

THE MINERAL INDUSTRY OF

MALI

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Gold was the only commodity mined at a significant scale in Mali in 1994. The country has a wide variety of other mineral deposits, but few have been developed due to a lack of infrastructure and local demand. Gold sales in 1994 were believed to have been worth about \$67 million; the country's sole formal gold mine accounted for about 55% of this. Gold accounted for more than 95% of the estimated total value of mineral commodities produced in Mali and about 20% of the country's total exports of goods. Because of France's January 12, 1994 administrative devaluation by 50% of the regional currency,² several of Mali's basic economic indicators differed significantly from those of 1993. For example, Mali's gross domestic product in 1994 was estimated at about \$1.85 billion; by comparison, the 1993 value was about \$2.65 billion.

Mali's geology is dominated by Precambrian rocks in the southwestern and central parts of the country and Paleozoic to Cenozoic rocks over most of the remainder. The Precambrian rocks are of the greatest economic importance, particularly those in the Birimian Series greenstone belts occurring near Kéniéba, Bougouni, and Sikasso. The greenstone belts, as elsewhere in west Africa, host gold deposits, commonly within shear zones and quartz veins. There was extensive gold exploration underway during the year, and a number of kimberlites near Kéniéba continued to be explored for diamonds. Artisanal mining of diamonds has been reported in the area, but no data exist on the output. Iron ore deposits in the Kéniéba area were considered uneconomic, as were large but low-grade bauxite deposits. A small area of Birimian rocks south-southeast of Gao hosts a large but presently uneconomic manganese deposit. An ultramafic intrusive about 80 kilometers (km) southwest of Sikasso has platiniferous nickel-copper mineralization, but the potential resource there has yet to be demonstrated.

In northeast Mali near Tessalit, Precambrian granitic and volcanic rocks exposed in the Adrar des Iforas massif host a wide variety of minerals, including copper, gold, tin, uranium, and zinc. The area's remoteness has made exploration difficult and would likely preclude economic exploitation of most of the deposits. Paleozoic and younger sedimentary rocks, particularly in northern and eastern Mali, host a number of industrial mineral deposits, such as gypsum, limestone, phosphate rock, and salt. Some of these are or have been exploited on a small scale. The petroleum potential of Mali's sedimentary basins has attracted modest

exploration interest in the past.

The Government continued to upgrade and coordinate existing geological data on Mali, to attract foreign exploration and mining investment, and to stimulate and make more efficient Mali's artisanal mining sector. The mining law continued to be Ordonnance No. 91-065/P-CTSO of September 19, 1991. Petroleum exploration and exploitation were regulated by Decree No. 30 of May 23, 1969, and by Decree No. 21, April 20, 1970.

The Government remained committed to a privatization program, including that of the Kalana gold mine; an offer of sale of the Kalana Mine was made in September 1994. The mine ceased production in 1991, but since had been on a care-and-maintenance status. The Government has the right to 20% equity in all new mining ventures, of which 10% is a free share and the remainder a buy-in option. The Government held a 20% share of the Syama gold mine—the remainder being held by BHP International Minerals, 65%, and the International Finance Corp. (IFC), 15%—as well as 20% shares in various gold and diamond reconnaissance exploration and advanced projects. Mining was overseen by the Direction Nationale de Géologie et des Mines (DNGM), which was part of the Ministry of Mines, Energy, and Water.

Despite artisanal mining of gold and salt having been ongoing in Mali for centuries, the scale and methodology of the operations have resulted in only minor environmental degradation by comparison with problems associated with slash-and-burn agriculture, the widespread use of firewood for energy, and overgrazing by livestock. Mercury use by artisanal miners in Mali appears to be slight. To date, the formal gold mines in Mali have recycled or neutralized their cyanide. Waste sulfur (from sulfide ore) at the Syama gold mine winds up in the roaster's calcined tails rather than being vented to the atmosphere.

Production data for 1994 were available only for the Syama gold mine, but overall production of mineral commodities was believed to be significantly unchanged from 1993 levels (*See table 1*). The Syama Mine's gold output was 3,016 kilograms (kg) in 1994, a 1.6% decline from 1993 output due in part to a month-long strike in March and April. The remainder of Mali's gold production was from artisanal production.

Very few data were available on Mali's 1994 trade, but that involving mineral commodities remained dominated by exports of gold and by imports of petroleum products,

cement, and fertilizers. There was likely significant smuggling of gold into Mali, particularly from Burkina Faso, but data on this commerce were not available. Most of Mali's international trade was by rail to the port facilities at Dakar, Senegal; and by truck to Abidjan, Côte d'Ivoire; Lomé, Togo; and Cotonou, Benin. There was no significant mineral trade between the United States and Mali.

Mali's exports of goods totaled about \$335 million in 1994. Gold exports, assumed equal to production levels, amounted to an estimated \$67 million. The decline in the Syama Mine's gold output was more than offset by a 6% to 7% increase in the average gold price in 1994. However, the overall level of gold exports remains uncertain because of the component of artisanal production. Total imports of goods into Mali in 1994 reportedly amounted to \$617 million. Although data for 1994 were unavailable, mineral commodity imports have traditionally been dominated in value by refined petroleum products, worth about \$53 million in 1992, the last year data were available, and were estimated to have been approximately the same in 1994. Mali's only operating formal gold mine in 1994 was at Syama, 75 km southwest of Sikasso. Gold output was hurt by a prolonged labor dispute early in the year. The dispute was partly over a demand for higher wages—an outcome of the dramatic devaluation of the local currency in January. During the year, the Syama Mine completed construction of its new sulfide ore processing circuit, featuring an environmentally benign whole-ore fluidized bed roaster. The roaster, and a dry-grinding circuit, were part of a program to expand gold output capacity to approximately 6,000 kilograms per year (kg/a). Ore processing capacity of the new circuits was reported by the company to be 4,000 metric tons (mt) per day.

Apart from BHP, a number of companies continued to explore for gold during the year. The most significant project appeared to be that of the Sadiola Hill deposit, the discovery of which was announced in 1993 by the Canadian company, International African Mining Gold Corp. (IAMGOLD), and its partner, Anglo American Corp. of South Africa (AAC). Approval of its mine development financing for the deposit was announced by the IFC in February 1995. The deposit, about 60 km southwest of Kayes, was to be operated as an open pit by La Société d'Exploitation des Mines d'Or de Sadiola S.A. This was a joint venture of Anmercosa Mining (West Africa) Ltd. (a 100%-subsidiary of AAC), 38%; AGEM Ltd. (a 100%-subsidiary of IAMGOLD), 38%; the Government, 18%; and the IFC, 6%. According to the IFC, the mine was expected to have a life of 13 years and a gold output, averaged for this period, of about 8,400 kg/a. Peak production levels would be in excess of 11,000 kg/a. Mining was to commence in late 1996.

Although Mali is a well-mineralized country, mineral exploration and development have been severely constrained by the lack of infrastructure, and reserves have been delineated only for a few gold deposits and some deposits of

industrial and construction minerals. In addition, resources have been delineated for bauxite, iron, and manganese.

According to BHP, oxide ore reserves at the Syama Mine were exhausted during the year. Mining plans for the sulfide ore were flexible and depended on the future gold price and the performance of the whole ore fluidized-bed roaster—a new technology for the company. Depending on the detailed mining scenario used, ore reserves at yearend 1993 were said to range from about 7 million metric tons (Mmt) grading about 6.5 grams per metric ton (g/mt) gold to 12 Mmt at 4 g/mt.

Original reserves for the Kalana-I deposit, upon which the existing (mothballed) mine was based, were about 1.5 Mmt grading 14.78 g/mt gold. Less than 15% of this inventory had been mined at the time of the mine's closure in 1991, but ore reserves accessible by the existing workings had been virtually exhausted and had proven to have grades generally well below those originally determined. Another deposit nearby, Kalana-II, was drilled by the Soviets but never exploited. It was generally agreed that both deposits needed reevaluation.

Various announcements in late 1993 and in 1994 concerning the Sadiola gold deposit claimed a minable inventory of about 50 Mmt grading about 2.5 g/mt gold and a total inventory of about 120 mt of gold. The only other gold deposits for which reserves are reasonably well known are the Loulo deposits, numbered 0 to 3, about 30 km northwest of Kéniéba. According to the Government, these contain a total resource of about 6.4 Mmt grading 4.38 g/mt of gold. The largest of the deposits is Loulo 0, which has about one-third of the total inventory. In late 1988, the Société Minière de Loulo, a joint venture between the Government (51%) and Compagnie Française de Mines of France (49%), was formed to exploit the property. The property was under option during 1994 by BHP, which was evaluating the deposits' viability.

Mali has a number of deposits of base and ferrous metals and of industrial minerals, including a few of the latter that are or have been exploited on a small scale. According to the Government,³ none of the deposits has large resources by world standards, and lack of infrastructure makes the exploitation of most of them uncertain.

Mali's transportation infrastructure in 1994 was underdeveloped and has proven to be a severe deterrent to mineral exploration and development. The country's only railroad consists of a 642-km segment of the 1,286-km, 1-meter-gauge line connecting Bamako with Dakar, Senegal. Railroad service continues to be subject to interruptions during the rainy season. Mali's highway network totals 15,700 km, of which 11% is paved, mostly in the south. The railroad and the major roads into Côte d'Ivoire are used to import mineral commodities, particularly fuels, as well as equipment and supplies. Mali's electrical grid was inadequate to service mineral development and mines have had to generate their own power. However, shortly before its closure in 1991, the Kalana Mine was linked to the Sélingué Dam's

power grid.

Development of most of Mali's mineral resources, with the exception of gold and possibly diamonds, is hindered by the country's general lack of infrastructure and local markets. Gold will likely continue to dominate the country's mineral economy, and output is forecast to increase significantly. The discovery potential for additional gold deposits is considered high. There appears to be significant potential for Mali becoming a modest producer of diamonds.

¹Text prepared May 1995.

²Where necessary, values have been converted from Communauté Financière Africaine francs (CFAF) to U.S. dollars at the rate of CFAF555.2=US\$1.00. The rate for 1993 was CFAF286.5=US\$1.00.

³Direction Nationale de la Géologie et des Mines, 1987, Mineral Resources of Mali: United Nations UNDP/DTCD MLI/85/007 Project, 64 pp.

Major Sources of Information

Direction Nationale de la Géologie et des Mines

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Telephone: 223-224-184, 223-225-821

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Société Nationale de Recherches et d'Exploitation des Ressources Minières du Mali (SONAREM)

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TABLE 1
MALI: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Thousand metric tons unless otherwise specified)

| Commodity 3/ | | 1990 | 1991 | 1992 | 1993 | 1994 |
|------------------------------------|-----------|-------|-------|-------|-------|-------|
| Cement, hydraulic | | 20 | 20 | 20 | 20 | 20 |
| Gold: Mine output, gold content 4/ | kilograms | 5,200 | 4,900 | 5,700 | 5,500 | 5,500 |
| Gypsum | tons | 700 | 700 | 700 | 700 | 700 |
| Phosphate rock | | 10 | -- | -- | -- | -- |
| Salt | | 5 | 5 | 5 | 5 | 5 |
| Silver 5/ | kilograms | 270 | 210 | 200 | 190 | 190 |
| Stone: Marble | tons | 160 | -- | -- | -- | -- |

1/ Previously published and 1994 data have been rounded by the U.S. Bureau of Mines to three significant figures.

2/ Includes data available through May 31, 1995.

3/ In addition to the commodities listed, Mali produced clays, other stone, and sand and gravel for local construction purposes, but information is inadequate to make reliable estimates of output levels.

4/ Includes estimate of artisanal production and may include some gold smuggled into Mali. The Kalana Mine accounted for about 8% of total gold in 1990; about 2% in 1991; less than 1% in 1992; and nil in 1993 and 1994. The Syama Mine accounted for about 42% of total gold in 1990; 49% in 1991; 57% in 1992; 56% in 1993; and 55% in 1994.

5/ Estimated silver content of doré bullion.