



2006 Minerals Yearbook

MADAGASCAR

THE MINERAL INDUSTRY OF MADAGASCAR

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Madagascar played a significant role in the world's production of gemstones and graphite. In 2006, Madagascar was the world's top-ranked sapphire producer; the country's share of global graphite production amounted to about 1%. Other domestically significant minerals produced included chromite and ornamental stones. Madagascar was not a globally significant consumer of minerals in 2006 (Pardieu and Wise, 2006b; Olson, 2007).

Minerals in the National Economy

In 2006, the manufacturing sector accounted for 12.3% of the gross domestic product, and the mining and construction materials sector, 0.6%. The mining sector provided about 500,000 full-time and seasonal jobs that included more than 100,000 miners and traders at the Ilakaka sapphire mines, more than 15,000 at the Andilamena ruby mines, and tens of thousands at the Alatsinainy Ibity tourmaline deposit (Ministry of the Economy, Finance, and Budget, 2006, p. 110; Pardieu and Wise, 2006a, c; Rakotomalala, 2006b; Resource Information Unit, 2007).

Production

In recent years, the production of chromite, labradorite, and salt have increased sharply; sapphire production has declined. The petroleum refinery was shut down in 2004. The production of most mineral commodities was estimated to have remained unchanged in 2006. Data on mineral production are provided 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 plant. Artisanal miners produced gemstones and gold. Ownership disputes between artisanal miners were reported at Ilakaka. State-owned Kraomita Malagasy (KRAOMA) was the country's only chromite producer (Pardieu and Wise, 2006c). Table 2 lists major mineral industry facilities in Madagascar.

Commodity Review

Metals

Bauxite and Alumina.—In November 2006, Alcan Inc. of Canada signed an agreement with Access Madagascar Sarl, which held the mineral rights for the Manantenina bauxite deposit in southeastern Madagascar. The companies planned to complete a concept study of the development of an alumina refinery with a capacity of between 1 and 1.5 million metric tons per year (Mt/yr) and of a bauxite mine in the second quarter of 2007. Alcan and Access Madagascar could engage in a

feasibility study if the concept study yielded favorable results (King, 2006).

Chromium.—KRAOMA produced chromite concentrates and lumpy ore from its mines at Ankazotaolana and Bemanevika. The Bemanevika Mine opened in early 2006; reserves at the Ankazotaolana Mine were expected to be depleted in December. Production declined by 6% in 2006. Starting in 2007, KRAOMA planned to produce 200,000 metric tons per year (t/yr) of chromite at Bemanevika (Ministry of Energy and Mines, 2006, p. 18).

Cobalt and Nickel.—Starting in late 2009, Dynatec Corp. of Canada, Korea Resources Corp. of the Republic of Korea, and Sumitomo Corp. of Japan planned to mine two nickel-cobalt deposits at Ambatovy. Dynatec received an environmental permit for Ambatovy in December 2006; construction was expected to start at the beginning of 2007. Lateritic slurry from the 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 t/yr of refined nickel and 5,600 t/yr of cobalt. Capital costs of the mine, pipeline, processing plants, refinery, power supply, and port facilities were estimated to be \$2.25 billion (Mining Journal, 2005a, 2007).

At the end of 2006, Diamond Fields International Ltd. was finalizing the purchase of the mining rights for the Valozoro nickel laterite deposit in south-central Madagascar. Pan African Mining Corp. of Canada explored at its Nickel Valley property in northern Madagascar (Diamond Fields International Ltd., 2007; Pan African Mining Corp., 2007).

Copper and Platinum-Group Metals.—Jubilee Platinum plc of the United Kingdom explored at the Ambodilafa copper-gold-nickel, the Lanjanina copper-nickel, and the Londokomanana copper-nickel-platinum-group-metals properties. Jubilee and TransAsia Minerals Ltd. formed a joint venture in October 2006 to explore at Londokomanana; TransAsia agreed to spend \$10 million on exploration during 3 years (Resource Information Unit, 2007).

Gold.—Golden Deeps Ltd. of Australia explored for gold at the Kelimaizina gold prospect in north-central Madagascar. In March 2006, Pan African completed the first phase of exploration at its Mountain of Gold property in west-central Madagascar; the company started the second phase in September (Resource Information Unit, 2007). Majescor Resources Inc. of Canada and Prom Resources Inc. of the United States also explored for gold.

Titanium and Zirconium.—Rio Tinto plc started construction at its mineral sands joint-venture project at Mandena in southeastern Madagascar [QIT Fer et Titane of Canada (a subsidiary of Rio Tinto), 80%; and the Government of Madagascar, 20%]. Production was expected to start in the third quarter of 2008; Rio Tinto planned to produce 750,000 t/yr of ilmenite by 2012. In future phases of the project, production could increase to 2 Mt/yr. The cost of the mine and processing

facilities was estimated to be \$440 million, and a new port at Eholo, \$145 million (Mining Journal, 2005b; Ministry of Energy and Mines, 2006, p. 18).

Kumba Resources Ltd. of South Africa and Ticor Ltd. of Australia were engaged in a feasibility study on the Toliara mineral sands deposit. The companies planned to complete the study in early 2007 (Ministry of Energy and Mines, 2006, p. 18).

Industrial Minerals

Cement and Crushed Stone.—Holcim (Madagascar) S.A. was Madagascar's only cement producer (the plant operated by LaFarge Group at Mahanjanga was shut down in 2004). In 2006, the company produced at its full capacity of 150,000 t/yr; national cement consumption was about 500,000 t/yr. Holcim also produced limestone at a rate of about 260,000 t/yr in 2006. By February 2007, Holcim planned to increase capacity at the Ibity plant to 240,000 t/yr of cement (Rampanjato, 2005; Rakotomalala, 2006a).

Chine Shuguang Maloci of China planned to complete a new cement plant at Ambohimambola by July 2007 that would produce 250,000 t/yr. The company planned to produce cement initially from imported clinker (Madagascar Tribune, 2006b).

Gemstones.—Madagascar was the world's leading producer of sapphire; most domestically mined sapphire was produced by artisanal miners at Ilakaka, Manombe, and Sakara in the south-central part of the country. Recent declines in production were attributable to the depletion of easily mined deposits near the surface at Ilakaka. In October 2005, the Marosely sapphire deposit was discovered south of Ranotsara; production from Marosely amounted to 500 kilograms by June 2006. Small amounts of sapphire were also produced at Ambondromihy (Pardieu and Wise, 2006b, c; Pezzotta, 2006).

Mayfair Mining and Minerals Inc. of the United Kingdom acquired a 51% interest in Union Prospection Minière (UPM) in May 2006 and a 100% interest in July. UPM held properties in the Ilakaka area that included the Benahy-Imaloto sapphire mine, which was operating in 2006. Mayfair planned a 3-year exploration program for these properties at an estimated cost of \$1.05 million (Mayfair Mining and Minerals Inc., 2006).

In August and September 2005, several metric tons of mostly carving-quality multicolored tourmaline were found at Nandihizana. Other deposits were found south of this area, including the Ankitsikitsika, the Antseny, and the Fiadanana deposits. In September 2006, tourmaline production increased at the Alatsinainy Ibity tourmaline deposit located near Antsirabe because of an increase in demand (Pezzotta, 2006; Rakotomalala, 2006b).

Ruby was mined near Andilamena in north-central Madagascar and at Vatondry on the east coast. In March 2006, a new ruby deposit was reportedly discovered at Antanodava in central Madagascar. Emerald was mined at Mananjary near the east coast. A wide variety of ornamental stones that included agate, labradorite, and rose quartz were also produced.

Graphite.—In March 2006, Graphite Technology Group Inc. of the United States acquired a 50% share in Société Minière de la Grande Ile, which operated the Ambatomitamba Mine and four other graphite mines. Graphite Technology was purchased

by BPK Resources Inc. of the United States in April, which changed its name to iCarbon Corp. (BPK Resources Inc., 2006). Etablissements Gallois was the country's leading graphite producer; Etablissements Izouard, Etablissements Rostaing, and Société Arsène Louys also mined graphite.

Salt.—Compagnie Salinière de Madagascar produced salt at Antsahampano in the northern part of the country. In 2006, Compagnie Salinière produced at its full capacity of 70,000 t/yr; the company planned to increase its capacity to 80,000 t/yr in 2010 (Taloumis, [2007]).

Mineral Fuels and Related Materials

Coal.—In August 2006, Pan African announced the conclusion of its first phase of study on the Sakamena and the Sakoa coalfields in southwestern Madagascar. The company planned further exploration (Pan African Mining Corp., 2007).

Petroleum.—Madagascar's only petroleum products refinery at Toamasina was shut down in August 2004 because of its small size and aging equipment. Galana Petroleum Ltd. announced plans to dismantle the refinery in June 2006 (Madagascar Tribune, 2006a).

Exxon Mobil Corp. and its joint-venture partners planned to drill a well at the Mahajanga offshore concession at a cost of \$100 million. Madagascar Oil (a subsidiary of Vuna Energy Ltd. of the United Kingdom) planned exploration at the Tsimiroro bituminous sands deposit. Sterling Energy plc of the United Kingdom held the Ambilobe and the Ampasindva licenses, which were located to the north of Mahajanga (Mining Journal, 2007).

Uranium.—Pan African and the Government agency l'Office des Mines Nationales et des Industries Strategiques (OMNIS) had a joint-venture agreement to explore, develop, and mine uranium at Faratsiho, Folakara, Makay, and Tranomaro. Pan African explored at Tranomaro in 2006; further exploration was planned in 2007. Cline Mining Corp. of Canada formed a joint venture with OMNIS to explore in western Madagascar in February 2006. UMC Energy plc purchased Cline's 80% share of the joint venture in September and Cline received a 40% share in UMC Energy (Pan African Mining Corp., 2007; Resource Information Unit, 2007).

Outlook

Madagascar's mineral industry is likely to grow significantly with the startup of ilmenite, rutile, and zircon production in 2008, and cobalt and nickel production in 2009. The depletion of placer sapphire deposits at Ilakaka and changes in the mining code designed to encourage large-scale capital investment could lead to an increase in mechanized sapphire mining operations. Cement and chromite production are expected to increase in 2007 (Pardieu and Wise, 2006b).

References Cited

BPK Resources Inc., 2006, Form 8-K on April, 26, 2006: Securities and Exchange Commission, 5 p.

- Diamond Fields International Ltd., 2007, 2007 second quarter report for the period ended December 31, 2006: Cape Town, South Africa, Diamond Fields International Ltd, unpaginated.
- King, Carolyn, 2006, Alcan to study devt of bauxite mine, refinery in Madagascar: Dow Jones Newswires, November 9, 1 p.
- Madagascar Tribune, 2006a, Galana raffinerie terminal: Madagascar Tribune [Antananarivo, Madagascar], June 15, 1 p.
- Madagascar Tribune, 2006b, La cimenterie d'Ambohimambola: Madagascar Tribune [Antananarivo, Madagascar], September 28, 1 p.
- Mayfair Mining and Minerals Inc., 2006, Mayfair Mining and Minerals Inc. completes the acquisition of control of Union Prospection Miniere, Madagascar: West Sussex, United Kingdom, Mayfair Mining and Minerals Inc., 2 p.
- Mining Journal, 2005a, Dynatec outlines major Malagasy project: Mining Journal, March 4, p. 7.
- Mining Journal, 2005b, Rio Tinto go-ahead in Madagascar: Mining Journal, August 5, p. 1, 9.
- Mining Journal, 2007, Madagascar—A Mining Journal supplement: Mining Journal, January, 12 p.
- Ministry of Energy and Mines, 2006, Madagascar—A legend of mining: Antananarivo, Madagascar, Ministry of Energy and Mines, 22 p.
- Ministry of the Economy, Finance, and Budget, 2006, Rapport économique et financier 2005-2006: Antananarivo, Madagascar, Ministry of the Economy, Finance, and Budget, 121 p.
- Olson, D.W., 2007, Graphite: U.S. Geological Survey Mineral Commodity Summaries 2007, p. 72-73.
- Pan African Mining Corp., 2007, Corporate overview—March 2007: Vancouver, British Columbia, Canada, Pan African Mining Corp., 4 p.
- Pardieu, Vincent, and Wise, R.W., 2006a, Ruby boomtown: Colored Stone, v. 19, no. 1, January/February, p. 30-33.
- Pardieu, Vincent, and Wise, R.W., 2006b, The once and future sapphire: Colored Stone, v. 19, no. 4, July/August, p. 36-39.
- Pardieu, Vincent, and Wise, R.W., 2006c, The world's biggest sapphire market: Colored Stone, v. 19, no. 2, March/April, p. 28-31.
- Pezzota, Frederico, 2006, New gem localities in Madagascar: Gems & Gemology, v. 42, no. 3, Fall, p. 116.
- Rakotomalala, Mahefa, 2006a, Investissement—Extension de la cimenterie d'Ibity: L'Express de Madagascar [Antananarivo, Madagascar], October 30, 1 p.
- Rakotomalala, Mahefa, 2006b, Mines—Alatsiny Ibyty connait la ruée vers la tourmaline: L'Express de Madagascar [Antananarivo, Madagascar], November 2, 1 p.
- Rampanjato, Arilala, 2005, Ciment—La demande a chute de plus de 100.000 tonnes: Gazette de la Grande Ile [Antananarivo, Madagascar], August 11, 1 p.
- Resource Information Unit, 2007, Madagascar, in Register of African Mining 2007: Subiaco, Australia, Resource Information Unit, p. 116-118.
- Taloumis, Panayotis, [2007], Bienvenue sur le site de la Compagnie Salinière de Madagascar: Antsiranana, Madagascar, Compagnie Salinière de Madagascar (Accessed August 2, 2007, at <http://www.salines-diego.com>.)

TABLE 1
MADAGASCAR: ESTIMATED PRODUCTION OF MINERAL COMMODITIES^{1,2}

(Kilograms unless otherwise specified)

Commodity ³	2002	2003	2004	2005	2006
METALS					
Beryllium, beryl in quartz concentrates, industrial and ornamental	1,000	1,000	1,000	1,000	1,000
Chromium, marketable output:					
Chromite concentrate, gross weight metric tons	3,000 ^r	12,000	21,000	36,000 ^r	32,000
Chromite ore, lumpy do.	8,000	33,000	56,000	105,000	100,000
Total do.	11,000 ^r	45,040 ⁴	77,386 ⁴	140,847 ^{r,4}	132,335 ⁴
Gold, mine output, Au content ⁵	--	10 ⁴	5 ^{4,6}	5 ^{4,6}	5
INDUSTRIAL MINERALS					
Abrasives, natural (industrial only)	NA ^r	NA ^r	NA ^r	NA ^r	NA
Cement, hydraulic metric tons	30,000	200,000 ^r	170,000 ^r	150,000 ^r	150,000
Clay, kaolin do.	170	170	170	170	170
Feldspar do.	3	3	3	3	3
Gemstones: ⁷					
Amethyst ⁸	617 ^{4,6}	620	620	620	620
Cordierite	158 ^{4,6}	160	160	160	160
Emerald	31 ^{4,6}	40	53 ^{4,6}	60	60
Garnet	599 ^{4,6}	600	600	600	600
Ruby	889 ^{4,6}	800	741 ^{4,6}	920	920
Sapphire	9,326 ^{4,6}	6,000	5,890 ^{4,6}	4,700	4,700
Tourmaline ⁸	63,722 ^{4,6}	64,000	64,000	68,000 ^r	68,000
Graphite, all grades metric tons	2,000	15,000	15,000	15,000	15,000
Gypsum do.	500	500	500	500	500
Mica, phlogopite do.	90	90	90	90	90
Ornamental stones: ⁷					
Agate	20,000	25,000	25,000	25,000	25,000
Labradorite metric tons	4,183 ⁴	5,500 ^r	6,200 ^r	6,200 ^r	6,200
Quartz do.	423 ⁴	430	430	430	430
Salt, marine ⁹ do.	50,000 ^r	50,000 ^r	55,000 ^r	65,000 ^r	75,000
Stone:					
Dimension do.	200	200	200	200	200
Limestone ¹⁰ do.	50,000	290,000	260,000	260,000	260,000
Marble do.	5,600	5,000	5,000	5,000	5,000
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	237	480 ^r	310 ^r	-- ^{r,4}	-- ⁴
Kerosene and jet fuel do.	163	330 ^r	210 ^r	-- ^{r,4}	-- ⁴
Distillate fuel oil do.	357	720 ^r	460 ^r	-- ^{r,4}	-- ⁴
Residual fuel oil do.	317	640 ^r	400 ^r	-- ^{r,4}	-- ⁴
Liquefied petroleum gas do.	14	30 ^r	20 ^r	-- ^{r,4}	-- ⁴
Total do.	1,088	2,200 ^r	1,400 ^r	-- ^{r,4}	-- ⁴

NA Not available. ^rRevised. -- Zero.

¹Estimated data are rounded to no more than three significant digits.

²Table includes data available through August 9, 2007.

³In addition to the commodities listed, modest quantities of crude construction materials (other clays, sand and gravel, and stone) and industrial calcite presumably are produced, but output was not reported quantitatively, and available information is inadequate to make reliable estimates of output levels.

⁴Reported figure.

⁵Does not include smuggled artisanal production, which is estimated to range from 1,000 to 2,000 kilograms per year.

⁶Reported exports.

⁷Does not include smuggled artisanal production.

⁸Includes both gem and ornamental quality.

⁹Compagnie Salinière de Madagascar and Grand Salins du Menabe only. Other companies reportedly produced small amounts of salt.

¹⁰Cement producers only.

TABLE 2
MADAGASCAR: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies		Location of main facilities	Annual capacity
Cement	Holcim (Madagascar) S.A. (Holcim Group, 90%)		Plant at Ibity	150,000.
Do. ¹	SA Nouvelle Cimenterie d'Amboanio (LaFarge Group, 66%, and Moustansir Ibarandty family, 34%)		Plant at Mahajanga	50,000. ^c
Chromium	Kraomita Malagasy (Government, 100%)		Mine at Ankazotaolana	250,000.
Do.	do.		Mine at Bemanekeva	200,000. ^c
Gemstones:				
Rough:				
Emerald	kilograms	Artisanal and small-scale miners	Mines at Mananjary	60. ^c
Labradorite		Marbres et Granits de Madagascar	Mines at Ambatofinandrahana and Bekily	4,200. ^c
Ruby	kilograms	Artisanal and small-scale miners	Mines at Andilamena and Vatomandry	1,000. ^c
Sapphire	do.	do.	Mines at Ilakaka and Sakara	5,000. ^c
Polished ²	do.	Dream Stones Trading	Plant in Antananarivo	15.
Graphite		Etablissements Gallois	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 Technology Group Inc., 50%)	Ambatomitamba Mine near Tamatave	6,000.
Do.		do.	Ambiani, Ambodihasina, Sandraka, and Sahamaloto Mines	3,600.
Do.		Société Arsène Louys	Mine at Ambatoharanana	3,000. ^c
Do.		Etablissements Izouard	Faliarno Mine near Moramanga	2,000.
Do.		Etablissements Rostaing	NA	NA.
Gypsum		Compagnie Salinière de Madagascar	NA	500.
Mica		Société des Mines d'Ampandrandava	Tolagnaro	2,000 processed.
Salt		Compagnie Salinière de Madagascar	Antsahampano	70,000.
Do.		Grand Salins du Menabe	Morondava	5,000. ^c

^cEstimated. NA Not available.

¹Shut down in 2004.

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