



# 2010 Minerals Yearbook

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SIERRA LEONE [ADVANCE RELEASE]

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# THE MINERAL INDUSTRY OF SIERRA LEONE

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Diamond remained the most significant mineral commodity to Sierra Leone's economy. The country was the world's 10th ranked producer of diamond, by volume, in 2010 and the world's third ranked producer of rutile. Other mineral commodities produced included bauxite, cement, gold, and ilmenite (Gambogi, 2011; Kimberley Process Rough Diamond Statistics, 2011).

## Government Policies and Programs

Sierra Leone adopted into law a new Mines and Minerals Act in 2009. Under the new law, all rights of ownership in and control of minerals in Sierra Leone were vested in the state. The Ministry of Mineral Resources and Political Affairs was the Government agency responsible for the general administration and implementation of the law. The Sierra Leone Geological Survey was responsible for undertaking the geologic mapping of Sierra Leone, in addition to reconnaissance and exploration operations and the compilation, publication, and dissemination of information concerning the geology and mineral resources of the country. The Minerals Advisory Board was responsible for advising and making recommendations to the Minister of Mines on matters relating to minerals, including reconnaissance, exploration, mining, processing, import and export, and the marketing of minerals; monitoring the implementation of every Government policy relating to minerals; granting applications for mining licenses, and renewing, suspending, transferring and canceling licenses, among other tasks (Ministry of Mineral Resources and Political Affairs, 2009, p. 12-14, 15-17; 2011; Revenue Watch Institute, undated).

## Production

In 2010, bauxite production increased by 44% to 1.0 million metric tons (Mt) from 757,000 metric tons (t) in 2009; cement production increased by 27.4% to 300,980 t from 236,240 t; diamond production, by 9.2% to 437,516 carats; gold production, by 72.2% to 270 kilograms (kg); ilmenite production, by 20% to 18,206 t; and rutile production, by 6.8% to 68,198 t. Data on mineral production are in table 1.

## Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

## Mineral Trade

Based on statistics reported by the Kimberley Process Certification Scheme, a total of 550,395 carats of diamond worth \$129.6 million was exported in 2010. In terms of volume, this indicated an increase of 37% compared with diamond exports in 2009; the value of these exports increased by 64%.

Sierra Leone's exports to the United States were valued at about \$29 million compared with about \$24.3 million in 2009; \$3.9 million of these exports was rough diamond. Imports from the United States were valued at about \$61 million in 2010 compared with \$42.5 million in 2009; these included \$142,000 in iron and steel products, \$349,000 in drilling and oilfield equipment, and \$6.8 million in excavating machinery (U.S. Census Bureau, 2011a, b).

## Commodity Review

### Metals

**Bauxite and Alumina.**—Netherlands-based Vimetco N.V. operated the country's only bauxite mine. In December, the company decided to operate Sierra Leone's bauxite mines without the support of a contractor and transferred its bauxite mining management to Alum S.A of Romania in 2011. The Romanian alumina producer is a wholly owned subsidiary of Alro S.A., in which Vimetco held an 84.2% interest. In 2010, bauxite production was about 1.0 Mt compared with 757,000 t in 2009 (Vimetco N.V., 2011a, b).

In June, Sierra Leone Exploration and Mining Company Ltd. (SLEMCO) signed a joint-venture agreement with India-based ABG Shipyard Co. to mine bauxite in Porto Loko District, which is located about 120 kilometers (km) northeast of the country's capital city of Freetown in Northern Province. Based on satellite observations, the joint venture estimated that there are reserves of 321 Mt of bauxite in Porto Loko District and part of Kambia. The joint venture envisioned producing about 10 Mt/yr for a period of 34 years. The joint venture also planned the construction of a \$400 million alumina refinery (Economic Times, The, 2010; Samba, 2011).

**Gold.**—London-based Cluff Gold plc, through its subsidiary Baomahun Gold Ltd., held a 100% interest in the Baomahun gold project, which is located about 180 km east of Freetown in Southern Province. In June, Cluff Gold announced a 27% increase in the project's measured and indicated mineral resources at Baomahun, which were reported to be 15 Mt at an average grade of 2.9 grams per metric ton (g/t) gold. Inferred mineral resources were estimated to be 12 Mt at an average grade of 2.6 g/t gold. A preliminary assessment (scoping study) was completed in August. The assessment indicated that Baomahun had the potential to be developed as an open pit and underground gold mine. The assessment estimated an average production of about 4,883 kilograms per year (kg/yr) (reported as 157,000 troy ounces per year) of gold during a mine life of 8 years. The company expected to begin production at Baomahun by mid-2013. Cluff Gold planned to conduct a 12,000-meter (m) diamond drilling program in the first quarter of 2011 and expected to have initial results in the second quarter of 2011. Work on a definitive feasibility study

was ongoing and was expected to be completed by the third quarter of 2011. The company expected to complete a feasibility study for a hydroelectric powerplant by the fourth quarter of 2011. Environmental and social studies, the development of engineering plans, and mine infrastructure planning were underway (Cluff Gold plc, 2011, p. 8-11, 55).

Axmin Inc. of Canada continued to explore for gold at the Komahun gold project, which is located within the Nimini Hill concession in east-central Sierra Leone. In December, Axmin's exploration licenses for the Matotoka, the Nimini Hills East, and the Nimini Hills West prospects were renewed for 2 years. The Makong mining license was not renewed, and the exploration expenditures were written off. In 2008, the indicated mineral resources at Komahun were estimated to be 370,000 t at a grade of 9.1 g/t gold and the inferred mineral resources were estimated to be 3.1 Mt at a grade of 4.3 g/t gold. A preliminary economic assessment in 2009 indicated that the Komahun project had the potential to be developed as an underground gold mine with target production levels of about 1,600 kg/yr (reported as 50,000 troy ounces per year) and an estimated mine life of 6 years. The company planned to conduct a drilling program at Komahun by 2011 (Axmin Inc., 2011, p. 7-8).

**Iron Ore.**—Bermuda-based African Minerals Ltd. (AML) held 100% ownership in the Tonkolili project, which is located in the Sula Mountains Greenstone Belt about 190 km from Tagrin Point. In August, the Government granted and the Parliament ratified the mining lease for the Tonkolili project and related infrastructure, which included two mining licenses, for a period of 25 years. In December, SRK Consulting completed a preliminary mineral resource estimate that totaled 12.8 billion metric tons (Gt) of measured, indicated, and inferred resources for the Kasafoni, the Marampon, the Numbara, and the Simbili deposits combined. The mineral resource estimates, which were based on 199,602 m of diamond drilling, included 126.6 Mt of direct-shipping hematite lump ore at an average grade of 59.1% iron, 11.5 Gt of magnetite at an average grade of 30.1% iron, and 1.1 Gt of sapolite at an average grade of 40% iron. The first phase of the project was expected to begin in the fourth quarter of 2011, which included the rehabilitation of Pepel Port, the reconstruction of a 74-km railway, the completion of a new 126-km narrow-gage railroad, and the establishment of a mine at a cost of \$1.2 billion. The company expected direct-shipping hematite lump ore production of about 12 million metric tons per year (Mt/yr) at an average grade of about 59.1% iron during a mine life of 9 years. The second phase would include new port facilities at Tagrin Point and a 37-km narrow-gage railroad at a cost of \$2 billion. Production from the second phase was expected to reach 35 Mt/yr of hematite concentrate from the exploitation of sapolite during a mine life of 18 years. A definitive feasibility study for phase 2 was expected to be completed by 2011. The third phase of the project included the production of 45 Mt/yr of magnetite concentrate, the construction of a large-scale magnetite concentrator, and the construction of the 220-km standard-gage rail line from the mine to the port at Tagrin at a cost of \$6 billion. The company put the phase 3 feasibility study program on hold in the second quarter of 2010 and planned to focus on the completion of phases 1 and 2 instead. In June, China Railways Materials

Commercial Corp. invested \$247 million in AML and signed an agency agreement for the sale of iron to China. The agreement included the sale of about 5 to 8 Mt/yr from the hematite production in phases 1 and 2 for a minimum of 20 years. The AML expected to change the agreement into a fixed offtake agreement by 2014. The company also had a guaranteed offtake agreement for about 10 Mt/yr of magnetite for its phase 3 for a minimum of 20 years (African Minerals Ltd., 2011, p. 7, 24-27).

Cape Lambert Resources Ltd. of Australia acquired 100% interest in the Marampa iron ore project, which is located 90 km northeast of Freetown. In October, the Government granted the company three reconnaissance licenses covering a total area of about 917 square kilometers (km<sup>2</sup>). Cape Lambert also submitted to the Government five applications for reconnaissance licenses covering about 120 km between Marampa and Kukuna. As of December, a total of 24,749 m of diamond and reverse-circulation drilling was completed at Marampa, which included resource drilling at the Gafal West and the Matukia prospects and initial drilling at the Mafuri, the Makambo, the Petifu, and the Rotret prospects. A preliminary mineral resource estimate was conducted by Golder Associates Pty Ltd. of Australia, which totaled 197 Mt of inferred resources at an average grade of 28.5% iron, for the Gafal West and Matukia prospects. Cape Lambert expected to have a mineral resource update for the Gafal West, the Gafal South, the Matukia, the Mafuri, and the Rotret prospects by July 2011. A scoping study at Marampa was ongoing by Bateman Engineering Pty Ltd. for the establishment of a standalone open pit mining operation and a concentrator to produce 5 Mt/yr of hematite concentrate. The company expected to announce the results of the study by early 2011. Cape Lambert planned to begin production in late 2012 with an expected mine life of 20 years based on preliminary mineral resource estimates (Cape Lambert Resources Ltd., 2010a, b; 2011a, p. 66, b).

In July, Cape Lambert and AML signed an agreement that gave Cape Lambert the right of access to the Marampa railway and Pepel Port. Cape Lambert would have an initial minimum transport capacity of 2 Mt/yr and hold 33% interest in the Marampa infrastructure. AML and the Government held the remaining 57% and 10% interests, respectively. Rehabilitation of the Marampa infrastructure was underway in 2010 (Cape Lambert Resources Ltd., 2011a, p. 66).

**Titanium and Zirconium.**—Sierra Rutile Ltd. (SRL) of the British Virgin Islands owned and operated the Sierra Rutile Mine, which is located in southwestern Sierra Leone near the Imperri Hills about 30 km from the Atlantic Ocean and 135 km from the capital city of Freetown. The mine produced 7,092 t of zircon, 68,198 t of rutile, and 18,206 t of ilmenite, during the year, which was an increase of 27.5%, 20.1%, and 6.8%, respectively, compared with that of 2009. The company expected production of rutile and ilmenite in 2011 to be similar to the 2010 levels of production owing to the company's plans to move its Dredge 1 to a new part of the current ore body, and that production would increase in 2012. The company planned to limit zircon production in 2011 until the SRL strategic review, which would cover plans to expand rare-earth element production, was completed in the fourth quarter of 2011. The company expected to increase ilmenite and rutile production by

2012. An updated resource estimate for SRL's deposits reported total measured, indicated, and inferred mineral resources to be about 600 Mt of rutile. The company continued with its exploration program to increase the life of its operations and planned to conduct a new drilling program in 2011 and 2012. The company expected to optimize the dredge deployment strategy, improve mine planning, and identify further expansion to the ore reserve (Sierra Rutile Ltd., 2011, p. 1, 6, 11-12).

### **Industrial Minerals**

**Diamond.**—The Government and Koidu Holdings S.A signed a new agreement for the Kouidu kimberlite project mining lease area in September. In November, the Parliament ratified the mining lease agreement, which contained provisions for the mining and commercial exploitation of the Kouidu kimberlite and development of the surrounding community. The Kouidu kimberlite project was located within the Tankoro Chiefdom of the Kono District of Eastern Province about 2 km from Koidu, which is the district capital (AllAfrica Global Media, 2010; Awareness Times Newspaper, 2010).

In April, New York-based Dolat Ventures Inc. acquired a 75% stake in Millennium Mining LLC of Sierra Leone. Millennium was the company that operated alluvial diamond mining in Sewa River, which is located within the Tinkonko Chiefdom of the Bo District of Southern Province. The company announced that its daily processing capacity was 20 t of gravel with an average finding of about 7 to 10 carats per day of diamond. The diamond was extracted from the ground by hand and washed in a 2-t wash plant. In July, Dolat announced the installation of the new wash plant, which has two 4.3-m wash pans and a grease-separating system. The new wash plant would increase its processing capacity to 90 metric tons per hour of gravel. The company expected to increase capacity to about 1,500 metric tons per day of gravel and to find an average of 600 carats per day of diamond (Dolat Ventures, Inc., 2010a-c).

Mexivada Mining Corp. of Canada, through its subsidiary Mexivada Gold and Diamond Mining Company (SL) Ltd., discontinued its small-scale mining test along Nayafi Stream in the Kono District in May 2009. The company announced unfavorable distribution in the stream channel and an insufficient quantity of diamond to establish a full-scale operation (Mexivada Mining Corp., 2009).

Guernsey-Paragon Diamonds Ltd. through its subsidiary Sierra Leone Hard Rock Ltd. held 100% ownership in the Konoma alluvial diamond project, which is located about 220 km east of Freetown in the Kono District. The company held four mining exploration licenses covering a total area of 162 km<sup>2</sup> along the Bafi River. The mining facilities at Konoma included a 2-Mt/yr dense media separation (DMS) plant, a smaller mobile 5-Mt/yr DMS sampling plant, a mining fleet, laboratory equipment, and a main camp. Konoma, which resumed operations in February, produced 5,400 carats of diamond during the year. Indicated and inferred mineral resources were estimated to be 119,000 carats of diamond. In 2010, the company concentrated its diamond operation on reserve and resource delineation at Konoma (Obtala Resources plc, 2010; Paragon Diamonds Ltd., 2011, p. 3).

Stellar Diamonds plc, through its subsidiary Sierra Leone Ltd., held 100% ownership in the Tongo kimberlite dyke project in eastern Sierra Leone. The company began a bulk sampling program in June with the objective to collect 1,000 to 2,000 carats for grade and value estimation of the diamond. The program was expected to be completed by early 2011 (Stellar Diamonds plc, 2010).

### **Mineral Fuels**

**Petroleum.**—Sierra Leone did not produce or refine petroleum and was dependent upon imports for its petroleum requirements. On November 15, however, Houston-based Anadarko Petroleum Corp. announced a deepwater discovery at its Mercury-1 exploration well within offshore exploration Block SL 07B-10, which is located about 64 km east-southeast of the company's Venus B-1 discovery. The Mercury-1 well, which was drilled to a total depth of approximately 4,861 m (reported as 15,950 feet) in about 1,600 m (reported as 5,250 feet) of water, reportedly encountered more than 41 m (reported as 135 net feet) of oil pay crude in two Cretaceous fan systems. The company planned to conduct additional exploration and appraisal drilling by 2011. Anadarko (65%) operated the Mercury-1 well in joint venture with Repsol Exploracion Sierra Leone, S.L. (25%), and Tullow Sierra Leone B.V. (10%) (Anadarko Petroleum Corp., 2010).

### **Outlook**

Sierra Leone's economy is likely to continue to depend greatly on revenues from the diamond sector. The passage of the new Mines and Minerals Act suggests that the country is on its way to establishing a transparent investment climate, which is likely to attract foreign direct investment (FDI) in the mineral sector. The presence of multinational corporations engaged in iron ore exploration also suggests that FDI in the mineral sector is likely to continue to increase in the coming years. The country's infrastructure is likely to be revamped in the next 5 to 8 years if proposed infrastructure developments, which include the construction of a hydroelectric powerplant, ports, railroads, and roads, come to fruition as part of the planned investments in the mineral industry.

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TABLE 1  
SIERRA LEONE: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Commodity		2006	2007	2008	2009	2010
Bauxite	thousand metric tons	1,072	1,169	954	757	1,090
Cement		234,440	235,830	254,160	236,240	300,980
Diamond <sup>2</sup>	carats	603,566 <sup>3</sup>	603,623 <sup>3</sup>	371,261 <sup>3</sup>	400,843 <sup>3</sup>	437,516 <sup>3</sup>
Gold, mine output, Au content	kilograms	71	212	191	157	270
Ilmenite, gross weight <sup>4</sup>		13,819	15,750	17,528	15,161	18,206
Rutile, gross weight		73,802	82,527	78,908	63,864	68,198

<sup>1</sup>Table includes data available through August 18, 2011.

<sup>2</sup>About 60% gem quality and 40% industrial quality.

<sup>3</sup>Source: Kimberley Process Certification Scheme.

<sup>4</sup>In addition to ilmenite and rutile, the country produced small amounts of zircon.

TABLE 2  
SIERRA LEONE: STRUCTURE OF THE MINERAL INDUSTRY IN 2010

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bauxite	Sierra Mineral Holdings I Ltd. (Vimetco N.V., 100%)	Sierra Minerals Mine, 150 kilometers southeast of Freetown	1,200
Cement	Sierra Leone Cement Corp. Ltd.	Freetown plant	NA
Diamond	thousand carats Koidu Holdings S.A. (KHS) (BSG Resources Ltd., 65%, and Magma Diamond Resources Ltd., 35%)	Two kimberlite pipes, 2 kilometers from the district capital of Koidu	120
Titanium, ilmenite	Sierra Rutile Ltd.	Sierra Rutile Mine, 130 kilometers southeast of Freetown	15
Titanium, rutile concentrate	do.	do.	100

do. Ditto. NA Not available.