

# THE MINERAL INDUSTRY OF AFRICA AND THE MIDDLE EAST

By G. J. Coakley, B. Michalski, and P. M. Mobbs

## Africa

For many African countries, fuel and nonfuel mineral production and development constitute a significant part of the economy and remain a key to future economic growth. The continent is richly endowed in mineral resources including significant reserves of antimony, bauxite, chromite, coal, cobalt, copper, diamond, gold, fluor spar, manganese, phosphate rock, platinum group metals, titanium minerals (rutile and ilmenite), uranium, vanadium, vermiculite, and zirconium minerals, along with crude petroleum and natural gas.

Natural resource development has proved vital to the economies of African nations because of its role in generating employment and foreign exchange and in providing the stimulus to develop the power and transportation infrastructure of the region. South Africa is one of the world's major mining and mineral processing nations. Within the continent, the countries of subequatorial Africa comprised the dominant mineral-producing region. Most of Africa's mineral industries were export oriented and thus exposed to world market fluctuations. Mineral trade plays a significant role in African economies with mineral exports accounting for between 50% and 95% of total export earnings for Algeria, Angola, Botswana, Gabon, Guinea, Namibia, Niger, Nigeria, Zaire, and Zambia and between one-third and one-half of total export earnings for Ghana and South Africa.

Historically, Africa has been a major supplier of strategic and economic minerals to the United States and world markets. As highlighted in table 1, Africa accounts for between 11% and 45% of the world supply of eight major mineral commodities, chromite, cobalt, diamond, gold, manganese ore, crude petroleum, phosphate, and uranium and are major producers of valued added ferroalloys and aluminum. In addition, Guinea produces about 13% of the world's bauxite, the principal source of aluminum.

Most of Africa's mineral industries were export-oriented and thus exposed to world market fluctuations. A number of African countries dependent on one mineral commodity, typically bauxite, copper, natural gas, petroleum, phosphate, or diamond, were seeking to diversify their economies by developing downstream mineral processing industries or additional mineral resources.

Africa possesses significant mineral resources, however

the exploration emphasis in 1995 was on high-unit-value minerals, such as gold and diamond. According to the Metals Economics Group of Halifax, Nova Scotia over \$320 million of exploration budgets for the companies surveyed were expended in Africa. This large increase from \$199 million in 1994 indicates renewed international interest in African mineral investment. Attracting most of the gold exploration attention were the extensive Birimian greenstone belts in Burkina Faso, Côte d'Ivoire, Ghana, Guinea, Mali, and Niger. East Africa also attracted the interest of gold exploration teams with prospects being evaluated in Eritrea, Ethiopia, Kenya, Tanzania, Sudan, and Uganda. In southern Africa, Zimbabwe, South Africa, and Mozambique were also targets for gold exploration. Botswana and Namibia saw active exploration for diamonds, while prospects for ending the civil war in Angola were opening renewed interest in Angola's diamond potential. A few American companies joined the hunt for minerals in Africa, which was being aggressively pursued by Canadian, Australian, and South African mining companies.

In the uranium sector, reduced world demand resulted in exploration being curtailed in Namibia and cutbacks in production in Namibia and South Africa. There was a renewed interest in examining old mine tailings and smelter slag piles for their potential retreatment under current market conditions and using new technologies. In Zimbabwe, slag was being reprocessed to recover ferrochrome. International companies were interested in reprocessing slag and tailings dumps in Uganda, Zambia, and Zaire for cobalt; for copper in Zambia and Zaire; and for gold in Botswana, Ghana, and South Africa using bioleaching technology. Exploration of titaniferous sand deposits was underway in Madagascar, Mozambique, and South Africa. Nickel exploration was progressing in Côte d'Ivoire, South Africa, and Tanzania.

A number of African countries were attempting to attract new foreign investment to their mineral sectors. New mining laws and regulations came into effect in Eritrea, Guinea, and Zambia. Madagascar revised its petroleum investment terms and Tunisia issued a new investment decree in 1995. In much of Africa, however, political and economic uncertainty, poor power and transportation infrastructure, and growing western interests in Latin America and Asia ventures remained formidable constraints to investment.

Privatization of state-owned mineral operations was being pursued by Algeria, Egypt, Ghana, Madagascar, Morocco,

Nigeria, Tunisia, Uganda, Zambia, and Zimbabwe. The South African minerals industry, dominated by large private mining companies, continued to evolve through divestiture of some holdings in South Africa and by seeking investment opportunities outside the country.

Several new African mines were opened in 1995, including the Ancuabe graphite mine in Mozambique, the Ayanfuri gold mine in Ghana, the Lero gold mine in Guinea, the Maghara coal mine in Egypt, the Phoenix nickel-copper mine in Botswana, and the Sanyati copper mine in Zimbabwe. Soda Ash Botswana (Pty.) Ltd. was liquidated in May 1995 and a new company, Botswana Ash (Pty.) Ltd., reopened operations in September. The Obenemasi Mine (formerly the Konongo Mine) was reopened under new ownership in Ghana. A 300-metric-ton-per-year capacity electrolytic cobalt refinery was built in Morocco, and in Zimbabwe, the Redcliff iron ore sinter plant was completed.

South Africa was the world's largest producer of chromium, ferrochromium, gold, manganese, platinum-group metals, vanadium, and vermiculite. The country also was a significant producer of antimony, asbestos, coal, diamond, fluor spar, iron, phosphate rock, rutile, titanium, uranium, vermiculite, and zirconium. Faced with deeper reserves, declining ore grades, and increased labor unrest South Africa's gold production declined for the third year in a row. Asbestos production in South Africa and Zimbabwe continued to decline with an ever diminishing world demand. Two projects, valued at more than a billion dollars each, were near completion in South Africa; startup was expected in 1996 for the 466,000-ton-per-year Alusaf aluminum smelter and the 500,000-ton-per-year Columbus stainless steel project.

In southern Africa, Zimbabwe was a significant producer of chromium, ferrochrome, gold, lithium, nickel, and vermiculite. Zambia, Zaire, and Botswana were leading suppliers of cobalt, Botswana was a significant nickel ore producer, and Zambia was one of the top producers of gem-quality emeralds. Angola, Botswana, Namibia, South Africa, and Zaire were among the world's leading producers of diamond. Algeria was a leading helium producer, Gabon was a major manganese and uranium miner, and Guinea had world-class output of bauxite. Morocco, Senegal, Togo, and Tunisia were among the world's top 11 phosphate rock producers. Kenya and Morocco were leading fluor spar suppliers and Ghana was a significant aluminum, gold and manganese producer. Sierra Leone, formerly the world's second leading rutile producer, suspended production because of the civil war. Historically among the top copper producers in the world, Zaire and Zambia continued to see a decline in this industry with Zambia operating at about 70% of capacity and Zaire's economic collapse allowing them to operate at only 10% of capacity. Both countries were entertaining proposals to privatize state-owned copper industries.

Not all African countries were major mineral producers. In

many African nations, the production of mineral commodities represented only a minor part of the economy. Mineral output in these countries often was limited to the mining or quarrying of common construction materials such as clay, sand, and stone.

The production of natural gas and petroleum and the refining of petroleum products were significant factors in the mineral economies of a number of African countries. Nigeria was Africa's largest oil producer, followed by Libya, Egypt, Algeria, Angola, and Gabon. Major oil companies were actively exploring offshore southern Africa, Angola and Congo and small independent oil companies were actively expanding offshore exploration activity in West Africa.

Development continued in the Alba and Zafiro Fields, offshore Equatorial Guinea. Successful drilling of Chad's Doba basin resulted in the proposal to run an oil export pipeline from Chad through Cameroon to the coast. In Sudan, a Canadian independent was redeveloping the Heglig Field. An American independent restarted oil and natural gas production offshore Côte d'Ivoire during the year. Côte d'Ivoire's last producing field had been abandoned in 1992. In Tunisia, the Miskar Field began flowing natural gas in 1995. South Africa, which has been dependent on synthetic fuels produced from coal, was prepared to start up its first commercial oil field in the Bredasdorp Basin offshore from Cape Town in January 1996.

Civil war or strife continued to adversely affected mineral exploration and development in Burundi, Liberia, Rwanda, Sierra Leone, Somalia, and Sudan. In Sierra Leone, rebel forces overran the rutile mine of Sierra Rutile Holdings Ltd. and the bauxite operations of Sierra Leone Ore and Metal Co. in January 1995. The mines were still closed at yearend. The Liberian cease-fire of 1995 collapsed, however in Angola, the signing of peace accords should reopen the country to new mineral investment.

## **Middle East**

The 15 Middle East countries covered in this report cover a land area of 6.17 million square kilometers, about two-thirds the size of the United States, and had a 1995 population of approximately 216 million people. The average gross domestic product (purchasing power parity) per capita in this energy-rich region in 1995 was about \$10,200, ranging from a high of \$24,000 in the United Arab Emirates to a low of \$2,520 in Yemen.

The mineral economy of the Middle East was dominated by the production of petroleum, supplemented by aluminum, cement, natural gas, nitrogen, phosphate rock, and potash output. The region as a whole accounted for 30% of world crude petroleum production in 1995 and, according to the 1996 International Petroleum Encyclopedia, was endowed with 65% of the world reserves of crude oil, including 26% in Saudi Arabia. A number of Middle Eastern countries continued to diversify oil-dominant economies with growth

in the solid minerals sector.

Saudi Arabia was the world's leading producer of crude oil. Iran, the United Arab Emirates, and Kuwait also were significant suppliers of petroleum to the world market. (*See table 2.*) Turkey was a major producer of barite, boron minerals, cement, feldspar, ferrochromium, glass, magnesite, marble, perlite, pumice, steel, and strontium. Bahrain was a significant supplier of aluminum to the world. Israel and

Jordan had world-class output of phosphate rock and potash. Israel was also the second largest bromine producer.

Oman, Qatar, and Yemen were evaluating new liquefied natural gas facilities. Iraq was floating the possibility of issuing petroleum production sharing agreements with European petroleum companies, but remained unable to market petroleum or petroleum products because of the sustained embargo by the United Nations.

TABLE 1  
AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES 1/ 2/ FOR 1995

(Thousand metric tons unless otherwise specified)

Country	Aluminum	Cement e/	Chromite	Coal, hard e/	Cobalt, mine Co con- tent (metric tons)	Copper, mine Cu con- tent	Diamond (thousand carats) e/ 3/	Gold (kilograms)
Algeria	--	6,822 4/	--	20	--	--	--	--
Angola	--	300	--	--	--	--	2,900	--
Benin	--	380	--	--	--	--	--	--
Botswana	--	--	--	640	270	25	16,802	86
Burkina Faso	--	--	--	--	--	--	--	4,000 e/
Burundi	--	--	--	--	--	--	--	10
Cameroon	79 e/	620	--	--	--	--	--	1,000
Central African Republic	--	--	--	--	--	--	530	120 e/
Congo	--	100	--	--	--	--	--	5 e/
Cote d'Ivoire	--	500	--	--	--	--	75	1,983
Egypt	190 e/	17,665 4/	1 e/	--	--	--	--	--
Eritrea	--	50 4/	--	--	--	--	--	59
Ethiopia	--	611 4/	--	--	--	--	--	4,500
Gabon	--	130	--	--	--	--	1	75 e/
Ghana	135	1,300	--	--	--	--	632	53,141
Guinea	--	--	--	--	--	--	365	7,863 r/
Kenya	--	1,420	--	--	--	--	--	155 e/
Liberia	--	--	--	--	--	--	150	800 e/
Libya	--	3,210 4/	--	--	--	--	--	--
Madagascar	--	60	103	--	--	--	--	500 e/
Malawi	--	139 4/	--	--	--	--	--	--
Mali	--	20	--	--	--	--	--	5,500 r/
Mauritania	--	120 4/	--	--	--	--	--	--
Morocco	--	6,401 4/	--	550	548	14	--	--
Mozambique	--	20	--	40	--	--	--	900 e/
Namibia	--	--	--	--	--	23	1,382	2,393
Niger	--	30	--	--	--	--	--	1,000 e/
Nigeria	--	3,000	--	90	--	--	--	5 e/
Rwanda	--	5 4/	--	--	--	--	--	100 e/
Senegal	--	590	--	--	--	--	--	550 e/
Sierra Leone	--	--	--	--	--	--	214	4
Somalia	--	25	--	--	--	--	--	--
South Africa	210	9,071 4/	5,085	201,657	290	162	10,949	523,809
Sudan	--	391 4/	25 e/	--	--	--	--	3,700 e/
Swaziland	--	--	--	170	--	--	--	--
Tanzania	--	800	--	--	--	--	--	44
Togo	--	350	--	--	--	--	--	--
Tunisia	--	4,938 4/	--	--	--	--	--	--
Uganda	--	85 4/	--	--	--	--	--	1,506 r/
Zaire	--	25	--	130	1,674	29	17,000	600 e/
Zambia	--	250	--	400	5,908	324	--	100 e/
Zimbabwe	--	1,100	707	5,700	100 e/	9	250 4/	24,344
Total, Africa 5/	614	60,528	5,921	209,397	8,790	585	51,250	638,852
Total, world	19,900	1,443,689	14,337	3,561,188	23,843	10,100	113,376	2,219,087
Share of world total	3%	4%	41%	6%	37%	6%	45%	29%
United States	3,375	78,320 4/ 6/	--	934,147	--	1,849	--	316,913

See footnotes at end of table.

TABLE 2  
MIDDLE EAST: PRODUCTION OF SELECTED MINERAL COMMODITIES 1/ 2/ FOR 1995

(Thousand metric tons unless otherwise specified)

Country	Alumi- num e/	Boron	Cement, hydraulic	Chromite	Copper, mine Cu content	Gypsum e/	Natural gas 3/	
							Plant liquids (thousand 42-gallon barrels)	Dry (million cubic meters)
Bahrain	451 4/	--	197	--	--	--	10	6,513
Cyprus	--	--	1,021	--	--	90	--	--
Iran	118	1 e/	16,300 e/	129 e/ 5/	102	8,230 4/	60	35,113
Iraq	--	--	2,108	--	--	450 6/	25	3,115
Israel	--	--	4,800 e/	--	--	48	--	(7/)
Jordan	--	--	3,508	--	--	190	--	283
Kuwait	--	--	1,950	--	--	--	95	5,947
Lebanon	--	--	3,538	--	--	2	--	--
Oman	--	--	1,177	5	--	--	10	4,814
Qatar	--	--	667	--	--	--	55	13,592
Saudi Arabia	--	--	15,773	--	1	375	701	40,210
Syria	--	--	4,463	--	--	336 4/	9	4,814
Turkey	62	30	33,143	2,080	38	600	--	283
United Arab Emirates	240	--	5,918	37	--	90	160	30,016
Yemen	--	--	1,088	--	--	80	--	--
Total, Middle East 8/	871	31	95,651	2,251	141	10,491	1,125	144,700
Total, world	19,890	2,888	1,443,689	14,337	10,102	96,502	5,474	2,217,221
Share of world total	4%	1%	7%	16%	1%	11%	21%	7%
United States	3,375	1,194	78,320 9/	--	1,850	16,587 4/ 10/	1,762	532,360

  

Country	Nitro- gen N in ammo- nia e/	Petroleum, crude 11/ (thousand 42-gallon barrels)	Phos- phate rock (gross weight)	Potash e/ K <sub>2</sub> O equivalent	Salt e/	Steel, crude	Sulfur
Bahrain	358 4/	14,468	--	--	--	--	--
Cyprus	--	--	--	--	--	--	--
Iran	700	1,329,695	--	--	936 4/	4,696	890 e/
Iraq	500	204,400	1,000 e/ 12/	--	250	300 e/	475 e/
Israel	41 13/	--	4,063 12/	1,325	1,200	200	--
Jordan	--	--	4,984	1,068	25	30 e/	--
Kuwait	325	750,805	--	--	45	--	--
Lebanon	--	--	--	--	3	--	--
Oman	--	310,615	--	--	--	--	--
Qatar	650	--	--	--	--	606	--
Saudi Arabia	2,000	3,004,315	--	--	--	2,451	2,200
Syria	67	222,650	1,551	--	111 4/	70 e/	--
Turkey	350	--	--	--	1,444	12,745	--
United Arab Emirates	250	831,835	--	--	--	--	--
Yemen	--	127,750	--	--	110	--	--
Total, Middle East 8/	5,241	6,796,533	11,598	2,393	4,124	21,098	3,565
Total, world	96,111	22,792,790	129,955	24,658	192,439	755,065	53,173
Share of world total	5%	30%	9%	10%	2%	3%	7%
United States	13,000 4/ 14/	2,394,400	43,460	1,480 4/	42,150 9/	95,172	11,798 e/

e/ Estimated.

1/ Table prepared by Glenn J. Wallace.

2/ Data may be different from that appearing in individual country production tables owing to availability of more current data.

3/ Source: Energy Information Administration / International Petroleum Statistics Report, July 1997.

4/ Reported figure.

5/ Concentrate.

6/ For cement production only. Information is insufficient to formulate reliable estimates for output for other uses (plaster, mortar, etc.).

7/ Less than 1/2 unit.

8/ May not add to totals shown because of independent rounding.

9/ Includes Puerto Rico data.

10/ Excludes byproduct gypsum.

11/ Including lease condensate.

12/ Beneficiated.

13/ May include nitrogen content of urea.

14/ Synthetic anhydrous ammonia; excludes coke oven byproduct ammonia.

Source: U.S. Geological Survey.