GEMSTONES

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In this report, the terms "gem" and "gemstone" mean any mineral or organic material (such as amber, pearl, and petrified wood) used for personal adornment, display, or object of art because it possesses beauty, durability, and rarity. Of more than 4,000 mineral species, only about 100 possess all these attributes and are considered to be gemstones. Silicates other than quartz compose the largest group of gemstones; oxides and quartz compose the second largest (table 1). A further subcategory of gemstones is colored gemstone, which in this report designates all nondiamond gemstones, including amber, coral, and shell. In addition, synthetic gemstones, cultured pearls, and gemstone simulants are discussed but are treated separately from natural gemstones (table 2). Trade data in this report are from the U.S. Census Bureau. Quantities are reported in carats, unless otherwise noted. All percentages in the report were computed based on the unrounded data. Current information on industrial-grade diamond and industrial-grade garnet can be found in the U.S. Geological Survey (USGS) Minerals Yearbook chapters on industrial diamond and industrial garnet.

Gemstones have fascinated humans since prehistoric times. They have been valued as treasured objects throughout history by all societies in all parts of the world. Amber, amethyst, coral, diamond, emerald, garnet, jade, jasper, lapis lazuli, pearl, rock crystal, ruby, serpentine, and turquoise are some of the first stones known to have been used for making jewelry. These stones served as symbols of wealth and power. Today, gems are not worn to demonstrate wealth as much as they are for pleasure or in appreciation of their beauty.

Production

Commercial mining of gemstones has never been extensive in the United States. More than 60 varieties of gemstones have been produced commercially from domestic mines, but most of the deposits have been relatively small compared with other mining operations. In the United States, much of the current gemstone mining is conducted by collectors, gem clubs, and hobbyists rather than business organizations.

The commercial gemstone industry in the United States consists of individuals and companies that mine gemstones or harvest shell and pearl, firms that manufacture synthetic gemstones, and individuals and companies that cut natural and synthetic gemstones. The domestic gemstone industry is focused on the production of colored gemstones and on the cutting of large diamonds. Industry employment is estimated to range from 1,000 to 1,500 workers (U.S. International Trade Commission, 1997, p. 1).

Most natural gemstone producers in the United States are small businesses that are widely dispersed and operate independently. The small producers probably have an average of less than three employees, including those who only work part time. The number of gemstone mines operating from year to year fluctuates because the uncertainty associated with the discovery and marketing of gem-quality minerals makes it difficult to obtain financing for developing and sustaining economically viable deposits (U.S. International Trade Commission, 1997, p. 23).

The total value of natural gemstones produced in the United States during 2002 was estimated to be at least $12.6 million (table 3). The production value was 15% less than that of the preceding year. The production decrease was mostly because the 2002 shell harvest was 49% less than in 2001.

The estimate of 2002 U.S. gemstone production was based on a survey of more than 230 domestic gemstone producers conducted by the USGS. The survey provided a foundation for projecting the scope and level of domestic gemstone production during the year. However, the USGS survey did not represent all gemstone activity in the United States, which includes thousands of professional and amateur collectors. Consequently, the USGS supplemented its survey with estimates of domestic gemstone production from related published data, contacts with gemstone dealers and collectors, and information garnered at gem and mineral shows.

Natural gemstone materials indigenous to the United States are collected, produced, and/or marketed in every State. During 2002, all 50 States produced at least $1,000 worth of gemstone materials. Seven States accounted for nearly 80% of the total value, as reported by survey respondents. These States, in order of declining value of production, were Tennessee, Arizona, Oregon, California, Arkansas, Idaho, and Montana. Some States were known for the production of a single gemstone material—Tennessee for freshwater pearls and Arkansas for quartz, for example. Other States produced a variety of gemstones, like Arizona, whose gemstone deposits included agate, amethyst, azurite, chrysocolla, garnet, jade, jasper, malachite, obsidian, onyx, opal, peridot, petrified wood, smithsonite, and turquoise. There is also a wide variety of gemstones found and produced in California, Idaho, Montana, and North Carolina.

The United States has two significant operations in known diamond-bearing areas. The first, the Kelsey Lake diamond mine, is the United States' only commercial diamond mine and is close to the Colorado-Wyoming State line near Fort Collins, CO. Kelsey Lake did not report any production during 2002, and the company was upgrading the equipment in the processing plant. The mine is owned and operated by Great Western Diamond Co. (a subsidiary of McKenzie Bay International, Ltd. of Canada). The Kelsey Lake property includes nine known kimberlite pipes, of which three have been tested and have shown that diamonds are present. The remaining six pipes have yet to be fully explored and tested for their diamond potential.

Of diamonds recovered, 50% to 65% was clear gem quality, and almost one-third was one carat or larger in size. The identified resources are at least 17 million metric tons (Mt) grading an average of 4 carats per hundred metric tons (Taylor Hard Money Advisers, 2000§[1]).

The second operation is in Crater of Diamonds State Park near Murfreesboro in Pike County, AR, where a dig-for-fee operation for tourists and rockhounds is maintained by the State. Crater of Diamonds is the only diamond mine in the world that is open to the public. The diamonds occur in a lamproite breccia tuff associated with a volcanic pipe and in the soil developed from the lamproite breccia tuff. In 2002, 614 diamonds with an average weight of 0.12 carat were recovered at Crater of Diamonds State Park. Seven of the diamonds weighed more than 1 carat each. Since the diamond bearing pipe and the adjoining area became a State park in 1972, more than 22,000 diamonds have been recovered (J. Michael Howard, Geology Supervisor, Arkansas Geological Commission, written commun., 2003). Recent exploration demonstrated that there is about 78.5 Mt of diamond-bearing rock in this diamond deposit (Howard, 1999, p. 62). An Arkansas law, enacted early in 1999, prohibits commercial diamond mining in the park (Diamond Registry Bulletin, 1999).

Studies by the Wyoming Geological Survey have shown that Wyoming has the potential for a $1 billion diamond mining business. Wyoming has many of the same geologic conditions as Canada, and there is evidence of hundreds of kimberlite pipes in the State. Twenty diamondiferous kimberlite pipes and one diamondiferous mafic breccia pipe have been identified in southern Wyoming. Two of the largest kimberlite fields, State Line and Iron Mountain, and the largest lamproite field, Leucite Hills, in the United States are in Wyoming. There has been slight interest in the southern Wyoming and northern Colorado area by several diamond mining firms, but the only diamond mine developed in the area thus far is the Kelsey Lake mine. Individual diamond gems worth $89,000 and $300,000 have been found there (Associated Press, 2002§).

In addition to natural gemstones, synthetic gemstones and gemstone simulants are produced in the United States. Synthetic gemstones have the same chemical, optical, and physical properties as the natural materials that they appear to be. Simulants have an appearance similar to that of a natural gemstone material, but they have different chemical, optical, and physical properties. Synthetic gemstones produced in the United States include alexandrite, cubic zirconia, diamond, emerald, moissanite, ruby, sapphire, and turquoise. Simulants of coral, lapis lazuli, malachite, and turquoise also are manufactured in the United States. In addition, certain colors of synthetic sapphire and spinel, used to represent other gemstones, are classified as simulants.

Synthetic gemstone production in the United States was more than $18.1 million during 2002; simulant gemstone output was even greater and was estimated to be more than $100 million. Six firms in six States, representing virtually the entire U.S. synthetic gemstone industry, reported production to the USGS. The States with reported synthetic gemstone production were Arizona, California, Florida, Michigan, New York, and North Carolina.

One U.S. company, Gemesis Corp., produced consistent-quality synthetic gem diamond and reported a third year of production in 2002. The synthetic diamonds are produced using technology, equipment, and expertise developed by a team of scientists from Russia and the University of Florida. The weight of the synthetic diamond stones range from 1.5 to 2 carats, and the stones are yellow, brownish yellow, colorless, and green (Weldon, 1999§). During 2002, Gemesis moved into a new facility near Sarasota, FL, where it now has 27 diamond-growing machines running and eventually plans to have a total of 250 machines installed. Each of the machines is capable of growing 3-carat rough diamonds by generating temperatures and pressures that recreate the conditions in the Earth's mantle, where diamonds form (Davis, 2003). In the next year and a half, Gemesis machines could be producing as many as 30,000 to 40,000 stones each year, and revenues may hit $70 million to $80 million per year (Diamond Registry Bulletin, 2001). Gemesis diamonds will be available in retail jewelry stores in fall 2003. The prices of the Gemesis synthetic diamonds will be below those of natural diamond but still above the prices of simulated diamond (Weldon, 2003§).

A second U.S. company, Apollo Diamond, Inc., has developed and patented a method for growing gem-quality diamonds by chemical vapor deposition (CVD). The CVD technique transforms carbon into plasma, which then is precipitated onto a substrate as diamond. CVD has been used for more that a decade to cover large surfaces with microscopic diamond crystals, but until this process, no one had discovered the combination of temperature, gas composition, and pressure that results in the growth of a single diamond crystal. Robert Linares of Apollo Diamond received a patent for the process in June 2003. Now CVD diamonds can be grown for about $5 per carat. CVD diamonds precipitate as nearly 100% pure, almost flawless diamond and, therefore, may not be discernible from natural diamond. Apollo Diamond is planning to start selling their diamonds on the jewelry market by January 2004 (Davis, 2003).

In 2002, a North Carolina firm entered its fifth year of marketing moissanite, a gem-quality synthetic silicon carbide it produces. Moissanite is also an excellent diamond simulant, but it is being marketed for its own gem qualities.

Consumption

Although the United States accounts for little of the total global gemstone production, it is the world's leading gemstone market. U.S. gemstone markets accounted for more than an estimated 35% of world gemstone demand in 2002. The U.S. market for unset gem-quality diamond during the year was estimated to have exceeded $12.1 billion. Domestic markets for natural, unset nondiamond gemstones totaled about $788 million.

A poll conducted by a U.S. jewelry retailers association in the mid-1990s showed that about two-thirds of domestic consumers who were surveyed designated diamond as their favorite gemstone (ICA Gazette, 1996). In 2002, the top-ten-selling colored gemstones, in descending order, were blue sapphire, ruby, emerald, tanzanite, amethyst, rhodolite garnet, pearl, opal, peridot, and blue topaz. Only 27% of the jewelry retailers said their sales were down in 2002 compared with 37% in 2001.

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

During 2002, 32% of the retail gemstone jewelry purchases were in the under $500 price range (Prost, 2003). During the 2002 holiday season, consumers were cautious, and the U.S. retail sales increase was a low 2.2% overall (by value). Mall-based jewelry stores posted only an 0.8% increase compared with sales of the 2001 holiday shopping season (Diamond Registry Bulletin, 2003d). In 2002, the value of the U.S. diamond jewelry market increased by 5% from that of 2001 to $27.4 billion. This means that the U.S. market accounted for more than one-half of the world's diamond jewelry sales in 2002. During 2002, diamond engagement rings accounted for 84% of all engagement rings purchased, an increase of 2.5% compared with 2001. The value of the U.S. diamond engagement ring market was $4.3 billion (Diamond Registry Bulletin, 2003c). In addition to jewelry, gemstones are used for collections, decorative art objects, and exhibits.

Prices

Gemstone prices are governed by many factors and qualitative characteristics, including beauty, clarity, defects, demand, durability, and rarity. Diamond pricing, in particular, is complex; values can vary significantly depending on time, place, and the subjective evaluations of buyers and sellers. There are more than 14,000 categories used to assess rough diamond and more than 100,000 different combinations of carat, clarity, color, and cut values used to assess polished diamond (Pearson, 1998).

Colored gemstone prices are generally influenced by market supply and demand considerations, and diamond prices are supported by producer controls on the quantity and quality of supply. Values and prices of gemstones produced and/or sold in the United States are listed in tables 3 through 5. In addition, customs values for diamonds and other gemstones imported, exported, or reexported are listed in tables 6 through 10.

De Beers Group companies are a significant force affecting gem diamond prices worldwide because they mine about one-half of the diamonds produced each year. The companies also sort and valuate about two-thirds (by value) of the world's annual supply of rough diamonds through De Beers' subsidiary Diamond Trading Co. (DTC), which has marketing agreements with other producers.

Foreign Trade

During 2002, total U.S. gemstone trade with all countries and territories was about $17.3 billion, which was approximately 12% more (by value) than gemstone trade of the previous year. Diamonds accounted for about 96% of the 2002 gemstone trade total. In 2002, U.S. exports and reexports of diamond were shipped to 73 countries and territories, and imports of all gemstones were received from 114 countries and territories (tables 6-10). During 2002, U.S. trade in cut diamonds increased by about 15% compared with the previous year, and the United States remained the world's leading diamond importer. The United States is a significant international diamond transit center as well as the world's largest gem diamond market. The large volume of reexports shipped to other centers reveals the significance that the United States has in the world's diamond supply network (table 6).

Synthetic gemstone trade increased by more than 15% for the United States in 2002 compared with the previous year. Synthetic gemstone imports from Austria, China, Germany, Hong Kong, Switzerland, and Thailand made up almost 87% (by value) of the total domestic imports of synthetic gemstones during the year. Prices of certain synthetic gemstone imports, such as amethyst, were very competitive. The marketing of synthetic imports and enhanced gemstones as natural gemstones and the mixing of synthetic materials with natural stones in imported parcels continued to be problems for some domestic producers in 2002. There were also problems with some simulants being marketed as synthetic gemstones during the year.

World Review

The gemstone industry worldwide has two distinct sectors—diamond mining and marketing and the production and sale of colored gemstones. Most diamond supplies are controlled by a few major mining companies; prices are supported by managing the quality and quantity of the gemstones relative to demand, a function performed by De Beers through DTC. Unlike diamonds, colored gemstones are primarily produced at relatively small low-cost operations with few dominant producers; prices are influenced by consumer demand in addition to supply availability.

In 2002, world diamond production totaled about 132 million carats—76.5 million carats gem quality and 55.2 million carats industrial grade (table 11). Most production was concentrated in a few regions—Africa [Angola, Botswana, Congo (Kinshasa), Namibia, and South Africa], Asia (northeastern Siberia and Yakutia in Russia), Australia, North America (Northwest Territories in Canada), and South America (Brazil and Venezuela). In 2002, Australia led the world in total diamond output quantity (combined gemstone and industrial), and Botswana was the world's leading gemstone diamond producer in terms of output value and quantity.

De Beers reported that its sales of rough diamonds for 2002 were $5.15 billion, which was up by 15.7% from $4.45 billion in 2001. De Beers diamond stocks were reduced by nearly $1 billion during the year, and De Beers reported a net income of $434 million in 2002, down from $492 million the previous year (Diamond Registry Bulletin, 2003b).

The Antwerp High Council in Belgium reported that overall diamond trade increased by 14.8% to $26.3 billion during 2002. That was the combination of an increase of 18.9% in rough diamond trade and an increase of 10.7% in polished diamond trade. The United States was the strongest market for Antwerp polished diamond with exports to the United States increasing by 13% to $2.28 billion during 2002 (Diamond Registry Bulletin, 2003a).

Additional events in 2002 significant to diamond mining, production, and marketing worldwide include the following:

- The Ekati Diamond Mine, Canada's first operating commercial diamond mine, completed its fourth full year of production. In 2002, Ekati produced 4.98 million carats of diamonds (BHP Billiton Ltd., 2003). BHP Billiton has an 80% controlling ownership of the Ekati Mine in the Northwest Territories in Canada. Ekati has estimated reserves of 60.3 Mt of ore in kimberlite pipes that contain

54.3 million carats of diamonds, and the mine life is projected to be 25 years. Operating at full capacity, Ekati production is expected to range from 3.5 million to 4.5 million carats per year. Ekati diamonds are sold by BHP's Antwerp sales office. The Ekati is now producing from the Koala, Misery, and Panda kimberlite pipes (BHP Billiton Ltd., 2001). The Ekati already accounts for 4% of the world market by weight and 6% by value (Law-West, 2002). In 2002, BHP Billiton began using underground mining techniques to recover diamonds from deeper portions of the Koala and Panda kimberlite pipes, which were first open pit mined (Diamond Registry Bulletin, 2002). De Beers' hold on the world diamond market was further reduced at the end of 2002 when the agreement between Ekati and De Beers to sell 35% of Ekati production to De Beers expired and was not renewed. The agreement had helped Ekati get started in the world diamond market and ended on good terms (Jewelers' Circular Keystone, 2002).

- The Diavik Diamond Mine, also in the Northwest Territories, has estimated reserves of 25.6 Mt of ore in kimberlite pipes, containing 102 million carats of diamond, and the mine life is projected to be 20 years. Diavik received the required permits and regulatory approval in 2000 and began site infrastructure development and project construction. Diavik is an unincorporated joint venture between Diavik Diamond Mines Inc. (60%) and Aber Diamond Mines Ltd. (40%). The Diavik mine began diamond production in December 2002, and it should be built up to full production by February 2003—60 days ahead of the projected opening date (Professional Jeweler, 2002§). The mine is expected to produce about 102 million carats of diamond at a rate of 6 million carats per year worth about $63 per carat (Diavik Diamond Mines Inc., 2000, p. 10-12).
- A third Canadian commercial diamond project in the Northwest Territories is the Snap Lake diamond project. De Beers Canada Mining Inc. has projected that Snap Lake would begin production in 2006 or 2007 (Law-West, 2002). The Snap Lake diamond project has estimated reserves of 22.8 Mt of ore in a kimberlite dike that contains 38.8 million carats of diamond. The mine life is projected to be 20 years or more (Jack T. Haynes, Assistant Site Manager, De Beers Canada Mining Inc., oral commun., 2001).

In 2002, the worldwide diamond industry recovered somewhat from low demand in 2001 and moved toward the record levels of 2000. The world rough diamond supply increased by almost 10%, world demand for polished wholesale diamonds increased by 4%, and world diamond jewelry retail sales increased by 3% compared with the levels of 2001. This growth was constrained by economic uncertainties, weak stock markets, low consumer confidence, corporate "creative accounting" scandals, the hostilities in Afghanistan, and the long lead time to the expected arrival of U.S. and allied troops in Iraq. Worldwide diamond jewelry retail sales were valued at $56.9 billion, containing diamond valued $14.5 billion (polished wholesale prices) (Diamond Intelligence Briefs, 2003).

In 2002, an international rough diamond certification system called the Kimberley Process Certification Scheme (KPCS) was implemented to solve the problem of conflict diamonds—those rough diamonds used by rebel forces and their allies to help finance warfare aimed at subverting governments recognized as legitimate by the United Nations (U.N.). The KPCS was agreed upon by U.N. member nations, the diamond industry, and involved nongovernmental organizations. The KPCS includes the following key elements: the use of forgery-resistant certificates and tamper proof containers for shipments of rough diamonds; internal controls and procedures that provide credible assurance that conflict diamonds do not enter the legitimate diamond market; a certification process for all exports of rough diamonds; the gathering, organizing, and sharing of import and export data on rough diamonds with other participants of relevant production; credible monitoring and oversight of the international certification scheme for rough diamonds; effective enforcement of the provisions of the certification scheme through dissuasive and proportional penalties for violations; self regulation by the diamond industry that fulfills minimum requirements; and the sharing of information with all other participants on relevant rules, procedures, and legislation as well as examples of national certificates used to accompany shipments of rough diamonds (Weldon, 2001§). The KPCS will not be fully implemented until all participating countries have passed the necessary laws to carry it out.

- In the United States, the Clean Diamond Trade Act, which will implement effective measures to stop trade in conflict diamonds, was passed by the U.S. House of Representatives on November 28, 2001, and by the U.S. Senate on January 7, 2003. The President signed the Act into law on April 25, 2003. Enactment of the Clean Diamond Trade Act made the United States a full participant in the KPCS (U.S. House of Representatives, 2003§). U.S. participation is critical to the success of the KPCS in excluding conflict diamonds from the legitimate supply chain because the United States has the largest part of the world diamond market. The industry and trade associations have played an active role in achieving this progress in ending the problem of conflict diamonds (Professional Jeweler, 2003§).

- Near the end of 2001, De Beers quietly settled private civil class actions related to the industrial diamond case in Ohio against De Beers Industrial Diamonds Division (Pty) Ltd. and General Electric Co. The settlement established a $20 million cash fund plus interest and also provided for payment of an in-kind rebate of industrial diamonds that "class members" purchase from the plaintiffs during the period from January 1, 2002, to December 31, 2003. The settlement covered an alleged illegal price fixing that took place from November 1, 1987, through May 23, 1994 (Tacy Diamond Intelligence, 2002§).

In July, a Chicago, IL-based firm made the first prototype gem-quality diamond produced from cremated human remains. The firm began offering this service to the public in August 2002. By yearend 2002, a significant number of orders had been placed, and more than 30 diamonds had been produced. The diamonds are produced domestically and in Spain and Russia. During 2002, all diamonds produced were blue, but since yearend they are also producing yellow diamonds (Dean Van

Den Biesen, Vice President of Operations, LifeGem, Inc., oral commun., September 5, 2003).

Worldwide production of natural gemstones other than diamond was estimated to have exceeded $2 billion per year. Most nondiamond gemstone mines are small, low-cost, and widely dispersed operations in remote regions of developing nations. Foreign countries with major gemstone deposits other than diamond are Afghanistan (aquamarine, beryl, emerald, kunzite, lapis lazuli, ruby, and tourmaline), Australia (beryl, opal, and sapphire), Brazil (agate, amethyst, beryl, ruby, sapphire, topaz, and tourmaline), Burma (beryl, jade, ruby, sapphire, and topaz), Colombia (beryl, emerald, and sapphire), Kenya (beryl, garnet, and sapphire), Madagascar (beryl, rose quartz, sapphire, and tourmaline), Mexico (agate, opal, and topaz), Sri Lanka (beryl, ruby, sapphire, and topaz), Tanzania (garnet, ruby, sapphire, tanzanite, and tourmaline), and Zambia (amethyst and beryl). In addition, pearls are cultured throughout the South Pacific and in other equatorial waters; Australia, China, French Polynesia, and Japan are key producers.

The U.S. colored gemstone market posted a recovery compared with the economic turbulence of 2001, showing considerable improvement in terms of value, but still not as good as the 2000 value. The industry is in a slight growth pattern, but the threatening hostilities with Iraq prevented an immediate economic recovery. The surge in retail spending through the holiday season reasserted the U.S. dominance as a gemstone market, while the European Union and Japan declined for the third year in a row. The rest of the Asian markets grew or remained the same as in the previous year. The popularity of colorful gemstones, colored synthetic gemstones, and "fancy" colored diamonds continued to increase. This was evidenced by increased sales in 2002 (Colored Stone, 2003).

In 2002, the American Gem Trade Association (a U.S. and Canadian trade association) announced that it was adding tanzanite to the traditional list of birthstones. Tanzanite is the first stone added to the traditional birthstone list in 90 years, and it joins turquoise and zircon as an additional birthstone for the month of December. Tanzanite was first introduced as a gemstone in 1969. It is by far the most popular of blue gemstones after sapphire. Tanzanite is characterized by combinations of royal blue and burgundy hues, which have an almost universal appeal. While some tanzanite displays a trace of blue when it is originally mined, most crystals emerge from the Earth with a muted gray green color. All tanzanite has been subjected to a heat process to produce the violet blue hues. The only known source of tanzanite is a 5-square-mile area in the hills of Merelani, 10 miles south of the Kilimanjaro International Airport, between Moshi and Arusha in Tanzania. With its growing popularity among consumers, adding it to the traditional list of birthstones will only increase the demand for tanzanite (American Gem Trade Association, 2002§).

U.S. shell production decreased again in 2002. Shell has been one of the largest segments of U.S. gemstone production for several years. The U.S. shell material from mussels is used as seed material for culturing pearls. This production decrease is the result of overharvesting in past years, the killing off of U.S. native mussel species by nuisance or invasive exotic species, and a decline in market demand. During the past 10 years, the United States has lost about three-quarters of the native mussel population, and one-half of the approximately 300 total U.S. native mussel species are now listed as endangered species. The zebra mussel is the invasive exotic species that has done most of the damage, and it has been introduced into U.S. rivers and waterways in discharged ballast water from transoceanic ships (Iowa Department of Natural Resources, 2001§; Scott Gritterf, Fisheries Biologist, Iowa Department of Natural Resources, oral commun., November 14, 2002). The market still has never completely recovered from the die-off of Japanese oysters. Japan had stockpiled seed materials, and now they are using manmade seed materials or seed materials from China and other sources. There has also been an increase in the popularity of darker and colored pearls that do not use U.S. seed material (Ted Kroll, Assistant Director of Fisheries, Kentucky Department of Fish and Wildlife, oral commun., November 15, 2002).

Outlook

There are indications that there will be continued growth in U.S. diamond and jewelry markets in 2003. Historically, diamonds have proven to hold their value despite wars or economic depressions (Schumann, 1998, p. 8).

Diamond exploration is continuing in Canada, and many new deposits have been found. There are several other commercial diamond projects and additional discoveries located in Alberta, British Columbia, the Northwest Territories, Nunavut, Ontario, and Quebec. When the Snap Lake mine begins production, Canada could account for 15% to 20% of the total world diamond production. If Canadian production continues to increase at about the same rate, Canada will probably eclipse South Africa's diamond production within a decade.

Independent producers, such as Argyle Diamond Mines in Australia and Ekati and Diavik in Canada, will continue to bring a greater measure of competition to global markets. More competition presumably will bring more supplies and lower prices. Further consolidation of diamond producers and larger amounts of rough diamond being sold outside the DTC will continue as the diamond industry adjusts to De Beers giving up its control of the industry.

Numerous synthetics, simulants, and treated gemstones will enter the marketplace and necessitate more transparent trade industry standards to maintain customer confidence.

More diamond, gemstones, and jewelry will be sold through online marketplaces and other forms of e-commerce that emerge to serve the diamond and gemstone industry. This will take place as the gemstone industry and its customers become more comfortable with and learn the applications of new e-commerce tools.

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TABLE 1
GUIDE TO SELECTED GEMSTONES AND GEM MATERIALS USED IN JEWELRY

Name	Composition	Color	Practical size[1]	Cost[2]	Mohs	Specific gravity	Refraction	Refractive index	May be confused with	Recognition characteristics
Amber	Hydrocarbon	Yellow, red, green, blue	Any	Low to medium	2.0-2.5	1.0-1.1	Single	1.54	Synthetic or pressed plastics, kaurigum	Fossil resin, color, low density, soft and trapped insects.
Apatite	Chloro-calcium phosphate	Colorless, pink, yellow, green, blue, violet	Small	Low	5.0	3.16-3.23	Double	1.63-1.65	Amblygonite, andalusite, brazilianite, precious beryl, titanite, topaz, tourmaline	Crystal habit, color, hardness, and appearance.
Azurite	Copper carbonate hydroxide	Azure, dark blue, pale blue	Small to medium	do.	3.5-4.0	3.7-3.9	do.	1.72-1.85	Dumortierite, hauynite, lapis lazuli, lazulite, sodalite	Color, softness, crystal habits and associated minerals.
Benitoite	Barium titanium silicate	Blue, purple, pink, colorless	do.	High	6.0-6.5	3.64-3.68	do.	1.76-1.80	Sapphire, tanzanite, blue diamond, blue tourmaline, cordierite	Strong blue in ultraviolet light.
Beryl:										
Aquamarine	Beryllium aluminum silicate	Blue-green to light blue	Any	Medium to high	7.5-8.0	2.63-2.80	do.	1.58	Synthetic spinel, blue topaz	Double refraction, refractive index.
Bixbite	do.	Red	Small	Very high	7.5-8.0	2.63-2.80	do.	1.58	Pressed plastics, tourmaline	Refractive index.
Emerald	do.	Green	Medium	do.	7.5	2.63-2.80	do.	1.58	Fused emerald, glass, tourmaline, peridot, green garnet doublets	Emerald filter, dichroism, refractive index.
Emerald, synthetic	do.	do.	Small	High	7.5-8.0	2.63-2.80	do.	1.58	Genuine emerald	Lack of flaws, brilliant fluorescence in ultraviolet light.
Golden (heliodor)	do.	Yellow to golden	Any	Low to medium	7.5-8.0	2.63-2.80	do.	1.58	Citrine, topaz, glass, doublets	Weak-colored.
Goshenite	do.	Colorless	do.	Low	7.5-8.0	2.63-2.80	do.	1.58	Quartz, glass, white sapphire, white topaz	Refractive index.
Morganite	do.	Pink to rose	do.	do.	7.5-8.0	2.63-2.80	do.	1.58	Kunzite, tourmaline, pink sapphire	Do.
Calcite:										
Marble	Calcium carbonate	White, pink, red, blue, green, or brown	do.	do.	3.0	2.72	Double (strong)	1.49-1.66	Silicates, banded agate, alabaster gypsum	Translucent.
Mexican onyx	do.	do.	do.	do.	3.0	2.72	do.	1.60	do.	Banded, translucent.
Charoite	Hydrated sodium calcium hydroxi-fluoro-silicate	Lilac, violet, or white	Small to medium	do.	5.0-6.0	2.54-2.78	XX	1.55-1.56	Purple marble	Color, locality.
Chrysoberyl:										
Alexandrite	Beryllium aluminate	Green by day light, red by artificial light	Small (CIS) Medium (Sri Lanka)	High	8.5	3.50-3.84	Double	1.75	Synthetic	Strong dichroism, color varies from red to green, hardness.
Cats-eye	do.	Greenish to brownish	Small to large	do.	8.5	3.50-3.84	do.	1.75	Synthetic, shell	Density, translucence, chatoyance.
Chrysolite	Beryllium aluminate	Yellow, green, and/or brown	Medium	Medium	8.5	3.50-3.84	Double	1.75	Tourmaline, peridot	Refractive index, silky.

See footnotes at end of table.

TABLE 1--Continued
GUIDE TO SELECTED GEMSTONES AND GEM MATERIALS USED IN JEWELRY

Name	Composition	Color	Practical size[1]	Cost[2]	Mohs	Specific gravity	Refraction	Refractive index	May be confused with	Recognition characteristics
Chrysocolla	Hydrated copper silicate	Green, blue	Any	Low	2.0-4.0	2.0-2.4	XX	1.46-1.57	Azurite, dyed chalcedony, malachite, turquoise, variscite	Lack of crystals, color, fracture, low density and softness.
Coral	Calcium carbonate	Orange, red, white, black, purple, or green	Branching, medium	do.	3.5-4.0	2.6-2.7	Double	1.49-1.66	False coral	Dull translucent.
Corundum:										
Ruby	Aluminum oxide	Rose to deep purplish red	Small	Very high	9.0	3.95-4.10	do.	1.78	Synthetics, including spinel, garnet	Inclusions, fluorescence.
Sapphire, blue	do.	Blue	Medium	High	9.0	3.95-4.10	do.	1.78	do.	Inclusions, double refraction, dichroism.
Sapphire, fancy	do.	Yellow, pink, colorless, orange, green, or violet	Medium to large	Medium	9.0	3.95-4.10	do.	1.78	Synthetics, glass and doublets, morganite	Inclusions, double refraction, refractive index.
Sapphire and ruby, stars	do.	Red, pink, violet, blue, or gray	do.	High to low	9.0	3.95-4.10	do.	1.78	Star quartz, synthetic stars	Shows asterism, color side view.
Sapphire or ruby, synthetic	do.	Yellow, pink, or blue	Up to 20 carats	Low	9.0	3.95-4.10	do.	1.78	Synthetic spinel, glass	Curved striae, bubble inclusions.
Cubic zirconia	Zirconium and yttrium oxides	Colorless, pink, blue, lavender, yellow	Small	do.	8.25-8.5	5.8	Single	2.17	Diamond, zircon, titania, moissanite	Hardness, density, refractive index, lack of flaws and inclusions.
Diamond	Carbon	White, blue-white, yellow, brown, green, red, pink, blue	Any	Very high	10.0	3.516-3.525	do.	2.42	Zircon, titania, cubic zirconia, moissanite	High index, dispersion, hardness, luster.
Feldspar:										
Amazonite	Alkali aluminum silicate	Green-blue	Large	Low	6.0-6.5	2.56	XX	1.52	Jade, turquoise	Cleavage, sheen, vitreous to pearly, opaque, grid.
Labradorite	do.	Gray with blue and bronze sheen color play (schiller)	do.	do.	6.0-6.5	2.56	XX	1.56	do.	Do.
Moonstone	do.	Colorless, white, gray, or yellow with white, blue, or bronze schiller	do.	do.	6.0-6.5	2.77	XX	1.52-1.54	Glass, chalcedony, opal	Pale sheen, opalescent.
Sunstone	do.	Orange, red brown, colorless with gold or red glittery schiller	Small to medium	do.	6.0-6.5	2.77	XX	1.53-1.55	Aventurine, glass	Red glittery schiller.
Garnet	Complex silicate	Brown, black, yellow, green, red, or orange	do.	Low to high	6.5-7.5	3.15-4.30	Single strained	1.79-1.98	Synthetics, spinel, glass	Single refraction, anomalous strain.
Hematite	Iron oxide	Black, black-gray, brown-red	Medium to large	Low	5.5-6.5	5.12-5.28	XX	2.94-3.22	Davidite, cassiterite, magnetite, neptunite, pyrolusite, wolframite	Crystal habit, streak and hardness.
Jade:										
Jadeite	Complex silicate	Green, yellow, black, white, or mauve	Large	Low to very high	6.5-7.0	3.3-3.5	Crypto-crystalline	1.65-1.68	Nephrite, chalcedony, onyx, bowenite, vesuvianite, grossularite	Luster, spectrum, translucent to opaque.
Nephrite	Complex hydrous silicate	do.	do.	do.	6.0-6.5	2.96-3.10	do.	1.61-1.63	Jadeite, chalcedony, onyx, bowenite, vesuvianite, grossularite	Do.

See footnotes at end of table.

TABLE 1--Continued
GUIDE TO SELECTED GEMSTONES AND GEM MATERIALS USED IN JEWELRY

Name	Composition	Color	Practical size[1]	Cost[2]	Mohs	Specific gravity	Refraction	Refractive index	May be confused with	Recognition characteristics
Jet (gagate)	Lignite	Deep black, dark brown	do.	Low	2.5-4.0	1.19-1.35	XX	1.64-1.68	Anthracite, asphalt, cannel coal, onyx, schorl, glass, rubber	Luster, color.
Lapis lazuli	Sodium calcium aluminum silicate	Dark azure-blue to bright indigo blue or even a pale sky blue	do.	do.	5.0-6.0	2.50-3.0	XX	1.50	Azurite, dumortierite, dyed howlite, lazulite, sodalite, glass	Color, crystal habit, associated minerals, luster, and localities.
Malachite	Hydrated copper carbonate	Light to black-green banded	do.	do.	3.5-4.0	3.25-4.10	XX	1.66-1.91	Brochantite, chrysoprase, opaque green gemstones	Color banding, softness, associated minerals.
Moissanite	Silicon carbide	Colorless and pale shades of green, blue, or yellow	Small	Low to medium	9.25	3.21	Double	2.65-2.69	Diamond, zircon, titania, cubic zirconia	Hardness, dispersion, refractive index, lack of flaws and inclusions.
Obsidian	Amorphous, variable (usually felsic)	Black, gray, brown, dark green, white, transparent	Large	Low	5.0-5.5	2.35-2.60	XX	1.45-1.55	Aegirine-augite, gagate, gadolinite, hematite, pyrolusite, wolframite	Color, conchoidal fracture, flow bubbles, softness, and lack of crystal faces.
Opal	Hydrated silica	Reddish orange, colors flash in white gray, black, red, or yellow	do.	Low to high	5.5-6.5	1.9-2.3	Single	1.45	Glass, synthetics, triplets, chalcedony	Color play (opalescence).
Peridot	Iron magnesium silicate	Yellow and/or green	Any	Medium	6.5-7.0	3.27-3.37	Double (strong)	1.65-1.69	Tourmaline, chrysoberyl	Strong double refraction, low dichroism.
Quartz:										
Agate	Silicon dioxide	Any	Large	Low	7.0	2.58-2.64	XX	XX	Glass, plastic, Mexican onyx	Cryptocrystalline, irregularly banded, dendritic inclusions.
Amethyst	do.	Purple	do.	Medium	7.0	2.65-2.66	Double	1.55	Glass, plastic, fluorite	Macrocrystalline, refractive index, color, transparent, hardness.
Aventurine	do.	Green, red-brown, gold-brown, with metallic metallic iridescent reflection	do.	Low	7.0	2.64-2.69	do.	1.54-1.55	Iridescent analcime, aventurine feldspar, emerald, aventurine glass	Macrocrystalline, color, metallic iridescent flake reflections, hardness.
Cairngorm	do.	Smoky orange or yellow	do.	do.	7.0	2.65-2.66	do.	1.55	do.	Macrocrystalline, refractive index, color, transparent, hardness.
Carnelian	do.	Flesh red to brown red	do.	do.	6.5-7.0	2.58-2.64	do.	1.53-1.54	Jasper	Cryptocrystalline, color, hardness.
Chalcedony	do.	Bluish, white, gray	do.	do.	6.5-7.0	2.58-2.64	do.	1.53-1.54	Tanzanite	Do.
Chrysoprase	do.	Green, apple-green	do.	do.	6.5-7.0	2.58-2.64	do.	1.53-1.54	Chrome chalcedony, jade, prase opal, prehnite, smithsonite, variscite, artifically colored green chalcedony	Do.
Citrine	Silica	Yellow	Large	Low	7.0	2.65-2.66	Double	1.55	do.	Macrocrystalline, refractive index, color, transparent, hardness.
Crystal:										
Rock crystal	do.	Colorless	do.	do.	7.0	2.65-2.66	do.	1.55	Topaz, colorless sapphire	Do.
Jasper	do.	Any, striped, spotted, or sometimes uniform	do.	do.	7.0	2.58-2.66	XX	XX	do.	Cryptocrystalline, opaque, vitreous luster, hardness.

See footnotes at end of table.

TABLE 1--Continued
GUIDE TO SELECTED GEMSTONES AND GEM MATERIALS USED IN JEWELRY

Name	Composition	Color	Practical size[1]	Cost[2]	Mohs	Specific gravity	Refraction	Refractive index	May be confused with	Recognition characteristics
Crystal--Continued:										
Onyx	Silica	Many colors	Large	Low	7.0	2.58-2.64	XX	XX	Topaz, colorless sapphire	Cryptocrystalline, uniformly banded, hardness.
Petrified wood	do.	Brown, gray, red, yellow	do.	do.	6.5-7.0	2.58-2.91	Double	1.54	Agate, jasper	Color, hardness, wood grain.
Rose	do.	Pink, rose red	do.	do.	7.0	2.65-2.66	do.	1.55	do.	Macrocrystalline, refractive index, color, transparent, hardness.
Tiger's eye	do.	Golden yellow, brown, red, blue-black	do.	do.	6.5-7.0	2.58-2.64	XX	1.53-1.54	XX	Macrocrystalline, color, hardness, hatoyancy.
Rhodochrosite	Manganese carbonate	Rose-red to yellowish, stripped	do.	do.	4.0	3.45-3.7	Double	1.6-1.82	Fire opal, rhodonite, tugtupite, tourmaline	Color, crystal habit, reaction to acid, and perfect rhombohedral cleavage.
Rhodonite	Manganese iron calcium silicate	Dark red, flesh red, with dendritic inclusions of black manganese oxide	do.	do.	5.5-6.5	3.40-3.74	do.	1.72-1.75	Rhodochrosite, thulite, hessonite, spessartine, pyroxmangite, spinel, tourmaline	Color, black inclusions, lack of reaction to acid and hardness.
Shell:										
Mother-of-pearl	Calcium carbonate	White, cream, green, blue-green, with iridescent color play	Small	Low	3.5	2.6-2.85	XX	XX	Glass and plastic imitation	Luster, iridescent play of color.
Pearl	do.	White, cream to black, sometimes with hint of pink, green, purple	do.	Low to high	2.5-4.5	2.6-2.85	XX	XX	Cultured and glass or plastic imitation	Luster, iridescence, structure, x-ray.
Spinel	Magnesium aluminum oxide	Any	Small to medium	Medium	8.0	3.5-3.7	Single	1.72	Synthetic, garnet	Refractive index, single refraction, inclusions.
Spinel, synthetic	do.	do.	Up to 40 carats	Low	8.0	3.5-3.7	Double	1.73	Spinel, corundum, beryl, topaz, alexandrite	Weak double refraction, curved striae, bubbles.
Spodumene:										
Hiddenite	Lithium aluminum silicate	Yellow to green	Medium	Medium	6.5-7.0	3.13-3.20	do.	1.66	Synthetic spinel	Refractive index, color, pleochroism.
Kunzite	do.	Pink to lilac	do.	do.	6.5-7.0	3.13-3.20	do.	1.66	Amethyst, morganite	Refractive index, color, pleochroism.
Tanzanite	Complex silicate	Blue to lavender	Small	High	6.0-7.0	3.30	do.	1.69	Sapphire, synthetics	Strong trichroism, color.
Topaz	do.	White, blue, green, pink, yellow, gold	Medium	Low to medium	8.0	3.4-3.6	do.	1.62	Beryl, quartz	Color, density, hardness, refractive index, perfect in basal cleavage.
Tourmaline	do.	Any, including mixed	do.	do.	7.0-7.5	2.98-3.20	do.	1.63	Peridot, beryl, garnet corundum, glass	Double refraction, color, refractive index.
Turquoise	Copper aluminum phosphate	Blue to green with black, brown-red inclusions	Large	Low	6.0	2.60-2.83	Double	1.63	Glass, plastics, variscite, dumortierite, dyed howlite, chrysocolla	Difficult if matrix not present, matrix usually limonitic.
Unakite	Granitic rock, feldspar, epidote, quartz	Olive green, pink, and blue-gray	do.	do.	6.0-7.0	2.60-3.20	XX	XX	XX	Olive green, pink, and gray-blue colors.
Zircon	Zirconium silicate	White, blue, brown, yellow, or green	Small to medium	Low to medium	6.0-7.5	4.0-4.8	Double (strong)	1.79-1.98	Diamond, synthetics, topaz, aquamarine	Double refraction, strongly dichroic, wear on facet edges.

XX Not applicable.
[1]Small--up to 5 carats; medium--5 to 50 carats; large--more than 50 carats.

TABLE 2
SYNTHETIC GEMSTONE PRODUCTION METHODS

Gemstone	Production method	Company/producer	Date of first production
Alexandrite	Flux	Creative Crystals	1970s.
Do.	Melt pulling	J.O. Crystal	1990s.
Do.	do.	Kyocera	1980s.
Do.	Zone melt	Seiko	1980s.
Cubic zirconia	Skull melt	Various producers	1970s.
Emerald	Flux	Chatham	1930s.
Do.	do.	Gilson	1960s.
Do.	do.	Kyocera	1970s.
Do.	do.	Seiko	1980s.
Do.	do.	Lennix	1980s.
Do.	do.	Russia	1980s.
Do.	Hydrothermal	Lechleitner	1960s.
Do.	do.	Regency	1980s.
Do.	do.	Biron	1980s.
Do.	do.	Russia	1980s.
Ruby	Flux	Chatham	1950s.
Do.	do.	Kashan	1960s.
Do.	do.	J.O. Crystal	1980s.
Do.	do.	Douras	1990s
Do.	Zone melt	Seiko	1980s.
Do.	Melt pulling	Kyocera	1970s.
Do.	Verneuil	Various producers	1900s.
Sapphire	Flux	Chatham	1970s.
Do.	Zone melt	Seiko	1980s.
Do.	Melt pulling	Kyocera	1980s.
Do.	Verneuil	Various producers	1900s.
Star ruby	do.	Linde	1940s.
Do.	Melt pulling	Kyocera	1980s.
Do.	do.	Nakazumi	1980s.
Star sapphire	Verneuil	Linde	1940s.

TABLE 3
VALUE OF U.S. GEMSTONE PRODUCTION, BY TYPE[1]

(Thousand dollars)

Gem materials	2001	2002
Beryl	(2)	9
Coral, all types	83	108
Diamond	(3)	(3)
Garnet	46 r	46
Gem feldspar	(2)	379 e
Geode/nodules	375	(2)
Opal	44	(2)
Quartz:		
Macrocrystalline[4]	307	246
Cryptocrystalline[5]	381	84
Sapphire/ruby	152	212
Shell	2,860	1,440
Topaz	(2)	(2)
Tourmaline	334	105
Turquoise	(2)	540
Other	8,350	8,420
Total	14,900	12,600

[e]Estimated. [r]Revised.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Included in "Total."

[3]Included with "Other."

[4]Macrocrystalline quartz (crystals recognizable with the naked eye) includes amethyst, amethyst quartz, aventurine, blue quartz, citrine, hawk's eye, pasiolite, prase, quartz cat's eye, rock crystal, rose quartz, smoky quartz, and tiger's eye.

[5]Cryptocrystalline (microscopically small crystals) includes agate, carnelian, chalcedony, chrysoprase, fossilized wood, heliotrope, jasper, moss agate, onyx, and sard.

TABLE 4
PRICES OF U.S. CUT DIAMONDS, BY SIZE AND QUALITY IN 2002[1]

Carat weight	Description, color[3]	Clarity[2] (GIA terms)	Representative prices		
			January[4]	June[5]	December[6]
0.25	G	VS1	$1,200	$1,200	$1,200
.25	G	VS2	1,150	1,150	1,150
.25	G	SI1	975	975	975
.25	H	VS1	1,100	1,100	1,100
.25	H	VS2	1,000	1,000	1,000
.25	H	SI1	925	925	925
.50	G	VS1	3,200	3,200	3,200
.50	G	VS2	2,800	2,800	2,800
.50	G	SI1	2,400	2,400	2,400
.50	H	VS1	2,800	2,800	2,800
.50	H	VS2	2,400	2,400	2,400
.50	H	SI1	2,200	2,200	2,200
.75	G	VS1	3,800	3,800	3,600
.75	G	VS2	3,600	3,600	3,500
.75	G	SI1	3,300	3,300	3,200
.75	H	VS1	3,500	3,500	3,300
.75	H	VS2	3,450	3,450	3,200
.75	H	SI1	3,000	3,000	2,900
1.00	G	VS1	5,800	5,800	5,800
1.00	G	VS2	5,500	5,500	5,500
1.00	G	SI1	4,800	4,800	4,800
1.00	H	VS1	5,200	5,200	5,200
1.00	H	VS2	4,900	4,900	4,900
1.00	H	SI1	4,700	4,700	4,700

[1]Data are rounded to no more than three significant digits.
[2]Gemological Institute of America (GIA) color grades: D—colorless; E—rare white; G, H, I—traces of color.
[3]Clarity: IF—no blemishes; VVS1—very, very slightly included; VS1—very slightly included; VS2—very slightly included, but not visible; SII—slightly included.
[4]Source: Jewelers' Circular Keystone, v. 173, no. 2, February 2002, p. 49.
[5]Source: Jewelers' Circular Keystone, v. 173, no. 7, July 2002, p. 52.
[6]Source: Jewelers' Circular Keystone, v. 174, no. 1, January 2003, p. 40.

TABLE 5
PRICES PER CARAT OF U.S. CUT COLORED GEMSTONES IN 2002

Gemstone	Price range per carat	
	January[1]	December[2]
Amethyst	$7-$14	$7-$14
Blue sapphire	800-1,300	750-1,200
Blue topaz	3-5	3-5
Emerald	1,300-2,000	1,300-2,000
Green tourmaline	70-125	70-150
Pearl:[3]		
Cultured saltwater	5	5
Natural	210	210
Pink tourmaline	60-125	60-125
Rhodolite garnet	18-30	18-30
Ruby	1,200-1,550	1,100-1,450
Tanzanite	170-270	200-300

[1]Source: The Guide, spring/summer 2002, p. 14, p. 30, p. 43, p. 59, p. 71, p. 85, p. 95, p. 97, p. 103, p. 125, and p. 137. These figures are approximate current wholesale purchase prices paid by retail jewelers on a per stone basis for fine-quality stones.
[2]Source: The Guide, fall/winter 2002-2003, p. 14, p. 30, p. 45, p. 61, p. 72, p. 86, p. 96, p. 98, p. 104, p. 123, and p. 135. These figures are approximate current wholesale purchase prices paid by retail jewelers on a per stone basis for fine-quality stones.
[3]Prices are per 4.6 mm pearl.

TABLE 6
U.S. EXPORTS AND REEXPORTS OF DIAMOND (EXCLUSIVE OF INDUSTRIAL DIAMOND), BY COUNTRY[1]

Country	2001 Quantity (carats)	2001 Value[2] (millions)	2002 Quantity (carats)	2002 Value[2] (millions)
Exports:				
Belgium	573,000	$454	343,000	$278
Canada	98,800	29	105,000	41
France	35,400	135	8,760	37
Germany	23,400	4	3,360	3
Guatemala	135,000	13	168,000	17
Hong Kong	336,000	125	251,000	89
India	294,000	35	83,100	12
Israel	575,000	512	246,000	477
Japan	35,400	27	13,800	31
Mexico	91,500	20	199,000	43
Netherlands	36,600	7	460	8
Switzerland	102,000	163	9,570	48
Thailand	85,500	15	28,200	5
United Kingdom	42,300	68	19,000	19
Other	133,000	96	76,500	57
Total	2,600,000	1,700	1,550,000	1,160
Reexports:				
Belgium	1,340,000	565	2,650,000	801
Canada	117,000	47	109,000	59
Dominican Republic	52,600	7	102,000	9
Hong Kong	1,390,000	347	2,470,000	381
India	723,000	92	1,230,000	157
Israel	1,760,000	899	4,290,000	1,250
Japan	91,100	32	181,000	35
Malaysia	16,700	4	64,200	6
Mexico	29,100	4	12,900	3
Singapore	76,400	14	158,000	20
Switzerland	277,000	130	382,000	191
Thailand	185,000	25	368,000	55
United Arab Emirates	194,000	27	253,000	71
United Kingdom	103,000	102	364,000	134
Other	68,100	49	117,000	59
Total	6,420,000	2,340	12,700,000	3,230
Grand total	9,010,000	4,050	14,300,000	4,400

[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Customs value.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF DIAMOND, BY KIND, WEIGHT, AND COUNTRY[1]

Kind, range, and country of origin	2001 Quantity (carat)	2001 Value[2] (millions)	2002 Quantity (carat)	2002 Value[2] (millions)
Rough or uncut, natural:[3]				
Belgium	73,800	$75	17,800	$12
Botswana	4,880	12	6,350	18
Brazil	16,800	8	20,000	15
Canada	8,650	9	9,900	2
Congo (Brazzaville)	4,750	10	9,630	14
Congo (Kinshasa)	15,200	10	27,800	24
Ghana	20,400	3	3,180	3
Guinea	7,060	14	6,850	19
Guyana	34,500	4	54,900	6
Hong Kong	3,780	4	353	(4)
Israel	9,120	10	5,590	15
Russia	24,400	11	26,700	6
South Africa	297,000	290	436,000	353
United Kingdom	367,000	84	344,000	69
Venezuela	6,110	3	15,100	5
Other	6,880	5	29,600	7
Total	900,000	550	1,010,000	567
Cut but unset, not more than 0.5 carat:				
Australia	3,440	(4)	2,650	1
Belgium	731,000	216	770,000	227
Brazil	12,600	2	7,660	2
Canada	3,320	1	4,960	1
China	33,800	7	70,400	6
Dominican Republic	6,970	1	12,900	1
Hong Kong	316,000	59	403,000	64
India	9,050,000	1,510	11,500,000	1,890
Israel	992,000	535	997,000	454
Japan	7,980	3	2,500	1
Mexico	140,000	12	249,000	12
Singapore	9,240	2	4,110	1
Sri Lanka	10,500	2	7,110	2
Switzerland	10,900	4	6,600	2
Thailand	77,700	14	99,600	11
United Arab Emirates	86,500	21	82,300	18
United Kingdom	7,490	7	12,000	4
Other	22,000	9	23,500	7
Total	11,500,000	2,410	14,300,000	2,710
Cut but unset, more than 0.5 carat:				
Belgium	1,100,000	1,840	1,280,000	2,060
Canada	3,910	14	7,520	27
France	7,150	31	2,250	17
Hong Kong	192,000	145	89,800	153
India	673,000	406	1,120,000	742
Israel	2,550,000	4,560	3,040,000	5,300
Japan	5,110	13	2,960	7
Mauritius	3,770	7	3,230	7
Russia	62,900	112	45,200	78
South Africa	24,100	161	30,600	127
Switzerland	13,700	118	13,500	101
Thailand	9,100	9	5,140	5
United Arab Emirates	19,700	17	7,520	8
United Kingdom	15,700	118	21,000	100
Other	23,300	72	27,600	67
Total	4,710,000	7,630	5,690,000	8,800

[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Customs value.
[3]Includes some natural advanced diamond.
[4]Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF GEMSTONES, OTHER THAN DIAMOND, BY KIND AND COUNTRY[1]

Kind and country	2001 Quantity (carats)	2001 Value[2] (millions)	2002 Quantity (carats)	2002 Value[2] (millions)
Emerald:				
Australia	161,000	(3)	10,200	(3)
Belgium	11,700	$2	26,800	$1
Brazil	2,050,000	6	4,940,000	6
China	2,120	(3)	18,100	(3)
Colombia	1,070,000	58	683,000	69
Germany	29,700	1	15,200	1
Hong Kong	354,000	6	102,000	4
India	2,040,000	20	2,100,000	20
Israel	127,000	26	97,900	20
Japan	16,900	1	1,090	(3)
Sri Lanka	41,000	2	95	(3)
Switzerland	36,300	10	75,200	9
Taiwan	83	(3)	33	(3)
Thailand	287,000	5	538,000	7
United Kingdom	5,770	1	44,500	4
Zambia	106,000	1	408	(3)
Other	32,000	3	18,000	2
Total	6,370,000	141	8,670,000	143
Ruby:				
Belgium	500	1	15,000	2
Brazil	134	(3)	301	(3)
Burma	9,740	3	11,000	3
China	8,940	(3)	45,600	(3)
Colombia	328	(3)	--	--
Germany	24,800	(3)	18,200	1
Hong Kong	123,000	4	140,000	4
India	762,000	2	1,110,000	5
Israel	26,500	1	32,700	2
Japan	28,400	(3)	2,300	(3)
Pakistan	1,400	(3)	--	--
Sri Lanka	4,260	1	3,210	(3)
Switzerland	26,400	10	13,800	15
Thailand	1,940,000	43	2,220,000	50
United Kingdom	21,800	2	20,800	4
Other	25,700	2	24,300	1
Total	3,000,000	69	3,660,000	88
Sapphire:				
Australia	3,270	(3)	82,700	1
Belgium	1,720	1	8,440	1
Brazil	642	(3)	1,250	(3)
Burma	395	1	669	4
Canada	250	(3)	664	(3)
China	15,100	(3)	28,800	(3)
Colombia	3,680	(3)	--	--
France	1,670	1	1,710	1
Germany	42,500	1	143,000	2
Hong Kong	281,000	8	251,000	7
India	873,000	5	828,000	4
Israel	40,700	3	26,700	2
Sri Lanka	294,000	20	274,000	25
Switzerland	36,900	12	31,600	8
Thailand	4,470,000	66	5,040,000	77
United Kingdom	17,500	3	32,700	4
Other	65,900	2	28,700	3
Total	6,150,000	122	6,780,000	139

See footnotes at end of table.

TABLE 8--Continued
U.S. IMPORTS FOR CONSUMPTION OF GEMSTONES, OTHER THAN DIAMOND, BY KIND AND COUNTRY[1]

Kind and country	2001 Quantity (carats)	2001 Value[2] (millions)	2002 Quantity (carats)	2002 Value[2] (millions)
Other:				
Rough, uncut:				
Australia	NA	$4	NA	$3
Brazil	NA	13	NA	10
China	NA	1	NA	3
Colombia	NA	(3)	NA	(3)
Fiji	NA	2	NA	2
Hong Kong	NA	1	NA	1
India	NA	2	NA	1
Indonesia	NA	2	NA	2
Kenya	NA	(3)	NA	(3)
Nigeria	NA	(3)	NA	(3)
Pakistan	NA	1	NA	3
Philippines	NA	1	NA	1
Russia	NA	(3)	NA	(3)
South Africa	NA	1	NA	1
Switzerland	NA	(3)	NA	(3)
Taiwan	NA	(3)	NA	(3)
Tanzania	NA	1	NA	1
Thailand	NA	1	NA	2
United Kingdom	NA	1	NA	1
Zambia	NA	(3)	NA	1
Other	NA	7	NA	8
Total	NA	38	NA	41
Cut, set and unset:				
Australia	NA	16	NA	16
Austria	NA	1	NA	2
Brazil	NA	7	NA	8
Canada	NA	1	NA	1
China	NA	12	NA	26
Columbia	NA	1	NA	1
French Polynesia	NA	5	NA	7
Germany	NA	15	NA	18
Hong Kong	NA	44	NA	32
India	NA	82	NA	75
Indonesia	NA	1	NA	(3)
Israel	NA	5	NA	5
Japan	NA	20	NA	11
Mexico	NA	2	NA	1
South Africa	NA	1	NA	1
Sri Lanka	NA	6	NA	6
Switzerland	NA	2	NA	2
Taiwan	NA	1	NA	2
Tanzania	NA	10	NA	7
Thailand	NA	27	NA	31
United Kingdom	NA	8	NA	8
Other	NA	3	NA	6
Total	NA	268	NA	265

NA Not available. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Customs value.

[3]Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 9
VALUE OF U.S. IMPORTS OF SYNTHETIC AND IMITATION GEMSTONES, BY COUNTRY[1]

(Thousand dollars)[2]

Country	2001	2002
Synthetic, cut but unset:		
Australia	224	27
Austria	2,980	2,730
Belgium	80	72
Brazil	62	143
China	13,700	10,300
France	974	831
Germany	10,000	9,630
Hong Kong	2,410	1,950
India	819	822
Italy	43	50
Japan	53	28
Korea, Republic of	1,360	727
Netherlands	74	65
Singapore	157	79
Spain	31	14
Sri Lanka	1,250	844
Switzerland	7,530	6,360
Taiwan	464	312
Thailand	1,970	1,670
Other	165	913
Total	44,300	37,600
Imitation:[3]		
Austria	64,800	39,900
China	1,330	2,260
Czech Republic	13,700	8,850
Germany	1,140	1,300
Hong Kong	255	1,560
India	355	1,280
Italy	207	139
Japan	400	247
Korea, Republic of	1,120	467
Spain	147	72
Taiwan	245	164
Other	497	434
Total	84,300	56,700

[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Customs value.
[3]Includes pearls.

Source: U.S. Census Bureau.

TABLE 10
U.S. IMPORTS FOR CONSUMPTION OF GEMSTONES[1]

(Thousand carats and thousand dollars)

Stones	2001		2002	
	Quantity	Value[2]	Quantity	Value[2]
Diamonds:				
Rough or uncut	900	550,000	1,010	567,000
Cut but unset	16,200	10,000,000	19,900	11,500,000
Emeralds, cut but unset	6,370	141,000	8,670	143,000
Coral and similar materials, unworked	NA	10,900	NA	10,400
Rubies and sapphires, cut but unset	9,150	191,000	10,400	226,000
Pearls:				
Natural	NA	8,520	NA	1,490
Cultured	NA	47,200	NA	35,000
Imitation	NA	1,290	NA	968
Other precious and semiprecious stones:				
Rough, uncut	1,020,000	22,200	812,000	24,200
Cut, set and unset	NA	213,000	NA	229,000
Other	NA	5,070	NA	6,580
Synthetic:				
Cut but unset	345,000	44,300	251,000	37,600
Other	NA	5,760	NA	5,610
Imitation gemstone[3]	NA	83,000	NA	55,700
Total	XX	11,400,000	XX	12,900,000

NA Not available. XX Not applicable.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Customs value.

[3]Does not include pearls.

Source: U.S. Census Bureau.

TABLE 11
NATURAL DIAMOND: ESTIMATED WORLD PRODUCTION, BY TYPE AND COUNTRY[1, 2, 3]

(Thousand carats)

Type and country[4]	1998	1999	2000	2001	2002
Gemstones:					
Angola	2,400	3,360	3,914 [5]	4,653 [5]	5,400
Australia	18,400	13,400 [r]	12,000 [r]	10,700	15,100
Botswana	14,800 [r]	17,200 [r]	18,500 [r]	19,800 [r]	21,300
Brazil	100 [5]	900 [5]	1,000 [5]	1,000 [5]	700
Canada	203 [5]	2,429 [5]	2,435 [r, 5]	3,685 [r, 5]	4,984 [5]
Central African Republic	330	311	346	360	375
China	230	230	230	235	235
Congo (Kinshasa)	5,080	4,120	3,500	9,100	9,100
Cote d' Ivoire	210	270	210	210	160
Ghana	658 [r]	546 [r]	792 [r]	936 [r]	770
Guinea	294	287 [r]	278	270	270
Guyana	50 [r, 5]	45 [r, 5]	82 [r, 5]	179 [r, 5]	100
Liberia	150	120	100	100	120
Namibia	1,350 [r]	1,630 [r]	1,450 [r]	1,487 [r, 5]	1,350
Russia	11,500	11,500	11,600	11,600	11,500
Sierra Leone	200	450	450	450	450
South Africa	4,280 [r]	4,010 [r]	4,320 [r]	4,470	4,350
Tanzania	83	200	301	216 [r]	182
Venezuela	80	59	29 [r]	14 [r]	15
Zimbabwe	10	15	8 [r]	-- [r]	--
Other	19 [r]	20 [r]	24 [r]	25 [r]	25
Total	60,400	61,100 [r]	61,600 [r]	69,500 [r]	76,500
Industrial:					
Angola	364	373	435	517	600
Australia	22,500	16,381 [5]	14,700	13,100	18,500
Botswana	5,000	5,730 [r]	6,160 [r]	6,600 [r]	7,100
Central African Republic	200	120	115	120	125
China	900	920	920	950	955
Congo (Kinshasa)	21,000	16,000	14,200	9,100	9,100
Cote d' Ivoire	100	128	110	110	90
Ghana	165 [r]	136 [r]	198 [r]	234 [r]	193
Guinea	98	96 [r]	91	100 [r]	100
Liberia	150	80	70	70	80
Namibia	71 [r]	-- [r]	106 [r]	--	--
Russia	11,600	11,500	11,600	11,600	11,500
Sierra Leone	50	150	150	150	150
South Africa	6,420 [r]	6,010 [r]	6,470 [r]	6,700	6,530
Tanzania	15	35	53 [r]	38 [r]	33
Venezuela	17	36	80 [r]	38 [r]	40
Zimbabwe	19	30	15 [r]	-- [r]	--
Other	44 [r]	52 [r]	64 [r]	66 [r]	68
Total	68,700	57,800 [r]	55,500 [r]	49,500 [r]	55,200
Grand total	129,000	119,000 [r]	117,000 [r]	119,000 [r]	132,000

[r]Revised. -- Zero.
[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.
[2]Table includes data available through May 27, 2003.
[3]In addition to the countries listed, natural diamond is produced in Nigeria, but information is inadequate to estimate output.
[4]Includes near-gem and cheap-gem qualities.
[5]Reported figure.