



# 2010 Minerals Yearbook

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## MALI AND NIGER

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# THE MINERAL INDUSTRIES OF MALI AND NIGER

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## MALI

Mali's mineral sector was dominated by the production of gold. No other mineral commodities were produced in significant quantities in the country, with the exception of rock salt and semiprecious stones, such as amethyst, epidote, garnet, prehnite, and quartz. Diamond was produced in small quantities as a byproduct of the mining of gold, but information on diamond production was inadequate to make reliable estimates of output. The country's vast undeveloped mineral resources included bauxite, chromium, copper, granite, gypsum, iron ore, kaolinite, lead, lithium, manganese, marble, nickel, niobium, palladium, phosphate rock, rutile, silver, talc, thorium, tin, titanium, tungsten, uranium, and zirconium. The Government agency responsible for the mineral sector in Mali is the Direction Nationale de la Géologie et des Mines, which is part of the Ministère des Mines de l'Énergie et de l'Eau.

### Production

In 2010, gold production decreased by 14% to 36,344 kilograms (kg) from 42,364 kg produced in 2009. Data on mineral production are in table 1.

### Structure of the Mineral Industry

At least 13 international companies were engaged in gold exploration and (or) production in Mali. These included Rolute Mining Ltd. of Australia; Canadian companies African Gold Group Inc., Avion Gold Corp., Axmin Inc., IAMGOLD Corp., Legend Gold Corp., Merrex Gold Inc., and Rockgate Capital Corp.; AngloGold Ashanti Ltd. of South Africa; and Avnel Gold Mining Ltd., Cluff Gold plc, and Randgold Resources Ltd. of the United Kingdom. Table 2 is a list of major mineral industry facilities.

### Commodity Review

#### Metals

**Gold.**—Gold was produced at both the artisanal and industrial levels. Most of the artisanal gold produced in the country came from the Kenieba Valley, which is located about 500 kilometers (km) from the capital city of Bamako. Orpailleurs (artisanal gold miners) recovered gold from alluvial deposits in Kenieba and, to a lesser extent, from other areas throughout the country. At the industrial level, gold was produced from the Kalana, the Loulo, the Morila, the Sadiola Hill, the Syama, the Tabakoto, and the Yatela Mines.

Gold production from the Kalana underground gold mine decreased by 36% to 334 kg from 519 kg produced in 2009. The decrease in production at the Kalana Mine was attributable to

the processing of lower head grades. The mine was operated by Société de la Mine d'Or de Kalana, which was a joint venture between Avnel (80%) and the Government (20%) (Avnel Gold Mining Ltd., 2010, p. 13).

Gold production at the Loulo Mine decreased by 10% to 9,845 kg from 10,936 kg produced in 2009. The decrease in production was mainly attributable to lower plant throughput as a result of reduced plant availability and efficiency during the first 6 months of the year. The Loulo Mine was operated by Société des Mines de Loulo S.A. (Somilo), which was owned by Randgold Resources (80%) and the Government (20%). The mine site comprised the Gara, the Loulo 3, and the Yalea open pit operations and the Gara and the Yalea underground mines, which were under development (Randgold Resources Ltd., 2011, p. 16–18).

Gold production from the Morila Mine, which is located about 180 km southeast of Bamako, decreased by 30% to 7,422 kg from 10,637 kg produced in 2009. The mine treated low-grade stockpiles during the year and planned to continue to do so until 2013. As a result, attributed production was expected to decrease further as the mine reaches the end of its life. The mine was operated by Morila Ltd., which was a joint venture among AngloGold Ashanti and Randgold Resources (40% each) and the Government (20%) (AngloGold Ashanti Ltd., 2011, p. 93).

The Sadiola Hill open pit gold mine was owned by a joint venture of AngloGold Ashanti and IAMGOLD (41% interest each) and the Government (18% interest). Production from the Sadiola Hill Mine, which is located about 77 km south of Kayes, decreased by 19% to 8,927 kg from 11,011 kg in 2009. The decrease in production was mostly a result of the 12% decrease in the head grade processed owing to the depletion of ore reserves at the main pit. The joint venture evaluated the development of two expansion projects at the Sadiola Hill Mine, which included a deep sulfide project and an oxide expansion project. The deep sulfide project would treat about 5 million metric tons per year (Mt/yr) of oxide ore and about 3.6 Mt/yr of sulfide ore. The joint venture expected to begin initial waste stripping at Sadiola's main pit and the commissioning of the sulfide plant in 2012. Once current oxide ore reserves are depleted, the joint venture planned to treat only sulfide material at a rate of 7.2 Mt/yr. The deep sulfide project was expected to add new resources of 130,600 kg to the Sadiola Hills Mine. The project was at the feasibility stage, and the feasibility study was scheduled to be completed in early 2011. A prefeasibility study for the oxide expansion project was also underway in 2010 (AngloGold Ashanti Ltd., 2011, p. 94–95).

Gold production from Syama open pit mine increased by about 215% to 2,425 kg from 770 kg produced in 2009. During the year, the Syama treatment plant was affected by several mechanical issues, which included the failure of the Mill 1 motor, repairs and modifications to the roaster stack and wet scrubber, and major repairs to the crushing circuit. Despite

the mechanical issues, gold production increased by 14.8% in the second half of the year, which was attributable to the successful changeover from refractory ore to direct leach of lamprophyre-type ore. A feasibility study, which included the expansion of the Syama gold operations by processing milling oxide ore resources, continued during the year. The study design and cost estimates were based on treating 1.5 Mt/yr of oxide ore. The design and the construction were expected to take about 18 months at a capital cost of about \$64 million. Annual production for about 4 years was estimated to be between 2,500 and 3,100 kg. By yearend, Resolute Mining announced the preliminary results of the grid power connection feasibility study that was conducted by BEC Engineering of Australia. The study evaluated the supply and installation of the 92-km grid connection from Sikasso to the Syama Mine at a cost of \$42.2 million. The Syama Mine was operated by Société des Mines de Syama S.A., which was owned by Resolute Mining (80%) and the Government (20%). The mine is located about 300 km southeast of the country's capital city of Bamako (Resolute Mining Ltd., 2010a, p. 9–10, 13–14; 2010b).

Gold production from the Tabakoto Mine (which included the Dioulafoundou, the Segala and the Tabakoto deposits) increased by 72% to 2,726 kg from 1,586 kg produced in 2009. In October, Avion announced that underground mine development had begun at the Tabakoto deposit. In late October, the company also began waste stripping at the Dioulafoundou deposit. In December, Avion also announced updated mineral resources for the Tabakoto open pit and underground projects. Indicated and inferred open pit mineral resources were estimated to be 992,000 metric tons (t) of ore at an average grade of 4.27 grams per metric ton (g/t) gold and 2.95 million metric tons (Mt) at an average grade of 3.57 g/t, respectively. Total measured and indicated underground mineral resources were estimated to be 5.01 Mt an average grade of 5.23 g/t gold, and inferred mineral resources were estimated to be 6.06 Mt an average grade of 4.55 g/t gold. The company planned a plant expansion at Tabakoto, which was expected to increase the processing capacity to 4,000 metric tons per day (t/d) from 2,000 t/d in 2012. Avion held an 80% interest in the Tabakoto Mine and the Government held the remaining 20% (Avion Gold Corp., 2011a, p. 4; 2011b).

Gold production from the Yatela open pit mine decreased by about 32% to 4,666 kg from 6,905 kg produced in 2009. The decrease in production was attributed to the decline in the head grade of the ore stacked as a result of nonconformity at the bottom of mineralized structures in the Alamoutala satellite pit. The mine was owned by Sadiola Exploration Company Ltd., which was a joint venture among AngloGold Ashanti and IAMGOLD (40% each) and the Government (20%). The joint venture planned to conduct an exploration program during 2011 to extend the life of the operation further (AngloGold Ashanti Ltd., 2011, p. 97–98).

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## NIGER

In 2010, Niger was the world's fifth ranked producer of uranium and accounted for about 7.8% of world production. Other mineral commodities produced in the country included cement, coal, gold, gypsum, limestone, salt, silver, and tin (World Nuclear Association, 2011).

### Production

Uranium production increased by 29% to 4,198 t from 3,243 t produced in 2009. The production data for other mineral commodities included in table 1 were estimated for 2010.

### Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

### Commodity Review

#### Metals

**Gold.**—Semafo Inc. of Canada held 80% interest in the Samira Hill Mine and the Government held the remaining 20%. The mine, which was the only industrial gold operation in the country, was located about 90 km west of the capital city of Niamey. As of December, measured mineral resources were estimated to be 8.0 Mt of ore at an average grade of 1.54 g/t gold, and indicated mineral resources were estimated to be 20.9 Mt of ore at an average grade of 1.49 g/t gold. In 2010, gold production from the Samira Hill Mine was 1,596 kg compared with 1,770 kg in 2009. The decrease in production was attributable to the throughput decline as the company processed harder ore. The company planned to complete the pre-stripping of the Samira Hill main pit by the second quarter of 2011 (Semafo Inc., 2011a, p. 11; 2011b, p. 9).

In March, Semafo announced the discovery of two new gold zones at Samira Hill—the Boulon Jounga North and the Libdorado Northwest zones. The Boulon Jounga potential area trends northeast across about 8 km, and reverse-circulation drilling highlights include up to 10.74 g/t gold across 3 m. The company reported estimated values at Libdorado of up to 5.59 g/t gold across 10 meters (m) and 5.11 g/t gold across 11 m. In October, the company announced exploration results at Libdorado that include 27.77 g/t gold across 4 m. The company planned a definition drilling at Libdorado in 2011, which would include 40,000 m of reverse-circulation drilling and 30,000 m

of air-core drilling in high-priority targets and three early-stage targets (Semafo Inc., 2010; 2011a, p. 15).

### Mineral Fuels and Related Materials

**Uranium.**—Production of uranium came from the Akouta underground mine, which was operated by Compagnie Minière d'Akouta (COMINAK), and the Arlit open pit mine, which was operated by Société des Mines de l'Air (SOMAIR). COMINAK was owned by Paris-based Areva Group (34%), the Government of Niger (31%), Overseas Uranium Resources Development Co. of Japan (25%), and ENUSA Industrias Avanzadas, S.A. of Spain (10%). SOMAIR was owned by Areva Group (63.4%) and the Government of Niger (36.6%).

In 2010, Areva continued with its plans to develop the world-class Imouraren uranium deposit, which was located about 160 km north of Agadez and 80 km south of Arlit. In December 2009, the company signed a partnership agreement with Korean Electric Power Corp. (KEPCO). Under the terms, KEPCO acquired a 10% interest in Imouraren S.A., which was jointly owned by Areva (56.65%) and the Government (33.35%). Areva planned to invest about \$1.6 billion to develop a mine at Imouraren, which would have a production capacity of 5,000 metric tons per year of uranium during a mine life of

more than 35 years. The mine, which was expected to begin production in 2013, was expected to create 1,400 direct jobs (Areva Group, 2010; 2011, p. 71, 128, 229).

Other companies exploring for uranium in the country included Artemis Resources Ltd., Oklo Uranium Ltd. and Paladin Energy Ltd. of Australia; Canadian companies Bayswater Uranium Corp., Homeland Uranium Inc., and Orezone Gold Corp.; China Nuclear International Uranium Corp.; and South Africa-based URU Metals Ltd.

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TABLE 1  
MALI AND NIGER: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Metric tons unless otherwise specified)

Country and commodity	2006	2007	2008	2009	2010 <sup>e</sup>
MALI <sup>2</sup>					
Gold, mine output, Au content <sup>3</sup>	51,957	43,850	41,160	42,364	36,344 <sup>4</sup>
Salt <sup>e</sup>	6,000	6,000	6,000	6,000	6,000
Semiprecious stones <sup>5</sup>	10,000	10,000	10,000	10,000	10,000
NIGER <sup>6</sup>					
Cement, hydraulic <sup>e</sup>	62,000	42,000	40,000	40,000	40,000
Coal, bituminous	176,320	171,296	182,912	225,072	225,000
Gold, mine output, Au content	2,615	3,427	2,314	1,985 <sup>r</sup>	1,900
Gypsum	13,043	4,615	8,661	19,737 <sup>r</sup>	19,700
Limestone	25,000 <sup>r</sup>	64,465 <sup>r</sup>	25,619 <sup>r</sup>	29,691 <sup>r</sup>	29,700
Salt <sup>e</sup>	1,300	1,300	1,300	1,300	1,300
Silver, mine output, Ag content	100 <sup>e</sup>	139	289	200 <sup>e</sup>	200
Sulfuric acid: <sup>e</sup>					
Gross weight	70,000	70,000	70,000	70,000	70,000
Sulfur content	23,000	23,000	23,000	23,000	23,000
Tin, mine output, Sn content	13	11	-- <sup>r</sup>	12 <sup>r</sup>	12
Uranium, U content	3,434	3,153	3,032	3,243	4,198 <sup>4</sup>

<sup>e</sup>Estimated data are rounded to no more than three significant digits. <sup>r</sup>Revised. -- Zero.

<sup>1</sup>Table includes data available through September 9, 2011.

<sup>2</sup>In addition to the commodities listed, Mali also produced sand and gravel solely for domestic consumption, but information is inadequate to make reliable estimates of output.

<sup>3</sup>Excludes artisanal production, which is estimated to be about 4,000 to 5,000 kilograms per year.

<sup>4</sup>Reported figure.

<sup>5</sup>Artisanal production of semiprecious stones includes amethyst, epidote, garnet, prehnite, and quartz.

<sup>6</sup>In addition to the commodities listed, phosphate rock, tungsten ore, and a variety of construction materials (clays, sand and gravel, and stone) were produced, but information is inadequate to make reliable estimates of output.

TABLE 2  
MALI AND NIGER: STRUCTURE OF THE MINERAL INDUSTRIES IN 2010

(Metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
MALI				
Gold	kilograms	Artisanal miners	Kenieba Valley	5,000.
Do.	do.	Avion Resources Corp., 80%, and Government, 20%	Tabakoto Mine, Kenieba Valley	3,100.
Do.	do.	Morila Ltd. (AngloGold Ashanti Ltd., 40%; Randgold Resources Ltd., 40%; Government, 20%)	Morila Mine, 180 kilometers southeast of Bamako	13,000.
Do.	do.	Sadiola Exploration Company Ltd. (AngloGold Ashanti Ltd., 40%; IAMGOLD Corp., 40%; Government, 20%)	Yatela Mine, 50 kilometers southwest of Kayes	2,500,000 ore.
Do.	do.	Société d'Exploitation des Mines d'Or de Sadiola S.A. (AngloGold Ashanti Ltd., 41%; IAMGOLD Corp., 41%; Government, 18%)	Sadiola Hill Mine, 77 kilometers south of Kayes	5,300,000 ore.
Do.	do.	Société de la Mine d'Or de Kalana (Avnel Gold Mining Ltd., 80%, and Government, 20%)	Kalana Mine, 300 kilometers south of Bamako	900.
Do.	do.	Société des Mines de Loulo S.A. (Somilo) (Randgold Resources Ltd., 80%, and Government, 20%)	Loulo Mine, 350 kilometers west of Bamako	11,000.
Do.	do.	Société des Mines de Syama S.A. (Resolute Mining Ltd., 80%, and Government, 20%)	Syama Mine, 300 kilometers southeast of Bamako	7,800.
NIGER				
Cement		Société Nigérienne de Cimenterie (Damnaz Cement Company Ltd.)	Malbaza Uzine, southwestern Niger	80,000.
Coal		Société Nigérienne de Charbon (SONICHAR)	Anou Araren, central Agadez region	300,000.
Gold	kilograms	Société des Mines du Liptako S.A. (SML) (Semafo Inc., 80%, and Government, 20%)	Samira Hill Mine, 90 kilometers west of Niamey	3,000.
Uranium		Compagnie Minière d'Akouta (COMINAK) [Areva Group, 34%; Government, 31%; Overseas Uranium Resources Development Co., 25%; ENUSA Industrias Avanzadas S.A., 10%]	Akouta underground mine, northern Niger	2,000.
Do.		Société des Mines de l'Air (SOMAIR) (Areva Group, 63.4%, and Government, 36.6%)	Arlit open pit mine, 6 kilometers northwest of Arlit, Agadez region	3,000.

Do. do. Ditto.