2008 Minerals Yearbook

GEMSTONES [ADVANCE RELEASE]

U.S. Department of the Interior
U.S. Geological Survey

September 2010

GEMSTONES

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In 2008, the estimated value of natural gemstones produced in the United States was more than $11.5 million, and the estimated value of U.S. laboratory-created gemstone production was more than $51.4 million. The total estimated value of U.S. gemstone production was almost $62.9 million. The value of U.S. gemstone imports was $20.9 billion, and the value of combined U.S. gemstone exports and reexports was estimated to be $15.3 billion.

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 in terms of chemical composition; 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, respectively.

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.

Legislation and Government Programs

Congress has authorized the sale of all diamond in the National Defense Stockpile (NDS), which is managed by the Defense National Stockpile Center (DNSC), Defense Logistics Agency. Many of the industrial diamond stones in the NDS were determined to be lower gemstone quality diamonds during an evaluation of the stockpiled diamonds that was conducted in the mid-1990s. The entire remaining inventory of the stockpiled diamond stones was authorized for sale in the NDS’s fiscal year 2008 annual plan. This was accomplished in one sale that was held in July in which 473,000 carats of diamond were sold for $8.22 million (Lough, 2008). At yearend 2008, the DNSC reported no remaining inventory of industrial diamond stone in the NDS.

Most U.S. producers of laboratory-created or synthetic gemstones prefer calling their gems “cultured” rather than laboratory-created, referring to the fact that the gems are grown much like a cultured pearl is grown. The Jewelers Vigilance Committee along with 10 other jewelry industry trade associations filed a petition with the Federal Trade Commission (FTC) in December 2006, requesting the Guides for the Jewelry, Precious Metals, and Pewter Industries be amended to prohibit the use of the term “cultured” to describe these laboratory-created gemstones. It was the position of the trade associations that the term was deceptive, misleading, and unfair. However, the FTC denied the petition by unanimous vote in July 2008 (Federal Trade Commission, 2008).

In December 2007, both houses of the U.S. Congress passed the Burma Jade Act of 2008, and it was signed into law by the President on July 29, 2008. The Act became Public Law 110–286 (122 Stat. 2632), which imposes sanctions to prohibit the U.S. importation of gemstones (specifically rubies and jadeite) and hardwoods from Burma (Myanmar). This Act was to promote a coordinated international effort to restore civilian democratic rule to Burma. The Act did not prevent the export of Burmese gems from the United States nor did it prevent U.S. sales of Burmese gems already in the United States (JCK Online, 2008; U.S. Congress, 2008).

Production

U.S. gemstone production data were 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 gathered at gem and mineral shows.

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 are relatively small compared with those of 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 operations (U.S. International Trade Commission, 1997, p. 23).

The total value of natural gemstones produced in the United States during 2008 was estimated to be about $11.5 million (table 3). This production value was a 4% decrease from that of 2007, owing to a 32% decrease in shell production.

Natural gemstone materials indigenous to the United States are collected, produced, and/or marketed in every State. During 2008, all 50 States produced at least $1,300 worth of gemstone materials. Nine States accounted for 80% of the total value, as reported by survey respondents. These States were, in descending order of production value, Tennessee, Arizona, Oregon, Utah, California, North Carolina, Arkansas, Idaho, and Colorado. 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's 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.

In 2008, the United States had only one active operation in a known diamond-bearing area in Crater of Diamonds State Park near Murfreesboro in Pike County, AR. The State of Arkansas maintains a dig-for-fee operation for tourists and rockhounds at the park; 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 2008, 946 diamond stones with an average weight of 0.204 carats were recovered at the Crater of Diamonds State Park. Of the 946 diamond stones recovered, 27 weighed more than 1 carat. Since the diamond-bearing pipe and the adjoining area became a State park in 1972, 27,827 diamond stones with a total carat weight of 5,517.25 have been recovered (Waymon Cox, park interpreter, Crater of Diamonds State Park, written commun., January 22, 2009). 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).

There have been no commercially operated diamond mines in the United States since 2002. Diamond was produced at the Kelsey Lake diamond mine, located close to the Colorado-Wyoming State line near Fort Collins, CO, for several years until April 2002. The Kelsey Lake property has now been fully reclaimed.

Canadian diamond mining industry success stimulated some interest in exploration for diamond deposits in areas of the United States with similar geologic settings and terrain. The States where these areas are located are Alaska, Colorado, Minnesota, Montana, and Wyoming (Associated Press, 2002, 2004; Diamond Registry Bulletin, 2005a). Although exploration and field studies have found a number of large diamond deposits, thus far none have attracted long-term investors and have been able to open a commercially feasible mine.

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 gemstones. Simulants have an appearance similar to that of a natural gemstone material, but they have different chemical, optical, and physical properties. Laboratory-created gemstones that have been produced in the United States include alexandrite, diamond, emerald, garnet, moissanite, ruby, sapphire, spinel, turquoise, and zirconia. However, during 2008, only cubic zirconia, diamond, moissanite, and turquoise were produced commercially. 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 $51.4 million during 2008, which was a 30% decrease compared with that of 2007. This was owing to a very large decrease in laboratory-created moissanite production. The value of U.S. simulant gemstone output was estimated to be more than $100 million. Five companies 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 were, in descending order of production value, North Carolina, Florida, New York, Massachusetts, and Arizona.

Since the 1950s, when scientists manufactured the first laboratory-created bits of diamond grit using a high-pressure, high-temperature (HPHT) method, this method of growing diamonds has become relatively commonplace in the world as a technology for laboratory-created diamonds, so much so that thousands of small plants throughout China were using the HPHT method and producing laboratory-created diamonds suitable for cutting as gemstones. Gem-quality diamonds of one carat or more are harder to manufacture because at that size it is difficult to consistently produce diamonds of high quality, even in the controlled environment of a lab using the HPHT method. But after 50 years of development, that situation is changing, and several laboratory-created diamond companies are producing high-quality diamonds that equal those produced from mines (Park, 2007).

Gemesis Corp. in Sarasota, FL, consistently produced gem-quality laboratory-created diamond and reported a ninth year of production in 2008. 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 ranges from 1½ to 2 carats, and most of the stones are yellow, brownish yellow, colorless, and green. Gemesis uses diamond-growing machines, each machine capable of growing 3-carat rough diamonds by generating HPHT conditions that recreate the conditions in the Earth's mantle where natural diamonds form (Davis, 2003). Gemesis could be producing as much as 30,000 to 40,000 stones each year, and annual revenues may reach $70 million to $80 million. Gemesis diamonds are available for retail purchase in jewelry stores and on the Internet, and the prices of the Gemesis laboratory-created diamonds are 30% to 50% less than those of comparable natural diamond but above the prices of simulated diamond (Gemesis Corp., 2010).

Apollo Diamond, Inc. near Boston, MA, developed and patented a method for growing extremely pure, gem-quality diamond with flawless crystal structure by chemical vapor deposition (CVD). The CVD technique transforms carbon into plasma, which is then precipitated onto a substrate as diamond. CVD has been used for more than a decade to cover large surfaces with microscopic diamond crystals, but until this process, no one had discovered the temperature, gas composition, and pressure combination that resulted in the growth of a single diamond crystal. CVD diamond precipitates as nearly 100% pure, almost flawless diamond and therefore may not be distinguishable from natural diamond by some tests (Davis, 2003). In 2007, Apollo Diamond produced laboratory-created stones that ranged from 1 to 2 carats and expected to expand to larger stones in the future. Growth of CVD diamonds is limited only by the size of the seed placed in the diamond growing chamber. Late in 2006, Apollo started selling jewelry directly to consumers through a jeweler in Boston. In 2008, the company increased its production of large stones and was selling online through an Apollo Diamond Web store. Apollo diamonds sell at costs that average 15% less than those of comparable natural diamonds (Apollo Diamond, Inc., 2008). Besides when used as gemstones, CVD diamond is most highly valued as a material for high-tech uses. CVD diamond could be used to make extremely powerful lasers; to create cellular telephones that fit into a watch and storage devices for MP3 players that could store 10,000 movies, not just 10,000 songs; to create frictionless medical replacement joints; to create windows on spacecraft; to create surgical diamond blades and scalpels; to create tweeters for audio equipment; or as coatings for cars that would not scratch or wear out. The greatest potential use for CVD diamond is in computers and other electronic devices that utilize processors (Maney, 2005; Park, 2007).

Both Apollo and Gemesis prefer to call their diamonds "cultured" rather than laboratory-created, referring to the fact that the diamonds are grown much like a cultured pearl is grown.

The Carnegie Institution of Washington Geophysical Laboratory and the University of Alabama jointly developed and patented the CVD process and apparatus to produce ½-inch-thick 10-carat single diamond crystals at very rapid growth rates (100 micrometers per hour). This faster CVD method uses microwave plasma technology and allows multiple crystals to be grown simultaneously. This size is about five times that of commercially available laboratory-created diamonds produced by HPHT methods and other CVD techniques. A researcher at the Carnegie Institution 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). Apollo and the Carnegie Institution have noted that diamonds produced by the CVD method are harder than natural diamonds and diamonds produced by HPHT methods.

In 2008, Charles & Colvard, Ltd. in North Carolina entered its 11th year of producing and marketing moissanite, a gem-quality laboratory-created silicon carbide. 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 those of corundum (ruby and sapphire) and diamond, which gives it durability (Charles & Colvard, Ltd., 2007).

U.S. shell production decreased by 32% in 2008 compared with that of 2007. U.S. mussel shells are used as a source of mother-of-pearl and as seed material for culturing pearls. Pearl producers in Japan have begun 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 and freshwater pearls that do not use U.S. seed material. In some regions of the United States, shell from mussels was being used more as a gemstone based on its own merit rather than as seed material for pearls. This shell material was being processed into mother-of-pearl and used in beads, jewelry, and watch faces.

Consumption

Although the United States accounted for little of the total global gemstone production, it was the world's leading gemstone market. It was estimated that U.S. gemstone markets accounted for more than 35% of world gemstone demand in 2008. The U.S. market for unset gem-quality diamond during the year was estimated to be about $19.7 billion, an increase of 4% compared with that of the previous year. Domestic markets for natural, unset nondiamond gemstones totaled approximately $1.12 billion in 2008, which was an 8% decrease from that of 2007.

In the United States, about two-thirds of domestic consumers designate diamond as their favorite gemstone when surveyed (Wade, 2006). The popularity of colored gemstones, colored laboratory-created gemstones, and "fancy" colored diamonds remained high in 2008, but the values of the domestic markets for almost all types of colored natural, unset nondiamond gemstones decreased from 2007 values (table 10) owing to the impact of the recession on luxury spending. Colored stone popularity also was evidenced by their share of overall gemstone sales remaining constant in 2008 (Yonick, 2008). The largest demand for colored stones was in the American and Asian colored diamond markets with strong sales of champagne, cognac, grey, black, pink, orange, and yellow stones (Diamond Registry Bulletin, 2007).

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 valuations 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 remain a significant force affecting the price of gem-quality diamond worldwide because they mine a significant portion of the world's gem-quality diamond produced each year, and they also purchase diamonds from Russia. In 2008, De Beers companies produced 48.1 million carats, down from 2007 production of 51.1 million carats. De Beers companies also sorted and valuated a large portion (by value) of the world's annual supply of rough diamond through De Beers' subsidiary Diamond Trading Co. (DTC), which had marketing agreements with other producers. In 2008, DTC had diamond sales of $5.93 billion, which was a slight increase from diamond sales of $5.92 billion in 2007 (De Beers Group, 2008, p. 27; 2009, p. 17). There were about 200,000 diamond jewelry retail outlets worldwide. From these retail outlets, about 45% of diamond jewelry was sold in the United States, 33% in Asia, and 11% in Europe. There were an estimated 32,000 retail outlets specializing in fine jewelry in the United States. Of these jewelry-only retailers, 79% are small, independent businesses that are highly competitive in their local markets. The remaining 21% are major national and regional chains and online retailers. The estimated U.S. retail jewelry sales were $60 billion in 2008, down slightly from the prior year's sales (IDEX Magazine, 2009). The market shares by type of outlet, in descending order of value, were local independents, 21%; national and regional chains, 15%; department stores, 13%; television shopping networks, 11%; Internet auction sites, 11%; discount chains, 8%; Internet jewelry sites, 6%; and others (catalogs, boutiques, and other outlets), 15% (Profile America, Inc., 2008).

Foreign Trade

During 2008, total U.S. gemstone trade with all countries and territories was valued at about $36.2 billion, which was an increase of 11% from that of 2007. Diamond accounted for about 97% of the 2008 gemstone trade total. In 2008, U.S. exports and reexports of diamond were shipped to 76 countries and territories, and imports of all gemstones were received from 95 countries and territories (tables 6–10). In 2008, U.S. import quantities in cut diamond decreased by 16%, compared with those of 2007. U.S. imports in rough and unworked diamond decreased by 47%, owing to decreases of 45% or more in the quantities imported from Botswana, Brazil, Canada, Ghana, India, Russia, and South Africa (table 7). The United States remained the world's leading diamond importer and was a significant international diamond transit center as well as the world's leading gem-quality diamond market. In 2008, U.S. export quantities of gem-grade diamond decreased by 29% compared with those of 2007. The large volume of reexports shipped to other centers revealed the significance that the United States had in the world's diamond supply network (table 6).

Imports of laboratory-created gemstone decreased by 17% for the United States in 2008 compared with trade in 2007. Laboratory-created gemstone imports from Austria, Brazil, China, Germany, Hong Kong, India, Sri Lanka, Switzerland, and Thailand, with more than $500,000 in imports each, made up about 90% (by value) of the total domestic imports of laboratory-created gemstones during the year (table 9). Prices of certain imported laboratory-created gemstones, 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 2008. There also were continuing problems with some simulants being marketed as laboratory-created gemstones during the year.

World Review

The gemstone industry worldwide has two distinct sectors—diamond mining and marketing and colored gemstone production and sales. 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 2008, world natural diamond production totaled about 159 million carats—87.0 million carats gem quality and 71.8 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 2008, Russia led the world in total natural diamond output quantity (combined gemstone and industrial) with 23% of the world estimated production. Botswana was the world's leading gemstone diamond producer, followed by Russia, Canada, Angola, Congo (Kinshasa), South Africa, Guinea, and Namibia in descending order of quantity. These eight countries produced 97% (by quantity) of the world's gemstone diamond output in 2008.

In 2002, the international rough-diamond certification system, the Kimberley Process Certification Scheme (KPCS), was agreed upon by United Nations (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 sharing 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). In 2008, India assumed the chair of KPCS for the period from January 1 through December 31, 2008. India was one of the founding members of the KPCS and was the sixth in succession to hold the chair after South Africa, Canada, Russia, Botswana, and the European Commission (Kimberley Process, 2008). The list of participating countries expanded to include 50 nations plus the rough diamond-trading entity of Taipei. Out of these 50 countries, Cote d' Ivoire was under UN sanctions and was not trading in rough diamonds, and Venezula had voluntarily suspended exports and imports of rough diamonds until further notice. The KPCS was implemented to solve the problem of conflict diamonds. The participating nations in the KPCS account for approximately 98% of the global production and trade of rough diamonds (Diamond Registry Bulletin, 2005b; Kimberley Process, 2009).

Globally, the value of production of natural gemstones other than diamond was estimated to be about $2 billion in 2008. 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.

Worldwide in 2008, 18 diamond projects containing at least 1 million carats in resources were explored and developed. However, because of global economic turmoil in late 2008 and into 2009, almost all of these were undergoing review as the mining companies attempted to conserve funds and survive until the market improved (Metals Economics Group, 2009).

Botswana.—The Lerala Mine owned by DiamonEx Ltd. started mine production in October. The mine was expected to produce 330,000 carats per year. In early November, the company held its first sale of 10,600 carats. However, in January 2009, DiamonEx placed the Lerala Mine on care-and-maintenance status owing to difficult market conditions (Metals Economics Group, 2009).

Brazil.—The Duas Barras Mine, a placer mine located in Minas Gerais and wholly owned by Vaaldiam Resources Ltd., had reached commercial production level in September 2007 and completed its first diamond sale in January 2008. In 2008, Vaaldiam's production increased to 50,000 carats per year from 25,000 carats per year (Metals Economics Group, 2008).

Canada.—Canadian diamond production was 14.8 million carats during 2008, a decrease of about 14% compared with that of the previous year. Diamond exploration continued in Canada, with several commercial diamond projects and additional discoveries in Alberta, British Columbia, the Northwest Territories, Nunavut, Ontario, and Quebec. In 2008, Canadian production accounted for 9.3% of the world's combined natural gemstone and industrial diamonds.

The Ekati Diamond Mine, Canada's first operating commercial diamond mine, completed its 10th full year of production in 2008. Ekati produced 3.6 million carats of diamond from 4.43 million metric tons (Mt) of ore. BHP Billiton Ltd. has an 80% controlling ownership in Ekati, which is in the Northwest Territories. Ekati has estimated remaining reserves of 44.1 Mt of ore in kimberlite pipes that contain 23.3 million carats of diamond. BHP Billiton projected the remaining mine life to be 14 years (BHP Billiton Ltd., 2009, p. 10; Perron, 2009, p. 17.1).

The Diavik Diamond Mine, Canada's second diamond mine, also located in the Northwest Territories, completed its sixth full year of production. In 2008, Diavik produced 9.2 million carats of diamond, a decrease of 23% from the previous year's production. At yearend 2008, Diavik Diamond Mine Inc. estimated the mine's remaining proven and probable reserves to be 20 Mt of ore in kimberlite pipes containing 62 million carats of diamond and projected the total mine life to be 16 to 22 years (Diavik Diamond Mine Dialogue, 2007; Perron, 2009, p. 17.2). The mine is an unincorporated joint venture between Diavik Diamond (60%) and Harry Winston Diamond Mines Ltd. (40%). In response to the downturn in the economy in the last quarter of 2008, Diavik announced that the mine would cease production between July 14 and August 24, 2009, and be placed on a care-and-maintenance schedule (Perron, 2009, p. 17.2).

Canada's third diamond mine, the Jericho Diamond Mine, is located in Nunavut and is a wholly owned by Tahera Diamond Corp. Tahera estimated Jericho's reserves to be 2.6 Mt of ore and 3.11 million carats of diamond (Tahera Diamond Corp., 2007). The mine experienced startup problems related to ore mining and processing, and suffered financial problems owing to the cost of transporting supplies to the mine site, higher than anticipated operational costs, higher than expected oil prices, and appreciation of the Canadian dollar versus the American dollar. All these problems combined to force the company to enter into protection under Canada's Companies' Creditors Arrangement Act on January 16, 2008, and the mine suspended production on February 6. At yearend, the company was still trying to reach an agreement with its creditors. As a result, the mine's 2008 production was only 118,000 carats (Perron, 2009, p. 17.3).

The Snap Lake Mine, which is wholly owned by De Beers Canada Inc., is located in the Northwest Territories. The Snap Lake deposit is a tabular-shaped kimberlite dyke rather than the typical kimberlite pipe. The dyke is 2.7 meters thick and dips at a 15 degree angle. It is being mined using a modified room-and-pillar underground mining method. The mine started mining operations in October 2007, reached commercial production levels in the first quarter of 2008, and officially opened on June 25. The mine was expected to produce 1.4 million carats per year, and the mine life was expected to be about 20 years. De Beers announced plans to suspend production for 6 weeks in July and August 2009 to align production with market demand (Perron, 2009, p. 17.3).

The Victor Mine, which also is wholly owned by De Beers Canada, is in northern Ontario on the James Bay coast. The Victor kimberlite consists of two pipes with surface area of 15 hectares (37.1 acres). The mine initiated mining operations at the end of December 2007 and was officially opened on July 26, 2008. In 2008, the mine produced 730,000 carats valued at $307 million. The mine has 27.4 Mt of ore with average ore grade of 0.23 carat per metric ton estimated minable reserves. The open pit mine was expected to produce 600,000 carats per year, and the mine life was expected to be about 12 years. De Beers announced that the mine would suspend production for 6 weeks in July and August 2009 to align production with market demand (Perron, 2009, p. 17.3).

South Africa.—The Savanna Mine, a placer mine located in North-West, started production during the last quarter of 2008. The mine was expected to reach a production level of 18,000 carats per year. The mine is owned by Bonaparte Diamond Mines Ltd. (Metals Economics Group, 2009).

The Voorspoed Mine, located near Kroonstad, officially opened in November. The mine is 74% owned by De Beers Consolidated and 26% by Ponahalo Capital Ltd. and was expected to produce 800,000 carats per year for 12 to 16 years (Metals Economics Group, 2009).

Outlook

Historically, diamond gemstones have proven to hold their value despite wars or economic depressions (Schumann, 1998, p. 8), but this did not hold true for the worldwide economic downturn in 2008. Gemstone production, trade, market trends, and consumption demonstrated significant decreases during 2008, mostly concentrated in the last third of the year. There were no indications that this was likely to change during 2009. In 2008, total online sales rose by 7% compared with those of 2007. However, online retail jewelry sales decreased by 12% from levels of the previous year, making jewelry one of the poorer performing categories (JCK Online, 2009). These trends in U.S. gemstone markets were a reflection of the impact of the global recession on luxury spending.

Once the economy improves, Internet sales of diamonds, gemstones, and jewelry were expected to continue to grow and increase in popularity, as were other forms of e-commerce that emerge to serve the diamond and gemstone industry. This is likely to take place as the gemstone industry and its customers become more comfortable with and learn the applications of new e-commerce tools (Profile America, Inc., 2008).

Independent producers, such as Ekati and Diavik in Canada, will likely 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 is expected to continue as the diamond industry adjusts to De Beers' reduced influence on the industry.

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

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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, natural	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 to medium	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:										
Cat's-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 refraction, refractive index.
Sapphire or 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, artificially 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, natural	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.

Do., do. Ditto. 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.

TABLE 2
LABORATORY-CREATED GEMSTONE PRODUCTION METHODS

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

Do., do., Ditto.

TABLE 3

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

(Thousand dollars)

Gem materials	2007	2008
Beryl	18	18
Coral, all types	150	150
Diamond	(2)	(2)
Garnet	67	130
Gem feldspar	1,330	916
Geode/nodules	53	91
Opal	328	357
Quartz:		
Macrocrystalline[3]	215	334
Cryptocrystalline[4]	300	344
Sapphire/ruby	283	556
Shell	3,370	2,290
Topaz	(2)	(2)
Tourmaline	59	112
Turquoise	475	508
Other	5,260	5,670
Total	11,900	11,500

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

[2]Included with "Other."

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

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

TABLE 4

PRICES PER CARAT OF U.S. CUT ROUND DIAMONDS, BY SIZE AND QUALITY IN 2008

Carat weight	Description, color[1]	Clarity[2] (GIA terms)	Representative prices		
			January[3]	June[4]	December[5]
0.25	G	VS1	$1,495	$1,495	$1,495
Do.	G	VS2	1,350	1,350	1,350
Do.	G	SI1	1,200	1,200	1,200
Do.	H	VS1	1,400	1,400	1,400
Do.	H	VS2	1,300	1,300	1,300
Do.	H	SI1	1,070	1,070	1,070
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
1.00	G	VS1	6,500	6,500	6,500
Do.	G	VS2	6,100	6,100	6,100
Do.	G	SI1	5,000	5,000	5,000
Do.	H	VS1	5,500	5,500	5,500
Do.	H	VS2	5,300	5,300	5,300
Do.	H	SI1	4,600	4,600	4,600
2.00	G	VS1	12,300	12,300	12,300
Do.	G	VS2	10,900	10,900	10,900
Do.	G	SI1	9,400	9,400	9,400
Do.	H	VS1	10,200	10,200	10,200
Do.	H	VS2	9,400	9,400	9,400
Do.	H	SI1	7,900	7,900	7,900

Do.Ditto.

[1]Gemological Institute of America (GIA) color grades: D-colorless; E-rare white; G, H, I-traces of color.

[2]Clarity: IF—no blemishes; VVS1—very, very slightly included; VS1—very slightly included; VS2—very slightly included, but not visible; SI1—slightly included.

[3]Source: Jewelers' Circular Keystone, v. 179, no. 2, February 2008, p. 120.

[4]Source: Jewelers' Circular Keystone, v. 179, no. 7, July 2008, p. 64.

[5]Source: Jewelers' Circular Keystone, v. 180, no. 1, January 2009, p. 52.

TABLE 5
PRICES PER CARAT OF U.S. CUT COLORED GEMSTONES IN 2008

Gemstone	Price range per carat	
	January[1]	December[2]
Amethyst	$10–22	$10–22
Blue sapphire	770–1,500	825–1,650
Blue topaz	5–10	5–10
Emerald	2,400–4,000	2,400–4,000
Green tourmaline	45–60	50–70
Cultured saltwater pearl[3]	5	5
Pink tourmaline	60–125	60–135
Rhodolite garnet	20–35	20–35
Ruby	1,850–2,200	1,850–2,200
Tanzanite	300–450	300–475

[1]Source: The Guide, spring/summer 2008, p. 22, 37, 51, 65, 74, 85, 96, 98, 104, and 119. These figures are approximate current wholesale purchase prices paid by retail jewelers on a per stone basis for 1-to-less than carat, fine-quality stones.

[2]Source: The Guide, fall/winter 2008–09, p. 22, 37, 51, 65, 74, 85, 96, 98, 104, and 119. These figures are approximate current wholesale purchase prices paid by retail jewelers on a per stone basis for 1-to-less than carat, fine-quality stones.

[3]Prices are per 4.5 to 5-millimeter pearl.

TABLE 6

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

	2007		2008	
Country	Quantity (carats)	Value[2] (millions)	Quantity (carats)	Value[2] (millions)
Exports:				
Australia	65,000	$18	103,000	$18
Belgium	3,510,000	891	1,600,000	685
Canada	82,400	81	79,700	116
Costa Rica	82,200	7	55,200	6
France	192,000	168	136,000	136
Hong Kong	1,460,000	529	1,340,000	814
India	714,000	502	1,480,000	1,220
Israel	4,500,000	2,390	2,650,000	2,130
Japan	131,000	46	54,800	12
Mexico	907,000	128	678,000	110
Netherlands	9,790	2	19,000	3
Netherlands Antilles	14,900	43	16,200	35
Singapore	125,000	18	98,500	19
South Africa	48,400	12	31,400	4
Switzerland	203,000	149	99,400	270
Taiwan	34,400	6	15,000	12
Thailand	177,000	49	226,000	54
United Arab Emirates	287,000	107	165,000	115
United Kingdom	146,000	52	121,000	84
Other	225,000	105	248,000	103
Total	12,900,000	5,310	9,210,000	5,940
Reexports:				
Armenia	4,760	(3)	13,400	(3)
Australia	30,200	9	33,800	14
Belgium	4,540,000	1,260	5,790,000	1,890
Canada	241,000	155	230,000	195
Dominican Republic	48,700	6	61,400	12
France	11,200	2	30,500	23
Guatemala	89,000	9	104,000	14
Hong Kong	3,900,000	1,030	2,680,000	1,350
India	2,080,000	511	2,250,000	482
Israel	9,700,000	2,470	10,200,000	3,400
Japan	125,000	37	178,000	39
Malaysia	37,000	3	20,100	3
Mexico	33,700	5	4,590	2
Singapore	199,000	26	190,000	22
South Africa	86,400	62	65,700	108
Switzerland	519,000	523	530,000	551
Thailand	205,000	39	152,000	26
United Arab Emirates	671,000	112	1,390,000	250
United Kingdom	513,000	186	499,000	229
Other	184,000	70	331,000	134
Total	23,200,000	6,510	24,800,000	8,750
Grand total	36,100,000	11,800	34,000,000	14,700

[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 7

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

Kind, range, and country of origin	2007 Quantity (carats)	2007 Value[2] (millions)	2008 Quantity (carats)	2008 Value[2] (millions)
Rough or uncut, natural:[3]				
Angola	8,850	$43	62,300	$34
Australia	228	1	1,620	1
Botswana	207,000	126	108,000	147
Brazil	31,100	5	760	1
Canada	45,200	56	19,900	31
Congo (Kinshasa)	37,400	147	37,100	138
Ghana	7,480	1	1,400	2
Guyana	3,890	1	6,590	1
India	228,000	1	120,000	4
Namibia	6,530	1	6,550	5
Russia	551,000	31	90,200	19
South Africa	213,000	360	119,000	296
Other	26,000	75	153,000	73
Total	1,370,000	848	725,000	752
Cut but unset, not more than 0.5 carat:				
Belgium	494,000	203	295,000	118
Canada	8,350	9	10,900	13
China	68,300	36 r	110,000	34
Dominican Republic	60,500	6 r	65,800	20
Hong Kong	132,000	33	157,000	25
India	7,390,000	1,660	6,520,000	1,430
Israel	696,000	380	512,000	267
Mauritius	6,540	14 r	8,410	14
Mexico	407,000	57	52,600	10
Singapore	631	(3) r	132	(3)
South Africa	4,350	2	12,400	4
Switzerland	1,750	1	760	1
Thailand	105,000	25	72,200	21
United Arab Emirates	122,000	25	69,400	18
Other	39,900	16	71,500	24
Total	9,540,000	2,460 r	7,960,000	2,000
Cut but unset, more than 0.5 carat:				
Belgium	982,000	2,800 r	929,000	3,130
Canada	14,700	51	22,800	78
Hong Kong	31,000	87	76,800	361
India	1,690,000	2,030	1,440,000	2,450
Israel	2,850,000	9,100	2,210,000	9,120
Mexico	39,900	6	389	(3)
Russia	73,200	185 r	57,600	178
South Africa	84,900	712	55,200	759
Switzerland	12,800	238	19,200	383
Thailand	15,800	20 r	11,700	22
United Arab Emirates	53,600	79 r	33,100	124
Other	100	352	101,000	400
Total	5,840,000	15,700	4,960,000	17,000

[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.

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	2007 Quantity (carats)	2007 Value[2] (millions)	2008 Quantity (carats)	2008 Value[2] (millions)
Emerald:				
Belgium	1,310	$1	529	$2
Brazil	1,090,000	6	106,000	6
Canada	2,200	(3) r	2,830	(3)
China	25,900	(3) r	2,210	(3)
Colombia	918,000	120	530,000	155
France	1,020	1	130,000	9
Germany	49,300	2	13,800	3
Hong Kong	161,000	8	877,000	10
India	1,210,000	22	1,800,000	29
Israel	135,000	32	162,000	25
Italy	3,870	2	4,240	2
Switzerland	6,690	8	23,900	24
Thailand	612,000	14	564,000	13
United Kingdom	771	2	1,050	2
Other	66	4	83,300	17
Total	4,220,000	222 r	4,300,000	297
Ruby:				
Belgium	6,640	1	9	(3)
China	2,930	(3) r	7,360	1
Dominican Republic	2,340	(3)	994	(3)
France	2,580	1	1,210	1
Germany	21,100	2	12,400	1
Hong Kong	181,000	3	851,000	10
India	2,100,000	6	2,350,000	5
Israel	7,760	1	1,370	1
Italy	1,010	3	6,030	1
Kenya	9,550	1	(3)	(3)
Sri Lanka	4,300	1	7,260	1
Switzerland	9,710	23	10,600	11
Thailand	2,380,000	70	1,980,000	59
United Arab Emirates	157,000	(3) r	1,760	1
Other	66,400	3	43,300	8
Total	4,960,000	114	5,280,000	100
Sapphire:				
Australia	4,460	2	1,550	(3)
Austria	32,800	(3) r	124	(3)
Belgium	3,910	(3) r	110	1
China	311,000	1	269,000	2
Dominican Republic	3,670	(3)	882	(3)
Germany	65,100	3	36,200	5
Hong Kong	255,000	7	972,000	9
India	1,740,000	7	1,150,000	12
Israel	23,800	3	28,800	4
Italy	3,650	1	2,340	2
Singapore	3,630	(3)	3,630	(3)
Sri Lanka	378,000	50	316,000	46
Switzerland	21,800	21	17,800	19
Thailand	3,740,000	76	2,900,000	75

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	2007 Quantity (carats)	2007 Value[2] (millions)	2008 Quantity (carats)	2008 Value[2] (millions)
Sapphire—Continued:				
United Arab Emirates	4,460	(3) r	8,140	$5
United Kingdom	9,310	2	1,100	4
Other	63,500	6	384,000	7
Total	6,670,000	178 r	6,090,000	191
Other:				
Rough, uncut:				
Australia	NA	4	NA	3
Brazil	NA	11	NA	7
Canada	NA	3	NA	1
China	NA	4	NA	3
Colombia	NA	3	NA	1
Czech Republic	NA	2	NA	2
Germany	NA	1	NA	1
India	NA	3	NA	2
Japan	NA	1	NA	1
Pakistan	NA	2 r	NA	2
Tanzania	NA	2	NA	3
Other	NA	11	NA	16
Total	NA	47 r	NA	42
Cut, set and unset:				
Australia	NA	14	NA	15
Austria	NA	4	NA	4
Brazil	NA	18	NA	19
Canada	NA	1	NA	1
China	NA	55	NA	35
France	NA	2	NA	1
Germany	NA	40	NA	34
Hong Kong	NA	48	NA	32
India	NA	97	NA	74
Israel	NA	5	NA	8
Italy	NA	1	NA	1
South Africa	NA	7	NA	1
Sri Lanka	NA	10	NA	5
Switzerland	NA	4	NA	8
Taiwan	NA	2	NA	1
Tanzania	NA	7	NA	5
Thailand	NA	74	NA	58
United Arab Emirates	NA	1	NA	1
United Kingdom	NA	1	NA	1
Other	NA	11	NA	15
Total	NA	402	NA	319

rRevised. NA Not available.

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 9

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

(Thousand dollars)

Country	2007	2008
Laboratory-created, cut but unset:		
Austria	3,420	2,330
Brazil	353	645
Canada	158	24
China	12,800	9,860
Czech Republic	107	55
France	272	298
Germany	12,800 r	12,700
Hong Kong	1,530	898
India	1,190	1,040
Italy	35	48
Japan	176	251
Korea, Republic of	368	207
Netherlands	119	5
South Africa	7	281
Sri Lanka	3,260	1,300
Switzerland	989	620
Taiwan	187	174
Thailand	885	1,330
United Arab Emirates	83	146
Other	2,530	1,960
Total	41,300	34,200
Imitation:[3]		
Austria	72,400 r	73,100
Brazil	17 r	25
China	3,090	21,000
Czech Republic	8,510	7,510
France	8	25
Germany	1,260	723
Hong Kong	104	46
India	142	83
Italy	262	148
Japan	10	58
Korea, Republic of	439	198
Russia	5	15
Taiwan	7	183
Thailand	15	10
United Kingdom	4	193
Other	305	275
Total	86,600	104,000

[r]Revised.

[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	2007		2008	
	Quantity	Value[2]	Quantity	Value[2]
Diamonds:				
Rough or uncut	1,370,000	848,000	725,000	752,000
Cut but unset	15,500 r	18,100,000	12,900	19,000,000
Emeralds, cut but unset	4,280 r	222,000 r	4,300	297,000
Coral and similar materials, unworked	6,300	16,800	5,320	12,200
Rubies and sapphires, cut but unset	11,600	291,000	11,400	291,000
Pearls:				
Natural	NA	23,100	NA	14,100
Cultured	NA	55,200 r	NA	34,600
Imitation	NA	4,280	NA	4,190
Other precious and semiprecious stones:				
Rough, uncut	1,260,000	26,400	1,100,000	18,800
Cut, set and unset	NA	361,000	NA	285,000
Other	NA	9,510	NA	9,200
Laboratory-created:				
Cut but unset	163,000	41,300	60,300	34,200
Other	NA	11,400	NA	13,500
Imitation gemstone[3]	NA	86,600	NA	104,000
Total	XX	20,100,000	XX	20,900,000

[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: WORLD PRODUCTION, BY COUNTRY AND TYPE[1, 2, 3]

(Thousand carats)

Country and type[4]	2004	2005	2006	2007	2008
Gemstones:					
Angola	5,490 e	6,371 r	8,258 r	8,732 r	8,100 e
Australia	6,058	8,577	7,305	231	273
Botswana[e]	23,300	23,900	24,000	25,000	25,000
Brazil[e]	300 5	208 r	181 r	182 r	200 p
Canada	12,618	12,314	13,278	17,144 r	14,803 p
Central African Republic[e]	263	300	340	370	400
China[e]	100	100	100	100	100
Congo (Kinshasa)	5,900	7,000	5,700	5,300 e	5,400
Côte d'Ivoire[e]	201	210	210	210	210
Ghana	725	810	780	720 e	520 e
Guinea	555	440	380	815 e	2,500 e
Guyana	445 r	357 r	341 r	269 r	269 p
Namibia	2,004	1,902	2,400	2,200 e	1,500
Russia[e]	23,700	23,000	23,400	23,300	21,925 5
Sierra Leone	318	395	401 r	360 e	220 e
South Africa[e]	5,800	6,400	6,100	6,100	5,200
Tanzania[e]	258	185	230	239 r	190
Venezuela[e]	40	46	45	45	45
Zimbabwe[e]	151	160	160	100	100
Other[6]	191 r	109 r	70 r	65 r	82
Total	88,400	92,800 r	93,700 r	91,500 r	87,000
Industrial:					
Angola[e]	610	708 r	918 r	970	900
Australia	18,172	25,730	21,915	18,960	15,400
Botswana[e]	7,800	8,000	8,000	8,000	8,000
Brazil[e]	600	600	600	600	600
Central African Republic[e]	88	80	85	93 r	80
China[e]	960	960	965	970	1,000
Congo (Kinshasa)	23,600	28,200	22,800	21,300 r	21,600
Côte d'Ivoire[e]	99	90	90	90	90
Ghana[e]	180	200	190	180	120
Guinea	185	100	95	200 e	600 e
Russia[e]	15,200	15,000	15,000	15,000	15,000
Sierra Leone	374 e	274	252	240	150
South Africa[e]	8,500	9,400	9,100	9,100	7,700
Tanzania[e]	46	35	42	44 r	34
Venezuela[e]	60	69	70	70	70
Zimbabwe[e]	100	900	100	400	400
Other[7]	95 r	94 r	67 r	72 r	97
Total	76,700	90,400	80,300	76,300 r	71,800
Grand total	165,000	183,000	174,000	168,000 r	159,000

[e]Estimated. [p]Preliminary. [r]Revised.

[1]World totals, U.S. data, 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 19, 2009.

[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 Cameroon, Congo (Brazzaville), Gabon (unspecified), India, Indonesia, Liberia, and Togo (unspecified).

[7]Includes Congo (Brazzaville), India, Indonesia, and Liberia.