

# THE MINERAL INDUSTRIES OF THE GAMBIA, GUINEA-BISSAU, AND SENEGAL

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## THE GAMBIA

The Gambia is a West African country bounded on the west by the Atlantic Ocean and on the east, north, and south by Senegal. The country's estimated 1.5 million inhabitants shared a total land area of about 10,000 square kilometers (km<sup>2</sup>) (U.S. Central Intelligence Agency, 2003§<sup>1</sup>). The River Gambia, which is the country's most important geologic feature, flows along the entire length of the country and provides the principal means of freight and transportation. Mining accounted for less than 1% of the country's gross domestic product (GDP) based on purchasing power parity, which in 2003 was estimated to be \$2.54 million. The principal mineral commodities produced in The Gambia are clays, laterite, sand and gravel, silica sand, and zircon. Tourism was the largest source of foreign exchange followed by peanut exports and reexports. Exports, which also included cotton, fish, lint, palm kernels, and peanut products, were valued at \$102 million in 2003 (Resource Information Unit, 2003, p. 78; International Monetary Fund, 2004a§, b§).

All land and mineral resources in The Gambia belong to the State. The Geological Unit of the Department of State for Trade, Industry, and Employment is responsible for the administration of the mining sector. A new mineral and mining act proposed in 2001 was still being developed. The formulation of a new investment code and a new tax reform were also under study [Mbendi Information Services (Pty.) Ltd., 2004§].

The Gambian Government continued to encourage mineral exploration, in particular, offshore exploration for oil in the northern extent of the Casamance-Bissau subbasin. In 2003, exploration efforts included the ongoing exploration program of Amerada Hess of the United States (80%) and Fusion Oil and Gas plc of Australia (20%) in the deepwater PPL block. The companies evaluated options for the acquisition of three-dimensional (3-D) seismic data (U.S. Energy Information Administration, 2003§).

Carnegie Corporation Ltd. of Australia held an exclusive prospecting license in The Gambia that included three mineral sands deposits—Batukunku, Kartung, and Sanyang. Total measured, indicated, and inferred resources were estimated to be 15.1 million metric tons (Mt) that contained about 1 Mt of heavy minerals at a cutoff grade of 1%. The heavy-mineral assemblage for these deposits was estimated to be about 71% ilmenite, 15% zircon, 3% rutile, and 11% other. Before reaching a conclusion on the feasibility of developing these deposits, Carnegie decided to process the 50,000-metric-ton (t) zircon stockpile that remained at Brufut from the historical ilmenite operations of the late 1950s. Carnegie oversaw the construction

of a 40-metric-ton-per-hour gravity processing plant in South Africa and the onsite commissioning of the plant at Brufut in March 2003. In June, Carnegie (50%) in joint venture with Astron Limited of Australia (50%) began processing the stockpile material. The companies shipped about 12,000 t of the 12,600 t of zircon concentrate to China. The zircon concentrate was then to be processed by Astron Advanced Materials Ltd. (AAM) (a subsidiary of Astron Limited), which owned a processing plant on Hainan Island, China. Dredging operations began at the Sanyang deposit after the stockpile materials at Brufut were successfully processed. About 1,000 t of ilmenite-rutile-zircon concentrate was produced and exported to China. The companies planned to sell the sand as a byproduct of the operation to the local market (Industrial Minerals, 2003; Astron Limited, 2004, p. 4-5; Carnegie Corporation Ltd., 2004, p. 7-11).

During the year, AAM completed work on its No. 3 fused zirconium furnace, which was expected to increase capacity to about 7,000 metric tons per year (t/yr), and undertook expansions at another chemical plant. The company planned to begin work on furnace No. 4 and to install two additional furnaces with a total capacity of 13,000 t/yr. Plans for 2004 included the production of about 30,000 t of zircon concentrate (43% ZrO<sub>2</sub>) and 100,000 t of ilmenite concentrate (55% TiO<sub>2</sub>) from the Sanyang deposit (Astron Limited, 2004, p. 5).

In early 2003, the Government signed a \$5 million contract with a consortium led by Buried Hill Energy Incorporated to conduct a 3-D seismic survey following the completion of the evaluation of the oil potential in a 500-km<sup>2</sup> area offshore (International Monetary Fund, 2004a§).

## Outlook

The growth potential of the Gambian mining sector will depend on the success of ongoing onshore and offshore exploration activities and the successful development of the mineral sands deposits in Brufut.

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<sup>1</sup>References that include a section mark (§) are found in the Internet References Cited sections.

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## GUINEA-BISSAU

Guinea-Bissau is a West African country bounded on the west by the Atlantic Ocean, on the north by Senegal, and on the east and south by Guinea. In 2003, population was estimated to be about 1.4 million. The country's total land and water area, which includes 60 islands, is 36,120 km<sup>2</sup>. Its topography is characterized by low-lying coastal plains with numerous rivers, mangrove swamps, and some mountainous areas along the border with Guinea (U.S. Central Intelligence Agency, 2003§).

Mining was not a significant sector of the economy of Guinea-Bissau because mining activities were limited to small-scale production of construction materials, such as clays, granite, limestone, and sand. The country's prospective minerals include bauxite, diamond, gold, heavy minerals, petroleum, and phosphates. In 2003, the GDP based on purchasing power parity was estimated to be \$1.0 billion (International Monetary Fund, 2004§). Agriculture was the mainstay of the economy and accounted for about 69% of the GDP followed by services (17.6%) and industry (13.4%). Exports, which were valued at \$49 million, consisted of cashew nuts and fish (World Bank, 2004§).

In 2003, Champion Resources Inc. of Canada merged with Red Back Mining NL of Australia to form Red Back Mining Inc. (RBM). In July, the newly formed company entered into a purchase agreement with Geysler Ltd., which was a Dubai-based company, under which Geysler would acquire the company's subsidiary Champion Industrial Minerals (CIM) for \$10.5 million. CIM was the legal owner of the mining lease for the Farim phosphate deposit, which had estimated resources of more than 166 Mt at a grade of about 29% P<sub>2</sub>O<sub>5</sub>. Geysler, however, was unable to meet the purchase agreement deadline, and RBM followed with a court action that cited failure to fulfill obligations (Red Back Mining Inc., 2004).

Premier Oil plc of the United Kingdom reached an agreement with Occidental Petroleum Corporation of the United States to farm out 40% of its 100% paying interest in the Sinapa and the Esperanca blocks 2, 4A, and 5A offshore Guinea-Bissau. Drilling to test a 250-million-barrel oil prospect at the Sinapa-2 well was scheduled to begin in the first quarter of 2004. The companies jointly held two other licenses for blocks 7B and 7C offshore Guinea-Bissau and planned to acquire two-dimensional (2-D) seismic data for the blocks in 2004 (Premier Oil plc, 2003§).

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## SENEGAL

Senegal is a West African country bounded on the west by the Atlantic Ocean, on the northeast by Mali and Mauritania, and on the south by Guinea. In 2003, population was estimated to be about 10.6 million. The country's total land and water area is 196,190 km<sup>2</sup>. Its topography is characterized by low-lying plains rising to foothills in the southeast (U.S. Central Intelligence Agency, 2003§). Senegal had well-developed port facilities, an international airport that served 28 international airlines, and advanced telecommunications infrastructure (U.S. State Department, 2004§). Phosphate production, which was the country's second leading foreign exchange earner, dominated the mining sector. Other mineral commodities produced were basalt, cement, clays, gold, laterite, limestone, natural gas, and sand. In 2003, the GDP based on purchasing power parity was estimated to be \$17 billion. Exports were valued at \$1.3 billion and consisted mainly of cotton, fish, peanuts, refined petroleum products, phosphate rock, and phosphoric acid (International Monetary Fund, 2004§; World Bank, 2004§).

On November 12, 2003, the Senegalese Parliament approved a new Mining Code. Among the provisions are incentives to attract foreign investors that include total exemption from corporate tax and other levies for companies that hold exploration permits. In addition, the Government will have the right to set the level of its holding in an operating company and can, in addition to a fixed 10% stake, negotiate a stake in the equity of the operator on behalf of the Government and the country's private sector (Africa Mining Intelligence, 2003b). In June 2003, the Government sponsored the Senegal International Mining Conference. The purpose of the conference was to present the country's new mining legislation, to attract mining professionals from other African countries, to promote investment opportunities in Senegal, and to search for joint-venture partners to mine iron ore at Faleme and construct a new railroad. The event constituted Senegal's first international mining congress and represented one of the Government's attempts to develop the mining industry (Africa Mining Intelligence, 2003c). Prior to the new legislation, mining companies that conducted an environmental impact study and presented a program for restoration were granted mining licenses in forest areas. Under the new law, however, mining licenses are banned in these areas. More than 230 forest reserves existed in Senegal (Africa Mining Intelligence, 2003a).

France and India were Senegal's major trading partners. During fiscal year 2002-03, India imported about \$140 million worth of phosphoric acid. The Government of India, through Indian Farmers Fertilizer Cooperative Ltd. (IFFCO) and Southern Petrochemicals Industries Corporation Ltd. (SPIC), were equity partners in Industries Chimiques du Senegal (ICS), which was Senegal's phosphate mining and processing company. IFFCO and SPIC collectively held about 30% interest in the company (Federation of Indian Chambers of Commerce and Industry, 2004§; India Ministry of Chemicals and Fertilizers, 2004§).

In 2003, production of attapulgitite was 177,000 t. Attapulgitite was mined from an open pit located about 240 kilometers (km) south of Dakar. The attapulgitite was hauled by truck to the capital where it was loaded as bulk shipments of between 1,500 and 8,000 t and shipped to overseas markets. Senegal's biggest attapulgitite market was the European cat litter industry (Industrial Minerals, 2003).

Phosphate rock production was about 2 Mt. Phosphate rock was produced at the Taiba Mine, which was operated by Compagnie Senegalaise des Phosphates de Taiba (Senegalese Company of Phosphates from Taiba), a company that had merged with ICS in 1996. Ore was mined from the Keur Mor Fall and Tobène deposits. Part of the marketable phosphate rock was sent to the company's phosphoric acid plants in Darou Khoudoss and the remaining was sent to the Dakar port for export. Phosphoric acid production in 2003 was 511,000 t. The facilities at Darou consisted of two adjacent phosphoric acid production units with a combined production capacity of 660,000 t/yr of  $P_2O_5$ . Most of the phosphoric acid produced was exported to India. The company also imported solid sulfur to produce sulfuric acid at the plant. In addition, ICS owned a fertilizer manufacturing unit at Mbao, which is located about 18 km from Dakar. The plant had a production capacity of 250,000 t/yr. In 2003, fertilizer production was 251,090 t. Fertilizers were produced by combining phosphoric acid with ammonia and potash. Most of the fertilizer produced was sold to West African agriculture markets for the cultivation of cotton, peanuts, and vegetables (Industries Chimiques du Sénégal, 2003§).

In February 2002, ICS commissioned a project for doubling production capacity at its Darou phosphoric acid plant and for the development of its phosphate rock mines at a cost of about \$250 million. Plant capacity was to increase to 626,000 t/yr from 313,000 t/yr. In August 2003, ICS invested an additional \$10 million towards capacity expansion (Federation of Indian Chambers of Commerce and Industry, 2004§; India Ministry of Chemicals and Fertilizers, 2004§).

On October 28, Mineral Deposits Limited (MDL) of Australia signed a mining agreement with the Government for the development of the mineral sands deposit in the northern coast of Senegal. The deposit, which had been previously explored by DuPont Chemicals in the 1990s, is located about 100 km north of Dakar and extends northward for more than 50 km. It consists of a mineralized dune system of mostly nonvegetated sand masses that average about 2 km in width; some areas extend to up to 4.5 km in width. DuPont Chemicals' previous work had confirmed resources of about 19 Mt of ilmenite, 1.7 Mt of zircon, and 950,000 t of HiTi (a mix of rutile and

leucoxene). The sands were said to be free flowing with minimal slimes content. The mineral sands will be processed by using two cutter section dredges and floating plants that use cones, spiral gravimetric concentration, and magnetic separation processes to produce a heavy-mineral concentrate. MDL planned to stockpile the recovered ilmenite for future beneficiation. The remaining concentrate will be trucked or pumped to a dry mill in Mboro to produce the final leucoxene, rutile, and zircon (Mineral Deposits Limited, 2003, p. 3).

In 2003, 5 onshore and 14 offshore blocks of the Senegal Sedimentary Basin were offered for tender. A total of 142 exploratory wells had been drilled in the vicinity of Cap-Vert Peninsula and offshore Casamance, 16 of which were drilled for sulfur prospecting. Between 1971 and 2002, 47,520 km of 2-D seismic surveys and 2,840 km<sup>2</sup> of 3-D seismic surveys had been conducted in the basin (Senegal National Oil Company, 2003§).

Energy Africa of South Africa signed an exploration agreement with Petrosen, which was Senegal's state oil company, for the St. Louis block offshore Senegal. Energy Africa held a 90% interest in the license, and Petrosen held the remaining 10%. The block adjoins Mauritanian block 1 in which Energy Africa had a 32% interest (Africa Energy Intelligence, 2003a; Alexander's Gas & Oil Connections, 2003§).

Senegal's national electricity company, Senegal's Electricity Parastatal (SENELEC), was responsible for generating, transmitting, and distributing the majority of Senegal's electricity. In 2003, SENELEC issued a \$16.4 million bond to finance priority projects in the country's grid; the bond included an extension to the Cap de Biches, Tambacouda, and Ziguinchor power stations and the construction of a 60-megawatt (MW) station at Sangalkam. Following failed attempts to privatize the company, a SENELEC task force and experts from the World Bank urged the Government to consider the participation of independent power producers (IPP) to increase the country's power production potential. As a result, the Government decided to offer the construction of the Sangalkam station to an IPP (Africa Energy Intelligence, 2003b, c). The Government was also considering the construction of three secondary dams. The dams would provide an additional 225 MW to the Manantali system, which began operating in late 2002. Mali received 53% of the power generated by the dam followed by Senegal (32%) and Mauritania (15%) (Africa Energy Intelligence, 2003d).

## Outlook

The growth potential of the Senegalese energy sector will depend on the successful development of the Diam Niadio and Gadiaga gasfields, the successful exploration of the unexplored deepwater sections of the Senegal Sedimentary Basin, and the success of the new Mining Code to attract new foreign investment.

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TABLE 1  
THE GAMBIA AND SENEGAL: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Thousand metric tons unless otherwise specified)

Country and commodity	1999	2000	2001	2002	2003
<b>THE GAMBIA<sup>2</sup></b>					
Clay <sup>3</sup> metric tons	1,520	1,960	2,000 <sup>e</sup>	11,814 <sup>r,4</sup>	12,375 <sup>4</sup>
Laterites <sup>3</sup>	NA	NA	NA	410	227 <sup>4</sup>
Silica sand <sup>3</sup>	173	170	170 <sup>e</sup>	1,508 <sup>r,4</sup>	1,534 <sup>4</sup>
Zircon	--	--	--	--	13 <sup>4,5</sup>
<b>SENEGAL<sup>6</sup></b>					
Basalt <sup>3</sup>	NA	NA	NA	116	363 <sup>7</sup>
Cement, hydraulic	898 <sup>r</sup>	1,341 <sup>r</sup>	1,539 <sup>r</sup>	2,150	2,150 <sup>7</sup>
Clay <sup>3</sup>	NA	NA	NA	19	21 <sup>7</sup>
Clays, Fuller's earth (attapulgit)	118 <sup>r</sup>	149 <sup>r</sup>	121 <sup>r</sup>	176	177 <sup>7</sup>
Gold <sup>e,8</sup> kilograms	550	550	550	600 <sup>9</sup>	600 <sup>7,9</sup>
Laterites <sup>3</sup>	NA	NA	NA	112	304 <sup>7</sup>
Limestone <sup>3</sup>	NA	NA	NA	1,461	1,588 <sup>7</sup>
Natural gas <sup>e</sup> thousand cubic meters	56,000	56,000	56,000	3,368 <sup>9</sup>	12,638 <sup>7,9</sup>
<b>Petroleum:<sup>e</sup></b>					
Crude oil thousand 42-gallon barrels	1	1	1	--	--
Refinery products do.	6,000	6,000	6,424 <sup>r,9</sup>	6,400 <sup>r</sup>	6,400
<b>Phosphate rock and related products:</b>					
Calcium phosphate-based fertilizers	178	155	203	201	251
<b>Crude rock:</b>					
Aluminum phosphate	-- <sup>r</sup>	-- <sup>r</sup>	34 <sup>r</sup>	4	4 <sup>7</sup>
Calcium phosphate	1,814 <sup>r</sup>	1,775 <sup>r</sup>	1,708 <sup>r</sup>	2,000	2,000 <sup>7</sup>
Phosphoric acid	299	295	359	581	511
Sand <sup>3</sup>	NA	NA	NA	860	2,168 <sup>7</sup>
Salt	145 <sup>r</sup>	124 <sup>r</sup>	110 <sup>r</sup>	130 <sup>e</sup>	130 <sup>e</sup>

<sup>e</sup>Estimated; estimated data are rounded to no more than three significant digits. NA Not available. <sup>r</sup>Revised. -- Zero.

<sup>1</sup>Table includes data available through October 18, 2004.

<sup>2</sup>In addition to the commodities listed, The Gambia also produced a variety of construction materials (laterite, sand, and shell), but information is inadequate to make reliable estimates of output levels.

<sup>3</sup>Numbers converted from cubic meters to metric tons. Specific gravity, in grams per cubic meter--basalt, 2.8; clay, 2.55; laterites, 2.55; limestone, 2.6; and sand, 2.6.

<sup>4</sup>Source: Geology Department of the Republic of The Gambia.

<sup>5</sup>From sales.

<sup>6</sup>In addition to the commodities listed, Senegal also produced sand and gravel, and stone for local construction purposes and limestone for cement, but information is inadequate to make reliable estimates of output levels.

<sup>7</sup>Source: Direction Des Mines Et De La Geologie, République du Sénégal.

<sup>8</sup>Government estimate of unreported production of artisanal gold.

<sup>9</sup>Reported figure.