

2009 Minerals Yearbook

MADAGASCAR

THE MINERAL INDUSTRY OF MADAGASCAR

By Thomas R. Yager

Madagascar played a significant role in the world's production of ilmenite in 2009. The country was one of the world's top-ranked sapphire producers in early 2008. Starting in March 2008, gemstone production decreased precipitously because of the Government's ban on rough gemstone exports. Gemstone production decreased in other countries because of the worldwide economic crisis in late 2008 and 2009; Madagascar's significance to the world gemstone industry was unclear at the end of 2009. Other domestically significant minerals produced included chromite and ornamental stones. Madagascar was not a globally significant consumer of minerals in 2009 (Gambogi, 2010).

In March 2009, the Government was overthrown in a military coup. The interim Government suspended the issuance of mining permits and discussed the possibility of revising some mining contracts. In December, the interim Government announced that the planned auction of 50 offshore Indian Ocean petroleum exploration blocks would be delayed from November 2009 until August or September 2010 (Clarke, 2010; Watkins, 2010).

Minerals in the National Economy

In 2008 (the latest year for which data were available), the manufacturing sector accounted for an estimated 13.2% of the gross domestic product, and the mining and construction materials sector, 0.7%. Employment in the mining industry was estimated to be between 300,000 and 500,000 workers (Ministry of the Economy, Commerce, and Industry, 2008, p. 114).

Production

In 2009, the production of most gemstones increased sharply. Ilmenite, rutile, and zircon production started in 2009. Quartz production decreased by 91% in 2009; mica, by 71%; and chromite, by an estimated 17%. The country's petroleum refinery was shut down in 2005. Data on mineral production are in table 1.

Structure of the Mineral Industry

Most of Madagascar's mining and mineral processing operations were privately owned, including the gemstone, graphite, and salt mines and the cement plants. Artisanal miners produced gemstones and gold. State-owned Kraomita Malagasy SA (KRAOMA) was the country's only chromite producer. Table 2 lists major mineral industry facilities in Madagascar.

Commodity Review

Metals

Chromium.—In May 2009, KRAOMA restarted the production of chromite concentrates and lumpy ore from the

Bemanevika Mine, which had been shut down in October 2008. The Bemanevika Mine was estimated to have a remaining life of 15 years. KRAOMA exported its output to China, Japan, and Sweden (Rahaga, 2009).

Cobalt and Nickel.—Starting in 2010, a joint venture of Sherritt International Corp. of Canada (40%), Sumitomo Corp. of Japan (27.5%), Korea Resources Corp. of the Republic of Korea (27.5%), and SNC-Lavalin Inc. of Canada (5%) planned to mine two nickel-cobalt deposits at Ambatovy. Lateritic slurry from the Ambatovy ore-processing plant was to be processed at a pressure-acid-leaching plant at Toamasina. The plant was expected to produce a sulfide product that contained 55.2% nickel and 4.2% cobalt. The sulfide product would be processed at a refinery with a capacity of 60,000 metric tons per year (t/yr) of refined nickel and 5,600 t/yr of cobalt; the mine was expected to start production in the first quarter of 2011 and to reach full capacity in 2013. Capital costs of the mine, pipeline, port facilities, power supply, processing plants, and refinery were estimated to be \$2.5 billion. The life of the project was estimated to be 27 years (Mining Journal, 2005; Clarke, 2010).

Diamond Fields International Ltd. (DFI) of Canada completed its new resource estimate at the Valozoro nickel laterite deposit in south-central Madagascar in 2009. Inferred resources were estimated to be 11.5 million metric tons (Mt) at a grade of between 1.6% and 1.7% nickel (Diamond Fields International Ltd., 2009, p. 34-35).

Copper and Platinum-Group Metals.—Jubilee Platinum plc of the United Kingdom explored at its Ambodilafa nickel-copper-platinum-group metals prospect in 2009. The company planned a drilling program at Ambodilafa in 2010. Malagasy Minerals Ltd. (MML) of Australia conducted a sampling program at the Ampanihy nickel-copper property and drilling at the Vohibory copper-silver property in 2009 (Malagasy Minerals Ltd., 2009b, p. 3, 5; Clarke, 2010).

Niobium, Tantalum, and Rare-Earth Elements.—From September to December 2009, Tantalus Rare Earths AG of Germany conducted a sampling program at its concession in Antsiranana Province, which is prospective for niobium, tantalum, and rare-earth minerals that include heavy rare earths. Tantalus planned to start a drilling program in April 2010 (Tantalus Rare Earths AG, 2010).

Titanium and Zirconium.—QIT Madagascar Minerals SA [QIT Fer et Titane of Canada (a subsidiary of Rio Tinto plc), 80%, and the Government of Madagascar, 20%] started mining ilmenite, rutile, and zircon at Mandena in southeastern Madagascar in January 2009. The company planned to increase production to 750,000 t/yr of ilmenite, 25,000 t/yr of zircon, and 15,000 t/yr of rutile by 2011 or 2012. The ilmenite had a grade of 60% titanium dioxide (TiO₂). Ilmenite from the mine was exported to Canada for smelting. Production could increase to 2 million metric tons per year (Mt/yr) of ilmenite in the second phase of the project. The life of the mine was estimated to be 40 years (Kotze, 2008; Feytis, 2009; Clarke, 2010). Exxaro Resources Ltd. of South Africa and Madagascar Resources NL of Australia were engaged in a feasibility study of mining the Ranobe mineral sands deposit. Proposed ilmenite production in the study was 560,000 t/yr starting by 2014. In 2009, Exxaro relinquished its rights to Ranobe because of political uncertainty. Mainland Minerals Ltd. of China, which was a state-owned company, also explored for mineral sands (Feytis, 2009; Clarke, 2010).

Vanadium.—Energizer Resources Inc. of Canada (formerly Uranium Star Corp.) discovered vanadium mineralization hosted in graphite-rich sediment at its Green Giant property. The company planned to spend \$10 million on environmental, geotechnical, marketing, and metallurgical studies and to complete a feasibility study on a new mine by April 2011. Energizer hoped to identify a resource of at least 200 Mt of ore. MML conducted a rock chip and soil sampling program at Fotadrevo, which was on the Ampanihy property (Malagasy Minerals Ltd., 2009b, p. 8-9; Wolfe, 2009).

Industrial Minerals

Cement.—Madagascar had three operating cement plants that had a total (combined) capacity of 750,000 t/yr. Holcim (Madagascar) S.A. planned to replace its plant at Ibity with a new plant in early 2011. The new plant was expected to have a capacity of 800,000 t/yr and to cost \$200 million (Rakotomalala, 2008).

Gemstones.—In recent years, Madagascar was a globally significant producer of gemstones that included emerald, ruby, and sapphire. Emerald was produced near Mananjary; ruby, at Andilamena and Vatomandry; and sapphire, at Ilakaka, Manombe, Marosely, and Sakara.

In July 2007, Société Orgaco of France mined the 536-kilogram Heaven's Gift Emerald in matrix at the Morafeno Mine near Mananjary and exported it to Reunion later in the year. The Government asserted that the emerald was exported illegally and unsuccessfully sued Orgaco in Reunion. At the end of February 2008, the Government instituted a ban on the export of rough gemstones in response to the export of the Heaven's Gift Emerald. Madagascar's lapidary industry reportedly had the capacity to cut and polish about 2% of domestic rough gemstone production. Many foreign gemstone dealers left the country and gemstone mining declined sharply after the ban was implemented. In 2008, ruby and sapphire production was below the levels reached in 1998. The Government lifted the ban in July 2009 (National Institute of Statistics, 2000, p. 12; Jarrett, 2009).

Tsavorite, which is a green grossular garnet that obtains its color from trace amounts of chromium and vanadium, and vanadium-rich color-change garnet were produced at Behara in southern Madagascar. In August 2008, about 300 miners and gemstone traders were working at Behara (Pardieu and Hughes, 2009).

Demantoid garnet, which is a green andradite garnet that obtains its color from trace amounts of chromium, was mined near Antetezambato in northern Madagascar starting in March 2009. Gem-quality demantoid garnet was recovered from primary deposits up to a depth of 17 meters. From March to June, the number of artisanal miners producing demantoid garnet increased from several dozen to 5,000 (Rondeau and others, 2009). Norcross Madagascar Group (NMG) of the United States started mining gem-, cabochon-, and ornamental-grade amethyst near Ambatonrazaka in March 2008. The company planned to produce 19 metric tons (t) of amethyst in 2009 and 90 t in 2010 (Norcross Madagascar Group, undated).

EUROMAD S.A. of Italy and Marbres et Granits de Madagascar SARL (MAGRAMA) of Italy had royalty agreements with MML to mine labradorite from the anorthosite intrusives at Ianapera and Maniry. The companies produced about 3,000 t/yr of labradorite. SQNY International of India started mining labradorite at Ianapera and Maniry under a royalty agreement with MML in June 2009. Total production by EUROMAD, MAGRAMA, and SQNY was expected to increase significantly after 2009. NMG mined labradorite near Maniry at a rate of about 1,200 t/yr in 2009 (Malagasy Minerals Ltd., 2009a, p. 11; Norcross Madagascar Group, undated).

In 2008, NMG mined agate, amazonite, apatite, calcite, jasper, quartz, and rhodonite. The company opened new mines that included calcite and hematite mines in 2009 (Norcross Madagascar Group, undated).

Graphite.—In the late 1990s, Madagascar had four graphite mining companies that produced more than 16,000 t/yr. In recent years, national graphite production declined to about 5,000 t/yr because of increasing costs of petroleum products used for drying. Processing costs also increased because of declining grades at local graphite deposits as higher-grade materials were depleted. Etablissements Gallois S.A. was the only remaining company that regularly produced and exported graphite (National Institute of Statistics, 2000, p. 12; Feytis, 2010).

Mineral Fuels and Related Materials

Coal.—Straits Resources Ltd. of Australia engaged in exploration at Sakamena and Sakoa in 2009; the company was considering the development of a mine at Sakoa that could produce between 3 and 5 Mt/yr. In January 2009, Uranio Ltd. of Australia cancelled its planned acquisition of the Imaloto coal project because of the worldwide economic crisis (Ranjatoelina, 2009; Uranio Ltd., 2009; Clarke, 2010).

Petroleum.—At the onshore Tsimiroro project (located in Block 3104), Madagascar Oil Ltd. of the United States ran a pilot plant using steam injection to recover heavy petroleum. The company planned to conduct drilling in 2010 and to start an expanded pilot project in late 2011. Tsimiroro was estimated to have a recoverable resource of 600 million barrels of oil. Madagascar Oil and Total S.A. of France engaged in drilling at the Bemolanga tar sands project, which was located in Block 3102. The companies planned additional drilling in 2010 and to make a decision on the construction of a pilot extraction plant by mid-2011. Bemolanga was estimated to have a recoverable resource of 1.2 billion barrels. Sino Union Petroleum & Chemical International Ltd. of China planned to drill three wells in Block 3113 in 2009 (Grafton Resource Investments Ltd., 2009; Watkins, 2009).

Uranium.—UMC Energy plc of the United Kingdom held the Folakara project. In 2009, the company put its exploration plans on hold because of political uncertainty (Clarke, 2010).

Outlook

Madagascar's mineral industry is likely to grow significantly because of increased amethyst, cement, ilmenite, labradorite, rutile, and zircon production from 2010 to 2012, and the startup of cobalt and nickel production in 2011. Further growth in the mineral industry could result from the development of the Bemolanga and the Tsimiroro petroleum projects and the Green Giant vanadium project. The development of the mineral industry will depend on world market conditions and domestic political stability.

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TABLE 1 MADAGASCAR: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²		2005	2006 ^e	2007	2008 ^e	2009 ^e
METALS						
Beryllium, beryl in quartz concentrates ^e	kilograms	12,000	12,000	12,000	12,000	12,000
Chromium, marketable output:						
Chromite concentrate, gross weight ^e		36,000	32,000	30,000	21,000	17,000
Chromite ore, lumpy ^e		105,000	100,000	92,000	73,000	43,000
Total		140,847	132,335 ³	122,260	84,000 ³	60,000 ³
Gold, mine output, Au content ^{e, 4} INDUSTRIAL MINERAL	kilograms	10	30	50	72 ³	70
	L5	150,000	150,000	270.000^{-3}	460.000	460,000
Cement, hydraulic ^e Gemstones: ^{e, 5}		150,000	150,000	270,000	400,000	400,000
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Amethyst ⁶	kilograms	920 r	920 r	920 r	600 r	20,000
Cordierite	do.	160	160	160	30 r	65
Emerald	do.	22 ^{3,7}	70 ^r	672 ^{3,7}	25	55
Garnet	do.	600	600	600	100 ^r	250
Ruby	do.	840 ^{3,7}	400 r	78 ^{3,7}	14	30
Sapphire	do.	4,361 ^{3,7}	4,700	5,124 ^{3,7}	940	2,100
Tourmaline ⁶	do.	68,000	68,000	68,000	54,000 r	43,000
Graphite, all grades		6,400	4,857 ³	5,000 e	5,000	5,000
Gypsum ^e		500	500	500	500	500
Mica, phlogopite		546 ⁷	1,071 ^{3,7}	1,349 7	1,233 ^{3,7}	358 ^{3,7}
Ornamental stones: ^{e, 5}						
Agate	kilograms	25,000	25,000	25,000	25,000	25,000
Labradorite		4,200	4,200	4,200	4,200	4,600
Quartz		141 ^{3,7}	1,643 3,7	1,596 ^{3,7}	867 ^{3,7}	80 3,7
Salt, marine ^{e,8}		65,000	75,000	75,000	75,000	75,000
Stone: ^e						
Limestone ⁹		190,000	190,000	350,000	400,000	400,000
Marble		5,000	5,000	5,000	5,000	5,000
Titanium:						
Ilmenite concentrate			3		r, 3	240,000
Rutile concentrate			3		r, 3	5,000
Zirconium concentrate			3		r, 3	8,000
MINERAL FUELS AND RELATED	MATERIALS					
Petroleum:						
Crude th	housand 42-gallon barrels		3		2 ^{r, 3}	2
Refinery products:						
Gasoline	do.	1,211	3		3	3
Kerosene and jet fuel	do.	373	3		3	3
Distillate fuel oil	do.	463	3		3	3
Residual fuel oil	do.	677	3		3	3
Liquified petroleum gas	do.	50	3		3	3
Other	do.	161	3		3	3
			3		3	3

^rRevised. do. Ditto. -- Zero.

¹Table includes data available through August 11, 2010.

²In addition to the commodities listed, crude construction materials (other clays, sand and gravel, and stone), ornamental stones (amazonite, apatite, and

rhodonite), industrial abrasives and calcite, and kaolin presumably are produced, but available information is inadequate to make reliable estimates of output. ³Reported figure.

⁴Does not include smuggled artisanal production, which is estimated to be from 1,000 to 2,000 kilograms per year.

⁵Does not include smuggled artisanal production.

⁶Includes both gem and ornamental quality.

⁷Reported exports.

⁸Compagnie Salinère de Madagascar and Grand Salines de Menabe only. Other companies reportedly produced small amounts of salt.

⁹Cement producers only.

TABLE 2 MADAGASCAR: STRUCTURE OF THE MINERAL INDUSTRY IN 2009

(Metric tons unless otherwise specified)

Comn	nodity	Major operating companies	Location of main facilities	Annual capacity
Cement		Holcim (Madagascar) S.A. (Holcim Group, 90%)	Plant at Toamasina	230,000.
Do.		do.	Plant at Ibity	220,000.
Do.	Madagascar Long Cimenterie (Maloci)		Plant at Ambohimanambola	300,000.
Chromium		Kraomita Malagasy SA (Government, 100%)	Mine at Ankazotaolana ¹	250,000.
Do.		do.	Mine at Bemanevika	200,000. ^e
Gemstones:				200,000.
Rough:				
Amethyst		Norcross Madagascar Group (NMG)	Mines at Ambatonrazaka	90. ^e
Emerald	kilograms Artisanal and small-scale miners		Mines at Mananjary	130. ^e
Garnet	do.		Mines at Antetezambato	NA.
Do.	do.		Mines at Behara	NA.
Labradorite	Marbres et Granits de Madagascar SARL (MAGRAMA) and EUROMAD SA		Mines at Ianapera and Maniry	3,000. ^e
Do.		SQNY International	do.	NA.
Do.		Norcross Madagascar Group (NMG)	Mines at Maniry	1,200. ^e
Quartz	do.		Mines at Ramaratina	NA.
Ruby	kilograms	Artisanal and small-scale miners	Mines at Andilamena and Vatomandry	1,000. ^e
Sapphire	do.	Various producers, including the following:	Locations:	5,000. ^e
Supplie	Artisanal and small-scale miners		Mines at Ilakaka, Manombe,	5,000.
			Marosely, and Sakara	
		World Sapphire Group	Mines at Ilakaka	
		Tany Hafa S.A.	Mines at Sahambano	
		Canalta Gems Inc.	Mines at Nose-Be and Andovokonko	
Tourmaline	do.	Artisanal and small-scale miners	Mines at Alatsinainuy Ibity	NA.
Polished ²	do.	Dream Stones Trading	Plant in Antananarivo	15.
Graphite	uo.	Etablissements Gallois S.A.	Artsirakambo Mine near Brickaville	4,800.
Do.		do.	Marovinsty Mine near Vatomandry	3,600.
Do.	do		Ambalafotaka Mine	NA.
Do.		Société Minière de la Grande Ile (Graphite	1	6,000.
D0.			Ambatomitamba Mine near Tamatave ¹	0,000.
Do.		Technology Group Inc., 50%) do.	Ambiani, Ambodihasina, Sandraka, and	3,600.
D0.		d0.		5,000.
		a :/// A // A	Sahamaloto Mines ¹	
Do.		Société Arséne Louys	Mine at Ambatoharanana ¹	3,000. ^e
Do.		Etablissements Izouard	Faliarno Mine near Moramanga ¹	2,000.
Gypsum		Compagnie Salinere de Madagascar	Antsahampano	500.
Mica		Société des Mines d'Ampandranhava	Tolagnaro	2,000 processed.
Petroleum, crude	thousand 42-gallon barrels	Madagascar Oil Ltd.	Tsimiroro	17. ^e
Salt		Compagnie Salinère de Madagascar	Antsahampano	70,000.
Do.		Grand Salines du Menabe	Morondava	5,000. ^e
Titanium minerals		QIT Madagascar Minerals SA [QIT Fer	Mine at Mandena	750,000 ilmenite;
		et Titane (a subsidiary of Rio Tinto plc), 80%, and Government, 20%]		15,000 rutile.
Zirconium		do.	do.	25,000 zircon.

^eEstimated. Do., do. Ditto. NA Not available.

¹Not operating at the end of 2009.

²Includes amethyst, aquamarine, emerald, sapphire, tourmaline, and other gemstones.