



# 2011 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

Gold was Mali's principal mineral commodity. With the exception of phosphate rock, rock salt, and semiprecious stones, such as amethyst, epidote, garnet, prehnite, and quartz, no other mineral commodities were produced in significant quantities in the country. Phosphate rock production, which had stopped in the early 1990s, resumed in late 2010. Diamond was also produced in small quantities as a byproduct of the mining of gold, but information on production was inadequate to make reliable estimates of output. The country's vast undeveloped mineral resources included bauxite, chromium, copper, granite, gypsum, iron ore, kaolin, 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

Gold production decreased slightly by 1.7% to 35,728 kilograms (kg) from a revised 36,360 kg produced in 2010. Gold production did not include gold produced by artisanal miners, which was estimated to be between 4,000 to 5,000 kilograms per year. Production of salt and semiprecious stones was estimated. Data on mineral production are in table 1.

### Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

### Commodity Review

#### Metals

**Gold.**—At least 18 international mining companies were engaged in gold exploration and (or) production in Mali. These included Papillon Resources Ltd., Resolute Mining Ltd., and Oklo Resources Ltd. of Australia; Canadian companies African Gold Group Inc., Avion Gold Corp., Axmin Inc., Endeavour Mining Corp., Etruscan Resources Inc., Great Quest Metals Ltd., IAMGOLD Corp., Merrex Gold Inc., North Atlantic Resources Ltd., and Rockgate Capital Corp.; Glencar Mining plc of Ireland; AngloGold Ashanti Ltd. of South Africa; and Avnel Gold Mining Ltd., Cluff Gold plc, and Randgold Resources Ltd. of the United Kingdom.

Orpailleurs (artisanal gold miners) recovered gold from alluvial deposits in the Kenieba Valley and, to a lesser extent, from other areas throughout the country. At the industrial level, gold was produced from the Kalana, the Goukoto, the Loulo, the Morila, the Sadiola Hill, the Syama, the Tabakoto and Segala, and the Yatela Mines.

Gold production from the Kalana underground gold mine decreased by 11% to 297 kg from 334 kg produced in 2010. The decrease in production was attributed to lower tonnage milled and to a reduced head grade of 7.2 grams per metric ton (g/t) compared with a head grade of 7.7 g/t in 2010. Avnel Gold Mining, which operated the mine, was in the process of implementing an aggressive exploration program for the Kalana Mine. Exploration activities included diamond and reverse-circulation drilling, which was to be completed during the third quarter of 2012. In addition, the company planned to continue with its reverse-circulation drilling program for the Kalanako prospect, which is located in close proximity to the Kalana Mine, and to commence drill testing for the Dabaran, the Djirila, the Sananfarani, the Sanekourou, the Solomanina, the Tenintoumanina, and the Tonda targets. Avnel expected to produce about 249 kg of gold at the Kalana Mine in 2012 (Avnel Gold Mining Ltd., 2012).

In June, Randgold delivered the first ore from the Goukoto Mine to its processing plant at the Loulo Mine. The Goukoto and the Loulo Mines were jointly known as the Loulo-Goukoto Mine complex and together produced 10,767 kg of gold during the year. The Loulo Mine accounted for about 60% of this production. As a stand-alone operation, the Loulo Mine produced 6,458 kg, which represented a 34% decrease in production from that of 2010. The decrease in production was mainly attributed to flooding as a result of heavy rains during the third quarter of the year, a slower rampup from underground production, and the processing of harder ore. Randgold planned to produce about 15,600 kg of gold from the Loulo-Goukoto Mine complex in 2012. Additional ore would be sourced from the Goukoto and the Yalea South pits and from the Gara and the Yalea underground mines to reach the company's 2012 production goal (Randgold Resources Ltd., 2012, p. 23–27).

Gold production from the Morila Mine increased slightly (by 4.2%) to 7,714 kg from 7,403 kg in 2010. The mine had been treating low-grade stockpiles ever since mining concluded in 2009 because of ore depletion. The Morila Mine's carbon-in-leach processing plant had an annual throughput capacity of 4.3 million metric tons (Mt). As of yearend, the stockpile material remaining at the Morila Mine was 1.8 Mt. The Morila Mine was operated by Morila Ltd., which was a joint venture of AngloGold Ashanti (40%), Randgold (40%), and the Government of Mali (20%). Randgold expected to produce about 5,100 kg of gold from the mine in 2012 (AngloGold Ashanti Ltd., 2012, p. 59–60).

Gold production from the Sadiola Hill Mine increased slightly (by 2.8%) to 9,175 kg from 8,927 kg in 2010. A new crusher was installed at the mine's processing plant to pre-treat feed material, which was expected to enhance production. The company planned to mine the FE3 and the FE4 pits in 2012. The future of the Sadiola Hill Mine was dependent upon the successful development of the mine's deep sulfide project,

which was expected to add new resources of 90,200 kg of gold. Environmental impact assessment studies for the sulfide project were approved during the year, and the company had begun preparatory work for the design of the plant. The sulfide project was expected to become operational by the end of 2012 (AngloGold Ashanti Ltd., 2012, p. 61–62).

Gold production from the Syama Mine increased by 9.5% to 2,655 kg from 2,425 kg in 2010. The increase in production was mostly as a result of improvements in the overall metallurgical recovery rate, which was 70.9% compared with 68.7% during the previous year. A scoping study conducted by Snowden Mining Consultants announced the doubling of the open pit reserves for Syama to a total of 91,400 kg and a revised mine life of 13 years (Resolute Mining Ltd., 2012, p. 9, 13–14).

Production of gold at the Tabakoto Mine increased slightly (by 4.1%) to 2,837 kg from 2,726 kg in 2010. The mine was expected to produce between 3,000 and 3,200 kg in 2012 and about 4,700 kg thereafter once the expansion of the mine's mill is completed. The mill's capacity was to be expanded to 4,000 metric tons per day (t/d) from its current 2,000 t/d; the expansion project was expected to be completed in 2013. In 2012, ore would be mined from the Djambaye II and the Dioulafoundou pits and from the Tabakoto underground mine (Endeavour Mining Corp., 2012).

Gold production from the Yatela Mine decreased by 51.3% to 2,271 kg from 4,666 kg in 2010. The decrease was attributed to a sharp decrease in the head grade of the ore as the mine nears depletion. AngloGold Ashanti reported the expected remaining life of the mine to be 3 years. The focus for 2012 was on optimizing any residual opportunities at the Yatela main pit and the Yatela North pit (AngloGold Ashanti Ltd., 2012, p. 63–64).

**Iron Ore.**—Sahara Mining S.A. of India planned to mine a hematite deposit at the town of Tienfala in southwestern Mali. The deposit is located about 20 kilometers (km) northeast of the capital city of Bamako. The Tienfala iron ore complex, which was expected to produce about 600,000 metric tons per year (t/yr) of iron ore, would be the country's first iron ore mine. Output from the mine was to be processed at a 300,000-t/yr steel mill, which the company planned to build in Mali at a cost of \$300 million. Ore would be transported by road to the Dakar Port in Senegal or to the Port of Abidjan in Côte d'Ivoire. Output was expected to be shipped to China and India. The Tienfala iron ore complex included the construction of a 70-megawatt powerplant. The mine and steel mill were expected to generate about 5,000 jobs (Diallo, 2010; International Resource Journal, 2011; Sahara Mining S.A., 2012).

**Manganese.**—Massachusetts-based ACM Corp., through its subsidiary Metal Mass Pty. Ltd., explored for manganese about 120 km north of the city of Gao near the town of Ansongo in northeastern Mali. In July, Metal Mass acquired a mining permit from the Government for the construction of a manganese mine and related infrastructure. Mine construction and the installation of a crushing plant were underway during the year. The plant was expected to process about 1 million metric tons per year of manganese ore and to operate at 60% of capacity during the first stage of production, which was expected to begin during the first quarter of 2012. A Joint Ore Reserves Committee-compliant

resource report was expected to be completed in 2013 (ACM Corp., 2011a, b).

### **Industrial Minerals**

**Phosphate Rock.**—Toguna Agro-Industries SA of Mali, which had begun production of phosphate rock in November 2010, planned to increase the production capacity at its Tamaguilelt processing plant to 200,000 t/yr from its current production capacity of 20,000 t/yr by the end of 2012. The company mined phosphate rock from the Tamaguilelt deposit, which is located in the Tilemsi Valley in northeastern Mali. Phosphate rock was used in the production of fertilizers for the agricultural sector. Domestic consumption of phosphate rock for the production of fertilizers was estimated to be about 220,000 t/yr (Industrial Minerals, 2011).

At least two other companies, which included Great Quest Metals of Canada and Oklo Resources Ltd. of Australia, planned to develop phosphate rock deposits in the country. Great Quest Metals, through its 94% share in Engrais Phosphates du Mali S.A., held prospecting and exploration licenses for three concession areas in eastern Mali, which included the Ader Foul concession, the Tarkint Est concession, and the Tilemsi (Tina Hina) concession. Oklo Resources, through its subsidiary La Société Oklo Uranium Limited Mali sarl, held an exploration and mining license for a 530-square-kilometer area that was prospective for phosphate rock at Samit Nord, which is also located in eastern Mali near the center of the city of Gao (Great Quest Metals Ltd., 2012, p. 16–17; Oklo Resources Ltd., 2012, p. 4, 9–10).

### **Outlook**

Mali is likely to become a significant phosphate rock producer in sub-Saharan Africa in the next 3 to 5 years if plans to increase production and mine capacity come to fruition. Phosphate rock production is likely to benefit Mali's agricultural sector by reducing the country's reliance on imported fertilizers, which have become very costly given the long transportation distances to reach the local market.

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## NIGER

Niger was among the world's leading producers of uranium. In 2011, the country ranked fourth in terms of uranium production by volume, accounting for about 8% of world production. Other mineral commodities produced in the country included cement, coal, gold, gypsum, limestone, salt, silver, and tin (World Nuclear Association, 2012).

### Production

Gold production decreased by 2.6% to 1,879 kg from 1,929 kg in 2010. Uranium production increased by 3.6% to 4,351 t. Production data for other mineral commodities were estimated for 2011. Data on mineral production are in table 1.

### Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

### Commodity Review

#### Metals

**Gold.**—The Samira Hill Mine, which was the only industrial gold operation in the country, produced 1,452 kg during the year compared with 1,596 kg produced in 2010. Semafo Inc. of Canada, which operated the mine, invested \$5.8 million during the year in exploration activities aimed at identifying new oxide deposits at Samira Hill. Exploration activities included more than 34,000 meters (m) of air core drilling and 56,000 m of reverse-circulation drilling across the Boulon Jounga and the Libiri areas. The company also carried out early-stage exploration on the Tonde Babangou area. The company planned to invest \$6 million in exploration in 2012 and to produce between 1,400 and 1,500 kg of gold during the year. The 2012 exploration program would be aimed at identifying new near-surface oxidized mineralization (Semafo Inc., 2012a, p. 41–42; 2012b, p. 11).

#### Mineral Fuels and Related Materials

**Petroleum.**—On November 28, China National Petroleum Corp. (CNPC) announced the completion of the upstream and downstream integrated Agadem petroleum project and the inauguration of Niger's first petroleum refinery. First production

of petroleum from the Agadem oilfield was expected in 2012. The refinery, which was located in the city of Zinder about 900 km east of the capital city of Niamey near the border with Nigeria, was operated by CNPC (60%) in joint venture with the Government (40%). The refinery's production capacity was 20,000 barrels per day (bbl/d). Crude petroleum would be sourced from petroleum wells within Niger's Agadem oilfields. Local consumption of petroleum products was estimated to be 7,000 bbl/d, and excess production of crude petroleum and petroleum products was to be exported to neighboring countries. A pipeline connecting the Agadem oilfields to the Zinder refinery was to be built by either the end of 2013 or early 2014 (Petroleum Africa, 2011; Umar, 2011; China National Petroleum Corp., 2012).

**Uranium.**—A new uranium mine, the Azelik Mine, opened during the year. The mine was operated by Société des Mines d'Azelik, which was a joint venture of China National Nuclear Corp. (37.2%), the Government of Niger (33%), and Chinese companies ZXJOY Invest and Trendfield Holdings. The company expected to produce 700 t/yr of uranium and to increase production to 2,500 t/yr by 2015. The majority of uranium production in Niger, however, 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%) (China Daily, 2011; International Monetary Fund, 2011, p. 9; World Nuclear News, 2011).

Other companies exploring for uranium in the country included Artemis Resources Ltd., Aura Energy Ltd., and Paladin Energy Ltd. of Australia; GoviEx Uranium Inc., Homeland Uranium Inc., and Orezone Gold Corp. of Canada; and URU Metals Ltd. of South Africa.

### Outlook

The development of new uranium and petroleum projects is likely to contribute significantly to Niger's economy. The country is in line to become a net exporter of petroleum products and will likely see production of uranium double by 2016. The International Monetary Fund estimates that mineral exports will triple between 2011 and 2016 and that Government revenues generated from investments in the minerals sector are likely to increase by about 3.5% of the GDP (International Monetary Fund, 2011, p. 7).

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

(Metric tons unless otherwise specified)

Country and commodity	2007	2008	2009	2010 <sup>e</sup>	2011
MALI <sup>2</sup>					
Gold, mine output, Au content <sup>3</sup> kilograms	43,850	41,160	42,364	36,360 <sup>r</sup>	35,728
Phosphate rock	--	--	--	1,600 <sup>e</sup>	20,000 <sup>e</sup>
Salt <sup>e</sup>	6,000	6,000	6,000	6,000	6,000
Semiprecious stones <sup>e,4</sup>	10,000	10,000	10,000	10,000	10,000
NIGER <sup>5</sup>					
Cement, hydraulic <sup>e</sup>	42,000	40,000	40,000	40,000	40,000
Coal, bituminous	171,296	182,912	225,072	246,558 <sup>r</sup>	250,000 <sup>e</sup>
Gold, mine output, Au content kilograms	3,427	2,314	2,067 <sup>r,6</sup>	1,929 <sup>r,6</sup>	1,879 <sup>6</sup>
Gypsum	4,615	8,661	19,737	7,559 <sup>r</sup>	7,600 <sup>e</sup>
Limestone	64,465	25,619	29,691	29,700	29,700 <sup>e</sup>
Salt <sup>7</sup>	1,300 <sup>r</sup>	1,900 <sup>r</sup>	1,400 <sup>r</sup>	900 <sup>r</sup>	800
Silver, mine output, Ag content kilograms	139	289	300 <sup>r,e</sup>	300 <sup>r</sup>	300 <sup>e</sup>
Tin, mine output, Sn content <sup>8</sup>	11	--	6 <sup>r</sup>	6 <sup>r</sup>	6 <sup>e</sup>
Uranium, U content	3,153	3,032	3,243	4,198	4,351

<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 October 15, 2012.

<sup>2</sup>In addition to the commodities listed, Mali also produced diamond and 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 (kg/yr).

<sup>4</sup>Artisanal production of semiprecious stones includes amethyst, epidote, garnet, prehnite, and quartz.

<sup>5</sup>In addition to the commodities listed, phosphate rock, sulfuric acid produced from imported sulfur, 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.

<sup>6</sup>Includes artisanal and small-scale production of gold, which ranged between 150 and 400 kg/yr.

<sup>7</sup>Production estimate based on reported exports.

<sup>8</sup>Production of tin was by artisanal miners.

TABLE 2  
MALI AND NIGER: STRUCTURE OF THE MINERAL INDUSTRIES IN 2011

(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.	Endeavour Mining 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-Goukoto Mine complex, 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.
Petroleum	thousand 42-gallon barrels per day	China National Petroleum Corp., 60%, and Government, 40%	Agadez oilfields	NA. <sup>1</sup>
Petroleum refinery products	do.	China National Petroleum Corp., 60%, and Government, 40%	City of Zinder, 900 kilometers east of Niamey	7,300.
Phosphate rock	do.	Toguna Agro-Industries SA	Tilemsi Valley, northeastern Mali	20,000.
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.		Société des Mines d'Azelik	Azelik Mine	700.

Do. do., Ditto. NA Not available.

<sup>1</sup>Under development.