



2010 Minerals Yearbook

FRENCH GUIANA, GUYANA, AND SURINAME
[ADVANCE RELEASE]

THE MINERAL INDUSTRIES OF FRENCH GUIANA, GUYANA, AND SURINAME

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FRENCH GUIANA

French Guiana has been a French overseas Department since 1946, and as such is subject to French and European law. French Guiana's economy is dependent on that of France through trade and subsidies. In 2010, besides gold mining, other important industries in French Guiana were aerospace (mainly at the French space center in Kourou), fishing, and forestry. The mineral sector was administered by France. French Guiana's leading mineral commodity export was gold; the country imported chemicals, food, fuels, machinery, and transport equipment from France (IAMGOLD Corp., 2011a; U.S. Central Intelligence Agency, 2011).

Minerals in the National Economy

French Guiana's mineral resources included, in order of value, gold, petroleum, kaolin, niobium, tantalum, and clay. As of November 4, 2009 (the latest date for which information was available), the French authorities had not yet announced a new mining framework for French Guiana but had published a working document as a first step. In February 2009, the French Government declared a moratorium on all mining and exploration activities in French Guiana until a new "mining framework" was completed and assessed. This announcement suspended the granting of mining licenses pending the outcome of environmental reviews of exploration on all French Guiana concessions (U.S. Central Intelligence Agency, 2011).

IAMGOLD Corp. of Canada planned to work actively with Government officials and key stakeholders to develop a plan that would allow development of the Camp Caiman deposit, subject to appropriate restrictions and regulations (IAMGOLD Corp., 2011a).

The French Government, through the Prefect of French Guiana, released a new decision on August 26, 2010, however, which again denied a mining permit for the Camp Caiman project. IAMGOLD filed an appeal of this new decision on October 26, 2010, with the assistance of environmental experts (IAMGOLD Corp., 2011a, b).

Production

The leading mineral commodities produced in French Guiana in 2010 were cement, clays, crushed stone, gold, niobium and tantalum, and sand. Data on mineral production are in table 1.

Structure of the Mineral Industry

In recent years, the mineral industry of French Guiana had been focused on gold and petroleum exploration. Gold

exploration was conducted by Golden Star Resources Ltd. of the United States. Golden Star held 100% interest in the Paul Isnard gold project for most of the year. The property is located in the western part of French Guiana, 200 kilometers (km) west of Cayenne and is accessible from St-Laurent-du-Maroni by air and road. The Paul Isnard project covers rocks of the lower Proterozoic Paramaka Formation, which contains gold mineralization in the form of pyritic disseminated zones and sulfide-rich shear zones. As of January 2009, Golden Star reported an inferred mineral resource estimate of 9.2 million metric tons (Mt) grading 2.5 grams per metric ton (g/t) gold at Montagne d'Or on the southern boundary of the Paul Isnard concession (Columbus Gold Corp, 2011, p. 10; Golden Star Resources Ltd., 2011).

Golden Star sold the Paul Isnard and other projects to Auplata S.A. of France on December 2, 2010. Auplata entered into a joint-venture agreement with Columbus Gold Corp. (CGC) of Canada to complete exploration and to develop the Paul Isnard gold project. Under the agreement, CGC had the right to earn an initial 51% interest in the Paul Isnard project during a 2-year period by incurring minimum exploration expenditures of \$7 million, and by issuing common shares equal to 49% in a combination of Auplata (34%) and Pelican Venture SAS (Pelican) (15%). CGC could earn a 100% interest in Paul Isnard by completing a feasibility study during a 4-year period. On December 3, 2010, CGC entered into a final option agreement to acquire the Paul Isnard gold project, which includes the Montagne d'Or gold deposit, which is estimated to contain 2 million troy ounces of gold within 33.2 Mt of ore grading 1.69 g/t gold (Columbus Gold Corp, 2011, p. 10; Golden Star Resources Ltd., 2011; Reuters.com, 2011).

IAMGOLD held a 100% interest in the Camp Caiman gold development project, which is located 45 km southeast of Cayenne. According to the feasibility study for the Camp Caiman project, the deposit's proven and probable minable reserves as of January 2009 were estimated to contain 34.2 t (1.1 million troy ounces) of gold within 12.3 Mt of ore averaging 2.8 g/t gold; measured and indicated reserves were estimated to contain 49.8 t (1.6 million troy ounces) of gold within 20.4 Mt of ore averaging 2.5 g/t gold; and inferred reserves were estimated to contain 7.7 t (249,000 troy ounces) of gold within 3.8 Mt of ore averaging 2.1 g/t gold (IAMGOLD Corp., 2011a, b).

Commodity Review

Metals

Gold.—Gold exploration and investment activities in French Guiana were ongoing at projects with significant gold

anomalies, such as the Wayamaga contact between the Armina and the Orapu formations and the Paul Isnard gold project. Extensive exploration has been conducted at Paul Isnard, including airborne topographic surveys, airborne geophysical surveys, metallurgical studies, and a soil geochemical survey. The planned budget at Paul Isnard was \$8.5 million in 2011 for a two-phase drilling program. The planned resource confirmation and potential expansion within the Montagne d'Or gold deposit were to take place in the second half of 2011 (Columbus Gold Corp., 2011, p. 17).

IAMGOLD was planning to develop the Camp Caiman gold deposit using an open pit mining method. The mill would process 5,500 metric tons per day (t/d), or more than 2 million metric tons per year (Mt/yr), of ore, subject to the mining and milling capacities for the diverse categories of gold in the estimated reserves and resources (IAMGOLD Corp., 2011a, b).

Mineral Fuels

Petroleum.—In South America, Tullow Oil plc of the United Kingdom had interests in the prospective Guyana Basin, which includes French Guiana, Guyana, and Suriname. According to Tullow, the Guyana Basin offers significant frontier exploration opportunities, including geologic structures that are similar to those of the Jubilee field of Ghana across the Atlantic Ocean. Tullow had collected more than 9,000 km of two-dimensional (2-D) seismic data and 380 km of three-dimensional (3-D) seismic data in the basin's Guyane Maritime portion block to advance a number of known leads to drillable prospect stage. Tullow's drilling program in an area of 2,500 square kilometers (km²) was based on the 3-D seismic data completed in March 2010. Processing and interpretation of the drilling data were to take place during 2010. In the fourth quarter of 2009, Tullow entered into a joint-venture agreement with two new partners in the French Guiana acreage—Royal Dutch Shell plc of the Netherlands (45%) and the Total S.A. of France (25%)—which left Tullow with a 27.5% interest and the Northern Petroleum Plc of the United Kingdom with the remaining 2.5%. The joint venture was formed in preparation for high-impact drilling, which was planned to commence on the Zaedyus prospect in March 2011. The assignment of interests to both Shell and Total was, however, awaiting formal approval from the French Government. Tullow was also drilling a strategic deepwater basin-testing well on the Zaedyus prospect (Tullow Oil plc, 2011, p. 5, 34, 157).

Outlook

A new mining framework has not yet been presented by the Government, but a working document was made available in early 2009, which provides for a consultative process in which investors are active participants. Once the new mining framework is in place, gold exploration and investment activities in French Guiana will likely move forward at projects with significant gold anomalies, such as the Wayamaga contact between the Armina and the Orapu formations where Golden Star has outlined a potential for gold resources. Columbus Gold and IAMGOLD are also likely to move forward with their Paul

Isnard and Camp Caiman gold projects, respectively (Columbus Gold Corp., 2011, p. 17; IAMGOLD Corp., 2011a).

Tullow's petroleum exploration projects are expected to progress and expand through new ventures, portfolio management, license rounds, and exploration. The evaluation of data collected in 2009 will continue in 2010, and key exploration campaigns are planned for 2011 (Tullow Oil plc, 2011, p. 5).

References Cited

- Columbus Gold Corp., 2011, Distinguished mine finders—Nevada & French Guiana: Columbus Gold Corp., 57 p. (Accessed June 23, 2011, at http://www.columbusgoldcorp.com/i/pdf/columbus-gold-presentation_2011.04.04.pdf.)
- Golden Star Resources Ltd., 2011, South American exploration—Paul Isnard gold project sold to Auplata SA: Golden Star Resources Ltd. (Accessed June 23, 2011, at <http://www.gsr.com/Operations/SouthAmerican.asp>.)
- IAMGOLD Corp., 2011a, Operations—Development projects—Camp Caiman, French Guiana: IAMGOLD Corp. (Accessed June 23, 2011, at <http://www.iamgold.com/English/Operations/Development-Projects/Camp-Caiman/default.aspx>.)
- IAMGOLD Corp., 2011b, Recent developments outlook—Camp Caiman project, French Guiana: IAMGOLD Corp. (Accessed June 23, 2011, at <http://www.iamgold.com/English/Operations/Development-Projects/Camp-Caiman/Recent-Developments-Outlook/default.aspx#top>.)
- Reuters.com, 2011, Auplata SA acquires stake in Columbus Gold Corp., Columbus to hold 51%: Reuters.com, December 2. (Accessed June 23, 2011, at <http://www.reuters.com/assets/sdPrint?aid=2036161&tocker=ALAU.PA&repo=ADC56>.)
- Tullow Oil plc, 2011, 2010 annual report and accounts: Tullow Oil plc, 168 p. (Accessed June 24, 2011, at http://www.tulloil.com/files/pdf/reports/2010_annual_report.pdf.)
- U.S. Central Intelligence Agency, 2011, French Guiana, in *The world factbook*: U.S. Central Intelligence Agency. (Accessed June 14, 2011, at <http://www.cia.gov/library/publications/the-world-factbook/geos/fr.html>.)

GUYANA

Guyana's gross domestic product (GDP) based on purchasing power parity increased to \$6.4 billion in 2010 from \$5.2 billion in 2009, or by almost 23.1%. This increase was in spite of the effects of the global financial crisis and was attributed to positive performances in the services, construction, transportation, and communication sectors. The agriculture and manufacturing sectors also recorded positive growth whereas the mining and quarrying sector contracted because of reduced production of bauxite, which decreased by 24%, and diamond, which decreased by 65.3%; gold output, however, increased by almost 1.1% (table 1). Inflation was 6.8% in 2010 compared with 2.9% in 2009 owing to rising food prices. The value of Guyana's exports was estimated to be about \$814 million in 2010; exports included such commodities as bauxite and alumina, food products, gold, and timber. Guyana's export partners included Canada (27.5%), the United States (17%), the United Kingdom (10.8%), the Netherlands (5%), Trinidad and Tobago (4.3%), Jamaica (4.1%), and others (31.3%). Imports were valued at nearly \$1.4 billion and included such products as food, machinery, manufactures, and petroleum. Guyana's import partners included the United States (25.2%), Trinidad and Tobago (23.2%), Cuba (6.4%), and China (6.1%) (Bank of Guyana, 2011, p. 7, 9, 15; U.S. Central Intelligence Agency, 2011).

Minerals in the National Economy

Output in the mining sector decreased by 6.9% owing to decreases in the production of bauxite and diamond and despite an increase in gold output. Bauxite production decreased to 1.1 Mt in 2010 from 1.4 Mt in 2009, reflecting the decrease in world demand and falling prices. Diamond production decreased to 49,920 carats in 2010 from 143,982 carats in 2009. Gold production increased slightly to 9,594 kilograms (kg) in 2010 from 9,492 kg in 2009 owing to high gold prices and increased production by small- and medium-scale miners. Bauxite and gold were the country's major mineral exports (table 1; Bank of Guyana, 2011, p. 10).

Government Policies and Programs

According to Canada-based Sacre-Coeur Minerals, Ltd., Guyana has been friendly towards foreign investment, particularly to investment in natural resource development, during the past decade. General business, mining, and tax laws are well developed and uniformly administered, including duty-free and tax-free import privileges for mining equipment. Several major successful natural resource ventures were commissioned by foreign investors in the past 10 years, including the world-class Omai gold mine, which was a joint venture of two North American mining companies, IAMGOLD and Golden Star (Sacre-Coeur Minerals Ltd., 2011b).

In Guyana all mineral rights are vested in the State. The Guyana Geology & Mines Commission (GGMC) is the Government agency that regulates all activities in the Mines Division and Petroleum Division in accordance with the Mining Act of 1989. The GGMC examines Guyana's mining concessions, mining and prospecting permits and licenses, and quarry licenses; it also promotes mineral development and performs mineral exploration. The Mines Division of the GGMC provides services to the mining sector. Mining licenses, which are issued in the production phase, are granted for a period of 20 years and can be renewed indefinitely. Operating plans must be filed with the the GGMC. Annual dues are progressive, beginning at \$0.50 per acre and increasing to a maximum of \$3.00 per acre over 6 years during the prospecting phase. Once production begins, the prospecting license must be converted to a mining license, and the annual dues increase to \$5.00 per acre. Gold production from all types of mineral concessions in Guyana is subject to a statutory 5% net smelter return royalty, payable to the Guyana Gold Board. From time to time, the Government of Guyana has reduced this royalty/severance tax to a lesser figure during periods of low gold prices and under individually negotiated tax concessions to motivate development of major mineral projects (Guyana Geology & Mines Commission, 2011; Sacre-Coeur Minerals Ltd., 2011a).

The Petroleum Division regulates all activities in the crude oil industry; provides timely economic, environmental, and technical advice; and supports competitiveness and efficiency in the petroleum sector. The GGMC issues three types of licenses: the petroleum prospecting license, which is issued for a period of 4 years, with two optional renewals to extend the exploration period for 3 more years each; the petroleum production license,

which runs for 20 years; and the production-sharing agreement, which offers such incentives as a 75% cost recovery, 50% profit share, and 10% reduced consumption tax on fuel for petroleum exploration operations, among other incentives (Guyana Geology & Mines Commission, 2011).

Production

In 2010, Guyana continued to be a significant industrial minerals producer in the world. The production of bauxite decreased to 1.1 Mt in 2010 from about 1.4 Mt in 2009, or by about 24%. The production of diamond decreased by almost two-thirds; gold production increased slightly to 9,594 kg from 9,492 kg in 2009, or by nearly 1.1%; production of construction materials increased, and production of crushed stone and sand increased by more than 51% and 36%, respectively (table 1; Bank of Guyana, 2011, p. 10; Bray, 2011).

Structure of the Mineral Industry

Table 2 is a list of the major mineral industry facilities in Guyana. The table provides the location and production capacities of these facilities. Bosai Minerals Group Co., Ltd. (BMG) (also known as Nanchuan Minerals Group Co., Ltd.) was a leading privately owned corporation that was based in Chongqing, China. BMG's subsidiary Bosai Minerals (Guyana) Inc. operated a bauxite mine and processing operation in Linden, Guyana. This operation produced the well-known RASC refractory bauxite, as well as chemical and cement grades. The operation's annual production amounted to 600,000 t in 2010. These grades of bauxite were exported worldwide by Bosai Minerals. BHP Billiton Ltd. of Australia and Goldstone Resources Inc. of the United Kingdom were interested in exploring laterites for a source of bauxite. Guyana Goldfields Inc. (a Canada-based junior mineral exploration company primarily focused on the exploration and development of gold deposits in the Guiana Shield in South America) was undertaking technical studies to advance and develop the Aurora gold project in Guyana. Sacre-Coeur Minerals was engaged in the acquisition, exploration, and development of properties for the potential mining of diamond and gold in the Guiana Shield, initially focusing on exploration for gold on its properties in Guyana (Guyana Goldfields Inc., 2011; Nanchuan Minerals Group, 2011; Sacre-Coeur Minerals Ltd., 2011b).

Commodity Review

Metals

Bauxite and Alumina.—In 2010, the value of exports of bauxite increased to \$114.6 million from \$79.5 million in 2009. The increase was owing to the significant increase in the export price to \$100.9 per metric ton in 2010 from \$56.5 per metric ton in 2009 for metallurgical-grade bauxite used for the production of alumina (table 1; Bank of Guyana, 2011, p. 15-16; Bray, 2011).

According to the GGMC, feasibility studies were to be conducted for an alumina plant with a capacity of at least 250,000 metric tons per year (t/yr), a hydroelectric plant, and a

smelter. For that purpose, the Guyana Government and United Company RUSAL of Russia entered into a letter of intent to conduct the feasibility studies, which could start by the end of 2011. The Omai bauxite mine contains estimated reserves of 200 Mt. Bosai Minerals' target for production was planned to be 400,000 t/yr of calcined alumina. Also, BHP Billiton and Goldstone Resources were planning to evaluate the Pakaraima laterites as a source of bauxite feed for an alumina plant (Guyana Geology & Mines Commission, 2011).

Gold.—In 2010, the increase in gold production in Guyana was owing to consistently active mining by small- and medium-scale miners that benefited from the continued increase in gold prices on the international market. Guyana's gold exports amounted to \$346.2 million, which was 23% higher than in 2009. This increase was owing to higher export prices. The average export price per troy ounce of gold increased by more than 26.7% to \$1,144.6 per troy ounce from \$903.1 per troy ounce in 2009. The export volume, however, decreased by 3% to 302,654 troy ounces (9.4 t) from 311,884 troy ounces (9.7 t) in 2009 (Bank of Guyana, 2011, p. 15-16).

Guyana Goldfields' principal interest was in its Aurora gold property, where the company continued to conduct exploration and development work. The Aurora property consists of a number of gold deposits, which are located on the eastern side of the Aurora zoned intrusion in the Cuyuni greenstone belt of the Guiana Shield in the Amazon Craton. Guyana Goldfields planned to begin the first year of production at the Aurora gold project by 2013 and to produce an average of 7,776 kilograms per year (250,000 troy ounces per year) during a 17-year mine life with an operating cash cost of \$364 per troy ounce. Guyana Goldfields expected that the Aurora gold project would be a large, highly profitable world-class gold mine which would be developed and come online in the next 3 years. On January 28, 2009, Guyana Goldfields acquired the Aranka gold property, which is located 30 km northeast of the Aurora area and had 19 contiguous prospecting licenses. The Aranka gold project was in the prospecting and exploration stage. Current activities included field mapping, geochemical sampling, and testing of potential zones by trenching and exploratory drilling (Guyana Goldfields Inc., 2011).

Sacre-Coeur held six gold permits—the Kartuni regional block, the Kurupung regional block, the Lower Puruni regional block, the Million Mountain property, the Northwest regional block, and the Potaro-Kuribrong regional block. The Million Mountain area and the adjacent Peters Mine area are one of Guyana's gold mining centers. Owing to the drilling conducted in and around the Peters Mine's main open pit and the Million Mountain Block, seven new highly prospective targets for gold mineralization were identified; each of these new zones is characterized by a silica-rich intrusive body intruded into brittle greenstones (Sacre-Coeur Minerals, Ltd., 2011b).

Infinito Gold Ltd. of Canada held 100% interest in the Marudi Mountain gold project, which is divided into the following four zones: the Marudi Ridge, the Mazoa, the Paint Mountain Ridge, and the Peace Creek-Toucan Hill. Infinito Gold had an agreement with Shoreham Resources Ltd. of Canada to accelerate the development of the Marudi Mountain and Paint Mountain gold prospects. Shoreham would earn 75% interest

upon completing \$4 million in exploration during 4-year period, and Infinito Gold would hold 25% interest in the joint venture if a mine is developed (Infinito Gold Ltd., 2011).

Industrial Minerals

Diamond.—In 2010, diamond production in Guyana decreased to 49,920 carats from 143,982 carats in 2009 (table 1) as a result of mining more gold than diamond and owing to relatively low prices on the global market for diamond. During 2009-10, two Canada-based companies were actively prospecting for diamond in Guyana—Infinito Gold and Sacre-Coeur. Infinito Gold held interest in the Maple Creek and the Potaro projects. In 2010, the Maple Creek project produced a small amount of diamond. Infinito Gold had an agreement with Shoreham for the Potaro diamond prospect to acquire 100% interest in return for cash and a gross overriding royalty. Sacre-Coeur held prospecting permits for the Kurupung River region, which is an important historic diamond producer in Guyana; the Potaro-Kuribrong regional block, which is located in north-central Guyana; and a claim permit and claim license in the Mahdia-Issano regional block, which is located in northwestern Guyana (Infinito Gold Ltd., 2011; Olson, 2011; Sacre-Coeur Minerals, Ltd., 2011b).

Mineral Fuels and Related Materials

Petroleum and Natural Gas.—CGX Energy Inc. is a Canada-based oil and gas exploration company focused on the exploration for oil in Guyana. ON Energy Inc. (a public company registered in Guyana) was owned by CGX (62%) and local investors (38%). CGX held interest in 39,659 km² (9.5 million acres) offshore Guyana. The company had interest in the following four offshore properties: the Corentyne License Annex, the Corentyne License, and the Pomeroun License (100% ownership in each); and the Georgetown License (25% interest). Onshore, the company had a 62% interest in the Berbice License. Several significant targets identified in the Corentyne Petroleum Prospecting License (PPL) included the Eagle prospect, which covers 117.4 km² (29,000 acres) and had an estimated potential resource of 610 million barrels (Mbbbl) of oil, and the Wishbone West prospect, which had an estimated potential resource of more than 100 Mbbbl of oil. Because of disputes concerning the offshore border between Guyana and Suriname, however, particularly the long-standing dispute with Suriname about the axis of the territorial sea boundary in potentially oil-rich waters, restrictions on access to a portion of the contracted area in the Corentyne PPL was extended to June 2013 (CGX Energy Inc., 2011a).

In June 2010, the partners to the Georgetown Block, which included Repsol Exploration S.A. of Spain (Repsol) (operator), Tullow Guyana B.V. of the United Kingdom, and CGX contracted the *Atwood Beacon* jack-up drilling rig (operated by Atwood Oceanics Pacific Ltd.), to drill a well on the Georgetown Block offshore Guyana at a per-day operating rate of about \$115,000. Also, CGX intended to drill two exploratory wells offshore Guyana—the Jaguar-1 well on the Georgetown Block and the Eagle-1 well on the Corentyne PPL.

CGX's portion of the costs associated with the drilling of the Jaguar-1 well was estimated to be between \$30 million and \$40 million, and the cost of drilling the Eagle-1 well was estimated to be about \$40 million (CGX Energy Inc., 2011b, p. 7–9).

In November 2009, Tullow had added to its portfolio of South American projects through the acquisition of a 30% interest in the Georgetown Block from Repsol YPF S.A. of Spain. The block covers 11,100 km² in water depths of 50 to 200 meters (m) and has geologic characteristics similar to those of French Guiana and to proven basins on the other side of the Atlantic. An extensive 3-D seismic survey of the Georgetown Block was completed early in 2009. The data had been processed and interpreted and a number of stratigraphic trap prospects of the Upper Cretaceous and Tertiary Periods had been identified. Drilling of a first exploratory well was expected to begin by the end of 2010 (Tullow Oil plc, 2011, p. 53).

According to the GGMC, four additional companies were licensed to undertake exploratory work in Guyana: Century Guyana Ltd., CGX, Exxon Mobil Corp. of the United States, and Repsol YPF. Other companies interested in the Guyana's petroleum sector included CGX's ON Energy and Groundstar Resources Ltd. of Canada, and Sadhna Petroleum Inc. of Trinidad and Tobago. ExxonMobil planned to commence seismic work to determine whether drilling should take place offshore. Sadhna was to drill several wells along the coastal areas of Berbice and Demerara in the Takutu basin in the Rupununi; the GGMC would drill at three places in the northwest that had historical reports of gas emissions. The GGMC also anticipated that Groundstar Resources would be doing work in the Takutu basin, and that ON Energy would be drilling in Berbice and Canje; CGX would also be doing work offshore (Guyana Geology & Mines Commission, 2011).

Uranium.—U3O8 Corp. of Canada obtained exclusive uranium exploration rights from the GGMC for two permitted areas in western Guyana (the Roraima Basin and the Kurupung Batholith) for a total of 1.3 million hectares. Under the agreement with the GGMC, U3O8 Corp. had the right to apply for a maximum of 35 prospecting licenses. U3O8 Corp. was focusing on the Roraima Basin; the company considered the Roraima Basin to be geologically similar to the Athabasca Basin, which contains the world's largest known resource of uranium and accounts for 20% of world's uranium production. U3O8 Corp. expected to start drilling the most promising areas of the Roraima Basin in 2010. U3O8 Corp. had also defined an initial NI 43-101 uranium resource in the Kurupung Batholith, which contains 5.8 million pounds, or 2.6 Mt, of equivalent yellow cake—uranium concentrate (U₃O₈) at 0.100% (indicated reserves) and 1.3 million pounds, or 590,000 t, of U₃O₈ at 0.090% (inferred resources) (U3O8 Corp., 2011).

Outlook

Production of bauxite, diamond, and gold will likely continue to be dominant commodities in Guyana's mining sector. Bosai Minerals expects to produce 600,000 t/yr of calcined alumina. Prospecting for diamond is likely to continue in the Kurupung River and the Maple Creek region, which are important historic diamond producers, and in the Potaro-Kuribrong regional

blocks, which are located in north-central Guyana. Gold exploration activities are likely to continue as a result of several gold exploration projects that progressed in 2010. Uranium exploration in the Roraima Basin and the Kurupung Batholith in western Guyana will likely intensify. The future plans of Prometheus Resources (Guyana) Inc. (a subsidiary of U3O8 Corp.) in Guyana include a detailed exploratory program in its uranium permit areas. Offshore hydrocarbon exploration in Guyana will likely increase because of the progress in the resolution of the maritime boundary disputes between Guyana and Suriname (Guyana Geology & Mines Commission, 2011; U3O8 Corp., 2011).

According to the GGMC, there are some indications of the presence of natural gas on the two Essequibo Islands of Leguan and Wakenaam. Study and analysis would need to be carried out to determine if the findings are commercially feasible, however. Also, the GGMC foresees positive prospects for the production of biodiesel, ethanol, and hydropower. ESSAR Steel Group of India is building a large steel mill in Trinidad and Tobago and is working with the GGMC to evaluate various potential iron ore bodies in Guyana. The GGMC is also working with ESSAR to reevaluate potential manganese ores in Guyana and whether any iron or manganese could be found to be used in its steel mill in Trinidad and Tobago (Guyana Geology & Mines Commission, 2011).

References Cited

- Bank of Guyana, 2011, Annual report 2010: Bank of Guyana, 116 p. (Accessed June 23, 2011, at <http://www.bankofguyana.org.gy/bog/images/Reports/annrep2010.pdf>.)
- Bray, E.L., 2011, Bauxite and alumina: U.S. Geological Survey Mineral Commodity Summaries 2011, p. 26-27.
- CGX Energy Inc., 2011a, Corporate profile—Affiliated companies: CGX Energy Inc. (Accessed June 26, 2011, at <http://cgxenergy.ca/affiliated.html>.)
- CGX Energy Inc., 2011b, Annual information: CGX Energy Inc., 42 p. (Accessed June 26, 2011, at <http://cgxenergy.ca/documents/CGXAIF2011.pdf>.)
- Guyana Geology & Mines Commission, 2011, The mining sector in Guyana—Unlocking the mineral and petroleum wealth of Guyana: Guyana Geology & Mines Commission. (Accessed June 26, 2011, at <http://www.ggmc.gov.gy/index.html>.)
- Guyana Goldfields Inc., 2011, Company highlights: Guyana Goldfields Inc. (Accessed June 26, 2011, at <http://www.kitco.com/leadgen/companies/guyana/>.)
- Infinito Gold Ltd., 2011, A gold exploration & development company: Infinito Gold Ltd. (Accessed June 26, 2011, at <http://www.infinitogold.com/s/Corporate.asp>.)
- Nanchuan Minerals Group, 2011, Overseas—Bosai Minerals operation in Linden, Guyana: Nanchuan Minerals Group. (Accessed June 26, 2011, at <http://www.nanchuanminerals.com/>.)
- Olson, D.W., 2011, Gemstones: U.S. Geological Survey Mineral Commodity Summaries 2011, p. 62-63.
- Sacre-Coeur Minerals, Ltd., 2011a, Properties & projects—Mining in Guyana: Sacre-Coeur Minerals, Ltd. (Accessed June 24, 2011, at http://www.scm minerals.com/properties_mining.htm.)
- Sacre-Coeur Minerals, Ltd., 2011b, Properties & projects: Sacre-Coeur Minerals, Ltd. (Accessed June 26, 2011, at <http://www.scm minerals.com/properties.htm>.)
- Tullow Oil plc, 2011, 2010 Annual report and accounts: Tullow Oil plc, 168 p. (Accessed June 24, 2011, at http://www.tullowoil.com/files/pdf/reports/2010_annual_report.pdf.)
- U3O8 Corp., 2011, Guyana—New uranium resource in South America: U3O8 Corp. (Accessed June 26, 2011, at <http://www.u3o8corp.com/main3.aspx?id=108>.)
- U.S. Central Intelligence Agency, 2011, Guyana, in The world factbook: U.S. Central Intelligence Agency. (Accessed June 25, 2011, at <https://www.cia.gov/library/publications/the-world-factbook/geos/gy.html>.)

SURINAME

In 2010, Suriname's mineral activities included the mining of bauxite; the refining of alumina; the production of cement, gold, iron ore, and petroleum and byproducts of copper, nickel, and platinum; and the quarrying of clays, sand and gravel, and stone. Suriname has an interesting mining history; its role as one of the leading bauxite and alumina producers in the world spans more than 90 years. The country's leading petroleum producer was the Government-owned Staatsolie Maatschappij Suriname N.V., which was founded on December 13, 1980, as a limited-liability company under Surinamese law. Since then, with the creation of Staatsolie and the introduction of joint ventures between the public and the private sectors, the petroleum industry has continued to develop (Staatsolie Maatschappij Suriname N.V., 2011; U.S. Central Intelligence Agency, 2011).

Minerals in the National Economy

In Suriname, mineral production has been focused on alumina, bauxite, gold, and petroleum. The country's economy was dominated by the mining industry, with exports of alumina, gold, and petroleum accounting for about 85% of exports; thus, the economy was highly vulnerable to mineral price volatility. In 2010, the petroleum sector's financial performance was \$355 million with a net profit of \$225 million and a contribution to the Government's budget of \$150 million. Suriname's total exports, among which were included such mineral commodities as alumina, gold, and crude oil, were valued at about \$1.4 billion. Suriname's export partners in 2010 included Canada (35.5%), Belgium (15%), the United States (10.2%), the United Arab Emirates (10%), Norway (4.9%), the Netherlands (4.7%), France (4.5%), and others (15.2%). Imports in 2010 were valued at about \$1.3 billion and included such products as capital equipment, foodstuffs, and petroleum. Suriname's import partners included the United States (30.8%), the Netherlands (19.2%), Trinidad and Tobago (13%), China (6.8%), Japan (5.9%), and others (24.3%) (Staatsolie Maatschappij Suriname N.V., 2011; U.S. Central Intelligence Agency, 2011).

Production

In 2010, the production of alumina decreased to about 1.1 Mt from more than 1.9 Mt in 2009, or by more than 44%; bauxite production decreased to 4.0 Mt from 5.2 Mt in 2009, or by more than 23%. The production of crude petroleum in 2010 remained at about the same level as that of 2009; production of petroleum derivatives in 2010 was also at about the same level as in 2009. Data on mineral production are in table 1.

Structure of the Mineral Industry

In 2010, the main bauxite-alumina operators in Suriname were Alcoa Inc. of the United States and Alumina Ltd. of Australia. On July 31, 2009, Alcoa World Alumina and Chemicals (AWAC), which was the world's leading bauxite-alumina-aluminum producer, acquired BHP Billiton's 45% share of Suriname Aluminum Co.'s (Suralco's) 55%

interest in the Surinamese bauxite mining and alumina refining joint ventures. Suralco was owned by Alcoa (60%) and by Alumina (40%). AWAC activities involved bauxite mining, alumina refining, and selected smelting facilities located in Australia, Brazil, Guinea, Jamaica, Spain, Suriname, and the United States (Alcoa Inc., 2011a, c; Alumina Ltd., 2011; BHP Billiton plc, 2011, p. 70-71; Bray, 2011). Table 2 is a list of the major mineral industry facilities in Suriname.

Commodity Review

Metals

Bauxite and Alumina.—In 2010, the production of alumina decreased to about 1.1 Mt from almost 2.0 Mt in 2009. Production operations in Suriname included two bauxite mines and one alumina refinery. The country's open pit bauxite mines were the Coermotibo and Moengo. The Coermotibo project is located 23 km southeast of Paramaribo (the capital of Suriname) and 11 km east of the Paranam refinery. The mine was scheduled to be operational by August 2011. The Coermotibo Mine is located 38 km southeast of Paramaribo and 24 km east of the Paranam refinery. The Moengo Mine was not operating at its production capacity of 2 Mt/yr of bauxite owing to market conditions for alumina (table 1; Alcoa Inc., 2011b-d; BHP Billiton plc, 2011; Bray, 2011).

Alcoa managed the Afobaka hydroelectric facility and the Paranam alumina refinery operations in Suriname. With its 2.2-Mt/yr alumina refinery and 100-megawatt hydroelectric facility, Suralco was the leading private enterprise in Suriname and a key supplier of alumina to Alcoa facilities and markets throughout Europe and the United States (Alcoa Inc., 2011a, d).

Gold.—In 2010, Rosebel Gold Mines N.V. (RGM) was owned by IAMGOLD Corp. (95%) and the Government of Suriname (5%). The Rosebel Mine is located in the Brokopondo mineral district, approximately 100 km south of Paramaribo. Gold mineralization at the Rosebel deposit is associated with north-dipping quartz and quartz-carbonate veins and pyrite alteration localized along shear corridors developed at contacts between sandstone and siltstone units in the Rosebel formation. The mining permit was granted until 2027. In 2010, mining at Rosebel was carried out at the following five open pits, in order of volume—the Royal Hill, the Pay Caro, the East Pay Caro, the Koolhaven, and the Mayo. The following three additional open pits were planned to be in production by 2015, in order of volume—the Rosebel, the Roma, and the J-Zone. Mining would continue to be by conventional open pit methods, using shovels and trucks. The mining and processing facilities included an 11-Mt/yr-capacity mill, which included crushing and grinding, and gravity separation; a cyanidation circuit; and a carbon-in-leach plant (IAMGOLD Corp., 2011a-d).

In 2010, Rosebel produced 12,286 kg of gold compared with 12,193 kg in 2009, which was a less than 0.8% increase (table 1). On December 31, 2010, Rosebel's proven and probable gold reserves amounted to 172 Mt grading 1.1 g/t and containing 183.3 t (5.9 million troy ounces) of gold; measured and indicated resources were 232 Mt grading 1 g/t and containing 234.2 t (7.5 million troy ounces) of gold; and

inferred resources were 17.6 Mt grading 1.1 g/t and containing 18.9 t (609,000 troy ounces) of gold, which was sufficient for a mine life to 2022 (IAMGOLD Corp., 2011c).

In 2010, Golden Star Resources sold its joint venture interest in the Saramacca gold project to Newmont Mining Corp. of the United States for approximately \$8 million. The Government approved the transfer of the concession. Saramacca's extensive gold anomaly in eastern Suriname ranges from 12 to 15 km along the northern flank of the Brokolonko Range and extends to the southwest of the Gross Rosebel property (Golden Star Resources Ltd., 2011).

According to Newmont, the Guiana Shield remains a highly prospective area for new gold discoveries. Relatively new gold discoveries included Cassador and Saramacca in Suriname. Strong preliminary tests show multimillion tonnage resource target potential at Cassador (Newmont Mining Corp., 2011, p. 12).

Mineral Fuels

Petroleum and Natural Gas.—Staatsolie Maatschappij Suriname N.V., which was owned by the Government of Suriname, was engaged in exploration, drilling, production, refining, marketing, sales, transport, and generation of electricity and steam. Staatsolie's leading crude oilfields were, in order of value, Tambaredjo and Calcutta. In 2010, Staatsolie's refinery processing capacity was 7,000 barrels per day (bbl/d) of crude oil. Staatsolie's refinery products included, in order of value, diesel, fuel oil, and asphalt bitumen. Most of these derivatives were consumed in the local market and the surplus was exported to the Caribbean. Staatsolie actively promoted the hydrocarbon potential of Suriname, and monitored petroleum agreements on behalf of the Government (Staatsolie Maatschappij Suriname N.V., 2011).

Staatsolie's petroleum operations began onshore in the Saramacca District, which is located 55 km west of the capital, Paramaribo. In 2010, the company's crude production from the Calcutta and the Tambaredjo oilfields totaled 5.4 million barrels. The majority of the production was from the Tambaredjo field. In the neighboring Calcutta field, full-scale production activities continued in 2010. Staatsolie's exploration strategy was driven by its objective to increase onshore crude production to 16,000 bbl/d by 2012. In early 2010, proven reserves were 13 Mbbbl in the Calcutta field, 57 Mbbbl in the Tambaredjo field, and 18 Mbbbl in the Tambaredjo North-West area (Staatsolie Maatschappij Suriname N.V., 2011).

Staatsolie also supplied power to Suriname. A 14-megawatt powerplant at Tout Lui Faut had been in operation since July 2006. The Tout Lui Faut refinery used the steam that the powerplant generated. The electricity was sold to the local power company for further distribution within the country. The powerplant was to be incorporated as a separate entity named Staatsolie Power Company Suriname N.V. by early 2012 (Staatsolie Maatschappij Suriname N.V., 2011).

In South America, Tullow had exploration interests in the prospective Guyana Basin (which included French Guiana, Guyana, and Suriname) with a total acreage of 46,238 km²; Tullow had secured equity in the Guyana Georgetown

Block in 2008 and Block 47 offshore Suriname in 2010. A production-sharing contract for the block was expected to be finalized and would enhance Tullow's portfolio of exploration areas in the emerging Suriname-Guyana Basin. Tullow planned to acquire seismic data during 2011 and anticipated that wells would be drilled as part of its medium-term exploration program in the Equatorial Atlantic region of South America. Tullow planned to operate the license full time and to finance it during the exploration phase. Staatsolie, however, had the option to participate during the development and production phases by contributing 20% of the total cost (Tullow Oil plc, 2011a, p. 5, 22; 2011b).

Outlook

New gold discoveries included Cassador and Saramacca in Suriname. Strong preliminary tests show multimillion tonnage resource target potential at Cassador. Newmont's exploration will likely be carried out on its Saramacca gold project in Suriname, which lies within the same geologic-structural region as the adjacent Rosebel Mine. Rosebel's gold production in the years ahead is expected to increase owing to its investments in resource delineation, mine exploration programs, and additional leach tanks to improve recoveries. IAMGOLD is expected to launch an \$18.4 million mill expansion project that would increase its annual production capacity to between 9.3 and 9.5 t (300,000 and 305,000 troy ounces) from its current (2010) capacity of about 8.6 t (275,000 troy ounces), and reduce direct cash costs by approximately \$35 per ounce. The mill expansion is expected to increase mill feed to 8.9 Mt/yr of ore from 8 Mt/yr and to provide the option of an additional 15% to 25% increase of gold output should market conditions be appropriate (IAMGOLD Corp., 2011b, c; Newmont Mining Corp., 2011, p. 12).

The alumina industry in Suriname is expected to grow with the completion of the \$65 million 250,000-t/yr expansion of the Paranam facility that supports alumina storage, refining, shipping facilities, thermal power, and the head office of Suralco (Alcoa Inc., 2011a, c).

Crude petroleum production in Suriname is expected to continue to increase. Staatsolie's exploration strategy is driven by its objective to increase onshore crude production to 16,000 bbl/d by 2012 (Staatsolie Maatschappij Suriname N.V., 2011).

References Cited

- Alcoa Inc., 2011a, Alcoa in Suriname—Partners in development: Alcoa Inc. (Accessed June 28, 2011, at http://www.alcoa.com/suriname/en/info_page/home.asp.)
- Alcoa Inc., 2011b, Alcoa worldwide alumina refinery capacity: Alcoa Inc. (Accessed June 28, 2011, at http://www.alcoa.com/alumina/en/info_page/refineries.asp.)
- Alcoa Inc., 2011c, Suriname Aluminum Co.—Moengo: Alcoa Inc. (Accessed June 28, 2011, at http://www.alcoa.com/locations/suriname_moengo/en/home.asp.)
- Alcoa Inc., 2011d, Suriname Aluminum Co.—Paranam: Alcoa Inc. (Accessed June 28, 2011, at http://www.alcoa.com/locations/suriname_paranam/en/home.asp.)
- Alumina Ltd., 2011, Annual report 2010—At a glance: Alumina Ltd. (Accessed June 28, 2011, at <http://www.aluminalimited.com/database-files/view-file/?id=4994>.)

- BHP Billiton plc, 2011, Annual report 2010—Resourcing the future: BHP Billiton plc, 300 p. (Accessed June 27, 2011, at <http://www.bhpbilliton.com/home/investors/reports/Documents/bhpBillitonAnnualReport2010.pdf>.)
- Bray, E.L., 2011, Bauxite and alumina: U.S. Geological Survey Mineral Commodity Summaries 2011, p. 26-27.
- Golden Star Resources Ltd., 2011, South American exploration—Saramacca joint venture in Suriname: Golden Star Resources Ltd. (Accessed June 29, 2011, at <http://www.gsr.com/Operations/SouthAmerican.asp>.)
- IAMGOLD Corp., 2011a, Rosebel gold mine, Suriname—Geology and mineralization: IAMGOLD Corp. (Accessed June 23, 2011, at <http://www.iamgold.com/English/Operations/Operating-Mines/Rosebel-Gold-Mine-Suriname/Geology-Mineralization/default.aspx>.)
- IAMGOLD Corp., 2011b, Rosebel gold mine, Suriname—Mining and processing: IAMGOLD Corp. (Accessed June 23, 2011, at <http://www.iamgold.com/English/Operations/Operating-Mines/Rosebel-Gold-Mine-Suriname/Mining-Processing/default.aspx>.)
- IAMGOLD Corp., 2011c, Rosebel gold mine, Suriname—Operating mines: IAMGOLD Corp. (Accessed June 23, 2011, at <http://www.iamgold.com/English/Operations/Operating-Mines/Rosebel-Gold-Mine-Suriname/default.aspx>.)
- IAMGOLD Corp., 2011d, Rosebel gold mine, Suriname—Overview: IAMGOLD Corp. (Accessed June 23, 2011, at <http://www.iamgold.com/English/Operations/Operating-Mines/Rosebel-Gold-Mine-Suriname/Overview/default.aspx>.)
- Newmont Mining Corp., 2011, 2010 annual report: Newmont Mining Corp., 188 p. (Accessed June 29, 2011, at http://www.newmont.com/10ar/pdfs/Newmont_10AR.pdf.)
- Staatsolie Maatschappij Suriname N.V., 2011, Company profile—Confidence in our own abilities: Staatsolie Maatschappij Suriname N.V., 2 p. (Accessed June 27, 2011, at <http://www.staatsolie.com/Profile20fin.pdf>.)
- Tullow Oil plc, 2011a, 2010 annual report and accounts: Tullow Oil plc, 168 p. (Accessed June 24, 2011, at http://www.tulloil.com/files/pdf/reports/2010_annual_report.pdf.)
- Tullow Oil plc, 2011b, Group license interests: Tullow Oil plc, April 2011, 4 p. (Accessed June 25, 2011, at [http://library.the-group.net/tullow/client_upload/file/Group_licence_list_April_2011\(1\).pdf](http://library.the-group.net/tullow/client_upload/file/Group_licence_list_April_2011(1).pdf).)
- U.S. Central Intelligence Agency, 2011, Suriname, *in* The world factbook: U.S. Central Intelligence Agency. (Accessed June 25, 2011, at <https://www.cia.gov/library/publications/the-world-factbook/geos/ns.html>.)

TABLE 1
FRENCH GUIANA, GUYANA, AND SURINAME: PRODUCTION OF MINERAL COMMODITIES¹

(Thousand metric tons unless otherwise specified)

Country and commodity		2006	2007	2008	2009	2010 ^e
FRENCH GUIANA^e						
Cement	metric tons	62,000	62,000	62,000	62,000	62,000
Clays	do.	5,000	5,000	5,000	5,000	5,000
Columbite and tantalite	kilograms	1,500	1,500	1,500	1,500	1,500
Gold, mine output, Au content ²	do.	2,000	2,000	2,000	2,000	2,000
Sand		1,500	1,500	1,500	1,500	1,500
Stone, crushed		1,500	1,500	1,500	1,500	1,500
GUYANA^{3,4}						
Bauxite, dry equivalent, gross weight		1,479	2,243	2,092	1,448 ^r	1,100 ⁵
Diamond	carats	340,544	268,945	168,926	143,982 ^r	49,920 ⁵
Gold, mine output, Au content	kilograms	5,668	7,412	8,131	9,492 ^r	9,594 ⁵
Sand	metric tons	285,000	285,000	290,000	478,572 ^r	652,175 ⁵
Stone, crushed	do.	204,000	204,000	204,000	340,016 ^r	514,932 ⁵
SURINAME						
Aluminum:						
Bauxite, gross weight		4,924 ⁶	5,054	5,200	5,200 ^r	4,000
Alumina		2,153 ⁷	2,270 ⁷	2,153	1,953	1,083 ⁵
Cement, hydraulic ^e		65	65	65	65	65
Clays, common ^e		20	20	20	20	20
Gold, mine output, Au content ⁸	kilograms	9,362	9,360	9,798	12,193	12,286 ⁵
Petroleum:^e						
Crude ⁹	thousand 42-gallon barrels	4,800	4,800	5,600	5,650	5,700
Products	do.	2,500 ⁹	2,500	2,917 ⁵	2,943 ⁵	2,940
Sand and gravel:^e						
Gravel		35	35	35	35	35
Sand, common		160	160	160	160	160
Stone, crushed and broken		50	50	50	50	50

^eEstimated; estimated data are rounded to no more than three significant digits. ^rRevised. do. Ditto.

¹Table includes data available through May 31, 2011.

²Source: Direction Regionale de l'Industrie, de La Recherche et de l' Environment and Bureau de Recherches Géologiques et Minières.

³In addition to the commodities listed, Guyana also reported laterite production, in metric tons: 2006—12,000, and 2007 through 2010—NA and loam production, in metric tons: 2006—4,000; and 2007 through 2010—21,017.

⁴Source: Guyana Geology and Mines Commission, the Bank of Guyana, and Minerals Questionnaire 2009 and 2010.

⁵Reported figure.

⁶Source: World Bureau of Metal Statistics.

⁷Source: BHP Billiton Group.

⁸Source: IAMGOLD Corp.

⁹Source: Staatsolie Maatschappij Suriname N.V.

TABLE 2
GUYANA AND SURINAME: STRUCTURE OF THE MINERAL INDUSTRIES IN 2010

(Thousand metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
GUYANA				
Bauxite		Aroaima Bauxite Co. (United Company RUSAL, 90%, and Government, 10%)	Kwakwani, East Berbice District	2,000
Do.		Bosai Minerals (Guyana) Inc. (Bosai Minerals Group, 70%, and Government of Guyana, 30%)	Omai bauxite mine and processing plant located close to Linden on the Demerara River about 100 kilometers south of Guyana's capital city of Georgetown	1,200
Diamond	carats	Infinito Gold Ltd.	Maple Creek Mine, Kurupung region	145,000
Gold	kilograms	Guyana Goldfields Inc.	Aurora Mine, Cuyuni	10,000
Gravel		Baracara Quarries (private)	Quarry near Bartica, Mazaruni-Potaro District	100
Silica sand		Minerals and Technology Ltd. [Minerals and Chemicals of Texas (United States)]	Sand Hills, Demerara River, West Demerara District	300
Stone		Mazaruni Granite Products Inc. of Guyana (private)	Mazaruni River	3,650
SURINAME				
Alumina		Suriname Aluminum Co. (Suralco) (Alcoa, Inc., 60%, and Alumina Ltd., 40%)	Refinery at Paranam, produces metallurgical-grade alumina	2,200
Bauxite		do.	Coermotibo Mine, open pit mine, 23 kilometers southeast of Paramaribo; to commence in May 2007	2,000
Do.		do.	Moengo Mine, open pit mine, 38 kilometers southeast of Paramaribo; operations started in July 2006	2,000
Cement		Vensur N.V. (private, 100%)	Paramaribo, District of Para	60
Gold	kilograms	Rosebel Gold Mines N.V. (IAMGOLD Corp., 95%, and Government of Suriname, 5%)	Brokopondo District, 100 kilometers south of Paramaribo	12,500
Petroleum	thousand 42-gallon barrels	Staatsolie Maatschappij Suriname N.V. (Government, 100%)	Tambaredjo, District of Saramacca	4,500
Do.	do.	do.	Calcutta field (58 wells)	460
Petroleum products	do.	do.	Tambaredjo, District of Saramacca	2,600
Do., do. Ditto.				