Diamonds

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SUMMARY

World production of natural rough diamonds in 1996, the latest year for which statistics are available, was estimated at between 110 million and 117 million carats[1] (Mct). This compares with 110 Mct in 1994 and 113 Mct in 1995.

Major events in 1997 included: a downturn in the economies of Asian countries, particularly Japan but also Korea and Taiwan, which negatively affected profitability at many manufacturing (cutting and polishing) centres; Botswana's renewal of its contract with De Beers for another five years; and the signing by De Beers and Almazy Rossii-Sakha (Alrosa) of Russia of a 13-month contract that came into effect December 1, 1997. In the contract, De Beers (the Central Selling Organization (CSO)) will be entitled to buy approximately US$550 million per year of rough stones from run-of-mine and the stockpile. This accounts for about half of Russia's annual production. The other half will be offered to the domestic cutting and polishing industry. The portion that cannot be cut and polished locally will be offered to the CSO. This takes into account the Russian government's desire to further develop its domestic cutting and polishing industry. In addition, the Russians will be able to sell some diamonds directly in order to check the CSO's valuations, and Russian manufacturers will be allowed to become CSO sightholders.

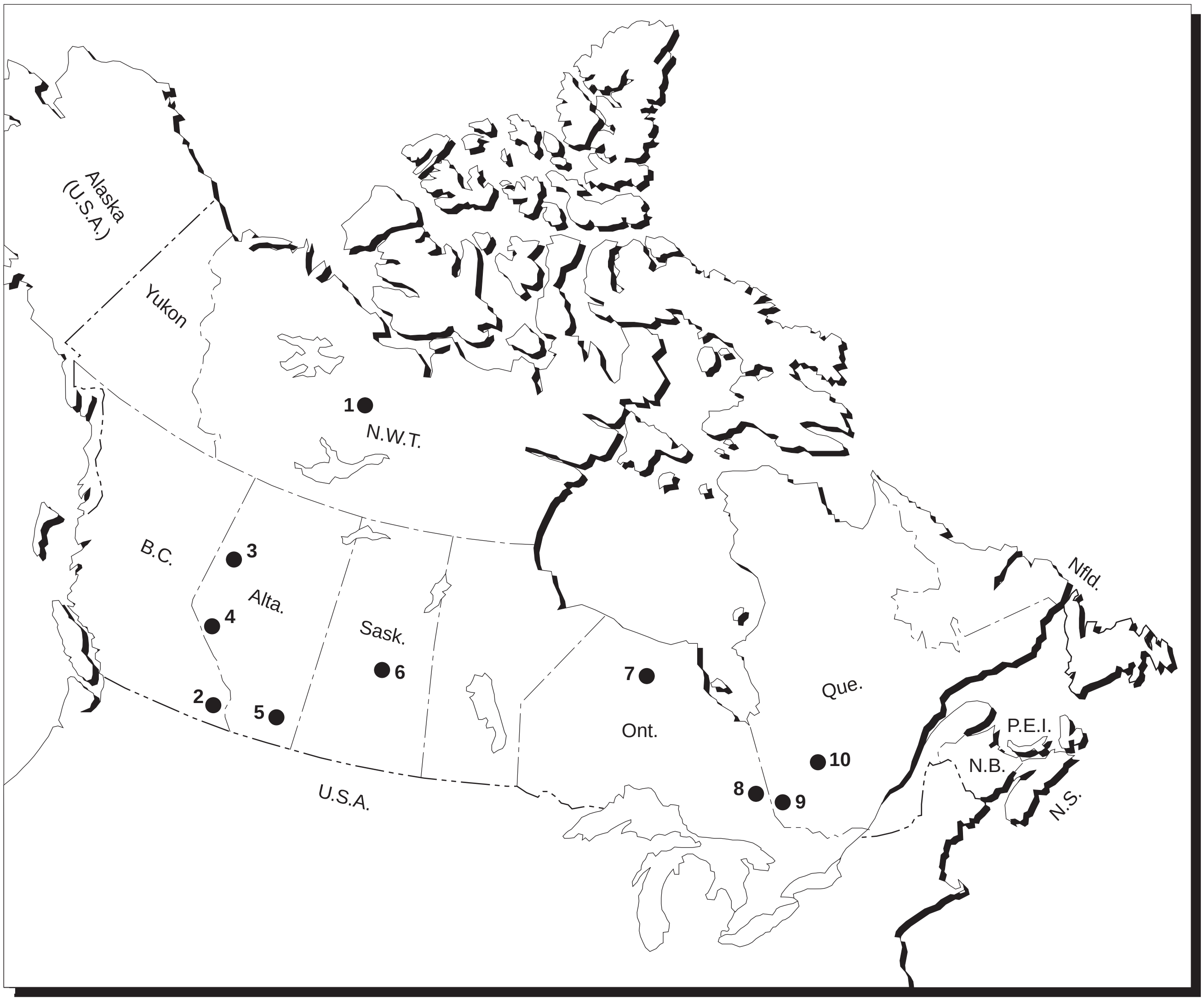
Elsewhere, in Angola, the country's first and very large 66-ha kimberlite mine at Catoca is being developed as a joint venture between Endiama of Angola and Alrosa of Russia as the major partners, with Odebrecht of Brazil and an Israeli diamond-trading company as minor partners. Unit production costs will average about US$30/ct. By 2000, production is expected to be close to 1 Mct/y and to remain at that level for many years. Alrosa will market 90% of the output. De Beers announced that it intends to construct a 12-story building in 1998 that will also house a secure diamond sorting and valuation operation in Angola's capital of Luanda, near Endiama's headquarters, at a cost of US$30 million. In addition, the building will include facilities for the training of Angolans in the sorting and valuing of rough diamonds. The diamonds will be sorted on a CSO basis. Angola's 1996 diamond production is estimated at some 3.7 Mct.

Other important events included the Congo's cancellation of its contract with De Beers, while in Israel manufacturers that are not sightholders may soon have access to a first-hand supply of rough stones if a rough bourse opens as planned in Tel Aviv in June 1998. In addition, the Government of South Africa's inquiry into the country's diamond industry is expected to produce its report in early 1998; the government has a political commitment to create more jobs and is looking at the diamond sector, including new diamond tax laws and all value-added aspects, especially the cutting and polishing and the jewellery manufacturing industries. At year-end, Argyle Diamonds was still evaluating its options (to go underground, to deepen the open pit, etc.) regarding the future of its Argyle mine. Also, De Beers restricted the supply of large rough stones and, as a consequence, prices for 3 grainers (0.66-0.89 ct) and larger, that are supported by De Beers, continued to increase; in addition, the abundant supply of lower grade rough stones for both industrial use and jewellery continued. Prices for rough stones smaller than 3 grainers continued to decline. As the prices of small rough stones fell, the overproduction of small polished stones continued and the prices of polished stones declined, thus further deteriorating profitability at cutting centres.

CANADIAN DEVELOPMENTS

In 1997, exploration for diamonds continued in several regions of Canada, as shown in Figure 1. Preliminary data indicate that diamond exploration expenditures declined from $155 million in 1996 to $93 million in 1997. Again, exploration was focussed principally in the Northwest Territories. Because of their strong interest in diamonds in Canada, both BHP Diamonds Inc. and De Beers opened offices in Vancouver, British Columbia. A representative from the International Gemmological Institute in Antwerp

Figure 1
Major Diamond Exploration Areas in Canada, 1997



Numbers refer to locations on map above.

1. Lac de Gras
2. Southeastern British Columbia
3. Peace River
4. Jasper
5. Badlands
6. Prince Albert
7. James Bay Lowlands
8. Kirkland Lake
9. Temiscamingue
10. Desmaraisville

held a course in Montréal on classifying and valuing rough diamonds.

The most advanced diamond project in Canada is the Ekati diamond mine near Lac de Gras in the Northwest Territories. Ekati is owned 51% by BHP of Australia, 29% by Dia-Met Minerals of Canada, and 10% each by C. Fipke and S. Blusson of Canada. Another interesting project, also near Lac de Gras, is the Diavik property owned 60% by Diavik Diamond Mines Inc., which is a subsidiary of Rio-Tinto plc of the United Kingdom, and 40% by Aber Resources Ltd. of Canada. Additional prospects in the same region include the Jericho project owned by Lytton Minerals and New Indigo Resources; the Camsell Lake project owned by Aber Resources Ltd. and Winspear Resources Ltd.; the AK properties owned by Mountain Province Mining Inc., Camphor Ventures, and Monopros Ltd. (a subsidiary of De Beers); and a project owned by Ashton Mining of Canada Inc.

BHP Diamonds Inc. has reported that the diamonds recovered to date from five kimberlite pipes at its Lac de Gras property, about 300 km northeast of Yellowknife, compare favourably with those at other diamond mines in the world. The original capital investment for the project is expected to be US$700 million (close to C$1 billion). Proven and probable reserves total 65.9 Mt at an average grade of 1.09 ct/t (which is high by world standards). The size of all of the pipes except one is reported to be less than 5 ha each. The pipes are small compared to the major producing pipes in Russia (Udachnaya, 20 ha), Botswana (Jwaneng, 45 ha; Orapa, 106 ha), and South Africa (Venetia, 13 ha; Finsch, 18 ha; Premier, 32 ha). The pipes are known as Panda, Koala, Fox, Misery and Sable. They are located under lakes that will have to be drained before mining starts. The current plan calls for the five pipes to be mined by open-pit and then underground methods over a period of 17 years. That lifespan is widely expected to be extended to at least 25 years as additional pipes such as Koala North and Bear Tooth have been identified for future bulk sampling.

All of the pipes are within 35 km by air of each other. Panda would be developed first, followed by Misery and Koala. Based on packages of rough diamonds sent to the CSO in London and to dealers in Antwerp and Tel Aviv, results on the pipes are approximately as follows: Panda, 1.03ct/t (diluted basis) evaluated at an average price of US$130/ct (which is 10% less than the dealer sales prices), for a value of US$134/t of ore; Misery, 4.26 ct/t at an average price of US$26/ct, for a value of US$111/t of ore; Koala, 0.95 ct/t at an average price of US$122/ct, for a value of US$116/t of ore; Fox, 0.40 ct/t at an average price of US$125/ct, for a value of US$50/t of ore; and Sable, 0.93 ct/t at US$64/ct, for a value of close to US$60/t of ore. As a whole, the diamonds average US$84/ct or US$91.50/t of ore. Several pipes will at some time be mined together. The operating costs will vary from about US$22 to US$35/t of ore.

In terms of value per carat (quality of the diamonds), Panda, Koala and Fox compare very favourably with the best pipes in South Africa, Botswana and Russia. It is reported that the pipes contain diamonds of all sizes and qualities, and up to 30% of the diamonds are gem quality.

The processing plant will receive 9000 t/d of ore during the first nine years of operation, and 18 000 t/d of ore thereafter. The cut-off grade will be a 1.0-mm particle size (about 0.01 ct). A single, centralized processing plant will be located southwest of the Koala pit. Processing will involve mainly crushing, scrubbing and dense media separation, plus some high-intensity magnetic separation and X-ray concentration, followed by on-site acid cleaning where small quantities of acid will be used to remove silicates, olivine, garnet, colour stains if any, etc., and then mechanical size sorting and primary sorting for mine valuation for the purpose of determining Canadian government royalties. Final (detailed) sorting will be done off site. Except for final cleaning, no chemicals will be used in the process, and the waste rock, it is reported, has a negligible potential for acid generation. The mine and processing plant will operate 24 hours per day, 365 days per year.

The Lac de Gras operation will employ between 500 and 600 workers. Production is expected to start in the fourth quarter of 1998 with Panda at a rate of around 3.5 Mct/y. The production rate will average 4.6 Mct/y over the life of the mine. At year-end, the project was about 70% completed. BHP announced that it was developing a plan for the marketing of rough diamonds from the Ekati mine, although it is likely that “multi-channels” will be used to market the diamonds, such as selling “run of mine” (rough stones that have not been sorted), selling “assortments” (rough stones that have been sorted and prepared for sale) to manufacturers, and selling by contracts to diamantaires, to the CSO, etc. BHP and Dia-Met Minerals have appointed IDH, a rough diamond dealer in Antwerp, to act as a marketing consultant for the Ekati mine.

The Diavik Diamond Mines Inc./Aber joint venture plans to develop four kimberlite pipes located under Lac de Gras, 30 km southeast of the Ekati mine, at a cost of some C$750 million. The pipes are referred to as A-154 South, A-154 North, A-418 and A-21. By world standards, these pipes are small in size (plus or minus 1 ha each), but are very high grade in terms of carats per tonne of kimberlite. The diamond values are variable between the four pipes. An independent valuation conducted in 1997 of diamonds recovered from the bulk sampling of A-418 and A-154 South reported values of US$56/ct and US$63/ct respectively, and that the diamonds are attractive and readily marketable. As of September 1997, in-situ resources for the four pipes were estimated at 37 Mt with grades varying between 1.9 and 4.6 ct/t. Subject to approval, production is planned for 2001 at a nominal production rate of 2 Mt/y of ore.

Lytton Minerals announced at year-end that it plans to go ahead with its Jericho project, which includes three pipes, two of which are on land and known as the JD/OD pipes. The decision was based on a representative sample taken from the JD/OD-1 pipe consisting of 9400 t of ore that yielded 10 539 ct (1.12 ct/t) with an average value of US$60/ct, or US$67/t of ore. The sample contained 67 diamonds larger than 5 ct each; the largest stone was just over 40 ct, and the largest gem-quality diamond was 23.89 ct. The pipes are located some 25 km northwest of the Lupin gold mine. Preliminary studies indicate that the Jericho project could support a 2400-t/d mine at a cost of C$75 million, and production could start in the year 2000.

Aber and Winspear are exploring the Camsell Lake area some 100 km south of Lac de Gras. In 1997, 13 drill holes intersected kimberlite dike material, and

11 of them are interpreted as representing one kimberlite dike. Significant quantities of coloured diamonds were recovered from a small sample of 137 kg that contained 401 diamonds. Some 44% of the diamonds were white (colourless), while 3% were off-white, 39% were yellow, 2.7% were green, 1% were pink, and the remainder included some off-yellows, browns and ambers. Close to 88% of the diamonds were transparent. There are plans in 1998 to process 100-200 t of this material to obtain the size distribution of the diamonds and a preliminary estimate of their value; other targets on the property will also be drill tested.

The AK properties located 40 km southeast of Camsell Lake consist of four diamondiferous pipes. The 5034 pipe is reported to contain a drill-indicated resource of 15 Mt down to 300 m with a grade of 1.5ct/t. The diamonds average US$55/ct, or US$82.5/t. Two of the new pipes (Hearne and Tuzo) appear to be highly diamondiferous based on initial caustic fusion results. Sampling of all four pipes in early 1998 will provide more detailed information on grade and values.

Ashton announced a kimberlite discovery in the Buffalo Hills area (Peace River region) of northern Alberta. Out of 17 kimberlites, 13 are diamond-bearing. The properties are being investigated under a joint venture comprised of Ashton and Alberta Energy Corporation as major partners, with Pure Gold Resources as a minor partner.

WORLD PRODUCTION

Natural Diamonds

World production of natural rough diamonds in 1996 was estimated by Standard Equities of South Africa at 109.7 Mct valued at US$7.57 billion, for an average price of US$69/ct. World production of natural diamonds grew from 43 Mct in 1980 to around 110 Mct in the mid-1990s, representing an increase of 4.5 Mct/y.

Major Gem-Producing Countries

In 1996, the major gem-producing countries, in millions of carats, were as follows, according to Yorkton Securities: South Africa, 4.35; Russia, 4.3; Botswana, 3.75; Australia, 1.8; Namibia, 1.65; and Angola, 1.0.

Ownership in Major Producing Countries

In South Africa, the mines are privately owned, and De Beers owns about 85% of the production; in Australia, the mines are privately owned (but not by De Beers); in the Congo, 25-40% of the production is controlled by the government-owned company MIBA; in Botswana and Namibia, the mines are owned 50% by the government and 50% by De Beers; in Angola, where production is from alluvial deposits, most mining and marketing is controlled to some extent by Endiama, a government-owned company; and in Russia, the mines are owned 100% by the government.

Grade Definition

Grade is the weight of diamonds expressed as carats per tonne (ct/t) of ore. It varies widely from one mine to another, but generally falls somewhere between 0.3 and 1.3 ct/t. The value of the ore per tonne equals the grade times the average value per carat of all the individual diamonds in the deposit.

Size (Weight) of Rough Diamonds at Mines

The average size of rough diamonds (stones) at individual mines varies from 0.01 ct (about 1 mm in size) to more than 0.7 ct. According to De Beers, many mines in the world average about 0.4-0.5 ct per stone. However, the number of stones larger than 1 ct (0.2 g) produced at mines is very small (approximately 400 000 stones per year) and, in carat terms, represents only about 0.5% of the total carats produced in the world. Most mined rough diamonds are small and, to put this into perspective, a 10-ct rough octahedron crystal, which is considered to be a large stone, has a side that measures only about 10.5 mm, while a 1-ct stone has a side that is close to 5 mm and a 0.5-ct stone has a side that measures 4 mm.

Production Costs

According to different sources, operating costs (excluding depreciation and interest) for kimberlites and lamproites are approximately US$5-$6/t for large and easy-to-access diamond mines operating in good climatic conditions, and are up to about US$35-$38/t for small mines located in remote areas and operating under harsh climatic conditions. The total production costs for these mines are around US$15/t and US$40-$45/t respectively.

STRUCTURE OF THE CANADIAN DIAMOND INDUSTRY

Diamond cutting and polishing (manufacturing): The diamond manufacturing industry in Canada is very small. The two major manufacturers are Sirius with a factory at Sidney, British Columbia, and Polar Star with a factory in Edmonton, Alberta. Other manufacturers include Cohenor and Hope Diamond with small factories in Montréal, Quebec.

Diamond tools and equipment manufacturing: These products include drill bits (d), segments for circular blades (s), grinding wheels (w), and specialty tools (t). The major manufacturing plants are: Fordia (d) at Ville St-Laurent, Quebec; Diamond Production (t) at Montréal, Quebec; North Star

Abrasives (s) at Montréal, Quebec; Diacan (w) at Québec City, Quebec; Diamond Systems (s) at Dorval, Quebec; Dimatec (d) at Winnipeg, Manitoba; JKS Boyle (d), Longyear (d), JKS Lamage (s) and Pilot Diamond Tools (d) in North Bay, Ontario; Diaset Products (d) at Delta, British Columbia; and Hobic Bit Industry (d,s) at Richmond, British Columbia.

Diamond jewellery manufacturing: There are approximately 20 major plants located mainly in the Toronto region, with a few in Montréal. There are also several small plants in Montréal.

In addition, Crystalline Manufacturing Ltd. of Calgary, Alberta, produces synthetic diamond films using the Carbon Vapour Deposition (CVD) method.

SYNTHETIC DIAMONDS

Synthetic diamonds that are manufactured using the high-pressure and high-temperature method compete with natural industrial diamonds as an abrasive mineral, and with silicon carbide (SiC), alumina (Al_2O_3), tungsten carbide (WC) and cubic boron nitride (CBN) as a manufactured abrasive material. The value of world synthetic diamond production is estimated at US$650 million-$800 million. Most marketed synthetic diamonds are 0.6-0.8 mm and smaller. A very popular type of synthetic diamonds is called "Synthetic Diamond Abrasives" (SDA). It is used for sawing, drilling or milling hard stones, concrete aggregate, refractory materials, masonry and asphalt.

Industry sources indicate that a plant producing synthetic diamonds using the high-pressure and high-temperature method, with an annual capacity of 10 Mct, requires about 60-70 employees, while a plant with an annual capacity of some 50 Mct requires 160-170 employees. One large press of 10 000 t produces about 5-6 Mct/y of synthetic diamonds.

To produce diamond grit with grain sizes up to about 1 mm, the following method is used. High-purity graphite powder, either natural or synthetic, is mixed with a metal (nickel, cobalt or iron) powder alloy that serves as a solvent catalyst. The pressure is applied and then the temperature is raised with an electric current. Liquid metal alloy starts to dissolve the graphite. When the metal alloy becomes saturated, small crystals begin to crystallize out in the form of stable carbon, which is diamond. Synthetic diamonds are allowed to grow to a certain size. Then the temperature is decreased and when the crystals have somewhat cooled, the pressure is removed. The masses of hard material removed from the presses go to a chemical cleaning section where they are crushed and boiled in various acid baths that dissolve non-diamond materials. The diamonds are then cleaned, dried and sent to a sorting department.

In 1997, synthetic diamonds that are manufactured using the high-pressure and high-temperature method were produced in some 20 countries. The two leading producers are De Beers of South Africa and General Electric of the United States. Together these two companies control approximately 70% of world production, and both produce a full range of synthetic diamond products. The smaller producers specialize in certain sizes and types of products. De Beers has plants near Johannesburg in South Africa; at Robertsfors, Sweden; in Hamburg, Germany; on the Isle of Man, British Isles; and in Shannon, Ireland. General Electric has plants at Worthington, Ohio, and in Dublin, Ireland.

In many applications, synthetic diamonds are preferred to natural industrial diamonds because they can be tailored (size and shape) to the customer's needs.

In general, larger crystals are used for cutting softer materials, and smaller crystals are used for the tougher materials.

THE DIAMOND-CUTTING INDUSTRY

Natural diamonds are cut and polished in some 30-40 countries. The major diamond-cutting centres in the world are Kempen and Antwerp, Belgium; Ramat-Gan and Tel-Aviv, Israel; New York City; and Surat and Mumbai (formerly Bombay), India. With the exception of India, which is a very small producer of rough diamonds, none of these countries mine diamonds. Many other countries also cut diamonds, but their industries are small.

Canada's cutting industry is very small, but its potential is good as Canada will soon become an important producer of gem-quality diamonds, and Canadian labour costs are in line with those in New York, Antwerp, Australia and Israel. In 1997, De Beers[2] reported that labour costs at manufacturing centres (based on the assumption that 1995 figures were used) were as follows (in U.S. dollars per hour): United States, $20; Belgium, $14; Israel, $12; South Africa, $4; and Moscow, $3.8. In Canada, average labour costs in U.S. dollars per hour were: Montréal, $7.5; Edmonton, $7.6; Vancouver, $8.5; and Toronto, $8.7. In rural regions such as the Gaspé, labour costs were $4.7 per hour.

De Beers' estimates of manufacturing costs at the major centres are as follows (in U.S. dollars): United States, $80/ct for +3-ct roughs; Belgium, $25-$40/ct for 0.5-1.0-ct roughs (although 1.0-2.5-ct roughs are more typical); Israel, $18-$30/ct for 0.2-1.0-ct roughs; and India, $10-$12/ct for 0.1-1.0-ct roughs. For the same size of roughs noted above, other sources indicate the manufacturing costs as: United States, $50-$100/ct; Belgium, $30-$60/ct; and Israel, $25-$50/ct.

Among the four major manufacturing centres, India, Israel and Belgium are net exporters of polished diamonds, and the United States is a net importer of polished diamonds.

Belgium is known as the world's largest trading centre for rough and polished diamonds. Its total trade in 1996, the latest year for which statistics are available, was 260 Mct valued at close to US$23 billion. Trade in rough stones was US$7.1 billion in imports and US$6.3 billion in exports, while trade in polished stones was US$4.4 billion in imports and $5.2 billion in exports.

India[3] cuts more carats of rough diamonds than any other country. In fiscal year 1996/97, India imported 98 Mct of rough stones valued at US$3.26 billion (US$33/ct) and exported 18 Mct of polished stones worth US$4.2 billion (US$233/ct). About 90% of Argyle's cuttable production is cut in India. Imports of rough stones in India have increased steadily from 38 Mct in 1990 to 98 Mct in 1997. During that period, import prices for rough stones have decreased steadily from a high of US$52/ct to US$33/ct. Exports of polished stones from India have increased steadily from 9 Mct in 1990 to 18 Mct in 1997; this growth rate is much higher than the growth rate in diamond jewellery sales. Therefore, as one can expect, export prices for polished stones have decreased steadily from US$286/ct to US$233/ct during that same period.

Israel is the second largest exporting country of polished diamonds. In 1996, rough stones for local production of polished stones (net imports minus exports) amounted to 5.74 Mct valued at US$2.98 billion (US$520/ct), and net exports of polished stones were 3.8 Mct worth US$3.998 billion (US$1050/ct). Israel is also the leader in diamond cutting and polishing technology, including the use of lasers and robots that cut, shape and polish diamonds. Israel cuts a very wide range of diamonds and is renowned for its fancy cuts.

New York cuts the largest and best-quality diamonds. In 1996, U.S. manufacturers, most of which are in New York City, imported rough stones worth US$730 million and exported rough stones (not suitable for local production of polished stones) worth US$174 million, for a net value of US$558 million. In 1996, U.S. trade in polished stones was US$2.2 billion in exports and US$5.8 billion in imports.

In Russia, most production of rough diamonds comes from Yakutia. As Russia wants to maximize employment, more diamonds mined in Russia are now cut in Russia. In 1997, preliminary figures indicate that the production of polished stones in Russia was valued at US$650 million-$700 million. Most production is exported, as domestic sales for diamond jewellery only account for about US$30 million.

Diamond-cutting is relatively labour-intensive when compared to many other sectors. Automated cutting and polishing techniques are increasingly being used to compete with low-wage operations. The types of automated equipment being acquired include automatic girdling machines (sometimes connected with stroboscopes), automatic blocking and facetting machines, lasers to shape the roughs, and computers that suggest an optimal cut based on the shape and dimensions of, and inclusions in, a rough stone. The major diamond-cutting centres have a very wide range of indirect jobs associated with them such as brokers, wholesalers, suppliers of machinery and equipment for cutters, bourses, insurance companies, travel agencies, jewellery manufacturing, etc.

Because of high labour costs, factories in New York cut bigger and better-quality diamonds. Belgium and Israel are in the middle of the labour-cost spectrum and, as a result, are generally involved in cutting stones of intermediate size and quality. India, with the lowest labour costs, cuts the smallest and least expensive diamonds. The literature also indicates that the average price per carat of polished diamonds produced in New York is about US$1400; in Antwerp, an estimated US$1000-$1100; in Tel Aviv, US$1000; and in India, US$250.

Employment related to diamond-cutting and polishing (manufacturing) changes from year to year and varies widely from factory to factory, running anywhere from 1 to 3000 workers. Total employment (full-time and part-time) in diamond manufacturing varies widely from country to country. For example, literature indicates that there are 500-600 cutters in the United States; around 3100 cutters in some 250 factories in Belgium; some 7000-8000 cutters in 35 factories in Thailand (there were no factories there in 1980); 7000 workers in some 450 factories in Israel; approximately 7000-8000 sawers, bruters and polishers in some 50 factories in Russia; 3000 workers in Sri Lanka; 1000 workers in 3 factories in Botswana; 1500 cutters in 120 factories in South Africa; 10 000 workers in 80 factories in China; and 600 000-700 000 workers in 30 000 factories in India.

CLASSIFICATION (SORTING) OF ROUGH DIAMONDS

Primary sorting for mine valuation is often done at or near the mine, and usually requires only a few sorters. Final sorting for shape and quality (colour and clarity) into detailed categories for final valuation requires more people and is often done near an important city for reasons of security, access to a larger labour pool and expertise, transportation, and general convenience.

The major final sorting and valuation centres are Kimberly,[4] South Africa; Gabarone,[4] Botswana; Windhoek,[4] Namibia; Perth (2200 km away from the mine), Australia; and Mirny (primary sorting) in Yakutia Province and Moscow (final sorting), Russia. Others include capital cities such as Freetown, Sierra Leone; Conarky, Guinea; and Kinshasa, the Congo. De Beers' main sorting house is in London, England where, the CSO reports, the rough diamonds are sorted into more than 14 000 categories. De Beers also sorts rough diamonds in Lucerne, Switzerland. Sorting costs vary according to the type of production, degree of automation, and labour costs. Production with a high gem content costs more to sort and value. Sorting costs vary from about US$0.35/ct to US$1.00/ct.

Each diamond mine contains diamonds that are specific to the mine in terms of size, crystal shape, clarity, colour, surface markings, etc.

Rough diamonds are classified in the following order: weight, shape, clarity and colour. The rough diamonds that are mined at different locations in the world and that are sold in whole or in part to the CSO are classified into thousands of categories at the final sorting centres, and into more than 14 000 categories by the CSO in London. This large sample, called the "master sample," is kept at the CSO's office in London, England. The CSO attaches a price (the current selling price) to each category of roughs contained in the master sample. All of the prices are contained in a proprietary price book that is used by the CSO's 600 sorters in London and by producing partners. The prices are changed in the book every time the CSO announces a price change. In London, the sorters sort and value the incoming rough diamonds that the CSO buys on the outside market, i.e., mostly alluvials from central/western Africa; re-sort some of the production already sorted at mines in Botswana, Namibia and South Africa, which are partly or wholly owned by De Beers; and prepare parcels for sightholders.

A simplified method of classifying the rough diamonds from a specific deposit can be described as follows. Once the rough diamonds from a production run have been cleaned of their surface impurities with acids to show their real colour (without cleaning, an under-valuation of 5-10% could arise), they are weighed, counted, sieved for size **(weight)**, and separated into 5 to 10 piles depending on the size distribution of the stones in the deposit. For small diamonds (i.e., smaller than 0.5 ct), weight is the most important classification factor. For final (detailed) sorting, the gem-quality stones are separated from the near-gems (i.e., roughs that may or may not produce a polished gem diamond economically). The gems are then classified into basic shapes (such as sawables and makeables), clarity and colour. After the gem diamonds are sorted, the near-gems are classified, but in fewer categories. Industrial diamonds (non-gems) are then classified as bort, dies, flets, stones, castings, etc.

Weight - The mines in South Africa, Botswana and Namibia that are partly or wholly owned by De Beers, and other mines whose production is classified and sold by the CSO, use the CSO selling assortment. Grainers are stones that weigh between 0.45 and 2.79 ct. There are 4 grainers in 1 carat. Large stones that weigh 2.80 ct and more are divided into carat sizes of up to 10.79 ct. Special stones weigh 10.8 ct and more, and are valued separately. A 2-grainer stone weighs 0.45-0.65 ct; a 3-grainer weighs 0.66-0.89 ct; a 4-grainer or 1-carater weighs 0.90-1.19 ct; a 6-grainer weighs 1.4-1.79 ct; an 8-grainer or 2-carater weighs 1.8-2.49 ct; a 10-grainer weighs 2.50-2.79 ct; and a 3-carater weighs 2.8-3.79 ct. Rough stones that are smaller than 0.45 ct are sieved into size groups defined as +11 (which yields mostly makeables above a 0.5-ct and 2-grainer sawable); +9 (0.25-ct sawable); +7 (sawable of 10 stones per ct); -7+6 (11 stones per ct); -6+5 (16 stones per ct); -5+4 (24 stones per ct); -4+3 (32 stones per ct); and -3+1 (50 stones per ct).

Shapes - De Beers uses the following shape classificaton system: stones, which are well-formed octahedrons or dodecahedrons, without "obvious" flaws; shapes, which are like stones, but are slightly deformed, elongated, or flatter on the edges and lightly flawed; cleavages, which are irregularly shaped or broken crystals; macles, which are twinned crystals of reasonable thickness, and often triangular in shape; flats, which are relatively thin elongated crystals with parallel surfaces; and cubes. Typical yields are as follows: stones, 45-48%; shapes, 40-45%; macles, cleavages, flats and cubes have lower yields. Because a dodecahedron has a higher yield than an octahedron, it can cost up to 10% more for the same quality.

The majority of round brilliants, which is the most popular cut diamond and also the most expensive (except for fancy-coloured diamonds), are produced mainly from octahedra, but also from dodecahedra. Stones produce round brilliant polished diamonds; shapes yield marquise, oval and emerald diamonds; thick macles produce triangles, hearts, marquise and pear shapes; and thin macles and flats produce baguettes. Because the round brilliants are the most expensive, the rough stones that produce round brilliants are also the most expensive.

Manufacturers classify their gem-quality rough diamonds as follows: (a) sawables are well-formed and high-clarity (regardless of colour) octahedrons and dodecahedrons that can be sawn or cleaved into two stones before being polished, and have a yield of around 45%, but can reach as high as 70%; (b) spotted are sawables of lower quality (clarity) with a yield of about 40%, but can reach as high as 65%; (c) makeables are polished as a single stone without first being sawn or cleaved (both thick macles and thick flats fall into this group, and they usually require more work than sawables and have a yield of

30-45%); and (d) cleavages are irregularly shaped or broken crystals with inclusions and cracks on cleavage planes (their yield is lower than the yield of makeables).

Clarity can be divided as follows:

- "I," if inclusions can be seen with the naked eye;
- "SI," if small inclusions are easy to see with a 10 X loupe;
- "VS," if small inclusions are difficult to see with a 10 X loupe; and
- "VVS," if small inclusions are very difficult to see with a 10 X loupe.

Colour can be divided into three categories "equivalent to polished stones":

- "H," white, if the stone appears to be colourless;
- "J," off-white, when the stone has a slight milky appearance; and
- M," if the stone appears to be yellowish or brownish.

Consequently, altogether, gem-quality diamonds from a mine can be divided or classified into 250-600 categories (piles). At some mines, such as alluvial mines, the number of categories is much lower. Industrial stones only need to be classified into a few categories. After the classification of a production run, each pile is weighed.

Rough diamonds larger than three quarters of a carat (diamonds that are mostly supported by De Beers) represent about two thirds of the total value of rough diamonds sold by the CSO. These diamonds are released to the market in a controlled way by the CSO at "sights," which are held about every five weeks in Europe (London and Lucerne) and South Africa (Johannesburg) to about 170-180 carefully chosen buyers known as "sightholders." Diamdel, which is a De Beers subsidiary, is one of the largest sightholders, and it distributes rough diamonds to manufacturers that are too small to qualify for sights. De Beers indicates that the minimum and maximum annual rough diamond purchases from the CSO per sightholder are respectively $5 million and 10% of the CSO's annual sales. The majority of the sightholders are manufacturers with large cutting operations, but some of the largest are rough dealers that sell their goods to a large number of small manufacturers. Each manufacturer receives a narrow range of goods for which the company specializes. Large dealers receive a wide range of goods because they supply many small manufacturers. Once the stones are cut and polished, they are sold to diamond merchants or wholesalers of polished diamonds. Finally, the diamonds are sold to manufacturing jewellers and retail outlets.

Debid is a division of De Beers that sells both natural and synthetic industrial diamonds.

MARKETING OF ROUGH DIAMONDS

Large producers may sell by contract their entire production to diamantaires, or to the CSO at prices determined by the CSO and using standardized samples. When production is sold to the CSO, the diamonds are purchased by the CSO for cash at the current selling price less 10% to cover costs such as advertising, marketing, classification and valuation (e.g., Debswana in Botswana). Large producers may also sell most of their production to the CSO and market a small portion (5-20%, called a "window") independently of the CSO in order to develop an in-house expertise and to check market prices for both rough and polished diamonds (e.g., as in Russia).

Small- to medium-sized producers may sell by tenders. This method optimizes profits, but there is a danger of collusion when there are only a few buyers. Tenders are also sensitive to short-term swings in the markets. Trans Hex of South Africa holds tenders in Cape Town and Johannesburg; Endiama holds tenders in Luanda, Angola; and other companies and government agencies hold tenders in Bengui, Central African Republic; Moscow, Russia; and Washington, D.C.

Small alluvial producers may sell to traders (middle-men) who have sales offices in large trading centres where dealers and manufacturers are invited to examine and buy the goods. The problem here is that valuations can be highly variable between dealers (e.g., Arslanian Frères and G. Evens of Antwerp). Small producers may also sell directly to polishers in order to avoid the middle-men.

Finally, diamonds can be sold as "brand" products to differentiate them from other types of diamonds (e.g., cognac, champagne and pinks from Argyle, Australia, or "Colorado" diamonds from Redaurum in the United States). These diamonds are sold by tenders or at auctions.

PROCESSING (REFINING) INDUSTRIAL DIAMONDS

Low-value natural and synthetic diamonds can be processed into higher-value products by simple methods. Processing methods for grit, powders and stones are as follows. Natural grit (about 40 microns to 1 mm) is crushed, washed, dried, screened into sizes, and separated into shapes (elongated vs. short) with the use of vibrating tables. The short are sold, while the elongated are ground again, and the cycle is repeated. Synthetic grit and powders are separated into sizes and shapes, cleaned of their surface impurities, and dried. Stones (larger than 1 mm) are screened, separated into shapes, and sold as such, or the stones can be lightly rounded mechanically for long life and resistance to premature breakdown; rounded mechanically and polished to resist wear, high-impact and premature breakdown; or rounded and polished with acids for resistance to severe impacts and high temperatures. There are no industrial diamond processing plants in Canada.

USES

Gem-Quality Diamonds

Gem-quality diamonds are used in jewellery. World retail sales of diamond jewellery have increased rapidly in the 1990s, as shown in Table 6. In 1997, preliminary figures indicate that some 67 million pieces of diamond jewellery were sold worth US$52 billion, with a total diamond content value of some US$12 billion and a diamond content weight of 21 Mct. The major markets for diamond jewellery in 1996 in terms of diamond content value were approximately as follows: the United States, 34%; Japan, 28%; Europe, 14%; East Asia, 8%; and other countries, 16%.

Industrial Diamonds

Industrial diamonds are diamonds that do not meet the standards of gem-quality diamonds because of their colour, clarity, size or shape. Industrial diamonds include natural and synthetic diamonds.

Diamonds are the hardest substance known. For this reason, the major use of industrial diamonds is as an abrasive. Industrial diamonds are used in equipment that drill, cut, grind and polish rocks (such as granite and marble), nonferrous metals, carbon fibres, composites, glass, refractories, ceramics, concrete, plastics, masonry bricks, etc. Natural and synthetic diamonds are widely used in the automotive, advanced technology and aerospace industries.

PRICES

Natural Diamonds

Natural industrial diamonds: Crushing bort sells for about US30¢/ct; casting sells for US$1-$2/ct; industrial stones sell for US$7-$10/ct; flets (e.g., a high-quality thin macle) sell for US$50/ct; and dies (larger diamonds of high quality but with poor (often yellow) colour that makes them unsuitable as gems) sell for up to US$200/ct.

Gem-quality rough diamonds: The price of a rough stone depends on its carat weight, shape, clarity and colour. The prices vary widely, but the following table is an indication of the prices paid at cutting and polishing factories for gem-quality rough stones. A 1-ct stone that sells for US$20 is very low quality, US$200 is medium quality, US$400 is good quality, and US$600 is top quality.

PRICES OF HIGH-QUALITY GEM ROUGH DIAMONDS

Weight/Stone (carats)	Price (US$/carat)
0.5	200-**300**
1	500-**600**
2	1 000-**1 200**
3-4	1 500-**2 500**
5-6	1 800-**3 000**
10-20	3 000-**4 500**
100	**10 000+**

Sources: Hasenfield-Stein, New York; Five Star Diamonds Corp., Montréal.
Note: Prices for fine-quality rough diamonds are shown in bold characters.

Synthetic Diamonds

Synthetic diamond prices depend on their particle strength, size and shape, and whether or not the diamonds are coated with a metal, etc. For this reason there are several hundred prices for synthetic industrial diamonds. Generally speaking, synthetic diamonds used in grinding and polishing vary in price from US30¢/ct up to US$1/ct. Strong and blocky material for use in sawing and drilling, and known in the trade as SDA and MBS (produced respectively by De Beers and General Electric), sells for up to US$3/ct. Large single crystals with excellent structure for use in specific applications sell for several hundred dollars per carat.

FORECAST AND OUTLOOK

Worlwide, the demand for 3-grainer polished diamonds up to a size of 2-3 ct with good colour and clarity is expected to continue to be strong. The surplus of small inexpensive polished diamonds should continue for a few years.

Prices for natural industrial diamonds should continue to decline if world production remains at its present level, or increases, due to strong competition from synthetic diamonds.

Synthetic diamonds will continue to replace natural industrial diamonds.

On the production side, the production of synthetic diamonds should continue to grow at a healthy rate.

Increases in the production of natural diamonds during the next few years will come mainly from an expansion at Orapa in Botswana, and from the development of new mines (Ekati and Diavik) in Canada.

Production at Jubilee in Russia is increasing and, if needed, De Beers could expand the Venetia, Finsch and Premier mines in South Africa. Finally, the Catoca mine is under development in Angola. Production decreases will probably come from the Argyle mine in Australia and from the Udachny mine in Russia.

ENDNOTES

1 One carat equals 0.2 grams.

2 *The Role of South Africa in the International Diamond Industry*, published by De Beers' Corporate Communications Departments, Johannesburg and Kimberley, South Africa.

3 Source for all data relating to India is Ashish Mehta, *Developments in the India Market*, London, England, October 1997.

4 Sorted and sold by De Beers.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of March 31, 1998.

TARIFFS

Item No.	Description	Canada MFN	Canada GPT	Canada USA	United States Canada
7102.10	Diamonds, unsorted, whether or not worked, but not mounted or set	Free	Free	Free	Free
7102.21	Diamonds, industrial, unworked or simply sawn, cleaved or bruted, but not mounted or set	Free	Free	Free	Free
7102.29	Diamonds, industrial, other, worked, not mounted or set	Free	Free	Free	Free
7102.31	Diamonds, non-industrial, unworked or simply sawn, cleaved or bruted	Free	Free	Free	Free
7102.39	Diamonds, non-industrial, other	Free	Free	Free	Free
7105.10	Natural or synthetic diamond dust or powder	Free	Free	Free	Free

Sources: Customs Tariff, effective January 1998, Revenue Canada; Harmonized Tariff Schedule of the United States, 1998.

TABLE 1. CANADA, DIAMOND TRADE, 1995-97

Item No.		1995		1996		1997p	
		(carats)	($000)	(carats)	($000)	(carats)	($000)
EXPORTS							
7102.10	Diamonds, unsorted, whether or not worked but not mounted or set						
	United States	..	320	..	341	..	113
	Guyana	–	–	–	–	..	63
	India	–	–	..	48	..	47
	Belgium	..	19	–	–	–	–
	Total	..	339	..	389	..	223
7102.21	Diamonds, industrial, unworked or simply sawn, cleaved or bruted						
	United States	4 069	26	1 091	46	5 978	59
	Romania	–	–	9 698	145	–	–
	Total	4 069	26	10 789	191	5 978	59
7102.29	Diamonds, industrial, other, worked, not mounted or set						
	United States	5 090	89	115	41	122	88
	Israel	12 000	82	25 078	93	18	20
	South Africa	–	–	–	–	1 863	15
	Other countries	2 300	28	24 288	152	–	–
	Total	19 390	199	49 481	286	2 003	123
7102.31	Diamonds, non-industrial, unworked or simply sawn, cleaved or bruted						
	Australia	–	–	–	–	1 061	220
	United States	345	45	712	110	3	16
	Belgium	–	–	2 272	34	–	–
	Total	345	45	2 984	144	1 064	236
7102.39	Diamonds, non-industrial, other						
	United States	6 854	7 627	22 229	12 954	7 707	10 491
	Belgium	5 708	8 417	3 387	1 654	1 439	1 143
	Israel	123	293	808	783	533	844
	Spain	–	–	–	–	211	225
	Hong Kong	392	803	3	5	35	147
	Other countries	917	1 280	808	306	112	124
	Total	13 994	18 420	27 235	15 702	10 037	12 974
7105.10	Diamond dust or powder						
	United States	171 124	115	107 491	82	83 710	46
	Total	171 124	115	107 491	82	83 710	46
IMPORTS							
7102.10	Diamonds, unsorted, whether or not worked, but not mounted or set						
	United States	..	10 811	..	9 489	..	9 872
	Israel	..	5 485	..	6 999	..	6 800
	Belgium	..	6 636	..	9 824	..	6 706
	India	..	4 097	..	6 245	..	6 453
	United Kingdom	..	16	..	789	..	1 132
	Other countries	..	4 334	..	2 833	..	2 025
	Total	..	31 379	..	36 179	..	32 988
7102.21.10	Diamonds, industrial, bort and black, for borers, unworked or simply sawn, cleaved or bruted, but not mounted or set						
	United States	332 821	1 018	176 522	641	199 395	799
	Belgium	127 940	793	53 471	535	91 913	653
	Ghana	42 080	240	58 958	393	126 335	454
	United Kingdom	33 233	195	19 857	143	28 261	195
	Ireland	40 998	186	94 081	281	53 867	180
	Congo, Democratic Republic of the	113 052	443	31 697	197	35 612	161
	Other countries	123 744	482	133 057	386	49 756	226
	Total	813 868	3 357	567 643	2 576	585 139	2 668
7102.21.90	Diamonds, industrial, other than bort and black, for borers, unworked or simply sawn, cleaved or bruted, but not mounted or set						
	Belgium	–	–	–	–	174 414	1 943
	Ireland	–	–	24 212	99	98 442	415
	United States	6 252	62	35 457	140	18 915	91
	Other countries	3 331	34	13 997r	138r	10 031	69
	Total	9 583	96	73 666r	380r	301 802	2 518

TABLE 1 (cont'd)

Item No.		1995		1996		1997p	
		(carats)	($000)	(carats)	($000)	(carats)	($000)
IMPORTS (cont'd)							
7102.29.10	Diamonds, industrial, bort and black, for borers, worked, but not mounted or set						
	United States	101 918	345	43 379	161	1 972	70
	Australia	384	6	–	–	796	23
	Other countries	370 678	1 282	39 278	446	6 125	24
	Total	472 980	1 633	82 657	607	8 893	117
7102.29.90	Diamonds, industrial, other than bort and black, for borers, worked, but not mounted or set						
	Ireland	176 494	562	1 155 991	4 359	703 328	3 238
	Belgium	1 857	30	3 498	56	11 964	981
	United States	14 590	259	345 842	2 228	111 027	778
	Other countries	5 165	17	38 789	493	11 035	512
	Total	198 106	868	1 544 120	7 136	837 354	5 509
7102.31	Diamonds, non-industrial, unworked or simply sawn, cleaved or bruted, not mounted or set						
	Belgium	466	526	738	803	2 016	1 571
	Brazil	–	–	–	–	1 023	760
	Israel	39	6	–	–	142	116
	United States	281	185	345	47	158	105
	Other countries	–	–	135	113	64	8
	Total	786	717	1 218	963	3 403	2 560
7102.39.00.10	Diamonds, non-industrial, worked, of a weight not exceeding 0.5 carats each						
	Israel	36 077	23 863	37 241	28 832	29 023	22 883
	Belgium	33 340	19 289	20 584	13 732	12 094	10 274
	United States	13 470	10 783	7 686	6 477	9 317	8 310
	India	3 819	1 392	7 524	2 781	7 631	2 703
	South Africa	245	528	–	–	179	364
	Other countries	6 365	5 899	504	399	430	792
	Total	93 316	61 754	73 539	52 221	58 674	45 326
7102.39.00.20	Diamonds, non-industrial, worked, of a weight exceeding 0.5 carats each						
	Belgium	39 077	28 769	41 379r	30 962r	44 751	37 309
	Israel	38 976	22 495	25 345	23 392	36 435	33 564
	United States	12 922	10 287	14 723	14 312	17 505	21 795
	India	20 932	6 573	34 679	8 497	59 989	19 908
	Other countries	6 051	6 756	2 946	2 556	3 888	5 039
	Total	117 958	74 880	119 072r	79 719r	162 568	117 615
7105.10.10	Diamond dust for borers; dust mixed with a carrier in cartridges or in tubes						
	United States	366 934	785	914 754	2 325	2 297 176	6 291
	Ireland	9 018	26	72 767	244	402 040	1 139
	Ghana	–	–	1 025	5	23 577	64
	Other countries	23 257	82	27 333r	104r	38 854	107
	Total	399 209	893	1 015 879r	2 678r	2 761 647	7 601
7105.10.91	Natural diamond dust or powder						
	United States	5 955	9	39 369	125	125 361	389
	Congo, Democratic Republic of the	4 100	6	2 138r	11r	10 719	42
	Other countries	–	–	15 357	17	1 459	7
	Total	10 055	15	56 864r	154r	137 539	438
7105.10.92	Synthetic diamond dust or powder						
	Ireland	1 463 147	4 072	954 114	2 975	1 029 604	2 785
	United States	1 790 218	5 545	1 796 748	4 860	1 003 566	1 925
	Italy	228 610	670	112 887	377	45 399	139
	Other countries	262 509	803	127 595	297	104 458	300
	Total	3 744 484	11 090	2 991 344	8 509	2 183 027	5 150

Source: Statistics Canada.
– Nil; . . Not available; p Preliminary; r Revised.
Note: Numbers may not add to totals due to rounding.

TABLE 2. WORLD PRODUCTION OF NATURAL DIAMONDS, BY TYPE AND COUNTRY,[1,2] 1992-96

Country	1992	1993	1994	1995	1996
			(000 carats)		
GEM-QUALITY DIAMONDS[3]					
Angola[3]	1 100	130	270	2 700[r]	3 600
Australia	18 100	18 800	19 500	18 300	18 897[a]
Botswana	11 200	10 300	10 550[a]	11 500	11 000
Brazil	653	1 000[r]	300[r]	700[r]	700
Central African Republic	307[a]	370	400	400	350
China	200	230	230	230	230
Gabon	400	400	400	400	400
Ghana	104[r,a]	106[r,a]	118[r]	126[r]	125
Namibia	1 520	1 120	1 312[a]	1 382[a]	1 300
Russia	9 000	8 000	8 500	9 000	9 250
Sierra Leone	180	90	155	113[a]	162
South Africa	4 600	4 600	5 050[r]	5 070[r]	5 360
Venezuela	302	145[r,a]	203	229[a]	230
Zaire	8 930	2 010	4 000	4 000	3 000
Other	305	277[r]	463[r]	608[r]	813
Total gem-quality	56 800[r]	47 600[r]	51 400	54 800[r]	55 400
INDUSTRIAL DIAMONDS					
Angola[3]	80	15	30	300[r]	400
Australia	22 100	23 000	23 800	22 400	23 096[a]
Botswana	4 790	4 420	5 000	5 300	5 000
Brazil	665	600[r]	600[r]	600[r]	600
Central African Republic	107[a]	125	131	130	120
China	800	850	850	900	900
Gabon	100	100	100	100	100
Ghana	590[r,a]	484[r,a]	473[r,a]	505[r]	505
Namibia	30	20	–	–	–
Russia	9 000	8 000	8 500	9 000	9 250
Sierra Leone	116	68	100	101[r]	108
South Africa	5 600	5 700	5 800[r]	5 880[r]	6 000
Venezuela	176	155[a]	214[a]	64[a]	60
Zaire	4 570	13 600	13 000	13 000	15 000
Other	218	210[r]	277[r]	344[r]	464
Total industrial	48 900[r]	57 400	58 900[r]	58 600[r]	61 600
Total world production	106 000	105 000	110 000	113 000[r]	117 000

Source: U.S. Geological Survey.
[r] Revised.
[a] Reported figure.
[1] World totals and estimated data are rounded to three significant digits; the numbers may not add to the totals shown. [2] Table includes data available through May 28, 1997. [3] Figures do not include smuggled artisanal production.

TABLE 3. WORLD DIAMOND PRODUCTION, 1996

	Carats	Average Price	Value
	(millions)	(US$/ct)	(US$ billions)
AFRICA			
Jwaneng mine[1]	11.20	130	1.45
Orapa mine[1]	5.60	60	0.34
Letihakane mine[1]	0.90	115	0.10
Total Botswana[1]	17.70	107	1.89
Namdeb mine[1]	1.40	320	0.45
ODM mine	0.06	180	0.01
Total Namibia	1.50	315	0.46
Venetia mine[1]	4.30	110	0.47
Premier mine[1]	1.60	95	0.15
Finsch mine[1]	2.10	60	0.13
Namaqualand mine[1]	0.70	180	0.13
Kimberley mine[1]	0.60	110	0.07
Koffiefontein mine[1]	0.10	130	0.01
Subtotal De Beers in South Africa[1]	9.40	102	0.96
Other South African mines	0.60	105	0.06
Total South Africa	10.00	102	1.02
Angola	3.70	300	1.10
Zaire	15.00	25	0.40
Other Africa	2.80	140	0.40
Total Africa	50.70	104	5.27
OTHER COUNTRIES			
Russia	13.70	89	1.20
South America	4.00	100	0.40
Australia	40.00	10	0.40
Illicit	0.30	750	0.20
Miscellaneous	1.00	100	0.10
Total other countries	59.00	45	2.30
Total world	109.70	69	7.57

Sources: Standard Equities Ltd., Cape Town, South Africa; also based on De Beers' 1996 annual report, on Ashton Mining's 1996 annual report, on estimates by Diamond Counsellor International, and on a few estimates by Terraconsult and Diamond International.
[1] Sold entirely via the CSO.

TABLE 4. DIAMONDS, PRINCIPAL CUTTING CENTRES

Country	Type of Diamonds Cut	
	Near Gems[1]	Gems[2]
MAJOR CENTRES		
Belgium (Antwerp, Kempen)		**√**
United States (New York)		**√**
Israel (Ramat Gan, Tel Aviv)		**√**
India (Bombay, Surat)	**√**	√
Russia (Smolensk, Moscow)		**√**
Ukraine		**√**
INTERMEDIATE CENTRES		
South Africa		**√**
Thailand	**√**	**√**
China	**√**	√
Sri Lanka	**√**	
MINOR CENTRES		
Armenia	**√**	√
Australia		**√**
Botswana		**√**
Brazil		**√**
Central African Republic	**√**	**√**
Puerto Rico	**√**	√
Hong Kong	**√**	**√**
Taiwan	**√**	√
Korea, Republic of	**√**	**√**
Japan		**√**
Singapore	**√**	√
Indonesia	**√**	√
Vietnam	**√**	
Malaysia	**√**	
Mauritius	**√**	

Sources: Natural Resources Canada; De Beers Centenary AG.
√ Minor production; **√** Major production.
[1] Near gems (technical goods/Indian goods) are rough diamonds valued at approximately US$5-$80/ct. [2] Gems are rough diamonds with a value greater than US$80/ct.
Note: The categories "major, intermediate and minor" are defined by a combination of quantity (ct) and value of the rough diamonds cut.

TABLE 5. SYNTHETIC DIAMONDS, ESTIMATED WORLD PRODUCTION BY COUNTRY[1,2] 1993-96

Country	1993	1994	1995	1996
		(000 carats)		
Belarus	30 000[a]	25 000	25 000	25 000
British Isles	. .	. .	. .	. .
China	15 500	15 500	15 500	15 500
Czech Republic[3]	5 000	5 000	5 000	5 000
Czechoslovakia[4]	n.a.	n.a.	n.a.	n.a.
France	3 500	3 500	3 000	3 000
Germany	. .	. .	. .	. .
Greece	1 000	1 000	1 000	750
Ireland	65 000	65 000	60 000	60 000
Japan	32 000	32 000	32 000	32 000
Korea, Republic of	. .	. .	. .	. .
Poland	98	271	256	250
Romania	5 000	5 000	5 000	5 000
Russia	80 000	80 000	80 000	80 000
Serbia and Montenegro	–[r]	–[r]	–[r]	–
Slovakia[4]	5 000	5 000	5 000	5 000
South Africa	60 000[a]	60 000	60 000	60 000
Sweden	25 000	25 000	25 000	25 000
Turkey	. .	. .	. .	. .
Ukraine	10 000[a]	8 000	8 000	8 000
United States	103 000	104 000	115 000	114 000
Total	440 000[r]	434 000[r]	440 000[r]	439 000

Source: U.S. Geological Survey.
– Nil; . . Not available; n.a. Not applicable; [r] Revised.
[a] Reported figure.
[1] World totals, U.S. data, and estimated data are rounded to three significant digits; the numbers may not add to the totals shown. [2] Includes data available through May 28, 1997. [3] Formerly part of Czechoslovakia; data were not reported separately until 1993. [4] Dissolved on December 31, 1992.

TABLE 6. RETAIL SALES OF DIAMOND JEWELLERY, 1980, 1985, 1987 and 1990-96

	1980	1985	1987	1990	1991	1992	1993	1994	1995	1996[p]
					(US$ billions)					
United States	6.2	10.2	13.4	13.4	13.0	13.4	14.8	15.6	16.8	17.9
Japan	5.3	5.4	11.0	14.1	15.1	14.5	15.3	15.8	16.9	14.4
Europe	3.8	2.8	5.4	8.2	7.9	8.3	7.1	6.9	7.3	7.3
East Asia	0.6	0.6	1.4	2.1	2.5	3.1	3.3	4.0	4.2	4.2
Other	4.7	4.6	6.5	7.6	7.9	7.8	7.9	8.4	8.2	8.5
Total world	20.7	23.6	37.7	45.4	46.5	47.0	48.3	50.7	53.4	52.3

Source: CSO Research and Information Department.
[p] Preliminary.