



2010 Minerals Yearbook

MOZAMBIQUE [ADVANCE RELEASE]

THE MINERAL INDUSTRY OF MOZAMBIQUE

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In 2010, Mozambique played a significant role in the world's production of aluminum, beryl, ilmenite, tantalum, and zircon. The country's share of world tantalum output was about 16%; ilmenite, about 6%; zircon, about 3%; and aluminum and beryl, about 1% each. Other domestically significant mineral processing operations included cement and natural gas. Mozambique was not a globally significant consumer of minerals or mineral fuels (Bray, 2011; Gambogi, 2011a, b; Jaskula, 2011; Papp, 2011).

Minerals in the National Economy

In 2009 (the latest year for which data were available), the manufacturing sector accounted for 11% of the gross domestic product, and mining and quarrying, 1.4%. At least 60,000 artisanal miners were estimated to be employed in gold production. In 2010, aluminum accounted for 50% of national exports; natural gas, 6%; and ilmenite, 4% (Shandro, Veiga, and Chouinard, 2009; African Development Bank Group, 2011, p. 2, 13; Bank of Mozambique, 2011).

Production

In 2010, the production of quartz increased by an estimated 398%; bauxite, by an estimated 205%; rutile, by 161%; coal, by an estimated 93%; zircon, by 76%; limestone, by an estimated 58%; tourmaline, by an estimated 55%; ilmenite, by 44%; cement, by 14%; and natural gas, by an estimated 11%. The production of aquamarine and sand decreased by an estimated 90% each; gold, by an estimated 84%; diatomite, by an estimated 80%; brick clay, by an estimated 74%; beryl, by an estimated 51%; dumortierite, by an estimated 35%; garnet, by an estimated 24%; and processed bentonite, by an estimated 17%. Granite, marble block, morganite, and semimanufactured steel production shut down by the end of 2009, and crude bentonite and marble slab, in 2010 (Government of Mozambique, 2011, p. 28).

Structure of the Mineral Industry

Most of Mozambique's mining and mineral processing operations were privately owned, including the cement plants, the Chipanga XI coal mine, the Marropino tantalum mine, the Moma mineral sands mine, the Mozal aluminum smelter, and the Temane gas processing plant. Artisanal miners produced gold and gemstones (table 2).

Commodity Review

Metals

Aluminum.—Mozambique was Africa's second ranked producer of aluminum after South Africa. The Mozal aluminum

smelter, which used alumina imported from Western Australia as raw material, produced 557,000 metric tons (t) in 2010 compared with 545,000 t in 2009. Aluminum exports were valued at \$1.16 billion in 2010 compared with \$868 million in 2009. Most of the increase in exports was attributable to increases in aluminum prices (BHP Billiton Ltd., 2010, p. 6; 2011, p. 6; Bank of Mozambique, 2011).

Copper and Gold.—Artisanal miners accounted for about 90% of Mozambique's gold production. The Government was encouraging artisanal miners to legalize their activities, to work in areas set aside for artisanal mining, and to use safer techniques. Mercury pollution from artisanal gold mining was a serious environmental problem (Shandro, Veiga, and Chouinard, 2009; African Power Mining & Oil Review, 2010).

Gold was also produced at the Mutamabarico Mine until late February 2009. In 2010, Metais de Moçambique was engaged in a dispute over ownership of the mine with former joint-venture partner Companhia Mineira de Gile (Escorpião, 2010).

In April 2010, Tsoza Refinaria de Ouro de Mocambique started production at Mozambique's first gold refinery in Manica Province. The refinery had a capacity of about 11,000 kilograms per year (kg/yr) of gold. In the fourth quarter of 2010, the Government announced plans to ban exports of unrefined gold (African Power Mining & Oil Review, 2010).

Pan African Resources plc of the United Kingdom was considering the development of a new mine at the Manica project. Production was expected to be nearly 2,600 kg/yr of gold; the life of the mine was estimated to be 11 years. In December 2010, Pan African completed a prefeasibility study on a new open pit mine at Manica; the company planned to complete a prefeasibility study on an underground mine in April 2011. African Queen Mines Ltd. of Canada explored for copper and gold at the King Solomon project in Tete Province in 2010. Baobab Resources plc of the United Kingdom explored for gold at the Bandire-Sussundenga project (Mining Journal, 2009b; Thompson, 2010; Pan African Resources plc, 2011, p. 22–23).

Iron Ore and Vanadium.—In September 2009, Baobab estimated that inferred resources at the Tete project were 47.7 million metric tons (Mt) at grades of 25.3% iron, 9.69% titanium dioxide (TiO_2), and 0.18% vanadium pentoxide (V_2O_5). The project is located north of Tete, which is the capital of Tete Province. The company hoped to increase resources to between 400 and 700 Mt. Baobab planned to complete a prefeasibility study on a new mine at Tete at the end of the second quarter of 2011. Depending on the outcome of the study, the company planned to complete a feasibility study in 2012. Production could start as early as 2014, depending on the results of the feasibility study. Baobab planned to produce between 2 million metric tons per year (Mt/yr) and 3 Mt/yr of magnetite concentrate at grades of 68% iron and 0.8% V_2O_5 (Mining Journal, 2009a; Mining Review Africa, 2010).

Niobium and Tantalum.—In April 2010, Noventa Ltd. reopened the Marropino niobium and tantalum mine, which was shut down in May 2009. Noventa produced 12,500 kilograms (kg) of tantalum pentoxide (Ta_2O_5) in concentrate from reprocessed tailings. In 2011, the company planned to increase production at Marropino to about 90,000 kg/yr of Ta_2O_5 and to expand capacity at the processing plant to more than 270,000 kg/yr of Ta_2O_5 from 140,000 kg/yr. Noventa planned to reopen the Mutala and the Morrua Mines in 2012 and 2015, respectively. The combined mine production life of the Marropino, the Morrua, and the Mutala Mines was estimated to be 15 years. Resources at Morrua were estimated to be about 3,600 t of contained Ta_2O_5 and at Marropino, nearly 1,700 t. Noventa planned to complete an updated resource assessment at Mutala in 2011 (Noventa Ltd., 2010; 2011, p. 6, 8, 11).

In March 2010, Pacific Wildcat Resources Corp. (PAW) of Canada announced that it had purchased a processing plant for the Muiane Mine. PAW planned to restart tantalum production at Muiane by March 2011. Indicated resources at Muiane were estimated to be about 1.38 Mt at a grade of 250 grams per metric ton Ta_2O_5 (Pacific Wildcat Resources Corp., 2010).

Titanium and Zirconium.—Kenmare Resources plc of Ireland produced ilmenite, rutile, and zircon at the Moma Mine. In 2010, ilmenite production increased to 678,400 t from 471,500 t in 2009; zircon, to 37,100 t from 21,100 t; and rutile, to 4,700 t from 1,800 t. Production was limited by a settling pond breach in October. Kenmare planned to increase production at Moma by between 15% and 20% in 2011. The company planned to expand capacity to 1.2 Mt/yr of ilmenite, 80,000 metric tons per year (t/yr) of zircon, and 22,000 t/yr of rutile in 2012. Reserves at Moma were estimated to be 925 Mt at grades of 3% ilmenite, 0.21% zircon, and 0.064% rutile (Kenmare Resources plc, 2010, p. 4; 2011, p. 6, 10, 13–14; Thompson, 2010).

Ilmenite exports from Moma were valued at about \$98 million in 2010 compared with \$45 million in 2009. European countries accounted for 56% of Mozambique's mineral sands exports; Asian countries, 27%; and the United States, 14% (Bank of Mozambique, 2011; Kenmare Resources plc, 2011, p. 72).

Depending on favorable results of its prefeasibility and feasibility studies, Baobab could start production of ilmenite at Tete by as early as 2014. Baobab planned to produce between 1 and 1.5 Mt/yr of ilmenite concentrate at grades of 50% TiO_2 and 10% iron. The company was also considering the possibility of producing synthetic rutile or ferrotitanium alloy products at Tete (Mining Review Africa, 2010).

In 2010, Rio Tinto plc of the United Kingdom explored at two mineral sands projects located 350 and 400 kilometers (km) north of Maputo, respectively. The development of the Corridor Sands Project at Chibuto was put on hold after it was relinquished by BHP Billiton in 2009 (Thompson, 2010).

Industrial Minerals

Cement.—Cimentos de Mocambique SARL [Cimentos de Portugal, SGPS, SA (Cimpor), 82.46%] produced cement at its Dondo, Matola, and Nacala plants, which had a total combined capacity of about 1.04 Mt/yr. Cimpor planned to increase the

capacity at Matola to 1 Mt/yr from 500,000 t/yr in 2011; the plants at Nacala and Dondo had capacities of 350,000 t/yr and 190,000 t/yr, respectively. In October, CIMPOR purchased a 51% share in Cimentos de Nacala S.A., which had a plant at Nacala with a capacity of 350,000 t/yr (table 2; International Cement Review, 2010, 2011; Cimentos de Portugal, SGPS, SA, 2011, p. 64–66).

In June 2010, a consortium of Chinese companies announced plans to build a new cement plant in Magude, which is located in the northern part of Maputo Province. The China Development Bank planned to fund development of the project. The plant would have a capacity of 500,000 t/yr; construction was expected to start in the second half of 2010 (World Cement, 2010).

National cement consumption increased to about 1.1 Mt in 2010 from about 1 Mt in 2009. Increased consumption was attributable to the rehabilitation of public infrastructure and the new construction in the mineral sector, real estate, and sea ports. Production by domestic plants was insufficient to meet demand (Cimentos de Portugal, SGPS, SA, 2011, p. 65).

Fluorspar and Rare Earths.—Globe Metals & Mining Ltd. of Australia engaged in exploration at the Mount Muambe fluorite deposit in 2010. Mount Muambe is a carbonatite deposit located 20 km southeast of the Moatize coal property in Tete Province. Globe announced the discovery of rare-earth mineralization at Mount Muambe, including heavy rare earths (Campbell, 2010).

Construction aggregate was mined at Xiluvo, which had a niobium- and rare-earth-enriched carbonatite deposit. Rare Earth International (REI) signed a farm-in agreement with the owners of the mining permit for the rights to the rare-earth elements (REE). In December 2010, Southern Crown Resources Ltd. of Australia announced that it had agreed to purchase REI (Southern Crown Resources Ltd., 2010).

Monazite, which is a phosphate mineral containing REE, was found at the Moma Mine. Heavy sands reserves at Moma were estimated to be 925 Mt at a grade of 0.021% monazite. In 2010, Kenmare commenced a study on recovering monazite from mine tailings (Kenmare Resources plc, 2011, p. 11).

Gemstones.—Elbaite tourmaline that obtained its blue or green color from copper was mined at Mavuco by Miranda Gems Hong Kong Ltd. of Hong Kong and Moz Gems Ltd. Tourmaline production was far below the levels reached in 2008 because of reduced demand during the worldwide economic crisis, the depletion of near-surface deposits, the discovery of new ruby deposits that led artisanal miners to abandon tourmaline mining, and Government attempts to reduce illegal mining at Mavuco. Between 5,000 and 6,000 artisanal miners were estimated to be working at Mavuco before production declined (Pardieu and others, 2009, p. 8; Bennett, 2011).

Gem-quality ruby was found in eluvial and primary deposits at Montepuez in Cabo Delgado Province. Production started at Montepuez in April 2009 and increased sharply in June and July; several thousand miners and dealers worked at the deposit. By November 2009, the Government awarded Mwiriti Lda. a mining license to Montepuez. As of April 2010, Mwiriti was engaged in mining and exploration at Montepuez. Many artisanal miners worked illegally on the company's property,

and as many as 4,000 artisanal miners had been evicted by police in previous months. Gem-quality ruby was produced at locations about 10 to 20 km from Montepuez. Mining may have continued at the M'sawize deposit in the Niassa National Reserve in 2010 (Pardieu and others, 2009, p. 7–9; Snee and Wu, 2010).

Sociedade Vision 2000 Lda. had a mechanized mining operation that produced pyrope and pyrope-almandine garnet at Cuamba in Niassa Province. Aquamarine and dumortierite were also mined in Mozambique.

Graphite.—In December 2008, TIMCAL Graphite & Carbon (a subsidiary of Imerys SA of France) was awarded the license to reopen the Ancuabe graphite mine in Cabo Delgado Province. The Ancuabe Mine, which operated from 1994 to 1999, shut down because of high power costs and the decrease in graphite prices to \$450 per metric ton from \$1,300 per metric ton. In March 2010, Imerys withdrew from the agreement because it considered reserves at the mine to be insufficient. Graphit Kropfmuhl AG (GK) of Germany subsequently began a reevaluation of the Ancuabe Mine. The company was considering the production of several thousand metric tons per year of graphite; GK planned to make a decision on reopening the mine in early 2011 (Feytis, 2010).

Mineral Fuels and Related Materials

Coal.—In May 2010, Beacon Hill Resources plc (BHR) acquired Minas Moatize Lda., which operated Mozambique's only coal mine. BHR increased production at the Chipanga XI Mine to 96,000 t/yr in November from 30,000 t/yr in May. By May 2011, the company planned to increase production to nearly 220,000 t/yr by opening a new open pit mine. BHR planned to start construction on an open pit mine with a capacity of 4 Mt/yr of run-of-mine coal in early 2012. Salable production was expected to be 2.36 Mt/yr of coking and thermal coal, which the company planned to export. Resources at the mine were estimated to be 33 Mt (Beacon Hill Resources plc, 2010; Thompson, 2010; Africa Mining Intelligence, 2011).

Vale S.A. of Brazil planned to produce 12.7 Mt/yr of coking coal and 4.9 Mt/yr of thermal coal at the Moatize Mine in Tete Province starting in late 2011. All the coking coal and about 2.4 Mt/yr of thermal coal were likely to be exported. About 2.5 Mt/yr of thermal coal would be consumed by a new coal-fired power station built by Vale at Moatize with a capacity of 600 megawatts (MW). Vale expected to reach full production by 2015. The capital costs of the project were estimated to be \$1.4 billion (Parker, 2010).

Development of the Moatize Mine depended upon the reopening of the railway from Moatize to Beira, which had been severely damaged during the civil war of the 1980s, and the completion of new port facilities at Beira. The new port facilities were expected to be completed in July 2011; the railway was likely to carry 5 Mt/yr of coal (Venter, 2010).

Riversdale Mining Ltd. of Australia and its joint-venture partner Tata Steel Ltd. of India planned to open the new Benga Mine in Tete Province in the second half of 2011. Production in the first stage of the project was expected to be 5.3 Mt/yr of run-of-mine coal. The second stage of the project was planned to start in 2013 with full production of 20 Mt/yr to be reached in

2015. Resources at Benga were estimated to be 4 billion metric tons (Gt), of which 502 Mt was reserves. The life of the mine at full production was estimated to be 20 years (Boswell, 2010; Thompson, 2010).

Riversdale planned to use coal from Benga in its new power station, which would have a capacity of 500 MW in the first stage and 2,000 MW in the second stage. The power station was expected to be on line by 2016, depending on the construction of necessary transmission infrastructure by the Government (Boswell, 2010).

In June 2010, Riversdale signed an agreement with Wuhan Iron and Steel Co. of China for the development of the Zambeze project, which is located adjacent to Benga. Resources at Zambeze were estimated to be 9 Gt. Eurasian Natural Resources Corp. plc (ENRC) of the United Kingdom continued to explore at 12 license areas previously held by Central African Mining and Exploration Company plc (CAMEC) of the United Kingdom; ENRC purchased CAMEC in November 2009. Coal India Ltd., ETA Star Coal India Pvt. Ltd., and Jindal Power and Steel Ltd. of India, and Nippon Steel Corp. of Japan also explored for coal (Thompson, 2010).

Natural Gas.—Production of natural gas from the Pande and the Temane gasfields increased to about 3.1 billion cubic meters in 2010 from 2.8 billion cubic meters in 2009. Sasol Ltd. of South Africa, which operated the project, exported most of its output through an 865-km pipeline to supply its South African chemical plants. Natural gas exports were \$134 million in 2010 compared with \$123 million in 2009. The company planned to increase its production capacity to 4.77 billion cubic meters per year from 3.13 billion cubic meters per year by 2011. Sasol planned to use the increased output to supply its expanded synthetic fuels plant in South Africa and a new gas-fired power station in Mozambique (Bank of Mozambique, 2011; Sasol Ltd., 2011, p. 20).

In September 2010, Sasol acquired exploration rights for the onshore Block A. Sasol indicated that the development of the offshore Blocks 16 and 19 held by the company and its joint-venture partners depended on successful exploration results in the adjacent M-10 and Sofala licenses. In 2010, Anadarko Petroleum Corp. of the United States and its joint-venture partners made three substantial natural gas discoveries in Offshore Area 1, which is located in the Rovuma basin. The company planned further exploration in 2011. Anadarko was considering the possibility of establishing a liquefied natural gas plant (Oil & Gas Journal, 2010; Sasol Ltd., 2011, p. 20).

Petroleum.—Mozambique produced neither crude petroleum nor refined petroleum products and relied on imports. OilMoz Lda. planned to build a new petroleum refinery at Marracuene with a capacity of 350,000 barrels per day. The company also planned to build a 500-MW gas-fired power station, a petrochemicals plant, a tank farm, and effluent and waste disposal plants. The project was expected to be completed by 2014 at an estimated cost of \$8 billion (Barradas, 2009; Koottungal, 2010).

Uranium.—In November 2010, African Eagle Resources plc of the United Kingdom sold its Balama and Sena uranium projects to Jacana Resources Ltd. of Australia. North River

Resources held the Mavuzi Mine in northwestern Mozambique, which produced uranium during the 1950s (Mining Journal, 2010).

Outlook

The mineral industry of Mozambique is likely to experience substantial growth in the near future. Growth is expected to be broadly based, with higher production of ilmenite, rutile, and zircon planned from 2011 through 2015; cement, from 2011 through 2014; niobium and tantalum, from 2011 through 2015; natural gas, in 2011 and 2012, and coal, from 2011 through 2016. By 2015, coal production capacity could increase to 40 Mt/yr from less than 100,000 t/yr in 2000. A new iron ore and vanadium mine and a petroleum refinery could open in 2014. Graphite mining could also restart in the near future. The outlook for coal, gemstones, ilmenite, niobium, rutile, tantalum, and zircon will depend heavily upon conditions in the world economy. The development of new coal mines also will depend on the rehabilitation of the rail network. New mines and related infrastructure could lead to increased consumption and production of local construction materials.

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TABLE 1
MOZAMBIQUE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2006	2007	2008	2009	2010 ^e
Aluminum:					
Bauxite	11,069	8,650	5,443	3,612	11,000
Metal, refined	564,000	564,000	536,000	545,000	557,000 ³
Beryl kilograms	16,400	30,600	7,600	45,000	22,000
Cement, hydraulic ⁴ thousand metric tons	605	665	744	777	884
Clays:					
Bentonite:					
Crude	3,515	10,469	17,661	7,387	--
Processed	692	762	614	577	480
Brick	222,052	150,000 ^e	80,000 ^e	15,661	4,100
Coal, bituminous	40,953	23,602	37,700	25,924	50,000
Diatomite ^e	1,300	651 ³	379 ³	200 ^r	40
Gemstones:					
Aquamarine kilograms	5,222	20,371	2,549	492	50
Dumortierite	664	63	142	84	55
Garnet kilograms	5,730	16,986	5,398	2,648	2,000
Morganite do.	2,052	2,613	7,274	2,600	--
Tourmaline do.	25,138	11,607	34,165	2,902	4,500
Gold ⁵ do.	85	95	298	511	80
Natural gas million cubic meters	2,662	2,722	3,037	2,803	3,100
Niobium (columbium) and tantalum, columbite-tantalite, ore and concentrate:					
Gross weight kilograms	95,100	196,433	395,646	404,668	430,000
Nb content ^e do.	6,800	14,000	28,000	29,000	31,000
Ta content ^e do.	27,000	56,000	110,000	113,000	120,000
Quartz do.	195,100	216,655	157,254	140,600	700,000
Salt, marine ^e	150,000	110,000	110,000	110,000	110,000
Sand cubic meters	1,404,184	1,470,000	718,577	1,260,492	130,000
Steel, semimanufactured	--	--	21,000 ^e	20,000 ^e	--
Stone:					
Granite do.	5,500 ³	5,500 ^e	5,500 ^e	350 ^e	--
Gravel and crushed rock do.	1,178,998	1,171,019	115,524	120,000 ^e	120,000
Limestone	155,871	1,350,000	47,754	234,135 ³	370,000
Marble:					
Block cubic meters	472	835	301	--	--
Slab square meters	12,825	16,647	7,932	250	--
Titanium:					
Ilmenite concentrate	--	140,515	328,875	471,500 ^r	678,400 ³
Rutile concentrate	--	8,782	6,552	1,800 ^r	4,700 ³
Zirconium concentrate	--	26,347	32,985	21,100 ^r	37,100 ³

^eEstimated; estimated data are rounded to no more than three significant digits. ^rRevised. do. Ditto. -- Zero.

¹Table includes data available through October 6, 2011.

²Other gemstones, such as ruby, were produced, but available information is insufficient to estimate production.

³Reported figure.

⁴Reported cement sales by Cimentos de Moçambique SARL only.

⁵Does not include unreported production; total output of gold was estimated to be roughly 600 to 900 kilograms per year.

TABLE 2
MOZAMBIQUE: STRUCTURE OF THE MINERAL INDUSTRY IN 2010

(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%)	Mozal smelter at Beluluane	506,000.
Bauxite		E.C. Meikles (Pty) Ltd.	Monte Snuta	12,000. ^c
Bentonite		Minerais Industriais de Moçambique Lda.	Mine at Mufiane	30,000.
Cement		Cimentos de Moçambique SARL [Cimentos de Portugal, SGPS, SA (Cimpor), 82.46%]	Plant at Matola	500,000.
Do.		do.	Plant at Dondo	240,000.
Do.		do.	Plant at Nacala	120,000.
Do.		Cimentos de Nacala S.A. [Cimentos de Portugal, SGPS, SA (Cimpor), 51%]	do.	350,000.
Coal, bituminous		Beacon Hill Resources plc (BHR)	Chipanga XI Mine at Moatize	96,000.
Diatomite		Diatomites de Moçambique Lda.	Diana quarry near Manica	4,800.
Gemstones:				
Garnet	kilograms	Sociedade Vision 2000 Lda.	Cuamba Mine	8,000.
Morganite	do.	Noventa Ltd. (Highland African Ventures Ltd., 36.7%)	Mine at Marropino ²	5,000. ^c
Ruby		Mwiriti Lda.	Montepuez Mine in Cabo Delgado Province	NA.
Do.		Artisanal miners	M'sawize Mine in Niassa Province	NA.
Tourmaline	kilograms	do.	13 kilometers northeast of Mavuco ²	2,600. ^c
Do.	do.	do.	3 kilometers northeast of Mavuco ²	NA.
Do.	do.	Mozambique Gems Ltd.	Mine near Mavuco	1,200. ^c
Do.	do.	Miranda Gems Hong Kong Ltd.	do.	NA.
Gold	do.	Agrupamento Mineiro (joint venture of Companhia Mineira de Gile and Metais de Moçambique)	Manica District ²	720.
Do.	do.	Artisanal miners	do.	600.
Graphite		Graphit Kropfmuhl AG (GK)	Mine at Ancuabe ²	10,000.
Marble, block	cubic meters	Marmonte Moçambique	Quarry at Pemba ²	1,500.
Natural gas	million cubic meters	Sasol Ltd., 70%	Temane and Pande	3,130.
Niobium (columbium) and tantalum, columbite-tantalite, ore and concentrate		Noventa Ltd.	Mine at Marropino	140 Ta ₂ O ₅ .
Steel, semimanufactured		ArcelorMittal South Africa Ltd.	Trem de Varao plant at Maputo ²	35,000.
Titanium		Kenmare Resources plc	Moma Mine in Nampula Province	800,000 ilmenite; 14,000 rutile.
Zirconium		do.	do.	50,000 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 2010.