



2010 Minerals Yearbook

MADAGASCAR [ADVANCE RELEASE]

THE MINERAL INDUSTRY OF MADAGASCAR

By Thomas R. Yager

Madagascar accounted for about 3% of world ilmenite production in 2010. 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 2010. Other domestically significant minerals produced included chromite and ornamental stones. Madagascar was not a globally significant consumer of minerals in 2010 (Jarrett, 2009; Pardieu, 2010; Gambogi, 2011).

The Government was overthrown in a military coup in March 2009. The interim Government suspended the issuance of mining permits and discussed the possibility of revising some mining contracts. In December 2009, 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. In October 2010, the interim Government announced that the auction would be postponed until the enactment of a new petroleum code (Clarke, 2010; McNeish, 2010; Watkins, 2010).

Minerals in the National Economy

Based on provisional data for 2010, the manufacturing sector accounted for 10.3% of the gross domestic product, and the mining and construction materials sectors combined, 0.9%. In 2010, the mining sector grew by an estimated 121%. Employment in gemstone mining at Ilakaka and Sakaraha was estimated to be about 50,000 workers (Ministry of the Economy, Commerce, and Industry, 2010, p. 92–93; Pardieu, 2010).

Production

In 2010, the production of mica increased by 478%; agate, by an estimated 300%; quartz, BY 291%; zircon, by an estimated 81%; ilmenite, by 79%; rutile, by an estimated 78%; labradorite, by an estimated 32%; limestone and marble, by an estimated 13% each; cement, by an estimated 11%; and graphite, by 10%. The production of most gemstones also increased substantially. Nickel and cobalt mining started in 2010. 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, mineral sands, nickel, 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

Cobalt and Nickel.—In July 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%) started mining nickel-cobalt laterite deposits at Ambatovy. Starting in mid-2011, 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 reach full capacity in 2013. Capital costs of the Ambatovy project were estimated to be \$4.76 billion in December 2010 (Mining Journal, 2005; Clarke, 2010; Sherritt International Corp., 2010).

Copper and Platinum-Group Metals.—Sunridge Gold Corp. of Canada engaged in soil sampling at its Besakoa copper-gold-zinc property in 2010; the company planned to start a drilling program in early 2011. Malagasy Minerals Ltd. (MML) of Australia conducted drilling at the Ampanihy nickel-copper property and the Vohibory copper-silver property in 2010. MML planned to continue drilling at Vohibory between March and April 2011 (Wait, 2010; Malagasy Minerals Ltd., 2011, p. 1–6).

Niobium (Columbium), Rare Earths, and Tantalum.—In 2010, Tantalus Rare Earths AG of Germany conducted a drilling program at its concession in Antsiranana Province, which is prospective for niobium, tantalum, zirconium, and rare-earth elements (REE) that include heavy rare earths. During the late 1980s, resources were estimated to be about 15 million metric tons (Mt) at a grade of 1.52% REE. Tantalus planned to continue its drilling program in 2011 and to complete an updated resource estimate (Bull & Bear's Resource Investor, 2010).

Titanium and Zirconium.—QIT Madagascar Minerals SA (QMM) [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. In 2010, ilmenite production increased to 287,000 metric tons (t) from 160,000 t in 2009. QMM also produced 12,600 t of zirsill, which is composed of quartz, sillimanite, and zircon, in 2010. In 2011, QMM planned to increase its output to 473,000 t of ilmenite and 22,000 t of zirsill; the company planned to reach the full capacity of 750,000 t/yr of ilmenite and 40,000 t/yr of zirsill by 2013. The

ilmenite, which was exported to Canada for smelting, had a grade of 60% titanium dioxide (Clarke, 2010; Anglo-Malagasy Society Newsletter, 2011).

Madagascar Resources NL of Australia held the undeveloped Ranobe mineral sands deposit, which had resources of 710 Mt at a grade of 4.07% ilmenite, 0.35% zircon, 0.32% leucoxene, and 0.12% rutile. In May 2010, Madagascar Resources signed a merger agreement with MML. The companies were considering the development of a new mine at Ranobe that could produce 200,000 t/yr of ilmenite and 23,000 t/yr of rutile and zircon during an estimated 20-year project life. In September, MML announced that it was canceling the proposed merger (Malagasy Minerals Ltd., 2010a, p. 18–19; 2010b).

Vanadium.—At the end of November 2010, Energizer Resources Inc. of Canada estimated that resources at its Green Giant property were 59.2 Mt at a grade of 0.682% vanadium pentoxide (V_2O_5). Vanadium mineralization was hosted in graphite-rich sediment. Depending on the results of feasibility studies, Energizer planned to start a new mine to produce battery-grade V_2O_5 in 2014. The company expected to produce between 13% and 14% of the world's vanadium supply. In 2011, MML planned a drilling program at the Fotadrevo vanadium prospect, which was located on the Ampanihy property (Energizer Resources Inc., 2010; Grace, 2011; Malagasy Minerals Ltd., 2011, p. 10).

Industrial Minerals

Cement.—Holcim (Madagascar) S.A. had plants at Toamasina and Ibity with capacities of 300,000 t/yr and 160,000 t/yr, respectively. Madagascar Long Cimenterie (Maloci) of China had a plant with a capacity of 360,000 t/yr; the company was producing cement at the rate of 300,000 t/yr in early 2010. Maloci's plans to open a new plant were delayed by decreases in cement demand in 2009. In March 2010, the company postponed the opening of the new plant indefinitely because of political instability. Domestic cement demand was estimated to be about 500,000 t/yr; recent decreases in consumption were partially attributable to the completion of the Ambatovy Mine and the Mandena Mine (Edmond, 2010; Razafindramiadana, 2010).

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 Sakaraha.

At the end of February 2008, the Government instituted a ban on the export of rough gemstones in response to the export of the 536-kilogram (kg) 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. The Government lifted the ban in July 2009 (Jarrett, 2009; Pardieu, 2010).

Sapphire was discovered in southern Madagascar at Ilakaka and Sakaraha in 1998, and Madagascar became one of the world's leading sapphire producers. Alexandrite and other chrysoberyl, garnet, spinel, zircon, and other gemstones were also mined at Ilakaka and Sakaraha. In mid-2010, an estimated

50,000 workers were directly or indirectly employed in gemstone mining at Ilakaka and Sakaraha compared with about 100,000 in 2005. Mining has declined because of the depletion of near-surface deposits, the ban on rough gemstone exports, and the global economic crisis. Most production at Ilakaka and Sakaraha was attributable to artisanal miners; only three large-scale mechanized mining companies were in operation in 2010. Large-scale operations were hampered by high fuel costs and an inability to enforce mining rights (Pardieu, 2010).

Blue sapphire was also mined at several primary deposits by small groups of artisanal miners near Andranondambo. Nantin Ltd. of Malaysia and about 200 artisanal miners produced sapphire at Ankazoabo, which is located north of Andranondambo. Société d'Investissement Australien à Madagascar of Australia and other mining companies shut down operations in recent years; many buyers were considering relocation to the ruby mines in Mozambique (Pardieu, 2010).

Demantoid garnet, which is a green andradite garnet, was mined from primary deposits near Antetezambato in northern Madagascar starting in March 2009. From March to June, the number of artisanal miners producing demantoid increased from a few dozen to 5,000. Production declined sharply after October 2009 because of the depletion of near-surface deposits and flooding by seawater during high tides. By November 2010, production was minimal with only a few dozen miners still working. During the peak mining period in 2009, output was estimated to be about 20 kilograms per week of gem-quality demantoid. Total production amounted to hundreds of kilograms of gem-quality demantoid and a much larger amount of lower quality material. More than 90% of the total production at Antetezambato was estimated to have taken place between April and November 2009 (Rondeau and others, 2009; Pezzotta, Adamo, and Diella, 2011).

In July 2009, about 300 kg of dark blue aquamarine were mined from a pegmatite at Tsaramanga in central Madagascar. The Tsaramanga Mine historically produced tourmaline and pink beryl. Production in 2010 was primarily rose quartz; large crystals of aquamarine were occasionally mined (Isatelle, 2010).

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. Norcross Madagascar Group of the United States mined labradorite near Maniry at a rate of about 1,200 t/yr in 2009 (Malagasy Minerals Ltd., 2010a, p. 17; Norcross Madagascar Group, undated).

Graphite.—Madagascar had four graphite mining companies that produced more than 16,000 t/yr in the late 1990s. National graphite production declined to an average of about 5,000 t/yr between 2005 and 2010 because of the 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 mined and exported graphite (National Institute of Statistics, 2000, p. 12; Feytis, 2010).

Stone, Crushed.—In September 2010, Gulf Industrials Ltd. of Australia purchased the Soalara Limestone project in southeastern Madagascar. Gulf Industrials was considering the development of a new quarrying operation that would produce 2 million metric tons per year (Mt/yr) of limestone initially and ramp up to 5 Mt/yr during a period of 2 years. Domestic limestone demand was estimated to be 1.7 Mt/yr; the company was also considering the export of about 2 Mt/yr to an Asian steel producer and as much as 1 Mt/yr to East African cement producers. Jindal Steel & Power Ltd. of India was also exploring limestone deposits in Madagascar (Gulf Industrials Ltd., 2010, p. 4).

Mineral Fuels and Related Materials

Coal.—Asia Thai Mining Co. Ltd. of Thailand planned to continue with the development of a new mine in the Sakoa coalfield after completing a prefeasibility study. Straits Resources Ltd. of Australia engaged in exploration in the Sakoa coalfield in 2010 (Energizer Resources Inc., 2010).

Petroleum.—At the onshore Tsimiroro project (located in Block 3104), Madagascar Oil Ltd. of the United States conducted drilling for heavy petroleum in 2010. The company planned to conduct further drilling and to start a steam flood pilot project in late 2011. Tsimiroro was estimated to have resources of 965 million barrels of petroleum. 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 to make a decision on the construction of a pilot extraction plant by mid-2011. Bemolanga was estimated to have resources of 1.18 billion barrels (Madagascar Oil Ltd., 2010).

Thorium and Uranium.—In the second half of 2010, LP Hill plc of Australia engaged in rock chip, soil, and steam sediment sampling at the Tranomaro project. Plans to engage in drilling at Tranomaro depended on the results of the sampling program and receipt of environmental clearances. 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; exploration remained on hold in 2010 (Clarke, 2010; LP Hill plc, 2011).

Outlook

Madagascar's mineral industry is likely to grow significantly because of increased cobalt, ilmenite, nickel, rutile, and zircon production from 2011 to 2013, and the startup of vanadium production in 2014. Further growth in the mineral industry could result from the development of the Bemolanga and the Tsimiroro petroleum projects, the Sakoa coal project, and the Soalara Limestone project. The development of the Sakoa project was expected to decrease costs significantly for the Green Giant project. The development of the mineral industry will depend on world market conditions and domestic political stability (Energizer Resources Inc., 2010).

References Cited

Anglo-Malagasy Society Newsletter, 2011, Mining: Anglo-Malagasy Society Newsletter, March, no. 71, p. 17–18.

- Bull & Bear's Resource Investor, 2010, Tantalus project in Madagascar challenges Chinese monopoly in high-tech, green technology metals: Bull & Bear's Resource Investor, July, p. 17–19.
- Clarke, Jody, 2010, Politics alter investment environment: Mining Journal, April 30, p. 15–17.
- Edmond, R., 2010, Ciment—La consommation en baisse en attendant la grande cimenterie présidentielle: Midi Madagaskara, [Antananarivo, Madagascar], November 29. (Accessed August 20, 2011, at <http://fr.allafrica.com/stories/201011300418.html>).
- Energizer Resources Inc., 2010, Energizer Resources releases updated resource estimate; Green Giant tonnage more than doubles: Toronto, Ontario, Canada, Energizer Resources Inc. press release, November 30, 3 p.
- Feytis, Alexandra, 2010, The bright side of graphite: Industrial Minerals, July, no. 514, p. 31–39.
- Gambogi, Joseph, 2011, Titanium mineral concentrates: U.S. Geological Survey Mineral Commodity Summaries 2011, p. 174–175.
- Grace, K.M., 2011, Fuelling the future: Victoria, British Columbia, Canada, ResourceClips.com press release, January 31, 1 p.
- Gulf Industrials Ltd., 2010, Annual report 2010: Sydney, New South Wales, Australia, Gulf Industrials Ltd., 46 p.
- Isatelle, Flavie, 2010, Dark blue aquamarine from Tsaramanga, Madagascar: Gems & Gemology, v. 46, no. 4, Winter, p. 312–313.
- Jarrett, Diana, 2009, Madagascar mess: Rapaport Diamond Report, v. 32, no. 1, January, p. 172–173.
- LP Hill plc, 2011, Interim results for the six months ended 31 December 2010: South Perth, Western Australia, Australia, LP Hill plc, 9 p.
- Madagascar Oil Ltd., 2010, Admission to AIM & first day of dealing: Houston, Texas, Madagascar Oil Ltd. press release, November 29, 5 p.
- Malagasy Minerals Ltd., 2010a, Annual report to 30th June 2010: West Perth, Western Australia, Australia, Malagasy Minerals Ltd., 76 p.
- Malagasy Minerals Ltd., 2010b, Proposed merger with Madagascar Resources: West Perth, Western Australia, Australia, Malagasy Minerals Ltd. press release, September 24, 1 p.
- Malagasy Minerals Ltd., 2011, Quarterly report for the period ended 31st December 2010: West Perth, Western Australia, Australia, Malagasy Minerals Ltd., 19 p.
- McNeish, Hannah, 2010, Madagascar delays oil exploration licensing round on law changes: Bloomberg.com. October 21. (Accessed August 17, 2011, at <http://www.bloomberg.com/news/2010-10-21/madagascar-delays-oil-exploration-licensing-round-on-law-changes.html>).
- Mining Journal, 2005, Dynatec outlines major Malagasy project: Mining Journal, March 4, p. 7.
- Ministry of the Economy, Commerce, and Industry, 2010, Rapport économique et financier 2009-2010: Antananarivo, Madagascar, Ministry of the Economy, Commerce, and Industry, 105 p.
- National Institute of Statistics, 2000, Journée Africaine de la Statistique 1999—Les points saillants: Antananarivo, Madagascar, National Institute of Statistics, 42 p.
- Norcross Madagascar Group, [undated], Press releases: Norcross Madagascar Group. (Accessed August 4, 2010, at http://www.madagascarminerals.com/press_releases.cfm).
- Pardieu, Vincent, 2010, Update on sapphire mining in southern Madagascar: Gems & Gemology, v. 46, no. 4, Winter, p. 321–322.
- Pezzotta, Frederico, Adamo, Ilaria, and Diella, Valeria, 2011, Antetazambato, northern Madagascar—Review and new data: Gems & Gemology, v. 7, no. 1, Spring, p. 2–14.
- Razafindramiadana, Lantoniaina, 2010, Cimenterie—La deuxième unité de Maloci en veilleuse: L'Express de Madagascar [Antananarivo, Madagascar], March 10. (Accessed August 20, 2011, at http://www.cci.mg/index.php?p=journaux&id=4&id_det=2200#).
- Rondeau, Benjamin, Fritsch, Emmanuel, Mocquet, Blanca, and Luizac, Yves, 2009, Ambanja (Madagascar)—A new source of gem-diamond garnet: InColor, no. 11, Summer, p. 22–24.
- Sherritt International Corp., 2010, Sherritt provides update on the Ambatovy project: Toronto, Ontario, Canada, Sherritt International Corp. press release, December 17, 1 p.
- Wait, Megan, 2010, Encouraging results: Creamer Media's Mining Weekly, v. 16, no. 44, November 12–18, p. 18.
- Watkins, Eric, 2010, Reprise in Madagascar: Oil & Gas Journal, v. 108, no. 2, January 18, p. 37.

TABLE 1
MADAGASCAR: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2006 ^e	2007	2008 ^e	2009 ^e	2010 ^e
METALS					
Beryllium, beryl in quartz concentrates ^c	12,000	12,000	12,000	12,000	12,000
Chromium, marketable output:					
Chromite concentrate, gross weight	NA ^r	NA ^r	NA ^r	NA ^r	NA
Chromite ore, lumpy	NA ^r	NA ^r	NA ^r	NA ^r	NA
Total	132,335 ³	122,260 ³	84,000 ³	60,000 ³	90,000
Cobalt, mine output, Co content	-- ³	-- ³	-- ³	-- ³	700
Gold, mine output, Au content ^{e,4}	30	50	72 ³	70	70
Nickel, mine output, Ni content	-- ³	-- ³	-- ³	-- ³	7,500
INDUSTRIAL MINERALS					
Cement, hydraulic	150,000	270,000 ³	460,000	370,000 ^r	410,000
Gemstones: ^{e,5}					
Amethyst ⁶	920	920	600	20,000	20,000
Cordierite	160	160	30	60 ^r	80
Emerald	70	672 ^{3,7}	25	50 ^r	70
Garnet	600	600	100	200 ^r	300
Ruby	400	78 ^{3,7}	15 ^r	30	40
Sapphire	4,700	5,124 ^{3,7}	900 ^r	1,700 ^r	2,500
Tourmaline ⁶	68,000	68,000	54,000	43,000	48,000
Graphite, all grades	5,465 ^{r,3,7}	5,351 ^{r,3,7}	4,967 ^{r,3,7}	3,437 ^{r,3,7}	3,783 ^{3,7}
Gypsum ^e	500	500	500	500	500
Mica, phlogopite	1,071 ^{3,7}	1,349 ^{3,7}	1,233 ^{3,7}	358 ^{3,7}	2,069 ^{3,7}
Ornamental stones: ^{e,5}					
Agate	25,000	25,000	13,000 ^r	1,500 ^r	6,000
Labradorite	4,200	4,200	4,200	4,700 ^r	6,200
Quartz	1,665 ^{r,3,7}	1,677 ^{r,3,7}	887 ^{r,3,7}	104 ^{r,3,7}	407 ^{3,7}
Salt, marine ^{e,8}	75,000	75,000	75,000	75,000	75,000
Stone: ^e					
Limestone ⁹	190,000	350,000	400,000	320,000 ^r	360,000
Marble	5,000	5,000	5,000	4,000 ^r	4,500
Titanium:					
Ilmenite concentrate	-- ³	-- ³	-- ³	160,000 ^{r,3}	287,000 ³
Rutile concentrate	-- ³	-- ³	-- ³	3,200 ^r	5,700
Zirconium concentrate	-- ³	-- ³	-- ³	5,300 ^r	9,600
MINERAL FUELS AND RELATED MATERIALS					
Petroleum, crude	-- ³	-- ³	2 ³	2	--

^eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ^rRevised. do. Ditto. NA Not available. -- Zero.

¹Table includes data available through August 25, 2011.

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 Salinere 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 2010

(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	300,000.
Do.		do.	Plant at Ibity	160,000.
Do.		Madagascar Long Cimenterie (Maloci)	Plant at Ambohimanambola	360,000.
Chromium		Kraomita Malagasy S.A. (Government, 100%)	Mine at Ankazotaolana ¹	250,000.
Do.		do.	Mine at Bemanevika	200,000. ^e
Cobalt		Ambatovy Minerals S.A. (Sherritt International Corp., 40%; Sumitomo Corp., 27.5%; Korea Resources Corp., 27.5%)	Mine at Ambatovy	5,600.
Gemstones:				
Rough:				
Amethyst		Norcross Madagascar Group (NMG)	Mines at Ambatonrazaka	90. ^e
Aquamarine		Small-scale miners	Mine at Tsaramanga	NA.
Emerald	kilograms	Artisanal and small-scale miners	Mines at Mananjary	130. ^e
Garnet		do.	Mines at Antetetzambato	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.	2,000. ^e
Do.		Norcross Madagascar Group (NMG)	Mines at Maniry	1,200. ^e
Quartz		do.	Mines at Ramaratina	NA.
Do.		Small-scale miners	Mine at Tsaramanga	NA.
Ruby	kilograms	Artisanal and small-scale miners	Mines at Andilamena and Vatomandry	1,000. ^e
Sapphire	do.	Various producers, including the following: Artisanal and small-scale miners World Sapphire Group Tany Hafa S.A. Canalta Gems Inc. Nantin Ltd. and artisanal miners	Locations: Mines at Ilakaka, Manombe, Marosely, and Sakara Mines at Ilakaka Mines at Sahambano Mines at Nose-Be and Andovokonko Mines at Ankazoabo	5,000. ^e
Tourmaline	do.	Artisanal and small-scale miners	Mines at Alatsinainuy Ibity	NA.
Polished ²	do.	Dream Stones Trading	Plant in Antananarivo	15.
Graphite		Etablissements Gallois S.A.	Artsirakambo Mine near Brickaville	4,800.
Do.		do.	Marovinsty Mine near Vatomandry	3,600.
Do.		do.	Ambalafotaka Mine	NA.
Gypsum		Compagnie Salinere de Madagascar	Antsahampano	500.
Mica		Societe des Mines d'Ampandranhava	Tolagnaro	2,000 processed.
Nickel		Ambatovy Minerals S.A.	Mine at Ambatovy	60,000.
Petroleum, crude	thousand 42-gallon barrels	Madagascar Oil Ltd.	Tsimiroro ¹	17. ^e
Salt		Compagnie Salinere de Madagascar	Antsahampano	70,000.
Do.		Grand Salines du Menabe	Morondava	5,000. ^e
Titanium minerals		QIT Madagascar Minerals SA [QIT Fer et Titane of Canada (a subsidiary of Rio Tinto plc), 80%, and Government, 20%]	Mine at Mandena	750,000 ilmenite; 15,000 rutile.
Zirconium		do.	do.	25,000 zircon.

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

¹Not operating at the end of 2010.

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