



2014 Minerals Yearbook

MOZAMBIQUE

THE MINERAL INDUSTRY OF MOZAMBIQUE

By Thomas R. Yager

In 2014, Mozambique's share of world ilmenite production was about 9%; zircon, 4%; and aluminum, 1%. The country also played a significant role in the world's production of tantalum. Other mineral and mineral processing operations included bauxite; cement; clays; coal; construction materials; diatomite; such gemstones as aquamarine, dumortierite, garnet, ruby, and tourmaline; gold; refined lead; natural gas; natural gas condensate; niobium (columbium); quartz; rutile; and salt. Mozambique was not a globally significant consumer of minerals or mineral fuels in 2014 (Noventa Ltd., 2012; Imprensa Nacional de Mocambique, 2015, p. 12; Bedinger, 2016a, b; Bray, 2016; Papp, 2016).

Minerals in the National Economy

The manufacturing sector accounted for 11.3% of the gross domestic product (GDP) in 2014, and the mining and quarrying sector, 2.9%. The value of output in the mining and quarrying sector increased by 13% in 2014 compared with 15.7% in 2013. Employment in the large-scale mining sector was about 15,000 workers in 2012 (the latest year for which data were available), which included 10,000 in the coal mining subsector. It was estimated that 150,000 workers were employed in artisanal mining operations (World Bank Group, 2013, p. 3–4; Banco de Mocambique, 2015b, p. 73).

In 2014, exports were valued at \$3.92 billion, of which aluminum accounted for 26.9%; coal, 12.5%; natural gas, 8.7%; and ilmenite, rutile, and zircon, a combined total of 4.9%. In 2010, aluminum accounted for 49.7% of the value of exports; natural gas, 5.7%; ilmenite, rutile, and zircon, a combined total of 4.2%; and no coal exports were reported. In 2014, imports were valued at \$7.95 billion, of which mineral fuels accounted for 14.8%, and cement, 1% (Banco de Mocambique, 2015a, p. 54–55).

In 2014, the Government passed the Mining Law (Law No. 20/2014 of August 18), which replaced Law No. 14/2002 of June 26, 2002. The Mining Law mandated that minerals mined in Mozambique be beneficiated domestically when economically feasible. The law established that mining contracts be signed with companies that have the Government as a shareholder and minimum levels of local content. Regulations about domestic beneficiation and local content were expected to be established in the near future. The Mining Law also encourages preferences to be given to goods and services purchased from Mozambican companies or individuals. The new High Authority for the Extractive Industry would be established to oversee the mining and quarrying sector; it was unclear what powers the High Authority would have (Lex Africa, 2015).

The Mining Law mandated differing levels of environmental impact assessments for various categories of mining activity, which were classified as Category A, Category B, and Category C. Environmental regulations applicable to the mining and

quarrying sector were the Regulation on Health and Safety for Mineral Activities (Decree No. 61/2006 of December 26); the Environmental Regulation for Mineral Activities (Decree No. 26/2004 of August 20); and The Basic Rules on Environmental Management for Mineral Activities (Ministerial Diploma No. 189/2006 of December 14) (Lex Africa, 2015).

The Government also passed the Specific Regime of Taxation and Fiscal Benefits for Mining Operations (Law No. 28/2014 of September 23), which replaced the Law Nos. 11/2007 and 13/2007 of June 27, 2007. Under the new law, royalty rates for diamond were set at 8%; for gemstones, heavy mineral sands, and precious metals, at 6%; for base metals, coal, ornamental stones, and other minerals, at 3%; and sand and stone, at 1.5%. All mineral products consumed by local industries received a reduction of 50% in royalties paid. The new tax law was to be effective as of January 1, 2015 (Lex Africa, 2015).

In 2014, the Government passed the Petroleum Law (Law No. 21/2014 of August 18), which replaced Law No. 3/2001 of February 21. The Petroleum Law established that Government-owned Empresa Nacional de Hidrocarbonetos E.P. (ENH) would represent the Government in natural gas and petroleum operations. ENH would be involved in all natural gas and petroleum operations and in every stage, including exploration, natural gas and crude petroleum production, petroleum refining, natural gas processing to liquefied natural gas (LNG), transportation, storage and marketing. The Petroleum Law also mandated that 25% of natural gas production from new discoveries be sold to the domestic market (Campbell, 2015b; Lex Africa, 2015).

Production

In 2014, the production of zircon concentrate increased by 62% compared with that of 2013; rutile concentrate, by 53%; crude and processed bentonite, by 29% each; garnet, by 28%; ruby, by an estimated 27%; coal, by an estimated 25%; ilmenite concentrate, by 19%; cement, by 16%; and refined lead, by 13%. The production of rhyolite decreased by an estimated 80% in 2014; limestone, by 68%; sand, by 62%; bauxite, by 52%; niobium, by an estimated 48%; tantalum, by an estimated 47%; natural gas condensate, by 29%; and gravel and crushed stone and natural gas, by 16% each. Aquamarine production ceased in 2014 (table 1; Imprensa Nacional de Mocambique, 2015, p. 12; Eduardo Alexandre, National Director of Mines, Mozambique National Directorate of Mines, written commun., January 9, 2015).

Structure of the Mineral Industry

Most of Mozambique's mining and mineral processing operations were privately owned, including the cement plants, the coal mines, the Muiane tantalum mine, the Moma mineral sands mine, and the Mozal aluminum smelter. The Government

held a 30% share in the Pande and Temane gas fields through ENH. The mineral industry also included a number of small-scale and artisanal operations that produced construction materials, gemstones, gold, niobium (columbium), and tantalum. Capacity, location, ownership, and production information was not readily available for many of these operations (table 2).

Commodity Review

Metals

Aluminum.—Mozambique was Africa's second-ranked producer of aluminum after South Africa in 2014. The Mozal aluminum smelter, which used alumina imported from Western Australia as raw material, produced 567,000 metric tons (t) in 2014 compared with 562,000 t in 2013 (BHP Billiton Ltd., 2014, p. 24; 2015, p. 25).

Beryllium.—Mozambique had industrial-grade beryl deposits at Ígaro, Lugela, and Vila Maior in Zambesia Province. African Rare Gemwood and possibly other companies mined industrial-grade beryl in recent years; production shut down in 2013.

Gold.—In November 2014, Auroch Minerals NL of Australia estimated that resources at the Fair Bride deposit, which is part of the Manica project, were 9.55 million metric tons (Mt) at a grade of 3 grams per metric ton gold. Auroch planned to complete a scoping study on a new mine at Fair Bride in the first quarter of 2015. The company hoped to identify additional resources of gold at Fair Bride and other parts of the Manica project through drilling (Auroch Minerals NL, 2015).

Iron Ore and Vanadium.—In March 2013, Baobab Resources plc of the United Kingdom completed a prefeasibility study with successful results on a new mine located north of Tete. Titaniferous-vanadiferous magnetite from the mine was expected to be smelted into pig iron and ferrovanadium. For the estimated 37-year life of the mine, planned production was 2 million metric tons per year (Mt/yr) of iron ore at a grade of 56% iron, which would be processed to produce 1 Mt/yr of pig iron and 3,200 metric tons per year (t/yr) of ferrovanadium. The company was also considering the construction of a new steel plant. Total resources at the project were 727 Mt at a grade of 33.8% iron and 0.4% vanadium pentoxide (V_2O_5). Baobab planned to complete a feasibility study for the project in 2014. Depending on the results of the study, construction on the mine could be completed in the first half of 2017. At yearend, the study was not completed (Baobab Resources plc, 2014, p. 7, 12, 20, 29; 2015, p. 9–10).

In late July 2014, Syrah Resources Ltd. of Australia completed a scoping study on producing vanadium from its Balama graphite project. Depending on the results of its feasibility study on a new graphite mine, Syrah could produce about 5,000 t/yr of V_2O_5 at Balama after starting and ramping up graphite production. Resources at Balama were estimated to be 1.15 billion metric tons (Gt) at a grade of 0.23% V_2O_5 (Syrah Resources Ltd., 2014).

Lead.—Gravita Mozambique Lda. (a subsidiary of Gravita India Ltd.) operated a secondary lead refinery in Maputo with a capacity of 3,800 t/yr. In fiscal year 2014 (April 1, 2013, to March 31, 2014), the company's production increased to 1,933 t from 1,704 t in fiscal year 2013 (Gravita India Ltd., 2014, p. 17).

Niobium (Columbium) and Tantalum.—Mozambique's niobium and tantalum production decreased by 48% and 47%, respectively, in 2014 because of the closure of the Marropino Mine in August 2013. Columbite-tantalite produced in Mozambique had an estimated tantalum pentoxide content of 25%. Noventa Ltd. of the United Kingdom shut down mining operations because of the power supply interruptions, the poor quality of the roads to transport the mine's output, the lack of port facilities to process radioactive uranium and thorium contained in concentrate, and the depletion of higher grade ore near the surface. Ore at greater depths was lower grade and costlier to process (Noventa Ltd., 2012; Mining Review Africa, 2013).

TAN Mining and Exploration of South Africa (a subsidiary of Pacific Wildcat Resources Corp. of Canada) produced niobium and tantalum at the Muiane Mine; the reserves at the mine were likely to support 5 years of mining at full capacity. In August 2014, mining was disrupted by former workers of Minas Gerais de Mocambique, which was the formerly state-owned company that operated Muiane during the 1980s. At the end of 2014, mining had not yet restarted at Muiane (Mozambique News Agency, 2014a).

Titanium and Zirconium.—Kenmare Resources plc of Ireland produced ilmenite, rutile, and zircon at the Moma Mine. In 2014, ilmenite concentrate production increased to 854,600 t from 720,100 t in 2013; rutile concentrate production, to 6,100 t from a revised 4,000 t; and zircon concentrate production, to 50,800 t from 31,400 t. Kenmare planned to increase rutile and zircon recoveries in 2015. The company expected to produce about 1 Mt/yr of ilmenite during the remaining life of the mine. Reserves at Moma were estimated to be 815 Mt at grades of 2.7% ilmenite, 0.18% zircon, and 0.064% rutile (Kenmare Resources plc, 2015, p. 9, 16, 33–34).

Pathfinder Minerals plc of the United Kingdom was considering the development of a new mine at the Moebase-Naburi project that could produce 1.24 Mt/yr of ilmenite, 65,000 t/yr of zircon, and 24,000 t/yr of rutile. Capital costs of the project were estimated to be \$533 million. Resources were estimated to be about 2 Gt at grades of 3.32% ilmenite, 0.17% zircon, and 0.062% rutile. At the end of 2014, Pathfinder was engaged in a dispute with JV Consultores Internacionais regarding the rights to the Moebase/Naburi project (Industrial Minerals, 2015).

Industrial Minerals

Cement.—Cimentos de Portugal, SGPS, SA (Cimpor) produced cement at five plants in Dondo, Matola, and Nacala. In 2014, Cimpor increased its total capacity to 3.1 Mt/yr from 2.9 Mt/yr in 2013 (Cimentos de Portugal, SGPS, SA, 2015, p. 33).

In 2014, Consolidated General Minerals plc (CGM) of the United Kingdom was building a new cement plant at Beira with a capacity of 800,000 t/yr. CGM planned to start operations at the plant in April 2015 (Ambrian plc, 2015).

Gemstones.—Gem-quality ruby was found in alluvial and primary deposits in Niassa Province and at Montepuez in Cabo Delgado Province. Ruby was mined by Montepuez Ruby Mining (MRM) (Gemfields plc of the United Kingdom, 75%, and

Mwiriti Lda., 25%), which was a large-scale mining operation, at Montepuez and by artisanal miners in Niassa Province.

MRM started bulk sampling operations at Montepuez in August 2012. In 2014, MRM's ruby and corundum production increased to more than 1,700 kilograms (kg) from nearly 1,400 kg in 2013. The majority of the production was corundum; reported national ruby production was 236 kg in 2013. Gemfields and Mwiriti planned to double the capacity of the processing plant at Montepuez in 2015 and to increase the capacity by an additional 278% eventually (Chapin, Pardieu, and Lucas, 2015; Eduardo Alexandre, National Director of Mines, Mozambique National Directorate of Mines, written commun., January 9, 2015).

Rhodolite garnet was mined in Niassa Province; national garnet production was 362,762 kg in 2014 compared with 283,175 kg in 2013. In 2014, 10,233 kg of garnet production was gem quality. Tourmaline was produced in the Barue District of Manica Province. Increased output of garnet and tourmaline in recent years was attributable to new producers starting operations and increased inspections of mines by the Government that resulted in improved reporting of output. Mozambique Gems Ltd.'s aquamarine mining operations shut down by the start of 2014. Durmortierite was mined in Tete Province (Imprensa Nacional de Mocambique, 2015, p. 12; Eduardo Alexandre, National Director of Mines, Mozambique National Directorate of Mines, written commun., January 9, 2015).

Graphite.—The Ancuabe graphite mine in Cabo Delgado Province, which operated from 1994 to 1999, was shut down because of high power costs and decreasing graphite prices. AMG Advanced Metallurgical Group N.V. of the Netherlands planned to reopen Ancuabe in early 2015. AMG planned to produce 6,000 t/yr of graphite; the estimated remaining life of the mine was between 5 and 7 years (AMG Advanced Metallurgical Group N.V., 2012; Cornish, 2014).

In 2014, Syrah Resources Ltd. of Australia was engaged in a feasibility study on a new graphite mine at the Balama project in northern Mozambique. Depending on the results of the study, Syrah could start mining at Balama in 2016. The company planned to produce 220,000 t/yr of concentrates with a content of between 96% and 98% graphite. As of early June, Syrah had signed offtake agreements for at least 180,000 t/yr of its production. Total resources at Balama were estimated to be 1.15 Gt at a grade of 10.2% graphite (Syrah Resources Ltd., 2013, p. 4–7; Mozambique News Agency, 2014c).

In November 2014, Triton Minerals Ltd. of Australia completed a scoping study on a new mine with favorable results at the Nicanda Hill deposit, which is located near Syrah's Balama project. Depending on the results of a feasibility study, Triton could start construction on the new mine in the first quarter of 2016 and start mining in the second quarter of 2017. Production was expected to be 210,000 t/yr of concentrates with a content of 94% graphite during the estimated 30-year life of the mine. Resources at Nicanda Hill were estimated to be 1.46 Gt at grades of 10.7% graphite and 0.27% V₂O₅ (Barradas, 2015).

Mineral Fuels and Related Materials

Coal.—Vale S.A. of Brazil operated the Moatize Mine in Tete Province; capacity was 8.5 Mt/yr of coking coal and 2.5 Mt/yr of thermal coal. The company's actual production was 4.91 Mt of salable coal in 2014 compared with 3.82 Mt in 2013. Production was limited by port and rail capacity constraints. Vale planned to increase capacity to 22 Mt/yr of salable coal by the end of 2015, of which 17 Mt/yr would be coking coal and 5 Mt/yr would be thermal coal. In 2014, ACWA Power International of Saudi Arabia signed an agreement with the Government to build a new power station with a capacity of 300 megawatts (MW) at the Moatize Mine (Engineering & Mining Journal, 2014; Tex Report, The, 2014c; Vale S.A., 2015, p. 13).

Rio Tinto plc of the United Kingdom and its joint-venture partner Tata Steel Ltd. of India produced coal at the new Benga Mine, which is adjacent to the Moatize Mine. Rio Tinto and Tata produced 1.2 Mt of salable coal in the first 9 months of 2014, which was nearly unchanged compared with that of the same period in 2013. Capacity at Benga was 5.3 Mt/yr of run-of-mine coal, of which 1.6 Mt/yr was salable coking coal and 0.8 Mt/yr was salable thermal coal. Rio Tinto and Tata planned to increase production to 20 Mt/yr of run-of-mine coal, of which 6 Mt/yr would be salable coking coal for export, 4 Mt/yr would be salable thermal coal for export, and 2 Mt/yr would be consumed in a new coal-fired power station near Tete. Expansion plans were delayed by port and rail capacity constraints (Rio Tinto plc, 2014, p. 5; Tex Report, The, 2014d).

In October 2014, Rio Tinto sold its 65% share in Benga to International Coal Ventures Private Ltd. (ICVL) of India. ICVL planned to increase run-of-mine production at Benga to 13 Mt/yr of coal. The company also planned to build a new 300-MW coal-fired power station. By 2017, the power station and the mine expansion were likely to be completed at a cost of \$830 million and \$800 million, respectively (Campbell, 2015a).

ICVL also acquired the Zambeze coal project, which was adjacent to the Benga Mine, from Rio Tinto in August 2014. In the third quarter of 2013, the Government awarded Rio Tinto a mining license for Zambeze. ICVL planned to produce 7 Mt/yr of salable coking coal and 5 Mt/yr of salable thermal coal at Zambeze; mining was expected to start in 2023. The project could be delayed by decreased prices for coking coal (Tex Report, The, 2014d).

In mid-November 2013, Beacon Hill Resources plc (BHR) of the United Kingdom suspended production at the Minas Moatize Mine because of decreased prices for coking coal. Capacity at Minas Moatize was 1.8 Mt/yr of run-of-mine coal; BHR planned to reopen the mine and increase capacity to 2.8 Mt/yr by the second half of 2015. The company announced plans to increase production subsequently to 4 Mt/yr of run-of-mine coal, of which 0.92 Mt/yr would be salable coking coal for export, 0.88 Mt/yr would be salable thermal coal for export, and 0.55 Mt/yr would be thermal coal for domestic consumption. By December 2014, however, BHR was on the brink of bankruptcy (Tex Report, The, 2014e, 2015).

Jindal Steel & Power Ltd. of India produced coal at its Chirodze Mine in western Tete Province. The mine had a capacity

of 1.5 Mt/yr in 2014; Jindal planned to increase capacity to 3.5 Mt/yr in 2016 or 2017 and to 6.5 Mt/yr in 2020. Capacity at Chirodze could increase eventually to 10 Mt/yr. Coking coal from Chirodze was expected to be consumed in Jindal's steel plants in India, and thermal coal, at a new coal-fired power station in Mozambique with a capacity of 2,640 MW (Tex Report, The, 2014e).

In September 2014, Ncondezi Coal Company Ltd. of the United Kingdom and the Government were negotiating the power-purchase agreement for Ncondezi Coal's new 300-MW coal-fired power station. The company planned to produce about 1.5 Mt/yr of thermal coal to supply the power station at its new Ncondezi Mine. The mine was likely to be completed in the second half of 2016 and the power station in the first half of 2018. Ncondezi Coal could expand the power station to a capacity of as much as 1,800 MW. Resources at Ncondezi were estimated to be 4.7 Gt (Projects in Progress, 2014).

In 2013, the Government granted a mining license to Midwest Africa Ltd. (MAL) of India. MAL planned to start production at a new mine in the Moatize District in Tete Province by 2019. At full capacity, production was likely to be 6 Mt/yr of thermal coal and 1 Mt/yr of coking coal. The estimated capital cost of the project was \$1.4 billion (Tex Report, The, 2014a).

In April 2013, Talbot Group Investments (Pty) Ltd. of Australia and its joint-venture partners received a mining license for the Revuboe project, which is adjacent to the Moatize Mine. The companies planned to start mining at Revuboe by 2016. Planned production was 5 Mt/yr of coking coal, which would be exported to such countries as Japan and the Republic of Korea. Anglo American plc of the United Kingdom canceled plans to purchase Talbot's 58.9% share in Revuboe in late March 2013. Nippon Steel & Sumitomo Metal Corp. of Japan and POSCO Group of Korea were seeking a new joint-venture partner to purchase Talbot's share in the fourth quarter of 2014 (Tex Report, The, 2014f).

Vale and Caminhos de Ferro de Mocambique (CFM) planned to start operations at a new railway from Tete to the port of Nacala with an initial hauling capacity of 11 Mt/yr by early 2015. The capacity of the Nacala railway was likely to be increased to 18 Mt/yr by 2016. Vale also planned to complete a new coal-handling terminal at Nacala with an initial capacity of 11 Mt/yr and a subsequent expansion to 18 Mt/yr on the same timetable as the Nacala railway. The Sena railway, which had a capacity of 6 Mt/yr, was Mozambique's only railway for the export of coal. CFM planned to increase Sena's capacity to 20 Mt/yr by early 2016 (Baobab Resources plc, 2014, p. 23; Tex Report, The, 2014b).

Natural Gas.—Production of natural gas from the Pande and Temane gasfields decreased to 4.22 billion cubic meters in 2014 from nearly 5.01 billion cubic meters in 2013. Sasol Ltd. of South Africa, which operated the project, exported most of its output through a pipeline to supply its chemical plants in South Africa. Natural gas was also supplied to the power station at Ressano Garcia. The capacity at the natural gas processing plant for Pande and Temane was 4.78 billion cubic meters per year. At the end of June, reserves were estimated to be about 43 billion cubic meters (Sasol Ltd., 2014, p. 52, 102).

At the end of 2014, Mozambique used natural gas from Pande and Temane in two power stations. Aggreko plc of the United Kingdom operated a 232-MW power station at Ressano Garcia that supplied power to Electricidade de Mocambique (EDM), Eskom of South Africa, and NamPower of Namibia. In August, EDM and Sasol opened a new power station that would have 180 MW of capacity when fully operational. The new power station would eliminate a capacity deficit of 150 MW in Maputo City and Maputo Province (Mozambique News Agency, 2014b).

Anadarko Petroleum Corp. of the United States and its joint-venture partners held the exploration rights for Offshore Area 1, which is located in the Rovuma basin. As of the start of 2014, commercially recoverable reserves in Offshore Area 1 were estimated to be 1.77 trillion cubic meters of natural gas. Eni S.p.A. of Italy and its joint-venture partners held the exploration rights for Offshore Area 4; commercially recoverable reserves in Offshore Area 4 were 1.63 trillion cubic meters of natural gas (Standard Bank of South Africa Ltd., 2014, p. 29).

Anadarko and Eni were considering the development of an LNG plant at Palma in Cabo Delgado Province that would use natural gas from Offshore Areas 1 and 4. The initial capacity of the plant could be 10 Mt/yr (13.8 billion cubic meters per year) of natural gas or 20 Mt/yr; capacity could be increased to as much as 30 Mt/yr by 2025. Depending on a decision to proceed with the project by the third quarter of 2015, production could start by mid-2019. Capital expenditures for a production capacity of 10 Mt/yr were estimated to be \$26.1 billion, and for 30 Mt/yr, \$54.6 billion. Most of the production from the LNG plant was likely to be exported. Domestic natural gas consumption in a new gas-to-liquids plant could be 2.9 billion cubic meters per year; a new petrochemical plant and gas-fired power stations, 1.5 billion cubic meters per year each; and a new fertilizer plant, 480 million cubic meters per year (Standard Bank of South Africa Ltd., 2014, p. 29, 49, 51–52, 78).

Outlook

The mineral sector of Mozambique is likely to have substantial growth in the near future. Growth is expected to be broadly based, with increased production of ilmenite, rutile, and zircon planned for 2015; cement, for 2015 through 2017; coal, for 2015 through 2025; and natural gas, for 2019 through 2025. A new iron ore mine could open in 2017.

New mines in Mozambique could have substantial effects upon world markets for graphite and vanadium if brought into production. Graphite production could restart in 2015 and increase to more than 400,000 t/yr. World graphite production was 1.19 Mt in 2014. Vanadium production could start in 2017 and increase to more than 4,000 t/yr. World vanadium production was 82,700 t in 2014 (Olson, 2016; Polyak, 2016).

The new LNG plant could have a substantial effect upon the domestic economy. The annual GDP rate of growth between 2014 and 2035 could be 8.4% with LNG production at 30 Mt/yr compared with 5.7% without the project. The annual rate of growth of total exports could increase to 10.3% between 2014 and 2035 compared with 7.2% without the LNG project (Standard Bank of South Africa Ltd., 2014, p. 121).

Niobium and tantalum production is expected to decrease in 2015 because of the closure of the Muiane Mine.

Reduced output from Muiane could be offset by the reopening of the Morrua and the Mutala Mines.

The outlook for coal, gemstones, ilmenite, natural gas, rutile, and zircon will likely depend heavily upon favorable prices in world markets. Increases in coal production also will depend on the expansion of the port handling capacities and the rail network. The development of new mines and related infrastructure could lead to increased consumption and production of local construction materials.

References Cited

- Ambrian plc, 2015, Proposed merger of Ambrian Metals Limited with Consolidated General Minerals (Schweiz) AG: London, United Kingdom, Ambrian plc press release, February 17, 18 p.
- AMG Advanced Metallurgical Group N.V., 2012, AMG Mining secures graphite mining concession: Amsterdam, Netherlands, AMG Advanced Metallurgical Group N.V. press release, November 7, 2 p.
- Auroch Minerals NL, 2015, Quarterly activities report as of 31 December 2014: West Perth, Western Australia, Australia, Auroch Minerals NL press release, January 29, 11 p.
- Baobab Resources plc, 2014, Unlocking the iron & steel wealth of Mozambique: Baobab Resources plc, 33 p. (Accessed July 6, 2015, at <http://www.baobabresources.com/files/Baobab201402.pdf>.)
- Baobab Resources plc, 2015, Tete steel project—Developing Mozambique's steel industry: Baobab Resources plc, 33 p. (Accessed July 6, 2015, at <http://www.baobabresources.com/files/Baobab201502Indaba.pdf>.)
- Banco de Mocambique, 2015a, Balanca de Pagamentos de Mocambique 2014: Maputo, Mozambique, Banco de Mocambique, 96 p.
- Banco de Mocambique, 2015b, Relatorio annual 2014: Maputo, Mozambique, Banco de Mocambique, 152 p.
- Barradas, Sheila, 2015, Projects in progress: Mining Weekly, v. 21, no. 2, January 23–29, p. 34–35.
- Bedinger, G.M., 2016a, Titanium mineral concentrates: U.S. Geological Survey Mineral Commodity Summaries 2016, p. 178–179.
- Bedinger, G.M., 2016b, Zirconium and hafnium: U.S. Geological Survey Mineral Commodity Summaries 2016, p. 194–195.
- BHP Billiton Ltd., 2014, BHP Billiton operational review for the half year ended 31 December 2013: Melbourne, Victoria, Australia, BHP Billiton Ltd. press release, January 22, 25 p.
- BHP Billiton Ltd., 2015, BHP Billiton operational review for the half year ended 31 December 2014: Melbourne, Victoria, Australia, BHP Billiton Ltd. press release, January 21, 26 p.
- Bray, E.L., 2015, Aluminum, *in* Metals and minerals: U.S. Geological Survey Minerals Yearbook 2014, v. 1, p. 5.1–5.20. (Accessed August 23, 2017, at <https://minerals.usgs.gov/minerals/pubs/commodity/aluminum/myb1-2014-alumi.pdf>.)
- Campbell, Keith, 2015a, Big plans: Mining Weekly, v. 21, no. 4, February 6–12, p. 18.
- Campbell, Keith, 2015b, New broom: Mining Weekly, v. 21, no. 3, January 30–February 5, p. 18.
- Chapin, Merilee, Pardieu, Vincent, and Lucas, Andrew, 2015, Mozambique—A ruby discovery for the 21st century: *Gems & Gemology*, v. 51, no. 1, Spring, p. 44–54.
- Cimentos de Portugal, SGPS, SA, 2015, 2014 annual report: Lisbon, Portugal, Cimentos de Portugal, SGPS, SA, 205 p.
- Cornish, Laura, 2014, Triton Minerals unwrapping graphite gold: Mining Review Africa, issue 8, August, p. 24–27.
- Engineering & Mining Journal, 2014, ACWA to build power plant in Mozambique: Engineering & Mining Journal, v. 215, no. 4, April, p. 24.
- Gravita India Ltd., 2014, Annual report 2013–14: Jaipur, India, Gravita India Ltd., 108 p.
- Imprensa Nacional de Mocambique, 2015, Resolucao no. 15/2015—Aprova o plano economico e social para 2015 [Resolution no. 15/2015—Approves the economic and social plan for 2015]: *Boletim da Republica*, series I, no. 34, p. 5–70.
- Industrial Minerals, 2015, Pathfinder continues fight for Mozambique resource: Industrial Minerals, no. 569, February, p. 62.
- Kenmare Resources plc, 2015, Annual report & accounts 2014: Dublin, Ireland, Kenmare Resources plc, 144 p.
- Lex Africa, 2015, Mozambique, *in* Guide to mining in Africa 2015: Sandton, South Africa, Lex Africa, p. 35–41.
- Mining Review Africa, 2013, Highland African Mining closes Mozambique mine: Mining Review Africa, August 5. (Accessed August 26, 2014, at <http://www.miningreview.com/highland-african-mining-closes-mozambique-mine/>.)
- Mozambique News Agency, 2014a, Former workers occupy tantalite mine: Mozambique News Agency, August 8. (Accessed July 7, 2015, at <http://allafrica.com/stories/201408100044.html>.)
- Mozambique News Agency, 2014b, President inaugurates gas fired power station: Mozambique News Agency, no. 490, September 2, p. 4.
- Mozambique News Agency, 2014c, Triton discovers more graphite: Mozambique News Agency, no. 487, June 9, p. 3.
- Noventa Ltd., 2012, Operations update: St. Helier, Jersey [United Kingdom], Noventa Ltd. press release, November 28, 4 p.
- Olson, D.W., 2016, Graphite (natural): U.S. Geological Survey Mineral Commodity Summaries 2016, p. 74–75.
- Papp, J.F., 2016, Niobium (columbium) and tantalum, *in* Metals and minerals: U.S. Geological Survey Minerals Yearbook 2014, v. 1, p. 52.1–52.12. (Accessed August 23, 2017, at <https://minerals.usgs.gov/minerals/pubs/commodity/niobium/myb1-2014-niobi.pdf>.)
- Polyak, D.E., 2016, Vanadium: U.S. Geological Survey Mineral Commodity Summaries 2016, p. 182–183.
- Projects in Progress, 2014, Ncondezi Coal Company's Ncondezi coal project: Projects in Progress, September, p. 102.
- Rio Tinto plc, 2014, Rio Tinto delivers another strong quarterly production performance: London, United Kingdom, Rio Tinto plc press release, October 15, 27 p.
- Sasol Ltd., 2014, Form 20–F—2014: U.S. Securities and Exchange Commission, 263 p.
- Standard Bank of South Africa Ltd., 2014, Mozambique LNG—Macroeconomic study: Johannesburg, South Africa, Standard Bank of South Africa Ltd., 157 p.
- Syrah Resources Ltd., 2013, Syrah Resources Ltd.: 2013 Graphite and Graphene Conference, New York, New York, November 25–26, presentation, 30 p.
- Syrah Resources Ltd., 2014, Vanadium scoping study finalised: Melbourne, Victoria, Australia, Syrah Resources Ltd. press release, July 30, 12 p.
- Tex Report, The, 2014a, ICVL completes takeover of coal assets in Mozambique: The Tex Report, v. 46, no. 10996, August 12, p. 2.
- Tex Report, The, 2014b, Main infrastructure projects in Mozambique: The Tex Report, v. 46, no. 10998, August 15–18, p. 4–5.
- Tex Report, The, 2014c, Major metallurgical coal projects in Mozambique (1): The Tex Report, v. 46, no. 11026, September 29, p. 3.
- Tex Report, The, 2014d, Major metallurgical coal projects in Mozambique (2): The Tex Report, v. 46, no. 11027, September 30, p. 3.
- Tex Report, The, 2014e, Major metallurgical coal projects in Mozambique (3): The Tex Report, v. 46, no. 11028, October 1, p. 18.
- Tex Report, The, 2014f, Major metallurgical coal projects in Mozambique (4): The Tex Report, v. 46, no. 11029, October 2, p. 3.
- Tex Report, The, 2015, Topics on Mozambican coal during January to March: The Tex Report, v. 47, no. 11175, May 15, p. 18.
- Vale S.A., 2015, 2014 and 4Q14 production report: Rio de Janeiro, Brazil, Vale S.A., 17 p.
- World Bank Group, The, 2013, Project appraisal document on a proposed credit in the amount of SDR 32.6 million (US\$50 million equivalent) to the Republic of Mozambique for a mining and gas technical assistance project: Washington, DC, The World Bank Group, 83 p.

TABLE 1
MOZAMBIQUE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²		2010	2011	2012	2013	2014
METALS						
Aluminum:						
Bauxite		8,556	10,352	8,352	6,761	3,235
Metal, refined		557,000	562,000	564,000	562,000	567,000
Beryllium, beryl	kilograms	56,700	57,800	532,000	103,100 ^r	--
Gold ³	do.	106	111	178	198	197
Lead, secondary refined ^{c,4}		600	800	892 ⁵	1,704 ⁵	1,933
Niobium (columbium) and tantalum, columbite-tantalite, ore and concentrate:						
Gross weight	kilograms	55,054	139,145	407,734	210,746	111,767
Nb content ^c	do.	3,900	10,000	21,000 ^r	11,000 ^r	5,700
Ta content ^c	do.	15,000	39,000	83,000 ^r	43,000 ^r	23,000
Titanium:						
Ilmenite concentrate		678,400	636,800	574,400	720,100	854,600
Rutile concentrate		4,700	6,455	4,000	4,000 ^r	6,100
Zircon concentrate		37,100	43,600	46,900	31,400	50,800
INDUSTRIAL MINERALS						
Cement, hydraulic ⁶	thousand metric tons	884	976	1,184	1,299	1,502
Clays:						
Bentonite:						
Crude		11,417	423	24,000	21,135	27,167
Processed		459	493	1,459	968	1,250
Brick		43,143	99,561	46,691 ^r	32,000 ^{r,c}	32,000 ^c
Diatomite		123	48	541	675	680 ^c
Gemstones:						
Aquamarine	kilograms	1,579	60	588	645	--
Dumortierite		27	58	58	28	30 ^c
Garnet	kilograms	16,355	174,928	170,980	283,175	362,762
Ruby	do.	NA	NA	NA	236	300 ^c
Tourmaline	do.	14,669	26,279	486,468 ^r	513,654 ^r	520,000 ^c
Quartz	do.	707,411	838,684	51,750	56,599	57,000 ^c
Salt, marine ^c		145,000 ^r	150,000 ^r	150,000 ^r	150,000 ^r	160,000
Sand		1,150,052	1,678,736	2,137,613	3,237,285	1,222,000
Stone:						
Gravel and crushed stone	cubic meters	824,316	951,069	1,007,802	2,032,191	1,700,312
Limestone		263,908	415,883	1,322,424	2,856,999	900,788
Marble, block ^c	cubic meters	-- ⁵	225,144 ⁵	-- ^r	-- ^r	--
Rhyolite	do.	38,705	71,881	293,184	72,746	29,925
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous		38,260	648,220	4,954,000	6,343,400	7,900,000 ^c
Natural gas	million cubic meters	3,261	3,438	3,837	5,008	4,223
Natural gas condensate	thousand 42-gallon barrels	328	398	408	420 ^c	298

^cEstimated; estimated data are rounded to no more than three significant digits. ^rRevised. do. Ditto. NA Not available. -- Zero.

¹Table includes data available through February 19, 2016.

²Other gemstones, such as corundum and sapphire, were produced, but available information was inadequate to make reliable estimates of output.

³Does not include unreported production; total output of gold was estimated to be roughly 600 to 900 kilograms per year.

⁴Fiscal year ending on March 31 of calendar year.

⁵Reported figure.

⁶Cement sales reported by Cimentos de Moçambique SARL only.

TABLE 2
MOZAMBIQUE: STRUCTURE OF THE MINERAL INDUSTRY IN 2014

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity ¹
Aluminum		Mozambique Aluminum SARL (BHP Billiton Ltd., 47.1%; Mitsubishi Corp., 25%; Industrial Development Corp. of South Africa Ltd., 24%)	Mozal smelter at Beluluane	561,000.
Bauxite		Mina Alumina Lda.	Vila de Manica	12,000. ^c
Bentonite		Minerais Industriais de Moçambique Lda	Mine at Mufiane	30,000.
Beryl		African Rare Gemwood	Mine in Zambezia Province ²	NA.
Cement		Cimentos de Moçambique SARL [Cimentos de Portugal, SGPS, SA (Cimpor), 82.46%]	Plants at Dondo, Matola, and Nacala	2,750,000.
Do.		Cimentos de Nacala S.A. [Cimentos de Portugal, SGPS, SA (Cimpor), 100%]	Plant at Nacala	350,000.
Coal, bituminous		Vale S.A.	Moatize Mine in Tete Province	11,000,000.
Do.		International Coal Ventures Private Ltd., 65%, and Tata Steel Ltd., 35%	Benga Mine in Tete Province	2,400,000.
Do.		Jindal Steel & Power Ltd.	Chirodze Mine in Tete Province	1,500,000.
Do.		Beacon Hill Resources plc (BHR)	Minas Moatize Mine near Tete ²	880,000.
Diatomite		Diatomites de Moçambique Lda	Diana quarry near Manica	4,800.
Gemstones:				
Aquamarine	kilograms	Mozambique Gems Ltd.	Mine near Mavuco ²	3,600. ^c
Garnet	do.	Sociedade Vision 2000 Lda.	Cuamba in Niassa Province	8,000. ³
Do.	do.	Artisanal miners	Various locations	NA.
Ruby	do.	Montepuez Ruby Mining (MRM) (Gemfields plc, 75%, and Mwiriti Lda., 25%)	Montepuez Mine in Cabo Delgado Province	1,600. ^c
Do.	do.	do.	M'sawize Mine in Niassa Province	NA.
Tourmaline	do.	Artisanal miners	Various mines in Barue District in Manica Province	NA.
Gold	do.	Artisanal miners	do.	600.
Lead, refined		Gravita Mozambique Lda. (Gravita India Ltd., 100%)	Plant at Maputo	3,800.
Marble, block	cubic meters	Marmonte Moçambique	Quarry at Pemba ²	1,500.
Natural gas	million cubic meters	Sasol Ltd., 70%, and Empresa Nacional de Hidrocarbonetos, E.P., 30%	Temane and Pande	4,780.
Niobium (columbium) and tantalum, columbite-tantalite, ore and concentrate		Noventa Ltd.	Marropino Mine ²	270 Ta ₂ O ₅ .
Do.		TAN Mining and Exploration	Muiane Mine	34 Ta ₂ O ₅ .
Titanium		Kenmare Resources plc	Moma Mine in Nampula Province	1,200,000 ilmenite; 21,000 rutile.
Zirconium		do.	do.	75,000 zircon.

^cEstimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto. NA Not available.

¹Abbreviations used in this table for commodities include the following: Ta₂O₅—tantalum oxide.

²Not operating at the end of 2014.

³Gem quality only.