THE MINERAL INDUSTRY OF

SOUTH AFRICA

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The Republic of South Africa holds a major economic and physical presence on the African continent. Its rich natural resource endowment serves as a base for one of the strongest economies in Africa with a per capita gross domestic product (GDP), based on purchasing power parity data for 2000, of $9,400[1] per capita; it ranks fifth in population and land area on the continent with 43.6 million people and 1,219,912 square kilometers, respectively. During 2001, its export-oriented economy was affected by the slowdown in the world economy with real GDP growth declining to 2.2% from 3.4% in 2000 (International Monetary Fund, 2003§[2]). Following a 25% devaluation of the rand against the U.S. dollar in 2000, the rand dropped another 50% in 2001 going from a monthly average of 7.78 rand to the dollar in January to 11.59 rand in December 2001. On the other hand, the depreciated rand helped the international competitiveness of South African exports.

Reporting on the economic impact of HIV/AIDS in South Africa, the International Monetary Fund (2003, p. 19) highlighted the seriousness of this pandemic. HIV infected more than 5 million people (11% of the population) in South Africa in 2001 and 20% of the working age population. The report forecasts that "without drastic policy measures and changes in social behavior, HIV/AIDS can be expected to continue spreading and to take a heavy toll on the population and the labor force. Between now (2001) and 2010, around 10% to 15% of the population could die from AIDS-related diseases: population and labor force growth could slow to zero (compared with a non-HIV/AIDS baseline projection of 1.5%); life expectancy could drop to 38 years from the current level of close to 54 years; and the HIV infection rate could reach 15% of the population and 25% of the labor force." This has significant implications for a mining industry that employed 2.7% of the population or approximately 407,000 workers in 2001. This did not include an additional 50,000 to 60,000 workers employed in the processing industries, such as aluminum, cement, ferroalloys and steel.

According to the South Africa Department of Minerals and Energy, in 2001, South Africa produced more than 55 different mineral commodities from about 749 mines and quarries, including 71 diamond, 55 coal, 35 gold and 11 platinum-group metals (PGM) operations. It ranks first in the world in production of alumino-silicates (andalusite), chromite, ferrochrome, gold, PGM, vanadium, and vermiculite. It is also a major world supplier of antimony, ferromanganese, manganese, titanium, and zirconium. Mining and quarrying contributed $7.8 billion or 7.5% to the GDP in 2001 and accounted for 34.3% of all merchandise trade. Export sales had been historically dominated by gold until 2000 and 2001, when, as a result of declining gold prices and production and increased PGM production and prices, PGM were the leading export by value. For 2001, PGM export sales were $3.9 billion compared with $3.39 billion for gold exports. The next leading exports were coal at $3.1 billion and diamond. While diamond export data are not published, the value of rough diamond production is estimated at more than $1 billion. In addition to exports of mining and quarrying products, $2.2 billion in value-added processed mineral products were exported in 2001, of which, ferroalloys accounted for $873 million and aluminum for $661 million. Imports for 2001 included $4.38 billion of primary and processed mineral products (primarily industrial mineral products, nonferrous metals, and diamonds), and $3.74 billion in petroleum and petroleum products resulting in a net positive mineral and fuel merchandise trade balance of about $1.9 billion (South Africa Department of Minerals and Energy, 2002, p. 6-21).

The most important mineral commodities produced in South Africa, in terms of value, were PGM, gold, coal, ferroalloys (ferrochromium, ferromanganese, ferrosilicon, and ferrovanadium), aluminum, steel, titanium, iron ore, diamond, vanadium, and copper. Additionally, important output of metallic commodities included antimony, chromite, cobalt, lead, manganese, nickel, silver, uranium, zinc, and zirconium. Significant industrial minerals production included andalusite (aluminum silicate), aggregate and sand, asbestos, dimension stone, fluorspar, limestone and lime, phosphate rock, sulfur, and vermiculite. South Africa was a major producer and the world's third largest exporter of coal, and it was also the largest producer of synthetic liquid fuels and petrochemicals derived from coal. South Africa's well-developed railway and port infrastructure served the domestic minerals industry and those in neighboring countries.

Government Policies and Programs

The Ministry of Mines and Energy's Department of Minerals and Energy (DME) is the primary Government entity responsible for the establishment and implementation of minerals and energy policy and for oversight of the country's mineral industry. Within the DME are the Mineral Development Branch, which is responsible for regional mineral development, minerals economics (Minerals Bureau), mine rehabilitation, and mining rights; the Energy Branch, which promotes the optimum utilization of energy resources; and the Mine, Health & Safety Inspectorate. A number of parastatal institutions were associated

[1]Where necessary, values have been converted from South African rands (R) to U.S. dollars at the rate of R8.60=US$1.00 for 2001, and R6.94= US$1.00 for 2000.

[2]References that include a section twist (§) are found in the Internet References Cited section.

with DME, including the Atomic Energy Corp.; the Council for Nuclear Safety; the Council for Geosciences (formerly the Geological Survey of South Africa); the Council for Mineral Technology (Mintek), the parastatal mineral-research organization; the National Electricity Regulator; the South African Diamond Board; and the Central Energy Fund (Pty.) Ltd.(CEF), through which the State's interest in the liquid fuel industry is owned, developed, and managed commercially.

Following 5 years of public and internal Government debate, the Department of Minerals and Energy published its Minerals Development Draft Bill in the Government Gazette of December 18, 2000. The draft bill was opened to public comment through March 31, 2001. The Minerals Development Draft Bill will give the State exclusive custodianship of all mineral rights and focused on the freeing up of unexploited mineral rights long held by the major mining houses to provide more opportunities in the mining sector for black South African entrepreneurial groups and for foreign investment. The introduction to the bill states, "The fundamental principles which underpins this Bill are

"a. mineral resources is the common heritage of all South Africans and belongs collectively to all the peoples of South Africa;

"b. it is a universally recognized right of a State to exercise full and permanent sovereignty over all it natural resources;

"c. public trusteeship of South Africa's mineral resources;

"d. to redress the results of past racial discrimination and ensure the historically disadvantaged persons participate in the minerals and mining industry and benefit from the exploitation of the nation's mineral resources;

"e. security of tenure for prospecting and mining operations;

"f. environmental protection and sustainable development; and

"g. promotion of local and rural economic development and social upliftment of communities affected by mining.

"The minerals and mining law dispensation proposed in the draft bill is based on the universally accepted principle that mineral resources are part of South Africa's national patrimony and that the State is the custodian of the nation's mineral resources. It is from the aforementioned principles that the State derives its entitlements to control, administer, manage access to South Africa's mineral resources, and to grant prospecting rights and mining rights and issue retention permits.

"Therefore, on commencement of the new legislation, prospecting rights, mining rights, retention permits, and permission to remove minerals will only be granted by the State. As far as possible, the bill reduces ministerial discretion by ensuring that discretionary powers are exercised based on prescribed criteria." The full text of the Minerals Development Draft Bill, 2000, is accessible at URL http://www.polity.org.za/govdocs/notices/2000/not4577.html. Draft legislation incorporating public comment on the Bill was expected in early 2002.

In its initial reaction to the Minerals Development Draft Bill, 2000, the Chamber of Mines, representing the largest sectors of the South African mining industry, supported the underlying objectives of the bill but expressed concern over the legislation's ability to achieve these objectives without "unintended negative consequences." The Chamber argued that the Bill would "1. Undermine fundamental property rights. 2. Give excessive discretion to a single person (the Minister of Mines and Energy). 3. Offer no right of appeal to the courts. 4. Create legislative and regulatory uncertainty. 4. Make it more onerous to meet licence requirements and 5. Introduce a royalty system that could put thousands of jobs at risk." The Chamber was concerned over the lack of clarity on compensation for expropriated properties and the impact proposed taxes could have on production costs and the international competitiveness of the industry (South Africa Chamber of Mines, 2001§).

Subject to the enactment of the new Mineral Development Bill by Parliament, the South African mineral industry operated under the Mining Titles Registration Act, 1967; the Central Energy Fund Act, 1977; the Petroleum Products Act, 1977; the Diamonds Act, 1986; the Electricity Act, 1987; the Mineral Technology Act, 1989; the Minerals Act, 1991; the Minerals Amendment Act, 1993; the Nuclear Energy Act, 1993; the Liquid Fuels and Oil Repeal Act, 1993; the Mineral and Energy Laws Rationalization Act, 1994 (which repealed the Mining Rights Act of 1967); and the Mine Health and Safety Act, 1996. A 1998 ruling by the Minister of Finance set the corporate tax rate at 35% for all companies entering offshore oil and gas sub-leases with Soekor (Pty.) Ltd. by the end of 1999.

Environmental Issues

The Department of Environmental Affairs and Tourism (DEAT) is the focal point for environmental planning and management within South Africa. DEAT has been developing a comprehensive set of geospatial data and environmental indicators for use in national environmental and land-use planning and resource management, which are accessible through its Web site at URL http://www.environment.gov.za. DEAT implements the National Environmental Management Act (107 of 1998) (NEMA) which created a framework for environmental management in South Africa. It established principles for sustainable development, procedures for coordinating the environmental functions of government, and mechanisms for civil society participation.

As required under NEMA, the Department of Minerals and Energy put in place during 2000 an Environmental Management Plan addressing mineral sector issues. The Department of Minerals and Energy's Environmental Management Plan is available on its Web site through a drop down menu under Publications at URL http://www.dme.gov.za.

Production

In 2001, South Africa was one of the largest and most diverse minerals producer in the world. Mineral production statistics are listed in table 1. For 2001, the DME Minerals Economics Directorate (Minerals Bureau) reported the value of primary mined products at $13.39 billion and of processed mineral materials at $2.85 billion. In addition, hydrocarbons, valued at $251 million, were produced in 2001. The mining and quarrying sector paid out $2.8 billion in wages and more than $675 million in taxes to the Government. On a value basis, in 2001, about 22% of primary mined products and 23% of processed mineral materials were consumed domestically. Coal

exports remained constant between 2002 and 2001 at approximately 68 million metric tons (Mt), while in 2001, 89 Mt of domestic coal production went for internal power generation and 48 Mt for value-added synthetic fuel and petrochemicals production. Using South Africa's natural comparative advantage in its mineral resource endowment of chromite, coal, iron ore, manganese, and nickel, these materials were also converted to value-added ferroalloy and steel products for world markets (South Africa Department of Minerals and Energy, 2002, p. 6-14).

Trade

In 2001, the total value of sales of primary minerals, as reported by the DME Minerals Economics Directorate (Minerals Bureau), was $16.24 billion, of which $12.65 was exported, compared with $14.2 billion and $11 billion, respectively in 2000. For 2001, the total value of all processed mineral materials was $2.85 billion, of which $2.2 billion was exported. The major exports by value in 2001 were PGMs at $3.39 billion; gold, $3.39 billion; coal, $1.98 billion; ferroalloys, $870 million; aluminum, $661 million; iron ore, $400 million; and vanadium, $103 million. Other significant exports, for which individual value data were not provided included diamond, steel, titanium, and zirconium.

The majority, by value, of primary mineral exports, including precious minerals went to European markets, followed by the Pacific Rim countries; the Middle East and the Near East; and North America and Central America, with less than 10% each. Exports within Africa accounted for less than 1% of the South African mineral export trade.

Although South Africa was self-sufficient in the vast majority of its mineral needs, an increasing amount of mineral commodities were being imported. Significant mineral imports included alumina, coking coal, rough and cut diamonds, certain ferroalloys, magnesite, magnesia, nickel, precious metals, and sulfur. Imports of primary and processed mineral products in 2001 totaled $5.37 billion with an additional $3.37 billion in crude petroleum imports reported (South Africa Department of Minerals and Energy, 2002, p. 14-21).

Structure of the Mineral Industry

The South African minerals and energy industries operated on a free enterprise, market- driven basis. Ownership of mineral rights was held by either the Government or private entities. Mineral rights would revert to the State under terms of the draft Minerals Development Bill, 2000. Government involvement in these sectors was minimal and primarily confined to ownership of the national electric power utility, Eskom, and Southern Oil Exploration Co. (Soekor), the national oil and gas exploration company, including additional declining subsidies provided to synthetic fuels programs of Mossgas (Pty.) Ltd. and Sasol Limited, two parastatals. Sasol received a subsidy when the derived price of oil, a figure calculated by the Government monthly following oil price swings, falls below $16 a barrel.

In South Africa, the bulk of mineral land holdings and production had been historically controlled by five mining investment houses. Since 1994, however, the industry has undergone a major corporate restructuring, or "unbundling," aimed at simplifying a complex system of interlocking ownership that existed in the past, establishing separate core-commodity-focused profit centers, and diversifying and rationalizing nonperforming assets to make the newly restructured companies more competitive internationally. The structure and ownership of the industry as of mid-2002 are listed in table 2.

In mid 2001, the Government approved the $19 billion takeover of De Beers Consolidated Mines Ltd. (De Beers) by Anglo American plc (Business Day, 2001§).

The Chamber of Mines, whose members represent the majority of coal, gold, and uranium producers, was responsible for a variety of advisory and service functions for mining interests in South Africa. One of its main activities was the annual wage negotiations between member mines and the National Union of Mineworkers.

Commodity Review

Metals

Aluminum.—Because South Africa has no economically exploitable deposits of bauxite and no alumina production capacity, all alumina feedstock for the production of aluminum metal is imported. BHP Billiton Aluminium South Africa Ltd. was the sole producer of primary aluminum from its Bayside smelter and the newer Hillside smelter at Richards Bay. For the fiscal year ending June 30, 2002, and despite a power outage in September 2001, that resulted in 12,500 metric tons (t) of lost production, the Hillside smelter increased production slightly to 502,000 t of aluminum metal compared with 498,000 t in the previous fiscal year. Production at the Bayside smelter, dropped slightly to 174,000 t of aluminum from 178,000 t in fiscal year 2000-01. In April 2002, BHP Billiton will begin construction on the $449 million Hillside III Expansion Program, which will expand Hillside smelting capacity by another 132,000 metric tons per year (t/yr) of aluminum by 2002 (BHP Billiton PLC., 2002a, p. 14§). At that time, aluminum smelting capacity in Mozambique and South Africa will represent about 5% of world production capacity.

Antimony.—Metorex Ltd., a subsidiary of Crew Development Corp. of Canada, which operated the Consolidated Murchison Mine near Gravelotte in the Northern Province, was South Africa's only producer of antimony (as stibnite concentrate); its output of about 8% of world production made South Africa the second largest producer after China. The mine hoists ore from three shafts, the Athens, the Beta, and the Monarch. Production from the reequipped Beta Shaft resumed in the first quarter of 2001. For the fiscal year ending June 30, 2002, Consolidated Murchison treated 35,000 metric tons per month (t/mo) averaging 1.4% antimony and 1.91 grams per metric ton (g/t) gold. Recovery rates were 87.55% for antimony and 97.65% for gold. With recommissioning of the Beta Shaft in 2001, production of stibnite concentrates increased by 36% over the previous year to 9,570 t containing an average of 59% antimony, while lower grades reduced gold production 17% to 903 kilograms (kg) of gold. As of June 30, 2002, proved and

probable reserves amounted to 1.7 Mt at 2.0% antimony and 2.0 g/t gold, inclusive of 15% dilution and a mine call factor of 85%. Mineral resources exclusive of reserves total 8.5 Mt at grades of 2.5% antimony and 2.7 g/t gold (Metorex Ltd., 2002a§).

Chromite and Ferrochromium.—Chromite ore production decreased by 17% in 2001 to 5.5 Mt as the industry responded to reduced demand and a sell off of excess stocks. South Africa was the global leader in chromite ore production and export. Production came from more than 20 mines located within the Bushveld Ultramafic Complex. About 85% of the ore went to supply domestic ferrochrome smelters, and the remainder was exported. Domestic consumption of chromite ore was the highest in the world, feeding the world's leading ferrochrome industry, as well as one of the world's major chromium chemicals and refractories industries. Chromite ore sales were valued at about $117 million in 2001, of which about $44 million was export revenue (South Africa Department of Minerals and Energy, 2002, p. 108-111).

For the fiscal year ending June 30, 2002, BHP Billiton's Samancor Group, the world's largest integrated ferroalloys producer, produced 2.4 Mt of chromite ore and 837,000 t of chrome alloys compared with 3.16 Mt of chromite ore and 908,000 t of chrome alloys in the previous fiscal year. Samancor's operations are organized under two mining centers. Eastern Chrome Mines, based at Steelpoort and Western Chrome Mines, with its mine office at Mooinooi, near Rustenburg. As part of a restructuring and cost-reduction program, the Palmiet Ferrochrome facility was closed in late 2001, a new pelletizing plant was opened at Tubatse, and two new 85,000-t/yr-capacity ferrochrome furnaces were commissioned at the Wonderkop Joint Venture in mid-2001 (BHP Billiton PLC., 2002b§, p. 12, 24).

Responding to weak markets during 2001, Xstrata AG limited ferrochrome production to 860,600 t to avoid a stock buildup and idled four ferrochrome furnaces in 2001, following closure of two furnaces in 2000. Production levels in 2001 represented about a 66% capacity utilization of its three smelting operations at Rustenburg, Wonderkop, and Lydenburg. Production of salable chrome ore for the year decreased to 1.5 Mt from 1.9 Mt in 2000. The company's four captive chrome mines provided about 74% of feed to Xstrata ferrochrome plants with additional feed purchased locally, including chrome-bearing tailings from platinum mines. In March 2002, the Swiss based Xstrata Ag was scheduled to transfer all of its assets and liabilities to the newly formed United Kingdom company, Xstrata AG, with Glencore International holding a 40% controlling share (Xstrata AG, 2002b, p. 5-6).

In May 2001, the Associated Manganese Mines of South Africa Limited, formally changed its name to Assmang Limited. Assmang was jointly controlled by Anglovaal Mining Limited and Assore Limited. Its Chrome Division operated the Dwarsrivier chrome mine and the Machadodorp ferrochrome works both in Mpumalanga. Its $44 million, 54-megavoltampere furnace and a 350,000-t/yr chromite pelletizing plant at Machadodorp were commissioned during 2001. For the financial year ended June 30, 2002, Assmang produced 39,000 t of chromite ore plus 159,000 t of charge chrome originating from the Dwarsrivier Mine (Assmang Ltd., 2002b§).

Copper.—Palabora Mining Company Limited, which is owned by Rio Tinto plc. operates the largest integrated copper complex in South Africa. Progress continued on the transition of the operations from an 80,000-metric-ton-per-day (t/d) open pit mine to a 30,000-t/d underground mine, now scheduled for full startup in November 2002. Open pit mining will stop in April 2002. The $380 million underground development project will extend the life of the mine for another 20 years. During 2001, the volume of ore treated decreased by 45% to 14.5 Mt with an average grade of 0.65% copper yielding 225,300 t of copper concentrates, containing 74,466 t of copper. The copper concentrate grade was 32.6%. The Palabora smelter produced 85,517 t of copper anodes, down 6% from 2000; while the refinery output declined to 86,904 t of copper cathodes from 87,683 t in 2000. Palabora also produced a variety of other products from the unique carbonatite mineralogy of its deposit including 264 t of nickel sulfate, 139,214 t of sulfuric acid, 41,585 kg uranium oxide, 166,078 t of 90.52% vermiculite concentrates, and 7,897 t of zirconium dioxide chemicals, as well as 9,518 kg precious metals contained in refinery tankhouse slimes. The Palabora Mine also generated 201,000 t of byproduct magnetite concentrates grading nearly 62% iron and 1.6% titanium dioxide, which were either sold to the coal-washing industry or stockpiled for possible future use in a proposed new hot-briquetted iron facility in Mozambique. Measured mineral resources were reported at 5.75 Mt of oxide ore grading 0.6% copper. Three categories of proved and probable mineral reserves were given for the open pit of 4.65 Mt at 0.69% copper, for the underground of 242 Mt at 0.68% copper, and of sulfide ore of 40 Mt at 0.14% copper (Palabora Mining Company Limited, 2002, p. 60-63).

O'okiep Copper Co. (Pty.) Ltd., which was owned by Metorex, operated a copper mine at Nigramoep and a copper smelter at Nababeep, in the Northern Cape Province. For the fiscal year ending June 30, 2002, O'okiep milled 67,000 t/mo of ore at an average head grade of 1.79% copper. With a 95% smelter recovery rate, blister copper production was 13,000 t/yr. Mining operations at Nigramoep were to be phased out during 2002. However, a new $7 million concentrator was being built at Nababeep to retreat the slag dump, which contained about 7 years of reserves estimated at 4.4 Mt grading1.5% copper, and to treat copper concentrates imported from Metorex's Chibuluma operation in Zambia. This project should be complete early in 2002 and is expected to run for 7 years (Metorex Ltd., 2002b).

Copper was also produced in small amounts as a byproduct of lead-zinc and platinum mining.

Gold.—After a more than 30-year progressive decline in gold production from the historical peak production of 989 t in 1970 to 395 t of gold in 2001, gold production in South Africa appeared ready for a reversal of this trend. With three new large gold mine projects, representing a combined capital investment of more than $1.6 billion, coming onstream during 2002 and 2003, gold production is expected to reach 450 t by

2003 and close to 480 t by 2007. Anglovaal Minerals Ltd.'s gold subsidiary Avgold Ltd. expected to start production of its Target mine in 2002 at a rate of 4,900 kilograms per year (kg/yr) gold, increasing to full production of 15,500 kg/yr gold by 2007. The South Deep Mine, a 50%-50% joint venture between Western Areas Ltd. and Placer Dome, Inc. of Canada, producing at a one-half capacity rate of 12,500 kg/yr in 2001, will ramp up to full production of 23,300 kg/yr by 2007. The third major project, AngloGold's Moab Khotsong Mine, will start production in 2003 at a rate of 12,000 kg/yr gold, increasing to 16,600 kg/yr gold by 2007.

During 2001, member companies of the South African Chamber of Mines, representing 89% of gold production, milled 83 Mt of ore at an average grade of 4.13 g/t gold, yielding 342,551 kg gold. The industry employed 201,700 people in 2001, down from 216,200 people in 2000. Despite an 8% decline in gold production between 2000 and 2001 and a 3% drop in average annual gold price from $280 to $272 per ounce of gold, the value of gold sales in rand terms increased to 29 billion rand in 2001 from 25.3 billion rand in 2000. The devalued rand permitted the South African gold industry to absorb rand-denominated production costs and to maintain its international competitive position despite the lower dollar price for gold exports. Gold production was concentrated within the four major companies, AngloGold with 37.5%; Gold Fields Ltd., 26.2%; Harmony, 19% and Durban Roodeport Deep Inc., 8.4%. Harmony Gold Mining, which has developed into a major gold mining company since it was spun off from Randgold Resources Ltd. in 1997 to operate and turn around small, high-cost marginal gold operations, had the largest increase in production. Since 1995, through an aggressive policy of acquisitions costing more than $450 million, Harmony has increased its gold production to 77,760 kg/yr from 18,000 kg/yr, and since 1996 has increased its gold reserve base to more than 1,026 t (33 million ounces) from nearly 249 t (8 million ounces). The reserve base estimates were based on a gold price of $262 per troy ounce (Harmony Gold Mining Co. Ltd., 2001, 2002b§).

Encouraged by the Government's black economic empowerment policy, the gold industry saw increased participation of African companies during 2001. In January 2002, the Free Gold Joint Venture was set up between Harmony Gold and the black empowerment company, African Rainbow Mines Ltd. (ARMgold) based on the $157 million acquisition of the Free State operations of AngloGold (Harmony Gold Mining Co. Ltd., 2002a). In February 2002, Khumo Bathong Holdings acquired a 3% interest in Durban Roodepoort Deep Inc. and a 60% interest in its Crown Section tailings retreatment plant.

Iron and Steel.—*Iron Ore*.—In November 2001, Iscor Ltd. completed its unbundling of assets, retaining its iron and steel operations and spinning off all of its iron ore, coal, base-metals titanium, and industrial minerals mining operations into a new company, Kumba Resources Ltd. Iscor retained a 75% interest in Kumba, with the Industrial Development Corporation of South Africa taking 23.5%. The new companies began operating on January 1, 2002 (Kumba Resources Ltd., 2001§). In March 2002, Anglo American acquired a 20% interest in Kumba. In 2001, iron ore production in South Africa increased to 34.76 Mt, gross weight containing about 22.4 Mt of iron, or about 3% more than that of 2000. Of total sales of iron ore in 2001 of 34.88 Mt, valued at about $480 million, 67% was exported and 33% was shipped to domestic steel plants. Iscor was South Africa's largest iron ore producer in 2001. Its two iron mines, Sishen and Thabazimbi, on a contained iron basis, accounted for about 75% of the country's total output. The Sishen Mine in the Northern Cape Province, 23.81 million metric tons per year (Mt/yr) contained iron ore grading 65% iron, and the Thabazimbi Mine in the Northern Province, 2.17 Mt/yr of contained iron ore grading about 60% iron. Thabazimbi is a captive mine which supplies lump and fine iron ore to Iscor steel plants at Vanderbijlpark, outside of Johannesburg and at Newcastle in northern KwaZulu-Natal, while 80% of iron ore production at Sishen is railed to Saldanha Bay for export. The expansion of the Sishen Mine to 27 Mt/yr was completed in March 2002. The ongoing $100 million expansion program will increase the mine's production capacity to 30 Mt/yr of iron ore by 2003 and to 38 Mt/yr of iron ore by 2007. Concurrent with the expansion of the operation, the rail and port infrastructure associated with the Sishen-Saldanha exports will also be upgraded. Thabazimbi has a remaining mine life of between 6 and 8 years and a prefeasibility study is being conducted on replacing this production by developing the Welgevonden deposit, some 60 kilometers (km) south of Sishen, which contains a high-quality resource of 259 Mt of iron ore suitable for open pit mining (Iscor Ltd., 2002a§).

For the financial year ended June 30, 2002, Assmang Ltd. produced 4.77 Mt of iron ore from its operations at the Beeshoek Mine. A new $11 million iron ore jig plant was also commissioned during the year (Assmang Ltd., 2002b§).

Iron and Steel.—In 2001, South African crude steel production increased by 4% to 8.82 Mt and stainless steel production by 1% to 440,000 t. Iscor Ltd. is the main producer accounting for 6.45 Mt/yr of steel products for its financial year ended June 30, 2002, of which 46% are exported. Iscor steel operations are set up into two business units. Its flat steel products division operated the Saldanha Bay steel plant and the steel plant at Vanderbijlpark, which produced 3.51 Mt/yr of steel in the financial year ended June 30, 2002, representing 84% of the domestic market and 70% of Iscor's total steel volume. The Saldanha Steel (Pty.) Ltd. steel plant at Vredenburg near Saldanha Bay had the capacity to produce 1.25 Mt/yr of hot-rolled coil steel and was the world's first steel minimill to combine the Corex and the Midrex technologies (replacing blast furnace technology) and to be designed as an environmentally clean facility. The company has suffered through continually depressed world steel markets and prices and some startup design deficiencies and as a result, between July 2000 and June 2002, Saldanha Steel had 1.5 billion rand (approximately $200 million) in losses. Originally a joint venture between Iscor (50%) and IDC (50%), Iscor bought out IDC's share in November 2001 in an effort to rationalize operating efficiencies at Saldanha Steel with its other operations. Iscor will shift production of all thin- gauged steel products to Saldanha, freeing up 120,000 t of capacity at the Vanderbijlpark Works for other markets. For the financial year ending June 30, 2002, Saldanha Steel reported that production declined by 1% to 933,000 t of steel. Relining of the

refractories in the Corex furnace was expected to allow Saldanha to produce closer to its design capacity in 2003. Iscor's long steel products division operated the integrated steel works at Newcastle in the Kwa-Zulu Natal Province, and the electric-arc-furnace-based steelworks at Vereeniging in the Gauteng Province; together accounting for total sales of 2.01 Mt/yr of steel, 36% of which is exported (Iscor Ltd., 2002b§).

In August 2001, South African steel producers received an unfavorable ruling from the U.S. International Trade Commission (USITC), under Section 201 of the U.S. Fair Trade Act of 1974. The ruling claimed that imports of hot-rolled steel products from Argentina and South Africa had been sold in the United States at less than fair market value. Under the ruling, duties would be imposed on South African hot-rolled steel imports into the United States for at least 5 years (Steel News, 2001§). The ruling was subject to appeal by South Africa, and in May 2003, the USITC overturned its ruling stating that South Africa had acted responsibly in their trade relations with other countries. The ruling ended USITC investigations into South Africa stating that the U.S. steel industry was not injured or threatened by material injury by South African imports (Steel News, 2002§).

Effective January 2002, Acerinox, SA (Spain) acquired a 64% controlling interest in Columbus Stainless for $230 million, with Highveld, IDC, and BHP Billiton (Samancor) retaining 12% each. It was hoped that Acerinox's steel production experience could turn around the technical and economic problems Columbus has faced since it opened. Highveld announced that it took a $56 million loss on the sale. Columbus had a production capacity of between 500,000 and 600,000 t/yr of cold-rolled slab, plate, sheet, and coil depending on the product mix. For 2001, Columbus produced 439,300 t of slab steel, which was an 8% decrease compared with that of 2000, and salable production amounted to 433,907 t, which was a 15% increase compared with that of 1999. About 75% of production is exported. Highveld produced 935,760 t of carbon steel in 2001 compared with 947,588 t in 2000 from its plant at Witbank, Mpumalanga Province. Highveld's in-house production of crude carbon steel dropped 1% to 935,760 t in 2001 (Fraser, John, 2001, 2002; Highveld Steel and Vanadium Corp. Ltd., 2002§, p. 3.).

Lead and Zinc.—During 2001, Anglo American produced 45,800 t of lead and 24,300 t of zinc compared with 68,100 t of lead and 27,100 t of zinc in 2000 from its Black Mountain Mine near Aggeneys, Northern Cape Province. The mine also produced about 10,000 t/yr of copper. Ore reserves at Black Mountain were recalculated for yearend 2001 at a 56% higher tonnage and lower average grades as 12.7 Mt at a grade of 0.54% copper, 3.05% lead, and 1.78% zinc, plus measured and indicated mineral resources estimated at 3.2 Mt at a grade of 0.54% copper, 2.8% lead, and 1.01% zinc. Black Mountain has a remaining mine life of 13 years (Anglo American plc, 2002§).

In May 2000, Anglo American announced plans to invest $110 million in Black Mountain. The major element of the expansion project, scheduled for completion in 2004, will be the sinking and equipping of a new vertical shaft from surface to a depth of 1,750 meters (m) together with associated underground development. The life of the mine will be extended to at least 2013 (Anglo American plc, 2000§).

Maranda Mining Co. (Pty.) Ltd., owned by Metorex, operated the Maranda zinc-copper mine in the southwestern portion of the Murchison Greenstone Belt in the Northern Province. For the fiscal year ending June 30, 2002, Maranda milled at rate of 7,600 t/mo of ore at a head grade of 1.8% copper and 15.1% zinc. Production for the year of metal contained in concentrates was reported at 5,888 t of copper and 13,308 t of zinc. On June 30, 2002, proved and probable reserves were estimated to be 0.2 Mt at a grade of 15.4% Zn and 1.5% Cu, while mineral resources, exclusive of reserves, totaled 0.48 Mt at a grade of 20.5% zinc and 1.6% copper (Metorex Ltd., 2002c§).

BHP Billiton's Pering zinc/lead mine was scheduled for closure in late 2002.

Manganese and Ferromanganese.—South Africa dominated the world manganese market as the largest producer of manganese and with approximately 80% of the world's reserve base of manganese ore. In 2001, production declined to 3.26 Mt gross weight of manganese ore and concentrates compared with 3.63 Mt in 2000; these were primarily metallurgical grades that ranged from 30% to more than 48% manganese. For the financial year ended June 30, 2002, BHP Billiton's Samancor Manganese Division produced 1.87 Mt of ore from its Mamatwan open pit and Wessels underground mines near Hotazel, a decline of 14% from the previous year, and 406,000 t of manganese alloys. Proved and probable mineral reserves were reported at 37.25 Mt at a grade of 38% manganese at the Mamatwan Mine and 17.3 Mt at a grade of 48.3% manganese at the Wessels Mine. About 40% of Samancor's manganese ore production was exported to ferroalloy producers worldwide. The remainder was converted into alloys at Samancor's Manganese Division works at Meyerton, Gauteng Province and into manganese metal by the Manganese Metal Co. Pty. Ltd. The Manganese Division, in turn, exported 85% of its production (BHP Billiton PLC, 2002b§, p. 52-55).

Assmang operated the Gloria and the Nchwaning underground manganese mines in Northern Cape Province. Assmang was investing $75 million to add a new 2,200-m deep shaft complex at the Nchwaning III Mine, which was expected to be operational by late 2003. The expanded Nchwaning operation will have a run-of-mine capacity of about 2 Mt/yr of manganese, which could extend its mine life by more than 20 years. For its financial year ended June 30, 2002, Assmang sales included 993,000 t of manganese ore compared with 979,000 Mt in 1999 and 187,000 t of manganese alloys compared with 193,000 t in 1999. Ferromanganese production comes from Assmang plants at Cato Ridge near Durban and Machadadorp near Middleburg. Also during the year, Assmang dissolved its subsidiary company (Ferroalloys Ltd.) and brought its Cato Ridge ferromanganese plant in-house (Assmang Ltd., 2002a§).

Highveld produced 154,159 t of medium carbon manganese and silicomanganese alloys in 2001 (compared with 157,143 t in 2000) from its Transalloys Division at Witbank (Highveld Steel and Vanadium Corp. Ltd., 2002§, p. 3).

Nickel.—South Africa's nickel production was in the form of metal, metal-in-concentrate, and sulfate. About 88% of nickel production comes as a byproduct of PGM processing, nearly 250 t as nickel sulphate from the Palabora copper mine, and the remainder as primary production from the Nkomati nickel mine. In 2001, production held near constant at 36,400 t, while domestic sales of nickel, primarily to the stainless steel plants, amounted to about $128.2 million; export sales of nickel were valued at more than $82.2 million. Nickel production is expected to expand significantly between 2000 and 2007 as the platinum industry undergoes a 67% expansion and if the Nkomati Joint Venture proceeds with its proposed expansion. A proportional increase in byproduct nickel production from the expansion of the PGM industry is not expected; however, much of the new platinum production will come from the UG2 chromititic seams, which have a lower nickel content than the other reefs currently being mined for PGMs.

During 2001, the Nkomati Joint Venture [controlled by Avmin (75%)] milled 289,000 t of ore that produced 42,000 t of concentrate with an average nickel grade of 10.47%. This resulted in final metal production levels of 4,000 t of nickel and economically important byproduct production of copper (2,500 t), cobalt (54 t), and PGM (1,014 kg). The Joint Venture was expected to complete a feasibility study in early 2002 to assess the potential of completing the mining of the high-grade MSB ore body and to begin the underground and surface development of the lower grade MMZ ore body. The proposed $200 million project would increased production to 17,500 t/yr nickel, 9,000 t copper, 800 t cobalt, and 2,488 kg PGM (Anglovaal Mining Ltd. 2002§).

Platinum-Group Metals.—Surpassing gold in 2001 as the most important export commodity by value, PGM production in South Africa increased by 11% to 229,913 kg PGM with exports of 193,354 kg valued at $3.9 billion. Production by individual element included 129,746 kg platinum, 62,142 kg palladium,19,329 kg ruthenium, and 13,453 kg rhodium. The PGM industry employed nearly 100,000 workers in 2000.

A U.S. Geological Survey analysis of industry investment plans shows that between 2000 and 2007, more than $3.5 billion was projected to be spent in South Africa on adding 98,600 kg (3.17 million ounces) in new capacity, which will bring total PGM production capacity in South Africa to 246,300 kg (7.92 million ounces). This included $2 billion by Anglo American Platinum Corp. Ltd. (Anglo Platinum), which was the largest PGM producer in the world at about 37% of global platinum supply, to expand capacity 75% to 108,860 kg/yr PGM; $780 million by Impala Platinum Holdings Limited (Implats), which was the second largest producer in South Africa, to expand capacity 34% to 76,510 kg/yr PGM; $550 million by Lonmin plc to expand capacity 45% to 27,060 kg/yr PGM; $64 million by Northam Platinum Ltd., which is now majority controlled by the black empowerment company, Mvelaphanda Platinum Ltd., to increase capacity 31% to 13,060 kg/yr PGM; and several greenfield developments by Aquarius Platinum Ltd., of Australia, SouthernEra Resources Ltd. of Canada, and Two Rivers Platinum (Pty.) Ltd. which will add another 19,000 kg/yr to 20,000 kg/yr PGM by 2007. Other black empowerment companies participating as joint-venture or minority-interest partners in the expansion of the PGM sector include African Rainbow Minerals on the Twickenham (Maandagshoek) project; the Royal Bafokeng Nation on the Bafokeng Rasimone platinum mine project; TISO Capital (Pty.) Ltd. on the Dwarsrivier Farm Project; and the Bapo Ba Mogale tribe on the proposed Pandora Project.

Titanium and Zirconium.—Globally, South Africa ranked second in titanium production and third in titanium exports in 2000. Richards Bay Minerals (owned jointly by Rio Tinto and BHP Billiton) produced ilmenite, rutile, and zircon from beach sands north of Richards Bay. Richards Bay Minerals was the trading name for two registered companies—Richards Bay Iron and Titanium (Pty.) Ltd. (RBIT) and Tisand (Pty.) Ltd. Tisand is responsible for the dune mining operation and mineral separation. RBIT, which is responsible for the smelting and beneficiation process, produced an 85% titanium dioxide slag from ilmenite concentrates at the Richards Bay smelter as well as low-manganese pig iron. The flowsheet for the operation was available on the company Web site accessible at URL http://www.richardsbayminerals.co.za. The Richards Bay operation was the largest titanium mineral producer in the country and held the rights to more than 1 billion t heavy-mineral sands reserves, sufficient to maintain mining for approximately 20 more years. Production for the calendar year 2001 was estimated at 875,000 t titanium slag, 210 t zircon, and 90 t rutile (BHP Billiton PLC, 2002b, p. 75-76).

Namakwa Sands Limited operated a heavy-mineral sand mine at Brand-se-Baai and a mineral separation plant at Koekenapp, which is 340 km northwest of Cape Town, and a smelter at Vredenburg, which is near the export harbor at Saldanha Bay. Production of titanium slag decreased 5% in 2001 to 104,600 t titanium chloride slag; 114,100 t zircon; 84,400 t pig iron; 28,200 t titanium sulfate slag; and 27,100 t rutile. Remaining resources at Namakwa Sands at yearend 2001 were 539 Mt at a grade of 3.5% ilmenite, 0.9% zircon, and 0.2 rutile (Anglo American plc, 2002§).

The $275 million Ticor Heavy Minerals project, a joint venture between Kumba Resources (60%) and Ticor Ltd. of Australia (40%), was officially opened in September 2001, although full capacity was not expected to be reached until 2002. Kumba also held a controlling 50.12% interest in Ticor Ltd., giving it an effective 80% control of the project. The mine and plants are near the Richards Bay deep-sea port in the KwaZulu-Natal Province, and are expected to be at full capacity by 2005. The project is being developed in three phases:

- Phase 1—Establishment of the Hillendale mine and Mineral Separation Plant ("MSP"),
- Phase 2—Commissioning of the smelter's first furnace at Empangeni by 2003, and
- Phase 3—Establishment of the second mine at Fairbreeze and commissioning the smelter's second furnace by 2005.

The project design calls for production of 550,000 t/yr ilmenite, 250,000 t/yr titanium slag, 145,000 t/yr pig iron, 100,000 t/yr zircon, and 40,000 t/yr rutile by 2005. To assist with cash-flow, Kumba was selling a portion of the startup mine production. For the financial year ended June 30, 2002, the Ticor Heavy Mineral Project produced 686 t heavy-mineral concentrate, 471 t ilmenite, 45 t zircon, and 19 t rutile (Kumba

Resources Ltd., 2002§).

Titaniferous magnetite also was recovered at the Phalaborwa carbonatite as a byproduct of copper and phosphate rock production. Titaniferous slag was produced from Mapoch Mine magnetite ores at Highveld's Witbank steel plant.

Zirconium was produced as a zircon byproduct of mining at the Richards Bay Minerals and the Namakwa Sands mineral sands operations. During 2001, Palabora Mining Co. Ltd. permanently closed its Heavy Minerals plant which produced zirconium dioxide and calcined uranium oxide. The August 2001 closure was attributed to depleted feedstocks of baddeleyite ore from the open pit. Palabora concentrated its efforts at upgrading its new zirconium basic sulfate (ZBS) plant to make more value-added zirconia products. During 2001, Palabora produced 30.6 t of uranium oxide and 1,574 t zirconium concentrate. The ZBS plant was to be commissioned in early 2002 (Palabora Mining Company Limited, 2002).

With the decline in availability of natural zircon-bearing baddeleyite, a new South African company, Geratech Zirconium Beneficiation Ltd., has been developing a process to separate silica from zirconium in zircon sands to permit its use in making zirconium chemicals. With investment assistance from Sasol Technology and the South African Department of Arts, Culture, Science and Technology, a pilot plant at the Nuclear Energy Corp. facility in Pelindaba was upgraded to a capacity of 80 t/m in 2001 to allow the commercial production of acid zirconium sulfate tetrahydrite (AZST). During 2001, investors were being sought to construct a larger commercial AZST plant (Geratech Zirconium Beneficiation Ltd., 2001§).

Vanadium and Ferrovanadium.—South Africa was the world's largest producer and exporter of vanadium. Vanadium was produced from titaniferous magnetite mined from the Bushveld Complex. The largest producer was Highveld Steel and Vanadium Corp. Ltd. From calendar years 2000 to 2001, Highveld's production of vanadium slag increased by 5% to 73,666 t, while ferrosilicon decreased by 3% to 54,159 t (Highveld Steel and Vanadium Corp. Ltd., 2002, p. 3).

Xstrata was the second largest South African producer of vanadium through its holdings in Rhombus Vanadium Holdings Ltd. and Vanadium Technology (Pty.) Ltd. In 2001, despite vanadium demand being tied to weak steel markets, Xstrata benefitted from marketing contracts with Glencore International AG of Switzerland and increased production of vanadium pentoxide by 37% to 17,646 t and of ferrovanadium by 500% to 6,118 t. The large increase in ferrovanadium production reflects Xstrata policy to produce more value-added products within South Africa (Xstrata AG, 2002 b§, p. 6-7).

In another trade and antidumping conflict between South Africa and the United States, in November 2001, the U.S. Ferroalloys Association Vanadium Committee filed a petition with the U.S. Department of Commerce, International Trade Administration, charging Xstrata Alloys and Highveld Steel and Vanadium with dumping ferrovanadium products into U.S. markets at less than fair value. A January 2002 preliminary determination by the U.S. International Trade Commission and a July 2002 preliminary ruling by U.S. Department of Commerce, International Trade Administration, established "material injury" to the U.S. ferrovanadium industry and levied an antidumping duty on ferrovanadium sales into the United States of 37.29% on Xstrata and 45.58% on Highveld (U.S. Department of Commerce, 2002§; U.S. International Trade Commission, 2002§).

Industrial Minerals

South Africa produced about 30 different industrial minerals from more than 500 mines and quarries, about one-half of which was devoted to aggregate and sand production. The industrial minerals sector employed more than 14,000 workers and was a significant contributor to total mineral sales. In 2001, the value of total sales of industrial minerals produced decreased by more than 11% in dollar terms to $529.6 million compared with $602 million in 2000. Approximately 68% of those sales was on the domestic market. In terms of sales, the three dominant industrial mineral commodities were aggregate and sand, limestone and dolomite, and phosphate rock. The largest domestic consumers of South Africa's industrial minerals were the building and construction, metallurgical, and agricultural sectors. Total export earnings for industrial minerals were nearly $172 million in 2001. Granite and norite dimension stone accounted for 47% of industrial mineral exports; the other major export commodities were, by value, vermiculite, phosphate rock, andalusite, and asbestos. South Africa accounted for 40% of the world's supply of vermiculite, 37% of alumino-silicates (andalusite), and more than 6% of fluorspar and granite (South Africa Department of Minerals and Energy, 2002, p. 127-137).

Cement.—Domestic cement production increased by 2% to 9.17 Mt in 2001, but still substantially less than the 9.8 Mt of 1997. Domestic sales of cement were 8.04 Mt in 2001. The major consuming provinces were Gauteng (35.8.3%), Kwa-Zulu Natal (14.8%), Western Cape (11.9%), and Northern Province (now known as Limpopo Province) (9.9%). Export sales of cement to the neighboring states of Botswana, Lesotho, Namibia, and Swaziland increased by 3.7% to 1.13 Mt in 2001 (Cement and Concrete Institute of South Africa, 2002§). Following a buildup in capacity during the 1980s, demand has declined, and the industry, in recent years, has been operating at about 60% of capacity. The structure of the cement industry and current ownership is noted in table 2.

Diamond.—Rough diamond production increased by 3% in 2001 to 11.17 million carats. As in years past, mines owned by De Beers dominated the sector with more than 90% of the total production. Total diamond production for De Beers' South African operations in 2000 amounted to 10.29 million carats recovered from 23.3 Mt of material treated. The Venetia Mine, which was the largest De Beers operation, recovered 4,497,756 carats with a revenue per carat of $55; the Finsch Mine, 1,925,059 carats at $50 per carat; the Premier Mine, 1,782,420 carats at $46 per carat; the Namaqualand Mine, 809,928 carats at $159 per carat; the Kimberley Mine, 568,639 carats at $76 per carat; the Marsfontein Mine, 436,191 carats at $165 per carat; the Koffiefontein Mine, 151,498 at $228 per carat, and The Oaks Mine, 116,048 carats at $165 per carat. Recovered diamond grades varied considerably within the De Beers

operations during 2000—with 122 carats per 100 metric tons (cpht) recovered at Venetia, 82.2 cpht at Marsfontein, 62.6 cpht at Premier, 54.7 cpht at The Oaks, 45.8 cpht at Finsch, 16.2 cpht at the Kimberley Mine, 13.2 cpht at the Namaqualand Mine, and 6.9 cpht at the Koffiefontein Mine (The De Beers Group, 2002a§). In May 2001, De Beers announced plans to investigate development of the "Centenary Cut" at its Premier Mine. If approved, the estimated $660 million project would more than double production at Premier to 9 Mt/yr of ore from its current capacity of 4 Mt/yr. A mechanized block caving mining method would be used to extend the depth of the mine from the 730-m level to the 1,100-m level. An investment decision was expected in 2003 (The De Beers Group, 2002b§)-

For the financial year ended June 30, 2002, TransHex International produced 221,486 carats from its operations in northwest South Africa. Seven land operations, the largest at Baken, accounted for 176,642 carats of output with values ranging from $92 per carat to $931 per carat. Production from three shallow water and two deepwater operations amounted to 44, 844 carats ranging from $137 per carat to $358 per carat (The Trans Hex Group, 2002§).

During 2000, SouthernEra Resources Ltd. of Canada announced plans to develop its third diamond mine the Klipspringer in the Limpopo Province east of the towns of Potgietersrus and Pietersburg; completion is expected by 2003. The underground development will produce 160,000 carats per year at capital cost of $7 million. On the basis of a minable reserve of 3.6 Mt at an average recovered grade of 47 cpht, valued at $100 per carat, the Klipspringer project will have a mine life of more than 13 years. Ore will be treated at SouthernEra's existing dense-medium separation plant at Klipspringer. In April 2001, the Klipspringer Joint Venture (KJV) was established between SouthernEra (50%), De Beers and Steppon Investments (Pty.) Ltd., a jointly owned Black Economic Empowerment company with De Beers. The KJV replaced the Marsfontein Joint Venture, effectively extending the original joint venture with De Beers over a larger area of ground, including the Marsfontein and Klipspringer diamond mines. During 2001, SouthernEra recovered 84,715 carats, valued at $3.8 million from the nearly depleted Marsfontein Mine and from underground predevelopment work at Klipspringer (SouthernEra Resources Ltd., 2000§; 2002§, p. 19).

Increasing international concern over the growing evidence of illegally mined and exported diamond revenues being used to support civil conflicts in Angola, Sierra Leone, and elsewhere led to the holding of the first United Nations sponsored Kimberley Process Ministerial meeting in Botswana in November 2001. Attended by 35 countries involved with the mining of, cutting of, or trading in rough diamonds, the Kimberley Process aimed to establish a system of certificates of origin to control the global trade in diamonds. The meeting brought together most of the major stakeholders, including governments; the diamond mining, processing, and trading industry; and concerned nongovernmental organizations, such as Global Witness from London, whose research, along with several United Nations Security Council Panel of Experts reports, added considerable transparency to the issue. The extensive findings of these groups can be viewed at their respective Web sites at http://www.un.org/Docs/sc/committees/Angola/AngolaSpecEng.htm; http://www.un.org/Docs/sc/committees/SierraLeone/; http://www.kimberleyprocess.com/; and http://www.globalwitness.org/campaigns/diamonds/index.php.

Fluorspar.—In 2001, production of 286,400 t of fluorspar was distributed among three producers: Vergenoeg Mining Company (Pty.) Ltd. (owned by Metorex) and Witkop Fluorspar Mine (Pty.) Ltd. [owned by the Australian company, South Africa Land & Exploration Company (Sallies)], and Buffalo Fluorspar Mine, which was reopened by International Metal Processing of South Africa in 2000.

The open pit Vergenoeg Mine, which is 70 km north-northwest of Pretoria, milled 51,000 t/mo ore at a head grade of 38% calcium fluoride. Annual production was 15,363 t metallurgical-grade fluorspar and 111,489 t acid-grade fluorspar. As of June 30, 2002, mineral reserves were reported to be 4.5 Mt at grade of 36.8% calcium fluoride (CaF_2) plus mineral resources of 217.5 Mt grading 23.4% CaF_2 (Metorex Ltd., 2002d§).

The annual capacity of the Witkop operation from four quarries and a flotation plant was 140,000 t acid-grade fluorspar, and during 2001, the company was studying the feasibility for doubling capacity to 240,000 t/yr fluorspar.

Vermiculite.—The major producer was the Vermiculite Operations Division of Palabora, which extracted vermiculite from the pyroxenite units of the mineralogically diverse Phalaborwa Carbonatite Complex. In 2001, vermiculite concentrate production decreased by 20% to 166,078 t. The production decrease was attributed to heavy rainfalls during the year and led to a decision to build a covered roof over the stockpiles by early 2002. The company has been updating its vermiculite resource estimates and at yearend 2001 reported 99.2 Mt of measured, indicated, and inferred resources at an average grade of 28% vermiculite, of which proved and probable reserves were 45.7 Mt at an average grade of 32.1% vermiculite. Common to other industrial minerals, approximately 70% of Palabora's delivered costs of vermiculite to markets in Asia and Europe were in logistics and transport (Palabora Mining Co. Ltd., 2002, p. 16-17).

Mineral Fuels

Coal.—Following platinum and gold, coal was one of the most important sectors of the mineral economy of South Africa. During 2001, 55 coal mines employed more than 48,000 workers. South Africa remained the fifth largest coal-producing country in the world and the third largest coal exporter. In 2001, production held level at 223.5 Mt of salable coal valued at $3.1 billion; of this total 69.2 Mt, which was valued at $1.98 billion, was exported primarily through the Richards Bay Coal Terminal (RBCT). The RBCT had a steam coal exporting capacity of 72 Mt/yr with plans to expand the capacity to 81 Mt/yr by 2007. Export destinations for South African coal were, in order of importance, Europe, Asia and the Middle East, Africa, and South America. More than 88% of salable coal production was controlled by five companies—Ingwe Coal

Corp. Ltd. (29%), Anglo American Coal Corp. Ltd. (21%), Sasol Mining (Pty.) Ltd, (9%), Eyesizwe Coal (Pty.) Ltd. (9%), and Kumba Resources (8%). In 2001, 152.2 Mt of coal was consumed domestically. The majority of domestic sales went to electricity (89 Mt), synthetic fuels production (48 Mt), and industry (6 Mt). A reassessment of South Africa's coal reserves by the Department of Minerals and Energy was expected by the end of 2003 (South Africa Department of Minerals and Energy, 2002, p. 52-53).

In February 2002, Xstrata AG proposed acquiring all of the Australian and South African coal assets of Glencore International for $2.5 billion, including the assets of Duiker Mining Ltd. in South Africa. In 2001, Duiker Mining produced 17.7 Mt coal from 13 mines, including its 16% minority share of joint-venture operations with Ingwe coal. Duiker coal reserves at yearend 2001 were estimated at proven and probable reserves of 637 Mt, measured and indicated resources of 6.64 billion metric tons (Gt) and inferred resources of 3.6 Gt (Xstrata AG, 2002a§).

Petroleum and Natural Gas.—Soekor controlled all offshore oil and gas prospects. In 2001, the country produced only 4.2% of its crude oil requirements. Crude oil production offshore from Mossel Bay was limited to 15,000 barrels per day (bbl/d) from the Oribi Field and 10,000 bbl/d from the Oryx Field. Seventeen km to the west, Soekor discovered oil and gas in five wells drilled in the Sable Field; field development studies suggested the potential to produce 40,000 bbl/d from the Sable Field. Soekor was seeking to lease the Sable Field to a major contractor, which would supply a new Floating Production and Storage and Offloading (FPSO) vessel and operate the oilfield (Soekor E and P (Pty.) Ltd., 2001§).

As an outgrowth of the 1998 White Paper on Energy Policy, in January 2002, the Government established the Petroleum, Oil and Gas Corporation of South Africa (PetroSA), which was formed from a merger of three parastatal companies, Mossgass Pty. Ltd., a maker of synthetic fuels, Soekoer E & P (Pty.) Ltd., an oil and gas exploration company, and sections of the Strategic Fuel Fund, a trading and fuel storage agency. The Petrosa mission is to be an active player in global oil and gas exploration and production and in the production and marketing of petrochemicals. Details are available at the new company's Web site at http://www.petrosa.com.

Mossgas, which used natural gas to produce synthetic motor fuel at its plant at Mossel Bay, produced natural gas from several offshore fields under Mining Leases from Soekor. The F-A Field, which was discovered by Soekor in 1984 and is situated 85 km south of the town of Mossel Bay was producing at an average rate of 5.49 million cubic meters per day of natural gas and 9,500 bbl/d of condensate. The E-M gas field, which is situated 50 km west of F-A, was commissioned by Mossgas in September 2000. Combined with several other smaller fields in the area, gas resources were sufficient to supply Mossgas until 2008. Separate 91-km pipelines convey gas and condensate to the Mossgas synfuels plant where petrol, diesel, and kerosene were produced at a rate of 36,000 bbl/d of finished product (Soekor E and P (Pty.) Ltd., 2001§).

Synthetic Fuels.—South Africa had a highly developed synthetic fuels industry that took advantage of the country's abundant coal resources and offshore natural gas and condensate in Mossel Bay. The two major players were Sasol (coal-to-oil/chemicals), which was the world's largest manufacturer of oil from coal, and Mossgas (natural-gas-to-petroleum products). Sasol had the capacity to produce 150,000 bbl/d, and Mossgas, 45,000 bbl/d. Sasol's coal liquefaction plants were located at Secunda (oil) and Sasolburg (petrochemicals). Started by the Government in the 1950s to help reduce South Africa's dependence on imported oil, the company was privatized in 1979. In the coal liquefaction plants, coal is first gasified, then turned into a range of liquid fuels and petrochemical feedstocks. Further details on South Africa's energy and fuels industries, including Sasol's efforts to use imported natural gas from Mozambique and possibly Namibia to replace coal as the feedstock for its conversion process are available at the U.S. Energy Information Administration web site (U.S. Energy Information Administration, 2002§).

Reserves

South Africa's mineral reserves are large and varied and reflect the country's complex geology. A detailed description of the geology and mineral resources of South Africa was updated by the Council for Geosciences in 1998 (Wilson and Anhaeusser, 1998). The bulk of South Africa's mineral production is from the northern half of the country. Table 3 lists the reserve base for a number of South Africa's major minerals. Although data for many of the minerals listed are incomplete for the world, South Africa's reserves appear to rank among the top five countries and would rank first in the world for andalusite, chromite, gold, manganese, PGM, and vanadium.

Infrastructure

The country has a well-developed and extensive road and railroad infrastructure that served not only South Africa, but also the surrounding region. Roadways totaled 358,600 km, of which 17% was paved. Railroad infrastructure totaled 20,400 km, of which 9,090 km was electrified. Portnet maintained the largest and most efficient commodity export harbors in Sub-Saharan Africa, most of which handled minerals, notably Cape Town, Durban, East London, Mossel Bay, Port Elizabeth, Richards Bay, and Saldanha Bay. In addition to fulfilling the requirements of South Africa itself, the country's ports also served as outlets for such landlocked countries as Botswana, Lesotho, Swaziland, Zambia, and Zimbabwe. South Africa was also a regional supplier of electricity and petroleum products, two of a number of examples of the dependence of neighboring countries on South Africa's infrastructure and transportation networks.

Richards Bay handled more than one-half the volume of cargo among South African ports. The RBCT had a coal export capacity of about 72 Mt/yr out of a total bulk cargo port capacity of 75 Mt/yr. A second coal export facility was being

built at South Dunes near Richards Bay to handle an additional 12 Mt/yr of coal exports. Coal exports through Durban and the Mozambican port of Maputo were only a fraction of those through the RBCT. Durban's port facilities were designed mainly for small consignments of high-quality lump bituminous coal and anthracite that cannot be properly handled at Richards Bay.

Eskom had a nominal capacity of 41,298 megawatts, predominantly from coal-fired sources, with a small percentage of electricity being generated from nuclear sources, and operated more than 306,100 km of powerlines (Eskom, 2001§). South Africa also maintained 931 km of pipeline for the distribution of crude oil; 1,748 km for petroleum products; and 322 km for natural gas.

Outlook

South Africa is endowed with one of the richest and diverse concentrations of mineral resources on Earth and has, in terms of size and value, one of the top 10 mining and mineral-processing industries in the world. Contributing to more than 25% of the country's GDP, the minerals sector is expected to continue to play an important role in the economy for many years to come. The Government is balancing its need to focus policy initiatives and budget resources on redressing social and economic inequities in the country with its need to maintain economic and labor policies that allow South African exports to remain competitive in global markets. As a sign of confidence in the future of South Africa, domestic and foreign mineral investors have announced plans to commit more than $10 billion to develop or expand new mining and value-added mineral processing capacity between 2000 and 2007. These planned investments are, however, subject to internal and external forces that could delay or constrict actual implementation. Internally, the impact of the high rate of HIV/AIDS in the country on the able-bodied skilled and semiskilled workforce between 15 and 49 and on the resulting increasing direct and indirect labor costs to industry are of concern to investors. Some investment may be reevaluated depending on the outcome of the ongoing debate during 2001 and 2002 on the direction of mineral policy in South Africa including mineral rights, taxation, and local ownership. Externally, the weak global economy is having a negative affect on demand and prices of mineral commodities and is making many projects marginally economic to continue. Increased attention was being given to environmental issues, which are also factors in projects that require financing from international lending institutions. As a result of this weak demand in 2001 and early 2002, evidence indicated that many companies were beginning to rethink the timing of future investments, particularly in ferrous and base-metal projects. These factors will influence the way that the South African Government maintains the investment policies and economic incentives that will determine how South Africa competes for investment with the other major mineral-export-oriented-countries such as Australia and Canada.

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Mineral Economics Directorate (Minerals Bureau):
South Africa's mineral industry, annual.
Periodic directories, some of which are available online via a drop down menu under Publications at http://www.dme.gov.za. Recent directories include the following:
D1/2001 Operating mines, quarries and mineral processing plants
D2/2001 Operating and developing coal mines
D3/2001 Operating gold mines and recovery plants
D4/2001 Review of salt industry
D6/2001 Platinum-group metal mines
D7/2002 Diamond handbook and operating diamond mines
D8/2002 Ferrous minerals and producers
D9/2002 Producers of dimension stone
D10/2002 Producers of non-ferrous metals
D11/2002 Producers of industrial minerals
D12/2002 Operating and developing black empowerment mining companies
D13/2002 African mining companies, government depts & related organization
D14/2002 Producers of sand and aggregate
Mineral Production and Sales Statistics, monthly.

TABLE 1
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
METALS						
Aluminum metal, primary		673,043	677,000	689,230 r/	674,167 r/	662,497
Antimony concentrate: 2/						
Gross weight		5,888	7,316	9,100	6,288	8,181
Sb content (59.8% Sb)		3,415	4,243	5,278	3,710	4,827
Chromite, gross weight:						
44% to 48% chromic oxide	thousand tons	2,279 r/	2,329	2,447	2,261	2,180
Less than 44% chromic oxide	do.	3,883 r/	4,151	4,370	4,360	3,322
Total	do.	6,162 r/	6,480	6,817	6,621	5,502
Cobalt:						
Mine output, Co content e/		465	435	450	580	550
Refinery output:		318	296	306	397	373
Copper:						
Mine (company output), Cu content		153,058	164,000	144,263	137,092	141,865
Metal:						
Smelter		163,600	152,300	149,300	172,800	142,500
Refined, primary		130,200	125,600	134,500	126,100	132,078
Gold, primary	kilograms	491,680	465,100	451,300	430,816 r/	394,535
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand tons	33,225	32,965	29,512	33,707	34,757
Fe content (62%-65%)	do.	20,600 e/	20,438	18,442	21,570 r/	22,244
Metal:						
Pig iron	do.	6,192	5,650	4,587	6,300	5,800
Direct-reduced iron	do.	1,120	1,070	1,260	1,530	1,560
Ferroalloys, electric arc furnace:						
Chromium ferroalloys	do.	1,940	2,025	2,155	2,574	2,141
Ferromanganese	do.	499 r/	542	527	597	498
Ferrosilicon	do.	102	108	106	109 r/	108
Ferrovanadium e/	do.	5	6	6	18	18
Silicomanganese e/	do.	266	265	267	310 r/	253
Silicon metal	do.	34	33	36	40	39
Steel:						
Crude	do.	8,311	7,679	6,830 r/	8,481 r/	8,821
Stainless		439	430	450 r/e/	436	440
Lead:						
Concentrate, Pb content		83,114	84,128	80,191	75,280	50,771
Smelter, secondary		43,000	50,000	55,000	46,124 r/	48,909
Manganese:						
Ore and concentrate, gross weight:						
Metallurgical:						
More than 48% manganese	thousand tons	1,809	1,734	1,876	2,047	2,082
45% to 48% manganese	do.	84	12	12	302	--
40% to 45% manganese	do.	116	218	235	235	326
30% to 40% manganese	do.	1,111	1,049	970	1,029	832
Total 3/	do.	3,120	3,013	3,093	3,613	3,240
Chemical, 35% to 65% manganese dioxide	do.	33	31	29	22	26
Grand total	do.	3,153	3,044	3,122	3,635	3,266
Metal, electrolytic e/	do.	40	40	40	40	40
Nickel:						
Mine output, concentrate, nickel content e/		34,830	36,679	36,200	36,616	36,443
Metal, electrolytic		28,830 r/	29,039	28,345 r/	30,900	30,900 e/
Platinum-group metals: e/						
Platinum	kilograms	115,861	116,483	121,304	114,459	129,746
Palladium	do.	55,675	56,608	58,164	58,818	62,142
Rhodium	do.	11,664	11,633	12,752	12,067	13,453
Other 5/ e/	do.	13,266	15,419	24,259 r/	24,426	23,406
Total	do.	196,466	200,143	216,479 r/	209,770	228,747
Silver	do.	144,000 r/	144,482 r/	151,959 r/	144,143	109,570

See footnotes at end of table.

TABLE 1--Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
METALS--Continued						
Titanium: e/						
Ilmenite concentrate	thousand tons	2,240 r/	2,300	1,851 r/	1,800	1,750
Rutile concentrate	do.	123	130	100 r/	130	120
Total	do.	2,360	2,430	1,950	1,930	1,870
Titaniferous slag 5/	do.	1,100	1,100	1,168 r/	1,057 r/	1,140
Uranium oxide		1,324	1,138	1,084 r/	1,015	1,065
Vanadium, vanadium metal content		15,590 r/	18,868 r/	17,612	18,021	18,184
Zinc:						
Concentrate:						
Gross weight e/		132,000	129,000	129,200 r/	116,100	113,400
Zn content		71,062	69,630	69,733	62,703	61,221
Metal, smelter, primary		108,500	107,400	108,000	103,000	109,000
Zirconium concentrate (baddeleyite and zircon) e/		265,000	265,000	219,000 r/	253,000	262,000
INDUSTRIAL MINERALS						
Aluminosilicates:						
Andalusite		251,203	236,200	136,949	182,674	193,225
Sillimanite		--	65	--	--	--
Asbestos:						
Chrysotile		49,754	27,195	18,700	18,782	13,393
Crocidolite		232	--	--	--	--
Total		49,986	27,195	18,700	18,782	13,393
Barite		2,071	610	2,844 r/	1,628	--
Calcite		2,886	2,764	2,800 e/	2,800 e/	2,800 e/
Cement, hydraulic, sales	thousand tons	9,797 r/	9,581 r/	9,008 r/	8,991	9,165
Clays:						
Attapulgite		9,349	7,800	7,008 r/	10,287	9,299
Bentonite		75,500	48,382	49,261 r/	85,187	108,300
Fire clay		89,600	143,500	119,450 r/	112,637	141,303
Flint clay, raw and calcined		91,700	82,787	88,864	47,256	50,848
Kaolin		164,400	138,300	123,173 r/	88,897 r/	82,500
Brick clay, local sales	thousand tons	4,137	3,518	3,289 r/	5,347	5,823
Diamond, natural:						
Gem e/	thousand carats	4,500	4,700	4,400	4,745	4,467
Industrial e/	do.	5,586	6,051	5,622	6,060	6,700
Total	do.	10,086	10,751	10,022	10,805	11,167
Feldspar		68,100	56,400	59,336	66,774	66,100
Fluorspar:						
Acid-grade		201,000	222,000 r/	203,280 r/	201,737 r/	272,068
Ceramic-grade e/		4,000	--	--	--	--
Metallurgical-grade		2,000	15,000 r/	14,000 r/	10,618 r/	14,319
Total		207,000	237,000 r/	217,280 r/	212,355	286,387
Gemstones, semiprecious, Tiger's eye	kilograms	64,300	87,200	80,000 e/	80,000 e/	80,000 e/
Gypsum, crude		396,900	485,749	505,404 r/	413,105	382,830
Industrial or glass sand (silica)	thousand tons	2,463	2,223	2,170	2,138	2,132
Lime	do.	1,585	1,523	1,920	1,391	1,615
Magnesite, crude		76,699	74,300	64,000 r/	63,000 r/	33,900
Mica, scrap and ground		1,423	1,556	1,010	708	1,044
Nitrogen, N content of ammonia		752,400	722,800	784,800	560,200	505,900
Perlite		403	400 e/	400 e/	400 e/	400 e/
Phosphate rock:						
Gross weight	thousand tons	2,732	2,739	2,957 r/	2,796	2,420
Phosphorus pentoxide content e/	do.	1,066	1,068	1,153 r/	1,083	937
Pigments, mineral, natural:						
Ochers		186	122	118	550	801
Oxides		98	64	98	80	51
Total		284	186	216	630	852

See footnotes at end of table.

TABLE 1--Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
INDUSTRIAL MINERALS--Continued						
Salt		322,442	356,059	388,380 r/	345,632	356,075
Sodium sulfate, natural		49,071	48,613	53,400	49,712	57,759
Stone, n.e.s.:						
Dimension:						
Granite and norite 6/		804,300	669,363	782,000	648,818	716,294
Slate		11,000	23,547	24,500	24,952	40,984
Crushed and broken:						
Limestone and dolomite	thousand tons	22,214	19,754	19,030	15,881	18,764
Nepheline syenite		114,201	11,500 e/	--	--	--
Quartzite	thousand tons	8,500	10,203	8,360	7,965	7,412
Shale:						
For cement	do.	334	279	286 r/	294	243
Other 6/	do.	3,000 e/	3,707	3 r/	7,358	67
Total	do.	3,334	3,986	2,850	7,661	310
Aggregate and sand, n.e.s.	do.	31,692 r/	31,752 r/	29,261 r/	28,402 r/	26,416
Sulfur:						
S content of pyrite (53.45%)	do.	167	152	141	146	150
Byproduct:						
Metallurgy e/	do.	47	122	126	268	265
Petroleum	do.	256	178	139	184	123
Total	do.	470	452	406	452	388
Talc and related materials:						
Talc		12,574	11,328	7,900	5,600	3,030
Pyrophyllite (wonderstone)		10,610	11,500	13,277	11,989	14,386
Vermiculite		211,000	221,300	217,800	208,835	166,078
MINERAL FUELS AND RELATED MATERIALS						
Coal (salable product):						
Anthracite	thousand tons	1,997	2,064 r/	1,919 r/	1,618	1,607
Bituminous	do.	216,600 r/	222,283	221,541	222,500	221,893
Total	do.	218,597 r/	224,347 r/	223,460 r/	224,118	223,500
Natural gas	million cubic meters	1,756	1,560	2,039	2,088	3,000 e/
Petroleum: 7/						
Crude	thousand 42-gallon barrels	3,744	6,549	5,493	6,606	13,870
Refinery products:						
Liquefied petroleum gases	do.	3,650	3,650	3,650 r/e/	3,650	3,650 e/
Gasoline	do.	67,525	67,525	67,000 r/e/	67,000	67,000 e/
Jet fuel	do.	11,315	12,410	12,000 r/e/	12,000	12,000 e/
Kerosene	do.	6,205	7,300	7,000 r/e/	7,000	7,000 e/
Distillate fuel oil	do.	39,785	55,115	55,000 r/e/	55,000	55,000 e/
Residual fuel oil	do.	19,345	24,090	24,000 r/e/	24,000	24,000 e/
Lubricants (including greases) e/	do.	3,650	3,650	3,650 r/e/	3,650	3,650 e/
Other e/	do.	10,585	8,760	8,700 r/e/	8,700	8,700 e/
Total 8/	do.	162,060	182,500 r/	181,000 r/e/	181,000	181,000 e/

e/ Estimated. r/ Revised. -- Zero.
1/ Table includes data available through December 2002.
2/ Data are for the year ending June 30 of that stated.
3/ Difference between total production reported by Minerals Bureau and platinum, palladium, and rhodium supplies (shipments) reported in Johnson and and Matthey Annual Platinum Review. Includes ruthenium and iridium production plus excess platinum, palladium, and rhodium inventory.
4/ Estimated data are rounded to no more than thee significant figures; may not add up to totals shown.
5/ Except for about 45,000 metric tons per year slag derived from titaniferous magnetite by Highveld Steel, titaniferous slag is all from the smelting of ilmenite and likely represents most of that mineral's production, for which data are unavailable.
6/ Converted from reported cubic meters using 1 cubic meter = 2.7 tons.
7/ In addition, Sasol produces about 67 million barrels per year of synthetic liquid petroleum fuels from coal.
8/ Excludes refinery fuel and losses.

TABLE 2
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	BHP Billiton Aluminium South Africa (Pty.) Ltd. (BHP Billiton PLC., 100%)	Bayside smelter at Richards Bay	175.
Do.	do.	Hillside smelter at Richards Bay planned expansion by 2003	500+ increase to 650.
Andalusite	Rhino Minerals (Pty.) Ltd. [Mircal South Africa (Pty.) Ltd., 100%, acquired from Anglovaal Minerals Ltd. (Avmin) in July 1999]	Rhino Mine near Thabazimbi	120.
Do.		Havercroft Mine at Penge, North of Steelpoort	60.
Do.	Samrec Pty. Ltd. of France (private, 100%) (IImerys Group)	Annesley Mine at Penge, 50 kilometers north of Steelpoort	75.
Do.	do.	Andalusite Refractories Mine at Groot Marico 60 kilometers west of Rustenburg (Plant mothballed in 2000) Pilot plant for stauralite in 2001	12.
Do.	do.	Krugerspost Mine, near Lydenburg	50.
Do.	Hoogenoeg Andalusite (Pty.) Ltd. (Hernic Group)	Hoogenoeg Mine, 60 kilometers northeast of Potgietersrus	15.
Do.	do.	Buffelshoek near Thabazimbi	NA.
Antimony	Consolidated Murchison Ltd. [Metorex Pty. Ltd., 34.3%, Crew Development Corp. (Canada), 3.3%]	50 kilometers west of Phalaborwa	7 Sb concentrate. 1,000 kg gold byproduct.
Asbestos	Kaapsehoop Asbestos Pty. Ltd.	New Amianthus Mine in Mpumalanga	NA (chrysotile).
Do.	African Chrysotile Asbestos Ltd.	Msauli Mine near Barberton (closed)	NA (chrysotile).
Do.	Anglo Dutch Exploration & Mining Co. (Pty.) Ltd.	Stella Mine, east of Barberton (closed)	NA (chrysotile).
Do.	Griqualand Exploration and Finance Corp.	Kuruman Mine (closed in 1998)	NA (crocidolite).
Cement	Anglo Alpha Ltd. (Holderbank; Anglovaal Industries Ltd.).	Dudfield kiln near Lichtenburg, also grinding mill at Roodepoort	1,830.
Do.	do.	Ulco kiln 60 kilometers northwest of Kimberley	1,615.
Do.	Lafarge South Africa Ltd. [Lafarge (France)] [formerly Blue Circle Cement (Pty.) Ltd.]	Lichtenburg kiln, North West Province	2,400.
Do.	do.	White's kiln	200.
Do.	Natal Portland Cement Co. (Pty.) Ltd. (co-owned by Anglo Alpha, Cimentos de Portugal, and Lafarge).	Simumu plant, 125 kilometers southwest of Durban; also grinding mills at Durban and Newcastle	1,500.
Do.	Pretoria Portland Cement Co. Ltd. (Barlow Rand Group, 60.3%)	De Hoek, Dwaalboom, Herculese, Jupiter, Slurru, Riebeeck West, and Port Elizabeth kilns	5,500 (combined), clinker.
Chromite	Samancor Ltd. (BHP Billiton PLC., 60%, Anglo American plc, 40%)	Eastern Chrome Mines in Steelpoort Valley, Mpumalanga Province, includes: Lannex, Groothoek, Jagdlust, Mooihoek, Tweefontein, and Steelpoort mines	2,200 run-of-mine ore.
Do.	do.	Western Chrome Mines in Northern Province includes Elandsdrift, Mooinooi, Ruighoek, and Waterkloof-Millsell mines	1,800 run-of-mine ore.
Do.	Chromecorp Holdings Ltd. [Xstrata Ag, nee (Sudelektra Holdings AG, (Switzerland) 100%]	Kroondal Mine east of Rustenburg	1,260 ore; 880 concentrate.
Do.	do.	Wonderkop Mine east of Rustenburg	720 ore; 400 concentrate.
Do.	do.	Chroombronne Mine, near Rustenburg	576 ore; 432 concentrate.
Do.	do.	Purity Mine, near Rustenburg	360 ore; 252 concentrate.
Do.	Hernic Ferrochrome Pty. Ltd., [South African Chrome and Alloys Ltd.; EL Daniel (Germany); Nittetsu Shoji (Japan)]	Hernic Chrome Mine near Brits, North West Province, and Mooinooi Mine near Rustenburg	NA.
	Bayer Pty. Ltd.	Rustenburg Chrome Mine	NA.
Do.	Lavino South Africa (Pty.) Ltd. (Anglovaal Minerals Ltd., 51%; Middle Witwatersrand, 49%)	Grootboom Mine, near Lydenburg	500 ore.
Do.	Dilokong Chrome Mine (Pty.) Ltd. (Mining Corp. Ltd., 100%)	Dilokong Mine, near Lydenburg	480 ore.
Do.	Associated Manganese Mines of South Africa Ltd., (Anglovaal Minerals Ltd., 50.2%; Associated Ore & Metal Corp., 45.2%)	Dwarsrivier Mine	1,000 run-of-mine ore.
Coal	Amcoal Colliery and Industrial Operations Ltd. (Anglo American Plc. (52%)	8 collieries: Arnot, Bank, Goedehoop, Kriel, New Denmark, New Vaal, SA Coal Estates, and Vryheid Coronation, in Mpumalanga and KwaZulu-Natal	52,000 anthracite and bituminous.
Do.	Ingwe Coal Corp. Ltd. (Billiton Plc., 100%)	10 collieries in Mpumalanga and KwaZulu-Natal Provinces	59,000 anthracite and bituminous.
Do.	Duiker Mining Ltd. (Xstrata plc, 100% as of 2002)	Tweefontein Division (Waterpan, Boschmans, Witcons, and South Witbank mines	4500.
Do.	do.	iMpunzi Division (Phoenix, Tavisstock, ATC, and ATCOM mines	6,200.

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal--Continued:				
Do.		Duiker Mining Ltd. (Xstrata plc, 100% as of 2002)	Mpumalanga Division (Strathae, Tselentis and Spitzkop mines)	3,200.
Do.		do.	Goedgevonden Mine (opens 2004)	
Do.		do.	Ingwe manged operations including Rietspruit JV, 50%; Douglas Tavistock JV, 16% (Douglas and Middleburg Mines)	29,000.
Do.		Duvha Opencast Services (Pty.) Ltd. (Rand Mines Ltd., 71%)	Duvha Colliery, 18 kilometers southeast of Witbank	11,000 bituminous.
Do.		Kangra Group Pty. Ltd.	Savamore, Springlake, Taaboschpruit, and Welgedacht collieries.	4,300 bituminous and steam.
Do.		Sasol Mining (Pty.) Ltd. (Sasol, 100%)	Sigma Colliery, 2 mines, 75 kilometers south of Johannesburg (closed 1999).	5,500 bituminous.
Do.		do.	Secunda Collieries, 6 mines, 75 kilometers south of Witbank	43,000 bituminous.
Do.		Kumba Resources	Grootegeluk Mine, 120 kilometers north of Thabazimbi	12,000 steam coal. 2,000 coking coal. 450 metallurgical coal.
Do.		do.	Leeuwpan Colliery in Mpumalanga Province	1,250 steam coal.
Do.		do.	Durnacol Mine at Dannhauser, 40 kilometers south of Newcastle	530 coking coal.
Do.		do.	Tshikondeni Mine in Venda, about 100 kilometers southeast of Messina	410 coking coal.
Do.		Anglovaal Minerals Ltd. (100%)	Dortsfontein Colliery	700.
Do.		do.	Forzando Colliery	1,350.
Do.		Newcoal (Eyesizwe Coal (Pty) Ltd., 80%; Anglo Coal, 11%; Ingwe Coal Corp. Ltd., 9%)	Matla, Arnot underground, Glisa, and New Clydesdale collieries	18,000
Do.		Kuyasa Mining (Pty.) Ltd.	Ikhewezi mine, near Delmas	350.
Do.		Gold Fields Coal Ltd.	Greenside and New Clydesdale Collieries	3,000.
Do.		Anker Holdings B.V. (Netherlands)	Elandsfontein, Golfview, Van Oudshoornstrom, and Woestalleen collieries	5,000. e/
Do.		Wakefield Coal Division, [Metorex Pty. Ltd., 40.07% (Canada)]	Leeuwfontein and Side collieries in Witbank Coalfield	1,300 steam.
Copper		Palabora Mining Co. Ltd. (Rio Tinto Ltd., 46.4%; Anglo American plc /De Beers, 29%)	Palabora open pit mine and plant at Phalaborwa	130 metal in ore.
Do.		do.	Switch to underground mining in 2002	Then reduces to 75 metal in ore.
Do.		do.	Smelter at Phalaborwa	140 anodes.
Do.		do.	Refinery at Phalaborwa	125 cathodes.
Do.		O'okiep Copper Co. Ltd. [Metorex (Pty.) Limited 89%]	Nigramoep copper mine, near Nababeep, Northern Cape Province	15 Cu in concentrates.
Do.		do.	O'okiep smelter at Nababeep	42 blister.
Do.		Black Mountain Mineral Development Co. (Pty.) Ltd. (Anglo American plc., 100%)	Black Mountain Mine near Aggeneys, 100 kilometers northeast of O'okiep	5 Cu in concentrate.
Do.		Maranda Mining Co. [Metorex (Pty.) Limited, 29.1%]	Maranda zinc-copper mine in Murchison Range in Northern Province	1.6 Cu metal.
Diamond	thousand carats	De Beers Consolidated Mines Ltd., (Anglo American plc, 29%)	Finsch Mine, 100 kilometers west of Kimberly	2,500. e/
Do.	do.	do.	Kimberley Mine, Kimberley	800. e/
Do.	do.	do.	Koffiefontein Mine, 70 kilometers south of Kimberley	200. e/
Do.	do.	do.	Namaqualand Mines, 50 kilometers north of Port Nolloth	800. e/
Do.	do.	do.	Premier Mine, 70 kilometers east of Pretoria	1,700. e/
Do.	do.	do.	Venetia Mine, 150 kilometers north of Potgietersrus	5,000. e/
Do.	do.	SouthernEra Resources Ltd. (Canada), (In joint venture with De Beers or Randgold Resources on some operations)	Klipspringer project, includes 10 kimberlite fissures and pipes near Potgietersrus in Northern Province	1,000.
Do.	do.	Benguela Concessions Ltd.	Several marine operations along Namqualand coast. Moonstone mining ship	40.
Do.	do.	Trans Hex Group Ltd.	Baken deposit on Orange River; So Ver, Reuning, Komagass, and Hondklip Bay Mines, and 3 marine operations off Northern Province.	200.
Do.	do.	Trivalence Mining Corp. of Canada, (100%)	Palmietgat kimberlite mine	50
Fluorspar		Vergenoeg Mining Corp. (Pty.) Ltd. [Metorex Pty. Ltd., 70%; Minerales y Productos Derivados SA (Spain), 30%]	Vergenoeg Mine, 75 kilometers north of Pretoria	125 acid grade fluorspar. 10 metallurgical grade fluorspar.
Do.		Witkop Fluorspar Mine (Pty.) Ltd. [South Africa Land & Exploration Co. (Sallies), (Athlone International (Australia), 100%)]	Witkop Mine, 250 kilometers west of Johannesburg	140 acid-grade fluorspar (expand to 280 by 2002).

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Fluorspar--Continued:				
Do.		Van den Heever Fluorspar Works	Van Den Heever Mine, 120 kilometers west of Johannesburg	50 e/ metallurgical grade fluorspar.
Gold	tons	AngloGold Ltd.	Vaal River Operations--Includes Great Noligwa (ex Vaal Reefs Shaft 8), Kopanang (Vaal Reefs #9), and Tau Lekoa (Vaal Reefs #10) underground mines; Vaal River surface operations; and Moab Khotsong development	60 Au.
Do.	do.	do.	Ergo Operations: Slimes dam reprocessing	11 Au.
Do.	tons.	AngloGold Ltd.	West Wits Operations--Includes Tau Tona (ex-Western Deeps-East), Savuka (ex-Tau Tona (ex-Western Deeps-East), Savuka (ex-Western Deeps-West), Mponeng (ex-Western Deeps-South) underground mines plus Western Ultra Deep Levels project	42 Au. 12 Au by 2003.
Do.	do.	Gold Fields Ltd.	Beatrix, Driefontein, Kloof, Oryx, St.Helena, and Target mines; west and southwest of Johannesburg	125 Au South African operations only.
Do.	do.	Harmony Gold Mining Co. Ltd.	Free State Operations--Shafts include Harmony 2 and 4; Merriespruit 1, 7, and 3; Virginia, Unisel, Masimong 4 and 5; Brand 2, 3, and 5; Central, Saaiplaas and Virginia metallurgical plants; and Central refinery	26.5 Au.
Do.	do.	do.	Deelkraal and Elandsrand mines	18 Au.
Do.	do.	do.	Evander Operations--Includes six shafts and Kinross, Leslie and Winkelhaak metallurgical plants.	13 Au
Do.	do.	do.	Randfontein Operations--Includes Cooke 1, 2, and 3, and Doornkop shafts, and No. 4 and Doornkop metallurgical plants; and Doornkop South Reef development	22.5 Au.
Do.	do.	do.	Lindum open pit operations (closed in 2001)	included in Randfontein.
Do.	do.	do.	Kalgold open pit, heap leach and carbon-in-leach operation at Mafikeng, Northwest Province	3.2 Au.
Do.	do.	Free Gold (Pty.) Ltd. (Harmony Gold Mining Co. Ltd. 50%, and African Rainbow Minerals (Pty.) Ltd, 50% (Acquired from AngloGold end 2001)	Free State Operations--Includes Bambanani Tshepong, Matjabeng, and Joel underground mines and Free State surface operations.	48 Au.
Do.	do.	Avgold Ltd. (Anglovaal Mining Ltd., 60.1%)	Eastern Transvaal Consolidated Div. (Fairview, New Consort, and Sheba Mines), near Klersdorp	2.8 Au.
Do.	do.	do.	Target mine development	10.9 Au by 2002.
Do.	do.	Durban Roodeport Deep Ltd. (Khumo Bathong	Blyvoorruitzicht and Doornfontein Section	6.3 Au.
Do.	do.	Holdngs, 3%)	Buffelsfontein Section	5.5 Au.
Do.	do.	do.	Hartebeestfontein Section	15.5 Au.
Do.	do.	do.	Crown Section - tailings retreatment	4.1 Au.
Do.	do.	do.	Argonaut Deep project on hold (60 million troy ounce gold resource)	
Do.	do.	Western Areas Ltd. (JCI Gold, 50%, and Placer Dome Inc., 50%)	Western Areas	6 Au.
Do.	do.	do.	South Deep project	11.7 Au by 2002.
Do.	do.	Rand Refinery Ltd.	Germiston, Gauteng Province	1,200 refined Au.
Iron and steel:				
Iron ore		Kumba Resources (Iscor Ltd., (75%), Anglo American plc, (20%),	Sishen Mine at Sishen	27,000 ore, to 32,000 by 2002.
Do.		Do.	Thabazimbi Mine at Thabazimbi	2,900 ore.
Do.		Highveld Steel and Vanadium Corp. Ltd. (Anglo American plc, 74%)	Mapochs Mine at Roossenekal, 60 kilometers west of Lydenburg	3,000 titaniferous and vanadiferous magnetite ore.
Do.		Associated Manganese Mines of South Africa Ltd., (Anglovaal Minerals Ltd., 50.2%)	Beeshoek Mine near Postmasburg. New Beeshoek South Mine commissioned in 2001)	6,000 ore.
Ferroalloys 2/		Samancor Chrome Division, (BHP Billiton PLC., 60%, Anglo American plc, 40%).	Ferrometals plant at Witbank, (6 furnaces) (2 furnaces, 110,000 capacity closed in 1999) F1 and F2 20 megawatt furnaces (80,000 metric tons per year) closed August 2000	450 ferrochromium.
Do.		do.	Tubatse Ferrochrome plant at Steelpoort (6 furnaces)	340 ferrochromium.
Do.		do.	Middelburg Ferrochrome plant 35 kilometers east of Witbank, (3 furnaces)	235 ferrochromium.
Do.		Samancor Chrome Division, (BHP Billiton PLC., 60%, Anglo American plc, 40%).	Palmiet Ferrochrome plant at Krugersdorp, 30 kilometers west of Johannesburg, (3 furnaces)	120 ferrochromium. (Closed November 2001).

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Ferroalloys--Continued:				
Do.		Samancor Chrome Division, (BHP Billiton PLC., 60%, Anglo American plc, 40%).	Bathlako Ferrochrome plant at Ruighoek, northwest of Rustenburg	20 ferrochromium.
Do.		Chromecorp Holdings Ltd., [Xstrata AG, nee Sudelektra Holding AG (Switzerland), 100%]	Rustenburg (6 furnaces)	400 ferrochromium.
Do.		do.	Lydenburg (4 furnaces)	350 ferrochromium.
Do.		do.	Wonderkop (4 furnaces)	320 ferrochromium.
Do.		do.	Rustenburg slag retreatment plant	25 ferrochromium.
Do.		do.	Wonderkop slag retreatment plant	20 ferrochromium.
Do.		do.	Silicon Technology plant at Ballengeich, KZN	55 ferrosilicon.
Do.		Samancor and Xstrata Joint Venture (Billiton plc., 50%; Xstrata AG, 50%)	Wonderkop furnace (2 furnaces) (comissioned mid-2001)	170 ferrochromium.
Do.		South African Chrome and Alloys Ltd.	Elandsdift and Horizon Chromite Mines Proposed new ferrochrome smelter planned	150 ferrochromium. (150-170 ferrochromium).
Do.		Hernic Ferrochrome Pty. Ltd., [South African Chrome and Alloys Ltd; EL Daniel (Germany); Nittetsu Shoji (Japan)]	Plant near Brits (2 furnaces)	260 ferrochromium.
Do.		Feralloys Ltd. (Associated Manganese Mines of South Africa Ltd., 100%)	Machadadorp plant, (3 furnaces), 80 kilometers east of Middelburg	150 ferrochromium, 175 by 2000.
Do.		Cato Ridge Alloys Ltd. (Associated Manganese Mines of South Africa Ltd., 50%, Mizushima Ferroalloy Co. Ltd.,40%; Sumitomo Corp., 10%)	Cato Ridge, 75 kilometers west of Durban	245 ferromanganese.
Do.		Samancor Manganese Division, (Billiton plc., 54.6%, Anglo American plc, 28.9% , other private, 16.5%)	Metalloys Ltd. plant at Meyerton, (9 furnaces), 50 kilometers south of Johannesburg; can switch between FeMn and SiMn	530 high-carbon ferromanganese, 200 silicomanganese.
Do.		Advalloy (Pty.) Ltd., (Billiton/Samancor, 50%; Japan Metals & Chemicals Co., 35%; Mitsui & Co. Ltd., 15%)	Furnace at Samancor's Meyerton Plant	75 low-carbon and high-carbon ferromanganese.
Do.		Manganese Metal Co. (Pty.) Ltd. (Samancor Ltd.)	Plants at Krugersdorp and Nelspruit	44 electrolytic manganese.
Do.		Transalloys Division (Highveld Steel and Vanadium Corp. Ltd., 100%)	Witbank	50 medium-carbon ferromanganese.
Do.		do.	do.	175 silicomanganese.
Do.	tons	ASA Metals (Pty.) Ltd. (Eastern Asia Metal Investment Co. Ltd., 60%; Northern Province Development Corp., 40%)	Plant near Pietersburg, Northern Province (associated with Dilokong Chrome)	50 ferrochrome.
Do.		Rand Carbide Division, Highveld Steel and Vanadium Corp. Ltd., (100%)	Plant at Witbank, Mpumalanga Province	58 ferrosilicon.
Do.	tons	Vametco Minerals Corp. (Strategic Minerals Corp., USA, 100%)	Smelter near Brits	5,250 ferrovanadium.
Steel		Iscor Ltd.	Vanderbijlpark Works	3,200 flat products.
Do.		do.	Newcastle Works	2,000 profile products.
Do.		do.	Vereeniging Works	450 e/ specialty steels.
Do.		Highveld Steel and Vanadium Corp. Ltd. (Anglo American plc, 74%)	Witbank	1,000 cast billets, blocks, and slabs.
Do.		Saldanha Steel (Pty.) Ltd. (Iscor Ltd., 50%; Industrial Development Corp., 50%)	Hot-rolled steel coil plant at Saldanha Bay	1,200.
Do.		Columbus Stainless (Samancor, 33.3%; Highveld Steel and Vanadium Corp. Ltd., 33.3%; Industrial Development Corp., 33.3%)	Stainless steel plant at Middelburg	500.
Do.		Scaw Metals Division, Anglo Operations Ltd.	Germiston plant, Johannesburg	500 speciality castings and rolled products.
Do.		Duferco Steel Processing Ltd.	Cold-rolled slab steel at Saldanha Bay	400.
Do.		Davsteel Division, Cape Gate Pty. Ltd.	Vanderbijlpark plant, Gauteng	400 rebar, wire rod, and other shapes.
Do.		Cape Town Iron & Steel Works (Pty.) Ltd. (CISCO)	Kuilsrivier plant, Cape Town	180 rebar.
Manganese		Associated Manganese Mines of South Africa Ltd. (Avmin Ltd., 50.2%)	Gloria and N'Chwaning Mines near Black Rock, 70 kilometers north of Sishen	1,500 ore.
Do.		Samancor Ltd. (BHP Billiton PLC., 60%; Anglo American plc, 40%).	Mamatwan open pit mine and Mamatwan ore sintering plant, near Hotazel	2,200 ore, of which, 1,100 sintered ore.
Do.		do	Wessels underground mine, near Hotazel	1,200 ore.
Do.		Manganese Metal Co. Pty. Ltd. (Samancor Ltd.,100%)	Electrolytic plant, Nelspruit, Mpumalanga	26 manganese metal.
Do.		do.	Electrolytic plant, Krugersdorp, Gauteng	18 manganese metal.
Do.		Metmin, (Metorex Pty. Ltd., 100%)	Open pit mine in North West Province (Used as catalyst for extracting uranium from gold)	24 manganese dioxide.
Nickel		Nkomati Joint Venture (Anglovaal Mining Ltd., 75%; Anglo American plc, 25%)	Nkomati Mine in Mpumalanga Province	15 nickel in concentrate.
Do.				
Petroleum, crude	million 42-gallon barrels	Soeker (Government, 100%)	Oribi field 140 km southwest offshore from Mossel Bay	9.1.
Do.	do.	do.	Oryx field	1.8 e/.

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum, crude--Continued million 42-gallon barrels				
Do.	do.	Mossgas, (Government, 100% through Central Energy Fund)	9 wells in Mossel Bay	3.5.
Do.	do.	Shell and BP Refineries Pty. Ltd. (Shell South Africa, 50%; BP, 50%)	Sanref refinery in Durban	60 crude.
Do.	do.	Caltex Oil SA Pty. Ltd. (private, 100%)	Refinery in Cape Town	41 crude.
Do.	do.	National Petroleum Refiners of South Africa Pty. Ltd. (SASOL, Total SA)	Natref Refinery in Secunda, 100 kilometers southeast of Johannesburg	32 crude.
Do.	do.	Engen Ltd., (62%)	Engen Refinery in Durban	38 crude.
Phosphate		Phosphate Development Corp. Ltd. (Foskor Ltd.) (IDC, 100%)	Foskor mine and plant at Phalaborwa	2,900 phosphate rock. 3/
Do.	do.	Fer-Min-Ore Pty. Ltd. of South Africa	Glenover Phosphate Mine in Guateng, leach old dumps to produce phosphoric acid by 2002	NA.
Platinum-group metals	kilograms	Anglo American Platinum Corp. Ltd., (Anglo American Plc., 100%) (Anglo Platinum)	Rustenburg Section near Rustenburg, Rustenburg underground and open pit mines (New Waterval UG2 mine by 2002) Adding 12,285 kilograms per year platinum capacity by 2002	24,000 platinum metal. 10,260 palladium metal. 1,650 rhodium metal.
Do.	do.	do.	Rustenburg mill	9,000,000 tons per year ore.
Do.	do.	do.	Union Section, 50 kilometers south of Thabazimbi	9,850 platinum metal. 4,540 palladium metal. 1,470 rhodium metal.
Do.	do.	do.	Union mill	4,000,000 tons per year ore.
Do.	do.	do.	Amandelbult Section, 50 kilometers south of Thabazimbi mines	17,700 platinum metal. 8,150 palladium metal. 6,500 rhodium metal.
Do.	do.	do.	Amandelbult mill	6,000,000 tons per year ore.
Do.	do.	do.	Lebowa Platinum (Atok) Mine, 70 kilometers east of Potgietersrus	2,520 platinum metal. 1,100 palladium metal. 150 rhodium metal.
Do.	do.	do.	Lebowa Platinum Mill	1,000,000 tons per year ore.
Do.	do.	do.	Potgietersrust Platinums Mine (30 million metric tons per year low grade ore mined, most of which is stockpiled for future use)	5,160 platinum metal. 5,500 palladium metal. 350 rhodium metal.
Do.	do.	do.	Potgietersrust Platinum mill	3,100,000 tons per year ore.
Do.	do.	do.	Bafokeng Rasimone mine in Northern Province opening in 2000, full capacity by 2002	7,776 PGM metal.
Do.	do.	do.	Bafokeng Rasimone mill	2,400,000 tons per year ore.
Do.	do.	do.	Waterval Mine	12,285 PGM.
Do.	do.	do.	Total Amplats mill capacity	23,800,000 tons per year ore.
Do.	do.	do.	Waterval Mill	4,800,000 tons per year ore.
Do.	do.	do.	Waterval smelter	50 converter matte.
Do.	do.	do.	Rustenburg Base Metals Refiners Refinery	25 Nickel plus refined copper and cobalt, and precious metals concentrates.
Do.	do.	do.	Precious Metals Refinery - Total Amplats capacity	70,000 platinum metal, 34,000 palladium metal, 6,500 rhodium metal.
Do.	do.	Anglo Platinum and African Rainbow Minerals	Maandagshoek Mine (full capacity by 2003)	5,000 platinum metal.
Do.	do.	do.	Maandagshoek mill (to treat UG2 ore)	2,400,000 tons per year ore.
Do.	do.	Impala Platinum Ltd. (Impala Platinum Holdings Ltd., 100%) (Implats)	13 mine shafts and concentrator near Rustenburg, NW Province;	15,000,000 tons per year ore.
Do.	do.	do.	Smelter	NA.
Do.	do.	do.	Enhanced Precious Metals Refinery near Springs, Gauteng Province	62,200 platinum, 18,000 palladium, 4,600 rhodium.
Do.	do.	do.	Reopening Crocodile River Mine in 2001	1,555 platinum plus 930 other PGM.
Do.	do.	do.	Platexco properties, including Winnaarshoek Deposit adjacent to Implats Clapham, Forrest Hill and Dreikop properties. Plus Platexco Mokopane and Septre properties	6,220 PGM
Do.	do.	Lonmin Platinum (Lonmin Plc., 73%; Impala Platinum Holdings Ltd., 27%)	3 mines (Eastern Platinum, Karee, and Western Platinum, near Rustenburg	37,324 PGM (in concentrates), 10,000,000 tons per year ore.
Do.	do.	do	Smelter	Matte, 6000 grams per ton PGM.
Do.	do.	do.	Base Metals Refinery	Copper and nickel sulfate, and PGM concentrates.

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Platinum-group metals--Continued				
Do.	kilograms	Lonmin Platinum (Lonmin Plc., 73%; Impala Platinum Holdings Ltd., 27%)	Precious Metals Refinery, at Western Platinum, 20 kilometers east of Rustenburg	20,600 platinum, 9,330 palladium, 2,800 rhodium.
Do.	do.	Northam Platinum Ltd. (Mvelaphanda Platinum, 22.5%; Anglo Platinum, 20%)	Northam Mine 20 kilometers south of Thabazimbi	13,000 platinum.
Do.	do.	do.	Northam mill (treats merensky ore)	1,800,000 tons per year ore.
Do.	do.	do.	New mill in 2001 (to treat UG2 ore)	900 ore.
Do.	do.	do.	Northam Refinery	5,910 platinum.
Do.	do.	Kroondal Platinum Mines, [Aquarius Platinum Ltd., (Australia), 45%, and Implats, 15%]	Kroondal Mine, 10 kilometers east of Rustenburg; opening in 2000	3,110 platinum, 1,555 palladium, 467 rhodium.
Do.	do.	do.	Kroondal mill	1,200,000 tons per year ore.
Do.	do.	Aquarius Platinum Ltd. (Australia), (Implats,25%)	Marikana Mine, 20 kilometers SE of Rustenburg Feasibility study in 2000)	4,665 platinum planned.
Do.	do.	do.	Marikana mill	1,540,000 tons per year ore.
Do.	do.	do.	Everest South deposit feasibility study in 2001	5,440 PGM planned.
Do.	do.	Messina Holdings Ltd. (SouthernEra Resources Ltd., 70.4%) (Purchased from Implats in 1999)	Messina platinum deposit, near Klipspringer diamond mine, Limpopo Province, 2003 startup	2,176 platinum, 1,681 palladium, 247 rhodium.
Do.	do.	East Daggafontein Ltd. (Mvelaphanda Platinum, 100%)	Tailings dump retretament operation at East Daggafontein	NA.
Pyrophyllite		Alpha Ltd.	Idwala Industrial Minerals plant, and Witpoort Quarry	NA.
		Wonderstone Ltd., (The Associated Ore & Metals Corp. Ltd.)	Pyrophylite (wonderstone) mine in North West Province	NA.
Do.		G&W Base and Industrial Minerals Pty. Ltd.	Masala Mine, Mpumalanga	NA.
Salt		Salt is mined/extracted from 4 seawater and 50 salt-pan brine operations	Operations are distributed throughout the country with the greatest concentration within a major inland saltpan around the border of the Free State and Northern Cape Provinces	400.
Silicon		Silicon Smelters, [Invensil, subsidiary of Pechiney Electrometallurgie (77%), BHP Billiton PLC. (23%)]	Polokwane plant near Pietersburg, Limpopo Province (3 submerged arc furnaces)	45 silicon. 15 silica fume.
Synthetic fuels	million 42-gallon barrels	Sasol, (Government, 100%)	Coal to oil plant at Secunda and a coal to petrochemical plant at Sasolburg	54.8.
Do.	do.	Mossgas, (Government, 100% through Central Energy Fund).	Natural gas to petroleum products plant at Mossel Bay	16.4.
Titanium:				
Titanium concentrates		Richards Bay Minerals trading for Tisands (Pty.) Ltd. and Richards Bay Iron and Titanium (Pty.) Ltd. (Rio Tinto Plc., 50%; BHPBilliton Plc., 50%)	Opencast operations near Richards Bay	1,280 ilmenite concentrate, e/ 125 rutile concentrate e/.
Do.		Namakwa Sands Ltd. (Anglo Operations Ltd., a subsidiary of Anglo American plc, 100%)	Opencast mine near Brand-se-Baai and mineral separation plant at Koekenaap, 300 kilometers northwest of Cape Town	540 ilmenite concentrate, 42 rutile concentrate.
Titanium slag		Richards Bay Iron and Titanium (Pty.) Ltd./ Richards Bay Minerals (Rio Tinto Plc.)	Smelter at Richards Bay	1,000 titania slag.
Do.		Namakwa Sands Ltd. (Anglo Operations Ltd., a subsidiary of Anglo American plc, 100%)	Smelter at Vredenberg, Saldanha Bay area	230 titania slag (by 2000), 120 pig iron.
Do.		Highveld Steel and Vanadium Corp. Ltd.	Steel plant at Witbank	48 titania slag. e/
Uranium	tons	AngloGold Ltd. (Anglo American plc., 60%; De Beers, 40%)	Vaal Reefs Mine and plant near Klerksdorp	2,000 uranium oxide e/ (900 @= 1998-99 output).
Do.	do.	Avgold Ltd., (Anglovaal Minerals Ltd., 100%).	Hartebeestfontein Mine and plant, 5 kilometers southeast of Klerksdorp	400 uranium oxide. e/ (<200 @= 1998-99 output).
Do.	do.	Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	160 uranium oxide. e/
Vanadium	do.	Highveld Vanadium and Chemicals (Anglo American plc through Highveld Steel and Vanadium Corp. Ltd.)	Mapochs Mine near Lydenburg	25,000 vanadium pentoxide. e/
Do.	do.	do.	Highveld steel plant in Witbank	17,000 vanadium pentoxide.
Do.	do.	do.	Highveld Vantra plant in Witbank	8,000 vanadium pentoxide.
Do.	do.	Vametco Minerals Corp. (Strategic Minerals Corp., USA, 100%)	Krokodilkraal Mine and plant near Brits	5,000 vanadium pentoxide. e/
Do.	do.	Transvaal Alloys Pty. Ltd., (Highveld Steel and Vanadium Corp., 100%)	Wapadskloof Mine and plant, 60 kilometers northeast of Middelburg	2,250 vanadium pentoxide. e/
Do.	do.	Vanadium Technology Ltd., [Xstrata AG, nee Sudelektra Holding AG (Switzerland), 100%]	Kennedy's Vale (ex-Vansa Vanadium) Mine and plant, near Lydenburg	5,900 vanadium pentoxide, 1,500 ferrovanadium.
Do.	do.	Rhombus Vanadium Holdings Ltd., [Xstrata AG, nee Sudelektra Holding AG (Switzerland), 100%]	Ba-Mogopa Mine and Usko plant	13,500 vanadium.
Vermiculite		Palabora Mining Co. Ltd.	Palabora mine and plant at Phalaborwa	230 concentrate. e/
Do.		Natkruit Vermiculite Mine Pty. Ltd., (Verimex Trading Pty. Ltd.	Mine near Soutpansberg, Northern Province	22 concentrate, (closed, March 1999).

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Zinc	Zinc Corp. of South Africa Ltd. ("Zincor") (Iscor Ltd., 100%)	Struisbult Springszinc refinery at Springs, southeast of Johannesburg	120 Zn.
Do.	Black Mountain Mineral Development Co. (Pty.) Ltd. (Anglo American plc., 100%)	Black Mountain Mine near Aggeneys, 100 kilometers northeast of Okiep	26 Zn (in concentrate).
Do.	Maranda Mining Co. [Metorex (Pty.) Limited, 29.1%]	Maranda zinc-copper mine in Murchison Range in Northern Province	15 Zn metal in concentrates. 5.9 Cu metal in concentrates.
Do.	Pering Mine (Pty.) Ltd. (Billiton plc., 100%)	Pering Mine in Northern Cape Province, (closed July 2002)	27 Zn in concentrate, 6 Pb in concentrate.
Zirconium	Tisand (Pty.) Ltd./Richards Bay Minerals	Opencast mines near Richards Bay	300 zircon concentrate.
Do.	Namakwa Sands Ltd. (Anglo Operations Ltd., a subsidiary of Anglo American plc, 100%)	Opencast mine near Brand-se-Baai and mineral separation plant at Koekenaap,	140 zircon concentrate.
Do.	Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	14 baddeleyite. e/
Do.	do.	Zirconium basic sulphate plant at Phalaborwa	8 Zr basic sulphate (by1999).
Do.	Phosphate Development Corp. Ltd. (Foskor Ltd.) (IDC, 100%)	Plant at Phalaborwa	3 baddeleyite. e/
Do.	do.	Fused zirconia plant	6 synthetic zirconia.

e/ Estimated. NA Not available. Do. Ditto.
1/ Based on information available as of February 2003.
2/ Depending on market demand, furnace capacity can switch between ferrochromium and ferromanganese.
3/ Most of Foskor's phosphate output is from phosphate concentrates supplied by the neighboring Palabora copper mine.

TABLE 3
SOUTH AFRICA: RESERVE BASE OF MAJOR MINERALS 1/

(Million metric tons unless otherwise specified)

Commodity		Reserve base
Andalusite 2/		50.8
Antimony	thousand tons	250
Chromium, ore		3,100
Coal, recoverable		34,980
Cobalt 3/	thousand tons	15
Copper		13
Diamond 4/	million carats	1,120
Fluorspar		36
Gold	thousand tons	35.9
Iron ore, Fe content		1,500
Lead		3
Manganese		4,000
Natural gas	billion cubic meters	22
Nickel 3/		11.8
Petroleum	million barrels	29.4
Phosphate rock, concentrates		2,500
Platinum-group metals	thousand tons	62.8
Silver	do.	10
Titanium		146
Uranium 5/	thousand tons	218.3
Vanadium		12
Vermiculite		80
Zinc		15
Zirconium		14.3

1/ Metallic minerals are contained metal.
2/ Includes the aluminosilicate, sillimanite.
3/ Minerals Bureau estimates as of December 31, 1997.
4/ De Beers reserves and resource data only.
5/ Recoverable at a cost of less than $80 per kilogram.

Sources: Chamber of Mines Online Statistical Tables 1999, accessible at URL http://www.bullion.org.za/bulza/publications/Stats/MinRes.pdf. Minerals Bureau estimates as of December 31, 1999. U.S. Energy Information Administration, United States-South Africa, International energy data exchange, 1998, accessible at URL http://www.eia.doe.gov/emeu/international/safricadata.htm. Petroleum and natural gas estimates as of January 1, 1999.