



2011 Minerals Yearbook

MOZAMBIQUE

THE MINERAL INDUSTRY OF MOZAMBIQUE

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In 2011, Mozambique played a significant role in the world's production of aluminum, ilmenite, tantalum, and zircon. The country's share of world tantalum output was about 15%; ilmenite, about 9%; zircon, about 3%; and aluminum, 1%. Other domestically significant mineral processing operations included cement and natural gas. Mozambique was not a globally significant consumer of minerals or mineral fuels (Bray, 2012; Gambogi, 2012a, b; Papp, 2012).

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 2011, aluminum accounted for 48.9% of national exports; ilmenite, rutile, and zircon, 6.3% combined; natural gas, 5.8%; and coal, 0.8% (African Development Bank Group, 2011, p. 2, 13; Bank of Mozambique, 2012, p. A10).

Production

In 2011, the production of tantalum increased by an estimated 160%; niobium (columbium), by an estimated 156%; brick clay, by 131%; dumortierite, by 115%; tourmaline, by 79%; sand, by 46%; rutile, by 38%; bauxite, by 21%; quartz, by 19%; zircon, by 18%; gravel and crushed rock, by 15%; and cement, by 10%. Coal output also increased sharply. Marble block quarrying restarted in 2011. The production of aquamarine and crude bentonite decreased by 96% each, and diatomite, by 60% (Eduardo Alexandre, National Director of Mines, Mozambique National Directorate of Mines, written commun., September 12, 2012).

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 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 562,000 metric tons (t) in 2011 compared with 557,000 t in 2010. Aluminum exports were

valued at \$1.36 billion in 2011 compared with \$1.16 billion in 2010. Most of the increase in exports was attributable to increases in aluminum prices (BHP Billiton Ltd., 2011, p. 6; 2012, p. 6; Bank of Mozambique, 2012, p. A10).

Copper and Gold.—In June 2011, Pan African Resources plc of the United Kingdom completed its prefeasibility study on a new mine at the Manica project. Production was expected to be nearly 2,600 kilograms per year (kg/yr) of gold; the life of the mine was estimated to be 11 years. The capital costs of the mine were estimated to be \$80 million. In August, Pan African announced plans to spin off the Manica project as a separate company (Thompson, 2011).

Iron Ore and Vanadium.—In November 2011, Baobab completed its scoping study on a new mine located north of Tete, which is the capital of Tete Province. Estimated resources at the Tete project were 324 million metric tons (Mt) at a grade of 30% iron; the deposit also contained titanium and vanadium. Baobab planned a prefeasibility study for 2012. Depending on the outcome of prefeasibility and feasibility studies, the company could begin mining in 2016. Baobab planned to produce 3 million metric tons per year (Mt/yr) of magnetite concentrate at grades of 58% iron and 0.7% V_2O_5 . The company was also considering the possibility of producing 1 Mt/yr of pig iron (Mining Journal, 2011a; International Resource Journal, 2012).

Niobium and Tantalum.—In April 2010, Noventa Ltd. of the United Kingdom reopened the Marropino niobium and tantalum mine, which was shut down in May 2009. Noventa produced 38,400 kilograms (kg) of tantalum pentoxide (Ta_2O_5) in concentrate in 2011 compared with 12,500 kg in 2010. Production fell short of the company's target of 73,300 kg of Ta_2O_5 because of delays in completing the new processing plant, deterioration of the old plant, and shortages of power, skilled labor, and water. Noventa planned to complete its new processing plant with a capacity of 270,000 kg/yr of Ta_2O_5 in 2012 and to ramp up production to full capacity in the first quarter of 2013. The company also planned to reopen the Morrua and the Mutala Mines in 2013 and 2016, respectively. Resources at Morrua were estimated to be about 3,600 t of contained Ta_2O_5 , and at Marropino, more than 1,600 t (Noventa Ltd., 2012, p. 6–10, 21–22).

In 2011, Pacific Wildcat Resources Corp. (PAW) of Canada restarted small-scale production at the Muiane Mine. Contained resources at Muiane were estimated to be 340 t of Ta_2O_5 . PAW planned to invest revenues from the mining operation in further exploration at Muiane and other projects (Kachanovsky, 2011).

Titanium and Zirconium.—Kenmare Resources plc of Ireland produced ilmenite, rutile, and zircon at the Moma Mine. In 2011, ilmenite production decreased to 636,900 t from 678,400 t in 2010 because of power shortages and difficulties in mining a clay-rich zone of the deposit. Zircon production increased to 43,600 t in 2011 from 37,100 t in 2010 because

of the reprocessing of stockpiles. Rutile output increased to 6,500 t from 4,700 t. Kenmare planned to complete the expansion of its 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 the fourth quarter of 2012. The company expected to ramp up production to full capacity in 2013. Reserves at Moma were estimated to be 869 Mt at grades of 3% ilmenite, 0.21% zircon, and 0.063% rutile (Thompson, 2011; Kenmare Resources plc, 2012, p. 3–4, 8–9, 13).

Depending on favorable results of its prefeasibility and feasibility studies, Baobab could start production of ilmenite at its Tete project by 2016. Baobab planned to produce about 500,000 t/yr of ilmenite concentrate (Mining Journal, 2011a).

In May 2011, Pathfinder Minerals plc of the United Kingdom released the results of a scoping study on the Moebase/Naburi project. Pathfinder was considering the development of a new mine 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. At yearend, the company was engaged in an ownership dispute with J.V. Consultores Internacionais regarding the Moebase/Naburi project (Mining Journal, 2011c).

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 combined capacity of about 1.66 Mt/yr. Cimpor increased the capacity at Matola to 1.3 Mt/yr from 700,000 t/yr in 2011. The company also planned to increase its capacity at Dondo to 640,000 t/yr from 240,000 t/yr in 2013. In 2011, Cimpor increased its share in Cimentos de Nacala S.A., which had a plant at Nacala with a capacity of 350,000 t/yr, to 100% from 51% in 2011 (table 2; International Cement Review, 2011a, b; Cimentos de Portugal, SGPS, SA, 2012, p. 17, 69).

By as early as 2012, Chinese companies could complete three new cement plants in Mozambique. China International Fund planned to build a new plant at Salamanga with a capacity of between 800,000 t/yr and 1.5 Mt/yr; Africa Great Wall Cement Manufacture Lda. planned to build a plant in Magude with a capacity of 500,000 t/yr; and GS Cimento planned to build a plant adjacent to the Mozal smelter with a capacity of 500,000 t/yr (International Cement Review, 2011b).

Consolidated General Minerals plc (CGM) of the United Kingdom was planning to build a new cement plant at Beira with a capacity of 800,000 t/yr. CGM's plant was expected to take between 12 and 14 months to build after the necessary permits were obtained (Consolidated General Minerals plc, 2011; International Cement Review, 2011b).

National cement consumption increased to 1.4 Mt in 2011 from nearly 1.2 Mt in 2010. Maputo and other areas in southern Mozambique accounted for 62% of cement demand in 2010; central Mozambique, 23%; and southern Mozambique, 15% (International Cement Review, 2011b; Cimentos de Portugal, SGPS, SA, 2012, p. 68–69).

Diamond.—In July 2011, the Government reported that as many as 27 companies were engaged in diamond exploration

in Mozambique, most of which were domestically owned. The companies explored for diamond in Gaza, Inhambane, Manica, Maputo, Niassa, and Sofala Provinces; exploration activity was in an initial phase. By December, the Government planned to join the Kimberley Process Certification Scheme, which is a certification system established to reduce the trade in conflict diamond (Rapaport Diamond Report, 2011).

Fluorspar and Rare Earths.—Monazite, which is a phosphate mineral containing rare-earth elements (REEs), was found at the Moma Mine. Heavy sands reserves at Moma were estimated to be 869 Mt at a grade of 0.021% monazite. In 2011, Kenmare was engaged in a study on recovering monazite from mine tailings (Kenmare Resources plc, 2012, p. 9).

Construction aggregate was mined at Xiluvo, which had a niobium- and rare-earth-enriched carbonatite deposit. Southern Crown Resources Ltd. of Australia had a joint agreement with the owners of the mining permit for the rights to the REEs. In November 2011, Southern Crown estimated that resources at Xiluvo were 1.1 Mt at a grade of 2.05% rare-earth oxides (Southern Crown Resources Ltd., 2011).

Globe Metals & Mining Ltd. of Australia engaged in exploration at the Mount Muambe fluorite and rare earths deposit in 2011. Mount Muambe is a carbonatite deposit located 20 kilometers southeast of the Moatize coal property in Tete Province. Globe planned to complete an initial resource estimate in the first quarter of 2012 (Globe Metals & Mining Ltd., 2011).

Gemstones.—Gem-quality ruby was found in eluvial and primary deposits at Montepuez in Cabo Delgado Province. Mwiriti Lda. produced small amounts of ruby at Montepuez. In June 2011, Gemfields plc of the United Kingdom agreed to purchase a 75% share in Montepuez. Gemfields planned to start a large-scale mining operation by the end of 2012 (Gemfields plc, 2012).

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

Graphite.—The Ancuabe graphite mine in Cabo Delgado Province, 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. Graphit Kropfmuhl AG (GK) of Germany engaged in exploration at Ancuabe and other graphite projects in northern Mozambique in 2011. The company was considering the production of several thousand metric tons per year of graphite; GK hoped to complete negotiations with the Government regarding mining licenses by June 2012 (Feytis, 2010; Graphit Kropfmuhl AG, 2012, p. 3, 25).

Phosphate Rock.—Vale S.A. of Brazil was engaged in a feasibility study on a new phosphate mine at the Evate deposit. Depending on the results of the study, Vale could produce 2 Mt/yr of phosphate rock at Evate (Smith, 2011).

Mineral Fuels

Coal.—In October 2011, Beacon Hill Resources plc (BHR) had nearly completed a feasibility study on the expansion of

the Minas Moatize Mine. Depending on the results of the study, BHR planned to start production from a new open pit mine in the third quarter of 2012. By the third quarter of 2013, the company planned to ramp up production to the full capacity of 4 Mt/yr of run-of-mine coal, which included 1.45 Mt/yr of salable thermal coal and 900,000 t/yr of salable coking coal. The life of the mine was likely to be between 12 and 14 years (Mining Journal, 2011b).

In September 2011, Vale started production at the Moatize Mine in Tete Province. The company planned to produce 1.56 Mt of salable coal in 2011 and 6.37 Mt in 2012. Output was expected to reach the full capacity of 8.5 Mt/yr of coking coal and 2.5 Mt/yr of thermal coal in 2013. In 2014, Vale planned to increase capacity to 22 Mt/yr of salable coal, of which 17 Mt/yr would be coking coal. 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) (Parker, 2010; Tex Report, The, 2011b).

In 2011, Riversdale Mining Ltd. of Australia and its joint-venture partner Tata Steel Ltd. of India were building the new Benga Mine, which is adjacent to the Moatize Mine. In June, Rio Tinto plc of the United Kingdom purchased Riversdale. Rio Tinto planned to export 1 Mt of coking coal and 500,000 t of thermal coal from Benga in 2012. Full capacity in the first stage of mining at Benga was expected to be 5.3 Mt/yr of run-of-mine coal, of which 1.5 Mt/yr would be salable coking coal and 900,000 t/yr would be salable thermal coal. In the second stage of mining, planned output was 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. Rio Tinto planned an initial capacity of between 500 and 600 MW at the power station and to increase capacity to 2,000 MW (African Mining, 2011; Tex Report, The, 2011a, b).

With the purchase of Riversdale, Rio Tinto also took over the Zambeze coal project, which was adjacent to the Benga project. The company planned to start production at Zambeze in the first quarter of 2015. Rio Tinto planned to increase run-of-mine production to 42 Mt/yr by 2019; of the total, 10 Mt/yr would be salable coking coal and 6 Mt/yr would be salable thermal coal (Tex Report, The, 2011a).

Ncondezi Coal Company Ltd. planned to complete its prefeasibility study on a new mine at the Ncondezi project in July 2012; the environmental and social impact assessment study was expected to be completed in September 2012. Depending on the results of the studies, Ncondezi Coal could start mining in 2015. Production at Ncondezi was expected to be 10 Mt/yr of thermal coal, which was likely to be exported to India. Resources at Ncondezi, which is located northeast of the Moatize Mine, were estimated to be about 1.8 billion metric tons (Wolters, 2011).

Talbot Group of Australia and its joint-venture partners were engaged in a feasibility study on a new open pit mine at the Revuboe project, which is adjacent to the Moatize Mine. Depending on the results of the study, the companies could start development of a new mine in the first half of 2012 and start production in 2014 or 2015. Production was expected to

be 5 Mt/yr of coking coal, which would be exported including to Japan and the Republic of Korea. Capital costs of the project were estimated to be between \$500 million and \$600 million (Tex Report, The, 2011c).

Natural Gas.—Production of natural gas from the Pande and the Temane gasfields increased to 3.44 billion cubic meters in 2011 from 3.26 billion cubic meters in 2010. Sasol Ltd. of South Africa, which operated the project, exported most of its output through a pipeline to supply its South African chemical plants. Natural gas exports were valued at \$153 million in 2011 compared with \$134 million in 2010. In October 2011, Sasol completed the expansion of its production capacity to 4.78 billion cubic meters per year from 3.14 billion cubic meters per year. Sasol planned to consume about 700 million cubic meters per year of the increased output in a new gas-fired power station in Mozambique with a capacity of 140 MW (Bank of Mozambique, 2012, p. A10; Sasol Ltd., 2012a, p. 4; 2012b).

In October 2011, Anadarko Petroleum Corp. of the United States and its joint-venture partners increased its estimate of recoverable resources at Offshore Area 1, which is located in the Rovuma basin, to about 280 billion cubic meters. In November, estimated recoverable resources were revised to between 420 billion and 850 billion cubic meters based on recent drilling. Anadarko and its partners were considering the development of a liquefied natural gas (LNG) plant in Mozambique with a capacity of 10 Mt/yr (or 13.8 billion cubic meters per year of natural gas) that would use natural gas from Offshore Area 1. The final investment decision on the LNG plant was expected by the third quarter of 2013 (Petroleum Economist, 2011a; Oil & Gas Journal, 2012).

Eni S.p.A. of Italy and its joint-venture partners drilled the Mamba South-1 well in Offshore Area 4. In late 2011, the companies estimated that natural gas in place near Mamba South could be at least 420 billion cubic meters (Petroleum Economist, 2011b).

Outlook

The mineral industry 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 2012 and 2013; cement, for 2012 through 2014; niobium and tantalum, for 2012 and 2013; natural gas, for 2012, and coal, for 2012 through 2019. A new iron ore and vanadium mine could open in 2016. Graphite production could also restart.

The outlook for coal, gemstones, ilmenite, niobium, rutile, tantalum, and zircon will likely depend heavily upon conditions in the world economy. The development of new coal mines will also likely depend on the expansion of the rail network. The Sena railroad had a capacity of 6 Mt/yr; a new railroad from the Tete coalfields to the Port of Nacala that passes through Malawi would be necessary to export the planned production from the new coal mines. The development of new mines and related infrastructure could lead to increased consumption and production of local construction materials (Tex Report, The, 2011d).

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TABLE 1
MOZAMBIQUE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2007	2008	2009	2010	2011
Aluminum:					
Bauxite	8,650	5,443	3,612	8,556 ^r	10,352
Metal, refined	564,000	536,000	545,000	557,000	562,000
Beryl kilograms	30,600	7,600	45,100 ^r	56,700 ^r	57,800
Cement, hydraulic ³ thousand metric tons	665	744	777	884	976
Clays:					
Bentonite:					
Crude	10,469	17,661	92,098 ^r	11,417 ^r	423
Processed	762	614	577 ^r	459 ^r	493
Brick	150,000 ^e	80,000 ^e	15,661	43,143 ^r	99,561
Coal, bituminous	23,602	37,700	25,924	38,260 ^r	648,220
Diatomite	651	379	213 ^r	123 ^r	49
Gemstones:					
Aquamarine kilograms	20,371	2,549	592 ^r	1,579 ^r	60
Dumortierite	63	142	63 ^r	27 ^r	58
Garnet kilograms	16,986	5,398	2,648	16,355 ^r	17,000 ^e
Morganite ^e do.	2,613 ⁴	7,274 ⁴	2,600	--	--
Tourmaline do.	11,607	34,165	6,078 ^r	14,669 ^r	26,279
Gold ⁵ do.	95	298	511	106 ^r	111
Natural gas million cubic meters	2,722	3,037	2,833 ^r	3,261 ^r	3,438
Niobium (columbium) and tantalum, columbite-tantalite, ore and concentrate:					
Gross weight kilograms	196,433	395,646	404,668	55,054 ^r	139,145
Nb content ^e do.	14,000	28,000	29,000	3,900 ^r	10,000
Ta content ^e do.	56,000	110,000	113,000	15,000 ^r	39,000
Quartz do.	216,655	157,254	140,600	707,411 ^r	838,684
Salt, marine ^e	110,000	110,000	110,000	110,000	110,000
Sand	1,470,000	718,577	1,260,492	1,150,052 ^r	1,678,736
Steel, semimanufactured	--	21,000 ^e	20,000 ^e	--	--
Stone:					
Granite ^e cubic meters	5,500	5,500	350	--	--
Gravel and crushed rock do.	1,171,019	115,524	2,942,830 ^r	824,316 ^r	951,069
Limestone	1,350,000	47,754	234,135	263,908 ^r	270,000 ^e
Marble:					
Block cubic meters	835	301	--	--	225,144
Slab square meters	16,647	7,932	250	--	-- ^e
Titanium:					
Ilmenite concentrate	140,515	328,875	471,500	678,400	636,900
Rutile concentrate	8,782	6,552	1,800	4,700	6,500
Zirconium concentrate	26,347	32,985	21,100	37,100	43,600

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

¹Table includes data available through January 10, 2013.

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

³Reported cement sales by Cimentos de Moçambique SARL only.

⁴Reported figure.

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 2011

(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	563,000.
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	1,300,000.
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), 100%]	do.	350,000.
Coal, bituminous		Vale S.A.	Moatize Mine	11,000,000.
Do.		Beacon Hill Resources plc (BHR)	Minas Moatize Mine	220,000.
Diatomite		Diatomites de Moçambique Lda	Diana quarry near Manica	4,800.
Gemstones:				
Garnet	kilograms	Sociedade Vision 2000 Lda	Cuamba Mine	8,000. ²
Morganite	do.	Noventa Ltd. (Highland African Ventures Ltd., 36.7%)	Mine at Marropino ³	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 ³	2,600. ^c
Do.	do.	do.	3 kilometers northeast of Mavuco ³	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 ³	720.
Do.	do.	Artisanal miners	do.	600.
Graphite		Graphit Kropfmuhl AG (GK)	Mine at Ancuabe ³	10,000.
Marble, block	cubic meters	Marmonte Moçambique	Quarry at Pemba ³	1,500.
Natural gas	million cubic meters	Sasol Ltd., 70%	Temane and Pande	4,780.
Niobium (columbium) and tantalum, columbite-tantalite, ore and concentrate		Noventa Ltd.	Mine at Marropino	140 Ta ₂ O ₅ .
Do.	do.	Pacific Wildcat Resources Ltd.	Mine at Muiane	NA.
Steel, semimanufactured		ArcelorMittal South Africa Ltd.	Trem de Varao plant at Maputo ³	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.

²Gem-quality only.

³Not operating at the end of 2011.