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Gemstones

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In 2015, the estimated value of natural gemstones produced in the United States was $8.54 million (table 3), and the estimated value of U.S. production of synthetic gemstones was $55.1 million. The total estimated value of U.S. gemstone production was $63.6 million. The value of U.S. gemstone imports was $25.1 billion (table 10), and the value of combined U.S. gemstone exports and reexports was estimated to be $21.1 billion. In 2015, world production of natural diamond totaled 127 million carats, of which an estimated 70.9 million carats were gem quality (table 11). The value of diamond imported into the United States in 2015 exceeded $23.3 billion. This value was the combination of $20.6 billion of cut but unset diamonds more than 0.5 carat, $2.37 billion of cut but unset diamonds less than one-half carat, and $305 million of rough or uncut natural diamonds (table 7).

In this chapter, 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 chapter designates all natural nondiamond gems. In addition, synthetic gemstones and gemstone simulants are discussed but are treated separately from natural gemstones (table 2). Cultured and laboratory-created are terms also used to refer to synthetic gemstones. Imitation gemstones is a term also used to refer to gemstone simulants. Synthetic gemstones have the same chemical, optical, and physical properties as their natural gemstone counterparts. Simulants have appearances similar to those of natural gemstone materials, but they have different chemical, optical, and physical properties. Trade data in this chapter are from the U.S. Census Bureau. All percentages in the chapter were calculated using unrounded data. 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. In addition to jewelry, gemstones are used for collections, decorative art objects, and exhibits.

Production

U.S. gemstone production data were based on a survey of more than 250 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 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 commercial operations.

The commercial gemstone industry in the United States consists of individuals and companies that mine gemstones or harvest shell and pearl, firms that manufacture synthetic gemstones, and individuals and companies that cut and polish natural and synthetic 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 be between 1,200 and 1,500 individuals.

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 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.

The total value of natural gemstones produced in the United States was estimated to be $8.54 million during 2015 (table 3). This production value was a 10% decrease from that of 2014.

Natural gemstone materials indigenous to the United States are collected or produced in every State. During 2015, each of the 50 States produced at least $1,500 worth of gemstone materials. The leading 12 States accounted for 91% of the total value, as reported by survey respondents. These States were, in descending order of production value, Idaho, Arizona, Oregon, California, Montana, Arkansas, Maine, Colorado, North Carolina, Nevada, Texas, and Utah. Some States were known for

the production of a single gemstone material—Hawaii for coral, 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. A wide variety of gemstones also was found and produced in California, Idaho, Montana, and North Carolina.

In 2015, the United States had only one active operation in a known diamond-bearing area, Crater of Diamonds State Park near Murfreesboro, AR. The State of Arkansas maintains a dig-for-fee operation for tourists and amateur collectors at the park; Crater of Diamonds is the only diamond mine in the world that is open to the public for collecting diamonds. The diamonds occur in a lamproite breccia tuff associated with a volcanic pipe and in the soil developed from the lamproite breccia tuff. During 2015, 467 diamond stones with an average weight of 0.212 carat were recovered at Crater of Diamonds. Of the 467 diamond stones recovered, 12 weighed more than 1 carat. The largest diamond found during the year was an 8.52-carat white diamond. Since the diamond-bearing pipe and the adjoining area became a State park in 1972, 31,943 diamond stones with a total weight of 6,393.4 carats have been recovered (James Howell, Park Superintendent, Crater of Diamonds State Park, written commun., January 13, 2016). Exploration has demonstrated that this diamond deposit contains about 78.5 million metric tons (Mt) of diamond-bearing rock (Howard, 1999, p. 62). An Arkansas law prohibits commercial diamond mining in the park.

In addition to natural gemstones, synthetic gemstones and gemstone simulants were produced in the United States in 2015. Synthetic gemstones that have been produced in the United States include alexandrite, cubic zirconia, diamond, emerald, garnet, moissanite, ruby, sapphire, spinel, and turquoise. However, during 2015, only cubic zirconia, diamond, moissanite, and turquoise were produced commercially. Simulants of amber, chrysocolla, coral, lapis lazuli, malachite, travertine, and turquoise also were manufactured in the United States. In addition, certain colors of synthetic sapphire and spinel, used to represent other gemstones, are classified as simulants.

Synthetic gemstone production in the United States was valued at $55.1 million in 2015, which was an 8% increase compared with that of 2014. Five companies in five States, representing virtually the entire U.S. synthetic gemstone industry, reported production to the USGS. The States with reported synthetic gemstone production were, in descending order of production value, North Carolina, New York, Michigan, South Carolina, and California. The value of U.S. simulant gemstone output was estimated to be more than $100 million.

Since the 1950s, when scientists manufactured the first synthetic 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 synthetic diamonds, so much so that thousands of small plants throughout China were using the HPHT method and producing synthetic diamonds suitable for cutting as gemstones. Gem-quality diamonds of 1 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 laboratory using the HPHT method. After more than 50 years of development, several synthetic diamond companies were able to produce relatively large high-quality diamonds that equaled those produced from mines.

In the early 2000s, technology was developed for a method for growing single, extremely pure, gem-quality diamond crystals by chemical vapor deposition (CVD). The CVD technique transforms carbon into plasma, which is then precipitated onto a substrate as diamond. CVD had been used for more than a decade to cover large surfaces with microscopic diamond crystals, but in developing this process, synthetic diamond producers discovered the temperature, gas composition, and pressure combination that resulted in the growth of a single diamond crystal and were able to produce synthetic stones that ranged from 1 to 2 carats.

Beginning in 2015, Pure Grown Diamonds Inc. (formerly Gemesis Corp.; Lakewood Ranch, FL) moved its diamond production to Singapore (Singapore Business News, 2015). During 2015, Scio Diamond Technology Corp. (Greenville, SC) increased its capacity to produce colorless single-crystal diamonds at a higher quality and volume than the previous year. In 2014, Scio Diamond used CVD technology to produce synthetic single-crystal diamond stones that ranged from 1 to 2 carats for gemstone and industrial use. Scio Diamond reported that for the fiscal year ending March 31, 2015, the company had a 71% increase in production compared with that of the previous fiscal year. The average size of synthetic diamond crystals more than doubled in 2015 (Scio Diamond Technology Corp., 2015a, b).

Charles & Colvard, Ltd. in North Carolina was the only U.S. manufacturer of moissanite, a gem-quality synthetic silicon carbide and an excellent diamond simulant. The company used a proprietary patented technology. Moissanite was marketed for its own gem qualities; it exhibits a higher refractive index (brilliance) and higher luster than diamond. Its hardness is between that of corundum (ruby and sapphire) and that of diamond, which gives it durability. Charles & Colvard reported that moissanite sales increased by 20% to $30.8 million in 2015 compared with $25.6 million in 2014 (Charles & Colvard, Ltd., 2016, p. 3).

U.S. mussel shells are used as a source of mother-of-pearl and as seed material for culturing pearls. The value of U.S. shell production decreased by 64% in 2015 compared with that of 2014 (table 3) owing to decreased demand for U.S. shell materials. This decrease in demand was caused by the use of man-made seed materials and seed materials from China and other sources, such as pearl producers in Japan. The popularity of darker and colored pearls and freshwater pearls that do not use U.S. seed material has also contributed to decreased demand for U.S. shell materials. 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 only a small portion of total global gemstone production, it was the world's leading

diamond and nondiamond gemstone market, accounting for more than 35% of world gemstone demand in 2015. In the United States, the majority of domestic consumers designated diamond as their favorite gemstone. This popularity of diamonds is evidenced by the diamond market accounting for 93% of the total value of the U.S. gemstone market. The U.S. market for unset gem-quality diamond during the year was estimated to be $19.2 billion, a decrease of 9% compared with $21.1 billion in 2014. Domestic markets for natural, unset nondiamond gemstones totaled $1.52 billion in 2015, which was a 14% increase from $1.33 billion in 2014.

U.S. fine jewelry and watch retail sales, most of which included gemstones, were $75.4 billion in 2015, a slight increase from sales in 2014. Of this $75.4 billion, fine jewelry retail sales were $66.6 billion in 2015, a slight increase from those of 2014 (Gassman, 2016).

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. More than 14,000 categories are used to assess rough diamond, and more than 100,000 different combinations of carat, clarity, color, and cut values can be used to assess polished diamond.

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. Value of production and prices of gemstones produced and (or) sold in the United States are listed in tables 3, 4, and 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 remained a significant force, influencing the price of gem-quality diamond sales worldwide during 2015. De Beers companies constituted 20% of the total global diamond production and 31% of the total global diamond value (De Beers UK Ltd., 2016, p. 26, 28).

Since 2000, De Beers' control of world diamond pricing has gradually decreased. Instead, flexible pricing mechanisms have set the stage for new methods of rough diamond sales in addition to rough diamonds being sold through a limited number of sightholder sales, the method used for years by De Beers. Rough diamonds were also sold by auctions, placed sales, tender sales, and term contracts (De Beers UK Ltd., 2014, p. 39).

Foreign Trade

During 2015, total U.S. natural gemstone trade with all countries and territories was valued at about $43.4 billion, which was a decrease of 9% from that of 2014. Diamond accounted for about 96% of the 2015 gemstone trade total value. In 2015, U.S. exports and reexports of diamond were shipped to 93 countries and territories, and imports of all gemstones were received from 79 countries and territories (tables 6–10). In 2015, U.S. import quantities of cut diamond decreased by 5% compared with those of 2014, and the value also decreased by 5%. U.S. import quantities of rough and unworked diamond decreased slightly, but the value decreased by 44% (table 10). 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 2015, U.S. export and reexport quantities of gem-grade diamond decreased by 16% compared with those of 2014, and the value decreased by 13%. The large quantity of reexports revealed the significance of the United States in the world's diamond supply network (table 6).

Import values of natural gemstones decreased by 20% to $25 million for the United States in 2015 compared with those of 2014. Import values of synthetic gemstone increased by 22% to $28.3 million for the United States in 2015 compared with those of 2014 (table 9). This increase was owing to large increases in synthetic gemstone imports from India. Synthetic gemstone imports from Austria, China, Germany, India, Russia, and Singapore, with more than $24.7 million in imports, accounted for about 87% (by value) of total domestic imports of synthetic gemstones during 2015 (table 9). The marketing of imported synthetic gemstones and enhanced gemstones as natural gemstones and the mixing of synthetic materials with natural stones in imported parcels continued to be an issue for some domestic jewelers and sales companies in 2015. In addition, some simulants were marketed as natural or synthetic gemstones during the year, as in previous years.

World Review

The worldwide gemstone industry 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 influenced by consumer demand and supply availability and, to a lesser extent, by managing the quality and quantity of the gemstones relative to demand, a function that has been performed by De Beers sightholder sales. Unlike diamond, colored gemstones are primarily produced at relatively small, low-cost operations with few dominant producers; prices are influenced only by consumer demand and supply availability.

In 2015, world natural rough diamond production increased slightly to 127 million carats from 125 million carats in 2014. The 127 million carats of rough diamond produced included 70.9 million carats of gem-quality and 56.5 million carats of industrial-grade diamond (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). In 2015, Russia led the world in total quantity of natural rough diamond output (combined gemstone and industrial) with 33% of the estimated world production. Russia also was the world's leading gemstone diamond producer with 33%; followed by Botswana, 21%; Canada, 16%; Angola, 11%; South Africa, 8%; Congo (Kinshasa), 5%; and Namibia, 3%. These seven countries produced 97% (by quantity) of the world's gemstone diamond output in 2015. Rough diamond production was valued at more than $17.5 billion, a decrease

of 10% compared with that of 2014 (De Beers UK Ltd., 2016, p. 28).

During 2015, ALROSA Group and De Beers Group remained the two leading diamond producers by quantity and value. ALROSA's production was 27% of total global quantity and 25% of total global value; De Beers' production was 20% of total global quantity and 31% of total global value. More rough diamonds were being sold locally owing to De Beers' 10-year agreement with the Namibian Government for sorting, valuing, and sales of production from Namdeb Holdings (Pty) Ltd. Because of this deal, the Namibia Diamond Trading Co. expected sales of $430 million of rough diamonds annually to benefit the country domestically. The third-ranked company was Rio Tinto Ltd., which produced 12% of total global production quantity and approximately 5% of global production value (De Beers UK Ltd., 2016, p. 26, 28).

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 to prevent the shipment and sale of conflict diamonds. Conflict diamonds are diamonds that originate from areas controlled by forces or factions opposed to legitimate and internationally recognized governments and are used to fund military action in opposition to those governments or in contravention of the objectives of the UN Security Council. The KPCS monitors rough-diamond trade in both gemstone and industrial diamond. 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. Angola assumed the chair of KPCS from January 1 through December 31, 2015. As of December 31, 2015, the 54 participants represented 81 nations (including the 28 member nations of the European Union counted as a single participant) plus the rough-diamond-trading entity of Taipei (Taiwan). The temporary suspension of the Central African Republic's exports and imports of rough diamonds was lifted in July 2015. Venezuela continued its voluntary suspension of exports and imports of rough diamonds with no indication of when it planned to re-enter the market. The participating nations in the KPCS account for approximately 99.8% of the global production and trade of rough diamonds (Kimberley Process, 2017).

Globally, the value of production of natural gemstones other than diamond was estimated to be more than $2.5 billion in 2015. Most nondiamond gemstone mines are small, low-cost, and widely dispersed operations that are often in remote regions. 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 were key producers in 2015.

Worldwide diamond exploration spending decreased by 18% in 2015 with 52 companies allocating $367 million, compared with 48 companies allocating $447 million during 2014. The diamond share of overall worldwide mineral exploration spending remained 4.2% (SNL Metals Economics Group, 2015, p. 20). In 2015, worldwide average diamond values decreased by 6% to $108.96 per carat from the 2014 average value of $116.17 per carat (Danilov, 2016).

Russia.—Diamond production in Russia was 41.9 million carats during 2015, a 9% increase compared with that of 2014. Russia accounted for 33% of total global diamond production. Two new diamond mines started production in 2015 in Russia, the Botuobinskaya Mine and the Karpinsky-1 Mine (De Beers UK Ltd., 2014, p. 45).

The Botuobinskaya Mine in the Nakyn ore field in Yakutia, Russia, was wholly owned by ALROSA and began production in 2015. Beginning as an open pit, the mine was expected to produce more than 2 million carats per year during its projected 40-year mine life. The Botuobinskaya Mine was expected to offset the anticipated decrease in production of the Nyurbinskaya pipe 3 kilometers away. Together, these operations were expected to sustain the production of 7.5 million carats of rough diamond per year. The Botuobinskaya Mine reserves were estimated to contain 93 million carats of rough diamond, with an average diamond grade of 5.65 carats per ton (OJSC ALROSA, 2015).

The Karpinsky-1 Mine in Russia's Lomonosov diamond field was owned and operated by PJSC Severalmaz, a subsidiary of ALROSA, and had its first full year of production in 2015. Production was expected to be about 3 million carats per year after reaching full working capacity in 2015 (Klein, 2014; Mackenzie, 2014).

Outlook

As the domestic and global economies improve, internet sales of diamonds, gemstones, and jewelry are expected to continue to expand and increase in popularity, as are other forms of e-commerce that emerge to serve the diamond and gemstone industry. Internet sales are expected to add to and partially replace store sales.

Global diamond production is expected to increase during the next few years as a result of new projects coming onstream. By 2020, about 25% of diamond production will come from

projects that are currently being developed, but additional increases in output will come from expected expansions at currently operating mines, such as Rio Tinto's Argyle Mine in Australia. Mountain Province Diamonds Inc. is partnering with De Beers to open the Gahcho Kué Mine in the Northwest Territories of Canada. The mine is expected to produce 4.5 million carats per year when it is fully operational. Stornoway Diamond Corp. plans to open its Renard Mine in Quebec, Canada, where it expects to produce 1.6 million carats per year. Firestone Diamonds plc's main treatment plant, which is expected to produce 1 million carats per year, was under construction at the Liqhobong deposit in Lesotho (De Beers UK Ltd., 2016, p. 29).

More synthetic gemstones, simulants, and treated gemstones are likely to enter the marketplace and necessitate more transparent industry trade 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	2.5–2.0	1.1–1.0	Single	1.54	Synthetic or pressed plastics, kaurigum	Fossil resin, color, low density, soft, insects.
Apatite	Chlorocalcium phosphate	Colorless, pink, yellow, green, blue, violet	Small	Low	5.0	3.23–3.16	Double	1.65–1.63	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.	4.0–3.5	3.9–3.7	do.	1.85–1.72	Dumortierite, hauynite, lapis lazuli, lazulite, sodalite	Color, softness, crystal habits, associated minerals.
Benitoite	Barium titanium silicate	Blue, purple, pink, colorless	do.	High	6.5–6.0	3.68–3.64	do.	1.80–1.76	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	8.0–7.5	2.80–2.63	do.	1.58	Synthetic spinel, blue topaz	Double refraction, refractive index.
Bixbite	do.	Red	Small	Very high	8.0–7.5	2.80–2.63	do.	1.58	Pressed plastics, tourmaline	Refractive index.
Emerald, natural	do.	Green	Medium	do.	7.5	2.80–2.63	do.	1.58	Fused emerald, glass, tourmaline, peridot, green garnet doublets	Emerald filter, dichroism, refractive index.
Emerald, synthetic	do.	do.	Small	High	8.0–7.5	2.80–2.63	do.	1.58	Genuine emerald	Lack of flaws, brilliant fluorescence in ultraviolet light.
Golden (heliodor)	do.	Yellow to golden	Any	Low to medium	8.0–7.5	2.80–2.63	do.	1.58	Citrine, topaz, glass, doublets	Weak-colored.
Goshenite	do.	Colorless	do.	Low	8.0–7.5	2.80–2.63	do.	1.58	Quartz, glass, white sapphire, white topaz	Refractive index.
Morganite	do.	Pink to rose	do.	do.	8.0–7.5	2.80–2.63	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)	1.66–1.49	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.	6.0–5.0	2.78–2.54	XX	1.56–1.55	Purple marble	Color, locality.
Chrysoberyl:										
Alexandrite	Beryllium aluminate	Green by direct sunlight, or incandescent light, red by indirect sunlight or fluorescent light	do.	High	8.5	3.84–3.50	Double	1.75	Synthetic	Strong dichroism, color varies from red to green, hardness.
Cat's eye	do.	Greenish to brownish	Small to large	do.	8.5	3.84–3.50	do.	1.75	Synthetic, shell	Density, translucence, chatoyance.
Chrysolite	do.	Yellow, green, and (or) brown	Medium	Medium	8.5	3.84–3.50	do.	1.75	Tourmaline, peridot	Refractive index, silky.

See footnotes at end of table.

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

Name	Composition	Color	Practical size[1]	Cost[2]	Mohs	Specific gravity	Refraction	Refractive index	May be confused with	Recognition characteristics
Chrysocolla	Hydrated copper silicate	Green, blue	Any	Low	4.0–2.0	2.4–2.0	XX	1.57–1.46	Azurite, dyed chalcedony, malachite, turquoise, variscite	Lack of crystals, color, fracture, low density, softness.
Coral	Calcium carbonate	Orange, red, white, black, purple, or green	Branching, medium	do.	4.0–3.5	2.7–2.6	Double	1.66–1.49	False coral	Dull translucent.
Corundum:										
Ruby	Aluminum oxide	Rose to deep purplish red	Small	Very high	9.0	4.10–3.95	do.	1.78	Synthetics, including spinel, garnet	Inclusions, fluorescence.
Sapphire, blue	do.	Blue	Medium	High	9.0	4.10–3.95	do.	1.78	do.	Inclusions, double refraction, dichroism.
Sapphire, fancy	do.	Yellow, pink, colorless, orange, green, or violet	Medium to large	Medium	9.0	4.10–3.95	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	4.10–3.95	do.	1.78	Star quartz, synthetic stars	Shows asterism, color side view.
Sapphire or ruby, synthetic	do.	Yellow, pink, blue, green, orange, violet, or red	Up to 20 carats	Low	9.0	4.10–3.95	do.	1.78	Synthetic spinel, glass	Curved striae, bubble inclusions.
Cubic zirconia	Zirconium and yttrium oxides	Colorless, pink, blue, lavender, yellow	Small	do.	8.5–8.25	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	3.525–3.516	do.	2.42	Zircon, titania, cubic zirconia, moissanite	High index, dispersion, hardness, luster.
Feldspar:										
Amazonite	Alkali aluminum silicate	Green-blue	Large	Low	6.5–6.0	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.	6.5–6.0	2.56	XX	1.56	do.	Do.
Moonstone	do.	Colorless, white, gray, or yellow with white, blue, or bronze schiller	do.	do.	6.5–6.0	2.77	XX	1.54–1.52	Glass, chalcedony, opal	Pale sheen, opalescent.
Sunstone	do.	Orange, red brown, colorless with gold or red glittery schiller	Small to medium	do.	6.5–6.0	2.77	XX	1.55–1.53	Aventurine, glass	Red glittery schiller.
Garnet	Complex silicate	Brown, black, yellow, green, red, or orange	do.	Low to high	7.5–6.5	4.30–3.15	Single strained	1.98–1.79	Synthetics, spinel, glass	Single refraction, anomalous strain.
Hematite	Iron oxide	Black, black-gray, brown-red	Medium to large	Low	6.5–5.5	5.28–5.12	XX	3.22–2.94	Davidite, cassiterite, magnetite, neptunite, pyrolusite, wolframite	Crystal habit, streak, 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
Jade:										
Jadeite	Complex silicate	Green, yellow, black, white, or mauve	Large	Low to very high	7.0–6.5	3.5–3.3	Crypto-crystalline	1.68–1.65	Nephrite, chalcedony, onyx, bowenite, vesuvianite, grossularite	Luster, spectrum, translucent to opaque.
Nephrite	Complex hydrous silicate	do.	do.	do.	6.5–6.0	3.10–2.96	do.	1.63–1.61	Jadeite, chalcedony, onyx, bowenite, vesuvianite, grossularite	Do.
Jet (gagate)	Lignite	Deep black, dark brown	do.	Low	4.0–2.5	1.35–1.19	XX	1.68–1.64	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.	6.0–5.0	3.0–2.50	XX	1.50	Azurite, dumortierite, dyed howlite, lazulite, sodalite, glass	Color, crystal habit, associated minerals, luster, localities.
Malachite	Hydrated copper carbonate	Light to black-green banded	do.	do.	4.0–3.5	4.10–3.25	XX	1.91–1.66	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	2.69–2.65	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	5.5–5.0	2.60–2.35	XX	1.55–1.45	Aegirine-augite, gadolinite, gagate, hematite, pyrolusite, wolframite	Color, conchoidal fracture, flow bubbles, softness, lack of crystal faces.
Opal	Hydrated silica	Reddish orange, colors flash in white gray, black, red, or yellow	do.	Low to high	6.5–5.5	2.3–1.9	Single	1.45	Glass, synthetics, triplets, chalcedony	Color play (opalescence).
Peridot	Iron magnesium silicate	Yellow and (or) green	Any	Medium	7.0–6.5	3.37–3.27	Double (strong)	1.69–1.65	Tourmaline, chrysoberyl	Strong double refraction, low dichroism.
Quartz:										
Agate	Silicon dioxide	Any	Large	Low	7.0	2.64–2.58	XX	XX	Glass, plastic, Mexican onyx	Cryptocrystalline, irregularly banded, dendritic inclusions.
Amethyst	do.	Purple	do.	Medium	7.0	2.66–2.65	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	2.69–2.64	do.	1.55–1.54	Iridescent analcime, aventurine feldspar, emerald, aventurine glass	Macrocrystalline, color, metallic iridescent flake reflections, hardness.
Cairngorm	do.	Smoky orange or yellow	do.	do.	7.0	2.66–2.65	do.	1.55	Iridescent analcime, aventurine feldspar, emerald, aventurine glass	Macrocrystalline, color, refractive index, transparent, 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
Quartz:—Continued										
Carnelian	Silicon dioxide	Flesh red to brown red	Large	Low	7.0–6.5	2.64–2.58	Double	1.54–1.53	Jasper	Cryptocrystalline, color, hardness.
Chalcedony	do.	Bluish, white, gray	do.	do.	7.0–6.5	2.64–2.58	do.	1.54–1.53	Tanzanite	Do.
Chrysoprase	do.	Green, apple-green	do.	do.	7.0–6.5	2.64–2.58	do.	1.54–1.53	Chrome chalcedony, jade, prase opal, prehnite, smithsonite, variscite, artificially colored green chalcedony	Do.
Citrine	do.	Yellow	do.	do.	7.0	2.66–2.65	do.	1.55	do.	Macrocrystalline, color, refractive index, transparent, hardness.
Jasper	do.	Any, striped, spotted, or sometimes uniform	do.	do.	7.0	2.66–2.58	XX	XX	do.	Cryptocrystalline, opaque, vitreous luster, hardness.
Onyx	do.	Many colors	do.	do.	7.0	2.64–2.58	XX	XX	do.	Cryptocrystalline, uniformly banded, hardness.
Petrified wood	do.	Brown, gray, red, yellow	do.	do.	7.0–6.5	2.91–2.58	Double	1.54	Agate, jasper	Color, hardness, wood grain.
Rock crystal	do.	Colorless	do.	do.	7.0	2.66–2.65	do.	1.55	Topaz, colorless sapphire	Do.
Rose	do.	Pink, rose red	do.	do.	7.0	2.66–2.65	do.	1.55	do.	Macrocrystalline, color, refractive index, transparent, hardness.
Tiger's eye	do.	Golden yellow, brown, red, blue-black	do.	do.	7.0–6.5	2.64–2.58	XX	1.54–1.53	XX	Macrocrystalline, color, hardness, chatoyancy.
Rhodochrosite	Manganese carbonate	Rose-red to yellowish, stripped	do.	Low	4.0	3.7–3.45	Double	1.82–1.6	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.	6.5–5.5	3.74–3.40	do.	1.75–1.72	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	2.85–2.6	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	4.5–2.5	2.85–2.6	XX	XX	Cultured and glass or plastic imitation	Luster, iridescence, x-ray of internal structure.
Spinel, natural	Magnesium aluminum oxide	Any	Small to medium	Medium	8.0	3.7–3.5	Single	1.72	Synthetic, garnet	Refractive index, single refraction, inclusions.
Spinel, synthetic	do.	do.	Up to 40 carats	Low	8.0	3.7–3.5	Double	1.73	Spinel, corundum, beryl, topaz, alexandrite	Weak double refraction, curved striae, bubbles.

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
Spodumene:										
Hiddenite	Lithium aluminum silicate	Yellow to green	Medium	Medium	7.0–6.5	3.20–3.13	do.	1.66	Synthetic spinel	Refractive index, color, pleochroism.
Kunzite	do.	Pink to lilac	do.	do.	7.0–6.5	3.20–3.13	do.	1.66	Amethyst, morganite	Do.
Tanzanite	Complex silicate	Blue to lavender	Small	High	7.0–6.0	3.30	do.	1.69	Sapphire, synthetics	Strong trichroism, color.
Topaz	do.	White, blue, green, pink, yellow, gold	Medium	Low to medium	8.0	3.6–3.4	do.	1.62	Beryl, quartz	Color, density, hardness, refractive index, perfect in basal cleavage.
Tourmaline	do.	Any, including mixed	do.	do.	7.5–7.0	3.20–2.98	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	2.83–2.60	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.	7.0–6.0	3.20–2.60	XX	XX	XX	Olive green, pink, gray-blue colors.
Zircon	Zirconium silicate	White, blue, brown, yellow, or green	Small to medium	Low to medium	7.5–6.0	4.8–4.0	Double (strong)	1.98–1.79	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[1]

Gemstone	Production method	Company or 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.
Diamond	HPHT method[2]	General Electric Co.	1950s.
Do.	CVD method[3]	Apollo Diamond Inc.	2000s.
Do.	MPCVD method[4]	CIW & UA[5]	2000s.
Emerald	Flux	Chatham Created Gems, Inc.	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.
Moissanite	Sublimation method	Cree Research	1980s.
Ruby	Flux	Chatham Created Gems, Inc.	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, Inc.	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.

[1]Gemstones produced by proprietary methods include gems such as garnet, opal, and turquoise. Gemstone amethyst, citrine, and other quartz minerals are produced by the hydrothermal method.

[2]High-pressure, high-temperature (HPHT).

[3]Chemical vapor deposition (CVD).

[4]Microwave plasma chemical vapor deposition (MPCVD).

[5]The Carnegie Institution of Washington Geophysical Laboratory and the University of Alabama.

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

(Thousand dollars)

Gem materials	2014	2015
Beryl	128	177
Coral, all types	135	101
Diamond	61	72
Garnet	81	66
Gem feldspar	684	730
Geodes and nodules	82	51
Opal	88	143
Quartz:		
Macrocrystalline[2]	287	251
Cryptocrystalline[3]	226	59
Sapphire and ruby	262	313
Shell	693	250
Topaz	7	3
Tourmaline	74	177
Turquoise	1,300	1,330
Other	5,380	4,820
Total	9,490	8,540

[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Macrocrystalline quartz (crystals recognizable with the naked eye) includes amethyst, aventurine, blue quartz, citrine, hawk's eye, prasiolite, prase, quartz, cat's eye, rock crystal, rose quartz, smoky quartz, and tiger's eye.
[3]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 2015

Weight (carats)	Description, color[1]	Clarity[2] (GIA terms)	Representative prices		
			January[3]	June[4]	December[5]
0.25	G	VS1	$1,650	$1,650	$1,650
Do.	do.	VS2	1,575	1,575	1,575
Do.	do.	SI1	1,250	1,250	1,250
Do.	H	VS1	1,600	1,600	1,600
Do.	do.	VS2	1,500	1,500	1,500
Do.	do.	SI1	1,200	1,200	1,200
0.50	G	VS1	2,600	2,600	2,600
Do.	do.	VS2	2,400	2,400	2,400
Do.	do.	SI1	2,080	2,080	2,080
Do.	H	VS1	2,390	2,390	2,390
Do.	do.	VS2	2,320	2,320	2,320
Do.	do.	SI1	1,910	1,910	1,910
1.00	G	VS1	7,500	7,500	7,060
Do.	do.	VS2	7,140	7,140	6,600
Do.	do.	SI1	6,400	6,400	6,000
Do.	H	VS1	6,800	6,800	6,450
Do.	do.	VS2	6,080	6,080	6,000
Do.	do.	SI1	5,750	5,750	5,425
2.00	G	VS1	14,870	13,690	13,690
Do.	do.	VS2	12,880	12,250	12,250
Do.	do.	SI1	10,660	10,660	10,660
Do.	H	VS1	12,710	11,620	11,620
Do.	do.	VS2	10,800	10,450	10,450
Do.	do.	SI1	9,950	9,950	9,950

Do., 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: The Gem Guide, v. 34, no. 1, January/February 2015, p. 20–22.

[4]Source: The Gem Guide, v. 34, no. 4, July/August 2015, p. 24–26.

[5]Source: The Gem Guide, v. 34, no. 6, November/December 2015, p. 22–24.

TABLE 5
PRICES PER CARAT OF U.S. CUT COLORED GEMSTONES IN 2015

Gemstone	Price range per carat	
	January[1]	December[2]
Amethyst	$30–35	$30–35
Aquamarine	275–365	325–375
Citrine	13–22	13–22
Emerald	3,000–4,000	3,000–4,000
Opal, fire	375–500	375–500
Opal, white (also jelly opal)	65–80	65–80
Pearl, cultured saltwater[3]	5	5
Peridot	150–200	150–200
Rhodolite garnet	50–75	55–80
Ruby	2,200–3,000	2,640–3,600
Sapphire, blue	1,450–1,900	1,200–1,900
Tanzanite	400–425	375–395
Topaz, blue	7–10	7–10
Topaz, yellow	150–235	175–250
Tourmaline, green	125–175	135–200
Tourmaline, pink	175–215	175–200

[1]Source: The Gem Guide, v. 34, no. 1, January/February 2015, p. 49–50, 53, 57, 62–64, 66, 68–71, and 78. These figures are approximate wholesale purchase prices paid by retail jewelers on a per stone basis for 1 to than 1 carat, fine-quality stones.

[2]Source: The Gem Guide, v. 34, no. 6, November/December 2015, p. 51–52, 55, 59, 64–66, 68, 69–73, and 80. These figures are approximate wholesale purchase prices paid by retail jewelers on a per stone basis for 1 to than 1 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]

Country	2014		2015	
	Quantity (carats)	Value[2] (thousands)	Quantity (carats)	Value[2] (thousands)
Exports:[3]				
Aruba	954	$1,970	1,050	$4,320
Australia	30,500	32,100	30,600	32,900
Austria	122	872	738	756
Belgium	55,600	78,700	187,000	304,000
Brazil	30,700	5,910	10,600	3,080
Canada	50,200	91,400	38,600	70,600
China	6,740	25,600	1,370	4,900
Costa Rica	1,770	(4)	3,530	(4)
Denmark	3,420	1,270	596	1,010
Dominican Republic	32,300	12,300	30,800	12,200
France	3,250	4,930	67,100	24,600
Germany	21,200	12,500	9,790	9,760
Hong Kong	1,980,000	531,000	1,660,000	671,000
India	381,000	120,000	672,000	238,000
Ireland	12,800	83,400	16,900	90,300
Israel	78,500	234,000	243,000	608,000
Italy	6,930	1,110	75,200	10,000
Japan	3,090	8,110	9,320	8,970
Jordan	1,000	(4)	2	(4)
Laos	29	(4)	48	(4)
Lebanon	28,000	1,730	1,580	1,230
Malaysia	202	1,600	10,000	(4)
Mauritius	324	(4)	2,400	765
Mexico	416,000	67,200	316,000	71,600
Namibia	22	(4)	--	--
New Zealand	577 r	1,990	2,560	2,300
Panama	262	541	883	822
Peru	1,830	(4)	314	(4)
Singapore	3,910	27,600	6,780	9,960
Sint Maarten	12,800	40,000	7,320	26,000
South Africa	16,800	2,540	69	810
Sri Lanka	5,810	1,110	1,540	(4)
Switzerland	2,150	37,200	12,300	97,700
Taiwan	1,610	3,120	10,500	4,800
Thailand	153,000	21,200	146,000	24,000
United Arab Emirates	88,700	66,700	391,000	153,000
United Kingdom	26,300	85,200	6,670	41,500
Vietnam	4,190	6,150	43,900	33,500
Other	5,550 r	18,600 r	5,760	21,900
Total	3,470,000	1,630,000	4,020,000	2,590,000
Reexports:[3]				
Armenia	4,970 r	1,740	17,200	4,890
Aruba	3,290	5,070	3,240	6490
Australia	12,600	43,000	2,950	49,300
Austria	285	(4)	984	2,000
Belgium	927,000	3,600,000	635,000	2,590,000
Brazil	11,600	3,800	2,940	1,050
Canada	103,000	156,000	105,000	141,000
China	30,300	21,900	28,100	36,700
Costa Rica	22,200	(4)	12,600	(4)
Denmark	155	595	37	(4)
France	10,000	159,000	3,550	163,000
Germany	10,600	4,430	3,070	5,470
Hong Kong	2,850,000	2,920,000	2,470,000	2,310,000
India	3,560,000	3,630,000	2,760,000	3,510,000
Ireland	9	(4)	11	(4)
Israel	1,850,000	6,480,000	990,000	4,710,000

See footnotes at end of table.

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

Country	2014		2015	
	Quantity (carats)	Value[2] (thousands)	Quantity (carats)	Value[2] (thousands)
Reexports:[3]—Continued				
Italy	14,400	41,400	72,000	35,100
Japan	48,300	78,000	33,800	61,300
Jordan	792	(4)	297	(4)
Laos	5,740	3,420	7,970	4,810
Lebanon	1,200	2,830	4,180	9,080
Malaysia	8,230	6,490	85,300	1,510
Mauritius	583	(4)	778	564
Mexico	4,700	7,980	3,590	8,050
Namibia	7,030 r	8,210 r	12,200	7,820
New Zealand	279	859	132	(4)
Panama	1,970	1,570	30,900	12,200
Peru	4,220	(4)	28	(4)
Singapore	13,000	82,800	9,140	44,400
Sint Maarten	16,500	42,000	14,800	41,800
South Africa	56,300	170,000	13,100	141,000
Sri Lanka	1,870	15,600	311	710
Switzerland	88,700	1,250,000	158,000	1,180,000
Taiwan	34,800	15,900	26,100	6,020
Thailand	194,000	76,100	172,000	59,300
United Arab Emirates	1,030,000	389,000	402,000	398,000
United Kingdom	53,900	381,000	54,500	363,000
Vietnam	42,900	42,200	3,910	4,840
Other	12,100 r	40,800 r	2,790	22,500
Total	11,000,000	19,700,000 r	8,150,000	15,900,000
Grand total	14,500,000	21,300,000 r	12,200,000	18,500,000

rRevised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Values are free alongside ship.
[3]Export and reexport data are for Harmonized Tariff Schedule of the United States codes 7102.31.0000, 7102.39.0010, 7102.39.0050.
[4]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	2014 Quantity (carats)	2014 Value[2] (thousands)	2015 Quantity (carats)	2015 Value[2] (thousands)
Rough or uncut, natural:[3, 4]				
Angola	415	$5,590	23,400	$70,500
Australia	36,100	2,570	2,710	1,120
Botswana	69,300	127,000	55,100	61,300
Brazil	5,150	2,540	4,170	3,970
Canada	11,700	17,500	105,000	7,380
Congo (Kinshasa)	2,430	1,010	11,900	(5)
Guinea	199	1,570	29	760
India	35,300	(5)	1,520	(5)
Lesotho	1,080	69,000	1,760	27,900
Liberia	580	701	226	2,190
Namibia	4,830	7,440	2,810	5,040
Russia	51,700	51,600	64,200	23,100
Sierra Leone	1,150	4,710	748	2,020
South Africa	204,000	251,000	141,000	97,000
Tanzania	67	2,540	1,060	(5)
Other	1,410 r	2,380 r	2,220	2,340
Total	425,000	547,000	418,000	305,000
Cut but unset, not more than 0.5 carat:[6]				
Armenia	328	(5)	3,400	2,380
Australia	35,000	4,120	1,240	1,100
Belgium	169,000	107,000	190,000	101,000
Botswana	7,780	22,500	6,600	22,900
Brazil	208	(5)	940	611
Cambodia	--	--	7,030	6,280
Canada	9,410	10,400	12,600	10,600
China	60,700	93,000	37,100	44,600
Dominican Republic	2,370	(5)	3,680	(5)
France	498	(5)	2,370	803
Germany	3,380	1,360	3,720	981
Hong Kong	182,000	43,300	121,000	35,500
India	5,320,000	1,810,000	5,240,000	1,600,000
Israel	633,000	253,000	641,000	260,000
Italy	16,500	3,640	7,290	2,080
Japan	4,270	1,590	1,840	888
Laos	--	--	2,230	2,610
Mauritius	18,000	49,100	15,800	49,100
Mexico	74,400	16,300	83,400	20,500
Namibia	10,200	34,700	4,200	14,100
Panama	1,280	(5)	1,140	(5)
Singapore	20,200	623	2,610	1,600
South Africa	25,400	25,900	20,500	90,300
Spain	3,010	554	2,050	(5)
Sri Lanka	9,660	9,530	3,830	3,710
Switzerland	1,960	3,360	1,310	5,900
Thailand	58,600	11,600	40,200	12,100
United Arab Emirates	23,300	7,110	5,700	2,710
United Kingdom	29,100	4,670	22,400	4,450
Vietnam	52,400	63,500	58,800	68,700
Other	3,810 r	3,210 r	1,880	3,900
Total	6,770,000	2,580,000	6,540,000	2,370,000

See footnotes at end of table.

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

Kind, range, and country of origin	2014 Quantity (carats)	2014 Value[2] (thousands)	2015 Quantity (carats)	2015 Value[2] (thousands)
Cut but unset, more than 0.5 carat:[7]				
Armenia	1,480	1,200	3,870	2,630
Australia	3,330	65,500	3,460	59,300
Belgium	588,000	3,810,000	591,000	3,600,000
Botswana	24,000	139,000	28,300	118,000
Brazil	760	5,390	726	6,670
Canada	61,100	219,000	40,700	114,000
China	66,400	296,000	50,800	233,000
Dominican Republic	1,020	(5)	563	(5)
France	2,200	26,800	1,910	79,300
Germany	2,510	7,140	2,440	5,730
Hong Kong	40,500	294,000	62,900	262,000
India	2,300,000	5,810,000	2,200,000	6,180,000
Israel	1,800,000	9,000,000	1,530,000	8,410,000
Italy	1,180	14,700	1,480	11,700
Japan	1,670	8,260	2,000	5,820
Lebanon	313	590	1,280	6,900
Mauritius	6,910	47,400	9,140	53,900
Mexico	19,300	4,710	6,880	2,480
Namibia	11,400	59,700	12,000	47,000
Russia	16,000	109,000	10,100	90,500
Singapore	2,200	4,700	11,400	24,700
South Africa	38,600	864,000	37,000	583,000
Spain	1,400	3,200	1,270	2,540
Sri Lanka	1,790	15,800	216	730
Switzerland	7,520	440,000	8,100	403,000
Thailand	13,200	18,000 r	24,200	34,300
United Arab Emirates	9,210	64,500	8,880	56,700
United Kingdom	9,140	100,000	4,260	145,000
Other	3,310 r	12,600 r	2,720	17,300
Total	5,040,000	21,400,000	4,650,000	20,600,000

rRevised. -- Zero.
[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]Rough or uncut, natural data are for Harmonized Tariff Schedule of the United States (HTS) code 7102.31.0000.
[5]Less than ½ unit.
[6]Cut but unset, not more than 0.5 carat data are for HTS code 7102.39.0010.
[7]Cut but unset, more than 0.5 carat data are for HTS code 7102.39.0050.

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	2014 Quantity (carats)	2014 Value[2] (thousands)	2015 Quantity (carats)	2015 Value[2] (thousands)
Emerald:[3]				
Belgium	2,120	$4,950	825	$3,490
Brazil	148,000	15,100	234,000	16,800
Canada	2,710	(4)	2,210	(4)
China	10,000	(4)	9,570	906
Colombia	339,000	286,000	393,000	248,000
France	731	3,140	2,180	16,900
Germany	38,100	3,580	4,290	1,710
Hong Kong	90,500	30,000	92,300	30,200
India	1,580,000	122,000	1,910,000	137,000
Israel	183,000	54,200	188,000	56,300
Italy	5,790	2,190	815	3,710
Japan	5,300	(4)	1,180	(4)
Lebanon	1,640	(4)	59	(4)
Madagascar	5,070	(4)	83	(4)
Malaysia	8,610	(4)	5,170	(4)
Mozambique	--	--	661	(4)
Singapore	--	--	808	500
South Africa	16,300	3,590	9,670	1,790
Sri Lanka	5,180	5,690	2,410	1,150
Switzerland	5,320	49,400	5,030	20,500
Tanzania	3,600	(4)	6	(4)
Thailand	418,000	17,700	406,000	15,300
Turkey	1,370	(4)	--	--
United Arab Emirates	1,000	1,310	13,100	13,200
United Kingdom	3,960	14,700	794	4,490
Zambia	311,000	28,800	361,000	43,800
Other	156 r	1,000 r	6,030	1,000
Total	3,180,000	644,000	3,650,000	617,000
Ruby:[5]				
Afghanistan	6	735	3,180	(4)
Brazil	89	(4)	6,930	(4)
China	1,410	(4)	7,070	(4)
Germany	15,700	569	14,900	1,640
Hong Kong	24,800	4,690	16,800	11,400
India	1,830,000	11,600	1,310,000	14,800
Israel	7,470	5,580	3,660	5,180
Italy	5,750	(4)	317	1,520
Kenya	--	--	7,840	(4)
Madagascar	40,400	1,830	174,000	6,510
Mozambique	45,500	28,300	70,100	25,400
South Africa	37,000	2,950	13,000	4,450
Sri Lanka	74,200	4,230	2,200	1,290
Switzerland	1,210	3,270	678	1,310
Tanzania	2,000	949	30,800	(4)
Thailand	1,550,000	59,400	2,000,000	63,900
Turkey	16,700	(4)	2,750	(4)
United Arab Emirates	3,060	(4)	365	2,430
United Kingdom	1,200	1,220	2,020	1,670
Vietnam	2,100	(4)	1,400	1,490
Zambia	405	(4)	1,150	(4)
Other	10,500 r	7,160 r	2,780	6,040
Total	3,660,000	132,000	3,680,000	149,000

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	2014 Quantity (carats)	2014 Value[2] (thousands)	2015 Quantity (carats)	2015 Value[2] (thousands)
Sapphire:[6]				
Australia	6,820	(4)	4,520	591
Austria	45,900	(4)	--	--
Belgium	487	3,940	2,610	3,090
Brazil	23,100	593	35,100	(4)
Canada	1,040	(4)	881	(4)
China	21,300	1,080	16,800	968
France	246	4,260	3,100	19,900
Germany	45,700	1,660	39,100	3,140
Hong Kong	72,500	39,100	251,000	77,800
India	2,130,000	40,500	1,880,000	49,800
Israel	21,500	6,900	15,500	7,880
Italy	8,700	6,060	3,930	5,370
Japan	4,160	(4)	1,380	(4)
Madagascar	13,300	3,320	288,000	6,730
Mauritius	1,190	(4)	58	(4)
Mozambique	2,100	(4)	7,600	1,260
South Africa	207,000	3,420	7,940	(4)
Sri Lanka	478,000	117,000	361,000	89,800
Switzerland	13,000	54,600	16,000	78,900
Tanzania	1,690	(4)	38	(4)
Thailand	2,960,000	108,000	3,690,000	104,000
Turkey	1,380	(4)	4,410	(4)
United Arab Emirates	248	700	3,880	(4)
United Kingdom	674	2,350	3,470	11,000
Zambia	2,890	(4)	1,720	(4)
Other	1,250 r	22,100 r	1,910	3,330
Total	6,070,000 r	416,000 r	6,640,000	464,000
Other:				
Rough, uncut, all countries[7]	68,800,000 r	538 r	137,000,000	1,360
Cut, set and unset, all countries[8]	NA	435,000	NA	471,000

rRevised. 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]Emerald data are for Harmonized Tariff Schedule of the United States (HTS) code 7103.91.0030.
[4]Less than ½ unit.
[5]Ruby data are for HTS code 7103.91.0010.
[6]Sapphire data are for HTS code 7103.91.0020.
[7]Rough, uncut data are for HTS code 7103.10.4080.
[8]Cut, set and unset data are for HTS code 7103.99.1080.

Source: U.S. Census Bureau.

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

(Thousand dollars)

Country	2014	2015
Synthetic, cut but unset:[3]		
Austria	1,420	1,410
Belgium	735	281
Brazil	109	154
China	5,210	5,190
Czech Republic	128	115
France	569	423
Germany	9,190	9,080
Hong Kong	189	281
India	2,280	6,590
Netherlands	103	106
Russia	5	892
Singapore	1,700	1,580
South Africa	--	243
Sri Lanka	318	308
Switzerland	179	146
Thailand	739	882
Other	379 r	661
Total	23,300 r	28,300
Imitation:[4]		
Brazil	57	1
Canada	12	83
China	18,500	20,000
France	23	--
Germany	20	33
Hong Kong	102	90
India	15	44
Italy	24	40
Japan	31	2
Korea, Republic of	211	232
Pakistan	195	97
Spain	7	30
Taiwan	1,150	1,290
Thailand	276	194
United Kingdom	530	57
Other	19 r	18
Total	21,200 r	22,200

rRevised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Customs value.
[3]Synthetic, cut but unset; data are for Harmonized Tariff Schedule of the United States (HTS) code 7104.90.1000.
[4]Imitation gemstones, does not include pearls; data are for HTS code 3926.90.4000.

Source: U.S. Census Bureau.

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

(Thousand carats and thousand dollars)

Stones	2014		2015	
	Quantity	Value[2]	Quantity	Value[2]
Coral and similar materials, unworked[3]	7,780	$16,000	8,190	$16,500
Diamonds:				
Cut but unset[4]	11,800	24,000,000 r	11,200	22,900,000
Rough or uncut[5]	425	547,000	418	305,000
Emeralds, cut but unset[6]	3,180	644,000	3,650	617,000
Pearls:				
Cultured[7]	NA	24,400	NA	22,100
Imitation[8]	NA	53,400 r	NA	43,200
Natural	NA	20,600	NA	23,700
Rubies, cut but unset[9]	3,670	132,000	3,680	149,000
Sapphires, cut but unset[10]	6,070 r	416,000 r	6,640	464,000
Other precious and semiprecious stones:				
Rough, uncut[11]	3,140,000 r	24,000 r	2,520,000	38,600
Cut, set and unset[12]	NA	435,000	NA	471,000
Other[13]	NA	8,130 r	NA	11,400
Synthetic:				
Cut but unset[14]	55,500 r	23,300 r	50,400	28,300
Other[15]	NA	8,720 r	NA	3,380
Imitation gemstone[16]	NA	21,200 r	NA	22,200
Total	3,230,000	26,400,000	2,600,000	25,100,000

rRevised. NA Not available.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Customs value.
[3]Coral and similar materials, unworked; data are for Harmonized Tariff Schedule of the United States (HTS) code 0508.00.0000.
[4]Cut but unset; data are for HTS codes 7102.39.0010, 7102.39.0050.
[5]Rough or uncut; data are for HTS code 7102.31.0000.
[6]Emeralds, cut but unset; data are for HTS code 7103.91.0030.
[7]Cultured data are for HTS code 7101.21.0000.
[8]Imitation data are for HTS codes 7018.10.1000, 7018.10.2000
[9]Rubies, cut but unset; data are for HTS code 7103.91.0010.
[10]Sapphires, cut but unset; data are for HTS code 7103.91.0020.
[11]Rough, uncut; data are for HTS codes 7103.10.2020, 7103.10.2080.
[12]Cut, set and unset; data are for HTS code 7103.99.1080.
[13]Other data are for HTS code 7103.99.5080.
[14]Reconstructed, cut but unset synthetic; data are for HTS code 7104.90.1000.
[15]Reconstructed, worked but unset synthetic; data are for HTS code 7104.90.5000.
[16]Imitation gemstones, does not include pearls; data are for HTS code 3926.90.4000.

Source: U.S. Census Bureau.

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

(Thousand carats)

Country and type[2]	2011	2012	2013	2014	2015
Gemstones:					
Angola[3]	7,500	7,500	7,740 r	7,910	8,120
Australia[4]	157	184	235	186	271
Botswana[5]	16,000	14,400	16,200	17,300	14,500
Brazil, unspecified[6]	46	49 r	49	57	32
Cameroon, unspecified[7]	--	1 r	3	4	2
Canada, unspecified	10,795	10,451	10,600 r	12,012	11,677 p
Central African Republic[8]	259	293	65 r, 9	-- 9	-- 9
China, unspecified	(10)	2	1	--	--
Congo (Brazzaville), unspecified	77	52	56	53	40
Congo (Kinshasa)[11]	3,850	4,300	3,140	3,130	3,200
Côte d'Ivoire, unspecified	-- 12	-- 12	-- 12	1	15
Ghana, unspecified	302	233	169	242	174
Guinea[8]	243	213	162	131	134
Guyana, unspecified	51	44	60	100	118
India[13]	3	7	10	10	9
Lesotho, unspecified	224	479	414	346	304
Liberia[14]	25	25	32	39	41
Namibia, unspecified	1,256	1,629	1,689	1,918	2,053
Russia[15]	19,700	19,600	21,200	21,500	23,500
Sierra Leone[8]	286 r	433 r	487 r	496 r	400
South Africa[8]	5,640	5,660	6,520	5,950	5,780
Tanzania[16]	35 r	108 r	153 r	215 r	184
Togo, unspecified	(10)	(10)	(10)	(10)	(10)
Zimbabwe[17]	850	1,210	1,040	477	349
Total	67,300 r	66,800	70,000 r	72,000	70,900
Industrial:					
Angola[3]	833	833	860 r	879	902
Australia[4]	7,670	9,000	11,500	9,100	13,300
Botswana[5]	6,870	6,170	6,960	7,400	6,230
Central African Republic[8]	65	73	16 r, 9	-- 9	-- 9
Congo (Kinshasa)[11]	15,400	17,200	12,500	12,500	12,800
Guinea[8]	61	53	40	33	33
India[13]	9	20	27	27	24
Liberia[14]	17	17	21	26	27
Russia[15]	15,500	15,400	16,700	16,900	18,400
Sierra Leone[8]	71 r	108	122	124	100
South Africa[8]	1,410	1,420	1,630	1,490	1,440
Tanzania[16]	6 r	19 r	27 r	38 r	33
Zimbabwe[17]	7,650	10,900	9,370	4,290	3,140
Total	55,500 r	61,100 r	59,800 r	52,800	56,500
Grand total, unrounded	122,829	127,966 r	129,844 r	124,778	127,399

pPreliminary. rRevised. -- Zero.

[1]Gem and industrial diamond quantities except "unspecified" are estimated from reported country totals using percentages noted. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Reported values for countries for which proportions of gem and industrial qualities were not known are listed as "unspecified" under "Gemstones." Includes data available through January 17, 2018.

[2]In addition to the countries listed, Nigeria produced natural diamond, but information was inadequate to make reliable estimates of output.

[3]About 90% gem quality and 10% industrial quality.

[4]About 2% gem quality and 98% industrial quality.

[5]About 70% gem and near-gem quality and 30% industrial quality.

[6]Private sector and artisanal mining. Includes near-gem and cheap-gem qualities.

[7]From artisanal mining.

[8]About 80% gem quality and 20% industrial quality.

[9]From May 2013 through 2015, the Central African Republic was under a temporary suspension from the Kimberley Process Certification Scheme and was not trading in rough diamond.

TABLE 11—Continued
NATURAL DIAMOND: WORLD PRODUCTION, BY COUNTRY AND TYPE[1]

(Thousand carats)

[10]Less than ½ unit.
[11]About 20% gem quality and 80% industrial quality; the majority of production was from artisanal mining.
[12]In 2011–13, Côte d'Ivoire was under United Nations sanctions and was not trading in rough diamond.
[13]About 27% gem quality and 73% industrial quality.
[14]About 60% gem quality and 40% industrial quality.
[15]About 56% gem quality and 44% industrial quality.
[16]About 85% gem quality and 15% industrial quality.
[17]About 10% gem quality and 90% industrial quality.

Source: Kimberley Process Certification Scheme.