Diamonds

Michel A. Boucher

The author is with the Mining Sector,
Natural Resources Canada.
Telephone: (613) 992-3074

INTRODUCTION

World production of natural rough diamonds in 1993, the latest year for which statistics are available, was close to 108 million carats (Mct). This compares with 105 Mct in 1992. Close to 80% by weight and 70% by value of rough diamonds produced in the world are marketed by the Central Selling Organization (CSO), established by De Beers in support of its "single-channel" marketing of diamonds. CSO sales of rough diamonds in 1994 were US$4.25 billion, compared with US$4.37 billion in 1993, a decrease of 2.7%. While sales increased 1% in the first half of the year compared with the previous year, they declined 8% in the second half in response to: a build-up of stocks, particularly of Indian polished goods at the cutting centres; concerns over profitability in the cutting centres, especially Israel and Belgium, but also India; and, according to De Beers, continued direct sales to the markets by Russia in contravention of the CSO sales agreement.

Major events in 1994 included: a decrease in profitability in all the major cutting centres, continued problems concerning direct sales of rough diamonds by Russia, intensified tensions in the CSO-Russia new contract negotiations, the signing of an agreement between Namibia and the CSO regarding a new mining lease in Namibia, and a federal U.S. judge's decision to dismiss charges of price fixing for synthetic industrial diamonds between General Electric Co. and De Beers Centenary AG due to a lack of evidence presented by the Justice Department.

Demand for diamond jewellery continued strong in Southeast Asia. Sales in the United States were weak during the first half of the year but they improved in the second half. Demand in Europe and Japan remained weak.

Canada currently is not a commercial producer of natural diamonds. However, Canada's potential to become a producer was further defined during the year as several companies continued extensive exploration work at a number of locations.

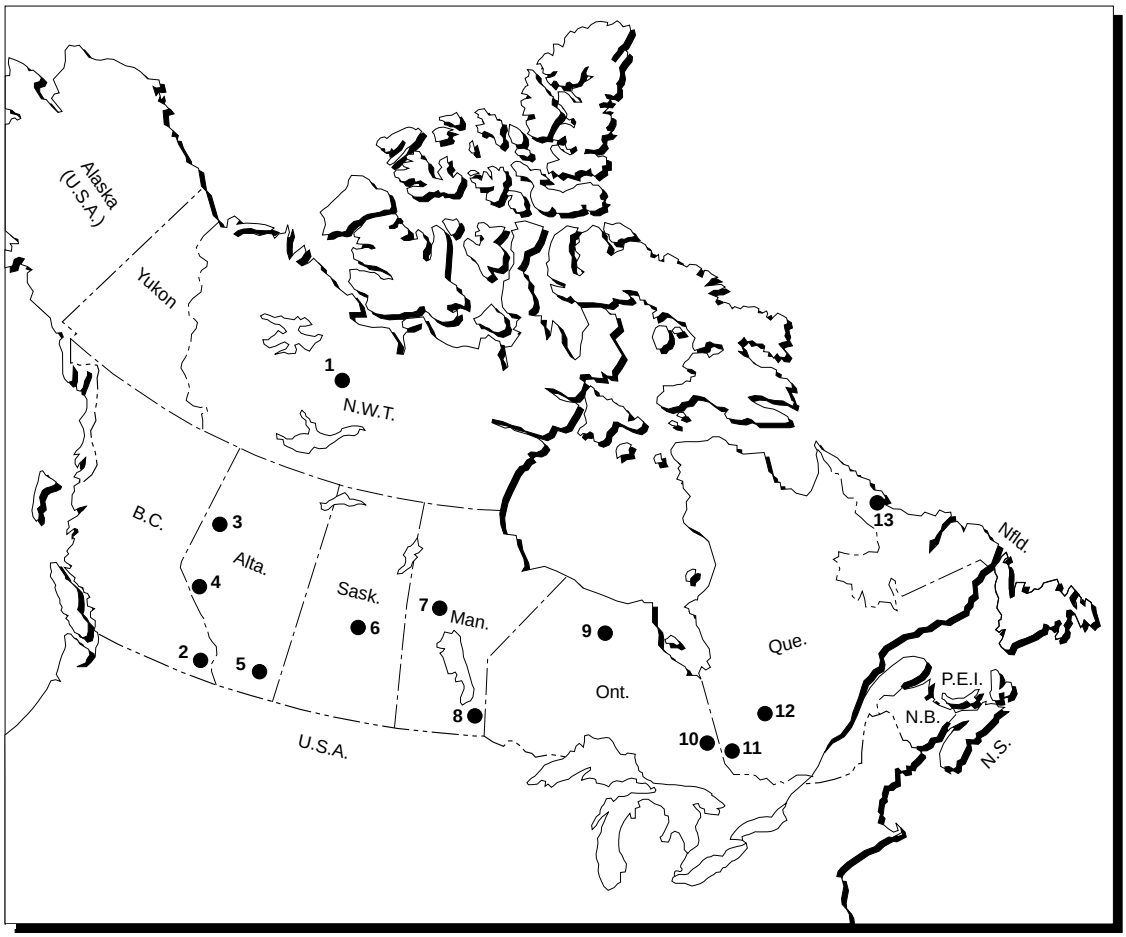
CANADIAN DEVELOPMENTS

A large area of northern and central Canada is underlain by a huge craton, which forms the nucleus of the North American continent. (A craton is part of the earth's crust and upper mantle that has attained stability, has been little deformed over a prolonged period of time, and has segments that are very old.) Studies of the global distribution of diamond-bearing rocks known as kimberlites show that these rocks are mainly confined to ancient cratons such as the one found in Canada. In addition, diamonds and diamond indicator minerals (e.g., subcalcic high-chrome garnet, chrome diopside, high-magnesia ilmenite, and high-chrome chromite) have been found in glacial deposits in numerous localities in Canada. Together these observations suggest that, given sufficient time and funds for exploration, the chances of discovering diamonds in Canada in commercial quantities are very good.

In 1994, exploration for diamonds continued, especially in the Northwest Territories, but also in Saskatchewan, Quebec, Alberta, Ontario, British Columbia, Manitoba, and Labrador. At year-end, BHP Diamonds Inc. 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 company has stated that, at today's prices for rough diamonds, the project to develop the pipes is economically feasible. Capital investment is expected to be in excess of US$500 million.

The five pipes, which are located under lakes that bear the same name, are known as Panda, Misery, Koala, Fox and Leslie. The lakes will have to be drained before mining can start. The pipes will be mined over approximately a 30-year period. Four pipes, starting with Panda to the northeast, followed by Koala, Leslie and Fox, are aligned almost in a straight line a few kilometres from each other in the watershed north of Lac de Gras. The fifth pipe, Misery, is located 27 km to the southeast, adjacent to Lac de Gras. The Panda open-pit would be developed

Figure 1
Major Diamond Exploration Areas in Canada, 1994



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. Snow Lake
8. Southeastern Manitoba
9. James Bay Lowlands
10. Kirkland Lake
11. Temiscamingue
12. Desmaraisville
13. Northern Labrador

first, followed by Misery (open-pit), Koala (open-pit), Panda (underground), Fox (open-pit), Koala (underground), and Leslie (open-pit). Preliminary results on two pipes are as follows: Koala, 0.75 ct/t at an average of US$110/ct, for a value of US$82/t ore; and Panda, 1.18ct/t at an average of US$127/ct, for a value of US$150/t of ore.

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 1.0-mm particle size (equivalent to 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, and sorting. No chemicals will be used in the process, and 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 work force during construction will reach 1000 at its peak. Production will employ a total of approximately 650 workers, of which 400 will be on shift and housed in a camp facility at the mine and processing plant site.

WORLD PRODUCTION

Natural Diamonds

An estimated 5000 kimberlite and lamproite pipes have been identified in the world. Between 300 and 500 contain diamonds. Of this number, less than

50 have proven to be commercial, and 25 have become major producers. Currently, 16 are producing mines. As noted earlier, world production of natural rough diamonds in 1993 was estimated at 108 Mct. Of the total production, some 50 Mct consisted of low-value industrial diamonds, 40-45 Mct were near-gems, and about 15-17 Mct were gem-quality diamonds. In terms of value, however, gems represent more than 75% of the total, near-gems about 20%, and industrial, 2-5%. World production of natural diamonds grew from 43 Mct in 1980 to 108 Mct in 1993; this represented an increase on average of 5 Mct/y. A large proportion of this increased production was absorbed through increased sales to Japan during the 1980s.

According to De Beers, 380 000 stones weighing over 1 ct each were produced in 1993; the total weight of the stones was 510 000 ct for an average of 1.34 ct per stone.

Natural diamonds are currently produced by some 20 countries. However, almost 95% of world production by weight has come from only five countries in recent years. They are, in decreasing order: Australia (38-42 Mct), Botswana (15-17 Mct), Zaire (15-18 Mct), Russia (11-18 Mct) and South Africa (8-10 Mct). In terms of value, Botswana is the leader, followed by Russia, the Republic of South Africa, Namibia, Australia, Zaire and Angola.

Australia and Zaire account for about 50-55%, by weight, of world production; however, more than 90% of their production consists of low-value industrial and near-gem diamonds. Diamonds mined in recent years have averaged about US$10/ct in Australia and US$15-$20/ct in Zaire. At the other end, Namibia, which produces less than 2% by weight of world production, has a very high proportion (+95%) of gem-quality diamonds, averaging US$220-$260/ct.

Grade (the weight of diamonds expressed as carats per tonne (ct/t) of ore) varies widely from one mine to another. However, the grade generally falls between 0.3 and 1.3 ct/t. Grades as low as 0.05 ct/t and as high as 7.0 ct/t have been exploited. The value of the ore per tonne equals the grade times the average value per carat of all the individual diamonds.

Diamonds are mined from pipes (mainly kimberlites, but also lamproites), from alluvial deposits, and from beach and offshore (marine) deposits. During transport of alluvial materials, the weak portions (cracks, inclusions, and other defects and impurities) of the diamonds are removed. This means that the gem ratio increases with transport and that, as a result, beach and offshore deposits usually have the highest gem ratio. Currently, there are less than 20 pipes being mined in the world in the following countries: Australia, Botswana, Russia, South Africa, Tanzania, and Zaire. Nearly two thirds of world production by weight comes from only five pipes situated in Australia, Botswana, Russia, and South Africa.

Synthetic Diamonds

Synthetic diamonds compete with natural industrial diamonds as an abrasive mineral and with silicon carbide (SiC), alumina (Al_2O_3), and cubic boron nitride (CBN) as a manufactured abrasive material. World production of synthetic diamonds in 1993 was estimated by the U.S. Bureau of Mines at 456 Mct; this compares with close to 420 Mct in 1992. The value of world synthetic diamond production is estimated at US$600 million-$800 million. Most marketed synthetic diamonds are 0.6-0.8 mm and smaller. A very popular type of synthetic diamond is called Saw Diamond Abrasives “SDA”; it is used for sawing, drilling or milling hard stones, concrete aggregate, refractory materials, masonry, and asphalt. Synthetic diamonds were invented in Sweden in 1953 and have been produced commercially since the late 1950s.

The production of synthetic diamonds using high-pressure and high-temperature methods is labour-intensive. Contrary to competing abrasive materials such as silicon carbide and alumina, the production of synthetic diamonds is not electricity-intensive. In 1994, synthetic diamonds were produced in at least 16 countries. The most important producing countries were, in decreasing order of importance, the United States, Russia, South Africa, Ireland, Japan, Belarus, Sweden, Germany, and China. Smaller plants exist in Serbia, Slovakia, Romania, France, England, Korea, and Greece. The two leading producers are De Beers of South Africa and General Electric of the United States. Each controls approximately 40% of world production; 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 the Republic of South Africa; in Sweden; and in Shannon, Ireland. General Electric has plants at Worthington, Ohio, and in Dublin, Ireland. Tomei of Japan is also a very important producer.

Consumption of synthetic diamonds continues to grow at a very healthy rate as industry conversion to super-abrasives continues. Although they are expensive compared with competing materials such as silicon carbide and alumina, synthetic diamonds are more cost-effective because they cut much faster and last much longer. In many applications, synthetic diamonds are preferred to natural industrial diamonds because they can be tailored to the customer’s needs. There are many types of synthetic diamonds, including those coated with metals such as copper or nickel for specific applications. Super-abrasives include synthetic diamonds, cubic boron nitride (CBN), polycrystalline synthetic diamond shapes (PDS), and compacts (PDC). More than 60% of all abrasive products used in Japan have diamond components, compared with about 40% in Europe and 20-30% in North America. For Canada, the gradual conversion from traditional abrasives (alumina and silicon carbide) to newer and better performing

super-abrasives is slowly eroding markets for traditional abrasives.

Because of their declining prices and technical superiority in industrial applications, synthetic diamonds continue to replace natural industrial-grade diamonds. The latter already make a relatively insignficant contribution to the revenue of most diamond mines. However, since they are recovered along with gem-quality diamonds, mines will continue to produce and sell industrial-grade diamonds.

Crystalline Manufacturing Ltd. of Calgary produces synthetic diamond films by the Chemical (also called Carbon) Vapour Deposition (CVD) method at a plant in Calgary, built in 1993 at a cost of some $4 million, excluding research and development. The process uses methane gas, argon and electricity as the key raw materials. Large quantities of electricity are required to disassociate methane gas at high temperature and to separate carbon from hydrogen before carbon is precipitated in the form of diamonds.

Major producers of industrial CVD products in the world are, in decreasing order: Sumitomo, De Beers, General Electric, St. Gobain (Norton), and Crystallume. Other important producers are: Diamonex (Monsanto), SI Diamond Tech, Asahi, Astex, ATM, Cemecon, Idemitsu, Mitsubishi, Nachi-Fiji, and Toshiba. World sales of CVD diamonds are estimated by General Electric at less than US$50 million. The industry reports that growth has slowed in recent years due to competition with polycrystalline synthetic diamonds. CVD products are used in three major fields of applications: (1) coatings on tools subject to wear; (2) optical-quality films (diamond is very hard and transparent to X rays, infrared and visible light); and (3) heat sinks and electronic substrates (diamond dissipates thermal energy very rapidly and has a heat conductivity five times that of copper). Future growth is expected to be in the computer, medicine, and thermal management fields.

CANADIAN TRADE AND CONSUMPTION

Canada's imports of gem-quality and industrial diamonds were valued at $211 million in 1990, $189 million in 1991, $187 million in 1992, $173 million in 1993, and $215 million in 1994. Some 90% of the imports were estimated to be gem-quality diamonds. Imports of synthetic diamond dust or powder were 5.92 Mct valued at $4.64 million in 1990, 7.36 Mct valued at $4.45 million in 1991, 5.32 Mct valued at $4.24 million in 1992, 2.11 Mct valued at $5.38 million in 1993, and 3.27 Mct valued at $8.71 million in 1994.

THE DIAMOND-CUTTING INDUSTRY

Natural diamonds are cut in some 30-40 countries. The major diamond-cutting centres in the world are Antwerp and Kempen, Belgium; Ramat-Gan and Tel-Aviv, Israel; New York City; and Surat and Bombay, India. With the exception of India, which is a very small producer of diamonds, none of these countries mines diamonds. Other countries with important cutting centres include the Republic of South Africa, Russia, Ukraine, Belarus, and Uzbekistan. Newcomers include Australia, Thailand, China, Botswana, Sri Lanka, Indonesia, Malaysia and, more recently, Yakutia in Russia. Many other countries also cut diamonds, but their industries are small. In recent negotiations with De Beers, the Namibian government indicated its desire for further processing in Namibia. As a consequence, De Beers and Namibian authorities are currently investigating the setting up of a cutting factory in Windhoek to be based on the supply by the CSO of rough diamonds on normal commercial terms.

Belgium is known as the world's largest trading centre for rough and polished diamonds, with a value of US$17 billion in 1993; close to 50% of the CSO's sales go to Antwerp. India cuts more carats of rough diamonds than any other country and, in 1993, it was the largest exporter of polished diamonds with a value of US$3.5 billion, followed by Israel at US$3.0 billion. Israel is the leader in diamond-cutting technology, and cuts a very wide range of diamonds; New York cuts the largest and best-quality stones.

In Russia, most production of rough diamonds comes from Yakutia. Yakutia has only recently established its own diamond-cutting industry and there were reportedly five cutting plants with capacities varying from 30 000 rough ct/y to close to 100 000 rough ct/y. The plants have been built as joint ventures with Belgian, Israeli, Japanese, and South Korean companies. Several more plants are planned over the next few years. Recently, Yakutia started sorting some of the diamonds it produces, with some being sold to its own cutting plants. An exchange facility for wholesale and retail trade in rough and cut diamonds is also planned.

Diamond-cutting is relatively labour-intensive in comparison with many other sectors. Automated cutting 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 facetting machines, lasers to shape the roughs, and computers that suggest an optimal cut based on the shape, dimensions and inclusions in a rough stone. Major diamond-cutting centres invariably have a very wide range of indirect jobs associated with them.

A review of the literature suggests that, on average, an employee cuts close to 800 rough ct/y. However, this number varies widely, depending on the size of the rough diamonds to be cut (usually, more carats can be cut from bigger diamonds), the difficulty of

the cut, and the level of automation in the factory. Because of high labour costs, factories in the United States usually cut bigger and better-quality diamonds. Belgium and Israel are in the middle of the labour-cost spectrum and, as a consequence, 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 production from New York is about US$1400; from Antwerp, US$750; from Tel Aviv, US$720-$750; and from India, US$250.

Employment related to diamond-cutting varies widely from factory to factory, running anywhere from 1 to 1000 workers. Total employment in diamond-cutting varies widely from country to country. For example, there are 500-600 cutters in the United States, 4000 in Belgium, some 8000 (35 factories) in Thailand, close to 10 000 each in Israel (600-650 factories) and Russia and more than 800 000 in India.

The major steps in diamond-cutting are: (a) studying the stone to locate the flaws (i.e., inclusions and imperfections in the stone), and marking with a pen where the stone is to be cut; (b) sawing (to remove flawed areas of the stone) with a saw impregnated with diamond dust or with a laser, or cleaving; (c) rounding or bruting (also known as "girdling") to shape the diamond into a round, pear, oval or other form; (d) facetting (also known as "brillianteering") by grinding sides into the diamond; and (e) polishing to remove surface irregularities and allow more light to penetrate the stone.

VALUATION AND SALES PROCEDURES

Rough Diamonds

The valuation of rough diamonds mined in the world is complex, with diamonds being classified into some 5000 categories, according to the industry. Rough diamonds are first sieved and sized; they are then classified. The stones are classified according to their *shape* ("sawables," which can be sawn with a diamond saw or laser, and "makeables," i.e., unsawable and which must be shaped by cleaving or other methods), *clarity* (five categories), and *colour* (five grades, which are further sub-divided into categories). Brilliant-cut gem diamonds usually have a yield (weight of the cut and polished stone/weight of the rough diamond) of 35-50% for sawables and 15-35% for less expensive makeable rough diamonds. The major sorting centres at or near diamond mines are Kimberly, Republic of South Africa; Gabarone, Botswana; Windhoek, Namibia; Perth, Australia; and Mirny, Russia. De Beers' main sorting house is in London, England. De Beers also sorts rough diamonds in Lucerne, Switzerland.

The CSO has been successful in maintaining a balance between the supply of and demand for rough diamonds for some 60 years. It buys surplus production of rough diamonds from mines and stockpiles during periods of weak demand in the jewellery market and sells off its stockpiled roughs as demand picks up. Production quotas may be applied to major producers when sales fall.

About 80% by weight of rough diamonds are marketed by the CSO and released to the market in a controlled way (to maintain a balance between the supply of and demand for different quality diamonds) by the CSO at "sights," which are held about every five weeks in Europe (London and Lucerne) and in South Africa, to about 170 carefully chosen buyers known as "sightholders." Some 40% of the sightholders reside in Belgium, 25% in India, some 25% in Israel, and about 10% in the United States. The majority of the sightholders are manufacturers that cut and polish the stones in their factories, although some wholesale firms that deal in rough diamonds also attend the sights. Once the stones are cut and polished, they are sold to diamond merchants or wholesalers of polished diamonds. Finally, the diamonds are in turn sold to manufacturing jewellers and retail outlets.

Cut and Polished Diamonds

To determine the value of an individual polished diamond, an appraiser looks at its combination of all the four "C"s: cut, colour, clarity, and carat (weight).

Cut

Polished diamonds come in a variety of shapes, the most common being round (also known as "brilliant"); other shapes (called "fancies") include oval, pear, marquise, heart, square, or triangle. Polished stones also vary in terms of their number of facets (surface planes). However, more important than these two factors to the value of the diamond is the **quality** of its cut. This is determined by: (a) the relative proportions of the table size, the crown height, and the pavilion depth of the diamond (which determines its brilliancy, i.e., the amount of light reflected through the stone); and (b) the angles of the facets (which determine the dispersion of light that creates the fiery rainbow colours). The quality of the cut is also determined by: (a) the symmetry of the table and the girdle and the location of the cullet (base); and (b) the quality of the polish. By far, the most popular cut diamond sold in the markets is the brilliant (58 facets). Fancy cuts represent about 10-20%, and single cuts (17 facets) represent about 10%.

Colour

The rarest and best colour in diamonds is no colour at all. The colour grade is a measure of the amount of colour present in a diamond. Most diamonds have a tinge of some colour (most often yellow or brown).

Strong (intense)-coloured diamonds called "fancies" command very high prices. Among the fancies, the browns (cognac) are the most common, followed by champagne and intense canary yellow. Orange and yellowish greens are rare; pink, blue, and dark green are the rarest colours and command the highest prices.

Clarity

This is a measure of the number, size, placement, and nature of flaws (inclusions and/or imperfections) within and on the surface of a diamond, visible at 10-power magnification. Inclusions are crystals, while imperfections are feathers, blemishes, cracks, etc.

Carat

One carat is equivalent to 0.2 grams. A carat is normally divided into 100 points. Because larger diamonds are rare, a 1-carat diamond will cost more than a cluster of 20 diamonds weighing a total of 1 carat.

USES

World retail sales of diamond jewellery in recent years have had a diamond content value of some US$9 billion and a diamond content weight of some 15-17 Mct. De Beers reports that, in 1993, world diamond retail jewellery sales had a diamond content valued at some US$9.1 billion. The major markets for diamond jewellery in 1993 in terms of diamond content value were approximately as follows: the United States, 32%; Japan, 23%; Europe, 13%; East Asia, 17%; and other countries, 15%. Since a considerable proportion of the rough stone is lost during cutting and polishing, only about 15-17% by weight of rough stones mined end up in jewellery. World retail sales of diamond jewellery reached highs of US$42.6 billion in 1992 and were estimated at US$42.5 billion in 1993. The East Asian market is growing steadily while, since the late 1980s, the markets of Europe, Japan and the United States have shown minimal growth.

Because they are the hardest substance known to man, natural and synthetic industrial diamonds are used in equipment that drill, cut, grind, and polish rocks (such as granite and marble), other materials (such as nonferrous metals, carbon fibre, and composites), and a range of nonmetallic materials (such as glass, refractories, ceramics, concrete, plastics, and masonry bricks). Natural and synthetic diamonds are widely used in the automotive, advanced technology, and aerospace industries.

PRICES

Published average mine prices of rough diamonds in recent years, including gem, near-gem and industrial diamonds, varied widely across producing countries: US$7-$8/ct in Australia, US$27/ct in Zaire, US$67/ct in Botswana, US$95/ct in Russia, US$105/ct in South Africa, US$157/ct in Angola, US$208/ct in Sierra Leone, and US$300/ct in Guinea and Namibia. This wide variation in prices has been mainly a function of the proportion of gem-quality diamonds produced by each country. As an example, in Australia the diamonds have a very low gem ratio, while in Namibia the gem ratio is very high. South Africa produces rough diamonds that vary in price from US$60 to $300/ct. In 1993, the average value of **gem** production in the major producing countries was as follows: US$250/ct in Namibia; US$150/ct in Russia; US$100/ct in Botswana; and US$100/ct in the Republic of South Africa.

Taking into account losses during cutting and polishing, as well as commissions paid to intermediaries, the price of a diamond sold to a jeweller is an estimated 5-6 times the price of the rough stone at the mine. Intermediary costs include those for advertising, sightholders' brokers, and wholesalers. The average U.S. wholesale asking price of the top 25 grades (D through H colour, and IF through VS2 clarity) of a 1-carat cut and polished diamond was about US$7300 at the end of 1993.

In 1993, the average value of U.S. imports of natural industrial diamond grit (40 microns to 1 mm) and powder (–40 microns), synthetic grit and powder, and industrial stones (>1 mm) were US$1.14/ct, US$0.64/ct, and US$4.56/ct, respectively. The prices of synthetic diamonds vary widely: 10¢/ct for friable material with irregular shapes; $1-$2/ct for polishing material; several dollars/ct for blocky, regular shapes with good crystal structure; and several thousand dollars/ct for large crystals with excellent structure for use in specific applications. The popular SDA diamonds noted earlier sell for $1-$3/ct.

PRODUCTION AND CONSUMPTION FORECAST AND OUTLOOK

It is difficult to forecast world production and consumption of diamonds with certainty. Production by certain countries cannot be estimated with precision because: (a) the information released by their governments is often vague or inaccurate; (b) smuggling is common practice in some countries; (c) stockpiles of roughs held by the CSO are published only in dollar value (US$4.38 billion as at December 31, 1994) at **cost**, and not in carats; and (d) Russia has a huge stockpile of rough gems estimated at US$3 billion-$5 billion. (Changes in either the CSO or Russian stockpiles can significantly affect world prices and, as a consequence, production.)

Bearing the above cautions in mind, some general comments can be made concerning future world diamond production. On the one hand, factors leading to a possible decline in production include: (a) the current rapid depletion of the reserves of certain mines in Russia and the Republic of South Africa; (b) the exhaustion of on-shore alluvial deposits of the Republic of South Africa and Namibia; (c) unstable conditions in certain countries of Africa, which are inhibiting production; and (d) uncertainties regarding the production potential of the Argyle mine in Australia in the early years of the next century. On the other hand, the above factors may be partially or totally offset by the following major supply developments: (a) increased offshore production in the Republic of South Africa and Namibia; and (b) the development of new mines in Canada and Russia.

On the consumption side, it is not known in precise terms how countries of East Asia and China will respond to increased advertising for diamond jewellery by De Beers, nor how forecast increases in Gross National Product/capita in these countries will translate into increased sales of diamonds.

In the short term, the oversupply of natural rough diamonds, especially in the lower-quality range categories, is likely to continue. However, industry sources predict that, by the late 1990s, consumption of diamonds should increase as Western economies recover and sales in Southeast Asian countries increase due to their rapidly growing economies. After the year 2000, sales to Eastern Europe are expected to pick up.

Johnson, Marriott & von Saldern estimate that, by the year 2000, world production of natural diamonds will vary from 84-136 Mct/y, with a best estimate of 113 Mct/y. An analysis by Yorkton Securities Inc. concluded that, without any production from Canada, world gem-diamond production should be around 17-18 Mct/y by the year 2000, and that an additional 3-4 Mct from Canada should be absorbable in world markets.

Note: Information in this review was current as of February 1, 1995.

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				
7102.21.10	Bort and black diamonds, for borers	Free	Free	Free	Free
7102.21.90	Other	9.5%	6.5%	Free	Free
7102.29	Diamonds, industrial, other, worked, not mounted or set				
7102.29.10	Bort and black diamonds, for borers	Free	Free	Free	Free
7102.29.90	Other	9.5%	6.5%	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
7105.10.10	Diamond dust for borers; dust mixed with a carrier in cartridges or in tubes	Free	Free	Free	Free
7105.10.91	Natural diamond dust or powder	9.5%	6.5%	Free	Free
7105.10.92	Synthetic diamond dust or powder	Free	Free	Free	Free

Sources: Customs Tariff, effective January 1995, Revenue Canada; Harmonized Tariff Schedule of the United States, 1995.

TABLE 1. CANADA, DIAMOND TRADE, 1992-94

Item No.		1992		1993		1994p	
		(carats)	($000)	(carats)	($000)	(carats)	($000)
EXPORTS							
7102.10	Diamonds, unsorted, whether or not worked						
	United States	..	210r	..	226	..	159
	Total	..	210r	..	226	..	159
7102.21	Diamonds, industrial, unworked or simply sawn, cleaved or bruted						
	United States	14 098	120	–	–	6 298	39
	Total	14 098	120	–	–	6 298	39
7102.29	Diamonds, industrial, n.e.s., excluding mounted or set diamonds						
	Mexico	–	–	–	–	13 000	533
	United States	5 620	87	12	12	85	55
	Ireland	–	–	100	12	–	–
	Total	5 620	87	112	24	13 085	588
7102.31	Diamonds, non-industrial, unworked or simply sawn, cleaved or bruted						
	United States	2 748	158	111	10	–	–
	New Zealand	40	40	–	–	–	–
	Total	2 788	198	111	10	–	–
7102.39	Diamonds, non-industrial, n.e.s., excluding mounted or set diamonds						
	United States	11 977	13 024	7 252	5 307	15 383	11 658
	Japan	–	–	–	–	2 647	5 297
	Hong Kong	108	99	11	21	81	57
	Other countries	258	353	20	35	9	3
	Total	12 343	13 478	7 283	5 364	18 120	17 017
7105.10	Diamond dust or powder						
	United States	425 921	199	128 168	196	164 975	258
	Bulgaria	–	–	–	–	29 600	29
	Other countries	2 270	5	50	...	–	–
	Total	428 191	205	128 218	197	194 575	287
IMPORTS							
7102.10	Diamonds, unsorted, whether or not worked, but not mounted or set						
	United States	..	10 664	..	18 825	..	17 243
	Belgium	..	22 703	..	16 712	..	9 898
	Israel	..	12 454	..	11 705	..	9 762
	India	..	3 770	..	5 106	..	5 882
	Iceland	..	689	..	2 121	..	634
	Other countries	..	1 841	..	1 429	..	1 671
	Total	..	52 128	..	55 905	..	45 099
7102.21.10	Diamonds, industrial, bort and black, for borers, unworked or simply sawn, cleaved or bruted, but not mounted or set						
	United States	209 899	1 022	246 403	974	338 908	1 168
	Ireland	25 476	90	–	–	135 673	508
	Zaire	27 009	99	44 789	198	88 524	404
	Belgium	3 346	33	6 979	69	42 627	347
	Other countries	15 879	101	8 643	58	77 196	509
	Total	281 609	1 348	306 814	1 301	682 928	2 945
7102.21.90	Diamonds, industrial, other than bort and black, for borers, unworked or simply sawn, cleaved or bruted, but not mounted or set						
	Ireland	–	–	–	–	19 000	89
	United States	1 938	6	2 347	21	3 879	38
	Other countries	–	–	643	5	–	–
	Total	1 938	6	2 990	28	22 879	127

TABLE 1 (cont'd)

Item No.		1992		1993		1994p	
		(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						
	Ireland	603 272	2 711	601 466	2 348	659 211	2 312
	United States	81 824	292	56 369	202	49 936	230
	Zaire	–	–	37 027	152	46 726	155
	South Africa	–	–	–	–	3 555	56
	Other countries	105 182	448	4 083	13	7 514	65
	Total	790 278	3 453	698 945	2 717	766 942	2 822
7102.29.90	Diamonds, industrial, other than bort and black, for borers, worked, but not mounted or set						
	Ireland	–	–	20 432	143	41 493	199
	United States	14 325	100	2 041	12	1 587	14
	Other countries	569	8	–	–	1 000	5
	Total	14 894	109	22 473	156	44 080	219
7102.31	Diamonds, non-industrial, unworked or simply sawn, cleaved or bruted, not mounted or set						
	Belgium	90	47	21	21	912	224
	United States	52	50	44	16	296	180
	Total	142	98	65	38	1 208	404
7102.39.00.10	Diamonds, non-industrial, worked, of a weight not exceeding 0.5 carat each						
	Belgium	38 580	18 199	57 507	23 140	51 943	24 758
	United States	22 330	11 030	17 656	11 055	29 803	21 606
	Israel	10 618	7 605	13 022	7 150	11 462	7 878
	Russia[1]	53 821	19 229	36 905	11 949	22 487	6 894
	India	6 549	2 365	6 163	1 988	7 581	3 159
	United Kingdom	53	37	530	561	1 066	961
	Other countries	2 825	1 181	2 201	1 877	2 101	1 445
	Total	134 776	59 646	133 984	57 726	126 443	66 710
7102.39.00.20	Diamonds, non-industrial, worked, of a weight exceeding 0.5 carat each						
	Belgium	18 999	14 412	20 445	18 111	35 506	28 841
	Russia[1]	19 560	36 574	10 684	15 731	20 088	27 181
	Israel	8 065	6 152	9 227	9 962	17 066	16 944
	United States	10 322	10 873	7 919	8 962	16 047	15 837
	India	1 536	742	1 822	566	13 610	4 518
	Iceland	260	138	241	301	523	682
	Other countries	1 401	1 489	1 024	1 151	2 320	2 301
	Total	60 143	70 380	51 362	54 794	105 160	96 312
7105.10.10	Diamond dust for borers; dust mixed with a carrier in cartridges or in tubes						
	United States	190 632	455	278 709	796	306 241	599
	Ireland	14 851	12	12 130	10	16 994	73
	Other countries	15 083	53	12 347	54	32 782	115
	Total	220 566	521	303 186	862	356 017	792
7105.10.91	Natural diamond dust or powder						
	United States	1 059	2	501	4	929	6
	Total	1 059	2	501	4	929	6
7105.10.92	Synthetic diamond dust or powder						
	United States	1 018 207	1 824	1 719 902	4 248	2 060 492	5 532
	Ireland	205 509	958	251 152	1 027	607 071	2 527
	Romania	113 500	189	133 000	94	522 900	369
	Russia[1]	3 933 263	1 096	–	–	7 431	24
	Other countries	49 660	175	7 256	8	73 574	251
	Total	5 320 139	4 245	2 111 310	5 378	3 271 468	8 706

Source: Statistics Canada.
– Nil; . . Not available; . . . Amount too small to be expressed; n.e.s. Not elsewhere specified; p Preliminary; r Revised.
1 Former U.S.S.R. for 1992.
Note: Numbers may not add to totals due to rounding.

TABLE 2. DIAMONDS, WORLD PRODUCTION, BY TYPE AND COUNTRY[1]

Country	1992				1993[e]			
	Natural				Natural			
	Gem[2]	Industrial	Total[3]	Synthetic[4]	Gem[2]	Industrial	Total[3]	Synthetic[4]
	(000 carats)							
Angola[5]	1 100[r]	80[r]	1 180[r]	–	470	30	500	–
Australia	17 750[r]	22 250[r]	40 000[r,e]	–	19 000	23 200	42 200	–
Belarus	–	–	–	30 000[r]	–	–	–	30 000
Botswana	11 160[r]	4 790[r]	15 946[r]	–	12 000	5 000	17 000	–
Brazil[e]	653[r]	665[r]	1 318[r]	–	600	900	1 500	–
Central African Republic	307[r]	107[r]	414[r]	–	307	106	413	–
China[e]	200	800	1 000	15 000	230	850	1 080	15 500
Czech Republic[7]	–	–	–	–	–	–	–	5 000
Czechoslovakia[8,e]	–	–	–	10 000[r]	–	–	–	–
France[e]	–	–	–	3 500[r]	–	–	–	3 500
Gabon[e]	400	100	500	–	400	100	500	–
Ghana[9]	570[r]	140[r]	710[r]	–	600	150	750	–
Greece[e]	–	–	–	750	–	–	–	1 000
Guinea[6]	90	5	95	–	90	5	95	–
Guyana	13[r]	32[r]	45[r,e]	–	14	36	50	–
India	15[r]	3[r]	18	–	16	3	19	–
Indonesia[e]	6	21	27	–	7	20	27	–
Ireland[e]	–	–	–	60 000	–	–	–	66 000
Ivory Coast[6,e]	11	4	15	–	11	4	15	–
Japan[e]	–	–	–	30 000	–	–	–	32 000
Liberia[10,e]	62[r,a]	93[r,a]	155[r,a]	–	60	90	150	–
Namibia	1 500[r]	50	1 548[r]	–	1 100	40	1 139[a]	–
Romania	–	–	–	–	–	–	–	–
Russia[e]	9 000	9 000	18 000	80 000	8 000	8 000	16 000	80 000
Servia and Montenegro[11]	–	–	–	5 000	–	–	–	5 000
Sierra Leone[6]	200[r]	96[r]	296[r]	–	90	68	158[a]	–
Slovakia	–	–	–	–	–	–	–	5 000
South Africa, Republic of								
Finsch mine	1 200	2 250	3 466	–	700	1 300	2 012[a]	–
Premier mine	740	1 700	2 444	–	500	1 100	1 596[a]	–
Venetia mine	660	1 200	1 868	–	1 750	3 200	4 969[a]	–
Other De Beers' properties[12]	1 350	500	1 849	–	900	350	1 249[a]	–
Subtotal	4 400[r]	5 750[r]	10 166[r]	60 000[e]	4 300	6 050	10 324	75 000
Swaziland	36	24	51[r]	–	27	18	45	–
Sweden[e]	–	–	–	25 000	–	–	–	25 000
Tanzania	48[r]	20[r]	68[r]	–	48	20	68	–
U.S.S.R.[13,e]	–	–	–	–	–	–	–	–
Ukraine	–	–	–	10 000[e]	–	–	–	10 000
United States	–	–	–	90 000	–	–	–	103 000
Venezuela	302[r]	176[r]	478[r]	–	335	200	535	–
Yugoslavia[14,e]	–	–	–	–	–	–	–	–
Zaire	8 934[r,a]	4 567[r,a]	13 501[r]	–	9 500	5 500	15 000	–
Total	56 757[r]	48 773[r]	105 521[r]	419 250[r]	57 205	50 390	107 620	456 000

Sources: Natural Resources Canada; U.S. Bureau of Mines.
– Nil; [e] Estimated; [r] Revised.
[a] Reported figure.
[1] Table includes data available through June 8, 1994. Total natural diamond output (gem plus industrial) for each country actually is reported, except where indicated by a footnote to be estimated. In contrast, the detailed separate production data for gem diamonds and industrial diamonds are U.S. Bureau of Mines estimates except Brazil (1989-90), and the Central African Republic (1989-90), for which source publications give details on grade as well as totals. The estimated distribution of total output between gem and industrial diamonds is conjectural, and for most countries, is based on the best available data at time of publication. [2] Includes near-gem and cheap-gem qualities. [3] Natural gem and industrial data may not add to totals shown because of independent rounding. [4] Includes all synthetic diamond production. [5] Figures do not include smuggled artisan production. [6] Figures are estimates based on reported exports and do not include smuggled diamonds. [7] Formerly part of Czechoslovakia. [8] Dissolved on December 31, 1992. [9] "Gem" vs. "Industrial" diamond breakdown has been revised to reflect the value of near-gem material, classified as industrial prior to 1991, but which was ultimately being sold for well above industrial prices. [10] Data for 1989 do not include smuggled production. Data for 1990-92 are estimates of artisan production, likely smuggled out of Liberia, but which are comparable to that hitherto reported to the government. [11] Formerly part of Yugoslavia. [12] Other De Beers' Group output from the Republic of South Africa includes the Kimberley mines, the Koffiefontein mine, and the Namaqualand mines. [13] Dissolved in December 1991. [14] Dissolved in April 1992.
Notes: This table does not include data for South Korea, the Federal Republic of Germany, or the United Kingdom. At the time of publication, synthetic diamond production capacity and/or the operational status of these plants had not been confirmed. Production capacity of the synthetic diamond facility in Romania is estimated at 3-5 Mct/y.

TABLE 3. DE BEERS' CSO ROUGH DIAMOND SALES AND STOCKS, 1985-94

Year	Sales	Stocks
	(US$ billions)	
1985	1.80	1.90
1986	2.56	1.85
1987	3.07	2.30
1988	4.17	2.00
1989	4.09	2.47
1990	4.17	2.68
1991	3.93	3.03
1992	3.42	3.76
1993	4.37	4.12
1994p	4.25	4.38

Sources: U.S. Bureau of Mines; American Diamond Industry Association.
CSO = Central Selling Organization.
p Preliminary.

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		
Republic of South Africa		√
Thailand	√	√
China, People's Republic of	√	√
Sri Lanka	√	
MINOR CENTRES		
Armenia	√	√
Australia		√
Botswana		√
Brazil		√
Central African Republic	√	√
Puerto Rico	√	√
Hong Kong	√	√
Taiwan	√	√
South Korea	√	√
Japan		√
Singapore	√	√
Indonesia	√	√

Sources: Natural Resources Canada; De Beers Centenary AG.
√ Minor production; √ Major production.
1 Near gems are rough diamonds valued at approximately US$5-$50/ct. 2 Gems are rough diamonds with a value greater than US$50/ct.
Note: The categories "major, intermediate and minor" are defined by a combination of quantity (ct) and value of rough diamonds cut.

TABLE 5. RETAIL SALES OF DIAMOND JEWELLERY, 1984-93

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993p
	(US$ millions)									
United States	8 400	9 577	10 407	11 773	11 877	12 194	11 397	11 101	11 274	12 019
Japan	4 850	4 765	7 506	9 682	12 647	12 467	12 358	13 308	12 713	13 459
Europe	2 852	2 911	4 270	5 599	6 834	7 408	8 447	7 932	8 289	7 116
East Asia	558	556	985	1 281	1 685	1 878	1 892	2 160	2 481	2 719
Other	3 842	4 299	5 070	5 824	6 097	6 960	7 160	7 353	7 248	7 201
World	20 500	22 109	28 247	34 260	39 541	40 905	41 361	41 852	42 605	42 514

Source: De Beers Consumers Advertising Division Research, unadjusted for inflation.
p Preliminary.

TABLE 6. PRICES OF COLOURLESS DIAMONDS VS. FANCY COLOUR DIAMONDS

Colourless Diamonds				Price	Fancy Colour Diamonds				Price
Carats	Shape	Colour	Clarity	Per Carat	Carats	Shape	Colour	Clarity	Per Carat
				(US$)					(US$)
(C) 5.05	Rectangular	G	IF	13 600	(C) 4.72	Rectangular	pink	VS1	140 400
(C) 23.25	Pear-shaped	F	IF	33 700	(S) 20.17	Emerald	blue	VS2	490 952
(S) 11.00	Pear-shaped	D	IF	35 227	(C) 10.64	Circular (round)	yellow	VS	7 250
(C) 4.13	Pear-shaped	E	IF	18 500	(S) 3.09	Emerald	blue	VS1	132 524
(C) 30.75	Rectangular	D	IF	79 000	(S) 28.59	Oval	yellow	VVS1	12 399
(C) 14.13	Rectangular	D	VVS1	32 900	(C) 12.02	Modified rectangular	light yellow	IF	10 275
(C) 5.46	Rectangular	F	VVS2	15 600	(C) 5.94	Square	intense yellow	VS1	41 200

Source: The Diamond Registry Bulletin, October 31, 1994, p. 5.
Notes: Sales results from both Sotheby's and Christie's major fall jewellery auctions show that fancy-coloured diamonds commanded substantially higher prices per carat – sometimes more than ten times the price fetched by stones of superior clarity including internally flawless stones or potentially internally flawless stones (if a small impurity can be removed through cutting). A notable exception: light yellow diamonds clearly command a lower price than pinks or blues. Auction houses are represented by (S) for Sotheby's or (C) for Christie's.