

THE MINERAL INDUSTRY OF

NAMIBIA

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Namibia is located on the southwest coast of Africa between South Africa and Angola. The 825,418 square kilometer country had an estimated population in 1997 of 1.63 million and a gross domestic product (GDP) per capita of about \$2,070. The mineral industry of Namibia provided about 15% of the country's \$3.2 billion¹ GDP in 1996 (iafrica.com Namibia, [no date] General information—GDP figures: accessed October 1, 1998 at URL <http://trade.iafrica.com.na/generalinfo/factsfigures/composition.htm>) and annually contributes to approximately 50% of the value of total exports earnings. In 1997, the industry was dominated by three established mining companies—Namdeb Diamond Corp (Pty.) Ltd., Rossing Uranium Ltd., and Tsumeb Corp. Ltd. The Government's proactive policies encouraged new entrants in copper, diamond, natural gas, and zinc.

Encouraged by a favorable investment environment and the supporting technical resource assessment work of the Geological Survey of Namibia, more than 40 mines were in operation and more than 60 companies were actively exploring in 1996 and 1997 (Mining Journal, 1997). A number of Australian and Canadian companies, predominately exploring for diamond and gold, augmented local prospecting activities. During 1997, 338 nonexclusive prospecting licenses, down by 31% from 1996; 121 exclusive prospecting licenses (an increase of 128%), and 74 mining claims (down 53%) were issued by the Mining Commissioner's Office in the Ministry of Mines and Energy. The Chamber of Mines reported exploration expenditures from over 40 member companies of \$21 million in 1997 compared with \$27.6 million (Chamber of Mines of Namibia, 1998). Marine diamonds continued to be the main focus of exploration with Ocean Diamond Mining Holdings (ODM) starting up offshore production in 1997 and with Namibian Minerals Corp. (Namco) expected to move into production in early 1998. The Haib copper and the Scorpion zinc projects were also progressing toward development.

Government Policies and Programs

The basic mining law is the Minerals (Prospecting and Mining) Act, No. 33 of 1992, which took effect on April 1, 1994. An accompanying Mining (Taxation) Act set forth revised fiscal and royalty provisions for the industry. The Mining Act was still being refined and additional amendments were expected in 1998. The Chamber of Mines of Namibia outlined the mining tax environment in a late 1995 promotional publication (Chamber of Mines of Namibia, 1995).

¹ Where necessary, values have been converted from the Namibian dollar (ND) to U.S. dollars at the rate of NS\$4.61=US\$1.00 for 1997 and NS\$4.29=US\$1.00 for 1996.

The system of taxation on diamond mining consisted of three separate taxes: income, diamond profits, and diamond export duties. The latter has now been replaced by a 10% royalty. The overall income tax on diamond mining companies is levied at the rate of 55% of taxable income, plus a surcharge of 10% on the market value of diamonds shipped and sold. The Income Tax Act provides that this 10% surcharge paid as diamond profits tax be credited against the income tax payable by diamond mines. A new Diamond Act is expected to be promulgated in 1998.

The fiscal regime for oil exploration companies consists of three principal elements: an income tax and an Additional Profits Tax (APT), both levied in terms of the Petroleum (Taxation) Act, No. 3 of 1991; and a 12.5% royalty, levied in terms of the Petroleum (Exploration and Production) Act, No. 2 of 1991. In October 1997, in preparation for the Third Petroleum Licensing Round, which will be open between October 1, 1998 and March 31, 1999, the Namibian Government amended the 1991 Petroleum (Exploration & Production) Act, No 2, the 1991 Petroleum (Taxation) Act, and the Model Petroleum Agreement to provide additional incentives to attract new foreign investment. These include, among others, options to extend the exploration period and lowering the production royalties from 12.5% to 5%, the petroleum income tax from 42% to 35% and the additional profits tax to 25% (Abraham, 1998).

The Foreign Investment Act of 1990 offers prospective investors a package of incentives, such as repatriation of profits, security of title and tenure, availability of foreign exchange, international arbitration, and fair compensation in case of expropriation.

The Ministry of Mines and Energy is responsible for making and enforcing policies related to minerals and energy. Within the ministry and attached to the Permanent Secretary are the Diamond Board, the Mining Advisory Board, and the National Energy Council, all of which have Government and private-sector representation. The Namibia Petroleum Co. (NAMCOR), and the Namibia national electric utility, NamPower, also are part of the ministry. The four main directorates in the ministry are the Geological Survey, Mining, Energy, and Administration and Finance. The three main functions of the Mining Directorate are evaluating and controlling mineral license applications, ensuring adequate safety standards in mining operations, and collecting, analyzing, and disseminating production statistics. An Ancillary Rights Commission was set up by the Ministry to handle dispute arbitration.

The Government also is empowered to review exploration licenses issued under the previous mining law to determine if the holders of the licenses are actually conducting exploration activities. If the Government determines that insufficient work is being done, then it can revoke the license and reissue the license

to another company. The license review was expected to free up considerable land area for exploration, previously locked up by the practice of “ringfencing” of claims. The Government was also working on new draft Mine Safety Regulations and a draft White Paper on a National Energy Policy during 1997.

Environmental Issues

As one of the major sectors of the economy, the mining industry plays an active role in funding conservation awareness and environmental education programs. Some of Namibia’s mines are located in or close to one of the world’s oldest deserts, the Namib, which is host to a number of extremely rare species of plant and animal life. Because this unique habitat is one of Namibia’s most valuable tourist assets, the ecosystem is closely monitored by the local and international scientific and conservation communities. The competition for limited water resources between human and industrial uses will remain an ongoing environmental concern for the country.

In addition to the desert, Namibia possesses several “wetland” areas of international repute, particularly the Etosha Salt Pan, the Kavango/Caprivi region, the Walvis Bay lagoon, and Sandwich Harbor, as well as the mouths of the Orange and Kunene Rivers. The fragile nature of these desert and wetland ecosystems must be taken into account during the consideration of any infrastructure projects such as railroads or pipelines between Walvis Bay and northeastern Namibia and Botswana. Comprehensive studies have been undertaken to assess the effects of marine mining operations with respect to these areas and, in particular, the changes in tidal patterns caused by the disposal of fine sediments during offshore mining. In addition, work is being carried out to assess the extent of any interaction between marine mining activities and the local fishing (mainly lobster) and mariculture (oyster and mussel production) industries and to provide information that will assist these industries to develop and coexist with minimal adverse effects upon each other.

Production and Trade

The production statistics in table 1 were compiled mostly from data provided by the Namibia Ministry of Mines and Energy in response to the U.S. Geological Survey’s annual minerals questionnaire and from Chamber of Mines and company reports. Production of mineral commodities generally declined in Namibia in 1997 compared with that of 1996. Copper, diamond, salt, semiprecious stones, uranium, and zinc production were all up, while declines in lead mine and copper and lead smelter production were attributed to the closure of the Tsumeb mine and problems with the startup of the new Ausmelt lead smelter. The declines in fluorspar and manganese production in 1997 were attributed to metallurgical problems and weak steel markets, respectively.

The latest available trade data showed that ores and minerals accounted for 51.2% of the value of total exports of \$1.43 billion in 1995 compared with 49.4% of the value of total exports of \$1.34 billion in 1994 (Africa Trade and Business Bulletin, 1998, [undated] Namibia Business and Investment Information, Imports and Exports Sections, accessed February 10, 1998 at URL

<http://www.bizafrica.com>. Note: Internet site cited superseded by commercial site <http://www.bizeurope.com/bsr/country/Africa.htm>). In 1995, diamond, which were approximately 96% gem quality, were the major mineral export valued at \$485 million, followed by gold at \$70 million, combined lead-zinc-silver exports at \$36 million and all others, including uranium, valued at \$113 million. Available breakouts on 1994 total imports of \$1.4 billion showed that mineral fuels and lubricants accounted for \$144 million and metals and metal products, \$72 million. The general trade pattern was likely the same in 1996 and 1997, with a nominal increase in the value of diamond exports and a decline in the value of copper and lead exports.

During 1997, the Chamber of Mines of Namibia membership consisted of 41 mining and exploration companies and 23 associated service representatives compared with 38 and 15 members respectively, in 1996. The 10 largest companies employed more than 8,100 workers in 1997; Namdeb accounting for more than 3,500. The majority of mining companies in Namibia were owned privately, whereas Government participation in mining remained limited as shown in table 2.

Commodity ReviewMetals

Copper-Lead-Zinc.—Tsumeb, a subsidiary of Gold Fields Namibia Ltd. of South Africa, produced copper from the retreatment of Tsumeb mine tailings and from the Khusib Springs, the Kombat and the Otjihase mines. Flooding, which shut down the Kombat Mine for nearly 2 months; poor recovery of copper and lead from tailings; and underground problems at the Otjihase Mine led to substantial operating losses during the year and forced Tsumeb to purchase 32% of the copper concentrates supplied to their captive smelter (Gold Fields Namibia Ltd., October 16, 1997, Smelter problems impact on Gold Fields Namibia; press release accessed October 27, 1997, at URL <http://www.goldfields.co.za/971016/Gfnsep.htm>). For calendar year 1997, Gold Fields Namibia milled 811,000 metric tons (t) of mined ore plus 991,999 t of retreated tailings, yielding concentrates containing 11,548 t of copper, 5,089 t of lead, and 43,031 kilograms (kg) of silver. The Tsumeb smelters produced 22,042 t of blister copper and 1,242 t of refined lead. The breakout of concentrate production included 5,340 t of copper and 6,282 t of lead concentrates from Tsumeb tailings; 18,959 t of copper and 6,282 t of lead from the Kombat Mine; 21,473 t of copper from the Khusib Springs Mine; and 26,283 of copper and 93,684 t of pyrite concentrates from the Otjihase Mine. A decision was made to suspend operations at the tailings retreatment facility and at the Ausmelt lead smelter at yearend for further metallurgical test work. The Ausmelt smelter had been shut down in August owing to technical problems requiring a relining of the refractory furnace and adjustments to the gas cooling system and tap holes. The smelter was originally designed to handle 100,000 tons per year (t/yr) of lead concentrates to produce 24,000 t/yr of lead bullion. Gold Fields reported strike related losses of \$7 million in 1996 and further operating losses of nearly \$12 million in 1997. With no advance notice to employees, the Mineworkers Union of Namibia, or the Government, Gold Fields Namibia closed down all mining and smelting operations in Namibia and laid off around 2,000 workers

on April 16, 1998 (Business Day Online (Johannesburg), April 20, 1998, Gold Fields Namibia aims to liquidate three mines: accessed April 21, 1998, at URL <http://www.bday.co.za/98/0420/company/e6.htm>).

In other copper developments in 1997, Namibia Copper Joint Venture (Pty) Ltd., a partnership between the Australian firm of Great Fitzroy Mines NL (20%) and Namibia Copper Mines Inc. (80%) of the United States, completed a bankable feasibility study of the Haib porphyry copper deposit. Production could start by mid-2000. The Haib deposit has a reported minable resource of 604 million metric tons (Mt) of 0.341% copper. Project costs to develop the Haib open-pit mine and associated solvent extraction/electrowinning facilities are estimated to be \$560 million. The mine will operate at a rate of 94,000 tons per day of ore which is suitable for leaching and flotation and roasting. Production capacity is expected to be more than 100,000 t/yr of copper, 530 kilograms per year of gold, and 880 t/yr of molybdenum concentrate. The feasibility study, conducted by Minproc Engineers Ltd. and Kvaerner Davy, was based on a copper price of \$0.95 per pound and may have to be adjusted for declining copper prices (Namibia Copper Joint Venture (Pty) Ltd., 1998).

Imcor Tin (Pty.) Ltd., which operated the Rosh Pinah zinc-lead-silver mine, produced 40,519 t of zinc contained in 74,632 t of concentrates, up 13 % from 1996. The 26,288 t of lead concentrates produced contained 12,769 t of lead and 4.97 t of silver; these totals were up 3% and down 60 % respectively, from those of 1996. Most of the zinc concentrates are exported to Zincor in South Africa, and the lead concentrate is toll refined at Tsumeb where the silver is also recovered. Exploration in 1997 has proven sufficient additional ore reserves to extend the life of the mine from 3 years to 12 years. An extended period of uncertainty ended in 1997 with the signing of a memorandum of understanding on share holding and royalties between Imcor's principal owners, Iscor Ltd. of South Africa and Namibian Mining Ventures (Chamber of Mines of Namibia, 1998b; Namibia Economist, 1997, Zinc at Rosh Pinah to last another 12 years: July 12, 2. p., accessed December 8, 1997 on the Internet at URL <http://www.economist.com.na/july12/july12-story9.html>). Namibian Mining Ventures is a subsidiary of PE Minerals, a consortium of Namibian and Malaysian businessmen, who hold the mineral rights to Rosh Pinah. A new operating company, based out of Windhoek is to be set up under the terms of the agreement. (Mining Mirror, 1998).

In a potentially major zinc sectoral development, Reunion Mining plc. of the United Kingdom completed exploration drilling and a prefeasibility study on the Scorpion zinc deposit, 20 kilometers (km) north of the Rosh Pinah Mine, during 1997. By yearend, Reunion had earned a 24% interest in the Scorpion deposit from the Anglo American subsidiary, Erongo Mining and Exploration Co. Ltd. By the end of 1998, Reunion expects to earn a full 60% interest in the project by completing the feasibility study and making a commitment to develop the mine. Drilling results have outlined a mineral resource, based on a zinc price of \$0.55 per pound, of 21 Mt, grading 8.4% zinc, of which the probable reserve is 15 Mt, grading 11.3% zinc. Reunion geologists described the zinc mineralization as unusual in that it occurs predominantly in a zinc-rich clay, sauconite, along with

zinc oxides and hydroxides. The sauconite is found in a highly altered and weathered zone of intense faulting and brecciation at a contact of limestone and clastic sediments. The deposit is minable by open pit methods at a 2.5:1 ore-to-waste ratio and amenable to treatment by sulfuric acid leaching, solvent extraction, and electrowinning. An output of 130,000 to 150,000 t/yr of Special High Grade zinc metal during a project life of 10 to 12 years is planned. Preliminary estimates place capital development costs at more than \$160 million (Reunion Mining PLC, 1998).

Gold.—In 1997, gold production decreased by some 13% compared with that of 1996. Erongo's Navachab gold mine produced 2,302 kg, accounting for 95% of the national total during 1997. The ore treatment plant at Navachab was upgraded during 1997 to increase throughput to 1.3 million metric tons per year (Mt/yr). A reevaluation of ore reserves and pit modeling was expected to extend the life of the Navachab Mine.

Manganese.—Production of manganese from Otjosondu Mine, 160 km northeast of Windhoek, was 57% less than that of 1996. Privately owned Purity Manganese was forced to cut back on production during 1997 in response to weak demand for manganese by the global steel industry. The company also began plans to move from an open pit to an underground operation during the year. The underground ore has a manganese content of more than 46% and a manganese-to-iron ration of 9:1.

Tin.—A cooperative project between the Ministry of Mines and Energy and the Swedish International Development Co-operation Agency has been using the old Uis tin pegmatites to test a pilot small-scale mining program. The project aimed at legalizing the small-scale tin mining operations, evaluating mining methods, and setting up a drilling and blasting team. A small concentration plant was built, and assistance was provided in locating markets for the tin production. More than 3 t of tin concentrate was produced in 1996, and the first product shipments were made in 1997. During 1997, additional efforts were made to increase technical productivity and business skills of the small scale miners. It is planned to extend the same project model to South Africa (Magnus Ericsson, 1997).

Uranium.—Despite continued weak uranium markets, Rossing, increased production of uranium oxide by more than 7% to 3,425 t in 1997 to meet standing customer commitments. This still left the mine operating at only about two-thirds of capacity. The fourth largest producing uranium mine in the world, Rossing was owned 68.6% by RTZ Corp. plc. of the United Kingdom. Rossing plays an important part in the Namibian economy, accounting for about 12% of the GDP, 12 % of exports, and 4 % of total tax revenue.

Industrial Minerals

Diamond.—The coastal and offshore diamond resources of Namibia represent a major global source of diamond. It has been estimated that roughly 10 billion carats of diamonds were eroded from diamondiferous kimberlite pipes in the interior of southern

Africa during the Tertiary period. Of this amount, an estimated 3 billion carats are estimated to have survived the glacial and fluvial trip to the Atlantic Coast beaches of Namibia, near the mouth of the Orange River, during millions of years. The subsequent northward movements of the offshore Benguela Current have distributed diamond deposits along a substantial portion of the Namibian coastline. The diamonds found here are relatively consistent in size and quality and average around \$200 per carat (Cape Business News (Capetown), January 1998, The great diamond rush: accessed April 7, 1998, at URL <http://www.cbn.co.za/issue/jan98/diamonds.htm>). In 1997, production of diamond in Namibia increased by 1% in 1997 to 1.42 million carats. Namdeb accounted for 1,36 million carats of this output; about 65% came from onshore mining on its concession which covers nearly 130 km of the coastal strip northwards of the Orange River. In 1996, Namdeb moved 53.8 Mt of waste and ore material and treated 20.9 Mt of beach sand materials, recovering 768,757 carats at a grade of 3.7 carats per 100 tons. In April 1997, De Beers commissioned a new bucket wheel dredge and a floating treatment plant at a cost of \$40 million. This added capacity will allow more than 70 Mt of material to be mined a year, and for Namdeb to maintain diamond production at current levels for another 10 years. Many of the high-grade coastal deposits have been mined out, and production has been shifting to deeper offshore waters (Gooding, 1997).

De Beers Marine (Debmarmine), a subsidiary of the South African-based De Beers Consolidated Mines, handled offshore marine mining for Namdeb, accounting for about 480,000 carats equal to 35% of Namdeb diamond production in 1997. Their concession extends from Oranjemund to Luderitz and up to 200 km into the Atlantic Ocean. Debmarmine developed a new generation of undersea mining equipment that uses either flexible slurry hoses or a large 6- to 7- meter (m) diameter circular drillhead. The new technology allows them to mine in water up to 200 m in depth and lower-grade deposits economically. Debmarmine's floating treatment plant with a 3,500-metric-ton-per-hour (t/hr) capacity was commissioned in 1997. A fifth mining vessel is to be commissioned by yearend 1998. De Beers' \$12 million diamond cutting and polishing plant at Okahandja was on schedule to begin operations in early 1998.

Namco, a United Kingdom-based firm listed on the Toronto and Namibian stock exchanges, was scheduled to begin commercial mining of diamonds in early February 1998, following favorable bulk sampling results on its Hottentots Bay and Luderitz Bay marine concessions. In December 1997, Namco took delivery of a NamSSol, a 120-t underwater mining crawler, which will be operated from the mining vessel, *MV Kovambo*. The NamSSol crawler, operating 20 hours per day during an expected life of 10 years, will deliver a slurry containing 18% solids to the processing plant on the *Kovambo*. The processing plant will treat 50 tons per hour with an expected recovery of 90% of the diamonds. Namco expected to treat 1 million cubic meters of seabed gravels and to recover at least 150,000 carats per year of diamond from the first mining area, with an average size of around 0.36 carat and an average value of \$190 per carat. Full capacity operations were expected by mid-1998. Project capital costs were \$18 million (Mining Magazine, 1997).

In its second year of operation, ODM produced 57,021 carats in

calendar year 1997 from two offshore vessels, the *MV Namibian Gem* and the *Oceandia* and evaluated concessions covering an area of 3 nautical miles around the 12 islands off the Namibian coast from Luderitz. Production was up 9% from that of 1996 (Ocean Diamond Mining Holdings Limited, 1997, Carats, historical diamond production, accessed May 22, 1998, at URL <http://www.odm.co.za/odm8.htm>). The *Namibia Gem* is the principal mining vessel, and the *Oceandia* is used mainly for ore-reserve-development sampling. The *Namibia Gem*, a former oil rig supply ship, operates two 16-inch airlift dredging heads and has the capacity to treat 50 t/hr in an onboard dense medium separation (DMS) plant. The first deposit mined in the Basin Deposit in the Halifax Island area yielded excellent quality stones with an average size of 0.45 carats per stone, valued at \$189 per carat in 1997. Ore reserves in this area were estimated to be 220,000 carats (Cape Business News (Capetown), January 1998, ODM is the young tiger, accessed April 7, 1998, at URL <http://www.cbn.co.za/issue/jan98/ocean.htm>). ODM's first controlled underwater dredger, ADA, ("articulated dredging arm"), will be commissioned in March 1998.

In December 1997, Nora Exploration Inc. of Canada signed an option agreement with Namibian Gemstones Mining Corp. (Pty) Ltd. whereby Nora can obtain a 70% interest in the exploration and mining of the second largest offshore diamond area in Namibia by expending \$1.2 million and paying Namibian Gemstones \$3.6 million by September 15, 1998. Nora's initial work will include a detailed geophysical survey. Namibia Gemstones, a private Namibian company, holds a 23,000-km² deep-water concession extending northward from the Namibia/South Africa border from the 200-m isobath and deeper (Nora Exploration Inc., 1997). Noragem (Pty) Ltd., a wholly owned subsidiary of Nora, holds all the corporation's assets in Namibia including a 47% equity interest in Otjua Minerals (Pty) Ltd., which controls exploration and mining permits in Namibia.

In March 1997, Diamond Fields International Ltd. of Canada and its subsidiary, Namibian West Coast Diamond Company (Pty) Ltd. (NWCDC), acquired all the subsisting rights of BHP Minerals International Exploration Inc. (BHP) of Australia and Benguela Concessions Limited (Benco) not already owned by NWCDC in the Luderitz offshore diamond mining concessions. BHP and Benco ceded their rights to earn a 50% interest in Diamond Fields under the terms of a 1994 agreement in exchange for shares representing an 11.6% equity interest in Diamond Fields (Diamond Fields International Ltd., March 5, 1997, Diamond Fields concludes agreement with BHP and Benguela on Luderitz offshore diamond concession, press release accessed April 20, 1997, at URL <http://www.newswire.ca/releases/March1997/05/c0897.html>). During exploration of the 660-km² Luderitz offshore grants in 1994 and 1995, Diamond Fields delineated an indicated and inferred resource of more than 1.1 million carats; work on the project, however, was suspended after Diamond Fields' discovery of the Voisey's Bay nickel deposit in Labrador, Canada. The company resumed work on the property in late 1997 and in 1998, will proceed with a \$15 million program including advanced diamond sampling, a capital upgrade of the diamond- processing plant at Luderitz, and a project feasibility study for a 500,000-carat-per-year mine plan. A decision whether to proceed with mining will be made in late

1998 (Diamond Fields International Ltd., December 22, 1997, Diamond Fields International to proceed with diamond sampling and mine feasibility study on seabed grants on the coast of Namibia, press release, accessed January 7, 1998, at URL <http://www.newswire.ca/releases/December/1997/22/c5176.html>)

In 1997, Trans Hex International Ltd., the Canadian diamond exploration subsidiary of the South African parent company, Trans Hex Group Ltd., expended \$3.8 million on Block 9 of its Northbank, Orange River property. The money was spent on drilling and constructing a 100 t/hr HMS plant. Lazare Kaplan International of the United States had a 50% interest in the Northbank project. Drilling had indicated diamondiferous basal gravel resources of 30 million cubic meters (Mm³) in an oxbow paleochannel 1 km wide by 4.5 km long (Trans Hex International Ltd., August 26, 1997, Trans Hex International Ltd. progress report on alluvial diamond exploration projects, press release, accessed August 26, 1997 at URL http://biz.yahoo/bw/97/08/26/thi_y0023_1.html).

Four companies, DebMarine, Diamond Fields International, Namco, and ODM established the Namibian Marine Diamond Mining Association to act as one body in discussions with the Government on diamond prospecting and mining operations and regulations.

Fluorspar.—In 1997, Okorusu Fluorspar (Pty.) Ltd. was purchased by the Solvay Group of Belgium. The company experienced a further decline in fluorspar production to 23,208 t, a 28% decrease from that of 1996, and less than half of its 50,000-t capacity. Solvay planned to export all of the acid-grade fluorspar production to its hydrofluoric acid plant at Bad Wimpfen, Germany. Okorusu will account for a significant portion of Solvay's 70,000-t/yr demand for acid-grade fluorspar in Europe (Industrial Minerals, 1997a). The problem of excess silica in the new ore body was addressed with the commissioning of a new heavy medium separation plant in February 1997. In 1996, the Ministry of Mines and Energy approved the European Community's, Sysmin, soft loan of \$1.4 million to Okorusu for the removal of 1.2 Mt of overburden so that the "A" pit at Okorusu can be reactivated. Solvay planned to upgrade the productivity and technical aspects of the operation and to increase capacity to 80,000 t/yr by 1999 (Industrial Minerals, 1997a).

Salts.—In 1997, production of sodium chloride salt, industrial and refined, increased by 38% to 492,780 t. Salt and Chemicals (Pty.) Ltd. was the primary producer accounting for 432,290 t. In a development that will make Namibia one of the world's largest salt producers, the local company, Namsalt Holdings, owned by LKC Investment Holdings, announced plans to expand its salt production and refining capacity and to build a packaging plant and a bulk loading facility at its Cape Cross salt pan operation, 150 km north of Walvis Bay. The loading terminal will be on a floating barge from 500 to 600 m out at sea. Cape Cross will have the capacity to handle from 800,000 t to 1 Mt by the end of 1999. Investment costs were estimated to be between \$12 million and \$20 million. Namsalt also planned to increase their handling of bagged salt through Walvis Bay harbor from 120,000 t to between 180,000 and 200,000 t. Salt exports will be primarily to other African markets (Christof Maletsky, January 27, 1998,

Namsalt aims to head world's salt market, Business Day Online (Johannesburg), accessed January 27, 1998 at URL <http://www.bday.co.za/98/0127/world/w14.htm>).

International Project Development, a subsidiary of the Berlin Engineering Group of Germany, planned to invest around \$80 million to extract minerals from seawater near Walvis Bay. Subject to completion of project financing, full production from two seawater-treatment plants would begin by April 1999. An advanced electro dialysis process would extract aluminum, magnesium, bromine, and sodium salts, sulfur, and carbon dioxide among its byproducts. The process would also produce a "waste product" of 4 million (Mm³) of potable water. The latter's production in an export processing zone, where 70% of production must be exported, placed the domestic use of the desalinated drinking water in question (Christof Maletsky, January 8, 1998, R480m plan to extract products from sea, Business Day Online (Johannesburg), accessed January 8, 1998 at URL <http://www.bday.co.za/98/0108/news/n22.htm>).

Mineral Fuels

Exploration for petroleum and natural gas remained active during 1997. Participating companies included Norsk Hydro, Saga, and Statoil of Norway; Sasol and Energy Africa of South Africa; Ranger Oil of Canada; Hardy Oil & Gas of the United Kingdom; Amerada Hess, Chevron, and Texaco of the United States; and Shell Exploration and Production BV of the Netherlands. Exploration through, 1997, has identified four main offshore gas basins: Namibe Basin, in the north, extending to Walvis Ridge; Walvis Basin; Luderitz Basin, covering an area from Walvis Basin to Luderitz; and Orange Basin, extending to the south to South Africa's border.

The most promising field is the Kudu Block in the Orange Basin, which was originally discovered by Chevron in 1973. The Kudu Block is now held by Shell (75%), Texaco (15%), and Energy Africa (10%). Estimates by Namibia's national electricity company, NamPower, indicated that this field contained reserves of 280 billion cubic meters (Gm³) of low-sulfur natural gas and could achieve gas flow rates in excess of 2.1 million cubic meters per day. Intensive seismic studies indicate the potential for up to 283 Gm³, sufficient to power a 2,000-megawatt power plant for more than a century (U.S. Embassy, Pretoria, South Africa, 1996). Other reports indicate that Shell and the Kudu Field's other operators feel that these reserve estimates may be too optimistic and that Kudu recoverable gas reserves are more in the order of 56 Gm³. In May 1997, NamPower reached an agreement with the South African power company, Eskom, to build a 750-MW combined cycle powerplant at Oranjemund that will use Kudu natural gas reserves. A development decision is expected by mid-1998, which could result in the first gas production and electricity generation in late 2000 or early 2001. The Shell partnership will finance the \$350 million development of the Kudu gas field while sharing the \$500 million cost of building the powerplant with NamPower and Eskom. (Mbendi Information Services (Pty.) Ltd., March 25, 1998, Namibia—Oil industry profile—Upstream, accessed September 22, 1998, at URL <http://mbendi.co.za/indy/oilg/oilgnaus.stm>). A new gas powerplant would help alleviate the current power shortage in the country, which has been

acerbated by a shortage of rain to local hydroelectric dams.

Reserves

Other than individual company reserve data reported in the above commodity discussions, an accounting of mineral reserves of the major producing mines in Namibia was not available for this review. An on-line discussion of potential mineral investment opportunities in Namibia is presented in project profiles by the Ministry of Mines and Energy (Ministry of Mines and Energy, November 26, 1997, Africa Trade and Business Bulletin, Mining investment opportunities in Namibia, accessed September 10, 1998, accessed, at URL <http://www.bizafrica.com/namibia/busbul/minopp/minopp.html#proj> (see mining project links at end of text).. A new gas powerplant would help alleviate). Note: Internet site cited superseded by commercial site <http://www.bizeurope.com/bsr/country/Africa.htm>).

Infrastructure

Namibia has two principal ports, Walvis Bay and Luderitz. Walvis Bay has container and bulk mineral-handling facilities and oil storage tanks. More than 1 Mt/yr of freight is handled at Walvis Bay, compared with 50,000 t/yr at Luderitz. Since the March 1994 return of Walvis Bay from South Africa, the Government has established the port as a free trade zone, or export processing zone (EPZ) and expects it to become an important commercial gateway for the southern African region. Namibia has a well developed and maintained road transport system, with a railway network that links the principal centers of population to the coast and to South Africa. The country has about 40,000 km of roads, of which about 4,500 km is surfaced. A principal north-south axial road links southern Angola with South Africa, and east-west routes connect the Namibian coastal ports of Luderitz, Swakopmund, and Walvis Bay with South Africa and Botswana. The 2,400-km-long rail network is operated by TransNamib. The rail fleet consists of 100 diesel-electric locomotives and 2,400 railcars. Namibia's railways carry about 2 Mt/yr of freight.

Electricity throughout the country is provided by NamPower, the national power utility. Principal power stations include the 120-MW Van Eck coal-burning plant in Windhoek and the 240-MW Ruacana hydroelectric station on the Kunene River. The NamPower network interconnects with South Africa's power grid.

Outlook

The final depletion and closure of the world famous Tsumeb copper-lead-zinc mine in 1996 and the subsequent early 1998 decision by Gold Fields to liquidate the Tsumeb Corp. Ltd. operations in Namibia have put a damper on the long tradition of mining in Namibia. A reopening of the traditional diamond regions in the south to exploration for other commodities and the renewed interest in offshore and mainland mineral exploration opportunities by foreign investors, however, has given hope for a new generation of mineral and energy projects in Namibia. Proposed new diamond, copper, and zinc mines and the potential for new value added manufacturing or metal-processing industries

supported by the development of the Kudu natural gas field should keep the mineral sector a central part of the economy of Namibia for the foreseeable future. In the longer run, greater development of regional transportation infrastructure in northern Namibia, including the Caprivi Strip, could see Walvis Bay become a significant export route for new mineral developments in Angola and in the landlocked countries of Botswana and Zambia. With a climate that is among the driest in the world, Namibia will continue to deal with the lack of water resources as a constraint on development.

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Major Sources of Information

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Major Publications

Chamber of Mines of Namibia, Annual Report.
Geological Survey of Namibia, 1992. The Mineral Resources of
Namibia, 598 p.

TABLE 1
NAMIBIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity	1993	1994	1995	1996	1997 3/
METALS					
Antimony, sodium antimonate (47% Sb):					
Gross weight	13	29	--	16	--
Sb content	6	14	--	8 e/	--
Arsenic, white, 99% arsenic trioxide	2,290	2,775	1,661	1,559 r/	1,232
Beryl concentrate	15	--	--	--	--
Cadmium metal, refined	13	19	15 e/	14	2
Cesium, pollucite, gross weight e/	5	5	--	--	--
Copper:					
Mine output, concentrate (29% to 30% Cu):					
Gross weight	110,000	97,900	81,646	57,095	72,055
Cu content	29,500	28,400	22,530	14,845	20,320
Metal, blister 4/	34,800	30,100	29,799	16,659 r/	22,042
Gold kilograms	1,953	2,445	2,394	2,145 r/	2,433
Lead:					
Mine output, concentrate (30% to 32% Pb):					
Gross weight	36,400	43,800	57,105	58,197	32,378
Pb content	11,600	13,917	16,084	15,349 r/	13,577
Metal, refined, primary 4/	31,200	23,800	26,752	8,588 r/	1,242
Manganese: Mine output, concentrate (44% Mn):					
Gross weight	--	--	95,385	92,647 r/	39,671
Mn content	--	--	43,004	40,765 r/	17,455
Silver, mine output, Ag content of concentrate kilograms	72,000	62,000	69,000	42,352	33,540
Tin: Mine output, concentrate (61% to 67% Sn):					
Gross weight	6	6 e/	--	--	--
Sn content	4	4 e/	2	--	--
Uranium, U ₃ O ₈ content of concentrate	1,980	2,235	2,366	3,188	3,425
Zinc: Mine output, concentrate (49% to 53% Zn):					
Gross weight	34,557	64,568	59,290	69,689 r/	74,632
Zn content	17,624	33,400	30,209	35,873 r/	40,519
INDUSTRIAL MINERALS					
Diamond:					
Gem e/ thousand carats	1,120	1,312 3/	1,382 3/	1,402 r/	1,416
Industrial e/ do.	20	--	--	--	--
Total 5/ do.	1,141	1,312	1,382	1,402 r/	1,416
Fluorspar, concentrate, acid grade (97% CaF ₂)	43,466	52,226	36,889	32,285	23,208
Gypsum e/	380	121	--	--	--
Lithium minerals:					
Amblygonite	5	5 e/	3	46 r/	75
Lepidolite	87	90 e/	106	355	275
Petalite	647	650 e/	2,502	1,571	669
Total	739	745 e/	2,611	1,972 r/	1,019
Salt 6/	132,585	356,965	303,986	355,868 r/	492,780
Semiprecious stones:					
Agate	102	175	115	150	175
Amethyst	100	338	5	19	23
Chrysocolla kilograms	6,500 e/	6,500	--	--	--
Diopase do.	50 e/	50 e/	--	--	--
Quartz, crystal e/	50	50	--	15	--
Rose quartz	166	170	200	190	220
Sodalite	354	1,143	465	383	1,598
Tourmaline kilograms	600 e/	600 e/	--	437 r/	53
Stone, sand and gravel:					
Dolomite	--	--	--	5,401	7,635
Granite	2,952	11,585	4,518	5,218	6,675
Marble	13,359	12,061	16,935	12,673 r/	13,743
Quartz e/	339	350	--	--	--

See footnotes at end of table.

TABLE 1--Continued
NAMIBIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity	1993	1994	1995	1996	1997
INDUSTRIAL MINERALS--Continued					
Sulfur, pyrite concentrate:					
Gross weight (49% to 51% S)	113,703	121,634	103,140	90,735	94,585
S content	56,900	60,000 e/	51,330	45,338	46,476
Wollastonite	824	1,309	967	248 r/	194

e/ Estimated. r/ Revised.

1/ Estimated data are rounded to three significant digits.

2/ Table includes data available through Sept. 30, 1998.

3/ Reported figure.

4/ Includes products of imported concentrate.

5/ Data may not add to totals shown because of independent rounding.

6/ The increase in 1994 is due to production from Walvis Bay previously included under South Africa.

Sources: Ministry of Mines and Energy, July 2, 1998, minerals questionnaire and Chamber of Mines 1997 annual report.

TABLE 2
NAMIBIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1997

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper	Tsumeb Corp. Ltd. (Gold Fields Namibia Ltd., 66%)	Khusib Springs Mine	15,500 copper in concentrate.
Do.	do.	Tsumeb smelter	60,000 blister copper.
Do.	do.	Kombat Mine, 50 kilometers south of Tsumeb	10,000 copper in concentrate.
Do.	Otjihase Mine (Tsumeb Corp. Ltd., 70% JCI Ltd., 30%)	Otjihase Mine, near Tsumeb	18,000 copper in concentrate.
Diamond	thousand carats	Namdeb Diamond Corp. (Pty.) Ltd. (De Beers Centenary AG, 50%; Government, 50%)	Mines near Oranjemund; Elizabeth Bay Mine, 25 kilometers south of Luderitz; and marine operations.
Do.	do.	Namibian Minerals Corp.	Marine operations offshore Luderitz and Hottentots Bay
Do.	do.	Ocean Diamond Mining	Marine operations offshore Luderitz
Fluorspar	Okorusu Fluorspar (Pty.) Ltd. (Solvay Group, 100%)	Okorusu, 48 kilometers north of Otjiwarongo	50,000, 98% calcium fluoride.
Gold	Erongo Mining and Exploration Co. Ltd. (Anglo American Corp. 57.5%, Inmet Mining Corp. 20%; Randgold Ltd., 10%)	Navachab Mine near Karibib	3.
Lead	Tsumeb Corp. Ltd. (Gold Fields Namibia Ltd., 66%)	Tsumeb (Ausmelt) smelter	24,000 lead bullion
Do.	Imcor Tin (Pty.) Ltd. (Isacor Ltd., 100% , Namibian Mining Ventures, 50%)	Rosh Pinah Mine, 80 kilometers northeast of Oranjemund	15,000 lead in concentrate.
Lithium	SWA Lithium Mines (Pty.) Ltd. (Kloekner; Matramco)	30 kilometers south of Karibib	1,500 concentrate.
Manganese	Purity Manganese (Namibia) Ltd. (private, 100%)	Otjosondu, 160 kilometers north-east of Windhoek	100,000 ore with 45% manganese content.
Salt	Salt and Chemicals (Pty.) Ltd. (Sentrachem, 100%)	Walvis Bay	350,000.
Do.	Salt Company (Pty.) Ltd. (private, 100%)	Swakopmund	150,000.
Stone	cubic meters	Karibib Mining and Construction Co. (Namibia) Ltd. (private, 100%)	Granite quarry at Karibib
Do.	do.	do.	Marble quarry at Karibib
Uranium	Rossing Uranium Ltd. (RTZ Corp. plc., 68.6%; Industrial Development Corp. of South Africa; Government of Iran; Rio Algom, Canada)	Rossing, 30 kilometers east of Swakopmund	5,000 uranium oxide.
Zinc	Imcor Tin (Pty.) Ltd.	Rosh Pinah Mine, 80 kilometers northeast of Oranjemund	40,000 zinc in concentrate.