AN IMPORTANT EXHIBITION OF SEVEN RARE GEM DIAMONDS

John M. King and James E. Shigley

From late June to mid-September 2003, seven important gem diamonds went on temporary public display at the Smithsonian Institution in Washington, DC, in an exhibit titled "The Splendor of Diamonds." These diamonds, one colorless and six colored, are some of the rarest in the world: the 203.04 ct D-color De Beers Millennium Star, the 101.29 ct Fancy Vivid yellow Allnatt, the 59.60 ct Fancy Vivid pink Steinmetz Pink, the 27.64 ct Fancy Vivid blue Heart of Eternity, the 5.54 ct Fancy Vivid orange Pumpkin, the 5.51 ct Fancy Deep blue-green Ocean Dream, and the 5.11 ct Fancy red Moussaieff Red. This article provides background information on these spectacular diamonds and a record of some of the gemological observations obtained during their quality grading by GIA.

From June 27 through September 15, 2003, "The Splendor of Diamonds," a collection of unique gem diamonds, is on temporary display at the National Museum of Natural History (NMNH) at the Smithsonian Institution in Washington, DC (see figure 1). This museum is the home of the U.S. national gemstone collection, and is where the famous 45.52 ct blue Hope diamond has resided since its donation by Harry Winston in 1958. Since its renovation in 1997, the Harry Winston Gallery in the Janet Annenberg Hooker Hall of Geology, Gems, and Minerals has been one of the most popular sites in the museum. Typically around two to three million people visit this hall every summer (J. E. Post, pers. comm., 2003).

On only one other occasion has another important diamond been displayed in the same room; this was the historic 41 ct Dresden green diamond, which was exhibited on a rare loan from the Green Vaults in Dresden, Germany, in October 2000 ("Harry Winston . . .," 2000). The exhibition of these seven diamonds in the same setting attests to the rarity of this special collection. "The Splendor of Diamonds" at the NMNH includes the 203.04 ct colorless De Beers Millennium Star as well as six exceptional diamonds that represent some of the rarest of naturally occurring colors. On the initiative of GIA representatives and with the sponsorship of the Steinmetz Group, the seven diamonds were brought together from private collections throughout the world. Each is unique in its combination of size, color, and quality.

Over the years, GIA staff members have examined many important gemstones as part of our laboratory grading services and for research purposes. These opportunities have allowed us to characterize and document the gemological properties of a number of unique diamonds in public and private collections that would otherwise not be available for gemological study. Fryer and Koivula (1986, p. 102), in their account of the examination of four important gemstones on public display for a limited time (the Star of Bombay sapphire, the Portuguese diamond, and the Marie Antoinette diamond earrings), concluded with this statement: "We hope that our examinations will provide a more complete record

See end of article for About the Authors and Acknowledgments.

Authors' note: This article contains a number of photos illustrating subtle distinctions in color. Because of the inherent difficulties of controlling color in printing (as well as the instability of inks over time), the color in an illustration may differ from the actual color of the diamond.

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Figure 1. This collection of extraordinary gem diamonds is on temporary display at the National Museum of Natural History at the Smithsonian Institution in Washington, DC, during Summer 2003. Counter-clockwise from center, the 203.04 ct De Beers Millennium Star (courtesy of De Beers LV), the 59.60 ct Fancy Vivid pink Steinmetz Pink (courtesy of Steinmetz Group), the 27.64 ct Fancy Vivid blue Heart of Eternity (courtesy of a private collector), the 5.54 ct Fancy Vivid orange Pumpkin (courtesy of Harry Winston Inc.), the 5.11 ct Fancy red Moussaieff Red (courtesy of House of Moussaieff), the 5.51 ct Fancy Deep blue-green Ocean Dream (courtesy of Cora Diamond Corp.), and the 101.29 ct Fancy Vivid yellow Allnatt (courtesy of SIBA Corp.). Photo by Chip Clark, courtesy of the Smithsonian Institution.

on these stones for future researchers, and that the opportunity will become available to provide similar reports on other named pieces as we seek to learn more about these touchstones of gemology." Since then, *Gems & Gemology* has published gemological reports on the Hope Diamond (Crowningshield, 1989), the Dresden Green (Kane et al., 1990), and, most recently, the 128 ct Star of the South (Smith and Bosshart, 2002). The information on the seven diamonds discussed here represents a continuation of this kind of documentation for gemologists and the public.

GIA has issued Diamond Grading or Colored Diamond Grading Reports on all seven of these diamonds. Understanding the importance of the diamonds requires an understanding of their grading, inasmuch as all are extraordinary for their size in their color grades. Colorless to light yellow diamonds are color graded against a set of "master color comparison diamonds," and their color grade is

expressed as a set of letters from "D" to "Z" according to the grading system established by GIA in the early 1950s. For diamonds in the standard colorless to light yellow or brown range, those that are "most colorless" ("D" in the GIA system), like the De Beers Millennium Star, are not common and are typically valued much higher than the next grade.

For colored diamonds, the color grade is by far the most important factor in their value. They are graded using a series of "Fancy" grade terms that refer to a three-dimensional color space. Those diamonds in the "end grades" of Fancy Intense, Fancy Deep, and Fancy Vivid are the most strongly colored and valued. For more information, please see the articles by King et al. (1994, 1998, 2002) which elaborate on GIA's fancy-color diamond grading system.

The following takes a brief look at the known history of each of these special diamonds and summarizes the gemological observations made during grading by GIA.

Figure 2. Shown here is the 777 ct piece of rough from which the 203.04 ct De Beers Millennium Star was cut. Courtesy of Steinmetz Group.

THE DE BEERS MILLENNIUM STAR

In the early 1990s, an unnamed miner in an alluvial digging in the Mbuji-Mayi district of Zaire (now the Democratic Republic of Congo) discovered a 777 ct piece of rough (figure 2), the sixth largest "colorless" gem-quality diamond ever found (Balfour, 2000). De Beers purchased the large crystal fragment on the open market. Following three years of study, planning, and work by the Steinmetz Group on three continents, the original crystal was divided into three parts. The largest diamond cut from this crystal was a 203.04 ct, 54-facet pear-shaped brilliant measuring 50.06 × 36.56 × 18.54 mm. De Beers called it the *De Beers Millennium Star*.

In late 1999, the "De Beers Millennium Jewels" exhibit was unveiled at the Millennium Dome in London. This unique collection of diamonds was assembled to mark the passing of the millennium, an event De Beers had anticipated since purchasing the enormous piece of rough years earlier (Balfour, 2000). The centerpiece of this collection was the De Beers Millennium Star; all would soon be the focus of one the most flamboyant robbery attempts in modern history (see below).

When graded by GIA in 1997, the De Beers Millennium Star was noted to be "D" color and Flawless (no internal or surface clarity characteristics were seen using a binocular microscope and a fully corrected 10× loupe). It exhibits excellent polish and symmetry, and it has no fluorescent reaction when exposed to long-wave ultraviolet (UV) radiation. Large, colorless rough crystals with few or no mineral inclusions are usually type IIa diamonds (see Fritsch and Scarratt, 1992,

for more information on diamond types); the laboratory confirmed that the De Beers Millennium Star is a type IIa.

THE ALLNATT

This strongly colored yellow diamond is thought to have originated from the De Beers mine in South Africa, which produced a number of large yellow diamond crystals during its early years of production (Balfour, 2000). It is named for its former owner, Major Alfred Ernest Allnatt, a British soldier, sportsman, art patron, and noted philanthropist who purchased the diamond in the early 1950s.

Originally the Allnatt weighed 102.07 ct and was graded Fancy Intense yellow when it was purchased at the Christie's Geneva May 1996 auction (for a total price of US$3,043,496). Subsequently, the Allnatt was re-cut in a successful attempt to intensify the color appearance. When graded again by GIA in 2000, it weighed 101.29 ct and was classified as Fancy Vivid yellow. The clarity grade was VS_2.

The Allnatt, a type Ia diamond, is a round-cornered square modified brilliant that measures 24.44 × 23.74 × 21.60 mm. Its shape and cutting style are classic examples of those used in the early 20th century to retain maximum weight from well-formed octahedral rough crystals. Its shape is also probably influenced by the fact that its manufacture pre-dates the use of sawing. Therefore, the diamond naturally retains a closer relationship to the shape of the original piece of rough. It has steep crown and pavilion angles and a small table. In the case of this diamond, these proportions act to intensify the color appearance. When examined by GIA, the Allnatt also was noted to have good polish and good symmetry. When exposed to UV radiation, it exhibited weak blue long-wave fluorescence, and weak orangy yellow short-wave fluorescence, both common reactions in many yellow diamonds (Moses, 1997).

Yellow color in diamond may result from the presence of small amounts of nitrogen occurring either as single atoms or as aggregates of a few atoms at carbon sites in the atomic lattice. The cause of the strong yellow color in this diamond is due to aggregated nitrogen in triples (clusters of three atoms, called the *N3 center*), which is known in traditional gemological terminology as the "cape" absorption series (*GIA Diamond Dictionary*, 1993). Among colored diamonds, yellow and brown are the most common colors, but natural-color diamonds of this size with this strength of yellow are extremely rare. This is one of the largest strongly colored yellow diamonds ever seen in the GIA Gem Laboratory.

THE STEINMETZ PINK

Both intriguing and highly valued, pink diamonds have been treasured for many hundreds of years. Adding to this allure are the few famous pink diamonds with rich histories—such as the approximately 60 ct Nur-Ul-Ain, plundered from Delhi in 1739; the 28.15 ct Agra, believed to have belonged to the first Mogul Emperor Babur in the 15th century; or the 20.53 ct Hortensia, stolen from the French Royal Treasury during the French Revolution (*GIA Diamond Dictionary*, 1993; Bari and Sautter, 2001; King et al., 2002). Pink diamonds were encountered only sporadically until the discovery of the Argyle mine in the 1980s. While some of the small quantities of Argyle pink diamonds recovered thus far occur in very strong colors, these characteristically type Ia diamonds seldom exceed one carat and are often highly included (Shigley et al., 2001). Type IIa pink diamonds occur in larger sizes, but they are not commonly encountered with strong color (King et al., 2002). Therefore, a saturated-color pink diamond of this size is almost unprecedented.

The approximately 100 ct rough from which the Steinmetz Pink was cut was recovered from a mine in southern Africa (Moody, 2003), and the 59.60 ct oval-shaped mixed cut diamond was cut over a period of almost two years by the Steinmetz Group. It was only revealed to the public—around the neck of model Helena Christensen—in May 2003 at its unveiling in Monaco.

The cause of color in pink (and red) diamonds is what scientists call a *color center*—a microscopic imperfection at the atomic level that, in the case of pink diamonds, is thought to be the result of plastic deformation of the diamond's atomic lattice (Harlow, 1998; King et al., 2002). When graded in 2001 by GIA, the Steinmetz Pink was classified

as Fancy Vivid pink and Internally Flawless. It measures 26.93 × 20.64 × 13.68 mm, and displays very good polish and symmetry. When exposed to long-wave UV, it exhibited weak blue fluorescence and, to short-wave, very weak blue fluorescence. To date, it is the largest Fancy Vivid pink diamond graded by GIA.

THE HEART OF ETERNITY

As part of the Millennium Jewels display at London's Millennium Dome, De Beers also assembled an extraordinary group of 11 blue diamonds, with a total weight of 118 carats, known as the Midnight Collection (Balfour, 2000). Like the majority of blue diamonds in recent times, all of these blues were recovered from the Premier mine in South Africa; all 11 were also manufactured by the Steinmetz Group (see figure 3). The largest diamond in this collection was the 27.64 ct Fancy Vivid blue Heart of Eternity (Balfour, 2000).

Despite the enormous security surrounding these diamonds (including a special reinforced concrete viewing vault and 24-hour remote surveillance), this priceless display proved to be too great a temptation to a gang of jewel thieves. On the morning of November 7, 2000, in a scene reminiscent of a James Bond movie, the gang crashed a stolen earthmover into the Millennium Dome, through the outer security and up to the vault, lobbing smoke bombs and firing nail guns as they went. They planned to seize the diamonds and escape in a waiting speedboat down the Thames River. Fortunately for De Beers, Scotland Yard had learned of the plan months beforehand and surrounded the Millennium Jewels display with more than 100 elite undercover officers on the morning of the attempted robbery. When the gang entered the vault, they were trapped and swiftly arrested; the diamonds themselves had previously been replaced with replicas. The would-be thieves received sentences ranging from five to 18 years in prison (see Hopkins and Branigan, 2000; "Gang . . . ," 2001; Branigan, 2002).

Figure 3. Shown here with several other rough crystals is the sawn rough from which the Heart of Eternity was cut (second from left). Photo by John King.

The Heart of Eternity diamond was graded by GIA in 1999. It is the largest Fancy Vivid blue diamond GIA has graded to date. Blue diamonds such as the Heart of Eternity are very rare in nature (King et al., 1998); those with a very strong color such as this one are even more so.

The Heart of Eternity is cut as a heart-shaped modified brilliant measuring 19.25 × 21.76 × 11.43 mm. It exhibits very good polish and good symmetry. When exposed to ultraviolet radiation, it was inert to long-wave UV, but very weak red to short-wave UV. Similar to the Hope diamond (Crowningshield, 1989), when the exposure to short-wave UV was discontinued, the diamond continued to emit strong red phosphorescence lasting for approximately 15 seconds. When examined with magnification, it exhibited small included crystals, pinpoint inclusions, and internal graining. Its clarity grade is VS_2. Color zoning was also observed, appearing as narrow parallel bands of colorless and blue areas. Strategically locating color zoning during the manufacturing process is important to obtain the most saturated, even, face-up color appearance; this was done quite successfully in the Heart of Eternity. As is typical of natural-color type IIb blue diamonds, the Heart of Eternity is electrically conductive. This behavior is the result of small amounts of boron in the diamond's atomic structure, which substitutes for carbon, giving rise to the blue color as well as the conductivity.

In addition to the rare assemblage of the seven diamonds in this exhibition, "The Splendor of Diamonds" also offers an extraordinary opportunity to see three large, strongly colored blue diamonds in close proximity. In the same gallery, the famous Hope (its color grade updated in 1996) is a Fancy Deep grayish blue; nearby in the gem collection is

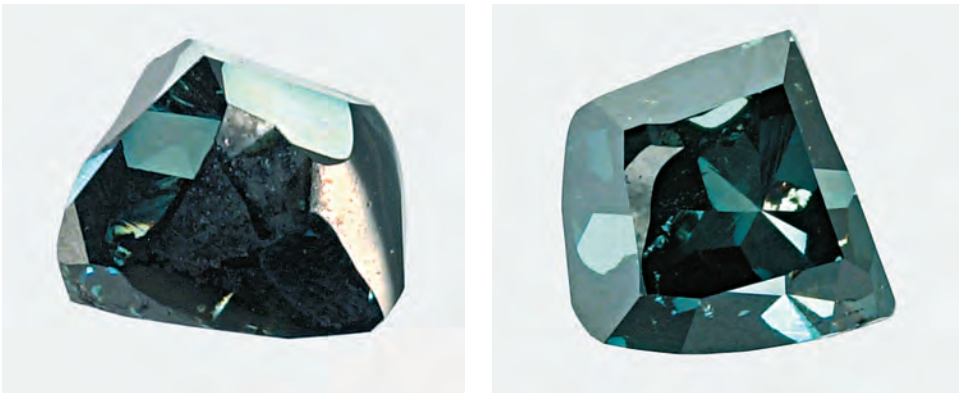


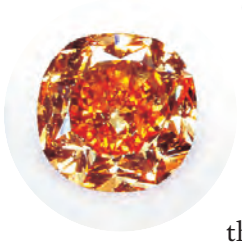
Figure 4. Shown here are two preform stages in the cutting of the 11.17 ct rough from which the 5.51 ct Fancy Deep blue-green Ocean Dream was fashioned. Photo by Elizabeth Schrader.

the 30.62 ct Blue Heart, which was graded Fancy Deep blue (King et al., 1998). While all are of relatively similar tone, subtle differences in saturation account for the differences in color grade.

THE PUMPKIN DIAMOND

Diamonds in the orange hue range are typically dark toned and weak to moderate in saturation. This generally results in a brown or brownish color appearance; an unmodified orange appearance is extremely rare (King and Moses, 1997). Many diamonds in the orange hue range are type Ib, but the Pumpkin was found to be type IIa (King and Moses, 1997).

The Pumpkin diamond was discovered in South Africa in the mid-1990s, and the rough is reported to have appeared predominantly brown with only a hint of orange (W. Goldberg, pers. comm., 1997). After cutting, however, this 5.54 ct gemstone displayed a pure, strongly saturated orange hue. When purchased by Harry Winston Inc. at auction in October 1998, its striking color and the date of the sale—the day before Halloween—led the company to dub it the Pumpkin (Auction report, 1997). It was loaned to actress Halle Berry for the 2002 Academy Awards, the night she won the "Oscar" for Best Actress, the first African-American ever so honored ("The splendor . . . ," 2003).



The Pumpkin diamond is fashioned as a cushion-shaped modified brilliant and measures 9.88 × 9.85 × 7.04 mm. The diamond was graded by GIA in 1997 as Fancy Vivid orange. It is one of the largest diamonds of this color ever examined by GIA. As has often been observed in diamonds in this hue range, the Pumpkin diamond displays cloud-like and needle-like inclusions as well as crystals. It exhibits very good polish and good symmetry. When exposed to ultraviolet radiation, the diamond emitted moderate orange fluorescence to long-wave UV, and weak-to-moderate orange fluorescence to short-wave UV. When the UV lamp was turned off, observers noted a weak yellow phosphorescence. Because of the type of reports requested by the clients, clarity grades were not provided for the Pumpkin, Ocean Dream, and Moussaieff Red diamonds.

THE OCEAN DREAM

The 11.17 ct rough from which this diamond was manufactured was recovered in central Africa in 2002. The crystal was polished into a 5.51 ct modified triangular brilliant in New York by Cora Diamond Corp.; it was dubbed the *Ocean Dream* because of its deep, saturated blue-green color.

Because large, natural-color diamonds with this coloration are *extremely* rare, most in the diamond industry associate them with artificial treatment (i.e., irradiation). Not only is such naturally occurring color highly unusual, but it is virtually never seen in diamonds this large.

Natural blue-green to green color in diamonds is the result of exposure to radiation in the earth and the subsequent formation of radiation-induced color centers. In nature, such radiation is typically alpha or beta; the limited penetrating ability of these particles is the reason most rough "green" diamonds have only a thin "skin" of color (Kane et al., 1990). A saturated body color can only be produced by high-energy penetrating radiation such as gamma or neutron, and in nature such sources are very rare, though they are easily produced in a nuclear reactor (Ashbaugh, 1989). Furthermore, these colors tend to be unstable to

heat. For a diamond to acquire a saturated green or blue-green body color in nature, it must remain close to a gamma or neutron source for thousands if not millions of years without being exposed to excessive heat (Ashbaugh, 1989; Kane et al., 1990). It is this very rare set of conditions that makes a diamond like the Ocean Dream almost unique.

Determining the cause of blue-green color—natural or altered—is challenging, as both situations produce similar gemological features (Kane et al., 1990). In addition, important identification criteria may be lost during the process of faceting the diamond, because of the shallowness of the green surface layer typically produced by natural radiation exposure (see Crowningshield, 1963). Determination that the color of the Ocean Dream was natural was aided by numerous examinations of the diamond throughout the cutting process from rough crystal until it was finished (see figure 4). Its origin was confirmed by microscopic examination of gemological features such as color zoning, as well as various spectroscopic results compared to data from smaller blue-green diamonds of known natural color.

When graded by GIA in 2003, this type Ia diamond was classified as Fancy Deep blue-green. It measured 11.49 × 11.47 × 6.47 mm. When exposed to long-wave UV, the Ocean Dream showed a moderate blue reaction. Its reaction to short-wave UV was a weak yellow.

THE MOUSSAIEFF RED

Few gem diamonds that could be described as predominantly red have ever been documented in the jewelry industry. They are so rare that less than two decades ago, Kane (1987) could report that the GIA Gem Laboratory had *never* graded a diamond with an unmodified "red" hue. As recently as 2002, King et al. listed only four Fancy red diamonds in the public domain, one of which was the Moussaieff Red.

Awareness of red diamonds expanded greatly following the 1987 public auction of the 0.95 ct "Hancock Red" (a purplish red stone) for a record $926,316-per-carat price (Kane, 1987). While the Moussaieff Red, a 5.11 ct modified triangular brilliant, may not seem large in comparison to the other gemstones in this collection, for a diamond of this color it is astounding—no other Fancy red diamond reported to date approaches even half its size. To have such a color in a diamond of this size is truly unprecedented. As discussed above and by King et al. (2002), the cause of color in pink and red diamonds is believed to arise from color centers created by plastic deformation.

The Moussaieff Red was fashioned from a 13.90 ct crystal that a Brazilian farmer recovered from an alluvial deposit during the mid-1990s (W. Goldberg, pers. comm., 1997). The finished stone was manufactured by the William Goldberg Diamond Corp. in New York, and measures 11.02 × 10.57 × 6.06 mm. When examined under a UV lamp, it emitted moderate-to-strong blue long-wave UV fluorescence, and weak blue short-wave UV fluorescence. The Moussaieff Red was found to be a type Ia diamond, and at the time of grading in 1997, it was noted to be the largest Fancy red diamond ever documented by GIA.

CONCLUSION

Members of the public have a unique chance to view a collection of superb gem diamonds at the Smithsonian's National Museum of Natural History in Washington, DC, from June 27 through September 15, 2003. The "Splendor of Diamonds" exhibit brings together seven diamonds that are each outstanding examples in terms of their color, quality, and size. Examination of these diamonds allowed GIA to record important information for the science of gemology.

It is difficult to explain to a public audience just how rare the gems in this special collection actually are. In nature, it is challenging for geologists to find diamond-bearing rocks, and all but a few occurrences lack sufficient high-quality diamonds to make them economically feasible to exploit. Even at productive mines, recovery of diamonds is tremendously expensive, and in most instances the number of crystals suitable for manufacturing as gemstones is very limited. Larger diamonds that are completely colorless or highly colored, such as the seven in this exhibit, are so unusual that even the majority of experienced diamond dealers and collectors will never have the chance to handle them. Large colored diamonds with colors like these described in this article are uncommon even for GIA to encounter. For most gemologists, as for members of the public, this is a once-in-a-lifetime opportunity to see and enjoy these "touchstones" of gemology.

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