



2014 Minerals Yearbook

MADAGASCAR

THE MINERAL INDUSTRY OF MADAGASCAR

By Thomas R. Yager

In 2014, Madagascar played a significant role in the world's production of cobalt, ilmenite, nickel, and zircon. The country's share of world mined and refined production of cobalt amounted to about 2.5% each; mined nickel, 1.6%; and zircon, 1%. Other domestically significant minerals produced included chromite, gemstones, and ornamental stones. Madagascar was not a globally significant consumer of minerals in 2014 (Bedinger, 2016a, b; Cobalt Development Institute, 2016; Kuck, 2016; Shedd, 2016).

Minerals in the National Economy

In 2014, the manufacturing sector accounted for 8% of the gross domestic product (GDP). The share of the mining and quarrying sector in the GDP increased to 4.2% in 2014 from 3.4% in 2013 and 1.1% in 2012; the increase was primarily attributable to increased production at the Ambatovy nickel-cobalt project (World Trade Organization, 2015, p. 13).

In 2014, total exports were valued at \$2.2 billion, of which nickel accounted for 27%; cobalt, 3.9%; and other minerals, including chromite, gemstones, graphite, ilmenite, mica, ornamental stone, rutile, and zircon, 5.1%. In 2007, total exports were valued at \$1.3 billion, of which minerals accounted for 2.9%. Increased mineral exports were attributable to the startup of ilmenite, rutile, and zircon production in 2009, and cobalt and nickel production in 2012 (World Trade Organization, 2015, p. 17).

In 2014, total imports were valued at \$3.3 billion, of which mineral fuels accounted for 22.1%, and mining and quarrying, 3.4%. In 2007, total imports were valued at \$2.4 billion, of which mineral fuels accounted for 16.6%, and mining and quarrying, 0.3% (World Trade Organization, 2015, p. 17).

In 2012 (the latest year for which data were available), formal employment in the mining and quarrying sector was about 12,500 workers. An additional 500,000 workers were estimated to be employed in artisanal mining, including about 350,000 in the gold mining subsector (World Bank Group, 2013, p. 17; 2015, p. 7).

Madagascar's mining and quarrying sector was governed by the Mining Code and its implementing decree (Law No. 99-022 of August 19, 1999, as amended by Law No. 2005-021 of October 17, 2005, and Decree No. 2006-910 of December 19, 2006). Exploration and production of petroleum was governed by the Petroleum Code and its implementing decree (Law No. 96-018 of September 4, 1996, and Decree No. 97-740 of June 23, 1997).

Production

In 2014, crude petroleum production increased by an estimated 261%; beryl, by an estimated 59%; amazonite, by an estimated 50%; ammonium sulfate, by 49%; chromite, by an estimated 48%; refined nickel, by 47%; refined cobalt, by 40%;

mined nickel, by an estimated 39%; and mined cobalt, by an estimated 31%. The production of rutile decreased by an estimated 45% in 2014; ilmenite and zircon, by an estimated 43% each; quartz, by an estimated 30%; agate, by an estimated 20%; and mica, by an estimated 13%. 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, gold, and mica. 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

Bauxite and Alumina.—Resources at the Manantenina project in southeastern Madagascar were estimated to be 10.1 million metric tons (Mt) of bauxite at a grade of 34.1% Al_2O_3 . Aziana Ltd. of Australia suspended field work in 2014 as it focused on searching for a joint-venture partner (Aziana Ltd., 2014, p. 13–14; Washbourne, 2014).

Chromium.—KRAOMA produced high-grade chromite from the Bemanevika Mine, which had a capacity of 150,000 metric tons per year (t/yr). In 2014, the company's production increased to an estimated 130,000 metric tons (t) from 88,000 t in 2013. The majority of KRAOMA's production was exported to China (Institut National de la Statistique de Madagascar, undated).

Cobalt and Nickel.—Sherritt International Corp. of Canada and its joint-venture partners mined nickel-cobalt laterite deposits at Ambatovy. Lateritic slurry from the Ambatovy ore-processing plant was processed into mixed cobalt and nickel sulfides at a pressure-acid-leaching plant at Toamasina. The sulfide product was processed at a refinery with a capacity of 60,000 t/yr of refined nickel and 5,600 t/yr of cobalt (Sherritt International Corp., 2015, p. 26).

In 2014, production of nickel and cobalt in mixed sulfides amounted to 39,968 t compared with 29,248 t in 2013. Refined nickel production increased to 37,053 t in 2014 from 25,148 t in 2013, and refined cobalt, to 2,915 t from 2,083 t. The recovery rate for nickel was 86% in 2014. Sherritt and its joint-venture partners planned to produce between 47,000 and 52,000 t of refined nickel in 2015; refined cobalt output was likely to be between 3,500 and 4,000 t. The life of the mine was estimated to be about 30 years (Sherritt International Corp., 2015, p. 14, 36, 40).

Copper and Gold.—Aziana was engaged in exploration at the Anosivola copper-gold project in 2014. The company hoped to identify resources of about 10 Mt at a grade of between 3% and 5% copper at Anosivola. Aziana also sold six of its gold exploration licenses to a Chinese company. Malagasy Minerals Ltd. (MML) of Australia engaged in soil sampling at its Ampanihy project in the second half of 2014 (Washbourne, 2014; Malagasy Minerals Ltd., 2015, p. 6).

Titanium and Zirconium.—QIT Madagascar Minerals S.A. (QMM) [owned by QIT Fer et Titane of Canada (a subsidiary of Rio Tinto plc, 80%, and the Government of Madagascar, 20%) mined ilmenite, rutile, and zircon at Mandena in southeastern Madagascar. In 2013, QMM produced 530,421 t of ilmenite and 31,345 t of zircon compared with 582,179 t of ilmenite and 31,242 t of zircon in 2012. The company's production decreased to an estimated 300,000 t of ilmenite and 18,000 t of zircon in 2014 because of weak demand in world markets; ilmenite output could decrease further to 240,000 t in 2015 (Extractive Industries Transparency Initiative Madagascar, 2015a, p. 7; 2015b, p. 64; Jorgic and Rabary, 2015).

In June 2014, World Titanium Resources Ltd. (WTR) of Australia submitted an Environmental Social Impact Assessment (ESIA) for its proposed Ranobe Mine, which is part of the Toliara Sands project in southwestern Madagascar. WTR planned to produce 407,000 t/yr of ilmenite and 44,000 t/yr of rutile and zircon concentrate at Ranobe. The company hoped to have Government approval of the ESIA in 2015. Depending on financing for the estimated capital cost of \$216 million, WTR could start production in 2021 and reach full capacity in 2023 (World Titanium Resources Ltd., 2014; World Bank Group, 2015, p. 15, 18).

Industrial Minerals

Cement, Clay, Pozzolanic Material, and Crushed Stone.—In 2014 Madagascar's cement output was 240,000 t compared with 230,000 t in 2013. Holcim (Madagascar) S.A. (Holcim Group of Switzerland, 90%) consumed clay, limestone, and pozzolanic material in the production of cement. In 2013, the company's production of pozzolanic material increased to 65,000 t from 54,979 t, and clay, to 29,751 t from 24,085 t. Limestone production remained nearly unchanged at 164,718 t in 2013 (Extractive Industries Transparency Initiative Madagascar, 2015a, p. 7; 2015b, p. 64).

Gemstones.—In recent years, Madagascar has produced a variety of gemstones that included aquamarine, emerald, and other types of beryl; demantoid, tsavorite, and other types of garnet; amethyst, citrine, and other types of quartz; and agate, amazonite, cordierite, jasper, labradorite, ruby, sapphire, and tourmaline. Most gemstones were exported prior to cutting and polishing.

In 2013, Red Graniti Madagascar SARL of Italy produced 3,591 t of labradorite at its quarry in the Atsimo-Andrefana Region compared with 1,564 t in 2012. EUROMAD S.A. of Italy, Marbres et Granits de Madagascar SARL (MAGRAMA) of Italy, and SQNY International of India had royalty agreements with MML of Australia to mine labradorite from the anorthosite intrusives at Ianapera and Maniry (Extractive

Industries Transparency Initiative Madagascar, 2015a, p. 7; 2015b, p. 64).

Norcross Madagascar Group of the United States mined agate, amazonite, amethyst, apatite, calcite, jasper, labradorite, rhodonite, rose quartz, and other quartz. In 2014, the company's amazonite production in the Amboasitra District increased by 50% compared with that of 2013. By June 2013, Norcross was producing beryl at its amazonite mine as a coproduct at the rate of 10 metric tons per month (t/mo). Beryl output was likely to have increased in 2014 as the mine had its first full year of production (Norcross Madagascar Group, 2013, 2015).

Most of the agate produced on Norcross' Ambarijeby agate property near Mahanjanga in the Boeny Region was mined illegally; illegal production estimated to be between 40 and 80 t/mo was shipped to China and an additional 10 t/mo was shipped to local cutting and polishing facilities in Antananarivo. Norcross managed to reduce illegal production by about 75% after July (Norcross Madagascar Group, 2015).

Graphite.—Madagascar's graphite production was limited in recent years by competition from Chinese producers, the depletion of near-surface deposits, high energy costs, and problems with infrastructure. Etablissements Gallois S.A. produced 3,833 t of graphite from the Ambalafotaka, the Antsirakambo, and the Marovintsy Mines in 2013 compared with 3,629 t in 2012; the company's production was unlikely to have changed substantially in 2014 (Syrett, 2012; Extractive Industries Transparency Initiative Madagascar, 2015a, p. 7; 2015b, p. 64).

In April 2014, Graphmada Equity Pte Ltd. (Stratmin Global Resources plc of the United Kingdom, 100%) was producing at the rate of about 1,400 t/yr at a grade of 92% graphite. Stratmin planned to increase production to 13,500 t/yr at a grade of 94% graphite. The estimated life of the mine was 10 years. Indicated resources at Loharno were estimated to be 421,000 t at a grade of 5.15% graphite, and inferred resources were estimated to be 5.23 Mt at a grade of 4.04% graphite (Industrial Minerals, 2014; Lismore-Scott, 2014).

Tirupati Carbon & Chemicals Pvt. Ltd. of India planned to open a new graphite mine and plant about 60 kilometers from Toamasina by the end of 2015. The mine and plant were likely to have a production capacity of 12,000 t/yr (Syrett, 2015).

In 2014, Energizer Resources Inc. of Canada estimated that measured resources at its Molo graphite deposit were 23.6 Mt at a grade of 6.32% graphite; indicated resources, 76.8 Mt at a grade of 6.25% graphite; and inferred resources, 40.9 Mt at a grade of 5.78% graphite. Energizer completed a preliminary economic assessment on a new mine at Molo in 2013 and planned to complete a feasibility study by the fourth quarter of 2013. Depending on favorable results of the study, Energizer could start construction at Molo in the second quarter of 2014 and mining by the fourth quarter of 2015. Production was likely to be 84,000 t/yr of graphite. The company subsequently revised the expected completion date of the feasibility study to February 2015 (Reed, 2013; Energizer Resources Inc., 2014).

MML engaged in drilling at the Maniry project in the second half of 2014. Aziana suspended field work at Antanisoa in 2014; the company was considering searching for a joint-venture partner for the project. In 2014, Aziana also sold a graphite

exploration property to a Chinese company (Washbourne, 2014; Malagasy Minerals Ltd., 2015, p. 2).

Mica.—Societe des Mines d’Ampandandra produced mica from its mines in southeastern Madagascar. Artisanal miners also produced mica near Analamaria in the Anosy Region. In 2014, national mica output decreased to an estimated 9,400 t from 10,779 t in 2013 (Institut National de la Statistique de Madagascar, undated).

Nitrogen.—Sherritt and its joint-venture partners consumed ammonia in the production of cobalt and nickel at Ambatovy. Ammonium sulfate fertilizer was produced as a byproduct; output increased to 97,780 t in 2014 from 65,410 t in 2013. The ammonium sulfate production capacity at Ambatovy was 210,000 t/yr (Sherritt International Corp., 2015, p. 40).

Rare Earths.—Tantalus Rare Earths AG of Germany was considering the development of a new mine at its rare earths project on the Ampasindava Peninsula in northwestern Madagascar. In December 2014, Tantalus revised its resource assessment to 628 Mt at a grade of 0.09% rare-earth oxides. The company estimated that neodymium would account for 33% of the revenues from a new mine; praseodymium, 19%; and dysprosium, 16% (Tantalus Rare Earths AG, 2014).

Mineral Fuels and Related Materials

Coal.—Lemur Resources Ltd. of Australia held the Ianapera, the Imaloto, and the Sakaraha projects in the northern part of the Greater Sakoa basin. In September 2013, Lemur completed a scoping study on a new mine at Imaloto with positive results. In the first 9 years of the mine’s life, the company could produce 410,000 t/yr of coal for use in a new coal-fired power station adjacent to the mine and 78,000 t/yr for export. In the remaining 10 years of the mine’s life, production could be 530,000 t/yr for use in the power station and 990,000 t/yr for export. Resources at Imaloto were estimated to be 136 Mt. The development of the mine depended on favorable results of further studies. As of the end of 2014, Lemur was engaged in a legal dispute over the ownership of a mining license at Imaloto (Lemur Resources Ltd., 2013; 2015, p. 2).

Petroleum.—In 2013, Madagascar Oil Ltd. of Bermuda started production at its pilot plant at the onshore Tsimiroro heavy oil project (located in Block 3104). The company produced nearly 360 barrels per day (bbl/d) in 2014 compared with about 100 bbl/d in 2013. In late October, Madagascar Oil submitted its development plan for Tsimiroro for approval by the Government. Depending on approval of the plan, Madagascar Oil planned to increase production to 6,000 bbl/d by 2018 and 10,000 bbl/d by 2020. Depending on the viability of an export pipeline, production could increase to between 25,000 and 50,000 bbl/d starting in 2024. Resources at Tsimiroro were estimated to be nearly 1.7 billion barrels (Madagascar Oil Ltd., 2014, p. 2, 6, 10, 12–13).

Outlook

In 2015, ammonium sulfate, cobalt, graphite, and nickel production is likely to increase. Madagascar could become one of the world’s leading graphite producers with the development of the Molo project. Ilmenite, rutile, and zircon production is

likely to decrease in 2015; output could increase in the future with the development of the Ranobe Mine. Further growth in the mineral industry could result from the development of coal, petroleum, and rare-earths projects. The development of the mineral industry will depend on world market conditions and domestic political stability.

References Cited

- Aziana Ltd., 2014, annual report 2013: Perth, Western Australia, Australia, Aziana Ltd., 103 p.
- Bedinger, G.M., 2016a, Titanium mineral concentrates: U.S. Geological Survey Mineral Commodity Summaries 2016, p. 178–179.
- Bedinger, G.M., 2016b, Zirconium and hafnium: U.S. Geological Survey Mineral Commodity Summaries 2016, p. 194–195.
- Cobalt Development Institute, 2015, 2014 production statistics: Cobalt News, v. 15, no. 2, April, p. 3–5.
- Energizer Resources Inc., 2014, Energizer Resources provides clarification on previous news release disclosures: Toronto, Ontario, Canada, Energizer Resources Inc. press release, December 29, 4 p.
- Extractive Industries Transparency Initiative Madagascar, 2015a, Rapport de reconciliation des paiements effectues par les industries extractives a l’Etat Malagasy et des percuces par l’Etat Malagasy exercice 2012: Antananarivo, Madagascar, Extractive Industries Transparency Initiative Madagascar, 128 p.
- Extractive Industries Transparency Initiative Madagascar, 2015b, Rapport de reconciliation des paiements effectues par les industries extractives a l’Etat Malagasy et des percuces par l’Etat Malagasy exercice 2013: Antananarivo, Madagascar, Extractive Industries Transparency Initiative Madagascar, 121 p.
- Industrial Minerals, 2014, Africa—Open for business?: Industrial Minerals, no. 557, February, p. 44–48.
- Institut National de la Statistique de Madagascar, [undated], Importation/exportation—Madagascar—2000–14: Institut National de la Statistique de Madagascar. (Accessed December 17, 2015, at <https://web.archive.org/web/20151113142038/http://instat.mg/madagascar-en-chiffres/>)
- Jorgic, Drazen, and Rabary, Lovasoa, 2015, Madagascar faces uphill struggle to revive bruised mining sector: Thomson Reuters, August 25. (Accessed December 14, 2015, at <http://uk.reuters.com/article/madagascar-mining-idUKL3N10W42720150825>.)
- Kuck, P.H., 2016, Nickel: U.S. Geological Survey Mineral Commodity Summaries 2016, p. 114–115.
- Lemur Resources Ltd., 2013, Imaloto coal project—Scoping study produces positive results: West Perth, Western Australia, Australia, Lemur Resources Ltd. press release, September 26, unpaginated.
- Lemur Resources Ltd., 2015, Annual report for the 14 month period ended 28 February 2015: West Perth, Western Australia, Australia, Lemur Resources Ltd., 80 p.
- Lismore-Scott, Siobhan, 2014, StratMin Global Resources: Industrial Minerals, no. 563, August, p. 58.
- Madagascar Oil Ltd., 2014, Delivering Madagascar’s first commercial heavy oil: Madagascar Oil Ltd., November, 28 p. (Accessed December 16, 2015, at <http://www.madagascaroil.com/wp-content/uploads/Company%20Presentation%206%20Nov%202014%20draft%2012%20Website.pdf>.)
- Malagasy Minerals Ltd., 2015, Activity report for the December quarter 2014: Mount Claremont, Western Australia, Australia, Malagasy Minerals Ltd., variously paginated.
- Norcross Madagascar Group, 2013, Press releases 2013: Norcross Madagascar Group. (Accessed August 21, 2014, at http://www.madagascarminerals.com/press_releases_2013.cfm.)
- Norcross Madagascar Group, 2015, Press releases: Norcross Madagascar Group. (Accessed December 16, 2015, at http://www.madagascarminerals.com/press_releases.cfm.)
- Reed, Camila, 2013, Turning a corner: Mining Journal, March 22, p. 12, 14.
- Shedd, K.B., 2016, Cobalt: U.S. Geological Survey Mineral Commodity Summaries 2016, p. 52–53.
- Sherritt International Corp., 2015, 2014 annual report: Toronto, Ontario, Canada, Sherritt International Corp., 142 p.
- Syrett, Laura, 2012, Elsewhere in the world: Industrial Minerals, no. 543, December, p. 61–63.
- Syrett, Laura, 2015, Tirupati to open 12,000 tpa Madagascan graphite mine in 2015: Industrial Minerals, no. 568, January, p. 9.

Tantalus Rare Earths AG, 2014, Tantalus Rare Earths AG—NI 43–101 technical report and updated resource estimate by SGS published (news with additional features): Gruenwald, Germany, Tantalus Rare Earths AG press release, December 17, 3 p.

Washbourne, Michael, 2014, Cash boost for focused Aziana: Australia's Paydirt, v. 1, no. 219, August, p. 104.

World Bank Group, 2013, Artisanal mining in critical ecosystems—A look at Gabon, Liberia, and Madagascar: Washington DC, World Bank Group, 23 p. (Accessed August 8, 2013, at <http://www.profor.info/sites/profor.info/files/docs/ASM-brochure.pdf>.)

World Bank Group, 2015, Economic contributions from industrial mining in Madagascar—Research summary: Antananarivo, Madagascar, World Bank Group, January 1, 48 p.

World Titanium Resources Ltd., 2014, Final environmental plan submitted for Ranobe mineral sands project: Mount Claremont, Western Australia, Australia, World Titanium Resources Ltd. press release, June 30, 2 p.

World Trade Organization, 2015, Trade policy review report by the Secretariat—Madagascar: Geneva, Switzerland, World Trade Organization, Report No. WT/TPR/S/318, June 9, 118 p.

TABLE 1
MADAGASCAR: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2010	2011 ^c	2012	2013	2014 ^c
METALS					
Beryllium, beryl in quartz concentrates ^e	12,000	12,000	16,000	85,000 ^r	135,000
Chromite, marketable output:	134,500	66,700 ³	111,500 ³	88,000 ^{r,3}	130,000
Cobalt:					
Mine output, Co content	--	-- ⁴	830 ^{r,c}	2,600 ^{r,c}	3,400
Refined	--	-- ⁴	493 ⁴	2,083 ⁴	2,915 ⁴
Gold, mine output, Au content ⁵	46	1 ⁴	157	--	-- ⁴
Nickel:					
Mine output, Ni content	--	-- ⁴	9,600 ^{r,c}	31,000 ^{r,c}	43,000
Refined	--	-- ⁴	5,695	25,148	37,053 ⁴
Titanium minerals:					
Ilmenite concentrate:					
Gross weight	287,000	521,627 ^{r,4}	620,700 ^r	530,421 ^r	300,000
TiO ₂ content	170,000 ^r	310,000 ^r	370,000 ^r	320,000 ^r	180,000
Rutile concentrate	5,700	9,000 ^r	12,000 ^r	11,000 ^r	6,000
Zircon concentrate	7,490	18,242 ^{r,4}	31,242 ^{r,4}	31,345 ^r	18,000
INDUSTRIAL MINERALS					
Ammonium sulfate	--	-- ⁴	15,823	65,410	97,780 ⁴
Cement, hydraulic ^e	150,000 ^r	160,000 ^r	230,000 ^r	230,000	240,000
Clay:					
Kaolin	259	260	230 ^r	200 ^r	200
Other	NA	NA	24,085	29,751	30,000
Gemstones: ^{e,6}					
Amethyst ⁷	90,000 ^r	90,000 ^r	90,000 ^r	90,000	90,000
Cordierite	80	80	100 ^r	100	100
Emerald	2	70 ^r	140 ^{r,3}	140	140
Garnet	300	300	400	400	400
Ruby	90	50 ^r	24 ^{r,3}	25	25
Sapphire	2,300	2,500 ^r	2,606 ^{r,3}	2,400	2,300
Tourmaline ⁷	20,000 ^r	25,000 ^r	25,000 ^r	25,000	25,000
Graphite, all grades	3,783 ³	3,573 ³	2,885 ³	5,283 ^{r,3}	5,316 ³
Gypsum	127	130	130	130	130
Mica, phlogopite	2,069 ³	3,411 ³	12,532 ³	10,779 ^{r,3}	9,400
Ornamental stones: ^{e,6}					
Agate	1,000 ^r	1,000 ^r	1,000 ^r	1,000 ^r	800
Amazonite	120	240 ^r	240 ^r	280 ^r	420
Calcite	NA	NA	200	175	180
Labradorite	6,800 ^r	7,000 ^r	8,500 ^r	11,000 ^r	11,000
Quartz	407 ³	214 ³	221 ³	415 ^{r,3}	290
Salt, marine ^{e,8}	78,000 ^r	85,000	85,000	85,000	85,000

See footnotes at end of table.

TABLE 1—Continued
MADAGASCAR: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2010	2011 ^c	2012	2013	2014 ^d
INDUSTRIAL MINERALS—Continued					
Stone:					
Dolomite	NA	NA	2,540	3,730	3,800
Granite	1,543 ³	3,701 ³	2,519 ³	3,078 ^{r,3}	3,100
Limestone ^{e,9}	110,000 ^r	110,000 ^r	164,183 ^r	164,718 ^r	170,000
Marble	--	1 ³	--	--	--
Pozzolan material	NA	NA	54,979	65,000	65,000
Titanium minerals:					
Ilmenite concentrate:					
Gross weight	287,000	521,627 ^{r,4}	620,700 ^r	530,421 ^r	300,000
TiO ₂ content	170,000 ^r	310,000 ^r	370,000 ^r	320,000 ^r	180,000
Rutile concentrate	5,700	9,000 ^r	12,000 ^r	11,000 ^r	6,000
Zircon concentrate	7,490	18,242 ^{r,4}	31,242 ^{r,4}	31,345 ^r	18,000
MINERAL FUELS AND RELATED MATERIALS					
Petroleum, crude	thousand 42-gallon barrels	--	-- ⁴	36	130

^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 February 22, 2016.

²In addition to the commodities listed, sand and gravel, ornamental stones in addition to those listed (apatite and rhodonite), industrial abrasives, and calcite presumably were produced, but available information was inadequate to make reliable estimates of output.

³Reported exports.

⁴Reported production.

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

⁶Does not include smuggled artisanal production.

⁷Includes both gem and ornamental quality.

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 2014

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Madagascar Long Cimenterie (Maloci)	Plant at Ambohimambola	360,000.
Do.	Holcim (Madagascar) S.A. (Holcim Group, 90%)	Plant at Ibity	150,000.
Chromium	Kraomita Malagasy S.A. (KRAOMA) (Government, 100%)	Mine at Bemanevika	150,000.
Clay	Holcim (Madagascar) S.A.	Mine in Vakinankaratra Region	30,000. ^c
Cobalt:			
Mine	Ambatovy Minerals S.A. (Sherritt International Corp., 40%; Sumitomo Corp., 27.5%; Korea Resources Corp., 27.5%)	Mine at Ambatovy	6,500. ^c
Refined	do.	Refinery near Toamasina	5,600.

See footnotes at end of table.

TABLE 2—Continued
MADAGASCAR: STRUCTURE OF THE MINERAL INDUSTRY IN 2014

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Gemstones:				
Amazonite		Norcross Madagascar Group	Mine in Amboasitra region	420. ^c
Amethyst		do.	Mines at Ambatonrazaka	90. ^c
Aquamarine		Small-scale miners	Mine at Tsaramanga	NA.
Emerald	kilograms	Artisanal and small-scale miners	Mines at Mananjary	150. ^c
Garnet		do.	Mines at Behara	NA.
Labradorite		Norcross Madagascar Group (NMG)	Quarries at Maniry	3,600. ^c
Do.		Red Graniti Madagascar SARL	Quarry in Atsimo-Andrefana Region	3,600. ^c
Do.		Marbres et Granits de Madagascar SARL (MAGRAMA) and EUROMAD S.A.	Quarries at Ianapera and Maniry	3,000. ^c
Do.		SQNY International	do.	2,000. ^c
Do.		Societe Labrador Madagascar	Quarry in Atsimo-Andrefana Region	600. ^c
Quartz		Norcross Madagascar Group (NMG)	Mines at Ramaratina	NA.
Do.		Small-scale miners	Mine at Tsaramanga	NA.
Ruby	kilograms	Artisanal and small-scale miners	Mines at Andilamena and Vatomaniry	100. ^c
Sapphire	do.	Various producers, including the following: Artisanal and small-scale miners Tany Hafa S.A.	Locations: Mines at Ilakaka, Manombe, Marosely, and Sakara Mines at Sahambano	2,600. ^c
Tourmaline		Artisanal and small-scale miners	Mines at Alatsinainy Ibity	NA.
Graphite		Etablissements Gallois S.A.	Artsirakambo Mine near Brickaville	4,800.
Do.		do.	Marovinsty Mine near Vatomaniry	3,600.
Do.		do.	Ambalafotaka Mine	NA.
Do.		Graphmada Equity Pte Ltd.	Mines at Antsirabe and Loharano	2,200. ^c
Do.		do.	Plant at Loharano	2,200.
Gypsum		Compagnie Salinere de Madagascar	Antsahampano	500.
Mica		Societe des Mines d'Ampandandrava (SOMIDA)	Mines in Anosy Region	1,000.
Do.		Artisanal and small-scale miners	do.	NA.
Nickel:				
Mine		Ambatovy Minerals S.A.	Mine at Ambatovy	70,000. ^c
Refined		do.	Refinery near Toamasina	60,000.
Nitrogen		do.	do.	210,000 ammonium sulfate.
Petroleum, crude	thousand 42-gallon barrels	Madagascar Oil Ltd.	Tsimiroro	180.
Salt		Compagnie Salinere de Madagascar	Antsahampano	80,000.
Do.		Grand Salines du Menabe	Morondava	5,000. ^c
Stone, dimension:				
Dolomite		PROCHIMAD	Quarry in Amoron'i Mania Region	3,800. ^c
Granite		Granitex SARL	Quarry in Manjakandriana Region	3,300. ^c
Limestone		Holcim (Madagascar) S.A.	Quarry in Vakinankaratra Region	170,000. ^c
Pozzolan material		do.	do.	65,000. ^c
Titanium minerals		QIT Madagascar Minerals S.A. [QIT Fer et Titane (a subsidiary of Rio Tinto plc, 80%, and Government, 20%)]	Mine at Mandena	750,000 ilmenite; 15,000 rutile.
Do.		Mainline Mining Ltd.	Mine in Analanjirofo Region ¹	80,000. ^c
Zirconium minerals		do.	do.	40,000 zircon.

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

¹Not operating at the end of 2014.