Diamonds

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SUMMARY

Major events in the Canadian diamond industry during 1998 included the following:

- On October 14, BHP Diamonds Inc. opened the Ekati mine in the Northwest Territories, the first major Canadian diamond mine.
- The Canadian government signed a three-year contract with Diamonds International Canada (DICAN) Ltd. to be the Canadian Government Diamond Valuator.
- Two companies and two schools began training diamond cutters in Canada.
- De Beers reduced its rough diamond sales by 28% to US$3.34 billion from US$4.64 billion in 1997.
- The continued downturn in the economies of Japan and other Asian countries, including Korea and Taiwan, resulted in reduced demand for finished goods throughout the year.
- De Beers extended its trade deal with Almazy Rossii-Sakha (Alrosa), the largest Russian diamond producer, through to the end of 2001. In the contract, De Beers (the Central Selling Organization (CSO)) will be guaranteed sales of at least US$550 million per year of rough stones from run-of-mine and the stockpile.
- In Angola, the country's first diamond mine at Catoca began production. The mine is 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.
- Israeli manufacturers who are not CSO sightholders now have access to a first-hand supply of rough stones. In June, a rough bourse in Tel Aviv was officially opened.

CANADIAN DEVELOPMENTS

Mine Developments

On October 14, 1998, BHP Diamonds Inc. (BHP), a wholly owned subsidiary of Broken Hill Pty Co. Ltd. of Australia, opened the first Canadian diamond mine. The Ekati diamond mine is located near Lac de Gras about 300 km northeast of Yellowknife in the Northwest Territories. The mine is owned 51% by BHP Diamonds, who is also the operator, 29% by Dia Met Minerals Ltd. of Kelowna, British Columbia, and 10% each by Charles Fipke and Stewart Blusson, both of Canada. Under the joint-venture agreement, BHP will market all diamond production for the first five years.

By the end of the year, the mine had produced nearly 200 000 carats (ct). Once full capacity is reached, annual production is expected to be about 3.5-4.5 Mct. At this level, the Ekati mine will account for about 4% of global diamond production by weight and 6% by value.

BHP spent nearly $200 million on the exploration and environmental assessment phase of the project. Following completion of the regulatory phase in January 1997, the company spent an additional $700 million on mining equipment, site development and construction of mine infrastructure, including a 9000-t/d processing plant.

Throughout the construction phase, BHP met commitments to maximize both northern purchases and northern hire. BHP employs about 550 people. Some 80% of the Ekati mine's staff are Northerners, of which over 50% are Aboriginals.

The mine's proven and probable kimberlite reserves total 78.0 Mt at an average grade of 1.09 ct/t (which is high by world standards). The current plan calls for the five pipes to be mined by open-pit and then

underground methods over a period of 17 years. The pipes are known as Panda, Koala, Fox, Misery and Sable. Their lifespan is widely expected to be extended to at least 25 years as additional pipes, such as Koala North and Beartooth, which have been identified for future bulk sampling, are exploited.

All of the pipes are within 35 km by air of each other. Panda is currently being mined and will be followed by Misery and Koala. The bulk sampling program results on the pipes are approximately as follows: Panda, 1.03 ct/t (diluted basis) evaluated at an average price of US$130/ct, 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. The operating costs will vary from about US$22 to $35/t of ore.

The Diavik diamonds project is a proposal to mine four kimberlite pipes located just offshore of a 20-km^2 island in Lac de Gras, approximately 300 km northeast of Yellowknife and 30 km southeast of BHP's Ekati diamond mine. The pipes are referred to as A-154 South, A-154 North, A-418 and A-21. Diamond grades and values are variable between the four pipes. An independent valuation conducted in 1998 of diamonds recovered from the bulk sampling of A-418 and A-154 South confirmed values of US$56/ct and US$63/ct, respectively. As of December 1998, reserves from the four pipes stood at 102 Mct contained in 26 Mt of kimberlite with a diluted grade of 3.9 ct/t. (This estimate, which was calculated to a depth of approximately 400 m, excludes inferred resources and takes into account underground mining plans.)

Diavik initiated a $30 million feasibility study in 1998 that it expects to complete in the second quarter of 1999. The study is examining the construction of three dykes to allow open-pit mining of the four pipes, with additional underground mining of the two higher-grade pipes (A-154 South and A-418). Mining and processing rates being examined range from 1.5 to 1.9 Mt of ore per year, yielding 6-8 Mct of diamonds annually at full production.

The project was submitted to the federal government for environmental assessment on March 8, 1998. The government established that the project would be assessed using the Comprehensive Study process as prescribed under the *Canadian Environmental Assessment Act*. Diavik filed its Environmental Assessment Report with the Canadian government on September 25 and, by the end of 1998, the project was about mid-way through the review process. Diavik expects to receive government approval by the second quarter of 1999 and the required licences and permits to allow construction and operations in the fourth quarter of 1999. Contingent on investor endorsement, construction of the $875 million project could begin in early 2000 with diamond production then beginning in mid-2002.

The Diavik diamonds project is a joint venture between Aber Resources Ltd. (40%) and Diavik Diamond Mines Inc. (60%). The latter company is a subsidiary of Rio Tinto plc and is the project manager. Each partner retains the right to market its own share of diamond production.

Canadian Government Diamond Valuator

In the Northwest Territories and Nunavut, the Canada Mining Regulations require that all diamonds produced in the territories be examined by a government valuator in order to establish a value for the diamonds for the purposes of calculating royalties owed to the Crown. The valuation must be done before the diamonds are sold or exported out of the territories.

In August 1998, the Canadian government signed a three-year contract with Diamonds International Canada (DICAN) Ltd. DICAN is a Canadian incorporated company with headquarters in Yellowknife, Northwest Territories. The company is a partnership between Aboriginal Diamonds Group Ltd. (51%) and WWW International Diamond Consultants Ltd. (49%).

DICAN has a team of nine individuals with expertise in the valuation of rough diamonds and statistical analysis of rough diamond production. As required by regulation, DICAN has provided the government with a value of diamond production from the Ekati mine for use in the calculation of royalties that BHP Diamonds Inc. will pay to the Crown.

Exploration Developments

In 1998, exploration for diamonds continued in several regions of Canada. Preliminary data indicate that diamond exploration expenditures declined from $92.2 million in 1997 to $73.9 million in 1998. Again, exploration was focussed principally in the Northwest Territories.

Monopros Ltd., the Canadian exploration arm of De Beers Consolidated Mines, announced late in 1998 that it would proceed with a $14 million bulk sampling program on the AK diamond property. The company plans to recover about 1000 ct from each of the Hearne, Tuzo and 5034 pipes, and an additional 200 ct from the Tesla pipe. The bulk sample will be processed at the Monopros dense media separation plant at Grande Prairie, Alberta, and the sample con-

centrates will be shipped to South Africa for final diamond recovery and evaluation. In addition to the bulk sample, Monopros has started delineation drilling to better define the resources in each of the four pipes. Based on earlier drilling, the company has estimated that the Hearne pipe contains about 8 Mt averaging 2.33 ct/t, the Tuzo pipe contains about 9 Mt averaging 2.20 ct/t, the 5034 pipe contains 15 Mt averaging 1.60 ct/t, and the Tesla pipe contains 4 Mt averaging 0.34 ct/t. Monopros, through a joint-venture agreement signed in 1997 with Mountain Province Mining Inc., which owns 90% of the AK property, and Camphor Ventures, which owns the other 10%, can earn up to a 60% interest in the property.

Lytton Minerals Limited and its joint-venture partners announced the discovery of a new pipe named Contwoyto-1 about 30 km east of the original Jericho pipes. The partners announced that analysis of a 90.2-kg core sample recovered 169 stones, of which 26 diamonds were greater than 0.5 mm in one direction and 12 of those were greater than 0.5 mm in two directions. Work is expected to continue during 1999.

Aber Resources Ltd. and Winspear Resources Ltd. continued the sampling program of the NW kimberlite dyke near Snap Lake on the Camsell lake property. During the summer, two 100-t samples about 250 m apart yielded a 226.72-ct parcel of diamonds. Included in the parcel were 25 diamonds weighing more than 1 ct each and the three largest stones weighed 10.82, 8.42 and 6.04 ct. In 1999, the partners are planning a $12 million program to collect a 6000-t bulk sample from the dyke in order to help verify its diamond potential.

Winspear Resources is continuing work on the Hilltop and Cache properties, which are immediately adjacent to the Camsell Lake property. The Cache property is a joint venture with SouthernEra Resources Ltd. (20%), while the Hilltop property is 100% owned by Winspear; Winspear is the operator at all three properties. Work on the Hilltop and Cache properties includes airborne magnetometer and electromagnetic surveys as well as till sampling. The company expects to continue its work during 1999 by spending $1.5 million on further delineation work.

Ashton Mining of Canada Inc. reported disappointing test results on its test of 479 t of mined soil and kimberlite. The company recovered only 56.45 ct larger than 1 ct in size. While the results are lower than expected, Ashton announced that it will continue exploring in Alberta and, at year-end, was awaiting the results of a 17-t sample taken from another pipe.

STRUCTURE OF THE CANADIAN DIAMOND VALUE-ADDED INDUSTRY

Diamond Cutting and Polishing

In comparison to other countries with cutting and polishing industries, the Canadian industry is quite small. However, the start of Canada's mine production of rough diamonds has created quite an interest in establishing new facilities in this country.

First, Canadian Diamond Cutting Works has set up a new operation in Montréal, Quebec. The company brought experienced cutters from Belgium to act as foremen and trainers to six local people interested in becoming diamond cutters and polishers. It expects to have a crew of about 20 employees processing 3000 ct per month within about two years.

Sirius Diamond Ltd., with a factory near Victoria, British Columbia, has begun polishing rough diamonds from the Ekati mine. The company has the first purchase agreement with BHP to produce cut and polished Canadian diamonds. As part of its sales promotion, Sirius laser engraves a polar bear on each Canadian diamond it polishes. Sirius has also provided training for Northerners in its factory so that, when its new facility now under construction in Yellowknife is completed, it will have trained local employees to start work. The facility is expected to employ 30 people within two years and, if its training program is a success, about 25 will be local hires. Initial production is expected to be at a rate of 2000 ct per month, rising to about 5000 ct per month as efficiencies and skills increase.

Other manufacturers include Cohenor and Hope Diamond with small factories in Montréal, Quebec, and Polar Star with a factory in Edmonton, Alberta.

New production facilities are expected to be built in Yellowknife to take advantage of being close to the source of the rough diamonds. At present, the Government of the Northwest Territories is reviewing about 10 proposals for building new operations in Yellowknife.

The General and Vocational College of Matane, Quebec (Collège d'enseignement général et professionnel (CÉGEP) de Matane), enrolled about 40 students in a course on diamond cutting and polishing for the 1998/99 winter term.

Aurora College in the Northwest Territories has also developed a diamond cutting and polishing course for northern students. In early October, Aurora College and Sirius Diamonds Inc. selected nine Northerners

(five men and four women) to begin a six-month training program to learn the skills of cutting and polishing diamonds. The program will be delivered at Sirius's facilities near Victoria, British Columbia, until its new operation opens in Yellowknife in May 1999. Following completion of the training program, the trainees will be employed by Sirius.

In addition, Aurora College has introduced a new course at its Yellowknife facilities entitled "Introduction to Diamonds." The 16-week course has space for 20 students who, upon completion of the course, will be qualified to apply for cutting and polishing jobs with Sirius.

Diamond Tools and Equipment Manufacturing

These products include drill bits, segments for circular blades, grinding wheels and specialty tools. The major manufacturing plants are: Fordia at Ville St-Laurent, Quebec; Diamond Production at Montréal, Quebec; North Star Abrasives at Montréal, Quebec; Diacan at Québec City, Quebec; Diamond Systems at Dorval, Quebec; Dimatec at Winnipeg, Manitoba; JKS Boyle, Longyear, JKS Lamage, and Pilot Diamond Tools, all in North Bay, Ontario; Diaset Products at Delta, British Columbia; and Hobic Bit Industry 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 smaller plants in Montréal.

Synthetic Diamond Production

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

WORLD PRODUCTION

Natural Rough Diamond Production

World production of natural rough diamonds in 1997 was estimated by Terraconsult bvba of Belgium at 119.7 Mct valued at US$6.9 billion, for an average price of US$58/ct. World production of natural rough diamonds grew from 43 Mct in 1980 to around 110 Mct/y in the mid-1990s, representing an increase of 4.5 Mct/y.

In 1997, the major producing countries included Botswana with 20 Mct valued at US$1.6 billion, Russia with 14.5 Mct valued at US$1.3 billion, South Africa with 10.3 Mct valued at US$983 million, Congo with 22.2 Mct valued at US$897 million, Angola with 5.3 Mct valued at US$806 million, Namibia with 1.1 Mct valued at US$410 million, and Australia with 40.2 Mct valued at US$322 million.

In Namibia, Namdeb (the Namibian government (50%) and De Beers (50%) joint venture) has installed a $40 million dredge that will allow the present production of 1.3 Mct/y to continue for the next 10 years.

In Angola, production at the Catoca kimberlite deposit began at the end of 1997. The joint-venture partners (Alrosa of Russia, Odebrecht of Brazil and the Angolan state-owned Endiama) have plans to gradually increase diamond production from 235 000 ct/y to 940 000 ct/y over the next nine years.

In Botswana there are plans to double the output of the Orapa mine from 6.7 Mct/y to 12.0 Mct/y by the year 2000.

In Australia, Ashton Mining Pty is continuing with the development of the Merlin mine project in the Northern Territory. The project, 77.4% owned by Ashton, is beginning phase one with the trial open-pit mining of four pipes. During this phase, ore grades are expected to be about 0.43 ct/t, which will generate revenues of about US$20 million per year.

Factors Affecting Diamond Mining

Grade

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 in the Deposit

Individually, rough diamonds can range in size from micro-sized to stones weighing in excess of 1000 ct. A much more telling measure of a mine's production is the average size of its rough diamonds. Depending on the mine, the average size of rough diamonds recovered can vary from 0.01 ct (about 1 mm in size) to more than 0.7 ct. Many mines in the world average about 0.4-0.5 ct per stone. It is interesting to note that the number of stones larger than 1 ct (0.2 g) produced at mines is very small (about 400 000 stones per year) and, in terms of total carats produced, this represents only about 0.5% of world production.

Mine Production Costs

According to different sources, production 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.

Synthetic Diamond Production

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 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 1998, 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.

DIAMOND CUTTING AND POLISHING 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 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 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 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 cuttable production from the Argyle mine in Australia 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 for diamond jewellery sales. Therefore, as can be expected, export prices for polished stones 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 in 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 rough 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$170 million, for a net value of US$560 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 of 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 faceting 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.

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 in size) 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. These stones often find use as cutting tools in various manufacturing industries. Also, these stones can be lightly rounded mechanically and then laser drilled for use as

mechanical dies for wire production. 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. 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 for 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. Prices vary widely, but the following 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.

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 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

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 Ekati mine once full production is met. 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 in Angola will also add to world production levels. Production decreases will probably come from the Argyle mine in Australia and from the Udachny mine in Russia.

Worldwide, the demand for polished diamonds of a size between 0.75 ct and 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.

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 February 26, 1999.

TARIFFS

Item No.	Description	Canada			United States
		MFN	GPT	USA	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	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 1999, Revenue Canada; Harmonized Tariff Schedule of the United States, 1999.

TABLE 1. CANADA, PRODUCTION AND DIAMOND TRADE, 1996-98

Item No.		1996		1997		1998p	
		(carats)	($000)	(carats)	($000)	(carats)	($000)
PRODUCTION							
	Northwest Territories	–	–	–	–	278 431	53 425
	Total	–	–	–	–	278 431	53 425
EXPORTS							
7102.10	Diamonds, unsorted, whether or not worked, but not mounted or set						
	United States	..	341	..	113	–	–
	India	..	48	..	47	–	–
	Guyana	–	–	..	63	–	–
	Total	..	389	..	223	–	–
7102.21	Diamonds, industrial, unworked or simply sawn, cleaved or bruted						
	United States	1 091	46	5 978	59	2 946	74
	Romania	9 698	145	–	–	–	–
	Total	10 789	191	5 978	59	2 946	74
7102.29	Diamonds, industrial, other						
	United States	115	41	122	88	248	107
	Belgium	19 047	116	–	–	–	–
	Other countries	30 319	129	1 881	35	–	–
	Total	49 481	286	2 003	123	248	107
7102.31	Diamonds, non-industrial, unworked or simply sawn, cleaved or bruted						
	United States	712	110	3	16	10 354	329
	Belgium	2 272	34	–	–	–	–
	Australia	–	–	1 061	220	–	–
	Total	2 984	144	1 064	236	10 354	329
7102.39	Diamonds, non-industrial, other						
	United States	22 229	12 954	7 707	10 491	1 556	5 210
	Belgium	3 387	1 654	1 439	1 143	502	569
	Israel	808	783	533	844	339	337
	Other countries	811	311	358	496	102	182
	Total	27 235	15 702	10 037	12 974	2 499	6 298
7105.10	Natural or synthetic diamond dust and powder						
	United States	107 491	82	83 710	46	93 851	58
	Total	107 491	82	83 710	46	93 851	58

TABLE 1 (cont'd)

Item No.		1996		1997		1998p	
		(carats)	($000)	(carats)	($000)	(carats)	($000)
IMPORTS							
7102.10	Diamonds, unsorted, whether or not worked, but not mounted or set						
	India	. .	6 245	. .	6 453	. .	13 322
	United States	. .	9 489	. .	9 869	. .	9 129
	Belgium	. .	9 824	. .	6 706	. .	8 931
	Israel	. .	6 999	. .	6 901	. .	8 169
	United Kingdom	. .	789	. .	1 132	. .	790
	Other countries	. .	2 833	. .	2 025	. .	1 460
	Total	. .	36 179	. .	33 086	. .	41 801
7102.21.00.10	Diamonds, industrial, bort and black, diamonds for borers, unworked or simply sawn, cleaved or bruted, but not mounted or set						
	United States	–	–	–	–	. .	524
	Ghana	–	–	–	–	. .	336
	Other countries	–	–	–	–	. .	752
	Total	–	–	–	–	. .	1 612
7102.21.00.90	Diamonds, industrial, other, unworked or simply sawn, cleaved or bruted, but not mounted or set						
	Belgium	–	–	–	–	52 678	374
	United States	–	–	–	–	30 852	227
	Israel	–	–	–	–	14 922	138
	Other countries	–	–	–	–	30 954	221
	Total	–	–	–	–	129 406	960
7102.21.10	Diamonds, industrial, bort and black, for borers, unworked or simply sawn, cleaved or bruted, but not mounted or set						
	United States	176 522	641	226 395	845	–	–
	United Kingdom	19 857	143	28 261	195	–	–
	Ireland	94 081	281	53 867	180	–	–
	Belgium	53 471	535	93 223	662	–	–
	Ghana	58 958	393	127 420	458	–	–
	Congo, Democratic Republic of the	31 697	197	35 612	161	–	–
	Other countries	133 057	386	49 754	226	–	–
	Total	567 643	2 576	614 532	2 727	–	–
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	–	–	172 501	1 933	–	–
	Ireland	24 212	99	98 442	415	–	–
	United States	35 457	140	19 842	99	–	–
	Other countries	13 997	142	10 031	69	–	–
	Total	73 666	381	300 816	2 516	–	–
7102.29.00.10	Diamonds, industrial, other, bort and black diamonds, for borers, but not mounted or set						
	United States	–	–	–	–	1 086	181
	India	–	–	–	–	559	175
	Other countries	–	–	–	–	8 648	148
	Total	–	–	–	–	10 293	504
7102.29.00.90	Diamonds, industrial, other than bort and black, for borers, worked but not mounted or set						
	Ireland	–	–	–	–	299 376	1 888
	Belgium	–	–	–	–	817	215
	United States	–	–	–	–	4 340	176
	Other countries	–	–	–	–	6 137	182
	Total	–	–	–	–	310 670	2 461
7102.29.10	Diamonds, industrial, bort and black, for borers, worked, but not mounted or set						
	United States	43 379	161	1 973	70	–	–
	Australia	–	–	796	23	–	–
	Other countries	39 278	446	6 125	24	–	–
	Total	82 657	607	8 894	117	–	–

TABLE 1 (cont'd)

Item No.		1996		1997		1998p	
		(carats)	($000)	(carats)	($000)	(carats)	($000)
IMPORTS (cont'd)							
7102.29.90	Diamonds, industrial, other than bort and black, for borers, worked, but not mounted or set						
	Ireland	1 155 991	4 359	704 328	3 241	–	–
	Belgium	3 498	56	11 964	981	–	–
	United States	345 842	2 228	111 025	777	–	–
	Other countries	38 789	493	11 035	512	–	–
	Total	1 544 120	7 136	838 352	5 511	–	–
7102.31	Diamonds, non-industrial, unworked or simply sawn, cleaved or bruted, not mounted or set						
	Belgium	738	803	2 016	1 571	2 568	1 923
	Israel	–	–	142	116	1 454	950
	Brazil	–	–	1 023	760	11 539	794
	Other countries	480	160	152	51	1 462	605
	Total	1 218	963	3 333	2 498	17 023	4 272
7102.39.00.10	Diamonds, non-industrial, other, of a weight not exceeding 0.5 carats each						
	Israel	37 241	28 832	29 339	22 999	31 026	21 859
	Belgium	20 584	13 732	12 094	10 274	16 371	14 459
	United States	7 686	6 477	9 327	8 203	8 020	7 029
	India	7 524	2 781	7 631	2 703	9 347	3 172
	Other countries	504	399	609	1 156	1 737	1 015
	Total	73 539	52 221	59 000	45 335	66 501	47 534
7102.39.00.20	Diamonds, non-industrial, other, of a weight exceeding 0.5 carats each						
	Israel	25 345	23 392	36 673	34 063	44 161	55 344
	Belgium	41 379	30 962	45 072	37 574	53 346	45 104
	India	34 679	8 497	60 178	20 132	66 205	23 686
	United States	14 725	14 317	17 989	22 108	16 655	20 825
	Other countries	2 946	2 556	3 888	5 039	3 102	2 266
	Total	119 074	79 724	163 800	118 916	183 469	147 225
7105.10.00.10	Diamond dust for borers; dust mixed with a carrier in cartridges or in tubes						
	United States	–	–	–	–	551 697	1 610
	Other countries	–	–	–	–	59 504	189
	Total	–	–	–	–	611 201	1 799
7105.10.00.91	Natural diamond dust and powder						
	United States	–	–	–	–	113 444	331
	Other countries	–	–	–	–	38 033	81
	Total	–	–	–	–	151 477	412
7105.10.00.92	Synthetic diamond dust or powder						
	Ireland	–	–	–	–	387 965	1 172
	United States	–	–	–	–	1 058 437	1 034
	Other countries	–	–	–	–	134 790	329
	Total	–	–	–	–	1 581 192	2 535
7105.10.10	Diamond dust for borers; dust mixed with a carrier in cartridges or in tubes						
	United States	914 754	2 325	2 309 406	6 333	–	–
	Ireland	72 767	244	402 040	1 139	–	–
	Other countries	28 358	109	62 488	171	–	–
	Total	1 015 879	2 678	2 773 934	7 643	–	–
7105.10.91	Natural diamond dust and powder						
	United States	39 369	125	125 343	389	–	–
	Other countries	17 495	28	12 177	49	–	–
	Total	56 864	153	137 520	438	–	–
7105.10.92	Synthetic diamond dust and powder						
	Ireland	954 114	2 975	1 029 604	2 785	–	–
	United States	1 796 748	4 860	1 006 125	1 932	–	–
	Italy	112 887	377	45 399	139	–	–
	Other countries	127 595	297	104 458	300	–	–
	Total	2 991 344	8 509	2 185 586	5 156	–	–

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