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The Mineral Industry of Madagascar

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Madagascar played a significant role in the world's production of gemstones and graphite in 2007. 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 2007 (Pardieu and Wise, 2006b; Olson, 2008).

Minerals in the National Economy

In 2006 (the latest year for which data were available), 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, 2006; Resource Information Unit, 2008).

Production

In 2007, limestone production increased by an estimated 81%; cement, by an estimated 80%; and gold, by an estimated 62%. The production of most mineral commodities was estimated to have remained unchanged in 2007. The petroleum refinery was shut down in 2004. 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 plant. Artisanal miners produced gemstones and gold. State-owned Kraomita Malagasy (KRAOMA) was the country's only chromite producer. 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 an initial capacity of 1.5 million metric tons per year (Mt/yr) and of a bauxite mine. The capacity of the alumina refinery could increase to 3 Mt/yr in the second phase of the project (Ranjatoelina, 2008).

Chromium.—KRAOMA produced chromite concentrates and lumpy ore from the Bemanevika Mine, which was estimated to have a remaining life of 15 years. The Ankazotaolana Mine was shut down in 2007 after its reserves were depleted. In 2007, chromite exports amounted to 125,000 metric tons (t); exports were expected to increase to 180,000 t in 2008 (Ranjatoelina, 2008; Razafindramiadana, 2008).

Cobalt and Nickel.—Starting in 2010, a joint venture of Dynatec 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. In 2007, Dynatec was purchased by Sherritt International Corp. of Canada.

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 2010 and to reach full production in 2012. Capital costs of the mine, pipeline, processing plants, refinery, power supply, and port facilities were estimated to be $3.3 billion. The life of the project was estimated to be 27 years (Mining Journal, 2005a; Ranjatoelina, 2008).

In May 2007, Diamond Fields International Ltd. (DFI) of Canada purchased the exploration rights for the Valozoro nickel laterite deposit in south-central Madagascar. Previous estimates of resources at Valozoro amounted to 3.6 million metric tons at a grade of 1.75% nickel. DFI was engaged in a channel sampling program to update the resource estimate, delineate an ore body model, and produce a mine development plan. Jubilee Platinum plc of the United Kingdom explored for nickel at its Londokomanana project in central Madagascar (Diamond Fields International Ltd., 2007; Resource Information Unit, 2008).

Copper and Platinum-Group Metals.—Jubilee and its joint-venture partner Impala Platinum Holdings Ltd. of South Africa were engaged in a joint venture to explore at the Ambodilafa copper–nickel–platinum-group metals (PGM) deposits. In late 2007, the companies announced plans to spend as much as $1.25 million on the second phase of their exploration program. Jubilee also conducted drilling at the Londokomanana copper-nickel-PGM project in mid-2007. In January 2007, Majescor Resources Inc. of Canada completed a drilling program at the Besakoa copper-gold-silver-zinc property in south-central Madagascar (Mining Review Africa, 2007; Majescor Resources Inc., 2008, p. 17; Resource Information Unit, 2008).

Gold.—In December 2006, Golden Deeps Ltd. of Australia decided to relinquish its Antanimbary property; the company engaged in drilling at Kelimaizina in north-central Madagascar in 2007. Pan African Mining Corp. of Canada explored for gold at its Mountain of Gold property in west-central Madagascar. The Government planned to award exploration rights to the Betsiaka gold deposit and to two deposits in Maevatananan in 2008 (Ranjatoelina, 2008; Resource Information Unit, 2008).

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%] planned to start production at Mandena in southeastern Madagascar by the end of 2008. The company 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 combined cost of the mine, the processing facilities, and a new port at Ehola was estimated to be $1 billion (Mining Journal, 2005b; Ranjatoelina, 2008).

Exxaro Resources Ltd. of South Africa and Madagascar Resources NL of Australia planned to complete their feasibility study of mining the Ranobe mineral sands deposit in 2008. The companies engaged in pilot washing and separation testing in 2007. Depending upon the results of the study, a new mine could be built with a capacity of 560,000 t/yr of ilmenite at a grade of 50% titanium dioxide (TiO_2), 140,000 t/yr of ilmenite at a grade of 58% TiO_2, 44,000 t/yr of zircon, and 10,000 t/yr of rutile. The life of the mine was expected to be about 25 years. Capital costs were estimated to be $250 million (Ranjatoelina, 2008).

Industrial Minerals

Cement.—Holcim (Madagascar) S.A. was Madagascar's only cement producer. In 2007, the company produced 160,000 t at its Toamasina plant and 110,000 t at its Ibity plant. Output was 40,000 t below Holcim's planned level because of mechanical problems. The Toamasina plant operated at 70% of capacity, and the Ibity plant, at 50% of capacity. Holcim planned to bring production at both plants to full capacity in 2009 (Madagascar Tribune, 2007, 2008).

By July 2007, Chine Shuguang Maloci of China planned to complete a new cement plant at Ambohimanambola that would produce 250,000 t/yr. The company initially planned to produce cement from imported clinker. Completion of the plant was delayed by problems with harbor infrastructure, power shortages, and insufficient local rail lines. In February 2007, Maloci announced plans to solicit a new financial partner to restart the project (Madagascar Tribune, 2006; Andrianantenaina, 2007).

In 2007, domestic cement consumption was 430,000 t compared with 380,000 t in 2006. Cement demand was expected to increase to 494,000 t in 2008. The Ambatovy nickel-cobalt project was likely to consume 70,000 t of cement; consumption was also likely to increase because of the new Mandena mineral sands mine (Madagascar Tribune, 2008).

Diamond.—Majescor acquired the Antsakabary property in northern Madagascar in February 2007. The company completed a bulk stream sediment sampling program at Antsakabary in November. Pan African engaged in exploration at its Malagasy regional project in 2007 (Majescor Resources Inc., 2008, p. 17; Resource Information Unit, 2008).

Gemstones.—Madagascar was one of the world's leading producers 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 decreases in production were attributable to the depletion of easily mined deposits near the surface at Ilakaka. Sapphire was also produced at Marosely, which is located south of Ranotsara, and at Ambondromihefy (Pardieu and Wise, 2006b, c; Pezzotta, 2006).

Mayfair Mining and Minerals Inc. of the United Kingdom held 16 properties in the Ilakaka area that included the closed Ampasimamitaka sapphire mine (also called the Benahy-Imaloto Mine). In 2008, Mayfair planned to restart production at the Ampasimamitaka Mine contingent upon adequate financing.

In August and September 2005, mostly carving-quality multicolored tourmaline was found at Nandihizana. Other deposits were found south of this area that included the Ankitsikitsika, the Antsengy, and the Fiadanana. By March 2007, many artisanal miners working at Nandihizana abandoned the deposit and returned to Andilamena and Ilakaka because of the lack of infrastructure and difficulties in forming cooperatives. The Government planned rehabilitation of the mine site to alleviate environmental damage and allow other economic activities to resume. Tourmaline was also mined at the Alatsinainy Ibity tourmaline deposit near Antsirabe (Rakotomalala, 2006; Saholiarisoa, 2007).

Ruby was mined near Andilamena in north-central Madagascar and at Vatomandry on the east coast. Emerald was mined at Mananjary near the east coast. A wide variety of ornamental stones, which included agate, labradorite, and rose quartz, were also produced.

Mineral Fuels and Related Materials

Coal.—In December 2007, Pan African commenced a drilling program at the Sakoa Coal deposit in southwest Madagascar. Pan African also held properties that included the Beroy and Vohipotsy coal-bearing basin and a significant portion of the Sakamena coalfield. The company planned drilling at Beroy, Sakamena, and Vohipotsy in the second phase of its exploration program (Modern Mining, 2008).

Petroleum.—At the onshore Tsimiroro block, Madagascar Oil Ltd. of the United States started running a pilot plant using steam injection to recover heavy oil in 2007. Madagascar Oil planned to start production at Tsimiroro in 2008. In October 2007, the Government awarded the onshore Block 1101 to Candax Energy Inc. of Canada and its joint-venture partner East African Exploration Ltd. (a subsidiary of Black Marlin Energy Ltd. of the United Arab Emirates). Block 1101 is located in Antsiranana Province. In April, the Government awarded Enermad Corp. 10 offshore blocks in the Mozambique Channel (Petroleum Economist, 2007; Pan African Mining Corp., 2008; Ranjatoelina, 2008).

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 2007. Cline Mining Corp. of Canada and OMNIS explored for uranium at Folakara in western Madagascar. In late August, Uranium Star Corp. of Canada acquired a 75% interest in the Three Horses property (Pan African Mining Corp., 2008; Resource Information Unit, 2008).

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 2010. 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. Chromite and cement production are expected to increase in 2008 and 2009, respectively (Pardieu and Wise, 2006b).

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TABLE 1
MADAGASCAR: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Kilograms unless otherwise specified)

Commodity[3]		2003	2004	2005	2006	2007
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	12,000	21,000	36,000	32,000	30,000
Chromite ore, lumpy	do.	33,000	56,000	105,000	100,000	95,000
Total	do.	45,040 [4]	77,386 [4]	140,847 [4]	132,335 [4]	125,000
Gold, mine output, Au content[5]		20 [r]	40 [r]	55 [r]	130 [r]	210
INDUSTRIAL MINERALS						
Cement, hydraulic	metric tons	200,000	170,000	150,000	150,000	270,000 [4]
Clay, kaolin	do.	170	170	170	170	170
Feldspar	do.	-- [r]	-- [r]	-- [r]	-- [r]	--
Gemstones:[6]						
Amethyst[7]		620	620	620	620	620
Cordierite		160	160	160	160	160
Emerald		40	53 [4, 8]	60	60	60
Garnet		600	600	600	600	600
Ruby		800	741 [4, 8]	920	920	920
Sapphire		6,000	5,890 [4, 8]	4,700	4,700	4,700
Tourmaline[7]		64,000	64,000	68,000	68,000	68,000
Graphite, all grades	metric tons	2,170 [r, 4]	7,770 [r, 4]	6,400 [r, 4]	15,000	15,000
Gypsum	do.	500	500	500	500	500
Mica, phlogopite	do.	90	90	90	90	90
Ornamental stones:[6]						
Agate		25,000	25,000	25,000	25,000	25,000
Labradorite	metric tons	5,500	6,200	6,200	6,200	6,200
Quartz	do.	430	430	430	430	430
Salt, marine[9]	do.	50,000	55,000	65,000	75,000	75,000
Stone:						
Dimension	do.	200	200	200	200	200
Limestone[10]	do.	290,000	260,000	260,000	260,000	470,000
Marble	do.	5,000	5,000	5,000	5,000	5,000
MINERAL FUELS AND RELATED MATERIALS						
Petroleum refinery products:						
Gasoline	thousand 42-gallon barrels	480	310	-- [4]	-- [4]	-- [4]
Kerosene and jet fuel	do.	330	210	-- [4]	-- [4]	-- [4]
Distillate fuel oil	do.	720	460	-- [4]	-- [4]	-- [4]
Residual fuel oil	do.	640	400	-- [4]	-- [4]	-- [4]
Liquefied petroleum gas	do.	30	20	-- [4]	-- [4]	-- [4]
Total	do.	2,200	1,400	-- [4]	-- [4]	-- [4]

[r]Revised. do. Ditto. -- Zero.

[1]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through August 14, 2008.

[3]In 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 available information is inadequate to make reliable estimates of output.

[4]Reported figure.

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

[6]Does not include smuggled artisanal production.

[7]Includes both gem and ornamental quality.

[8]Reported exports.

[9]Compagnie Salinière de Madagascar and Grand Salines de Menabe only. Other companies reportedly produced small amounts of salt.

[10]Cement producers only.

TABLE 2
MADAGASCAR: STRUCTURE OF THE MINERAL INDUSTRY IN 2007

(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 Toamasina	230,000.
Do.		do.	Plant at Ibity	220,000.
Do.		SA Nouvelle Cimenterie Amboanio (LaFarge Group, 66%, and Moustansir Ibaramdty family, 34%)	Plant at Mahajanga[1]	50,000.[e]
Chromium		Kraomita Malagasy (KRAOMA) (Government, 100%)	Mine at Ankazotaolana[1]	250,000.
Do.		do.	Mine at Bemanevika	200,000.[e]
Gemstones:				
Rough:				
Amethyst	kilograms	Norcross Madagascar Group	Mines at Ambatondrazaka[1]	NA.
Emerald	do.	Artisanal and small-scale miners	Mines at Mananjary	60.[e]
Labradorite		Marbres et Granits de Madagascar	Mines at Ambatofinandrahana and Bekily	4,200.[e]
Do.		Norcross Madagascar Group	Mines at Maniry	NA.
Quartz		do.	Mines at Ramartina	NA.
Ruby	kilograms	Artisanal and small-scale miners	Mines at Andilamena and Vatomandry	1,000.[e]
Sapphire	do.	Various producers, including:	Various locations, including:	5,000.[e]
Do.		Artisanal and small-scale miners	Mines at Ambondromihefy, Ilakaka, Manombe, Marosely, and Sakara	NA.
Do.		World Sapphire Group	Mines at Ilakaka	NA.
Do.		Tany Hafa S.A.	Mines at Sahambano	NA.
Do.		Canalta Gems Inc.	Mines at Nose-Be and Andovokonko	NA.
Do.		Mayfair Mining and Minerals Inc.	Mines at Ampasimamitaka[1]	NA.
Tourmaline	kilograms	Artisanal and small-scale miners	Mines at Alatsinainy Ibity	NA.
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 Arséne Louys	Mine at Ambatoharanana	3,000.[e]
Do.		Etablissements Izouard	Faliarno Mine near Moramanga	2,000.
Gypsum		Compagnie Salinière de Madagascar	Antsahampano	500.
Mica		Societe des Mines d'Ampandranhava	Tolagnaro	2,000 processed.
Salt		Compagnie Salinière de Madagascar	Antsahampano	70,000.
Do.		Grand Salines du Menabe	Morondava	5,000.[e]

[e]Estimated. Do., do. Ditto, NA Not available.

[1]Not operating in 2007.

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