

THE MINERAL INDUSTRY OF MADAGASCAR

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Chromite and graphite remained the most significant minerals produced in Madagascar in 1994. In addition to these minerals, the Malagasy mining industry produced some industrial mineral commodities, including a variety of semiprecious gemstones. Mineral production was a small contributor to the overall gross domestic product (GDP), which was estimated at \$10.4 billion in 1993, the last year for which data were available.² In the near term, foreign investment will be needed to further develop the mining industry. In 1994, the Government began to plan for the liberalization and privatization of aspects of the economy, to include the mining and mineral fuels sectors, with the eventual goal of a free market economy. The Government nationalized all mineral resources, with the exception of graphite and mica, in 1975.

By yearend 1994, a scheduled revision of the 1990 mining permits code had not taken place. The current mining code had been rejected by operators and the lack of a planned revision caused the World Bank to deny a scheduled \$10 million loan grant for the mining sector. The loan would also have been used to create another government agency, the technical assistance bureau for mining operators (BATEM), which would function under the guidance of France's Bureau de Recherches Géologiques et Minières (BRGM). As of yearend 1994, the Mining Code, Law No. 90-017 of 1990, revised and augmented the earlier Law No. 89/007 of December 12, 1989. The law stipulated three types of mining permits. The permits were further subdivided into exploration and exploitation permits. Type-I permits were for exploration and exploitation. Granted to individuals or groups of Malagasy nationality, type-I permits were valid for 2 years. Type-II and type-III permits were designed for small-to-large mining companies that were incorporated under Malagasy law. The duration of validity of type-II and type-III exploration permits was 3 and 5 years, respectively. Under the new mining code, the maximum size of type-II and type-III exploration permits was 400 square kilometers (km²) and 1,000 km², respectively. Type-II and type-III exploitation permits stipulated 100 km² and 200 km², respectively.

Petroleum legislation was to be rewritten for 1995. These new incentives were to attract foreign operators back to Madagascar after disappointing earlier exploration rounds. The Petroleum Code, Law No. 80-001 of June 6, 1980, provided for two different types of production-sharing contracts. The first type of contract covered equity ventures between foreign oil operators and the Office Militaire

National pour les Industries Stratégiques (OMNIS). The Government maintained 51% ownership, and cost and production-sharing were financed by income tax payments and royalties based on achieved rates of return.

Beginning in 1993, the Government planned privatization and reform for certain commercial ventures, including petroleum refining and distribution. These plans included restructuring Solitany Malagasy (SOLIMA), which operated the petroleum refinery at Toamasina. The closure of the Toamasina refinery had also been suggested. Additionally, the Government deregulated the petroleum market in 1993, but lifting prices to a level with global market prices was resisted.

By yearend 1994, Canada's Quebec Fer et Titane Inc. (QIT) had made no significant progress toward exploiting the ilmenite sands near Toalagnaro. In 1990, OMNIS conducted an environmental impact study of QIT's proposed dredge mining of coastal ilmenite sands. The study concluded that the mining operation would destroy 75% of the coastal forest zone over an area of 30 km². QIT had suggested that special conservation areas be set up to limit mining damage to the environment. At yearend, the World Bank had not offered any support for QIT's program.

The Government continued to seek multilateral and bilateral cooperation to aid in controlling the degradation of the environment incurred during the past few years. Uncontrolled slash-and-burn cultivation, deforestation, livestock overgrazing, and massive erosion threatened Madagascar's agricultural and hydroelectric potential, and the country's unique wildlife.

Official Government production figures for minerals were unavailable for 1994. However, production levels of all mineral commodities are assumed to have remained at 1993 levels. (*See table 1.*)

Mineral exports had to be authorized by the Ministry of Mines and Energy (MEM), with the exception of mineral samples associated with exploration. Significant amounts of gold and semiprecious stones were smuggled out of the country; this illegal trade was of concern to the Government. Planned for 1995, MEM was to form a new gold trading agency, which would attempt to increase the Government's share of revenue from gold production and trade. Characteristically, the Government's official gold statistics reported 37 kilograms (kg) exported in 1992 and less than 1 kg in 1993. Actual smuggled gold would make the export amounts far greater than official statistics indicated. The

Government was seeking cooperation from neighboring nations, such as Mauritius, to help interdict gold smuggling.

Madagascar imported all of its crude petroleum and some petroleum products, which was a significant burden to the economy. In any given year, the value of petroleum imports was equivalent to 15% to 30% of the total foreign exchange earnings garnered through exports.

The chromite industry in Madagascar was controlled by the parastatal (government-controlled company) Société Kraomita Malagasy (Kraoma). Graphite and mica production were owned and operated by foreign entities, but the Government had significant influence on these operations through taxes, royalties, and official approval of all foreign exchange transactions. Office Militaire National pour les Industries Stratégiques OMNIS, created in 1976, was involved primarily in research, joint ventures, and promotion of Madagascar's mineral potential, including hydrocarbons, and acted as the repository of the acquired exploration data. The MEMs' primary responsibility was for the energy sector. The execution of the MEMs' directives was carried out by the Directorate of Energy. The MEM also directed SOLIMA and the Electricity and Water Co. (JIRAMA). The distribution, importation, and refining of petroleum products were managed by SOLIMA.

Madagascar's chromite ore was mined from the area around Andriamena. Initiated in 1967, chromite production from the Andriamena district generally remained stable in recent years. A minimum of 25 chromite lenses had been identified within the dunite host rocks of the Andriamena complex, and more lenses may yet be identified. Ore beneficiation enabled Kraoma to produce a chromite concentrate grading 48% to 50% chromium oxide (Cr_2O_3) with 0.002% to 0.003% phosphorus and lumpy chrome ore grading 42% to 44% Cr_2O_3 according to a Government report. Typically, crude Malagasy chromite contained 0.007% phosphorus.

Madagascar had some scattered placer and lode gold deposits, and there existed a large black market for the mining and sale of gold. The Government officially reported only a few kilograms of gold production annually. However, actual production varied between 2 and 3 metric tons per year (mt/a) with an annual estimated value of \$25 million. The gold mining was primarily artisanal and employed approximately 5,000 to 10,000 people.

Madagascar continued to be a producer and exporter of high-quality crystalline flake graphite. Graphite was produced in Madagascar by five main companies, all headquartered in Antananarivo. Société Minière de la Grande Ile (SMGI) was the largest producer, and the other four producers were Etablissements Gallois, Société Louys, Etablissements Izouard, and Etablissements Rostaing. Three mines were operated by SMGI, with production of about 6,000 mt/a of graphite with a carbon content of 90% to 95%. A joint-venture partner or new owner was being sought by SMGI.

Madagascar had no domestic crude petroleum production. The country was entirely dependent on imports of crude

petroleum. In any given year, total petroleum consumption averaged about 21 million barrels per year. During the past several years, there was a modest amount of oil exploration by foreign companies in Madagascar. As of yearend 1993, no commercial hydrocarbon finds were reported. Established in 1966, the country's sole refinery was at Toamasina with a total throughput refining capacity of 16,500 barrels per day (bbl/d) with 2,600 bbl/d of catalytic reforming capacity.

Official estimates of chromite resources in Madagascar were 2.1 million metric tons (Mmt) of contained chromium, or less than 1% of the world total. Graphite reserves were estimated at more than 1 Mmt. The Government stated that Madagascar had significant deposits of bastnasite, bauxite, ilmenite, and iron ore. Deposits of coal, lignite, and uranium minerals also were known from the island. Discovered in the 1940's, total minable reserves of uranium-bearing minerals remained undetermined. Some small-scale mining of uranium-bearing minerals occurred, but was subsequently abandoned. Copper-nickel deposits existed, but were not considered economic. Semiprecious gemstone deposits have long been mined and exported in Madagascar; the Government desired to organize and streamline the industry to better exploit these resources.

Infrastructure development in Madagascar was inadequate for most mining development. Additional foreign aid was needed to improve the road system and telecommunications network. The hydroelectric potential of Madagascar was estimated at 14,000 megawatts (MW), but remained underexploited. Current installed hydropower capacity was 106 MW. Petroleum loading and unloading facilities existed at Toamasina, but were limited to oceangoing vessels of 50,000 deadweight tons.

The new Government's policy of liberalization and privatization toward a free market economy could conceivably attract foreign investment in the mining sector. However, the lack of infrastructure, coupled with increasingly strict environmental protection policies and insufficient capital investment, could forestall development in the mining sector, at least in the short term.

¹Text prepared Aug. 1995.

²Where necessary, values have been converted from Madagascar francs (FMG) to U.S. dollars at the rate of FMG3,790=US\$1.00.

Major Sources of Information

Ministry of Industry, Energy and Mines

Geological Department

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Office Militaire National pour les Industries

Stratégiques (OMNIS)

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Direction de L'Institut National de la
Statistique et de la Recherche Economique:
Bulletin Mensuel de Statistique, monthly.

Major Publication

Ministere des Finances et du Plan,

TABLE 1
MADAGASCAR: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Kilograms unless otherwise specified)

Commodity 3/	1990	1991	1992	1993	1994 e/
METALS					
Beryllium: Beryl in quartz concentrates, industrial and ornamental e/	3,350	3,000	3,000	3,000	3,000
Chromium: Chromite concentrate, gross weight metric tons	47,000	56,000	69,000	61,000	43,000
Chromite ore, lumpy do.	104,000	94,000	92,000	83,000	48,000
Total do.	151,000	150,000	161,000	144,000	91,000
Gold, mine output, Au content e/ 4/	216	200	200	200	200
Rare-earth minerals: e/					
Bastnasite (60% REO) metric tons	5	5	5	5	5
Monazite (55% REO)	100	100	100	100	100
INDUSTRIAL MINERALS					
Abrasives, natural: (industrial only) e/	10,000	10,000	10,000	10,000	10,000
Cement, hydraulic e/ metric tons	60,000	60,000	60,000	60,000	60,000
Clay, kaolin do.	485	496	756	700	700
Feldspar e/	5,000	4,000	4,000	4,000	4,000
Gemstones:					
Amazonite	2,190	2,000	2,000	2,000	2,000
Amethyst:					
Gem	1,710	1,700	1,700	1,700	1,700
Geodes e/	86	80	80	80	80
Citrine	50	6	6	6	6
Cordierite	1,560	20	7	7	7
Garnet	6,910	6,000	300	300	300
Tourmaline	54	302	257	300	300
Graphite, all grades metric tons	18,000	14,100	8,910	8,000	8,000
Mica, phlogopite:					
Block do.	93	90	4	4	4
Scrap do.	538	500	716	700	700
Splittings and sheet do.	90	90	78	70	70
Total do.	721	680	798	774	774
Ornamental stones:					
Agate	4,700	9,500	5,990	5,900	5,900
Apatite	1,140	4,000	4,000	4,000	4,000
Aragonite metric tons	786	126	120	120	120
Calcite do.	3,760	1,410	1,400	1,400	1,400
Celestite	26,000	26,000	1,320	1,300	1,300
Jasper	23,600	11,700	68,300	68,000	68,000
Labradorite	24,000	35,000	61,700	61,000	61,000
Other gem and ornamental e/ metric tons	250	250	250	250	250
Quartz:					
Crystal e/	32,000	32,000	32,000	32,000	32,000
Geodes e/	2,700	2,500	2,500	2,500	2,500
Hematoid	3,160	560	330	300	300
Piezoelectric	160	66,200	66,000	66,000	66,000
Rose quartz	10,800	4,800	27,700	27,000	27,000
Smelting e/	180,000	180,000	180,000	180,000	180,000
Other ornamental	14,400	1,270	3,600	3,000	3,000
Tourmaline	4,100	302	300	300	300
Salt, marine e/ metric tons	30,000	30,000	30,000	30,000	30,000
Stone:					
Calcite, industrial e/ do.	2,000	2,000	2,000	2,000	2,000
Dimension stone e/ do.	3,000	3,000	3,000	3,000	3,000
Marble, cipoline e/ do.	1	1	1	1	1
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Distillate fuel oil thousand 42-gallon barrels	798	922	900	900	900
Gasoline do.	405	434	400	400	400
Kerosene and jet fuel do.	253	291	290	290	290
Residual fuel oil do.	504	500	500	500	500
Other do.	26	20	20	20	20
Total do.	1,990	2,170	2,110	2,110	2,110

e/ Estimated.

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Table includes data available through Aug. 1995.

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

4/ Does not include an estimate of smuggled artisanal production.