THE MINERAL INDUSTRY OF

ANGOLA

By George J. Coakley

Angola had a population of about 11 million in a 1,246,700square-kilometer (km²) area, which includes Cabinda, a 100kilometer (km)-wide and 150-km-deep coastal strip located between the Republic of the Congo [Congo (Brazzaville)] and the Democratic Republic of the Congo [(Congo (Kinshasa)]. Cabinda was the source of about 70% of Angola's oil production. In 1998, the mineral economy of Angola was dominated by petroleum. The \$3.06 billion in petroleum exports, a 35% decline in value from 1997, accounted for 90% of all exports and for more than 80% of Government revenues. Angola's gross domestic product (GDP) was estimated, based on purchasing power parity, to be \$11 billion by yearend 1998, with petroleum and related services accounted for about 45% of the GDP (Central Intelligence Agency, 1999, Angola, The World Factbook, accessed November 11, 1999, at URL http://www.odci.gov/cia/publications/factbook/ao.htm).

Following more than 20 years of fighting, the country's lengthy civil war appeared to be resolved with the signing of the Lusaka Peace Protocol in 1994, and optimism that economic redevelopment would be fueled by new foreign investment in petroleum and mining was considerable by 1997. During 1998, however, the opposition forces of the National Union for the Total Independence of Angola (UNITA) failed to honor its obligations under the Lusaka Peace Protocol by not fully withdrawing its forces from areas occupied during the war, especially diamond mining areas, and by not fully cooperating in forming a new coalition government, the Government of Unity and National Reconciliation. As a result, renewed civil war broke out in the second half of the year, seriously affecting land-based mineral exploration and production operations, especially for diamonds. On June 12, 1998, the United Nations Security Council, through Resolution 1173 (1998), voted to impose additional sanctions on UNITA. The sanctions, which where adopted by the Security Council on June 12 and went into effect on June 25, ordered the freezing of financial resources or funds generated from property controlled by UNITA as an organization or by its leaders, their immediate families, and anyone acting on their behalf, and ban anyone from accepting or purchasing diamond exports from Angola except those with a certificate of origin from the Luanda Government. The importing of mining and transport equipment into UNITA-controlled areas was also banned (United Nations Security Council, June 12, 1998, Council to impose measures against UNITA, effective 25 June, unless it cooperates to extend State administration throughout Angola, press release SC/6530, accessed December 20, 1999, at URL http://www.un.org/News/

Press/docs/1998/19980612.sc6530.html).

The highlight of the mineral industry for 1998 was the

success of offshore deep-water petroleum exploration programs. Protected from the onshore civil war actions, the major oil companies reported nine significant new deep-water oil discoveries during the year. Added to the three major discoveries in 1997, these new fields represent as much as 6 billion barrels of recoverable crude oil (Africa Energy & Mining, June 1999; U.S. Energy Information Agency, 1999, Angola, Energy Country Analysis Brief, accessed December 12, 1999, at URL http://www.eia.doe.gov/emeu/cabs/angola.html). Angola anticipated that between \$4 billion and \$5 billion per year will be invested in the country during the next 5 years to develop these offshore petroleum resources (Embassy of Angola, Washington, DC, 1999, Oil industry developments-Sonangol outlines future plans for the oil sector in Angola, O Pensador, September/October, accessed December 12, 1999, at URL http://www.angola.org/news/pensador/october99/econ. html).

Government Policies and Programs

Mining and petroleum development are governed by several legal statutes, most of which have been updated since 1992. They include Foreign Investment Law No. 15/94 of October 23, 1994, which empowered the Foreign Investment Center to reject or approve new investment applications within 45 to 90 days on investments of up to \$50 million. Investments of more than \$50 million must be evaluated and forwarded to a Ministry of Planning and Economic Coordination within 40 days and a Negotiating Commission established within another 15 days. The Law on Geological and Mining Activities (Mining Law) No. 1/92 of January 17, 1992, administered by the Ministry of Geology and Mines, established the legal framework for prospecting, mining, processing, marketing, suspension or exhaustion, and reclamation of mineral resources, including stockpiles and waste heaps from old mining. Mineral rights were vested in the State. The law eliminated the state monopoly on mineral rights and provided for granting prospecting licences and mining titles to state-owned, mixed, private, or joint mining companies. As of mid-1997, 44 prospecting licences and 138 mining titles had been granted under the 1992 mining law. A separate law on diamonds was promulgated on January 7, 1994, and granted exclusive mineral rights for diamonds to Empressa Nacional de Diamantes de Angola (Endiama), the state-owned diamond mining company.

The laws on privatization were established under Law No. 10/94 of 1994. Under Decree No. 4-B/96 of May 31, 1996, which established the rules for taxation for the mining industry, domestic and foreign investors are treated equally. Corporate taxation was set at 40% of the net profit. Royalty rates were set

at 5% on precious stones and metals, 4% on semiprecious stones, 3% on metallic minerals, and 2% on other minerals. A surface tax of from \$1.00 to \$4.00 per square kilometer held was paid during exploration. Depreciation of fixed assets was allowed, and exploration costs can be written off during the first 3 years of the mining stage (Sambula, 1998). Petroleum exploration and development were administered under the Hydrocarbon Law of 1978, which made Sociedade Nacional de Combustiveis de Angola (Sonangol) the sole concessionaire for exploration and production. International oil companies operated in joint ventures or under production-sharing agreements with Sonangol.

Production and Trade

In 1998, Angola exported more than 268 million barrels of crude oil, of which 60% went to the United States. Angolan crude also was exported to Brazil and European and Asian markets. Disaggregated trade data for the current or recent few years were unavailable. Production of oil and gas continued on an upward trend, having increased by 37% between 1994 and 1999. Cement and reported diamond production increased, the latter reflecting the successful startup of several privatized operations from the active diamond fields in the northwestern provinces, prior to the renewed fighting between Government and UNITA forces.

Commodity Review

Industrial Minerals

The diamond areas in the Lunda Norte and the Lunda Sul Provinces, which were previously controlled by UNITA, and accounted for about \$400 million of Angola's annual national diamond output of \$1.1 billion, were opened to outside exploration and development companies in 1996. Some concession areas were not opened pending the full withdrawal of UNITA armed forces in 1997, while a number of operations were forced to suspend mining or close up completely, with the renewed outbreak of fighting, in 1998.

Sociedade Miniera de Catoca Ltda. (SMC) began production at the Catoca kimberlite pipe, 35 km south of Saurimo, in September 1997. By the end of 1998, the project had produced 1.245 million carats worth \$85 million. Catoca was the world's fourth largest kimberlite in terms of surface area and constituted the single largest diamond operation in Angola in terms of production value. SMC was a joint venture comprising Endiama (32.8%), Russia's Almazy Rossii-Sakha (32.8%), Brazil's Odebrecht Mining Services Inc. (18.4%), and Israel's Leve Leviev (16%). SMC produced between 80,000 and 90,000 carats per month at Catoca, and the output was expected to increase to 1.2 million carats in 1999 and 1.5 million carats in 2000. During 1998 and early 1999, SMC's operations were not impeded by UNITA operations in the area. To boost production at Catoca, SMC planned to invest an additional \$12 million during the next 2 years. After the first phase of the project ends in 2003, SMC planned to invest another \$250 million to \$300 million in a second phase, which

should boost production to 5 million carats per year. Diamond reserves in the Catoca kimberlite were estimated be 40 million carats, but that number could change as additional tests are performed on the structure (Embassy of Angola, Washington, DC, 1999, Mining sector developments—Catoca diamond production expected to grow despite war, O Pensador, April 1999, accessed June 11, 1999, at URL http://www.angola.org/news/pensador/april99/economic. html).

Sociedade de Desenvolvimento Mineiro de Angola, S.A.R.L. (SDM), a joint venture among Ashton Mining Ltd. of Australia, Endiama, and Odebrecht, was formed in 1995 to mine alluvial diamonds in the 85,600-km² Cuango River Valley concession, which is centered near the town of Luzamba in northeastern Angola. The first stage of development of the alluvial operations at the Tázua Mine and the final recovery plant at Luzamba was completed in 1998, with production beginning in August and the first parcel of 61,676 carats being sold to De Beers Central Selling Organization in London in December. For the third and fourth quarters of calendar year 1998, SDM produced 66,469.75 carats from 107,780 cubic meters of alluvial ore treated. Initial mining confirmed the high grade and diamond value projections of earlier studies, and the average value of diamonds sold was within the anticipated range of \$200 to \$350 per carat. Production from the river diversion at Tázua was expected to produce 250.000 carats in 1999; however, the project was set back by a January 7, 1999, ambush by an armed band, believed to be UNITA rebels, near the SDM operations in which two guards and two senior mine officials were killed (Ashton Mining Ltd., January 7, 1999, Ambush at Cuango Project, Angola, press release, accessed December 15, 1999, at URL

http://www.ashton.net.au/news/99_01_angola.html; October 22, 1999, Cuango, 1998 annual report, accessed December 15, 1999, at URL http://www.ashton.net.au/report/ index98. html). Security conditions remained a major concern and cost for the company.

DiamondWorks Ltd. of Canada (formerly Carson Gold Corp.) produced a total of 74,600 carats of diamonds in 1998 valued at \$10.96 million for an average price per carat of \$173 compared to 1997 production of 28,600 carats valued at \$5.16 million and an average price per carat of \$238. Production increases were accounted for by the first full year of operation of the Luo Mine, which yielded 54,500 carats, and 6-month startup output of the Yetwene Mine, which yielded 19,500 carats. An additional 600 carats came from exploration sampling of the Luarica concession. In June 1998, following a capital investment of \$12 million, DiamondWorks began commercial production of its second diamond property, the 550-km² Yetwene concession on the Chicapa and the Lumanha Rivers in Lunda Norte Province. In May 1997, DiamondWorks acquired a 50% interest in Yetwene by exercising agreements between DiamondWorks and Zizania Holdings Ltd. of the United Kingdom, the operator, along with a concurrent agreement between DiamondWorks' subsidiary, Branch Energy Ltd., and Sociedade Mineira do Lucapa and Sociedade Mineira e de Investimentos da Lunda, S.A., two Angolan companies. In 1996, Carson Gold and Branch Energy Ltd., its subsidiary, had acquired majority interest in reported resources of more than 10

million carats of diamond in the Luo and the Luarica concessions in Lunda Norte Province. Carson Gold was subsequently renamed DiamondWorks Ltd. of Canada in 1997 (DiamondWorks Ltd., June 27, 1996, Carson to become world player in diamond industry—Carson acquires major diamond concession in Africa, accessed June 3, 1997, at URL http://www.diamondworks.com/ news.html). In late 1998, full-scale production began at Yetwene, and by November, the new diamond recovery plant was producing at its designed rate of between 10,000 and 12,000 carats per month. The company was forced to suspend operations at Yetwene following an attack by a group of armed rebels on November 8, 1998, during which eight employees were killed and 8 more were taken hostage and are still missing. The company reported a long-term resource of 1.8 million carats of high quality diamonds at Yetwene, sufficient to maintain a production of 120,000 carats per year for 10 years. Subject to the availability of additional financing and increased political stability in Angola, DiamondWorks planned to add two additional diamond-processing plants to expand production capacity to 360,000 carats per year. The Luo Mine contained two of the world's largest kimberlite pipes, the Camatchia and the Camagico; production to date, however, has been restricted to the high-grade alluvial reserves in the adjacent Chicapa River. During 1999, mining efforts will shift from alluvial operations to mining of the kimberlite pipe at Camatchia. Production from Camatchia was expected to be 162,000 carats per year of diamonds with an average value between \$125 and \$150 per carat during 1999. (DiamondWorks Ltd., 1999, Review of operations, 1998 annual report, accessed December 15, 1999, at URL http://www.diamondworks.com/s/Financial

During 1998, SouthernEra Resources Ltd. of Canada recovered 144,500 carats of high-quality diamonds at its jointventure alluvial and fluvial mining operations at the Cassanguidi and the Luo concessions, including a 100-carat stone that was sold for \$400,000. By ceasing alluvial operations at yearend owing to decreased recoveries of diamond, considerable increases in security costs, and logistical resupply problems, the company recorded a loss on discontinued operations of \$5.3 million. Work continued, however, on the Camafuca-Camazambo project. Preparatory work on the Camafuca kimberlite pipe in early 1998 included test plant design, site infrastructure development, and site preparation. By yearend, a bulk sample of more than 15,000 metric tons was excavated, and a processing plant was being assembled to process and confirm previous bulk sampling results and to recover a new diamond parcel for valuation (SouthernEra Resources Ltd., January 7, 1999, Angola alluvial mining operations discontinued, press release, accessed February 12, 1999, at URL http://www.southernera.com/press/ pr990107.html; 1999, Angola—Operations overview, 1998 annual report, accessed December 12, 1999, at URL http://www.southernera.com/1Exploration&Operations.htm). In March 1997, the Angolan Council of Ministers had granted SouthernEra a 51% interest in a 160-hectare (ha) concession covering the Camafuca-Camazambo kimberlite pipe in the

Calonda area of Lunda Norte Province. Camafuca has been described as one of the world's largest undeveloped kimberlite pipes. SouthernEra will acquire a 51% interest in the Camafuca project by buying out SAA Distributors (Pty) Ltd., one of its partners, with a final \$6.5 million payment by April 1999. Other partners included Endiama (20%); Sociedade Miniera Do Lucapa, S.A.R.L. (SML), (15%); and Consorcio Minera Camafuca Camazambo, S.A.R.L. (Comica), (7%).

In June 1998, De Beers Centenary Angola Properties Limited (DEBCAP), a subsidiary of De Beers Centenary AG, and Endiama awarded a contract to a Portugese firm, Teixeira Duarte, to build a new diamond-sorting building behind the current Endiama headquarters in Luanda. De Beers will give 3 of the 12 floors of the \$30 million building to Endiama as their property. The building will house secure diamond sorting facilities incorporating current De Beers' diamond technology and will be used to train Angolan citizens to sort and value rough diamonds. Work on the 2-year construction project began in mid-1998 (De Beers Centenary AG, June 3 1998, De Beers awards tender for new sorting facility in Angola, press release, accessed June 11, 1998, at URL http://www.edata.co.za/debeers/press42.html).

In May 1998, the association of Endiama/De Beers, a joint venture between De Beers Angola Prospecting, a wholly owned subsidiary of De Beers Consolidated Mines Ltd., and Endiama. announced the discovery of two new kimberlites in its concession area in the Lunda Sul Province. The first kimberlites to be discovered since independence in 1975, they lie to the north of the city of Saurimo in the vicinity of the Catoca Mine. The pipes were intersected below a considerable depth of postkimberlite sediments and were identified by using De Beers' most recently developed technology. The Lunda concession was one of three areas granted to the association Endiama/De Beers in June 1996, within which the association has the right to any new kimberlites found (De Beers Centenary AG, May 11, 1998, Joint press release between Endiama & De Beers on the discovery of new kimberlites in Angola, press release, accessed June 11, 1998, at URLhttp://www.edata.co.za/ debeers/press40.html).

In May 1998, American Mineral Fields, Inc., of Canada, acquired the remaining 50% interest in International Defense and Security Forces Resources NV (IDAS) of the Netherlands Antilles and its Cuango Valley Luremo diamond concessions for \$2.5 million and a 30% net profit interest in production from the concessions up to a maximum of \$84 million. IDAS was a 50-50 joint-venture partner with Endiama, with respect to the mining lease in the Cuango Valley, and a 36,000-km² prospecting lease called the Cuango International, which borders the mining lease to the north. Development work on the Luremo River concession was delayed during the year, owing to the security situation in the area (American Mineral Fields, Inc, May 26, 1998, Purchase of IDAS Resources NV, press release, accessed December 22, 1999, at URL http://www.am-min.com/ 98/may% 2026-98.html).

In March 1998, Trans Hex International Ltd. of South Africa, signed a definitive agreement with Longreach Gold Oil Ltd. of Australia for the exploration and development of three concession areas in the Lunda Norte Province. This agreement

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required Trans Hex International to fund the exploration and development of each of the three concession areas located on the Chicapa and the Luachimo Rivers in the Lucapa area, in Lunda Norte Province—Proesda blocks Y, AC, and P, known as Diagema, Somicoa, and Kupolu, (respectively) up to a maximum of \$1.5 million per concession in return for which it would acquire 75% of Longreach's interest. Longreach held a 50% interest in the concessions with the balance being held by Angolan nationals. Any additional financing required would be funded by Trans Hex and Longreach on a 75%-to-25% basis or result in dilution. The Diagema project required the commitment of significant resources to a project with an increasing cost profile, in which Trans Hex International had a low equity interest. In the light of the weak international demand for diamonds and the extremely high political and security risk in the area, Trans Hex International reevaluated its exposure in Angola in November 1998 and terminated its agreement with Longreach and wrote down \$734,000 in exploration expenditures (Trans Hex International Ltd., March 31, 1999, Exploration—Angola, Notes to the 1999 consolidated financial statements, accessed December 22, 1999, at URL http://www.transhex.com/financial-fr.htm).

Fuels

Angola has been undergoing a major offshore petroleum exploration boom that will make it one of the major producers in Africa within the next 5 to 10 years. The boom has been stimulated by the opening of deep- water offshore blocks by the Government and by the development of new deep-water (1,000 to 3,000 meters) drilling and geophysical technologies by the petroleum industry. Between 1996 and mid-1999, more than 17 major new oilfields were discovered in offshore Angolan waters containing more than 6 billion barrels of recoverable oil resources. Chevron Corp. of the United States and Le Group Elf Aquitane (Elf) of France were the major petroleum operators. In 1998, Cabinda Gulf Oil Company (CABGOC), a Chevron subsidiary, accounted for nearly 65% of the crude production from fields located offshore Cabinda. Crude oil production, which has more than quadrupled since 1980, averaged 735,000 barrels per day (bbl/d) in 1998. Chevron held a 39.2% share in the CABGOC joint venture with Sonangol (41%), Elf (10%), and Agip Petroli of Italy (9.8%). Chevron reported that its four new deep-water offshore oilfield discoveries in Block 14—Kuito (discovered April 1997), Landana (January 1998), Benguela (July 1998), and Belize (October 1998)—contained an estimated 3 billion barrels of potential petroleum reserves (Chevron Corp., 1999, Chevron's answer to low oil prices—West Africa, 1998 annual report, accessed December 12, 1999, at URL http://www.chevron.com/finance/annual/ download/download.html). Discoveries by the Elf-led joint venture in Block 17 included Girassol (discovered in 1996 and containing reserves estimated to be approximately 1 billion barrels of petroleum), Dahlia (August 1997), Rosa (March 1998), and Lirio (September 1999) (Elf Aquitaine, September 3, 1998, Elf Aquitaine 1998 first half results show good resistance to drop in oil prices, press release, accessed

December 27, 1999, at URL

http://www.elf.fr/us/actu/presse/98/cdpresema.htm). The Dalia and the Rosa finds are potentially larger than Girassol, but further appraisal of both discoveries was planned.

An Exxon-led joint venture announced the discovery in 1998 of four new deep-water oilfields in Block 15—Kissanje (February 1998), Marimbe (March 1998), Hungo (July 1998). and Dikanza (October 1998)—with combined total resources of more than 2 billion oil equivalent barrels (Exxon, 1999, Financial and operating review, Exploration and production— West and Central Africa, 1998 annual report, accessed December 22, 1999, at URL http://www.exxon.mobil.com/ news/companypubs/index.html). Five offshore projects (four in Block 15 and the Girassol field, in which Exxon has a 20% interest) are targeted for start-up by 2005, with ultimate total gross new production of nearly 1 million barrels per day. Development has already begun in the Girassol field. Development planning is underway for Exxon-operated discoveries on Block 15 and additional resources on Block 17. Total investment in new field development, a new oil refinery, and natural gas processing facilities, will exceed \$20 billion.

A more detailed discussion of recent developments in the Angolan oil industry is available through the U.S. Energy Information Administration website: Energy country analysis brief—Angola, accessible at URL http://www.eia.doe.gov/emeu/cabs/angola.html.

Reserves

Proven reserves of petroleum at yearend 1998 were reported to be 5.4 billion barrels and natural gas reserves to be 45.3 billion cubic meters (U.S. Energy Information Administration, June 1999, Country analysis brief—Angola, accessed October 9, 1999, at URL http://www.eia.doe.gov/emeu/cabs/angola.html). As discussed earlier, the proving up of discoveries made between 1997 and 1999 could easily double these reserves. Overall diamond reserves have been estimated to be between 40 million and 130 million carats (Republic of Angola, [1997], Angola's mining sector—Diamonds, business & economics, accessed November 12, 1999, at URL http://www.angola.org/business/guide97/diamonds.html).

Infrastructure

Angola's infrastructure suffered major deterioration during the civil war either through direct military action or from lack of maintenance. Before rebuilding can be done, the removal of land mines from strategic transportation routes remains a major priority. In 1997, the Government signed an agreement with Tor di Valle of Italy to restore the 1,350-km-long Benguela Railroad from the port city of Lobito to the border near the Copperbelt of Congo (Kinshasa). Historically, the Benguela line was the major and economically most efficient route for cobalt, copper, and manganese exports from the Copperbelt. Tor di Valle agreed to spend up to \$500 million to renovate the line in return for rights to harvest and export the eucalyptus from 37,000 ha of plantations along the rail line (John Fleming, May 26, 1997, Rebuilding begins on Angola's

Benguela railway, Reuters, accessed May 27, 1997, at URL http://biz. yahoo.com/finance/97/05/26/). Renewed fighting in the area during 1998 and 1999 may well delay this renovation. In 1997, Odebrecht also contracted to construct the 329-megawatt powerplant at the Capanda Hydroelectric Project.

Outlook

Although offshore petroleum development and exports will dominate the economy of Angola for years to come and will provide a major impetus to rebuilding the war-torn economy and infrastructure, mineral development, especially of diamonds, will play a significant secondary role and will stimulate further economic growth on the local and regional levels. Geologic environments in Angola known to be favorable to economic mineralization have been off limits to exploration during the prolonged civil war. The return of mining investment and the application of modern exploration concepts and technology hold promise for additional mineral

discovery opportunities in Angola. The attraction of needed new mineral investment, however, will be contingent on the end of the civil war and the stabilization of the political environment.

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Major Source of Information

Ministry of Geology and Mines P.O. Box 1260 Luanda, Angola Telephone: (244-2) 326-724

Fax: (244-2) 321-655 or 322-569

 $\label{table 1} \textbf{TABLE 1} \\ \textbf{ANGOLA: PRODUCTION OF MINERAL COMMODITIES 1}/$

Commodity		1994	1995 e/	1996 e/	1997 e/	1998 e/
Cement, hydraulic e/	thousand metric tons	240 r/	200 r/	270	301 2/	350 2/
Diamond 3/4/	thousand carats	1,400	2,900	2,500 2/	1,234 2/	2,764 2/
Gas, natural: e/						
Gross 5/	million cubic meters	5,600	5,210 2/	5,804 r/	5,804 r/	5,804 e/
Dry	do.	560	560	566 r/	566 r/	566 e/
Granite	thousand cubic meters	1,490 e/	1,500	1,500	1,500	1,500 e/
Marble	do.	91	100	100	100	100 e/
Petroleum:						
Crude	thousand 42-gallon barrels	196,370	232,800 2/	259,150 2/	262,800 2/	268,275 2/
Refinery products e/ 6/	do.	9,000	10,585 2/	11,000	11,700	12,000 e/
Salt	metric tons	40,000	40,000	40,000	40,000	40,000

e/ Estimated. r/ Revised.

^{1/} Includes data available through September 1999.

^{2/} Reported figure.

^{3/} Does not include smuggled production.

^{4/} Production was approximately 90% gem grade and 10% industrial grade.

^{5/} Angola has no natural gas distribution system. Most gas was vented and flared.

^{6/} Includes asphalt and bitumen.