**THE MINERAL INDUSTRY OF**

# ANGOLA

## By George J. Coakley

The Republic of Angola had a population of about 11 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 that is located between the Congo (Brazzaville) and Congo (Kinshasa). The mineral economy of Angola was dominated by petroleum with diamond being another important source of revenues. Cabinda was the source of 62% of Angola's oil production followed by Block 3 with 23% in 1999 (the last year for which data was available). According to International Monetary Fund, petroleum and diamond accounted for 61.4% and 8.7%, respectively, of the nominal gross domestic product, which was estimated to be $5.6 billion in 1999; petroleum and petroleum products and diamond accounted for 87.8% ($5 billion) and 1.2% ($629 million), respectively, of the value of exports in 1999 (International Monetary Fund, August 2000, Angola—Recent economic developments, IMF Staff Country Report 00/111, accessed July 2, 2001, at URL http://www.imf.org/external/pubs/ft/scr/2000/cr00111.pdf).

The highlight of the mineral industry in Angola for 2000 continued to be the success of offshore deepwater petroleum exploration programs. Protected from the onshore civil war actions, the major oil-production-sharing consortiums, which were led by BPAmoco plc, Chevron Corp., ExxonMobil Angola Ltd., and TotalFinaElf, reported 34 significant new deepwater oil discoveries between 1996 and May 2001; 10 were found during 2000 (table 2). Added to the nine fields discovered in 1998 and the four other major discoveries since 1996, these new fields have the potential to double Angolan oil production to 1.3 million barrels per day by 2002. Production declined by 3% in 2000 to 272 million barrels.

### 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 empowers 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 the 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, which is administered by the Ministry of Geology and Mines, establishes the legal framework for prospecting, mining, processing, marketing, suspension or exhaustion, and reclamation of mineral resources, which include stockpiles and waste heaps from old mining. Mineral rights are vested in the State. The law eliminates the state monopoly on mineral rights and provides 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 Mining Law. The separate Law on Diamonds, which was promulgated on January 7, 1994, grants exclusive mineral rights for diamond to Empressa Nacional de Diamantes de Angola (Endiama), which was 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 is set at 40% of the net profit. Royalty rates are 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 is allowed, and exploration costs can be written off during the first 3 years of the mining stage (Sambula, 1998). Petroleum exploration and development are 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 operate in joint ventures or under production-sharing agreements with Sonangol.

### Commodity Review

**Diamond.**—Despite the ongoing civil war and United Nations (U.N.) sanctions against illegally mined diamond, officially reported diamond production increased by 17% to 4.3 million carats in 2000 compared with 1999 output of 3.7 million carats of diamond. According to the April 2001 U.N. report, 69% of the diamond under Government control in 2000 came from nine official mines; 31% was attributed to artisanal miners. The value of production was reported to be $398.5 million for the official sector and $347.6 million for the unofficial sector. Diamond smuggling by the National Union for the Total Independence of Angola (UNITA) and other sources was estimated to have increased to $250 million in 2000. The U.N. estimated that the total value of diamond mining, which included production from UNITA-controlled mines, was a minimum of $1.1 billion. The report also concluded "that the increase in non-UNITA smuggling during 2000 meant that illicit Angolan diamonds are still reaching diamond markets regardless of the certificate of origin system and which makes the tracing of UNITA smuggling more problematic." The U.N. report explained the operations of the Angola Selling Corp. (ASCorp), which was a Government single-channel marketing system designed to regulate diamond buying; efforts to train and regulate the estimated 100,000 artisanal miners working in Angola; and operations of the Guichet Unico, which was established to investigate applicants for diamond credentials and to issue credentials and to provide insights into illicit diamond trading and smuggling operations (United Nations Security Council, April 18, 2001, Addendum to the final report of the monitoring mechanism on sanctions against UNITA, accessed

July 15, 2001, at URL http://www.un.org/Depts/dhl/docs/s2001363.pdf).

In its December 2000 final sanctions monitoring report, the United Nations gave additional details on UNITA mining and international diamond smuggling operations between 1980 and 2000 (United Nations Security Council, December 21, 2000, Final report of the monitoring mechanism on sanctions against UNITA, accessed July 15, 2001, at URL http://www.un.org/Depts/dpa/docs/Monitoring%20final.PDF).

Sociedade Miniera de Catoca Ltda. (SMC) remained the largest producer in 2000 with output of around 1.5 million carats from its Catoca kimberlite pipe, which is 35 km south of Saurimo. SMC was a joint venture of Endiama (32.8%), Russia's Almazy Rossii-Sakha Co. (32.8%), Brazil's Odebrecht Mining Services Inc. (18.4%), and Israel's Lev Leviev (16%). Diamond reserves in the Catoca kimberlite were estimated to be at least 40 million carats (Embassy of Angola, Washington, DC, April 1999, Mining sector developments—Catoca diamond production expected to grow despite war, O Pensador, 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 of 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, 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, as well as an agreement to sell production to De Beers Diamond Trading Corporation, was completed in 1998. Despite ongoing security problems and related intermittent work suspensions during the past 2 years, SDM produced 210,000 carats of high-quality diamonds in 2000 and 185,000 carats in 1999. Bulk sampling of river terrace gravels near the Ganzo, the Ginge, and the Tázua River diversions was continuing (Mbendi Information Services, May 16, 2001, Angola—Mining—Diamond, accessed July 15, 2001, at URL http://mbendi.co.za/indy/ming/dmnd/af/an/p0005.htm).

The establishment of ASCorp as a single diamond-buying agent effectively blocked sales to De Beers, which was the traditional purchaser of most Angola diamonds. In response to international concerns regarding "conflict diamonds," De Beers announced earlier in 2000 that it would stop buying all diamond rough from Angola except for those purchased under its agreement with SDM. In an effort to reinstate its buying agreement with SDM, De Beers offered to forfeit part of a $50 million loan given to Endiama to build a diamond sorting facility in Luanda. The Government, however, said it would repay the De Beers loan (Mazal U'Bracha Magazine, December 20, 2000, Angola pays off De Beers, accessed July 2, 2001, at URL http://www.diamondsview.com/news_205_dec.htm).

Associacao Chitotolo [owned by Sociedade Miniera de Lumanhe (50%), ITM Mining Ltd. (35%), and Endiama (15%)] produced 194,000 carats of alluvial diamond in 2000 (Mbendi Information Services, May 16, 2001, Angola—Mining—Diamond, accessed July 15, 2001, at URL http://mbendi.co.za/indy/ming/dmnd/af/an/p0005.htm).

DiamondWorks Ltd. of Canada held a majority interest in the Luo and the Yetwene alluvial diamond projects. Following an armed attack on the Yetwene camp on November 8, 1998, operations were suspended. The company resumed operations in April 1999 and, when faced with financial and security problems, placed the Yetwene operation on a care and maintenance in November 1999 and throughout 2000. Diamond production for the 8-month period from April to November 1999 was 39,388 carats valued at $4.5 million. The company wrote down more than $23 million in assets in Angola for 1999. DiamondWorks' Luo property was able to produce for a 5-month period in 2000 before being placed on a care-and-maintenance basis in May 2000. Production at Luo was 18,999 carats compared with 46,028 carats in 1999. The value of production of Luo diamonds in 2000, net of applicable taxes and duties, was reported to be $4.3 million. At yearend 2000, DiamondWorks had an extension for mining rights to five kimberlite pipes, which included the large Camatcha Pipe, pending with the Government. The future of DiamondWorks was subject to a January 2000 financial restructuring agreement with Lyndhurst Ltd., which, if completed, would give Lyndhurst control of DiamondWorks (DiamondWorks Ltd., 2001).

During 2000, SouthernEra Resources Ltd. of Canada completed a feasibility study and restructured its position in the proposed Camafuca kimberlite joint venture. Ownership will be split among Welox Limited, (a member of the Leviev Group of Companies) (33%), SouthernEra (32%), Endiama (an affiliate of Endiama) (20%), and Sociedade Mineira do Lucapa Limitada (SML) (15%). Welox had agreed to provide up to $18 million of the financing for the first phase of the project. In January 2001, the joint-venture partners accepted SouthernEra's Phase I feasibility study and submitted its application for the mining permits required to begin construction, which will take around 9 months to complete following granting of permits. The feasibility study was based on total resources at Camafucha to a depth of 145 meters (m) estimated to be 209.5 million cubic meters containing 23.24 million carats of diamonds valued at $109 per carat. The initial 5-year-long Phase I project will remove 6.13 million cubic meters of dredged material containing an average grade of 0.18 carat per cubic meter valued at $117 per carat. Dredged material will move by a slurry pipeline to a land-based conventional dense media separation plant. Estimated capital cost of the dredge and processing plant was $16 million (SouthernEra Resources Ltd., January 10, 2001, Camafuca feasibility study accepted by SouthernEra's partners study predicts outstanding financial performance for diamond project, Press Release, accessed February 9, 2001, at URL http://www.southernera.com/News_Releases/nr010110.htm).

During 2000, a joint venture between De Beers Angola Prospecting Ltd., (a wholly owned subsidiary of De Beers Consolidated Mines Ltd.) and Endiama announced the discovery of 17 new kimberlites in its concession areas in the Lunda Norte and Lunda Sul Provinces. Drilling and quantitative sampling were ongoing at yearend 2000. Work on its Mavinga and Quela concessions was suspended owing to security considerations.

International Defense and Security Forces Resources NV (IDAS) of the Netherlands Antilles [a 50-50 joint venture between Endiama and American Mineral Fields, Inc. (AMF), of Canada], held the Cuango International area prospecting license and the Luremo mining license in the Cuango Valley. IDAS had only limited access to the UNITA-controlled areas during 2000; no official production was reported. In October, AMF wrote down the value of its deferred costs at its Angolan properties to $1.00. In December, following prolonged negotiations with the Government to resolve a boundary dispute that affected the Luremo area, AMF agreed to relinquish its old Cuango and Luremo license areas and to accept a new license that covered an area of 3,000 $km^2$ that roughly corresponds to its old Luremo license. The terms and official confirmation of the new license were still pending at yearend (American Mineral Fields, Inc., 2001, p. 5).

**Petroleum and Natural Gas.**—The first impact of recent deepwater discoveries on production should be seen in 2001 as the Girassol field in block 17 and the Kuito field in block 14 come into production at 200,000 barrels per day (bbl/d) and 100,000 bbl/d, respectively.

The Ministry of Petroleum reported two categories of petroleum reserves as of yearend 1999. Proven reserves already developed and ready for production were 3.16 billion barrels (Gbbl). Newly discovered reserves not yet developed were estimated to be 1.57 Gbbl of petroleum (International Monetary Fund, August 2000, Angola—Recent economic developments, accessed July 2, 2001, at URL http://www.imf.org/external/pubs/ft/scr/2000/ cr00111.pdf). A June assessment by industry analysts Douglas-Westwood of the United Kingdom indicated that West Africa has close to 17 Gbbl of oil equivalent in deepwater prospects primarily in Angola, Equatorial Guinea, and Nigeria. This includes two world-class fields—TotalFinaElf's Girassol oilfield in Angola and Shell Exploration and Production Ltd.'s Bonga oilfield in Nigeria. Capital investments to develop these resources will exceed $5 billion per year by 2004. In Angola alone, 25 deepwater fields were discovered between 1996 and mid-2000 with reserves estimated to be more than 8 Gbbl of oil equivalent, of which two-thirds is oil (OilOnline, August 14, 2000, Setting the west Africa scene, accessed December 20, 2000, at URL http://www.oilonline.com/news_spotlight_offshore_setting081400.html).

Chevron Corp. brought the Kuito field in block 14, which was the first of the deepwater (385-m deep) oilfields in Angola, into production in late 1999. Full capacity of the $400 million vessel *Kuito* floating production storage and offloading vessel (FPSO) of 100,000 bbl/d was reached in early 2000 (Oil Online, November 2, 1999, Kuito kicks off for Angola, accessed January 20, 2001, at URL http://www.oilonline.com/news_spotlight_offshore_kuito110299.html). Chevron held a 31% interest in block 14, in joint venture with Sonangol (20%); Agip Angola Exploracao BV (20%); TotalFinaElf (20%); and Petrogal Exploração (a subsidiary of Galp Energia of Portugal) (9%).

Girassol, which was the second deepwater (more than 1,100 m) oilfield in Angola, was developed by the consortium led by TotalFinaElf at a capital cost of $3 billion. The FPSO *Girassol* produced its first oil in late 2000; full capacity of 200,000 bbl/d was expected during 2001. Other partners in block 17 with TotalFinaElf (40%) included ExxonMobil (20%), BP Exploration (Angola) Ltd. (16.67%), Den Norske State Oljeselskap a.s. (13.33%), and Norsk Hydro ASA (10%) (Bouygues Offshore, [undated], Girassol FPSO, accessed January 20, 2001, at URL http://www.bouygues-offshore.com/company/notre_offre/fiches/girassol.htm).

The third deepwater project in Angola was the FPSO *Kizomba-A* that was being built by an ExxonMobil Corp. consortium in block 15. ExxonMobil reported recoverable hydrocarbon potential in excess of 3 Gbbl of oil equivalent in block 15. Planning for multiple developments was underway with the first due to come on-stream in 2004 (ExxonMobil Corporation, November 30, 2000, ExxonMobil affiliate announces deepwater discovery on block 17, offshore Angola, Press Release, accessed December 15, 2000, at URL http://www.exxon.mobil.com/em_newsrelease/). A capital cost of $3.1 billion will be required for the FPSO *Kizomba-A* and development of the 1 Gbbl of petroleum reserves contained in the Chocahlo and the Hunga fields in block 15. The project will produce 250,000 bbl/d of oil by 2004. A similar *Kizomba-B* project will follow to develop 1 Gbbl of reserves in the Dikanza and the Kisanje fields in block 15. Esso Exploration Angola Limited (Esso Angola) (a subsidiary of ExxonMobil) was the operator with a 40% working interest. Other coventurers included BP Exploration (Angola) Ltd. (26.67%), Agip Exploration B.V. (20%), and Statoil (13.33%) (OilOnline, August 14, 2000, Next mega-projects set for takeoff, accessed December 20, 2000, at URL http://www.oilonline.com/news_spotlight_offshore_westafrica081400.html). The large capital costs involved in the development of recent discoveries in Angola and Nigeria will likely lead to development being done in sequence rather than in parallel.

## 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 diamond, will play a significant secondary role and will stimulate further economic growth on the local and regional levels. Areas in Angola with geologic environments known to be favorable to economic mineralization, such as iron ore, nickel, and platinum-group metals, have been off-limits to exploration during the prolonged civil war. The return of foreign investment and the application of modern exploration concepts and technology were required to stimulate additional opportunities for mineral discoveries 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.

## References Cited


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DiamondWorks Limited, 2001, Annual report for 2000: Vancouver, British Columbia, Canada, DiamondWorks Limited, March 5, 13 p.

Sambula, A.C., 1998, Investing in mineral development in Angola: Global Mining Investment Opportunities Symposium, Montreal, Quebec, May 3-7, 1998, Presentation, 13 p.


## Major Source of Information

Ministry of Geology and Mines
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TABLE 1
ANGOLA:  PRODUCTION OF MINERAL COMMODITIES 1/

| Commodity | | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|
| INDUSTRIAL MINERALS | | | | | | |
| Cement, hydraulic | thousand metric tons | 270 | 301 2/ | 350 2/ | 350 | 350 |
| Diamond 3/ 4/ | thousand carats | 2,500 2/ | 1,234 2/ | 2,764 2/ | 3,732 2/ | 4,349 2/ |
| Granite | thousand cubic meters | 1,500 | 1,500 | 1,500 | 1,500 | 1,500 |
| Marble | do. | 100 | 100 | 100 | 100 | 100 |
| Salt | metric tons | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 |
| MINERAL FUELS AND RELATED MATERIALS | | | | | | |
| Gas, natural: | | | | | | |
| Gross 6/ | million cubic meters | 5,804 | 5,804 | 5,804 2/ | 5,800 | 5,800 |
| Dry | do. | 566 | 566 | 566 2/ | 560 | 560 |
| Petroleum: | | | | | | |
| Crude | thousand 42-gallon barrels | 259,150 2/ | 262,800 2/ | 268,275 2/ | 279,590 | 272,290 2/ |
| Refinery products e/ 5/ | do. | 11,000 | 11,700 | 13,180 2/ | 14,000 | 14,000 |
| Liquified petroleum gas | do. | 1,616 | 1,643 | 1,292 | 1,292 | 1,300 |

e/ Estimated.
1/ Includes data available through June 2001.
2/ Reported figure.
3/ Did not include smuggled production.
4/ Production was approximately 90% gem and 10% industrial grade.
5/ Included asphalt and bitumen.
6/ Angola has no natural gas distribution system.  Most gas was vented and flared.

TABLE 2
ANGOLA: OIL AND GAS DISCOVERIES AND PROPOSED INVESTMENT FROM 1996 TO 2006

| Company | Development | Commodity | Capacity 1/ | Investment (million dollars) 1/ | Startup date 1/ | Comments, reserves etc. |
|---|---|---|---|---|---|---|
| Texaco | Luanda liquefied natural gas plant | Natural gas | 5 billion cubic meters per year | $2,500 | 2005 | Gas processing plant. |
| Sonangol/ExxonMobil | Lobito refinery | Petroleum, refined | 200,000 barrels per day | 2,000 | | Under consideration. |
| Chevron Corp. (31%) PSA | Block 14 - Kuito | Petroleum | 100,000 barrels per day | 400 | 2001 | Discovered 1997. |
| Do. | Block 14 - Benguela | do. | | | | Discovered January 1998. |
| Do. | Block 14 - Landana | do. | | | | Discovered October 1998. |
| Do. | Block 14 - Belize | do. | | | | Discovered 1998. |
| Do. | Block 14 - Tombocco | do. | | | | Discovered October 2000. |
| Do. | Block 14 - Lobito-1X | do. | | | | Do. |
| Chevron summary | | do. | | 6,000 | 2000-06 | |
| ExxonMobil Angola (40%) PSA | Block 15 - Kissanje | do. | | | | Discovered 1998. |
| Do. | Block 15 - Marimba | do. | | | | Do. |
| Do. | Block 15 - Hungo | do. | | | | Do. |
| Do. | Block 15 - Dikanza | do. | | | | Do. |
| Do. | Block 15 - Chocalho | do. | | | | Discovered July 1999. |
| Do. | Block 15 - Xicomba | do. | | | | Discovered September 1999. |
| Do. | Block 15 - Mondo | do. | | | | Discovered June 2000. |
| Do. | Block 15 - Saxi-1 | do. | | | | Discovered August 2000. |
| Do. | Block 15 - Batuque-1 | do. | | | | Discovered November 2000. |
| Do. | Block 15 - Kizomba-A FPSO | do. | 250,000 barrels per day | 3,100 | 2004 | Develops Hunga and Chocalho fields, 1-billion-barrel reserves. |
| Do. | Block 15 - Kizomba-B FPSO | do. | | | | Develops Kissanje and Dikanza fields, 1-billion-barrel reserves. |
| Do. | Block 15 - Mblumbumba-1 | do. | | | | Discovered April 2001. |
| Do. | Block 15 - Vicango-1 | do. | | | | Discovered May 2001. |
| Do. | Block 15 - Mavacola-1 | do. | | | | Do. |
| ExxonMobil summary | | | | NA | | 3 billion barrels oil equivalent recoverable in block 15. |
| TotalFinaElf (35%) PSA | Block 17 - Girassol | do. | 200,000 barrels per day | 3,000 | 2001 | Discovered 1996. |
| Do. | Block 17 - Dalia | do. | | | 2004 | Discovered 1997. |
| Do. | Block 17 - Rosa | do. | | | | Discovered 1998. |
| Do. | Block 17 - Liro | do. | | 3,000 | 2002+ | Do. |
| Do. | Block 17 - Tulipa | do. | | | | Discovered June 1999. |
| Do. | Block 17 - Orquidea | do. | | | | Discovered September 1999. |
| Do. | Block 17 - Cravo | do. | | | | Discovered October 1999. |
| Do. | Block 17 - Camelia | do. | | | | Discovered December 1999. |
| Do. | Block 17 - Jasmine | do. | | | | Discovered 2000. |
| Do. | Block 17 - Perpetua 1 | do. | | | | Do. |
| TotalFinaElf summary | | | | NA | | |
| BPAmoco (50%)/Shell (50%) PSA | Block 18 - Platina | do. | | | | Discovered 1999. |
| Do. | Block 18 - Plutonio | do. | | | | Do. |
| Do. | Block 18 - Galio | do. | | | | Discovered 2000. |
| Do. | Block 18 - Paladio | do. | | | | Do. |
| Do. | Block 18 - Cromio | do. | | | | Discovered October 2000. |
| Do. | Block 18 - Cobalto | do. | | | | Discovered December 2000. |
| BPAmoco summary | | | | NA | | |
| Total | | | | 20,000 | | |

NA Not available. FSPO Floating production storage and offloading vessel.
1/ Blank column indicates no information was available.