THE MINERAL INDUSTRY OF

ANGOLA

By George J. Coakley

Angola had a population of about 10.5 million in a 1,246,700-square-kilometer (km^2) area, which includes Cabinda, a 100-kilometer (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 is the source of about 50% of Angola's oil production. In 1997 the mineral economy of Angola was dominated by petroleum. The $4.7 billion in petroleum exports accounted for 90% of all exports and for more than 80% of government revenues. Angola's gross domestic product (GDP) was $8.31 billion by yearend 1996, with petroleum and related services accounting for about 50% of GDP. The economy still suffered from an hyperinflation of 1,500 % per year. 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. During 1997, substantial progress was made in forming a new coalition government, the Government of Unity and National Reconciliation (GURN), in April and in the demilitarization of National Union for the Total Independence of Angola (UNITA) opposition forces and the withdrawal of UNITA forces from areas, especially diamond mining areas, occupied during the war. GURN began to rebuild a shattered economy and to attract foreign investment back to the minerals sector. Major successes in petroleum exploration and in diamond exploration and mine permitting in 1997 held considerable promise for the future of mineral development in Angola.

Mining and petroleum development are governed by several legal statutes, most of which have been updated within the past 5 years. 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 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 both prospecting licences and mining titles to either 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 as law No.15/94 on January 7, 1994, and granted exclusive mineral rights for diamonds to the state-owned diamond mining company, Empressa Nacional de Diamantes de Angola (Endiama).

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 is 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 (Sumbula, 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.

In 1997, Angola exported nearly 263 million barrels (Mbbl) of crude oil, of which 55% went to the United States. As part of a debt-servicing agreement, Angola exported nearly 7.3 Mbbl per year to Brazil. Angolan crude also was exported to European and Asian markets

Production of oil and gas continued on an upward trend, as did cement, a leading indicator of a rebuilding economic infrastructure. The apparent decline of diamond production was attributed to the withdrawal of UNITA forces from the active diamond fields in the northwestern provinces. Recent desegregated trade data were unavailable.

Among the metal commodities, exploration was most active for gold. Ashanti Gold Fields Co. Ltd. of Ghana held the 740 square kilometer (km^2) Bentiabo concession in Huila Province, with exploration ongoing in 1997. In July 1997, Anmercosa Exploration, a subsidiary of the Anglo American Corp. of South Africa, was awarded two concessions in southern Angola, near the border with Namibia. Anmercosa planned a 3-year, $1 million exploration program to examine the area for nickel, copper, zinc, and gold potential.

A consortium of Kobe Steel and Nissho Iwai of Japan and Odebrecht Mining Services Inc. of Brazil was exploring the feasibility of building a Midrex, direct-reduced iron plant in Angola using domestic iron ore resources. Initial interest in reopening the Kassinga iron ore mine in the southern part of the country had switched to determining the feasibility of developing the 1-billion-metric-ton Kassal-Kitunga titaniferous magnetite deposit, which had a more-favorable location and transport infrastructure. The Government also transferred the iron ore mining rights from the old State-owned company, Companhia de

Ferro de Angola (Ferrangol), to a newly constituted Kassinga Mining Joint Company which was to look at the potential for reopening Kassinga. Kassinga had remaining drilled resources of 100 million metric tons (Mt) of iron ore, principally hematite containing 30% to 34% iron (Metal Bulletin, 1997).

In February, Easton Minerals Ltd. of Canada was granted a 20,000-km^2 Prospecting License in the Cunene anorthosite complex centered around the city of Lubango in Huila Province. Easton acquired a 70% interest in the property from Cornerstone Diamond Corp. Ltd., which retained a 30% carried interest. Exploration priorities will be gold, nickel, copper, cobalt, vanadium, chromium, and platinum (Easton Minerals Ltd., 1997).

The diamond areas, which were previously controlled by UNITA, in Lunda Norte and Lunda Sul Provinces and accounted for about $400 million out of Angola's annual national diamond output of $1.1 billion were opened to outside exploration and development companies in 1996, although some concession areas were still waiting for the full withdrawal of UNITA armed forces in 1997. Endiama issued exploration licenses or entered into joint ventures for a number of projects.

Production began in May 1997 at Angola's first kimberlite mine at Catoca, in Lunda Sol Province. The $24 million project was capitalized by Sociedade Miniera de Catoca Ltda., a joint venture comprising Endiama (40%), Russia's Almay Rossii-Sakha (40%), and Brazil's Odebrecht Mining Services Inc. (20%). Production from the Catoca pipe, which had the fourth largest surface area of any known kimberlite, will begin at a rate of 250,000 carats per year in 1997-98, increase to 550,000 carats per year in 1998-99, 850,000 carats per year in 1999-2000 and 990,000 carats per year between 2000 and 2007. Mine production is expected to have an average value of $75 to $100 per carat, with output consisting of 35% gem quality, 15% near gem quality, and 50% industrial diamonds (Diamond International, 1997).

Sociedade de Desenvolvimento Mineiro de Angola, S.A.R.L. (SDM), a joint venture between Ashton Mining Ltd. of Australia, Endiama, and Odebrecht was formed in 1995 to mine alluvial diamonds in the 85,600 km^2 Cuango River Valley concession, centered near the town of Luzamba in northeastern Angola. Ashton reported the Cuango diamonds to bee high quality with an average value in the range of $200 to $350 per carat (Ashton Mining Ltd. of Australia, 1998, Annual report accessed June 1, 1998, at URL http://www.ashton.net.au/report/index.html). SDM agreed to develop the project only after UNITA- controlled diamond areas were transferred to the Angola Government in January 1998. Mining was expected to begin in the second half of 1998 following the rehabilitation or replacement of the existing plant and equipment. Initial project funding will be $50 million. In a separate project, Ashton entered a 50/50 joint venture with the Angolan company Bapsil Service Ltda. to explore a 10,000-km^2 diamond concession in the Luange River area adjacent to the SDM Cuango concession.

In 1996, the Canadian company, Carson Gold Corporation, and its subsidiary, Branch Energy Ltd., acquired majority interest in reported resources of more than 10 million carats of diamond in the Luo and 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). DiamondWorks began commercial production by using a floating dredge and processing alluvial gravels in a 50-metric-ton-per-hour dense-media separation plant at the Luo Mine in July 1997. The plant produced 28,590 carats from June through November 1997 with an average sales value of $238 per carat. Output included 36 stones, between 10 and 33 carats and 161 stones between 5 and 10 carats. Based on 1997 output, 1998 production is expected to exceed 80% gem quality with average values exceeding $300 per carat. The company also started to evaluate the Camatchia and the Camagico kimberlite pipes at Luo to determine the feasibility of an open pit mining operation capable of producing an additional 250,00 to 500,00 carats per year. DiamondWorks also began development work on a second property, the 550-km^2 Yetwene concession on the Chicapa and the Lumanha Rivers in Lunda Norte Province. DiamondWorks acquired a 50% interest in Yetwene in May 1997 by exercising agreements between DiamondWorks and the operator, Zizania Holdings Ltd. of the United Kingdom, along with a concurrent agreement between it's subsidiary, Branch Energy, and two Angolan companies, Sociedade Mineira do Lucapa and Sociedade Mineira e de Investimentos da Lunda, S.A. Operations at the Yetwene Mine were planned to start-up in the second quarter of 1998, with production expected to reach 8,000 carats per month of high quality diamonds with values similar to that at Luo (DiamondWorks Ltd., December 19, 1997, DiamondWorks diamond production surpasses 28,00 carats in fiscal 1997, accessed February 1, 1998 at URL http://www.diamondworks.com/s/Reports.asp?/NewsReleases=&rt=1&reportID=1052).

As part of the peace accord, UNITA formed a new legally recognized mining company, Sociedade Geral das Minas (SGM) in 1997. Endiama granted SGM rights to two non-producing diamond concessions, a kimberlite area in Cuando-Cubango Province and an alluvial area in the central highlands near Andula. Negotiations were underway on possible SGM participation in the SDM project and in the Luarica concession in Lunda Norte. The resolution of SGM's legally recognized property rights was a key to the withdrawal of UNITA forces from diamond mining areas they have occupied, and derived substantial revenue from, since 1992 (Financial Times, 1997).

SouthernEra Resources Ltd. of Canada (Reports accessible on the Internet at URL http://www.southernera.com) reached an agreement with Sphere Trading Ltd. in September 1996 to cooperate in exploration and development of 4 alluvial diamond concession areas, including the Luo concession. Sphere mined 48,000 carats averaging over $99 per carat from this area in 1996. For payment of $2.5 million SouthernEra obtained rights to 35% of profits from properties it operates and 10% of net profits from Sphere operations in return for technical expertise and financing. In 1997, SouthernEra mined approximately 22,000 carats of diamonds averaging over $350 per carat from riverbed and flood plain gravel operations on the Chicapa River at the Luo concession. In March 1997 the Angolan Council of Ministers granted SouthernEra a 51% interest in a 160 hectare concession covering the Camafuca-Camazambo kimberlite pipe in the Calonda area of Linda Norte Province. Camafuca is described as the world's largest undeveloped kimberlite pipe. Earlier exploration of the kimberlite ceased in 1982. An agreement called for buying out one of its partners, SAA Distributors (Pty) Ltd. with $5 million by April 1997 and $7 million by April 1998. They also agreed to spend $5 million on exploration within 5 years. Other partners include Endiama (20%), Socidade Miniera Do Lucapa, S.A.R.L. (SML), (15%), Consorcio Minera Camafuca Camazambo, S.A.R.L. (Comica), (7%) and SAA, (7%). SouthernEra began a large diameter drilling program to confirm earlier work on high grade areas and to collect a bulk sample for price evaluation. Further bulk sampling and installation of a test plant will be carried out in 1998.

De Beers Consolidated Mines Ltd. of South Africa (Press releases accessible on the Internet at URL http://edata.co.za/debeers/), in mid-1996, after a 10-year absence from Angola, acquired the right to examine the alluvial and kimberlite diamond potential at Mavinga in Cuando-Cubango Province, and at Quela in Malange Province and to explore for kimberlites in Lunda Norte and Lunda Sul Provinces. A 5-year, $50 million exploration program was planned. De Beers also contracted to build a $30 million diamond training and sorting facility in the capital city of Luanda.

Other diamond concession holders included, American Mineral Fields, Inc. (AMF) of Canada (Reports accessible on the Internet at URL http://www.am-min.com), which, in May 1996, acquired a 50% interest in diamond concessions held by a Dutch West Indies security firm, International Defense and Security Forces Resources N.V. (IDAS), on the Luremo River near the border with Congo-Kinshasa. IDAS held a 50% interest in two properties with Endiama (50%), a 3,700 km^2 mining lease in the Cuango Valley, Luremo, and a 36,000 km^2 prospecting lease called the Cuango International, which borders the mining lease to the north. In early January 1998, AMF entered an agreement to purchase 100% of IDAS for 2.25 million and a 30% net profit interest in production from the concessions up to a maximum of $84 million.

Botswana Diamondfields Inc, a subsidiary of the Crew Group of Canada (press releases accessible on the Internet at URL http://www.crewgroup.com/bwd/), entered a five year long joint venture agreement with Gema Dourada Ltd. (GDL) to explore a 13,230 km^2 concession in the most northern part of Lunda Norte province. A recent pre-feasibility study in the area by GDL and Endiama established a possible 1 million carat resource at grades in the range of 0.4 to 0.7 carat of diamond per cubic meter. (Botswana Diamondfields Inc., 1997)

Endiama also entered a joint venture with Sociedade Portuguesa de Emprendimentos in Socidade Mineira de Lucapa's 8,000 km^2 concession in the Camfue and Camiambo areas of Lunda Norte.

Trans Hex International Ltd. of South Africa (Press releases accessible on the Internet at URL http://www3.stockgroup.com/thi/) agreed to fund 75% of Longreach Gold Oil Ltd's (Australia) share of the exploration of the Diagema, Kupolu, and Somicoa diamond concessions, located on the Chicapa and Luachimo rivers in the Lucapa area, in Lunda Norte Province. Longreach holds a 50% interest in the concessions. Trans Hex consultants reported an indicated and inferred resource on two of the concessions at 400,000 carats of gem quality diamond in the $200 per carat range.

In the petroleum sector, the peace accord has led to renewed interest and investment in offshore petroleum exploration in the Angolan exclusive economic zone, particularly in the deep water blocks. Between 1993 and 1997 an estimated $4 billion has been spent on petroleum exploration and production in Angola. Favorable exploration results from offshore drilling in 1996 and 1997 indicated considerable potential for significantly expanding Angola's petroleum production over current levels of about 720,000 barrels per day (bbls/d) of crude oil, with production expected to increase by 70% to 1,217,000 bbls/d by 2003 (Arab Oil and Gas, 1997). This expansion in production will make Angola the fourth largest producer in Africa, after Nigeria, Libya and Algeria. Chevron of the United States and the French company Le Group Elf Aquitane (Elf) were the major petroleum operators. The Chevron subsidiary, Cabinda Gulf Oil Company (CABGOC), accounted for nearly 65% of crude production from fields located offshore Cabinda. Chevron spent $500 million on exploration, drilling, and production in 1996 and increased this amount to $700 million in 1997.

The U.S. Department of Energy, Energy Information Agency maintains an "Energy Country Analysis Brief " covering recent developments in the Angolan oil industry (Accessible on the Internet at URL http://www.eia.doe.gov/emeu/cabs/angola.html). Highlights from the May 1998 Energy Country Analysis Brief are summarized below. CABGOC is operated by Chevron which holds a 39.2% share in the joint venture with Sonangol (41%), Elf (10%) and Agip Petroli of Italy (9.8%). The largest producing fields are Takula (Area A), Numbi (Area A), and Kokongo (Area B). CABGOC and its partners hope to expand production in the three areas to 600,000 bbl/d by the turn of the century. CABGOC made a significant oil discovery, in deeper waters offshore Cabinda, in April 1997. The field, designated Kuito, has estimated recoverable reserves of 1 - 2 billion barrels. Kuito lies in waters 1,300 feet (400 meters) deep in Block 14, which is adjacent to Areas B and C. CABGOC is the operator of the production sharing agreement working on Block 14, and it has 31% interest in the venture. Other partners in the production sharing agreement are Sonangol (20%), Total (20%), Agip (20%), and Petrogal (9%). Initial production from Kuito is expected to begin in 1999 at the rate of 50,000 bbl/d, eventually increasing to 200,000 bbl/d. CABGOC announced in January 1998 a second major oil find on Block 14. The Landana field tested at rates similar to the Kuito field, and CABGOC and its partners are planning to drill three additional exploratory wells on Block 14 to delineate the size of the discovery. If viable, Landana could be on stream by the end of 1999.

Elf controls the second largest area of production in Angola in Block 3, which is located offshore of the northern coast. The largest fields on Block 3 are Pacassa, Cobo-Pambi, and Palanca. Elf has a 50% interest in Block 3. Other partners on the block include Sonangol, Agip, Svenska Petroleum, Nis Naftgas, Ina Naftaplin, and Ajoco. The Oombo field, a satellite of the Cobo-Pambi field (1996 production of 54,000 bbl/d), came on stream in January 1998 producing 9,500 bbl/d. Elf has made several discoveries on Block 17, which is located in deep offshore waters northwest of Luanda. The Girassol field was discovered in 1996 in 1,365 meters of water. Girassol is estimated to contain between 700 million to 2 billion barrels of recoverable reserves.

Development drilling on Girassol is scheduled to begin in September 1999, and production is planned to begin in the 4th quarter of 2000. Elf announced a second discovery on Block 17 in August 1997. The field, designated Dalia, has estimated recoverable reserves of 750 million to 1.5 billion barrels of oil. A second exploratory well was drilled on Dalia in December 1997, producing results similar to the initial find. Elf (35%) is partnering on Block 17 with, Esso Exploration Angola Ltd. (Exxon) of the United States (20%), BP Exploration (Angola) Ltd. of the United Kingdom (16.7%), Den Norske Stats Oljeseskap a.s (Statoil) of Norway (13.3%), Norsk Hydro ASA of Norway (10%), and Petrofina Exploration MBV (Fina) of Belgium (5%). Elf could have a combined production from the Girassol and Dalia fields of over 500,000 bbls/d by 2002 (Reuters, 1997).

Block 2, located offshore of the northern Angolan city of Soyo, is also currently in production. Texaco and Total (France) are both operators on Block 2. Major fields include Lombo, Sulele, and Tubarao. Texaco was producing 110,00 bbls/d from the shallow water Block 2-80/85 and was actively exploring the deep water Block 22. Fina is the operator of Angola's onshore production. Production is centered in two areas, Kwanza near Luanda, and the Congo basin near Soyo. Production facilities near Soyo were damaged during the civil war, and a $250 million post-war rehabilitation program is underway. Ganda, Pangala, Kitona, and N'Zombo are the major onshore fields.

Exxon (40%), in partnership with BP (26.7%), Agip (20%), and Statoil (13.3%) was actively drilling the Kissanje and Marimba sectors of Block 15 during 1997.

Ranger Oil of Canada is planning to drill additional wells near a 1996 discovery that tested at 7,400 bbl/d. Ranger has a 40% interest on the block, except for the Block 4-Kiame field where it has 100% interest. Production of 7,000 bbl/d on Kiame is scheduled to begin in 1998 at a development cost of $27 million. Ranger reported reserves of 8 million bbls of crude in about 142 meters of water. The recent offshore discoveries in Angola have sparked interest in Angola's unclaimed blocks. Block 19, located in deep water offshore Luanda, was awarded to a group composed of Fina (30% and operator), Ranger (25%) Sonangol (20%), United Meridian Corp. of the U.S. (20%), and the Israeli firm Naptha (5%). Texaco was named operator of Block 22, and Australian firm BHP was named operator of Block 21 in June 1997. Bids for Blocks 23, 24 and 25 were accepted in 1997, with the possibility of licenses being awarded in the first half of 1998. License awards for Blocks 31-34 may be granted by the end of 1998.

The Fina Petroleos De Angola refinery in Luanda has current capacity of 32,100 bbl/d. The refinery is a joint-venture between Sonangol (36%), Fina (61% and operator), and private investors (3%). Angola and China signed a letter of intent in January 1998 on joint construction of a second refinery at Lobito. A $1 billion, 200,000 bbl/d facility was planned. Angola was also in discussion with Mobil Corp. of the United States about the possibility of relocating a 100,000 bbl/d capacity oil refinery from Wort, Germany to Lobito (Wall Street Journal, 1997).

Proven reserves of petroleum at year-end 1997 were reported at 5.4 billion barrels and natural gas reserves at 48.1 billion cubic meters (see http://www.eia.doe.gov/emeu/cabs/angola.html). Overall diamond reserves have been estimated at 180 million carats (see http://www.angola.org/fastfacts/economic.html).

Angola’s infrastructure suffered major deterioration during the civil war, either through direct military action or from lack of maintenance. The removal of land mines from strategic transportation routes remains a major priority, before rebuilding can be done. In 1997, the Government made an agreement with the Italian company, Tor di Valle to restore the 1,350 kilometer long Benguela Railroad from the port city of Lobito to the border near the Copperbelt of Congo-Kinshasa. The Benguela line was historically the major and economically most efficient route for copper, cobalt and manganese exports from the Copperbelt. Tor di Valle has agreed to spend up to $500 million to renovate the line in return for rights to harvest and export 37,000 hectares of eucalyptus plantations along the rail line (Fleming, 1997). Odebrecht is also contracted to construct the 329MW power plant at the Capanda Hydroelectric project.

While off shore petroleum development and exports will dominate the economy of Angola for years to come and 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 level. Geological 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 continued stabilization of the political environment and the successful completion of post war efforts such as the clearance of land mines from principal transportation routes and mining areas..

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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

TABLE 1

ANGOLA: PRODUCTION OF MINERAL COMMODITIES 1/

Commodity		1993	1994	1995 e/	1996 e/	1997 e/
Cement, hydraulic e/	thousand metric tons	250	250	250	270	301 2/
Diamond 3/ 4/	thousand carats	1,000	1,400	2,900	2,500 2/	1,234 2/
Gas, natural: e/						
Gross 5/	million cubic meters	5,600	5,600	5,210 2/	19,800 r/	20,000 e/
Dry	do.	560	560	560	2,000 r/	2,000 e/
Granite	thousand cubic meters	1,130	1,490 e/	1,500	1,500	1,500
Marble	do.	104	91	100	100	100
Petroleum:						
Crude	thousand 42-gallon barrels	182,865	196,370	232,800 2/	259,150 2/	262,800 2/
Refinery products e/ 6/	do.	9,000	9,000	10,585 2/	11,000	11,700
Salt	metric tons	40,000 r/	40,000 r/	40,000 r/	40,000	40,000

e/ Estimated. r/ Revised.

1/ Includes data available through May 1998.

2/ Reported figure.

3/ Did not include smuggled production.

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

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

6/ Included asphalt and bitumen.