GEMSTONES

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In this report, the terms "gem" and "gemstone" mean any mineral or organic material (such as amber, pearl, petrified wood, and shell) 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 are the largest group of gemstones; oxides and quartz are the second largest (table 1). Gemstones are subdivided into diamond and colored gemstones, which in this report designates all natural nondiamond gems. In addition, laboratory-created 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. All percentages in the report were computed using unrounded data. Current information on industrial-grade diamond and industrial-grade garnet can be found in the U.S. Geological Survey (USGS) Minerals Yearbook, volume I, Metals and Minerals, chapters on industrial diamond and industrial garnet.

In 2004, the estimated value of natural gemstones produced in the United States was $14.5 million, and the estimated value of U.S. laboratory-created gemstone production was $30.7 million. The total estimated value of U.S. gemstone production was $45.2 million. The estimated value of U.S. gemstone imports was $15.5 billion, and the value of combined U.S. gemstone exports and reexports was estimated to be $7.23 billion.

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 worn more for pleasure or in appreciation of their beauty than to demonstrate wealth. In addition to jewelry, gemstones are used for collections, decorative art objects, and exhibits.

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 individual collectors, gem clubs, and hobbyists rather than by businesses.

The commercial gemstone industry in the United States consists of individuals and companies that mine gemstones or harvest shell and pearl, firms that manufacture laboratory-created gemstones, and individuals and companies that cut and polish natural and laboratory-created gemstones. The domestic gemstone industry is focused on the production of colored gemstones and on the cutting and polishing of large diamond stones. 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 2004 was estimated to be at least $14.5 million (table 3). The production value increased by 15% from that of the preceding year.

The estimate of 2004 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 2004, all 50 States produced at least $1,000 worth of gemstone materials. Seven States accounted for 79% of the total value, as reported by survey respondents. These States, in order of declining value of production, were Tennessee, Arizona, Oregon, California, Idaho, Montana, and Nevada. Some States were known for the production of a single gemstone material—Tennessee for freshwater pearls, for example. Other States produced a variety of gemstones, for example 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.

During 2004, the United States had only one operation in known diamond-bearing areas from which diamonds were produced. That diamond 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 of Arkansas. 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 2004, 383 diamond stones with an average weight of 0.2 carats were recovered at Crater of Diamonds State Park. Since the diamond-bearing pipe and the adjoining area became a State park in 1972, 22,833 diamond stones have been recovered (Rachel Engebrecht, park interpreter, Crater of Diamonds State Park, written commun., July 11, 2004). Exploration has demonstrated that there is about 78.5 million metric tons (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).

The Kelsey Lake diamond mine was a commercially operated diamond mine, located close to the Colorado-Wyoming State line near Fort Collins, CO. Diamond was produced at Kelsey Lake through April 2002, but the mine has been in care-and-maintenance mode since then with no additional production reported. 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 the 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 Mt grading an average of 4 carats per 100 metric tons (Taylor Hard Money Advisers, 2000§[1]).

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 in the United States, Leucite Hills, 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§).

The success of Canadian diamond mines has made people focus on whether there are also commercially producible diamond deposits in the United States. Currently, there are no operating commercial diamond mines in the United States. Australian and Canadian companies are now conducting diamond exploration in Alaska and Minnesota. Alaska has similar geologic terrain to the Northwest Territories; and garnet and other diamond indicator minerals, as well as 17 microscopic diamonds have been found near Anchorage. Two Canadian companies have invested $1 million in an exploration drilling program. Geologists from the University of Minnesota teamed with an Australian mining company are conducting a soil sampling program in Minnesota for mineral exploration, including diamond. The samples are being analyzed by Australia's WMC Resources Ltd. The scientists believe that there is good chance of success owing to Minnesota's similar geology to Canada (Diamond Registry Bulletin, 2005a).

In another exploration venture during the second half of 2004, Delta Mining and Exploration Corp. found a diamond-bearing kimberlite in an 80-acre site known as the Homestead property near Lewistown, MT. Preliminary tests have shown the presence of microscopic diamonds. The firm is now planning a $700,000 soil sampling program, as further exploration. Diamonds have been found in the stream beds and glacial valleys of Montana for years. One notable find was the 14-carat Lewis and Clark diamond found near Craig in 1990 (Associated Press, 2004§).

In addition to natural gemstones, laboratory-created gemstones and gemstone simulants are produced in the United States. Laboratory-created or synthetic gemstones have the same chemical, optical, and physical properties as the natural materials. Simulants have an appearance similar to that of a natural gemstone material, but they have different chemical, optical, and physical properties. Laboratory-created gemstones produced in the United States include alexandrite, 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 laboratory-created sapphire and spinel, used to represent other gemstones, are classified as simulants.

Laboratory-created gemstone production in the United States was valued at more than $30.7 million during 2004; simulant gemstone output was even greater and was estimated to be valued at more than $100 million. Five firms in five States, representing virtually the entire U.S. laboratory-created gemstone industry, reported production to the USGS. The States with reported laboratory-created gemstone production, in descending production value order, were North Carolina, Florida, Massachusetts, Michigan, and Arizona.

Gemesis Corp., a company in Sarasota, FL, produced consistent quality laboratory-created gem diamond and reported a fifth year of production in 2004. The laboratory-created diamonds are produced using equipment, expertise, and technology developed by a team of scientists from Russia and the University of Florida. The weight of the laboratory-created diamond stones range from 1.5 to 2 carats, and most of the stones are yellow, brownish yellow, colorless, and green (Weldon, 1999§). Gemesis uses diamond-growing machines, each machine capable of growing 3-carat rough diamonds by generating high pressures and high temperatures (HPHT) that recreate the conditions in the Earth's mantle, where natural diamonds form. Gemesis eventually plans to have 250 diamond-growing machines installed at their facility near Sarasota, FL (Davis, 2003); at that point, Gemesis could be producing as much as 30,000 to 40,000 stones each year, and annual revenues may hit $70 million to $80 million (Diamond Registry Bulletin, 2001). Gemesis diamonds became available for retail purchase in jewelry stores and on the Internet in fall 2003. The prices of the Gemesis laboratory-created diamonds are below those of natural diamond but above the prices of simulated diamond (Weldon, 2003§).

Apollo Diamond, Inc., a company near Boston, MA, has developed a method for growing gem-quality diamond by chemical vapor deposition (CVD). Robert Linares of Apollo Diamond received a patent for the process in June 2003. 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

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

resulted in the growth of a single diamond crystal. CVD diamond precipitates as nearly 100% pure, almost flawless diamond, and therefore may not be discernible from natural diamond by some tests (Davis, 2003). Apollo Diamond is producing 1-carat stones thus far, but hopes to be making 2-carat stones by 2006. The company is planning to start selling their diamonds in the jewelry market during the last half of 2005 at costs 10% to 30% below those of comparable natural diamonds (Hastings, 2005).

In early 2004, scientists at the Carnegie Institution's Geophysical Laboratory published a study that showed researchers grew diamond crystals by a special CVD process at very high growth rates. They were able to grow gem-sized crystals in a day; a growth rate 100 times faster than other methods used to date. The lead author of the study said that the diamonds were much harder to polish than conventional diamond crystals produced by HPHT methods. This is a new way of producing diamond crystals for such new applications as diamond-based electronic devices and next-generation cutting tools (Willis, 2004). By early 2005, the Carnegie Institution's Geophysical Laboratory and the University of Alabama had jointly developed and patented the CVD process and apparatus to produce 10-carat, ½-inch-thick single diamond crystals at very rapid growth rates (100 micrometers per hour). This faster CVD method uses microwave plasma technology, and it allows multiple crystals to be grown simultaneously. This size is about five times that of commercially available lab-created diamonds produced by HPHT and other CVD techniques. Dr. Russell Hemley of the Carnegie Institute stated, "High-quality crystals over 3 carats are very difficult to produce using the conventional approach. Several groups have begun to grow diamond single crystals by CVD, but large, colorless, and flawless ones remain a challenge. Our fabrication of 10-carat, half-inch, CVD diamonds is a major breakthrough" (Willis, 2004; Carnegie Institution of Washington, 2005; Science Blog, 2005§). Both Apollo Diamond and the Carnegie Institution have noted that their diamonds produced by the CVD method are harder than natural diamonds and diamonds produced by HPHT methods.

In 2004, the North Carolina company Charles & Colvard, Ltd. entered its seventh year of marketing moissanite, a gem-quality laboratory-created silicon carbide it produces. Moissanite is also an excellent diamond simulant, but it is being marketed for its own gem qualities. Moissanite exhibits a higher refractive index (brilliance) and higher luster than diamond. Its hardness is between corundum (ruby and sapphire) and diamond, which gives it durability (Charles & Colvard, Ltd., 2005§).

Consumption

Although the United States accounted for little of the total global gemstone production, it was the world's leading gemstone market. U.S. gemstone markets accounted for more than an estimated 35% of world gemstone demand in 2004. The U.S. market for unset gem-quality diamond during the year was estimated to have exceeded $14.6 billion. Domestic markets for natural, unset nondiamond gemstones totaled nearly $859 million.

In the United States, about two-thirds of domestic consumers designate diamond as their favorite gemstone when surveyed. In 2004, the top 10 selling colored gemstones, in descending order, were blue sapphire, fancy sapphire, ruby, tanzanite, emerald, pink tourmaline, amethyst, blue topaz, peridot, and pearl. Tsavorite garnet, aquamarine, opal, and green tourmaline dropped out of the top 10 from the previous year. Only 13% of the jewelry retailers said their sales were down in 2004 compared with 25% in 2003 (Wade, 2004; Prost, 2005). During 2004, U.S. retail jewelry store sales reached $28.3 billion, an increase of 5% compared with the previous year (by value). Jewelers' sales for the month of December 2004 were $6.7 billion, a 2% increase compared with that of December 2003 (Rapaport Diamond Report, 2005). Global retail sales of diamond jewelry increased by about 6.2% in 2004 compared with the previous year (Diamond Registry Bulletin, 2005d). The U.S. market accounted for more than 50% of the global diamond jewelry retail market in 2004.

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 more than 40% of the diamond produced each year (De Beers Group, 2004§). De Beers companies also sort and valuate about two-thirds (by value) of the world's annual supply of rough diamond through De Beers' subsidiary Diamond Trading Co. (DTC), which has marketing agreements with other producers (De Beers Group, 2003§).

Foreign Trade

During 2004, total U.S. gemstone trade with all countries and territories was valued at more than $22.1 billion, which was an increase of 18% from that of the previous year. Diamond accounted for about 96% of the 2004 gemstone trade total. In 2004, U.S. exports and reexports of diamond were shipped to 89 countries and territories, and imports of all gemstones were received from 169 countries and territories (tables 6-10). During 2004, U.S. trade in cut diamond increased by about 14% 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 leading 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).

In 2004, trade in laboratory-created gemstone increased by almost 13% for the United States compared with the previous year. Laboratory-created gemstone imports from Austria, China, Germany, Hong Kong, Sri Lanka, Switzerland, and Thailand made up almost 92% (by value) of the total domestic imports of laboratory-created gemstones during the year. Prices of certain laboratory-created gemstone imports, such as amethyst, were very competitive. The marketing of imported laboratory-created gemstones and enhanced gemstones as natural gemstones and the mixing of laboratory-created materials with natural stones in imported parcels continued to be problems for some domestic producers in 2004. There also were problems with some simulants being marketed as laboratory-created gemstones during the year.

World Industry Structure

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 diamond, colored gemstones are primarily produced at relatively small, low-cost operations with few dominant producers; prices are influenced by consumer demand and supply availability.

In 2004, world diamond production totaled about 156 million carats—89.4 million carats gem quality and 66.6 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 2004, Russia led the world in total diamond output quantity (combined gemstone and industrial). Botswana was the world's leading gemstone diamond producer, followed by Russia, Canada, and Australia, in descending quantity order.

Russian diamond production figures were released for the first time in December 2004. Production information had been kept as a state secret since the first diamond discovery in Siberia in 1955 (Diamond Registry Bulletin, 2005e).

De Beers reported that its sales of rough diamond for 2004 were $5.6 billion, which was up by 3% from $5.5 billion in 2003 (Diamond Registry Bulletin, 2004b; Diamond Registry Bulletin, 2005b).

Israel's polished diamond net exports increased by 14.4% to $6.33 billion during 2004, and its exports of rough diamond increased by 31% to $2.92 billion. The United States remained the leading diamond trading partner for Israel. Israel's rough diamond imports from the DTC were $932 million in 2004, which was 18% of their total rough imports. This was a drop from 22% in 2003 (Diamond Registry Bulletin, 2005c).

Additional events in 2004 significant to diamond mining, production, and marketing worldwide include the following:

- The Ekati Diamond Mine, Canada's first operating commercial diamond mine, completed its sixth full year of production. In 2004, Ekati produced 4.08 million carats of diamond from 4.54 Mt of ore (BHP Billiton Ltd., 2005). BHP Billiton Ltd. has an 80% controlling ownership of the Ekati, which is located in Northwest Territories in Canada. Ekati has estimated reserves of 60.3 Mt of ore in kimberlite pipes that contain 54.3 million carats of diamond, and Ekati projected the mine life to be 25 years. Ekati diamonds are sold by BHP's Antwerp sales office. The Ekati Mine is now producing from the Koala, Panda, and Misery kimberlite pipes. In November 2002, BHP began using underground mining techniques to recover diamonds from deeper portions of the Koala kimberlite pipe, which was first open-pit mined (Diamond Registry Bulletin, 2002). Plans were approved for underground mining of deeper portions of the adjacent Panda kimberlite pipe, and initial production was expected in early 2005 (BHP Billiton Ltd., 2004).
- The Diavik Diamond Mine, also in the Northwest Territories, completed its second full year of production. In 2004, Diavik produced 7.57 million carats of diamond from its A154 North ore body and the adjacent A154 South pipe. Both pipes are located within the same pit (Diavik Diamond Mines Inc., 2005). The Diavik Diamond Mine has estimated its reserves to be 25.6 Mt of ore in kimberlite pipes, containing 107 million carats of diamond, and Diavik projected the mine life to be 16 to 22 years. Diavik is an unincorporated joint venture between Diavik Diamond Mines Inc. (60%) and Aber Diamond Mines Ltd. (40%). The mine is expected to produce about 107 million carats of diamond at a rate of 8 million carats per year worth about $63 per carat (Diavik Diamond Mines Inc., 2000, p. 10-12).

In 2002, an international rough diamond certification system called the Kimberley Process Certification Scheme (KPCS) was implemented to solve the problem of conflict diamonds—rough diamonds used by rebel forces and their allies to help finance warfare aimed at subverting governments recognized as legitimate by the United Nations (UN). The KPCS was agreed upon by UN 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§). Canada acted as the chair and secretariat of the KPCS for the first 2 years, and in October, Russia assumed these duties. The KPCS will not be fully implemented until all participating countries have passed the necessary laws to carry it out. The Kimberley Process presently comprises 43 participants, and these participants account for approximately 99.8% of the global production of rough diamonds (Kimberley Process, 2005§). Discussions about the possible participation of several other countries are ongoing.

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 April 8, 2003, and by the U.S. Senate on April 10, 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 is the world's leading gem 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§).

At the end of 2003, De Beers and the U.S. Department of Justice began work toward settlement of its long-running dispute over alleged illegal price fixing. On July 13, De Beers Centenary AG pled guilty in Federal court in Ohio to conspiring to fix the price of industrial diamond in the United States and elsewhere, resolving a 1994 case. De Beers was sentenced to pay a $10 million fine. With this settlement, De Beers is now free to enter the U.S. market (Diamond Registry Bulletin, 2004c, d).

Worldwide, the value of production of natural gemstones other than diamond was estimated to have exceeded $2 billion in 2004. 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 an overall increase in sales during 2004 compared with the previous years sales. The popularity of colored gemstones, colored laboratory-created gemstones, and "fancy" colored diamonds continued to increase in 2004. This was indicated by the increased U.S. imports for consumption values in most colored stone categories (emerald, coral, rubies, sapphires, other precious and semiprecious stones, and laboratory-created) in 2004 compared with the values from the previous year (table 10). Colored stone popularity also was evidenced by their general slight sales increase in 2004 (Prost, 2005).

Tanzanite continued its popularity, moving back to fourth best selling stone in 2004 after moving up to third best selling stone in 2003. This popularity is in part owing to the American Gem Trade Association (a United States and Canadian trade association) adding tanzanite to the traditional list of birthstones for December in 2002. It is by far the most popular of blue and violet-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. Its rarity appears to also add to tanzanite's growing popularity among consumers.

Though U.S. shell production increased by 61% in 2004 compared with 2003, shell is not expected to ever be the large segment of U.S. gemstone production it was for several years in the past. The U.S. shell material from mussels is used as seed material for culturing pearls. The lower shell production is owing to overharvesting in past years, the killing off of U.S. native mussel species by 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 not completely recovered from the die-off of Japanese oysters. Seed material had been stockpiled in Japan, and now producers in Japan are using manmade seed materials or seed materials from China and other sources in addition to the stockpiled material. There also has 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). In some regions of the United States, shell from mussels is beginning to be used as a gemstone based on its own merit, rather than as seed material for pearls. This shell material is being used in beads, jewelry, and watch faces.

Outlook

There are indications that there may be continued growth in U.S. diamond and jewelry markets in 2005. 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, Northwest Territories, Nunavut, Ontario, and Quebec. Canada produced about 14% of the world's diamond in 2004, and in price per carat of diamond produced, Canada outranked many of the world's traditionally major diamond-mining countries (Diamond Registry Bulletin, 2004a). Canadian production continues to increase, and Canada is now third in production of gemstone diamond, after Botswana and Russia.

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 DTC will continue as the diamond industry adjusts to De Beers' reduced influence on the industry.

More laboratory-created gemstones, simulants, and treated gemstones will enter the marketplace and necessitate more transparent trade industry standards to maintain customer confidence.

Internet sales of diamonds, gemstones, and jewelry has grown tremendously during 2004, and they will continue to grow and increase in popularity, as will 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 (Diamond Registry Bulletin, 2004e, f).

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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	Chlorocalcium 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, 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[3]); medium (Sri Lanka)	High	8.5	3.50-3.84	Double	1.75	Synthetic	Strong dichroism, color varies from red to green, 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
Chrysoberyl—Continued:										
Cats-eye	Beryllium aluminate	Greenish to brownish	Small to large	High	8.5	3.50-3.84	Double	1.75	Synthetic, shell	Density, translucence, chatoyance.
Chrysolite	do.	Yellow, green, and/or brown	Medium	Medium	8.5	3.50-3.84	do.	1.75	Tourmaline, peridot	Refractive index, silky.
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 refreaction, 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, lack of flaws and inclusions, refractive index.
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.

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
Garnet	Complex silicate	Brown, black, yellow, green, red, or orange	Small to medium	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, 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.
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, yellow	Small	Low to medium	9.25	3.21	Double	2.65-2.69	Diamond, zircon, titania, cubic zirconia	Hardness, dispersion, lack of flaws and inclusions, refractive index.
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, gadolinite, gagate, 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.

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
Quartz—Continued:										
Amethyst	Silicon dioxide	Purple	Large	Medium	7.0	2.65-2.66	Double	1.55	Glass, plastic, fluorite	Macrocrystalline, color, refractive index, transparent, hardness.
Aventurine	do.	Green, red-brown, gold-brown, with 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, color, refractive index, 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	do.	do.	7.0	2.65-2.66	do.	1.55	do.	Macrocrystalline, color, refractive index, transparent, hardness.
Crystal:										
Rock	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.
Onyx	do.	Many colors	do.	do.	7.0	2.58-2.64	XX	XX	do.	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, color, refractive index, 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.

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
Rhodochrosite	Manganese carbonate	Rose-red to yellowish, stripped	Large	Low	4.0	3.45-3.7	Double	1.6-1.82	Fire opal, rhodonite, tugtupite, tourmaline	Color, crystal habit, reaction to acid, 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, spinel, pyroxmangite, spessartine, tourmaline	Color, black inclusions, lack of reaction to acid, hardness.
Shell:										
Mother-of-pearl	Calcium carbonate	White, cream, green, blue-green, with iridescent play of color	Small	do.	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, x-structure, 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	Do.
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	do.	1.63	Chrysocolla, dyed howlite, dumortierite, glass, plastics, variscite	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, 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.

[2]Low: up to $25 per carat; medium: up to $200 per carat; high: more than $200 per carat.

[3]Commonwealth of Independent States.

TABLE 2
LABORATORY-CREATED 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	2003	2004
Beryl	18	18
Coral, all types	118	261
Diamond	(2)	(2)
Garnet	56	207
Gem feldspar	659	659
Geode/nodules	(3)	(3)
Opal	(3)	(3)
Quartz:		
Macrocrystalline[4]	228	206
Cryptocrystalline[5]	391	383
Sapphire/ruby	474	473
Shell	2,490	4,000
Topaz	(3)	(3)
Tourmaline	48	45
Turquoise	827	699
Other	6,870 r	7,160
Total	12,500	14,500

See footnotes at end of table.

TABLE 3—Continued

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

[r]Revised.

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

[2]Included with "Other."

[3]Included in "Total."

[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 2004[1]

Carat weight	Description, color[2]	Clarity[3] (GIA terms)	Representative prices		
			January[4]	June[5]	December[6]
0.25	G	VS1	$1,200	$1,200	$1,200
do.	G	VS2	1,150	1,150	1,150
do.	G	SI1	975	975	975
do.	H	VS1	1,100	1,100	1,100
do.	H	VS2	1,000	1,000	1,000
do.	H	SI1	925	925	925
0.50	G	VS1	3,200	3,200	3,200
do.	G	VS2	2,800	2,800	2,800
do.	G	SI1	2,400	2,400	2,400
do.	H	VS1	2,800	2,800	2,800
do.	H	VS2	2,400	2,400	2,400
do.	H	SI1	2,200	2,200	2,200
0.75	G	VS1	3,600	3,600	3,600
do.	G	VS2	3,500	3,500	3,500
do.	G	SI1	3,200	3,200	3,200
do.	H	VS1	3,300	3,300	3,300
do.	H	VS2	3,200	3,200	3,200
do.	H	SI1	2,900	2,900	2,900
1.00	G	VS1	5,800	5,800	5,800
do.	G	VS2	5,500	5,500	5,500
do.	G	SI1	4,800	4,800	4,800
do.	H	VS1	5,200	5,200	5,200
do.	H	VS2	4,900	4,900	4,900
do.	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; SI1—slightly included.

[4]Source: Jewelers' Circular Keystone, v. 174, no. 2, February 2003, p. 44.

[5]Source: Jewelers' Circular Keystone, v. 174, no. 7, July 2003, p. 52.

[6]Source: Jewelers' Circular Keystone, v. 175, no. 1, January 2004, p. 28.

TABLE 5
PRICES PER CARAT OF U.S. CUT COLORED GEMSTONES IN 2004

Gemstone	Price range per carat	
	January[1]	December[2]
Amethyst	$7-14	$7-15
Blue sapphire	650-1,200	685-1,250
Blue topaz	3-5	3-5
Emerald	1,800-2,800	1,900-3,200
Green tourmaline	45-60	45-60
Pearl:[3]		
Cultured saltwater	5	5
Natural	210	210
Pink tourmaline	60-125	60-125
Rhodolite garnet	18-30	18-30
Ruby	800-1,125	800-1,125
Tanzanite	225-300	250-400

[1]Source: The Guide, spring/summer 2004, p. 14, 30, 45, 61, 72, 86, 96, 98, 104, 123, and 135. 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 2004-2005, p. 14, 30, 45, 61, 72, 86, 96, 98, 104, 123, and 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-milimeter pearl.

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

Country	2003		2004	
	Quantity (carats)	Value[2] (millions)	Quantity (carats)	Value[2] (millions)
Exports:				
Belgium	14,200	$11	189,000	$99
Canada	78,200	47	68,500	47
Costa Rica	18,800	1	31,800	3
France	3,150	7	16,300	11
Germany	4,790	4	1,370	1
Guatemala	2,850	(3)	5,990	1
Hong Kong	114,000	59	529,000	219
India	34,900	5	151,000	31
Israel	38,400	39	340,000	204
Japan	17,300	19	22,600	26
Mexico	205,000	32	397,000	124
Netherlands	307	3	421	3
Netherlands Antilles	19,000	21	47,200	23
Singapore	1,590	6	12,300	5
Switzerland	7,360	29	18,300	47
Thailand	34,400	6	68,500	15
United Arab Emirates	9,290	3	15,700	4
United Kingdom	4,080	7	26,300	28
Other	92,200 r	36 r	58,600	39
Total	699,000	335	2,000,000	932

See footnotes at end of table.

TABLE 6—Continued

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

	2003		2004	
	Quantity	Value[2]	Quantity	Value[2]
Country	(carats)	(millions)	(carats)	(millions)
Reexports:				
Armenia	--	--	61,800	3
Belgium	3,860,000	1,260 r	4,140,000	1,310
Canada	124,000	64	217,000	106
Dominican Republic	78,700	12	104,000	23
France	16,200	30	155,000	31
Guatemala	114,000	13	91,100	8
Hong Kong	2,670,000	471	2,620,000	489
India	1,420,000	234	1,710,000	335
Israel	5,700,000	1,920 r	6,340,000	2,570
Japan	185,000	46	181,000	46
Malaysia	28,800	5	41,100	9
Mexico	6,980	2	37,000	5
Singapore	204,000	30	262,000	46
South Africa	24,600	15	49,000	13
Switzerland	409,000	283	518,000	285
Thailand	266,000	55	284,000	70
United Arab Emirates	220,000	57	380,000	101
United Kingdom	397,000	140	487,000	171
Other	51,700 r	34 r	93,200	46
Total	15,800,000	4,670 r	17,800,000	5,670
Grand total	16,500,000	5,010 r	19,800,000	6,600

rRevised. -- Zero.

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

2Customs value.

3Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 7

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

	2003		2004	
	Quantity	Value[2]	Quantity	Value[2]
Kind, range, and country of origin	(carat)	(millions)	(carat)	(millions)
Rough or uncut, natural:[3]				
Angola	5,630	$21	6,590	$19
Australia	90,000	14	12,200	8
Belgium	7,160	4	28,100	6
Botswana	2,850	5	144,000	48
Brazil	65,100	29	9,530	8
Canada	13,700	18	36,500	38
Congo (Brazzaville)	10,400	9	9,140	8
Congo (Kinshasa)	20,400	31	20,900	17
Guyana	173,000	15	157,000	16
India	1,330	(4)	34,500	3
Israel	53,200	9	12,300	14
Namibia	611	(4)	28,700	1
Russia	20,000	10	250,000	20
South Africa	582,000	463	430,000	508
United Kingdom	441,000	61	15,300	18
Other	18,200 r	18 r	11,500	21
Total	1,500,000	707	1,210,000	753

See footnotes at end of table.

TABLE 7—Continued

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

	2003		2004	
Kind, range, and country of origin	Quantity (carat)	Value[2] (millions)	Quantity (carat)	Value[2] (millions)
Cut but unset, not more than 0.5 carat:				
Belgium	775,000	282	786,000	275
Canada	4,900	5	4,800	4
China	73,000	6	67,100	10
Congo (Kinshasa)	3,850	(4)	5,920	(4)
Dominican Republic	12,200	1	37,200	4
France	65	(4)	4,860	(4)
Hong Kong	374,000	59	200,000	43
India	10,500,000	1,750	9,720,000	1,770
Israel	1,050,000	525	969,000	477
Italy	2,860	(4)	3,960	(4)
Mexico	160,000	5	14,400	(4)
Russia	29,400	5	21,500	5
Singapore	2,710	1	9,460	2
Switzerland	47,800	8	7,390	2
Thailand	68,200	10	189,000	36
United Arab Emirates	198,000	31	122,000	24
United Kingdom	2,530	2	4,580	2
Other	47,400 r	16 r	37,200	16
Total	13,400,000	2,710	12,200,000	2,670
Cut but unset, more than 0.5 carat:				
Belgium	1,260,000	2,310	1,230,000	2,450
Canada	15,800	51	23,600	67
France	3,040	11	27,800	50
Hong Kong	76,500	124	71,300	111
India	1,210,000	815	1,530,000	1,080
Israel	3,000,000	5,540	3,080,000	6,660
Italy	2,510	3	4,870	5
Namibia	6	(4)	6,010	9
Russia	58,600	101	62,200	121
South Africa	35,100	149	40,500	242
Switzerland	15,100	158	20,100	155
Thailand	19,400	17	21,300	23
United Arab Emirates	10,200	10	23,800	21
United Kingdom	16,600	95	13,800	84
Other	30,000 r	68 r	35,700	126
Total	5,760,000	9,460	6,190,000	11,200

[r]Revised.

[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 ½ 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	2003 Quantity (carats)	2003 Value[2] (millions)	2004 Quantity (carats)	2004 Value[2] (millions)
Emerald:				
Afghanistan	--	--	5,860	$1
Belgium	8,150	$1	25,200	2
Brazil	262,000	5	355,000	4
China	10,800	(3)	227,000	1
Colombia	522,000	54	677,000	47
Germany	56,900	1	7,440	1
Hong Kong	101,000	5	57,100	4
India	1,460,000	21	1,880,000	18
Israel	128,000	23	259,000	21
Netherlands	--	--	50,200	(3)
South Africa	16	(3)	6,370	1
Swaziland	--	--	3,800	1
Switzerland	27,300	6	9,450	7
Thailand	419,000	7	424,000	8
United Arab Emirates	11,000	(3)	1,200	(3)
Zambia	214	(3)	2,620	(3)
Other	11,800 r	3 r	7,520	6
Total	3,020,000	126	4,000,000	122
Ruby:				
Belgium	8,330	1	6,450	2
Brazil	13,800	(3)	99,300	(3)
China	4,810	(3)	21,700	(3)
Dominican Republic	28,200	(3)	4,920	(3)
Germany	14,900	1	19,400	1
Hong Kong	181,000	7	52,100	4
India	1,910,000	5	1,300,000	4
Israel	7,190	1	41,300	1
Italy	2,540	2	6,570	(3)
Japan	6,860	(3)	25,200	(3)
Netherlands	--	--	50,200	(3)
South Africa	--	--	3,130	(3)
Sri Lanka	12,500	2	5,260	1
Thailand	2,260,000	47	2,090,000	43
United Arab Emirates	31,100	1	7,700	1
Other	74,400 r	19 r	12,100	16
Total	4,550,000	87	3,750,000	72
Sapphire:				
Australia	33,200 r	(3)	5,300	(3)
Bahrain	--	--	5,930	(3)
Belgium	10,400	1	4,480	1
China	12,500	(3)	120,000	(3)
Germany	35,800	3	41,000	2
Hong Kong	234,000	6	138,000	7
India	1,150,000	5	1,040,000	9
Israel	26,500	3	56,600	3
Japan	287	(3)	11,900	(3)
Netherlands	6,000	(3)	50,200	(3)
South Africa	76	(3)	13,300	(3)
Sri Lanka	314,000	30	455,000	42
Switzerland	75,100	6	29,900	11
Taiwan	725	(3)	10,700	(3)
Thailand	6,010,000	73	5,470,000	78

See footnotes at end of table.

TABLE 8—Continued

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

	2003		2004	
Kind and country	Quantity (carats)	Value[2] (millions)	Quantity (carats)	Value[2] (millions)
Sapphire—Continued:				
Turkey	--	--	11,200	(3)
United Arab Emirates	23,200	1	7,360	(3)
United Kingdom	21,800	3	7,820	3
Other	77,600 r	7 r	18,900	6
Total	8,040,000	136	7,500,000	163
Other:				
Rough, uncut:				
Australia	NA	$4	NA	$3
Brazil	NA	9	NA	8
Canda	NA	2	NA	3
China	NA	3	NA	3
Colombia	NA	1	NA	1
France	NA	1	NA	1
Germany	NA	3	NA	2
Hong Kong	NA	1	NA	1
India	NA	3	NA	1
Mexico	NA	(3)	NA	1
Netherlands	NA	1	NA	1
Pakistan	NA	1	NA	1
South Africa	NA	1	NA	7
Tanzania	NA	2	NA	1
Thailand	NA	1 r	NA	1
Other	NA	3 r	NA	4
Total	NA	35 r	NA	39
Cut, set and unset:				
Australia	NA	9 r	NA	9
Austria	NA	1	NA	3
Brazil	NA	8	NA	13
Canada	NA	1	NA	1
China	NA	34 r	NA	45
France	NA	1	NA	1
Germany	NA	32 r	NA	38
Hong Kong	NA	32 r	NA	35
India	NA	78 r	NA	82
Israel	NA	6	NA	4
Italy	NA	1	NA	1
Mexico	NA	(3)	NA	1
South Africa	NA	1	NA	5
Sri Lanka	NA	5	NA	7
Switzerland	NA	18 r	NA	10
Taiwan	NA	2	NA	2
Tanzania	NA	6	NA	7
Thailand	NA	37 r	NA	46
United Arab Emirates	NA	1	NA	2
Other	NA	4 r	NA	8
Total	NA	277 r	NA	320

r Revised. 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 ½ unit.

Source: U.S. Census Bureau.

TABLE 9
VALUE OF U.S. IMPORTS OF LABORATORY-CREATED AND IMITATION GEMSTONES, BY COUNTRY[1,2]

(Thousand dollars)

Country	2003	2004
Laboratory-created, cut but unset:		
Austria	477	2,410
Brazil	48	225
Canada	123	98
China	10,100	14,100
Cyprus	--	246
Czech Republic	5	114
France	881	989
Germany	11,300	13,800
Hong Kong	1,230	1,500
India	530	261
Italy	74	75
Japan	187	112
Korea, Republic of	712	649
Netherlands	35	232
Philippines	95	38
Sri Lanka	1,610	1,290
Switzerland	7,220	3,340
Taiwan	234	197
Thailand	1,180	1,090
United Kingdom	46	31
Other	223 r	96
Total	36,300	40,900
Imitation:[3]		
Austria	39,600	60,800
China	2,430	4,660
Czech Republic	6,100	7,000
Germany	1,120	974
Hong Kong	1,140	700
India	567	207
Italy	137	100
Japan	376	1,110
Korea, Republic of	674	774
Liechtenstein	--	28
Russia	70	53
Spain	133	165
Taiwan	72	220
Thailand	--	31
United Arab Emirates	21	62
Other	339 r	176
Total	52,700	77,000

[r]Revised. -- Zero.

[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	2003		2004	
	Quantity	Value[2]	Quantity	Value[2]
Diamonds:				
Rough or uncut	1,510 r	707,000	1,210	753,000
Cut but unset	19,100	12,200,000	18,400	13,900,000
Emeralds, cut but unset	3,020	126,000	4,000	122,000
Coral and similar materials, unworked	5,910	11,100	6,120	11,500
Rubies and sapphires, cut but unset	12,600	222,000	11,200	234,000
Pearls:				
Natural	NA	601	NA	NA
Cultured	NA	39,100	NA	29,500
Imitation	NA	2,920	NA	3,780
Other precious and semiprecious stones:				
Rough, uncut	1,360,000	21,900	1,130,000	25,200
Cut, set and unset	NA	241,000	NA	279,000
Other	NA	6,440	NA	5,680
Laboratory-created:				
Cut but unset	224,000	36,300	249,000	40,900
Other	NA	6,920	NA	8,110
Imitation gemstone[3]	NA	49,800	NA	73,300
Total	XX	13,600,000	XX	15,500,000

[r]Revised. 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 COUNTRY AND TYPE[1, 2, 3]

(Thousand carats)

Country and type[4]	2000	2001	2002	2003	2004
Gemstones:					
Angola	3,880 r	4,640 r	4,520	4,500 r	5,400
Australia	11,956 5	11,779 5	15,142 5	14,900	9,279 5
Botswana	18,500	19,800	21,300	22,800	23,300
Brazil	1,000	700	500	500	500
Canada	2,534 5	3,716 5	4,937 r, 5	11,200	12,618 p, 5
Central African Republic	348 r	340 r	312 r	250 r	250
China	230	235	235	235	250
Congo (Kinshasa)	3,500	3,640	4,400	5,400	6,000
Cote d'Ivoire	210	207	204	152 r	152
Ghana	792	936	770	760 r	800
Guinea	278	273	368	484 r	468
Guyana	82 5	179 5	248 5	413 r, 5	450
Liberia	100	100	48	36	18
Namibia	1,450	1,487 5	1,562 r, 5	1,481 r, 5	2,000
Russia	17,500 r	17,500 r	17,400 r	20,000 r	21,400
Sierra Leone	58	167	147 5	250 r	309
South Africa	4,320	4,470	4,350	5,070	5,780
Tanzania	301	216	204 r	201 r	305
Venezuela	29 5	14 5	46 5	11 r, 5	40
Zimbabwe	8	--	--	--	16
Other[6]	24	25	25	24	24
Total	67,100 r	70,400 r	76,700 r	88,700 r	89,400
Industrial:					
Angola	431 r	516 r	502	500 r	600
Australia	14,612 5	14,397 5	18,500 5	18,200	11,341 5
Botswana	6,160	6,600	7,100	7,600	7,800
Central African Republic	116 r	113 r	104	83 r	83
China	920	950	955	955	960
Congo (Kinshasa)	14,200	14,560 5	17,456 5	21,600	22,000
Cote d'Ivoire	110	102	102	78 r	78
Ghana	198	234	193	190 r	200
Guinea	91	91	123	161 r	157
Liberia	70	70	32	24	12
Namibia	106	--	--	--	--
Russia	11,700 r	11,700 r	11,600 r	13,000 r	14,200
Sierra Leone	19	56	205 5	257 r	304
South Africa	6,470	6,700	6,530	7,600	8,670
Tanzania	53 5	38 5	36 r, 5	36 r, 5	55
Venezuela	80 5	28 5	61 5	24 r, 5	60
Zimbabwe	15	--	--	--	31
Other[7]	64	66	68	67	66
Total	55,400 r	56,200 r	63,600 r	70,400 r	66,600
Grand total	122,000 r	127,000 r	140,000 r	159,000 r	156,000

[p]Preliminary. [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 June 3, 2005.

[3]In addition to the countries listed, Nigeria and the Republic of Korea produce natural diamond and synthetic diamond, respectively, but information is inadequate to formulate reliable estimates of output levels.

[4]Includes near-gem and cheap-gem qualities.

[5]Reported figure.

[6]Includes Gabon, India, and Indonesia.

[7]Includes India and Indonesia.