the Impunzi Complex, and the Tweefontein Complex. Output at Goedgevonden decreased to 6.47 Mt in 2020 from 6.59 Mt in 2019 and decreased to a total of 13.1 Mt from 14 Mt at Impunzi and Tweefontein. Production decreased because of the effects of the COVID-19 pandemic. The estimated remaining life of Goedgevonden was 20 years and at Impunzi and Tweefontein, 19 years (African Rainbow Minerals Ltd., 2020a, p. 13, 85–87; 2020b, p. 15, 17; 2021, p. 16–17).

Umcebo Mining Ltd. (Glencore, 48.7%) operated the Wonderfontein Mine; production at Wonderfontein was about 3 Mt in 2020. The estimated remaining life of Wonderfontein was 9 years (Glencore plc, 2021b, p. 44).

Izimbiwa Coal (Pty) Ltd. (Phembani Group, 50.01%, and Glencore, 49.99%) operated the Middelburg Complex; salable coal production was about 2.7 Mt in 2020. The estimated remaining life of the Middelburg Complex was 4 years. The Argent and Springboklaagte projects could extend the life of Izimbiwa by 20 to 25 years depending on obtaining environmental permits (Glencore plc, 2021b, p. 44).

Glencore also produced more than 1 Mt of coal at the Zonnebloem Mine in 2020. Based on an estimated remaining mine life of 23 years, production at the Zonnebloem Mine could be as much as 3.2 Mt/yr of salable coal (Glencore plc, 2021b, p. 43).

Seriti Coal (Pty) Ltd. operated the Kriel, the New Denmark, and the New Vaal Mines. New Vaal produced 17 Mt/yr of coal, and Kriel and New Denmark produced 5 Mt/yr each. All of Seriti's production was supplied to domestic power stations. Seriti expected to continue production at New Denmark and New Vaal until 2039 and at Kriel, until 2029 [Seriti Coal (Pty) Ltd., 2021].

Seriti started trial mining at the New Largo Mine in Mpumalanga Province in 2020. Depending on a long-term agreement with Eskom to supply the Kusile power station, Seriti planned to produce 12 Mt/yr of thermal coal at New Largo. The estimated life of the mine was at least 50 years. As of yearend, Eskom had not signed an agreement with Seriti to supply Kusile [Seriti Coal (Pty) Ltd., 2021; Steyn, 2021].

Anglo American produced 28.7 Mt in 2020 at the Goedehoop, the Greenside, the Isibonelo, the Khwezela, the Rietvlei, and the Zibulo Mines compared with 26 Mt in 2019. Production increased at Isibonelo and Rietvlei to 6.71 Mt in 2020 from 4 Mt in 2019; at Khwezela, to 6.18 Mt from 5.76 Mt; Goedehoop, to 6.12 Mt from 6.07 Mt. In 2020, production decreased to 5.15 Mt from 5.36 Mt in 2019 at Zibulo and to 4.49 Mt from 4.85 Mt at Greenside. About 57% of the company's sales were exports in 2020 (Anglo American plc, 2021, p. 14).

South32 produced coal at the Khutala, the Klipspruit, the Middelburg, and the Wolverkrans Mines in Mpumalanga Province. In 2020, the company's output decreased to 22.1 Mt from 24.6 Mt in 2019. South32 planned to produce at a rate of 18 to 21 Mt/yr in the first quarter of 2021. Seriti and South32 signed an agreement for Seriti to purchase South32's share in Khutala, Klipspruit, Middelburg, and Wolverkrans in 2019; the sale was expected to be completed by the end of March 2021 (Hancock, 2019; South32 Ltd., 2020, 2021).

Wescoal Holdings Ltd. operated the Elandspruit, the Khanyisa, and the Vanggatfontein Mines in Mpumalanga Province. Total sales from the company's operations were at a rate of 8.4 Mt/yr between April and September 2020 compared with 6.2 Mt/yr during the same period in 2019. Total run-of-mine production between April and September 2020 was at a rate of 8.8 Mt/yr. Wescoal planned to start mining at the Moabsvelden project in the first quarter of 2021 and to produce 0.5 to 1 Mt of run-of-mine coal between April and September 2021. The company also planned to reopen the Arnot Mine in 2021 and to produce 1.7 to 2.2 Mt by the end of April 2022 (Tex Report, The, 2020k).

Mbuyelo Coal (Pty) Ltd. (Mbuyelo Group, 49%, and IchorCoal N.V. of the Netherlands, 45.18%) operated the Manungu, the Vlakvarkfontein, and the Welgemeend Mines. The company produced a total of 7.2 to 8 Mt/yr of coal at its mines for use in Eskom's power stations. IchorCoal agreed to sell its share in Mbuyelo to Africa Coal Partners in October 2019. The sale was cancelled by IchorCoal in January 2020 (Tex Report, The, 2019b; IchorCoal N.V., 2021)

Universal Coal plc of the United Kingdom operated the Kangala Mine, the North Block Complex (NBC), the New Clydesdale Colliery (NCC), and the Ubuntu Mine in Mpumalanga Province. In the company's fiscal year 2020 (July 1, 2019, through June 30, 2020), salable production was 7.93 Mt compared with 6.72 Mt in fiscal year 2019. The NCC accounted for 2.91 Mt of salable production in fiscal year 2020; the NBC, 2.72 Mt; Kangala, 1.97 Mt; and Ubuntu, 333,000 t. Ubuntu opened in early 2020; sales were 7.39 Mt in fiscal year 2020 (Tex Report, The, 2020g, j).

TerraCom Ltd. of Australia purchased Universal Coal in 2020. The company planned to increase sales from its South African mines to a rate of more than 16 Mt/yr in TerraCom's fiscal year 2024 (July 1, 2019, through June 30, 2020) and to more than 18 Mt/yr in fiscal year 2025 and 2026. Production was expected to decrease starting in fiscal year 2027 (Tex Report, The, 2020f).

Iyanga Mining (Pty) Ltd. operated three mines in the Witbank Coalfield in Mpumalanga Province—the Klipfontein, the Leeuwpoort, and the Welgelegen Mines—and produced about 6 Mt/yr of coal (Beryl Group, 2020).

Menar Holding (Pty) Ltd. of Luxembourg held controlling interests in Canyon Coal (Pty) Ltd., which operated the Hakhano, the Khanye, the Phalanndwa and the Singani Mines, and in Zululand Anthracite Colliery (Pty) Ltd. Kangra Coal (Pty) Ltd. (a subsidiary of Menar) produced about 2 Mt/yr of salable coal from the Savmore Mine in Mpumalanga Province. Savmore was placed on care-and-maintenance status because of the effects of the COVID-19 pandemic and remained closed at yearend. Khanye produced about 1.4 Mt/yr of salable coal out of 2.4 Mt/yr run-of-mine production [James, 2019; Canyon Coal (Pty) Ltd., 2021; Parker, 2021].

Canyon planned to start mining at the De Wittekrans project in 2021. Run-of-mine production at De Wittekrans was expected to be 3.6 Mt/yr, of which about 2.4 Mt/yr was estimated to be salable coal. The estimated life of De Wittekrans was 24 years (Holman, 2013; Moodley, 2019; Bhowan-Rajah, 2021).

Resource Generation Ltd. (Resgen) of Australia planned to build the new Boikarabelo Mine in the Waterberg coalfield. The company hoped to obtain financing by March 2020 and to start mining by 2022. Resgen planned to produce 6 Mt/yr of salable coal at Boikarabelo. In October, IDC decided that it would no longer finance the project. As of yearend, it was unclear when mining would start (Resource Generation Ltd., 2020; McKay, 2021).

MC Mining Ltd. of Australia planned to develop the Makhado project at the Soutpansberg coalfield in Limpopo Province. The company planned to produce 1.11 Mt/yr of salable coal in the first phase of mining. Thermal bituminous coal was expected to account for 570,000 t/yr and metallurgical coal, 540,000 t/yr. MC Mining aimed to begin production at its Makhado project by the end of 2021, contingent on securing debt, investors, and equity to cover development costs (Tex Report, The, 2020d).

Eskom's power generating capacity was 44,000 to 46,000 megawatts (MW), most of which was coal-fired. The company had planned to reach full capacity at its Kusile and Medupi coal-fired power stations in 2015. The completion of Medupi was delayed until 2020 or 2021 and Kusile, until 2023. The delays in completing Kusile and Medupi led to power rationing by Eskom. In early December 2019, Medupi was shut down by flooding. Eskom requested a reduction in power usage of more than 20% from the mining and manufacturing industries as a result. Some mines reportedly shut down because of the power shortages (Burkhardt and Cohen, 2019; Tex Report, The, 2019a, c).

Power rationing by Eskom became more severe in 2020 in spite of reduced demand as industrial power users shut down temporarily because of the COVID-19 pandemic. As of yearend, Medupi was not operating at full capacity (MyBroadband, 2021).

MINERAL INDUSTRY HIGHLIGHTS IN 2021

In 2021, South Africa's GDP was about $376 billion.[2] The mining and quarrying sector accounted for 8.6% of the GDP; the value of output in the mining sector increased by 11.8% after decreasing by 11.9% in 2020. The value of total exports was $123 billion in 2021, of which crude mineral products accounted for 24.1%. Employment in the mining and quarrying sector was 458,954 workers in 2021, of which PGMs accounted for 37.4%; gold, 20.5%; coal, 20.2%; iron ore, 4.7%; chromite, 4.1%; manganese, 2.9%; diamond, 2.8%; and other minerals, 7.5% (Minerals Council South Africa, 2022, p. 21–22, 25).

Production

In 2021, helium production increased by an estimated 323%; mica, by 225%; slate, by an estimated 200%; pyrophyllite, by 193%; phosphate rock (gross weight), by 66%; refined PGMs other than palladium, platinum, and rhodium, by an estimated 58%; ferrochromium, by 54%; brick clay, by 47%; chromite and kaolin, by 41% each; industrial garnet, refined palladium, refined rhodium, and silicomanganese, by 40% each; granite, pig iron, and refined platinum, by 39% each; feldspar, by 36%; gypsum, by 33%; nickel matte, by an estimated 32%; iron ore, by 31%; refined nickel, by 30%; raw steel, by 29%; rolled steel, by an estimated 28%; smelted copper, refined gold, mined palladium, stainless steel, and vermiculite, by 27% each; mined platinum and mined ruthenium, by 26% each; sand for construction, by 25%; mined rhodium, by 23%; zinc, by 21%; manganese and selenium, by 19% each; limestone, by 18%; tellurium, by an estimated 17%; bentonite, diamond, lime, and uranium, by 15% each; cement, by an estimated 14%; mined iridium, by 13%; amethyst, direct-reduced iron, mined lead and sodium sulfate, by 11% each; and aggregates and magnesite, by 10% each. Flint clay production also increased greatly in 2021 (Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Sulfur production decreased by 94% in 2021; natural gas, by 92%; mined and refined cobalt, by 60% each; natural gas liquids, by 51%; anthracite coal, by 29%; total refined petroleum products, by an estimated 26%; ferromanganese, by 16%; nickel chemicals, by an estimated 13%; ilmenite and titaniferous slag, by an estimated 12% each; and rutile, by an estimated 11%. Mined cobalt production decreased in 2021 because the Nkomati Mine was placed on care-and-maintenance status. The production of refined petroleum products decreased because of refinery closures in 2020 (Bulelwa Satsha, Administrative Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Commodity Review

Metals

Chromium.—Glencore and Merafe mined 3.68 Mt of chromite for use in their ferrochromium plants in 2021. The companies planned to complete a new plant to extract chromite from PGM tailings at the Kroondal Mine in 2022. Total production at Glencore and Merafe's ferrochromium plants increased to 1.85 Mt in 2021 from 1.29 Mt in 2020. Planned ferrochromium production for 2022 was 1.8 to 1.87 Mt (Glencore plc, 2022, p. 1; Merafe Resources Ltd., 2022, p. 5, 20).

In fiscal year 2021 (October 1, 2020, through September 30, 2021), Tharisa Minerals produced about 1.51 Mt of chromite at the Tharisa Mine compared with 1.34 Mt in fiscal year 2020. The company planned to produce 1.75 to 1.85 Mt in fiscal year 2022. Sibanye-Stillwater's sales of chromite from UG2 ore increased to 2.18 Mt in 2021 from 1.81 Mt in 2020. Amplats produced 892,600 t of chromite from UG2 ore in 2021 compared with 785,800 t in 2020 [Tharisa Minerals (Pty) Ltd., 2021, p. 1, 14; Anglo American Platinum Ltd., 2022, p. 66; Sibanye-Stillwater Ltd., 2022].

Copper and Zinc.—South Africa's mined copper production decreased to 28,300 t in 2021 from 29,100 t in 2020, and mined zinc production increased to 193,785 t from 160,816 t. As of August 2021, Orion delayed the startup of mining at Prieska from 2023 to 2024 (table 1; Resources Rising Stars, 2020; Smart, 2021, p. 11, 13).

Gold.—Sibanye-Stillwater's production increased at the Driefontein Mine to 9,265 kg in 2021 from 7,790 kg in 2020; at the Beatrix Mine, to 6,380 kg from 5,280 kg; and at the Cooke Operations, to 4,642 kg from 4,569 kg. Production at the Kloof Mine remained nearly unchanged at 10,936 kg. DRDGold's operations produced a total of 5,625 kg in 2021 compared with 5,371 kg in 2020. As of yearend 2021, production at the Burnstone Mine had not restarted (Sibanye-Stillwater Ltd., 2022).

In September 2021, West Wits Gold Ltd. (a subsidiary of West Wits Mining Ltd.) of Australia completed a feasibility study on the first stage of a new mine at the Witwatersrand Basin Project in Gauteng Province. Planned production in the study was 1,200 kg/yr during an estimated mine life of 17 years. Mining was expected to start by September 2022. West Wits Gold also planned to start a feasibility study on the second phase of mining by yearend 2021 (West Wits Mining Ltd., 2021, p. 1, 4).

Iron Ore.—Kumba's iron ore production increased to 40.9 Mt in 2021 from 37.6 Mt in 2020. Production at the Sishen Mine increased to 28 Mt in 2021 from 25.8 Mt in 2020, and production at the Kolomela Mine increased to 12.8 Mt from 11.9 Mt. The company's revised production target for 2022 was 39 to 41 Mt (Anglo American plc, 2022, p. 9).

In May 2021, Palabora Mining produced magnetite at a rate of 8.44 Mt/yr at the Palabora Mine. Palabora Mining started an upgrade to its rail infrastructure in 2021 that would increase efficiency at its vermiculite loading facilities (Pala Connector, 2021; Letaba Herald, 2022).

Manganese.—Samancor Manganese produced 3.89 Mt of manganese ore at the Mamatwan and the Wessels Mines in 2021 compared to 3.21 Mt in 2020. The company planned to produce at a rate of nearly 3.5 Mt/yr in the first half of 2022 (South32 Ltd., 2021, 2022).

[2]Where necessary, values have been converted from South African rand (ZAR) to U.S. dollars (US$) at an average exchange rate of ZAR14.8=US$1.00 for 2021.

In March 2021, Glencore and Ntsimbitntle started production at the Mokala Mine in Northern Cape Province. The companies planned to produce more than 1 Mt/yr of manganese ore at Mokala, which had an estimated mine life of 10 years (Creamer, 2021).

Mn48 (Pty) Ltd. (Traxys Projects LP, 47%), and Ntsimbitntle planned to develop the Mn48 project in Northern Cape Province. The company completed a feasibility study in January 2020. Planned production at full capacity in the study was 1 Mt/yr of manganese ore at a grade of 48%. The estimated mine life was at least 19 years. As of yearend 2021, mining rights for the project had not been approved [Mn48 (Pty) Ltd., 2022].

Nickel.—Amplats produced 22,300 t of refined nickel in 2021 compared with 13,900 t in 2020. The company produced 14,911 t of mined nickel at Mogalakwena in 2021 compared with 15,482 t in 2020. In March, ARM placed the Nkomati Mine on care-and-maintenance status as previously planned because of low nickel prices on world markets (Anglo American Platinum Ltd., 2022, p. 1, 72; Thomson Reuters, 2022).

In March 2021, Thakadu started production at its nickel sulfate plant. The company planned to increase production to 16,000 t/yr by yearend 2021 and subsequently to 25,000 t/yr (Arnoldi, 2021b).

Platinum-Group Metals.—In 2021, Amplats produced about 180,800 kg of refined PGMs and gold. Refined platinum production was 87,189 kg in 2021; refined palladium, 57,025 kg; refined rhodium, 12,500 kg; and refined gold, iridium, and ruthenium, a total of about 24,100 kg. In 2020, Amplats produced about 97,800 kg of refined PGMs and gold. The company's production of refined platinum was 46,745 kg in 2020; refined palladium, 32,892 kg; refined rhodium, 6,669 kg; and refined iridium and ruthenium, a total of about 11,500 kg (Anglo American Platinum Ltd., 2022, p. 1).

Sibanye-Stillwater produced 31,006 kg of PGMs at the Marikana Mine in 2021. Platinum accounted for 15,556 kg of PGM-mine production in 2021; palladium, 7,227 kg; ruthenium, 4,751 kg; rhodium, 2,349 kg; and iridium, 788 kg. The company produced 23,821 kg of PGMs at the Marikana Mine in 2020. Platinum accounted for 12,598 kg of PGM-mine production in 2020; palladium, 5,702 kg; ruthenium, 2,965 kg; rhodium, 1,767 kg; and iridium, 1,122 kg (Sibanye-Stillwater Ltd., 2022).

Sibanye-Stillwater produced 24,019 kg of PGMs at the Rustenburg Mine in 2021. Platinum accounted for 12,363 kg of PGM-mine production in 2021; palladium, 6,356 kg; ruthenium, 2,856 kg; rhodium, 1,800 kg; and iridium, 644 kg. The company produced 19,960 kg of PGMs at the Rustenburg Mine in 2020. Platinum production was 10,379 kg in 2021; palladium, 5,268 kg; ruthenium, 2,324 kg; rhodium, 1,466 kg; and iridium, 523 kg (Sibanye-Stillwater Ltd., 2022).

In fiscal year 2021, Tharisa Minerals produced 4,908 kg of PGMs and gold compared with 4,420 kg in fiscal year 2020. Platinum accounted for 54.9% of production by volume in fiscal year 2021; palladium, 15.8%; ruthenium, 14.7%; rhodium, 9.8%; iridium, 4.6%; and gold, 0.2%. Tharisa Minerals planned to produce 5,100 to 5,400 kg in fiscal year 2022 [Tharisa Minerals (Pty) Ltd., 2021, p. 1, 14, 26].

Titanium and Zirconium.—In late June 2021, RBM suspended its mining operations because of local unrest. The company shut down one of its titanium slag furnaces in July because its stockpiles of ilmenite were depleted. In late August, RBM resumed its mining operations (Mining Technology, 2021).

In 2021, MCL produced 89,013 t of ilmenite, 9,861 t of zircon, and 2,612 t of rutile at Tormin compared with 67,460 t of ilmenite, 6,822 t of zircon, and 1,609 t of rutile in 2020. Increased production was partially attributable to higher grades of ilmenite, rutile, and zircon. MCL planned to produce 110,000 to 140,000 t of ilmenite and a total of 24,000 to 29,000 t of rutile and zircon in 2022 (Mineral Commodities Ltd., 2022).

Nyanza Light Metals Ltd. was engaged in the construction of its new TiO_2 pigment plant in the Richards Bay Industrial Development Zone. The final phase of construction was expected to be completed by May 2024 (Richards Bay Industrial Development Zone, 2021).

Vanadium.—In 2021, Glencore's production of V_2O_5 at Rhovan increased to about 9,300 t from 8,800 t in 2020. Bushveld produced a total of 3,592 t of vanadium content in 2021, which was nearly unchanged from that in 2020. In 2021, the company produced 2,453 t at Vametco and 1,138 t at Vanchem. In 2022, Bushveld planned to produce 2,450 to 2,550 t of vanadium content at Vametco and 1,750 to 1,850 t at Vanchem. Increased production at Vanchem would be attributable to a capacity expansion expected to be completed in the second quarter of 2022 (Bushveld Minerals Ltd., 2022; Glencore plc, 2022, p. 6).

Vanadium Resources Ltd. of Australia completed a scoping study on a new mine at the Steelpoortdrift project in Limpopo Province in September 2020 and a prefeasibility study in June 2021. Planned production in the study was nearly 18,000 t/yr of V_2O_5 during an estimated mine life of 25 years. Vanadium Resources planned to complete a feasibility study by March 2022. Depending on the results of the study, construction could start by the third quarter of 2022 and mining, by the fourth quarter of 2023 (Vanadium Resources Ltd., 2021, p. 1, 4, 6, 16).

Industrial Minerals

Diamond.—De Beers mined 5.31 million carats of diamond at Venetia in 2021 compared with 3.77 million carats in 2020. As of early 2021, mining at Venetia Underground was planned to start in the third quarter of 2022 (Cornish, 2021; Anglo American plc, 2022, p. 4).

In 2021, Petra Diamonds Ltd. produced 1.9 million carats of diamond at the Cullinan Mine compared with 1.7 million carats in 2020. At the Finsch Mine, production decreased to 1.24 million carats in 2021 from 1.43 million carats in 2020, and production at the Koffiefontein Mine decreased to about 46,000 carats from 60,000 carats (Petra Diamonds Ltd., 2021, p. 15–18; 2022, p. 17−19),

Garnet, Industrial.—In 2021, MCL produced 144,874 t of industrial garnet at the Tormin Mine compared with 153,743 t in 2020. The company planned to produce 150,000 to 180,000 t in 2022 (Mineral Commodities Ltd., 2022).

Vermiculite.—In 2021, vermiculite production at the Palabora Mine increased to 150,104 t from 118,223 t in 2020. Palabora Mining started an upgrade to its rail infrastructure in 2021 that would increase efficiency at its vermiculite loading facilities (Letaba Herald, 2022; Bulelwa Satsha, Administrative

Officer, Department of Minerals and Energy of the Republic of South Africa, written commun., March 15, 2022).

Mineral Fuels

Coal.—Exxaro's coal production decreased to 42.5 Mt in 2021 from 47.4 Mt in 2020. In the fourth quarter of 2021, the company completed an expansion of the Grootegeluk Mine's capacity by 1.7 Mt/yr of coking coal. Exxaro's plans to increase production at the Matla Mine to 10 Mt/yr were delayed from the second half of 2024 to the first half of 2025 (Exxaro Resources Ltd., 2021, p. 105; 2022, p. 10, 117).

As of April 2021, Eskom's effective power generating capacity was 30,000 MW, which was about 15,000 MW less than its nominal capacity. Peak demand was about 34,000 MW. Eskom's unplanned capacity losses of about 10,000 MW were attributable to aging infrastructure, the strain of operating power stations at near-full capacity, and the declining quality of coal used in generation. Eskom planned to add about 3,200 MW of new capacity by March 2025 with the completion of the Kusile and the Medupi power stations and to decommission about 3,340 MW of existing capacity (Fitch Ratings Inc., 2021).

Petroleum.—In 2021, South Africa's total production of refined petroleum products decreased to an estimated 88 million barrels (Mbbl) from 119 Mbbl in 2020 and 149 Mbbl in 2019. Glencore's refinery in Cape Town, which had a capacity of 100,000 barrels per day (bbl/d), closed in mid-2020 after a fire. Engen Ltd.'s refinery in Durban with a capacity of 120,000 bbl/d shut down in December 2020 after an explosion. Both refineries remained closed at the end of 2021 (table 1; Parker, 2022).

Outlook

Numerous producers are planning to develop new mines and plants and to expand capacity of existing operations for chromite, coal, copper, ferrovanadium, fluorspar, gold, manganese ore, nickel, PGMs, phosphate rock, sulfuric acid, vanadium, and zinc between 2022 and 2027. In addition to the COVID-19 pandemic, challenges to the industry included aging mines, decreasing ore grades, increasing costs, labor disputes, low levels of exploration activity, and power outages (Louw, 2017; Tex Report, The, 2019a, c; MyBroadband, 2021).

Increases in coal production will depend on the construction of new mines in the Waterberg coalfield. Development of new mines could be limited by the lack of infrastructure and water, the distances from domestic consumers and export terminals, the relatively low quality of the coal, and extraction challenges. Other factors are likely to include legal challenges to new coal-fired power stations, mining companies' plans to shift towards generating their own power, and difficulties in obtaining financing (Prevost, 2017; Ryan, 2020).

Increases in ferrovanadium production will depend on the relative prices of ferroniobium and ferrovanadium. Substitution of ferroniobium for ferrovanadium is expected to take place when ferrovanadium prices are $50 per kilogram or higher (Khaile, 2019b).

In the PGM-mining subsector, production could shift away from platinum and towards palladium. Many PGM-mining companies are producing less ore from the platinum-rich Merensky layer and more from the palladium-rich UG2 chromitite layer. Production also could shift away from platinum with the development of more palladium-rich deposits in the Northern Limb of the Bushveld Complex, which are shallower and likely to be cheaper to develop. For iridium, rhodium, and ruthenium, increased production because of the shift from the Merensky reef layer to the UG2 chromitite layer could be offset by decreased production because of the shift from the Western and Eastern Limbs to the Northern Limb (Impala Platinum Holdings Ltd., 2008).

References Cited

African Rainbow Minerals Ltd., 2020a, Integrated annual report 2020: Sandton, South Africa, African Rainbow Minerals Ltd., 136 p. (Accessed February 11, 2022, at https://arm.co.za/wp-content/uploads/2020/10/Integrated-Annual-Report-2020.pdf.)

African Rainbow Minerals Ltd., 2020b, Interim results for the six months ended 31 December 2019: Sandton, South Africa, African Rainbow Minerals Ltd., 48 p. (Accessed April 14, 2021, at https://arm.co.za/wp-content/uploads/2020/05/interim_booklet_31dec19.pdf.)

African Rainbow Minerals Ltd., 2021, Interim results for the six months ended 31 December 2020: Sandton, South Africa, African Rainbow Minerals Ltd., 54 p. (Accessed February 4, 2022, at https://arm.co.za/wp-content/uploads/2021/03/1H-F2021-Interim-Results-for-six-months-ended-31-December-2020.pdf.)

Afrimat Ltd., 2020, Interim results for the six months ended 31 August 2020: Cape Town, South Africa, Afrimat Ltd., October 29, 57 p. (Accessed February 17, 2022, at https://afrimat.co.za/investment-case/financials/#78-103-wpfd-presentations-1627409632.)

Afrimat Ltd., 2021, Final results presentation for the year ended 28 February 2021: Cape Town, South Africa, Afrimat Ltd., 54 p. (Accessed February 17, 2022, at https://afrimat.co.za/investment-case/financials/#78-103-wpfd-presentations-1627409632.)

Andrews, Mark, 2019a, Prieska rises in SA: Australia's Paydirt, v. 1, no. 275, September, p. 71.

Andrews, Mark, 2019b, The right Guy's behind Theta: Australia's Paydirt, v. 1, no. 274, August, p. 86.

Anglo American Platinum Ltd., 2019, Annual results 2018: Gauteng, South Africa, Anglo American Platinum Ltd., 124 p. (Accessed December 5, 2019, at https://www.angloamericanplatinum.com/investors/annual-reporting/reports-archive/2018.)

Anglo American Platinum Ltd., 2020, Annual results 2019: Gauteng, South Africa, Anglo American Platinum Ltd., 132 p. (Accessed March 17, 2021, at https://www.angloamericanplatinum.com/media/press-releases/2020/17-02-2020.)

Anglo American Platinum Ltd., 2021, Annual results 2020: Gauteng, South Africa, Anglo American Platinum Ltd., 196 p. (Accessed January 31, 2022, at https://www.angloamericanplatinum.com/media/press-releases/2021/22-02-2021.)

Anglo American Platinum Ltd., 2022, Annual results 2021: Gauteng, South Africa, Anglo American Platinum Ltd., 152 p. (Accessed December 16, 2022, at https://www.valterraplatinum.com/media/press-releases/2022/21-02-2022.)

Anglo American plc, 2021, Production report for the fourth quarter ended 31 December 2020: London, United Kingdom, Anglo American plc, January 28, 18 p. (Accessed February 10, 2022, at https://www.angloamerican.com/investors/quarterly-production-reporting/2021.)

Anglo American plc, 2022, Production report for the fourth quarter ended 31 December 2021: London, United Kingdom, Anglo American plc, January 27, 16 p. (Accessed March 16, 2022, at https://www.angloamerican.com/investors/quarterly-production-reporting/2022.)

AngloGold Ashanti Ltd., 2020, Q3 2020—Operations at a glance: Surrey, United Kingdom, AngloGold Ashanti Ltd., November 2. (Accessed February 16, 2022, at https://www.anglogoldashanti.com/investors/reporting/financial-results/#2020.)

ArcelorMittal South Africa Ltd., 2021, Integrated report 2020: Gauteng, South Africa, ArcelorMittal South Africa Ltd., 68 p. (Accessed February 14, 2022, at https://arcelormittalsa.com/Portals/0/ArcelorMittal%20IR%202020_HR.pdf.)

Arnoldi, Marleny, 2020a, Kropz says Elandsfontein advancing: Gauteng, South Africa, Mining Weekly, August 26. (Accessed February 11, 2022, at https://www.miningweekly.com/article/kropz-says-elandsfontein-advancing-2020-08-26.)

Arnoldi, Marleny, 2020b, Wesizwe delays Bakubung platinum mine commissioning to October 2021: Gauteng, South Africa, Mining Weekly, September 30. (Accessed February 16, 2022, at https://www.miningweekly.com/article/wesizwe-delays-bakubung-platinum-mine-commissioning-to-october-2021-2020-09-30.)

Arnoldi, Marleny, 2021a, Siyanda Bagatla Platinum Mine reports solid output expectation for 2021 financial year: Gauteng, South Africa, Mining Weekly, January 18. (Accessed February 3, 2022, at https://www.miningweekly.com/article/siyanda-bagatla-platinum-mine-reports-solid-output-expectation-for-2021-financial-year-2021-01-18.)

Arnoldi, Marleny, 2021b, Thakadu commissions nickel sulphate refinery: Gauteng, South Africa, Mining Weekly, March 9. (Accessed February 8, 2022, at https://www.miningweekly.com/article/thakadu-commissions-nickel-sulphate-refinery-2021-03-09/.)

Barradas, Shiela, 2018, Projects in progress: Mining Weekly, v. 24, no. 38, October 5–11, p. 22–23.

Barradas, Shiela, 2019, Projects in progress: Mining Weekly, v. 25, no. 18, May 17–23, p. 12–13.

Beech, Warren, and Livingston, J.B., 2017, The African mining and natural resources sector—Is it becoming uninvestable?: Mining Review Africa, no. 9, September, p. 10–11.

Bega, Sheree, 2021, State halts its R10bn long-term plan to fully treat acid mine water: Mail & Guardian [Johannesburg, South Africa], June 12. (Accessed February 11, 2022, at https://mg.co.za/environment/2021-06-12-state-halts-its-r10bn-long-term-plan-to-fully-treat-acid-mine-water/.)

Benjamin, Chantelle, 2020, South Africa lockdown closes smelter of Africa's only gold refinery: New York, New York, S&P Global, March 26. (Accessed February 4, 2022, at https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/south-africa-lockdown-closes-smelter-of-africa-s-only-gold-refinery-57775851.)

Beryl Group, [2020], Mining & resources: Beryl Group. (Accessed April 14, 2021, at https://berylgroup.co.za/mining-resources/.)

Bhowan-Rajah, Theresa, 2021, Two-phase coal project will secure production: Gauteng, South Africa, Mining Weekly, February 19. (Accessed February 23, 2022, at https://www.miningweekly.com/article/two-phase-coal-project-will-secure-production-2021-02-04.)

BP p.l.c., 2021, Statistical review of world energy 2021 (70th ed.): London, United Kingdom, BP p.l.c., 69 p. (Accessed November 9, 2021, at https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.)

Bray, E.L., 2022, Aluminum: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 22–23.

Bulbulia, Tanseem, 2019, Mining Charter provides certainty, concern lingers, says Leon: Mining Weekly, v. 25, no. 10, March 22–28, p. 9.

Burkhardt, Paul, and Cohen, Michael, 2019, How Medupi and Kusile are sinking South Africa: Bloomberg News, October 9. (Accessed June 10, 2021, at https://www.news24.com/fin24/Budget/how-medupi-and-kusile-are-sinking-south-africa-20191009.)

Bushveld Minerals Ltd., 2020, H1 2020 interim results: St. Peter Port, Guernsey [United Kingdom], Bushveld Minerals Ltd., February, 37 p. (Accessed February 18, 2022, at https://www.bushveldminerals.com/presentations/.)

Bushveld Minerals Ltd., 2021, Full year 2020 and Q4 operational update: St. Peter Port, Guernsey [United Kingdom], Bushveld Minerals Ltd., February 4. (Accessed February 4, 2022, at https://www.bushveldminerals.com/regulatory-news-rns/.)

Bushveld Minerals Ltd., 2022, Q4 and full year 2021 operational update: St. Peter Port, Guernsey [United Kingdom], Bushveld Minerals Ltd., January 26, 5 p. (Accessed January 13, 2023, at https://www.bushveldminerals.com/regulatory-news-rns/.)

Canyon Coal (Pty) Ltd., [2021], Khanye Colliery to drive company and community growth: Gauteng, South Africa, Canyon Coal (Pty) Ltd. (Accessed June 10, 2021, at https://www.canyoncoal.com/the-maroon-post-blog/khanye-colliery-to-drive-company-and-community-growth.)

Cornish, Laura, 2018a, Top African mining projects in development: Mining Review Africa, no. 1, January, p. 20–23.

Cornish, Laura, 2018b, Venetia Underground project—Dazzling achievements for a sparkling asset: Mining Review Africa, no. 1, January, p. 24–29.

Cornish, Laura, 2021, Venetia Underground project—DeBeers darling delivers in 2020: Mining Review Africa, no. 1, p. 16–20.

Creamer, Martin, 2010, From open hand to clenched fist: Mining Weekly, v. 16, no. 37, September 24–30, p. 10–11.

Creamer, Martin, 2016a, Ferrochrome price in sharp rise: Gauteng, South Africa, Mining Weekly, September 26. (Accessed March 8, 2018, at http://www.miningweekly.com/article/ferrochrome-price-in-sharp-rise-2016-09-26.)

Creamer, Martin, 2016b, Growing in importance: Mining Weekly, v. 22, no. 35, September 9–15, p. 23.

Creamer, Martin, 2019, Matter of urgency: Mining Weekly, v. 25, no. 10, March 22–28, p. 6–7.

Creamer, Martin, 2020, Struggling ferrochrome needs chrome export tax as interim measure— Richards Bay Alloys: Gauteng, South Africa, Mining Weekly, October 28. (Accessed April 21, 2021, at https://www.miningweekly.com/article/struggling-ferrochrome-needs-chrome-export-tax-as-interim-measure-richards-bay-alloys-2020-10-28.)

Creamer, Martin, 2021, New Mokala manganese mine heading for steady state, solar power: Gauteng, South Africa, Mining Weekly, September 28. (Accessed January 11, 2023, at https://www.miningweekly.com/article/new-mokala-manganese-mine-heading-for-steady-state-solar-power-2021-09-28.)

Davies, Janie, Radford, Charlotte, and Manthey, Ewa, 2020, S Africa lockdown impact on ores, alloys supply: London, United Kingdom, Fastmarkets AMM, April 1. (Accessed March 18, 2021, at https://www.amm.com/Article/3926228/S-Africa-lockdown-impact-on-ores-alloys-supply.html.)

de Klerk, Marize, 2019, South African sisters shine in diamond business dominated by men: Voice of America [Washington, D.C.], October 17. (Accessed June 7, 2021, at https://www.voanews.com/africa/south-african-sisters-shine-diamond-business-dominated-men.)

du Venage, Gavin, 2013, South African gold enters survival mode: Engineering & Mining Journal, v. 214, no. 7, July, p. 10–11.

Eastern Platinum Ltd., 2021, Eastern Platinum Limited reports annual results for 2020 and provides operations update: Vancouver, British Colombia, Canada, Eastern Platinum Ltd., March 26. (Accessed February 14, 2022, at https://eastplats.com/eastern-platinum-limited-reports-annual-results-for-2020-and-provides-an-operations-update/.)

EESTech Inc., 2019, EESTech Inc. announces Samancor ferrochrome reclamation agreement: New York, New York, PR Newswire, April 2. (Accessed March 30, 2021, at https://www.prnewswire.com/news-releases/eestech-announces-environmental-impact-assessment-for-samancor-project-300904070.html.)

Engineering & Mining Journal, 2015, South Africa's Bakubung platinum project ahead of schedule: Engineering & Mining Journal, v. 216, no. 2, February, p. 4.

Engineering & Mining Journal, 2016, Waterberg PFS considers 744,000 oz/y PGM production: Engineering & Mining Journal, v. 217, no. 11, November, p. 12.

Engineering & Mining Journal, 2017, DFS supports development of Ivanhoe's Platreef project: Engineering & Mining Journal, v. 218, no. 9, September, p. 22.

Engineering & Mining Journal, 2019, Positive DFS advances Waterberg project: Engineering & Mining Journal, v. 220, no. 11, November, p. 16.

Exxaro Resources Ltd., 2021, Integrated report 2020: Gauteng, South Africa, Exxaro Resources Ltd., 132 p. (Accessed February 15, 2022, at https://www.exxaro.com/investors/integrated-reports.)

Exxaro Resources Ltd., 2022, Integrated report 2021: Gauteng, South Africa, Exxaro Resources Ltd., 147 p. (Accessed January 13, 2023, at https://www.exxaro.com/investors/integrated-reports.)

Fitch Ratings Inc., 2021, Eskom's supply shortages to continue despite procurement: Fitch Ratings Inc., April 26. (Accessed January 13, 2023, at https://www.fitchratings.com/research/corporate-finance/eskom-supply-shortages-to-continue-despite-procurement-26-04-2021.)

Foskor (Pty) Ltd., 2020, integrated report for the year ended March 31, 2020: Gauteng, South Africa, Foskor (Pty) Ltd., 118 p. (Accessed February 11, 2022, at http://www.foskor.co.za/SitePages/Documents/Annual%20Reports.aspx.)

Frost, Halima, 2021, Gamsberg ramp-up exceeds expectations: Gauteng, South Africa, Mining Weekly, April 16. (Accessed February 18, 2022, at https://www.miningweekly.com/article/gamsberg-ramp-up-exceeds-expectations-2021-04-16.)

Galane, Mpuleng, 2018, Minerals statistical tables 1996–2017: Pretoria, South Africa, Department of Mineral Resources, Bulletin B1/2018.

Gambogi, Joseph, 2022a, Titanium mineral concentrates: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 178–179.

Gambogi, Joseph, 2022b, Zirconium and hafnium: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 194–195.

Ghilotti, Davide, 2020, Andalusite miners in South Africa halt production amid COVID-19 response: Industrial Minerals, March 25. (Accessed February 7, 2022, at https://www.indmin.com/Article/3925006/Channel/204638/Andalusite-miners-in-South-Africa-halt-production-amid-Covid-19-response.html.)
Gilliland, Wianda, 2019, R49bn to rehabilitate 6 000 mines: Mail & Guardian [Johannesburg, South Africa], December 6. (Accessed June 8, 2021, at https://mg.co.za/article/2019-12-06-00-r49bn-to-rehabilitate-6000-mines/.)
Glencore plc, 2021a, Full year 2020 production report: Baar, Switzerland, Glencore plc, February 3, 18 p. (Accessed February 4, 2022, at https://www.glencore.com/media-and-insights/news/full-year-2020-production-report.)
Glencore plc, 2021b, Resources & reserves as at 31 December 2020: Baar, Switzerland, Glencore plc, 48 p. (Accessed February 14, 2022, at https://www.glencore.com/dam/jcr:3c05a365-e6ae-4c1a-9439-960249a42e35/GLEN_2020_Resources_reserves_report.pdf.)
Glencore plc, 2022, Full year 2020 production report: Baar, Switzerland, Glencore plc, February 2, 18 p. (Accessed January 13, 2023, at https://www.glencore.com/media-and-insights/news/full-year-2021-production-report.)
Global Cement, 2020, South African cement plant capacity utilisation halves in June 2020: Surrey, United Kingdom, Global Cement, July 14. (Accessed February 16, 2022, at https://www.globalcement.com/news/item/11081-south-african-cement-plant-capacity-utilisation-halves-in-june-2020.)
Gold Fields Ltd., 2021, 2020 integrated annual report: Sandton, South Africa, Gold Fields Ltd., 112 p. (Accessed June 8, 2021, at www.goldfields.com/integrated-annual-reports.php.)
Golder Associates Inc., 2019, Palabora Copper (Pty) Ltd.—Draft consolidated environmental management programme: Montreal, Quebec, Canada, Golder Associates Inc., June, [variously paged]. (Accessed December 6, 2019, at https://www.golder.com/global-locations/africa/south-africa-public-documents/palabora-copper-draft-consolidated-empr-phalaborwa/.)
Harmony Gold Mining Company Ltd., 2020a, 2020 operational report: Randfontein, South Africa, Harmony Gold Mining Company Ltd., 35 p. (Accessed February 14, 2022, at https://www.har.co.za/20/download/HAR-OPS20.pdf.)
Harmony Gold Mining Company Ltd., 2020b, Interim results for the six months ended 31 December 2019: Randfontein, South Africa, Harmony Gold Mining Company Ltd., 34 p. (Accessed June 9, 2021, at https://www.harmony.co.za/invest/financials/fy20.)
Harmony Gold Mining Company Ltd., 2021, Interim results FY 21 for the six month period ended 31 December 2020: Randfontein, South Africa, Harmony Gold Mining Company Ltd., 43 p. (Accessed February 18, 2022, at https://www.harmony.co.za/invest/financials/fy21.)
Hatfield, A.K., 2022, Kyanite and related materials: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 94–95.
Heiberg, Tanisha, 2021, Northam Platinum sets out five-year output growth plan after profit bonanza: Thomson Reuters, March 19. (Accessed February 14, 2022, at https://www.mining.com/web/northam-platinum-profit-surges-74-on-metals-prices/.)
Holman, Jacqueline, 2013, South Africa grants Continental Coal mining right for De Wittekrans project: New York, New York, S&P Global Platts, September 6. (Accessed June 10, 2021, at https://www.spglobal.com/platts/en/market-insights/latest-news/coal/090613-south-africa-grants-continental-coal-mining-right-for-de-wittekrans-project.)
IchorCoal N.V., 2021, Update on sale of Mbuyelo Coal shares: Pretoria, South Africa, IchorCoal N.V., January 29. (Accessed February 16, 2022, at http://www.ichorcoal.com/media/corporate-news.)
Impala Platinum Holdings Ltd., 2008, Platinum map of Southern Africa—3rd edition: Bruma, South Africa, Books on the Wall Publishing.
Impala Platinum Holdings Ltd., 2020a, Annual integrated report 2020: Johannesburg, South Africa, Impala Platinum Holdings Ltd., 160 p. (Accessed January 31, 2022, at https://www.implats.co.za/pdf/annual-reports/annual-integrated-report/2020/implats-air-2020.pdf.)
Impala Platinum Holdings Ltd., 2020b, Condensed consolidated interim results for the six months ended 31 December 2019: Johannesburg, South Africa, Impala Platinum Holdings Ltd., 82 p. (Accessed June 10, 2021, at https://www.implats-ir.co.za/results/2020/interim-results-2020/pdf/statistics.pdf.)
Impala Platinum Holdings Ltd., 2021, Condensed consolidated interim results (reviewed) for the six months ended 31 December 2020: Johannesburg, South Africa, Impala Platinum Holdings Ltd., 82 p. (Accessed June 10, 2021, at https://www.implats-ir.co.za/results/2020/interim-results-2020/pdf/statistics.pdf.)
International Cement Review, 2018, Ready to rise again?: International Cement Review, August, p. 90–94.
Johnson Matthey plc, 2021, PGM market report May 2021: London, United Kingdom, Johnson Matthey plc, 59 p. (Accessed January 31, 2022, at https://matthey.com/-media/files/pgm-market-report/jm-pgm-markte-report-may-2021.pdf.)
Jupiter Mines Ltd., 2020, Annual general meeting—Wednesday 8 July 2020: Perth, Western Australia, Australia, Jupiter Mines Ltd., 10 p. (Accessed February 15, 2022, at https://www.jupitermines.com/investor-relations/presentations.)
Kalagadian, The, 2019, Thembeka Myedi shaft: The Kalagadian, June, p. 10. (Accessed May 13, 2021, at https://www.kalahariresources.co.za/pdf/TheKalagadian-June-2019.pdf.)
Khaile, Mandisa, 2018, Ferrous mineral commodities produced in the Republic of South Africa 2018: Pretoria, South Africa, Department of Mineral Resources, Directory D8/2018, 32 p.
Khaile, Mandisa, 2019a, Chromium, *in* South Africa's mineral industry 2018/2019: Pretoria, South Africa, Department of Mineral Resources, p. 122–124.
Khaile, Mandisa, 2019b, Substitutability of ferrovanadium in steel making: ME Bulletin, v. 1, no. 2, p. 10.
Kimberley Process Rough Diamond Statistics, [undated], Annual global summary—2020 production, imports, exports and KPC counts: Kimberley Process Rough Diamond Statistics, 1 p. (Accessed February 17, 2022, at https://kimberleyprocessstatistics.org/public_statistics.)
Kotze, Chantelle, 2018a, Bushveld Vanadium readies itself to ride the vanadium demand wave: Mining Review Africa, no. 3, March, p. 42–44.
Kotze, Chantelle, 2018b, Vedanta Zinc International's Gamsberg just the start of a Southern African zinc 'mega project' vision: Mining Review Africa, no. 6, June, p. 30–33.
Kotze, Chantelle, 2020, Theta Gold Mines—Clear growth strategy secures bright future: Mining Review Africa, no. 6, p. 24–26. (Accessed February 16, 2022, at https://clarioneventsmedia.com/Media/SmartEnergy/2020/2020issue6/index.html?r=86.)
Kotze, Chantelle, 2021a, Egoli—The next frontier at Pan African Resources' historic Evander gold mine: Mining Review Africa, no. 1, p. 22–24. (Accessed February 16, 2022, at https://clarioneventsmedia.com/Media/SmartEnergy/2020/2021issue1/index.html?r=8.)
Kotze, Chantelle, 2021b, Gold Fields' South Deep Mine—Solid steady-state strategy delivers top-notch turnaround: Mining Review Africa, no. 1, p. 34–36. (Accessed February 16, 2022, at https://clarioneventsmedia.com/Media/SmartEnergy/2020/2021issue1/index.html?r=8.)
Lassetter, W.M., 2020, Kyanite, andalusite, and sillimanite: Mining Engineering, July, p. 63–66. (Accessed April 6, 2021, at https://www.dmme.virginia.gov/DGMR/pdf/Mining%20Engineering_Kyanite_2020.pdf.)
Letaba Herald, 2022, PMC's trains do not wait with new railway upgrade: Letaba Herald [Tzaneen, South Africa], October 18. (Accessed January 9, 2023, at https://letabaherald.co.za/119358/pmcs-trains-do-not-wait-with-new-railway-upgrade/.)
Levitt Kirson Business Services (Pty) Ltd., 2020, National cementitious sales for South Africa 4th quarter 2019: Levitt Kirson Business Services (Pty) Ltd., 2 p. (Accessed March 16, 2021, at https://www.theconcreteinstitute.org.za/market-information.)
Liedtke, Simone, 2018, Certainty—At last: Mining Weekly, v. 24, no. 38, October 5–11, p. 12.
Lourens, M.C., and DeWater, T., 2020, Operating mines, quarries and mineral processing plants in the Republic of South Africa, 2020: Pretoria, South Africa, Department of Mineral Resources, Directory D1/2020, January, 165 p.
Louw, Leon, 2017, The state of SA mining: Mining Mirror, v. 30, no. 7, February, p. 14–25.
Magnum Mining & Exploration Ltd., 2019, Gravelotte update—May 2019: Subiaco, Western Australia, Australia, Magnum Mining & Exploration Ltd., June 3, 15 p. (Accessed June 4, 2021, at https://www.mmel.com.au/site/PDF/c8464e1a-f24b-4abb-919c-d8013116d9af/UpdatedCompanyPresentation.)

Magnum Mining & Exploration Ltd., 2020, Quarterly activities report 31 December 2019: Subiaco, Western Australia, Australia, Magnum Mining & Exploration Ltd., January 31, 16 p. (Accessed June 4, 2021, at https://www.mmel.com.au/site/PDF/0f00c585-f621-4b50-a16b-5f0db9aa3d44/QuarterlyActivitiesReport.)

Magnum Mining & Exploration Ltd., 2021, Quarterly activities report for three months ending 31 December 2020: Subiaco, Western Australia, Australia, Magnum Mining & Exploration Ltd., January 28, 11 p. (Accessed February 14, 2022, at https://www.mmel.com.au/site/PDF/22871696-ffb9-49ac-b7b5-b94aae3225b9/QuarterlyActivitiesReport.)

McKay, David, 2019, SA's Transnet inks transformative 650k sinter deal with Kalagadi Manganese: Johannesburg, South Africa, Miningmx, September 17. (Accessed June 10, 2021, at https://www.miningmx.com/news/markets/38520-sas-transnet-inks-transformative-650k-sinter-deal-with-kalagadi-manganese/.)

McKay, David, 2020a, IDC's Nchocho "optimistic" of solution to Kalagadi Manganese legal standoff: Johannesburg, South Africa, Miningmx, October 29. (Accessed February 15, 2022, at https://www.miningmx.com/news/ferrous-metals/44190-idcs-nchocho-optimistic-of-solution-to-kalagadi-manganese-legal-standoff/.)

McKay, David, 2020b, Ivanhoe moots low capex Platreef mine, but studies show new PGM supply is hard to deliver: Johannesburg, South Africa, Miningmx, December 9. (Accessed February 24, 2022, at https://www.miningmx.com/news/platinum/44648-ivanhoe-moots-low-capex-platreef-mine-but-studies-show-new-pgm-supply-is-hard-to-deliver/.)

McKay, David, 2021, SA coal firm Resgen on brink of administration after Noble Group declines to inject further funds: Johannesburg, South Africa, Miningmx, April 16. (Accessed February 15, 2022, at https://www.miningmx.com/news/energy/45915-resgen-on-brink-of-administration-after-noble-group-declines-to-inject-further-funds/.)

McRae, M.E., 2022a, Fluorspar: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 62–63.

McRae, M.E., 2022b, Nickel: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 114–115.

Merafe Resources Ltd., 2021, Integrated annual report 2020: Bryanston, South Africa, Merafe Resources Ltd., [variously paged]. (Accessed February 15, 2022, at https://www.meraferesources.co.za/reports/ir-2020/pdf/full-integrated.pdf.)

Merafe Resources Ltd., 2022, Integrated annual report 2021: Bryanston, South Africa, Merafe Resources Ltd., [variously paged]. (Accessed January 13, 2023, at https://www.meraferesources.co.za/reports/ir-2021/pdf/full-integrated.pdf.)

Mineral Commodities Ltd., 2021, Quarterly activities report December 2020: Belmont, Western Australia, Australia, Mineral Commodities Ltd., 13 p. (Accessed February 10, 2022, at https://www.mineralcommodities.com/investors-media/quarterly-reports/.)

Mineral Commodities Ltd., 2022, Quarterly activities report December 2021: Belmont, Western Australia, Australia, Mineral Commodities Ltd., 11 p. (Accessed December 15, 2022, at https://www.mineralcommodities.com/investors-media/quarterly-reports/.)

Minerals Council South Africa, 2020, Facts and figures 2019: Minerals Council South Africa, October, 43 p. (Accessed April 6, 2021, at https://www.mineralscouncil.org.za/industry-news/publications/facts-and-figures.)

Minerals Council South Africa, 2021, Facts and figures 2020: Minerals Council South Africa, October 14, 41 p. (Accessed February 10, 2022, at https://www.mineralscouncil.org.za/industry-news/publications/facts-and-figures.)

Minerals Council South Africa, 2022, Facts and figures 2021: Minerals Council South Africa, May 9, 50 p. (Accessed January 12, 2023, at https://www.mineralscouncil.org.za/industry-news/publications/facts-and-figures.)

Mining Weekly, 2018, Thakadu starts construction on nickel sulphate purification plant: Mining Weekly, v. 24, no. 35, September 14–20, p. 22.

Mining Weekly, 2020, PGMs miner focused on Waterberg mine project: Gauteng, South Africa, Mining Weekly, December 11. (Accessed February 4, 2021, at https://www.miningweekly.com/article/pgms-miner-focused-on-waterberg-mine-project-2020-11-26/.)

Mining Technology, 2021, Rio Tinto recommences operations at Richards Bay Minerals in South Africa: Melbourne, Victoria, Australia, Mining Technology, August 25. (Accessed January 13, 2023, at https://www.mining-technology.com/news/rio-tinto-operations-richards-bay/.)

Mn48 (Pty) Ltd., [2022], One of a kind, high grade Manganese (Mn) in a well developed, world renowned location: Mn48 (Pty) Ltd. (Accessed January 11, 2023, at https://mn48.net/new/.)

Modiselle, Mphonyana, 2019, Fluorspar, *in* South Africa's mineral industry 2018/2019: Pretoria, South Africa, Department of Mineral Resources, p. 159–163.

Moodley, Nelendhre, 2019, Power to the people: SA Mining, November, p. 10–11.

Motsie, P.R., 2018, Industrial minerals sector performance—Quarter 2, 2018: MB Bulletin, v. 31, no. 2, p. 24–26.

Moumakwa, D.O., 2012, Platinum group metals, *in* South Africa's mineral industry 2011/2012: Pretoria, South Africa, Department of Mineral Resources, p. 54–60.

Moumakwa, D.O., 2019, Platinum group metals (PGMs), *in* South Africa's mineral industry 2018/2019: Pretoria, South Africa, Department of Mineral Resources, p. 33–38.

Moumakwa, D.O., and Rakhudu, Tshepo, 2018, Operating platinum group metal mines in South Africa 2018: Pretoria, South Africa, Department of Mineral Resources, Directory D6/2018, 9 p.

Muravha, Munyadziwa, 2019, South Africa's phosphate rock production and sales during quarter 2 2019: ME Bulletin, v. 1, no. 2, p. 27–28.

MyBroadband, 2021, Real reason behind load-shedding in South Africa: Midrand, South Africa, MyBroadband, July 4. (Accessed February 23, 2022, at https://mybroadband.co.za/news/energy/404633-real-reason-behind-load-shedding-in-south-africa.html.)

Nippon Denko Co. Ltd., 2021, Consolidated financial report for fiscal year ended December 2020: Tokyo, Japan, Nippon Denko Co. Ltd., February 8, 27 p. (Accessed February 16, 2022, at http://www.nippondenko.co.jp/en/ir/.)

Northam Platinum Ltd., 2020, Condensed reviewed interim financial results and statistical information for the six months ended 31 December 2019: Waterfall City, South Africa, Northam Platinum Ltd., 133 p. (Accessed March 3, 2021, at https://www.northam.co.za/investors-and-media/publications/financials.)

Northam Platinum Ltd., 2021, Condensed reviewed interim financial results and statistical information for the six months ended 31 December 2020: Waterfall City, South Africa, Northam Platinum Ltd., 196 p. (Accessed February 4, 2022, at https://www.northam.co.za/investors-and-media/publications/financials.)

Olson, D.W., 2022, Garnet (Industrial): U.S. Geological Survey Mineral Commodity Summaries 2022, p. 66–67.

Pala Connector, 2021, Magnetite Division hits an "old" time high!: Phalaborwa, South Africa, Pala Connector, June, p. 5–6. (Accessed January 13, 2023, at https://www.palabora.com/Media/News.)

Pan African Resources plc, 2020, Integrated annual report for the year ended 30 June 2020: Johannesburg, South Africa, Pan African Resources plc, 218 p. (Accessed February 16, 2022, at https://www.panafricanresources.com/investors/financial-reports/.)

Parker, Darren, 2021, Menar extends opencast coal operations: Gauteng, South Africa, Mining Weekly, April 30. (Accessed February 23, 2022, at https://www.miningweekly.com/article/menar-extends-opencast-coal-operations-2021-04-30/.)

Parker, Darren, 2022, Retaining refining capacity could pose long-term risks for South Africa: Engineering News, April 8. (Accessed January 9, 2023, at https://www.engineeringnews.co.za/article/retaining-refining-capacity-could-pose-long-term-risks-for-south-africa-2022-04-08/rep_id:4136.)

Petra Diamonds Ltd., 2020, Interim results for the six months to 31 December 2019: London, United Kingdom, Petra Diamonds Ltd., 54 p. (Accessed April 6, 2021, at https://www.petradiamonds.com/investors/results-reports/.)

Petra Diamonds Ltd., 2021, Interim results for the six months to 31 December 2020: London, United Kingdom, Petra Diamonds Ltd., February 16, 63 p. (Accessed February 11, 2022, at https://www.petradiamonds.com/investors/results-reports/.)

Petra Diamonds Ltd., 2022, Interim results for the six months to 31 December 2021: London, United Kingdom, Petra Diamonds Ltd., February 22, 65 p. (Accessed August 24, 2022, at https://www.petradiamonds.com/investors/results-reports/.)

Piper, Dominic, 2019, Orion finds timing on its side: Australia's Paydirt, v. 1, no. 269, March, p. 74–77.

Polyak, D.E., 2022, Vanadium: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 182–183.

Prevost, Xavier, 2017, Coal's powerful role: Inside Mining, no. 1, January, p. 12–13.

Ramane, Lerato, 2018, South Africa's heavy mineral sands 2018 first quarter performance: MB Bulletin, v. 31, no. 1, p. 9–10.
Rand Refinery (Pty) Ltd., 2011, Integrated annual report 2011: Germiston, South Africa, Rand Refinery (Pty) Ltd., 136 p.
Rand Refinery (Pty) Ltd., 2019, Integrated annual report 2019: Germiston, South Africa, Rand Refinery (Pty) Ltd., 44 p. (Accessed October 23, 2020, at http://www.randrefinery.com/wp-content/uploads/2020/09/IAR19.pdf.)
Resource Generation Ltd., 2020, Project progress: Resource Generation Ltd., April, 13 p. (Accessed March 30, 2021, at https://www.resgen.com.au/investors-and-media/presentations/2020.)
Resources Rising Stars, 2020, Report says Orion's copper-zinc project is primed and ready: Perth, Western Australia, Australia, Resources Rising Stars, December 11. (Accessed February 17, 2022, at https://www.resourcesrisingstars.com.au/news-article/report-says-orion%E2%80%99s-copper-zinc-project-primed-and-ready.)
Richards Bay Industrial Development Zone, 2020, Construction of R4, 5 billion plant at Richards Bay Industrial Development Zone finally taking off: Richards Bay, South Africa, Richards Bay Industrial Development Zone, December 3. (Accessed March 24, 2021, at https://www.rbidz.co.za/index.php/media-hub/news.)
Richards Bay Industrial Development Zone, 2021, Construction starts on Richards Bay titanium dioxide plant's R200m first phase: Richards Bay, South Africa, Richards Bay Industrial Development Zone, May 7. (Accessed November 22, 2021, at https://www.rbidz.co.za/index.php/media-hub/news/99-news/223-construction-starts-on-richards-bay-titanium-dioxide-plant-s-r200m-first-phase.)
Richards Bay Minerals (Pty) Ltd., 2013, Richards Bay Minerals sustainable development report 2012: Richards Bay, South Africa, Richards Bay Minerals (Pty) Ltd., 52 p. (Accessed December 5, 2016, at http://www.riotinto.com/documents/2012_RBM_Sustainable_Development_Report_En.pdf.)
Richards Bay Minerals (Pty) Ltd., 2017, Richards Bay Minerals sustainable development report 2016: Richards Bay, South Africa, Richards Bay Minerals (Pty) Ltd., 56 p. (Accessed June 29, 2018, at https://responsibleminingindex.org/documents/33b8fc50f54028a04bb56288ced6ee0cd9ee90de.pdf.)
Richards Bay Minerals (Pty) Ltd., 2020, Invested in South Africa 2020: Richards Bay, South Africa, Richards Bay Minerals (Pty) Ltd., 15 p. (Accessed November 24, 2020, at https://www.riotinto.com/en/operations/south-africa/richards-bay-minerals.)
Rio Tinto plc, 2021, Annual report 2020: London, United Kingdom, Rio Tinto plc, 384 p. (Accessed January 31, 2022, at https://www.riotinto.com/en/invest/reports/annual-report.)
Ritchie, Gemma, 2020, Legal tug-of-war shutters one of SA's richest chrome mines: News24, December 18. (Accessed May 14, 2021, at https://www.news24.com/fin24/companies/mining/legal-tug-of-war-shutters-one-of-sas-richest-chrome-mines-20201218.)
Roskill Information Services Ltd., 2020, Fluorspar—New acid-grade fluorspar shipments by South Africa's SepFluor: London, United Kingdom, Roskill Information Services Ltd., January 16. (Accessed May 19, 2021, at https://roskill.com/news/fluorspar-new-acid-grade-fluorspar-shipments-by-south-africas-sepfluor/.)
Royal Bafokeng Platinum Ltd., 2021, Integrated report 2020: Johannesburg, South Africa, Royal Bafokeng Platinum Ltd., 169 p. (Accessed February 18, 2022, at https://www.bafokengplatinum.co.za/integrated-reports.php.)
Ryan, Brendan, 2019, Eskom finally admits to power faults: Australia's Paydirt, v. 1, no. 268, February, p. 7.
Ryan, Brendan, 2020, The future of South Africa's coal industry is not what it used to be: Johannesburg, South Africa, Miningmx, August 10. (Accessed June 11, 2021, at https://www.miningmx.com/news/energy/43166-the-future-of-south-africas-coal-industry-is-not-what-it-used-to-be/.)
Samancor Chrome (Pty) Ltd., [2018], Company overview: Sandton, South Africa, Samancor Chrome (Pty) Ltd. (Accessed March 18, 2021, at https://samancorcr.com/overview/.)
Sasol Ltd., 2020, Form 20–F for the year ended 30 June 2020: Sasol Ltd., [variously paged]. (Accessed February 16, 2022, at https://www.sasol.com/investor-centre/financial-reporting/form-20-f/archive.)
Schnebele, E.K., 2022, Manganese: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 106–107.
Schmidt, Donna, 2020, Sandvik partners with De Beers for Venetia expansion: London, United Kingdom, Mining Magazine, December 14. (Accessed February 11, 2022, at https://www.miningmagazine.com/supply-chain-management/news/1401295/sandvik-partners-with-de-beers-for-venetia-expansion.)
Schulte, R.F., 2022a, Chromium: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 48–49.
Schulte, R.F., 2022b, Platinum-group metals: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 126–127.
Sedibelo Platinum Mines Ltd., 2021, Management's discussion and analysis of financial condition and results of operations for the three and twelve-months ended December 31, 2020: St. Peter Port, Guernsey [United Kingdom], Sedibelo Platinum Mines Ltd., 22 p. (Accessed February 17, 2022, at http://www.platmin.com/reporting-and-investors/quarterly-md-and-a-reports/2020.)
Seriti Coal (Pty) Ltd., 2021, Fact sheet 2021: Seriti Coal (Pty) Ltd., 3 p. (Accessed February 10, 2022, at https://seritiza.com/wp-content/uploads/2019/05/Seriti-Fact-Sheet_2021.pdf.)
Sheaffer, K.N., 2022, Gold: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 72–73.
Shedd, K.B., 2022, Cobalt: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 52–53.
Sibanye Gold Ltd., 2018, Integrated annual report 2017: Westonaria, South Africa, Sibanye-Stillwater Ltd., March 29, 168 p. (Accessed February 16, 2022, at https://www.sibanyestillwater.com/news-investors/reports/annual/2017/.)
Sibanye-Stillwater Ltd., 2021a, Integrated report 2020: Westonaria, South Africa, Sibanye-Stillwater Ltd., April 22, 313 p. (Accessed February 16, 2022, at https://www.sibanyestillwater.com/news-investors/reports/annual/2020/.)
Sibanye-Stillwater Ltd., 2021b, Year-end F2020 historical statistics by operation: Sibanye-Stillwater Ltd., February 18. (Accessed February 4, 2022, at https://www.sibanyestillwater.com/news-investors/reports/quarterly/2020/.)
Sibanye-Stillwater Ltd., 2022, Year-end F2021 historical statistics by operation: Sibanye-Stillwater Ltd., March 3. (Accessed January 12, 2023, at https://www.sibanyestillwater.com/news-investors/reports/quarterly/2021/.)
Simmons, K.J., 2022, Vermiculite: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 184–185.
Smart, Errol, 2021, Growing shareholder value—A low-cost base metals giant in the making: Melbourne, Victoria, Australia, Orion Minerals Ltd., August, 32 p. (Accessed January 10, 2023, at https://orionminerals.com.au/investors/presentations/.)
Solomons, Ilan, 2017, Govt, NGOs, industry combining to fend off acid mine water threat: Gauteng, South Africa, Mining Weekly, November 10. (Accessed March 5, 2019, at http://www.miningweekly.com/article/govt-ngos-and-industry-joining-forces-to-fend-off-acid-mine-water-threat-2017-11-10/rep_id:3650.)
South African Revenue Service, 2021, SA trade statistics for December 2020 (including BELN): Pretoria, South Africa, South African Revenue Service, 8 p. (Accessed February 18, 2022, at https://www.sars.gov.za/customs-and-excise/trade-statistics/reports/.)
South32 Ltd., 2020, Quarterly report December 2019: Perth, Western Australia, Australia, South32 Ltd., 10 p. (Accessed March 4, 2021, at https://www.south32.net/investors-media/investor-centre/exchange-releases.)
South32 Ltd., 2021, Quarterly report December 2020: Perth, Western Australia, Australia, South32 Ltd., 11 p. (Accessed August 9, 2021, at https://www.south32.net/investors-media/investor-centre/exchange-releases.)
South32 Ltd., 2022, Quarterly report December 2021: Perth, Western Australia, Australia, South32 Ltd., 13 p. (Accessed January 9, 2023, at https://www.south32.net/investors-media/investor-centre/exchange-releases.)
State Diamond Trader, 2015, 2014–15 annual report: Johannesburg, South Africa, State Diamond Trader, 81 p.
Steyn, Lisa, 2021, Seriti's R400m Eskom bet may go up in smoke: Business Day [Johannesburg, South Africa], April 1. (Accessed February 17, 2022, at https://www.businessl0ive.co.za/bd/companies/mining/2021-04-01-seritis-r400m-eskom-bet-may-go-up-in-smoke/.)
Tex Report, The, 2017, First blast made at new farm of Mn ore owned by KMR, S. Africa: The Tex Report, v. 49, no. 11809, December 25, p. 2.
Tex Report, The, 2019a, Eskom, S. Africa asks all mining and manufacturing industries for 20% power reduction: The Tex Report, v. 51, no. 12283, December 12, p. 4.
Tex Report, The, 2019b, IchorCoal to sell shares in Mbuyelo Coal: The Tex Report, v. 51, no. 12237, October 4, p. 1.
Tex Report, The, 2019c, Large-scale power outage due to accident at Eskom power plant in South Africa: The Tex Report, v. 51, no. 12283, December 12, p. 4.
Tex Report, The, 2019d, Samancor in S. Africa expresses reducing production of FeCr & Cr ore: The Tex Report, v. 51, no. 12281, December 10, p. 19.

Tex Report, The, 2020a, East Manganese project in S. Africa launches preparation for mining: The Tex Report, v. 52, no. 12470, September 28, p. 1.

Tex Report, The, 2020b, Glencore announces production forecast during 2020 to 2023: The Tex Report, v. 52, no. 12523, December 14, p. 3.

Tex Report, The, 2020c, Kumba Iron Ore revises 2020 production guidance down to 37 Mt: The Tex Report, v. 52, no. 12519, December 8, p. 5.

Tex Report, The, 2020d, Ms. Berlin, acting CEO of MC Mining to retire from office: The Tex Report, v. 52, no. 12520, December 9, p. 2–3.

Tex Report, The, 2020e, S. Africa-based Transalloys declares force majeure by fire: The Tex Report, v. 52, no. 12459, September 9, p. 1.

Tex Report, The, 2020f, TerraCom to expand coal production in South Africa: The Tex Report, v. 52, no. 12499, November 9, p. 1.

Tex Report, The, 2020g, TerraCom's FY 2019/20 production and sales by coal mine: The Tex Report, v. 52, no. 12436, August 4, p. 13.

Tex Report, The, 2020h, Tshipi's manganese ore production & sales in Jun–Aug 2020: The Tex Report, v. 52, no. 12470, September 28, p. 1.

Tex Report, The, 2020i, Tshipi's manganese ore production & sales in Sep to Nov 2020: The Tex Report, v. 52, no. 12528, December 21, p. 18.

Tex Report, The, 2020j, Universal Coal starts to produce coal at a new mine: The Tex Report, v. 52, no. 12334, March 4, p. 4.

Tex Report, The, 2020k, Wescoal's production and sale in former half goes up massively: The Tex Report, v. 52, no. 12531, December 24, p. 18.

Tex Report, The, 2021a, Exxaro Resources produces 47.45 mil MT of coal in 2020: The Tex Report, v. 53, no. 12590, March 26, p. 10.

Tex Report, The, 2021b, Exxaro Resources' production goal in 2021 is 47.6 million tons: The Tex Report, v. 53, no. 12590, March 26, p. 2.

Tharisa Minerals (Pty) Ltd., 2020, Integrated annual report 2020: Tharisa Minerals (Pty) Ltd., 160 p. (Accessed February 11, 2022, at https://www.tharisa.com/annual-reports.php#annual-reports.)

Tharisa Minerals (Pty) Ltd., 2021, 2021 integrated annual report: Tharisa Minerals (Pty) Ltd., 164 p. (Accessed January 13, 2023, at https://www.tharisa.com/annual-reports.php#annual-reports.)

Thomson Reuters, 2019, Rio Tinto to restart South African unit in 2020 after security scare: Thomson Reuters, December 30. (Accessed March 26, 2021, at https://www.reuters.com/article/rio-tinto-operations-south-africa/update-1-rio-tinto-to-restart-south-african-unit-in-2020-after-security-scare-idUSL4N294143?source=news_body_link.)

Thomson Reuters, 2022, African Rainbow Minerals not convinced nickel price sustainable: Thomson Reuters, September 1. (Accessed January 13, 2023, at https://www.reuters.com/article/african-rainbow-minerals-results/update-2-african-rainbow-minerals-not-convinced-nickel-price-sustainable-idUSL1N3080C1.)

Tolcin, A.C., 2022, Zinc: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 192–193.

Transnet SOC Ltd., 2020, Freight rail 2020: Johannesburg, South Africa, Transnet SOC Ltd., 20 p. (Accessed February 11, 2022, at https://www.transnet.net/InvestorRelations/AR2020/Freight%20Rail%20 2020.pdf.)

Tshethlanyane, K.J., 2017, Developments in South Africa's titanium sector: MB Bulletin, v. 30, no. 2, p. 11–12.

Tuck, C.C., 2022, Iron ore: U.S. Geological Survey Mineral Commodity Summaries 2022, p. 90–91.

Vanadium Resources Ltd., 2021, Steelpoortdrift PFS delivers superior results: Victoria Park, Western Australia, Australia, Vanadium Resources Ltd., June 22. (Accessed January 13, 2023, at https://vr8.global/sites/default/files/asx-announcements/61037778.pdf.)

Vedanta Resources Ltd., 2020, Interim results for the six months ended 30 September 2020: Mumbai, India, Vedanta Resources Ltd., December 29, 122 p. (Accessed February 24, 2022, at https://www.vedantaresources.com/Pages/FinancialReports.aspx.)

Village Main Reef Ltd., [undated]a, Kopanang: Johannesburg, South Africa, Village Main Reef Ltd. (Accessed April 9, 2021, at http://www.villagemainreef.com/assets/operations/kopanang-mine.)

Village Main Reef Ltd., [undated]b, Tau Lekoa Mine: Johannesburg, South Africa, Village Main Reef Ltd. (Accessed April 9, 2021, at http://www.villagemainreef.com/assets/operations/tau-lekoa-mine.)

West Wits Mining Ltd., 2021, Quarterly Activities Report—Reporting Period 1 July – 30 September 2021: Melbourne, Victoria Australia, Australia, West Wits Mining Ltd., October 29, [10] p. (Accessed June 6, 2025, at https://wcsecure.weblink.com.au/pdf/WWI/02444139.pdf.)

World Gold Council, 2021, Gold demand trends full year and Q4 2020: London, United Kingdom, World Gold Council, January 28. (Accessed February 17, 2022, at https://www.gold.org/goldhub/research/gold-demand-trends/gold-demand-trends-full-year-2020/supply.)

TABLE 1

SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons, gross weight unless otherwise specified)

Commodity		2017	2018	2019	2020	2021
METALS						
Aluminum, metal, primary		716,000	714,000	717,000	717,000	714,000
Chromium, mine, chromite:						
44% to 48% Cr_2O_3	thousand metric tons	2,010	1,133	1,428	1,156	1,915
Less than 44% Cr_2O_3	do.	14,661	16,718	16,227	12,041	16,635
Total		16,700	17,900	17,700	13,200	18,600
Cobalt:						
Mine, Co content[e]		1,065 r	1,007 r	1,027 r	897	355
Refinery, metal powder and sulfate		1,065 r	1,007 r	1,027 r	897	355
Copper, Cu content:						
Mine, concentrates		65,500	46,900	52,500	29,100	28,300
Smelter, primary		52,600 r	33,300 r	26,000 r	22,000 e	28,000 e
Refinery, primary		66,200 r	43,900 r	35,600 r	21,800	20,400
Ferroalloys:						
Ferrochromium	thousand metric tons	3,485 r	3,516 r	3,248 r	2,404	3,700 e
Ferromanganese	do.	257	236	232	122	102
Ferrosilicon	do.	48	98 e	90 r	51 e	55 e
Ferrovanadium[e]	do.	7	7	7	7	7
Silicomanganese[2]	do.	160	164	172	108	151
Gold:						
Mine, Au content	kilograms	137,290	117,144	105,185	95,786	105,019
Refinery[e, 3, 4]	do.	300,000	370,000	330,000	260,000	330,000
Iron ore, mine:						
Gross weight	thousand metric tons	75,091	74,273	72,407	55,635	73,091
Fe content	do.	47,600	47,200	46,100	35,400	46,500
Iron and steel:						
Direct-reduced iron	do.	925	835	661	176	196
Pig iron	do.	4,352	4,611	3,791	2,103	2,917
Steel:						
Raw steel	do.	6,301	6,327	6,152	3,877	5,020
Products:						
Hot-rolled[e]	do.	5,600	5,650	4,000	2,500	3,200
Stainless	do.	591	550	469	453	576
Lead:						
Mine, Pb content, concentrate		48,150	35,118	42,936	28,048	31,224
Refinery, secondary[e]		54,000	56,000	56,000	55,000	56,000
Manganese:						
Mine, metallurgical:						
Gross weight:						
30% to 40% Mn	thousand metric tons	10,441	10,512	11,718	12,435	15,013
40% to 45% Mn	do.	2,884	2,189	2,786	2,002	2,168
45% to 48% Mn	do.	1,209	2,219	2,226	1,558	1,863
More than 48% Mn	do.	119	--	272 r	204	112
Total	do.	14,700	14,900	17,000	16,200	19,200
Mn content[e]	do.	5,700	5,800	6,600	6,200	7,300
Refinery, metal, electrolytic[e]	do.	30	30	30	28	30
Nickel, Ni content:						
Mine, sulfide ore, concentrate		48,463	43,236	43,443	34,908	31,846
Smelter, matte, for domestic use[e]		39,000	35,000	35,000	25,000	33,000
Refinery, metal, electrolytic		42,362	39,500	39,137 r	29,123	37,977
Products, chemicals		4,966	5,281	5,000 r, e	4,800 e	4,200 e
Platinum-group metals:						
Mine, primary:						
Iridium, Ir content	kilograms	6,057	6,357	6,464	6,186	7,006
Palladium, Pd content	do.	80,713	80,629	80,684	66,264	84,336

See footnotes at end of table.

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

(Metric tons, gross weight unless otherwise specified)

Commodity		2017	2018	2019	2020	2021
METALS—Continued						
Platinum-group metals:—Continued						
Mine, primary:—Continued						
Platinum, Pt content	do.	132,500	137,053	132,989	111,993	141,626
Rhodium, Rh content	do.	18,665	18,608	19,545	16,972	20,875
Ruthenium, Ru content	do.	24,821	27,999	28,386	25,058	31,463
Total	do.	263,000	271,000	268,000	226,000	285,000
Refinery:						
Palladium, Pd content	do.	93,126	89,667 [r]	90,000 [e]	75,000	105,000
Platinum, Pt content	do.	154,941 [r]	155,378 [r]	145,000 [e]	115,000	160,000
Rhodium, Rh content	do.	19,830	18,550	18,000 [e]	15,000	21,000
Other, elemental content[5]	do.	34,840	31,800	35,000 [e]	26,000	41,000
Total	do.	302,000	295,000 [r]	288,000 [r]	231,000	327,000
Selenium, anode slimes, Se content[e]	do.	12,000	9,300	8,500	8,000	9,500
Silicon, metal	thousand metric tons	5	51 [e]	33 [e]	-- [e]	-- [e]
Silver, mine, Ag content	kilograms	62,536	46,467	55,903	38,118	37,147
Tellurium, refinery, Te content, anode slimes[e]		5,300	4,200	3,900	3,600	4,200
Titanium:						
Mineral concentrates:						
Ilmenite and leucoxene[e]	thousand metric tons	2,100	1,900	1,800	1,700	1,500
Rutile	do.	110 [e]	110 [e]	105	95 [e]	85
Total	do.	2,210	2,010	1,910	1,800	1,590
Titaniferous slag	do.	1,000 [e]	950 [e]	903	820 [e]	720 [e]
Vanadium, V content		7,959	7,700	8,030	8,584	8,799
Zinc, mine, Zn content, concentrate		30,778	28,129	125,157	160,816	193,785
Zirconium, baddeleyite and zircon		361,813	341,308 [r]	324,000	310,000 [e]	320,000 [e]
INDUSTRIAL MINERALS						
Cement, hydraulic, sales[6]	thousand metric tons	14,134	13,680	12,726	11,000 [e]	12,500 [e]
Clay and shale:						
Clay:						
Bentonite		165,141	173,486	105,084	85,558	98,606
Brick clay[6]	thousand metric tons	7,103	5,588	4,706	3,774	5,532
Fire clay		430,650	525,853	751,238	657,266	598,974
Flint, raw and calcined		10,064	4,421	5,390	2,164	52,429
Fullers earth, attapulgite		18,286	17,246	11,090	12,496	13,189
Kaolin		31,186	23,724	27,827	20,639	29,168
Plastic clay		--	2,092	12,604	--	--
Shale:[6]						
For brickmaking	thousand metric tons	1,036	1,043	1,035	554	687
For cement[6]	do.	356	305	252	220	248
Diamond, gem and industrial	thousand carats	9,693	9,912	7,181	8,471	9,724
Feldspar, mine		116,705	76,803	76,255	48,427	65,726
Fluorspar:[e]						
Acid grade		206,000	198,000 [r]	236,000 [r]	240,000	360,000
Metallurgical grade		12,000	14,000 [r]	17,000 [r]	47,000	43,000
Total		218,000	212,000 [r]	253,000 [r]	287,000	403,000
Garnet, industrial		211,394	278,205	179,057	153,743	144,874
Gemstones:						
Amethyst	kilograms	500	500	500	450 [e]	500 [e]
Emerald	do.	--	2	2	--	-- [e]
Gypsum, mine		320,685	321,988	277,102	205,542	273,241
Helium[e]	million cubic meters	--	--	--	130,000	550,000
Lime[6]	thousand metric tons	1,221	1,332	1,239	1,004	1,152
Magnesite, crude[e]		80,000	90,000	99,000	90,000	99,000
Mica, ground and scrap		21	32	9	194	630
Nitrogen, ammonia, N content		500,000	470,000	460,000	450,000	430,000

See footnotes at end of table.

TABLE 1—Continued

SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons, gross weight unless otherwise specified)

Commodity		2017	2018	2019	2020	2021
INDUSTRIAL MINERALS—Continued						
Perlite[e]		1,000	1,000	1,000	950	1,000
Phosphate rock:						
Compounds, phosphoric acid, P_2O_5 content	thousand metric tons	450	453	382	287	301
Gross weight	do.	2,079	2,058	1,826	1,281	2,132
P_2O_5 content	do.	769	761	676	474	780
Phosphoric acid[7, 8]		449,697	452,526	382,035	287,000	301,000
Salt		492,860	478,285	510,012	538,355	543,955
Sand and gravel, industrial, unspecified	thousand metric tons	2,401	2,288	2,269	2,116	2,075
Sodium, compounds, sodium sulfate, natural		57,493	44,008	42,581	32,114	35,674
Stone, sand, and gravel, construction:						
Sand and gravel:[6]						
Aggregate	thousand metric tons	52,102	48,223	47,172	38,791	42,712
Sand	do.	14,306	13,707	11,778	10,087	12,585
Stone:						
Crushed, limestone, including dolomite	do.	23,752	22,746	22,275	20,288	23,983
Dimension:						
Granite, including norite[6]		291,148	387,397	384,019	371,212	515,863
Slate		848	2,000 e	2,000 e	2,000 e	6,000 e
Sulfur, byproduct, S content:						
Metallurgy		62,824	44,279 r	720,000 r, e	405,000 e	32,000 e
Petroleum		193,786	195,348 r	180,000 e	170,000 e	-- e
Total		257,000	240,000 r	900,000 r, e	575,000 e	32,000 e
Talc and related minerals:						
Pyrophyllite, wonderstone		55,048	98,245	134,451	92,318	270,944
Talc		3,728	3,897	979	--	--
Vermiculite		166,084	141,346	158,013	118,223	150,104
Wollastonite[e]		1,100	1,100	1,200 r	1,200	1,200
MINERAL FUELS AND RELATED MATERIALS						
Coal, marketable:						
Anthracite	thousand metric tons	3,336	3,317	3,808	4,301	3,072
Bituminous[e]	do.	247,000	246,000	251,000	240,000	222,000
Metallurgical[e]	do.	2,300	3,900	4,000	3,800	3,600
Coke, metallurgical, marketable[e]	do.	1,900	1,900	1,900	1,800	1,900
Natural gas	million cubic meters	822	685	734	618	49
Petroleum:						
Natural gas liquids, refinery	thousand 42-gallon barrels	322	250	312	335	164
Refinery:						
Distillate fuel oil	do.	43,723	40,411	63,701 r	51,000 e	38,000 e
Gasoline	do.	51,035	48,348	40,901 r	33,000 e	24,000 e
Jet fuel	do.	16,352	16,011	16,653 r	13,000 e	9,800 e
Kerosene	do.	4,785	4,677	4,607 r	3,700 e	2,700 e
Liquefied petroleum gas	do.	4,698	2,854	2,564 r	2,100 e	1,500 e
Residual fuel oil	do.	5,961	18,335	16,695 r	13,000 e	9,900 e
Other, including lubricants and greases	do.	4,068	3,852	3,939 r	3,200 e	2,300 e
Total	do.	131,000	134,000	149,000 r	119,000 e	88,200 e
Uranium, mine, U content		310	196	138	112	129

[e]Estimated. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through December 27, 2022. All data are reported unless otherwise noted. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Reported by the International Manganese Institute.

[3]Data are for the Rand Refinery (Pty) Ltd.

[4]Production is based on fiscal year, with a starting date of October 1 of the year shown.

[5]May include small amounts of gold.

[6]Sales

[7]Data are for Foskor (Pty) Ltd.

[8]Production is based on fiscal year, with an ending date of March 31 of the year shown.

TABLE 2
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2021

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aggregates, unspecified		AfriSam Consortium (Pty) Ltd.	18 mines in Gauteng, KwaZulu-Natal, Mpumalanga, and Western Cape Provinces	10,000.
Do.		Lafarge Mining South Africa (Pty) Ltd. (LafargeHolcim Ltd., 76.3%)	21 mines in Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga, and Western Cape Provinces	6,000.[e]
Do.		Pretoria Portland Cement Co. (Pty) Ltd. (Barloworld Trust Co. Ltd., 68%)	Mines at Francistown, Kgale, Laezonia, and Mooiplaas	3,000.
Aluminum		South32 Ltd.	Hillside smelter at Richards Bay	726.
Andalusite		Imerys South Africa (Pty) Ltd. (Imerys Group)	Annesley and Segorong Mines at Penge, and Thabazimbi Mine near Thabazimbi	250.[e]
Do.		Andalusite Resources (Pty) Ltd. [African Mineral Trading and Exploration (Pty) Ltd.]	Maroeloesfontein Mine, near Thabazimbi, Northern Cape Province	75.[e]
Antimony	metric tons	Stibium Mining (Pty) Ltd.	Cons Murch Mine near Gravelotte[1]	5,500.
Cement		Pretoria Portland Cement Co. (Pty) Ltd. (Barloworld Trust Co. Ltd., 68%)	De Hoek, Dwaalboom, Hercules, Jupiter, Riebeeck, and Slurry plants	7,000.
Do.		AfriSam Consortium (Pty) Ltd.	Dudfield, Roodepoort, and Ulco plants	4,600.
Do.		Lafarge Industries South Africa (Pty) Ltd. (LafargeHolcim Ltd., 76.3%)	Lichtenburg plant in North West Province	3,200.
Do.		Dangote Cement South Africa (Pty) Ltd. (Dangote Industries Ltd., 64%)	Plants near Delmas in Mpumalanga Province and at Lichtenburg	2,900.
Do.		Natal Portland Cement Co. (Pty) Ltd. (Cimentos de Portugal SGPS, S.A., 98%)	Simuma plant in KwaZulu-Natal Province	1,800.
Do.		Mamba Cement Co. (Pty) Ltd.	Plant near Northam	1,000.
Chromium:				
Chromite		Samancor Chrome (Pty) Ltd. [International Mineral Resources BV, 70%, and Batho Barena (Pty) Ltd., 28%]	Eastern Chrome Mines in Limpopo Province and Western Chrome Mines in North West Province	5,000.[e]
Do.		Glencore plc, 79.5%, and Merafe Resources Ltd., 20.5%	Magareng Mine in Mpumalanga Province	1,200.
Do.		do.	Thorncliffe Mine at Steelpoort	995.
Do.		do.	Kroondal Mine at Rustenburg	850.
Do.		do.	Helena Mine at Steelpoort	825.
Do.		do.	Waterval Mine in North West Province	650.
Do.		do.	Boshoek Mine in North West Province	NA.
Do.		Sibanye-Stillwater Ltd.	Marikana Mines (Eastern Platinum, Karee, and Western Platinum) and Pandora Mine	1,700.[e]
Do.		do.	Waterval Plant near Rustenburg Mine	830.[e]
Do.		Tharisa Minerals (Pty) Ltd.	Tharisa Mine in North West Province	1,920.
Do.		Assore Ltd.	Dwarsrivier Mine in Mpumalanga Province	1,600.[e]
Do.		Hernic Ferrochrome (Pty) Ltd. (Mitsubishi Corp., 51%)	Bokone and Morula Mines near Brits[1]	1,500.
Do.		Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Plants at Amandelbult Mine near Northam	1,000.[e]
Do.		Eastern Platinum Ltd. (Eastplats)	Crocodile River Mine in North West Province	1,000.[e]
Do.		Northam Platinum Ltd. [Zambezi Platinum (RF) Ltd., 31.37%, and Coronation Asset Management (Pty) Ltd., 27.71%]	Booysendal Mine near Roossenekal, Eland Mine near Brits, and Zondereinde Mine near Northam	1,000.[e]
Do.		Nkomati Joint Venture (African Rainbow Minerals Ltd., 50%, and MMC Norilsk Nickel, 50%)	Nkomati Mine in Mpumalanga Province[1]	900.
Do.		Cheetah Chrome South Africa (Pty) Ltd.	Dilokong Mine, near Burgersfort in Mpumalanga Province[1]	800.
Do.		Afarak Group Oyj	Mecklenburg, Stellite, and Zeerust Mines[1]	500.[e]
Do.		Siyanda Resources (Pty) Ltd.	Masa Plant at Union Mine near Northam	330.
Do.		Two Rivers Platinum Mine (Pty) Ltd. (African Rainbow Minerals Ltd., 55%, and Impala Platinum Holdings Ltd., 45%)	Two Rivers Platinum Mine near Steelpoort	320.[e]

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2021

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Chromium:—Continued			
Ferrochromium	Samancor Chrome (Pty) Ltd. [International Mineral Resources BV, 70%, and Batho Barena (Pty) Ltd., 28%]	Plants near Brits, Burgersfort, eMalahnai, Lydenburg,[2] Middelburg, and Rustenburg	2,400.
Do.	Glencore plc, 79.5%, and Merafe Resources Ltd., 20.5%	Lion plant at Steelpoort	720.
Do.	do.	Wonderkop plant at Marikana	553.
Do.	do.	Rustenburg plant at Rustenburg	430.
Do.	do.	Lydenburg plant at Lydenburg	396.
Do.	do.	Boshoek plant at Boshoek	240.
Do.	Traxys Group	Plant at Richards Bay[1]	150.
Do.	Afarak Group Oyj	Mogale plant in Gauteng Province	55.[e]
Clay and shale:			
Brick clay	Corobrik (Pty) Ltd.	Quarries at Bellville, Durban, Glencoe, Kempton Park, Klerksdorp, Oberholzer, Pietersburg, Potchefstroom, Pretoria, Roodeport, Springs, Welcom, Westonaria, and Witbank	3,600.[e]
Do.	Brikor Ltd.	Ilangabi Mine in Gauteng Province	800.
Fire clay	Ceramic Industries Ltd.	Quarries at Pretoria, Vereeniging, and Waterberg	530.[e]
Coal	Exxaro Resources Ltd. (BEE Holdco, 52.3%)	Grootegeluk Mine in Limpopo Province	33,400.
Do.	do.	Matla Mine in Mpumalanga Province	8,500.[e]
Do.	do.	Leeuwpan Mine in Mpumalanga Province	7,000.[e]
Do.	do.	Belfast Mine in Mpumalanga Province	2,700.
Do.	do.	Dorstfontein Complex in Mpumalanga Province	2,500.[e]
Do.	do.	Forzando Complex in Mpumalanga Province	2,000.[e]
Do.	Exxaro Resources Ltd., 50%, and Wescoal Holdings Ltd., 50%	Arnot Mine in Mpumalanga Province[1]	5,000.
Do.	Exxaro Resources Ltd., 50%, and Thungela Resources Ltd., 50%	Mafube Mine near Sasolburg	4,200.
Do.	Sasol Ltd.	Syferfontein Mine near Secunda	11,000.
Do.	do.	Twistdraai Mine near Secunda	9,700.
Do.	do.	Middelbult Mine near Secunda	8,000.
Do.	do.	Impumelelo Mine near Secunda	6,800.
Do.	do.	Bosjesspruit Mine near Secunda	6,300.
Do.	do.	Brandspruit Mine near Secunda[1]	3,300.
Do.	do.	Sigma Mine near Sasolburg	1,900.
Do.	South32 Ltd.	Middelburg and Wolverkrans Mines in Mpumalanga Province	17,000.
Do.	do.	Khutala Mine in Mpumalanga Province	12,000.
Do.	do.	Klipspruit Mine in Mpumalanga Province	7,000.
Do.	Thungela Resources Ltd.	Khwezela Mine near Witbank	8,700.
Do.	do.	Zibulo Mine in Mpumalanga Province	8,000.
Do.	do.	Goedehoop Mine in Mpumalanga Province	7,500.
Do.	do.	Isibonelo Mine in Mpumalanga Province	5,000.
Do.	do.	Greenside Mine near Witbank	5,000.[e]
Do.	Seriti Coal (Pty) Ltd.	New Vaal Mine near Vanderbijlpark	18,000.
Do.	do.	Kriel Mine in Mpumalanga Province	10,000.
Do.	do.	New Denmark Mine in Mpumalanga Province	5,000.
Do.	Glencore plc, 79.8%, and African Rainbow Minerals Ltd., 20.2%	Impunzi Complex and Tweefontein Complex at Witbank	18,000.[e]
Do.	do.	Goedgevonden Complex at Witbank	7,700.
Do.	Glencore plc	Zonnebloem Mine in Mpumalanga Province	3,300.[e]
Do.	Optimum Coal Mine (Pty) Ltd. [Tegeta Exploration & Resources (Pty) Ltd., 67.6%]	Optimum Complex in Mpumalanga Province[1]	10,000.
Do.	do.	Koornfontein Mine in Mpumalanga Province[1]	3,500.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2021

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal—Continued		Wescoal Holdings Ltd.	Vanggatfontein Mine in Mpumalanga Province	4,000.
Do.		do.	Elandspruit Mine in Mpumalanga Province	3,100.
Do.		do.	Khanyisa Mine in Mpumalanga Province	1,200.
Do.		Mbuyelo Coal (Pty) Ltd. (Mbuyelo Group, 49%, and IchorCoal N.V., 45%)	Manungu, Vlakvarkfontein, and Welgemeend Mines in Mpumalanga Province	8,000.[e]
Do.		Universal Coal plc	New Clydesdale Colliery in Mpumalanga Province	3,000.
Do.		do.	North Block Complex in Mpumalanga Province	2,600.
Do.		do.	Kangala Mine in Mpumalanga Province	2,400.
Do.		Canyon Coal (Pty) Ltd. [Menar Holding (Pty) Ltd.]	Hakhano1, Khanye, Phalanndwa and Singani Mines in Mpumalanga Province	3,700.[e]
Do.		Menar Holding (Pty) Ltd.	Savmore Mine in Mpumalanga Province	2,000.[e]
Do.		Zululand Anthracite Colliery (Pty) Ltd. [Menar Holding (Pty) Ltd., 76%]	Mine near Emakhalathini	870.[e]
Do.		Iyanga Mining (Pty) Ltd.	Klipfontein, Leeuwpoort, and Welgelegen Mines in Mpumalanga Province	6,000.[e]
Do.		Hosken Consolidated Coal (Pty) Ltd.	Palesa Mine in Mpumalanga Province	3,300.[e]
Do.		do.	Mbali Mine in Mpumalanga Province	1,500.[e]
Do.		Izimbiwa Coal (Pty) Ltd. (Phembani Group, 50.01%, and Glencore plc, 49.99%)	Middelburg Complex	3,800.[e]
Do.		Umcebo Mining Ltd. (Glencore plc, 48.7%)	Wonderfontein Mine near Belfast	3,700.[e]
Do.		Vunene Mining (Pty) Ltd. (IchorCoal N.V., 76%)	Vunene Mine in Mpumalanga Province	2,100.[e]
Do.		do.	Mbali Mine in Mpumalanga Province	1,600.
Do.		Eyethu Coal (Pty) Ltd.	Mooifontein and other mines in Mpumalanga Province	3,100.[e]
Do.		Imbawula Group	Spitzkop and Tselentis Mines near Ermelo	2,800.
Do.		Kuyasa Mining (Pty) Ltd.	Delmas Mine	2,000.
Cobalt:				
Mine	metric tons	Nkomati Joint Venture (African Rainbow Minerals Ltd., 50%, and MMC Norilsk Nickel, 50%)	Nkomati Mine in Mpumalanga Province[1]	1,200.[e]
Do.	do.	Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Amandelbult, Kroondal, Modikwa, Mogalakwena and Mototolo Mines in Bushveld Complex	500.[e]
Refinery	do.	Impala Platinum Holdings Ltd. (Implats)	Base Metals Refinery	900.[e]
Copper:				
Mine		Palabora Mining Co. Ltd.	Palabora Mine at Phalaborwa	65.[3]
Do.		Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Amandelbult, Kroondal, Modikwa, Mogalakwena and Mototolo Mines in Bushveld Complex	13.[3]
Do.		Nkomati Joint Venture (African Rainbow Minerals Ltd., 50%, and MMC Norilsk Nickel, 50%)	Nkomati Mine in Mpumalanga Province	10.
Do.		Impala Platinum Holdings Ltd. (Implats)	Impala Rustenburg Mine near Phokeng	7.[3]
Do.		Black Mountain Mineral Development Co. (Pty) Ltd. (Vedanta Resources Ltd., 69.6%)	Black Mountain Mine near Aggeneys in Northern Cape Province	6.[3]
Smelter		Palabora Mining Co. Ltd.	Smelter at Phalaborwa	110.[3]
Do.		Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Rustenburg Smelter near Rustenburg	11.[3]
Do.		Impala Platinum Holdings Ltd. (Implats)	Smelter near Phokeng	7.[3]
Refinery		Palabora Mining Co. Ltd.	Refinery at Phalaborwa	140.[3]
Do.		Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Refinery near Rustenburg	13.[3]
Do.		Sibanye-Stillwater Ltd.	Refinery at Brakpan	9.[3]
Do.		Impala Platinum Holdings Ltd. (Implats)	Refinery at Springs	7.[3]
Diamond	thousand carats	De Beers Consolidated Mines Ltd. (DeBeers Group of Companies, 76%)	Venetia Mine in Northern Cape Province	7,500.
Do.	do.	do.	Voorspoed Mine[1] in Free State Province	800.
Do.	do.	Petra Diamonds Ltd.	Finsch Mine in Northern Cape Province	2,000.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2021

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Diamond—Continued	thousand carats	Petra Diamonds Ltd.	Cullinan Mine in Gauteng Province	1,700.
Do.	do.	do.	Koffiefontein Mine in Free State Province	85.
Do.	do.	Ekapa Mining (Pty) Ltd.	Kimberley Mine in Northern Cape Province	800.
Do.	do.	DiamondCorp plc	Lace Mine[1] near Kroonstad	500.
Do.	do.	Jagersfontein Developments (Pty) Ltd.	Jagersfontein Mine in Free State Province	250.[e]
Do.	do.	West Coast Resources (Pty) Ltd. (Trans Hex Group, 67.2%)	Namaqualand operations	130.[e]
Do.	do.	Batho Pele cooperative[4]	Near Kimberley Mine in Northern Cape Province	NA.
Fertilizers, phosphate		Foskor (Pty) Ltd.	Plant at Richards Bay	350.
Fluorspar		Vergenoeg Mining Corp. (Pty) Ltd. (Minerales Y Productos Derivados SA, 85%)	Vergenoeg Mine at Rust de Winter	250 acid-grade; 30 metallurgical grade.
Do.		Sephaku Fluoride Ltd. (SepFluor)	Nokeng Mine at Rust de Winter	180 acid grade; 30 metallurgical grade.
Garnet, industrial		Mineral Commodities Ltd. (MCL)	Tormin Mine in Western Cape Province	300.
Gemstones:				
Amethyst	kilograms	Artisanal miners	Mines at Boekenhouthoek	500.[e]
Emerald	do.	Magnum Mining & Exploration Ltd.	Gravelotte Mine	600.
Gold:				
Mine[5]	do.	Harmony Gold Mining Co. Ltd.	Tshepong Mine in Free State Province	9,000.
Do.	do.	do.	Moab Khotsong Mine in Free State Province	7,700.
Do.	do.	do.	Kusasalethu Mine in Gauteng Province	5,300.
Do.	do.	do.	Doornkop Mine in Gauteng Province	3,500.
Do.	do.	do.	Kalgold, Phoenix, and other surface operations	2,700.
Do.	do.	do.	Target 1 Mine in Free State Province	2,600.
Do.	do.	do.	Bambanani Mine in Free State Province	2,400.
Do.	do.	do.	Masimong Mine in Free State Province	2,200.
Do.	do.	do.	Joel Mine in Free State Province	1,900.
Do.	do.	do.	Unisel Mine in Free State Province	1,000.
Do.	do.	Sibanye-Stillwater Ltd.	Kloof Mine in Gauteng Province	17,000.[e]
Do.	do.	do.	Beatrix Mine in Free State Province	6,800.[e]
Do.	do.	do.	Driefontein Mine in Gauteng Province	5,800.[e]
Do.	do.	do.	Burnstone Mine in Mpumalanga Province [1]	3,900.
Do.	do.	do.	Cooke Operations in Gauteng Province	1,600.[e]
Do.	do.	AngloGold Ashanti Ltd. (Anglo American plc, 41.8%)	Mponeng Mine in Gauteng Province	10,000.
Do.	do.	do.	Tau Tona Mine in Gauteng Province [1]	8,100.
Do.	do.	do.	Surface Operations in North West Province	7,000.[e]
Do.	do.	Gold Fields Ltd.	South Deep Mine in Gauteng Province	9,200.
Do.	do.	Pan African Resources plc	Barberton Mine in Mpumalanga Province	3,400.
Do.	do.	do.	Elikhulu Tailings Retreatment Project in Mpumalanga Province	2,300.
Do.	do.	do.	Evander Mines' 8 Shaft in Mpumalanga Province	1,200.
Do.	do.	do.	Barberton Tailings Retreatment Project in Mpumalanga Province	780.
Do.	do.	DRDGold Ltd. (Sibanye-Stillwater Ltd., 50.1%)	Ergo and Far West Gold Recovery Operations in Gauteng Province	6,200.[e]
Do.	do.	Village Main Reef Ltd. (Heaven-Sent Capital Group)	Kopanang Mine in Free State Province	2,900.[e]
Do.	do.	do.	Tau Lekoa Mine in North West Province	2,500.[e]
Do.	do.	Gold One International Ltd.	Modder East Mine in Gauteng Province	4,700.
Do.	do.	Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Amandelbult, Kroondal, Modikwa, Mogalakwena and Mototolo Mines in Bushveld Complex	3,000.[e]
Refinery	metric tons	Rand Refinery (Pty) Ltd. (AngloGold Ashanti Ltd., 42.41%, and Sibanye-Stillwater Ltd., 33.15%)	Plant at Germiston in Gauteng Province	410.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2021

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel:			
Iron ore	Kumba Iron Ore Ltd.	Sishen Mine at Sishen	38,000.
Do.	do.	Kolomela Mine in Northern Cape Province	14,000.
Do.	Assmang (Pty) Ltd.	Khumani Mine in Northern Cape Province	16,000.
Do.	do.	Beeshoek Mine near Postmasburg	4,000.
Do.	Palabora Mining Co. Ltd.	Palabora Mines at Phalaborwa	10,000.
Do.	Sedibeng Iron Ore (Pty) Ltd. [Black Ginger (Pty) Ltd., 64%]	Mine at Postmasburg in Northern Cape Province	2,000.
Do.	Foskor (Pty) Ltd.	Foskor Mine and plant at Phalaborwa	1,400.
Do.	Afrimat Ltd.	Demaneng Mine in Northern Cape Province	1,000.
Pig iron	ArcelorMittal South Africa Ltd.	Plants at Vanderbijlpark	3,200.
Do.	do.	Plant at Newcastle	1,800.
Do.	Richards Bay Minerals (RBM) (Rio Tinto plc, 74%, and Blue Horizon Investments, 24%)	Smelter at Richards Bay	550.
Steel, raw	ArcelorMittal South Africa Ltd.	Plant at Vanderbijlpark	2,900.
Do.	do.	Plants at Newcastle and Vereeniging	1,900.
Do.	do.	Plant at Saldanha[1]	1,300.
Do.	Columbus Stainless (Pty) Ltd. (Acerinox SA, 76%)	Stainless steel plant at Middelburg	750.
Do.	Scaw Metals Group	Germiston plant, Johannesburg	600.
Do.	Davsteel Division (Cape Gate Pty. Ltd.)	Plant at Vanderbijlpark	485.
Do.	Cape Town Iron & Steel Works (Pty) Ltd. (Cisco)	Kuils River plant, Cape Town[1]	300.
Steel, rolled	Davsteel Division (Cape Gate Pty. Ltd.)	Plant at Vanderbijlpark	460.
Do.	Cape Town Iron & Steel Works (Pty) Ltd. (Cisco)	Kuils River plant, Cape Town[1]	300.[e]
Do.	Duferco Steel Processing Ltd.	Cold-rolled slab steel plant at Saldanha Bay	240.
Lead, mine	Black Mountain Mineral Development Co. (Pty) Ltd. (Vedanta Resources Ltd., 69.6%)	Black Mountain Mine near Aggeneys in Northern Cape Province	55.
Lime	Idwala Lime [Idwala Industrial Holdings (Pty) Ltd.]	Plant at Daniëlskuil	1,000.
Do.	PPC Lime Ltd. (Pretoria Portland Cement Company Ltd.)	Plant at Lime Acres	900.
Do.	Inca Lime (Pty) Ltd. [Inca Mining (Pty) Ltd.]	Plant at Immerpan, Limpopo Province	100.
Magnesite	Chamotte Holdings	Strathmore Magnesite Mine	100.[e]
Manganese:			
Mine	Hotazel Manganese Mines (Pty) Ltd. (South32 Ltd., 60%)	Mamatwan Mine near Hotazel in Northern Cape Province	3,500 ore.
Do.	do.	Wessels Mine near Hotazel in Northern Cape Province	1,000 ore.
Do.	Assmang (Pty) Ltd.	Gloria and Nchwaning Mines near Black Rock	4,000 ore.
Do.	United Manganese of Kalahari (Pty) Ltd. (UMK) (Majestic Silver Trading 40 (Pty) Ltd., 51%, and Renova Group of Russia, 49%)	Russik Mine in Northern Cape Province	4,000 ore.
Do.	Tshipi e Ntle Manganese Mining (Pty) Ltd. [Jupiter Mines Ltd., 49.9%, and Ntsimbitntle Mining (Pty) Ltd. , 38.1%]	Tshipi Borwa Mine in Northern Cape Province	3,600 ore.
Do.	Kalagadi Manganese (Pty) Ltd. [Kalagadi Alloys (Pty) Ltd., 44%; Kalahari Resources (Pty) Ltd., 36%; and Industrial Development Corp., 20%]	Mine at Hotazel in Northern Cape Province	3,000 ore; 2,400 sinter.
Do.	Asia Minerals Ltd. (AML)	Mines at Farm Hotazel and Farm York	1,900 ore.
Do.	Guangxi N&H Metallurgy Development Co.	Lomoteng Mine	600 ore.
Ferromanganese	Assmang (Pty) Ltd.	Cato Ridge plant in KwaZulu-Natal Province	300.
Do.	do.	Machadodorp plant in Mpumalanga Province[1]	290.
Do.	Samancor Manganese (Pty) Ltd. (South32 Ltd., 60%)	Plant at Meyerton	500.
Silicomanganese	Transalloys (Pty) Ltd. (Renova Group, 23.78%)	Plant at Witbank	180.
Do.	Afarak Group Oyj	Mogale plant	55.[e]
Refinery, metal, electrolytic	Manganese Metal Co. Pty. Ltd. (Bright Resources, 70%, and To The Point Growth Specialists (Pty) Ltd., 30%)	Electrolytic plant at Nelspruit	30.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2021

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Nickel:				
Mine		Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Amandelbult, Kroondal, Modikwa, Mogalakwena and Mototolo Mines in Bushveld Complex	33.[e]
Do.		Nkomati Joint Venture (African Rainbow Minerals Ltd., 50%, and MMC Norilsk Nickel, 50%)	Nkomati Mine in Mpumalanga Province[1]	21.
Do.		Impala Platinum Holdings Ltd. (Implats)	Impala Rustenburg Mine near Phokeng	7.[e]
Do.		Sibanye-Stillwater Ltd.	Marikana and Pandora Mines near Marikana	4.[e]
Sulfate		do.	Refinery at Brakpan	4.[e]
Refinery		Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Refinery near Rustenburg	33.
Do.		Impala Platinum Holdings Ltd. (Implats)	Refinery at Springs	16.[e]
Nitrogen, ammonia		Sasol Ltd.	Plants at Sasolburg and Secunda	660.
Petroleum, refined	thousand 42-gallon barrels	South African Petroleum Refineries (BP Southern Africa, 50%, and Shell SA Energy, 50%)	Sapref refinery in Durban	65,700.
Do.	do.	Engen Ltd. (62%)	Enref refinery in Durban[1]	43,800.
Do.	do.	National Petroleum Refiners of South Africa (Pty) Ltd. (Sasol Ltd., 63.6%)	Natref refinery in Sasolburg	39,400.
Do.	do.	Astron Energy (Pty) Ltd. (Glencore plc)	Chevref refinery in Cape Town[1]	36,500.
Phosphate rock		Foskor (Pty) Ltd.	Foskor Mine and plant at Phalaborwa	2,800.
Phosphoric acid		do.	Plant at Richards Bay	720.
Platinum-group metals:				
Mine	kilograms	Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Mogalakwena Mine at Ga-Masenya	16,000 platinum; 17,500 palladium; 1,200 rhodium; 1,000 ruthenium; 260 iridium.
Do.	do.	do.	Amandelbult Mine near Northam	16,000 platinum; 7,300 palladium; 3,600[e] ruthenium; 2,600[e] rhodium; 950[e] iridium.
Do.	do.	Kroondal Platinum Mines (Anglo American Platinum Ltd., 50%, and Sibanye-Stillwater Ltd., 50%)	Kroondal Mine near Rustenburg	11,000 platinum; 6,000 palladium; 3,500 ruthenium; 2,200 rhodium; 800 iridium.
Do.	do.	Modikwa Platinum Mine (African Rainbow Minerals Ltd., 50%, and Anglo American Platinum Ltd., 50%)	Modikwa Mine at Makgemeng	4,200 platinum; 4,000 palladium; 1,200 ruthenium; 820 rhodium; 310 iridium.
Do.	do.	Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Mototolo Mine at Steelpoort	3,300 platinum; 2,100 palladium; 990 ruthenium; 570 rhodium; 220 iridium.
Do.	do.	Sibanye-Stillwater Ltd.	Marikana and Pandora Mines near Marikana	24,900 platinum; 11,600 palladium; 5,300 ruthenium; 3,400 rhodium; 1,100 iridium.
Do.	do.	do.	Rustenburg Mine near Rustenburg	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 2021

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Platinum-group metals:—Continued				
Mine—Continued	kilograms	Impala Platinum Holdings Ltd. (Implats)	Impala Rustenburg Mine near Phokeng	29,500 platinum; 16,000 palladium; 6,600 ruthenium; 4,000 rhodium; 1,600 iridium.
Do.	do.	do.	Marula Mine at Bothashoek	3,000 platinum; 3,100 palladium; 730 ruthenium; 620 rhodium; 220 iridium.
Do.	do.	Northam Platinum Ltd. [Zambezi Platinum (RF) Ltd., 31.37%, and Coronation Asset Management (Pty) Ltd., 27.71%]	Booysendal Mine near Roossenekal	6,200[e] platinum; 3,000[e] palladium; 1,800[e] ruthenium; 1,000[e] rhodium; 360[e] iridium.
Do.	do.	do.	Zondereinde Mine near Northam	6,100 platinum; 2,900 palladium; 1,400 ruthenium; 850 rhodium; 330 iridium.
Do.	do.	do.	Eland Mine near Brits	1,400[e] platinum-group metals.
Do.	do.	Siyanda Resources (Pty) Ltd.	Union Mine near Northam	10,700 platinum; 4,600 palladium; 1,800 rhodium; 3,100 iridium and ruthenium.
Do.	do.	Royal Bafokeng Platinum Ltd. (RBPlat) (Royal Bafokeng Nation, 100%)	Styldrift Mine near Phokeng	6,900 platinum; 3,100 palladium, rhodium, and gold.
Do.	do.	do.	Bafokeng Rasimone Platinum Mine near Phokeng	5,900 platinum; 2,400 palladium; 790 ruthenium; 460 rhodium; 150 iridium.
Do.	do.	Two Rivers Platinum Mine (Pty) Ltd. (African Rainbow Minerals Ltd., 55%, and Impala Platinum Holdings Ltd., 45%)	Two Rivers Platinum Mine near Steelpoort in Limpopo Province	5,500 platinum; 3,200 palladium; 1,600 ruthenium; 930 rhodium; 350 iridium.
Do.	do.	Nkomati Joint Venture (African Rainbow Minerals Ltd., 50%, and MMC Norilsk Nickel, 50%)	Nkomati Mine in Mpumalanga Province[1]	2,900[e] palladium; 1,200[e] platinum; 200[e] rhodium.
Do.	do.	Sedibelo Platinum Mines Ltd.	Pilanesberg Mine in North West Province	5,400 platinum; 1,700 palladium; 490 rhodium.
Do.	do.	Atlatsa Resources Corp., 51%, and Anglo American Platinum Ltd., 49%	Bokoni Mine at Sefateng[1]	4,100 platinum; 2,700 palladium; 470 rhodium.
Do.	do.	Tharisa Minerals (Pty) Ltd.	Tharisa Mine in North West Province	2,800 platinum; 860 palladium; 720 ruthenium; 490 rhodium; 220 iridium.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2021

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Platinum-group metals—Continued				
Mine—Continued	kilograms	Sylvania Platinum Ltd.	Sylvania Dump Operations	1,100[e] platinum; 520[e] palladium; 290[e] rhodium.
Smelter	do.	Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Polokwane smelter at Polokwane, Mortimer smelter at Swartklip, and Waterval smelter	85,000 platinum; 55,000 palladium; 12,000 rhodium.
Do.	do.	Impala Platinum Holdings Ltd. (Implats)	Smelter near Phokeng	81,000 platinum; 52,600 palladium; 11,600 rhodium; 17,000 gold, iridium, and ruthenium.
Refinery	do.	Anglo American Platinum Ltd. (Anglo American plc, 78%) (Amplats)	Precious Metals Refinery near Rustenburg	81,000 platinum; 54,000 palladium; 11,000 rhodium; 18,800 iridium and ruthenium.
Do.	do.	Impala Platinum Holdings Ltd. (Implats)	Refinery near Springs	71,500 platinum metal; 46,400 palladium metal; 10,200 rhodium metal; 15,000 gold, iridium, and ruthenium.
Do.	do.	Sibanye-Stillwater Ltd.	Refinery at Brakpan	31,000 platinum metal; 14,600 palladium metal; 7,000 ruthenium metal; 4,300 rhodium metal; 1,400 iridium metal.
Do.	do.	Heraeus South Africa (Pty) Ltd.	Refinery at Port Elizabeth	20,000[e] platinum metal; 10,000[e] palladium metal.
Pyrophyllite		Idwala Industrial Minerals (Benoni)	Ottsdal Mine in North West Province	15.
Do.		Wonderstone Ltd. (The Associated Ore & Metals Corp. Ltd.)	Wonderstone Mine (pyrophyllite mine), North West Province	NA.
Do.		G&W Base and Industrial Minerals Pty. Ltd.	Piet Retief Mine	NA.
Salt		Salt Refiners and Packers Holdings (Pty) Ltd.	Mine in Gauteng Province	100.
Do.		Kalkpoort Soutwerke CC	Mine in Northern Cape Province	60.
Do.		Cerebos Ltd.	Mine in Eastern Cape Province	40.
Do.		Orange River Salt Works (Pty) Ltd.	Mine in Northern Cape Province	30.
Sand, industrial		Thaba Chehu Mining (Pty) Ltd.	Samquarz Mine at Delmas	1,100.[e]
Do.		Maxima Silica (Pty) Ltd. (Incubex Minerals Ltd., 100%)	Mine near Boshoek	72.
Selenium	kilograms	Impala Platinum Holdings Ltd. (Implats)	Impala and Marula Mines	12,000.[e]
Do.	do.	Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	2,700.[e]
Silicon:				
Ferrosilicon		do.	New Castle plant at Ballengeich[1]	45.
Do.		do.	eMalahleni plant	40.
Metal		Ferroglobe plc	Polokwane plant, near Pietersburg[1]	55.
Do.		do.	eMalahleni plant	12.
Silver:				
Mine	metric tons	Black Mountain Mineral Development Co. (Pty) Ltd. (Vedanta Resources Ltd., 69.6%)	Black Mountain Mine near Aggeneys in Northern Cape Province	50.
Refinery	do.	Rand Refinery (Pty) Ltd. (AngloGold Ashanti Ltd., 42.41%, and Sibanye-Stillwater Ltd., 33.15%)	Plant at Germiston in Gauteng Province	60.

See footnotes at end of table.

TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2021

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Stone, dimension		Kelgran Investments (Pty) Ltd.	Quarry at Rustenburg in North West Province	58 granite blocks.
Do.		do.	Quarry in Limpopo Province	18 granite blocks.
Do.		do.	Quarry near Garies in Northern Cape Province	8 granite blocks.
Do.		do.	Quarry in Western Cape Province	8 granite blocks.
Do.		do.	Quarry near Springbok	6 granite blocks.
Do.		Leka Hartebeespoort Mining (Pty) Ltd.	Quarry near Hartbeespoort	40 granite blocks.
Sulfur		Sasol Synthetic Fuels (Pty) Ltd.	Plant at Secunda	180.
Do.		South African Petroleum Refineries (BP Southern Africa, 50%, and Shell SA Energy, 50%)	Plant at Durban	63.
Do.		Engen Petroleum Ltd.	do.[1]	47.
Do.		National Petroleum Refiners of South Africa (Pty) Ltd. (Sasol Ltd., 63.6%)	Plant at Sasolburg	44.
Do.		Astron Energy (Pty) Ltd. (Glencore plc)	Plant at Cape Town[1]	30.
Sulfuric acid		Foskor (Pty) Ltd.	Plant at Richards Bay	2,200.
Synthetic fuels	thousand 42-gallon barrels	Sasol Synthetic Fuels (Pty) Ltd.	Coal to oil plant at Secunda	58,400.
Do.	do.	Petroleum Oil and Gas Corporation of South Africa	Natural gas to petroleum products plant at Mossel Bay	16,400.
Tellurium	kilograms	Impala Platinum Holdings Ltd. (Implats)	Impala and Marula Mines	5,000.[e]
Do.	do.	Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	2,200.[e]
Titanium:				
Mineral concentrates		Richards Bay Minerals (RBM) (Rio Tinto plc, 74%, and Blue Horizon Investments, 24%)	Open cast operations, near Richards Bay	2,000 ilmenite;[e] 100 rutile.
Do.		Tronox Holdings plc	Namakwa Sands near Brand-se-Baai and mineral separation plant at Koekenaap	540 ilmenite; 31 rutile.
Do.		do.	Fairbreeze Mine in KwaZulu-Natal Province	500 ilmenite; 25 rutile.
Do.		Mineral Commodities Ltd. (MCL)	Tormin Mine in Western Cape Province	180[e] ilmenite; 5.5 rutile.
Titaniferous slag		Richards Bay Minerals (RBM) (Rio Tinto plc, 74%, and Blue Horizon Investments, 24%)	Smelter at Richards Bay	1,050.
Do.		Tronox Holdings plc	Empangeni smelter near Richards Bay	220.
Do.		do.	Smelter at Vredenberg, Saldanha Bay area	190.
Uranium oxide	metric tons	AngloGold Ashanti Ltd.	Surface Operations in North West Province	180.[e]
Do.	do.	Sibanye-Stillwater Ltd.	Cooke Operations in Gauteng Province	120.[e]
Vanadium	do.	Vanchem Vanadium Products (Pty) Ltd. (Bushveld Minerals Ltd., 100%)	Vanchem Plant at Witbank	4,200.
Do.	do.	Vametco Minerals Corp. (Bushveld Minerals Ltd., 100%)	Vametco Mine and Brits plant	3,750.
Do.	do.	Glencore plc	Rhovan Mine at Brits	5,600.
Do.	do.	do.	Rhovan plant at Brits	6,000 ferrovanadium.
Vermiculite		Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	200.
Wollastonite	metric tons	Incubex Minerals Ltd.	Mine near Garies	1,800.
Zinc, mine		Vedanta Resources Ltd., 69.6%	Gamsberg Mine in Northern Cape Province	250.
Do.		Black Mountain Mineral Development Co. (Pty) Ltd. (Vedanta Resources Ltd., 69.6%)	Black Mountain Mine near Aggeneys in Northern Cape Province	40.
Zirconium		Richards Bay Minerals (RBM) (Rio Tinto plc, 74%, and Blue Horizon Investments, 24%)	Open cast mines near Richards Bay	250 zircon in concentrate.
Do.		Tronox Holdings plc	Namakwa Sands near Brand-se-Baai and mineral separation plant at Koekenaap	125 zircon in concentrate.
Do.		do.	Fairbreeze Mine in KwaZulu-Natal Province	55 zircon in concentrate.
Do.		Mineral Commodities Ltd. (MCL)	Tormin Mine in Western Cape Province	38 zircon in concentrate.

[e]Estimated. Do., do. Ditto. NA Not available.
[1]Not operating at the end of 2021.
[2]Joint venture with Sinosteel Corp.
[3]Data from International Copper Study Group.
[4]Unlicensed artisanal miners also produced diamond near the Kimberley Mine in Northern Cape Province.
[5]Artisanal miners also produced gold from abandoned-large scale gold mining operations.

TABLE 3

SOUTH AFRICA: RESERVE BASE OF MAJOR MINERALS IN 2021[1]

(Million metric tons unless otherwise specified)

Commodity		Reserves
Alumino-silicates[2]		96
Antimony	thousand metric tons	27
Chromite ore		200
Coal, recoverable		66,700
Cobalt	thousand metric tons	40
Copper		11
Fluorspar		41
Gold	thousand metric tons	5
Iron ore		670
Lead	thousand metric tons	300
Manganese, ore		230
Nickel	thousand metric tons	3,700
Phosphate rock		1,600
Platinum-group metals	thousand metric tons	63
Titanium minerals		37
Uranium	thousand metric tons	322
Vanadium	do.	3,500
Vermiculite		14
Zinc		15
Zirconium	thousand metric tons	6

[1]Metallic minerals are contained metal, except for titanium, which is titanium dioxide content, and zirconium, which is zirconium dioxide content.

[2]Includes aluminosilicate and sillimanite.