VOLUME XLV

SUMMER 2009

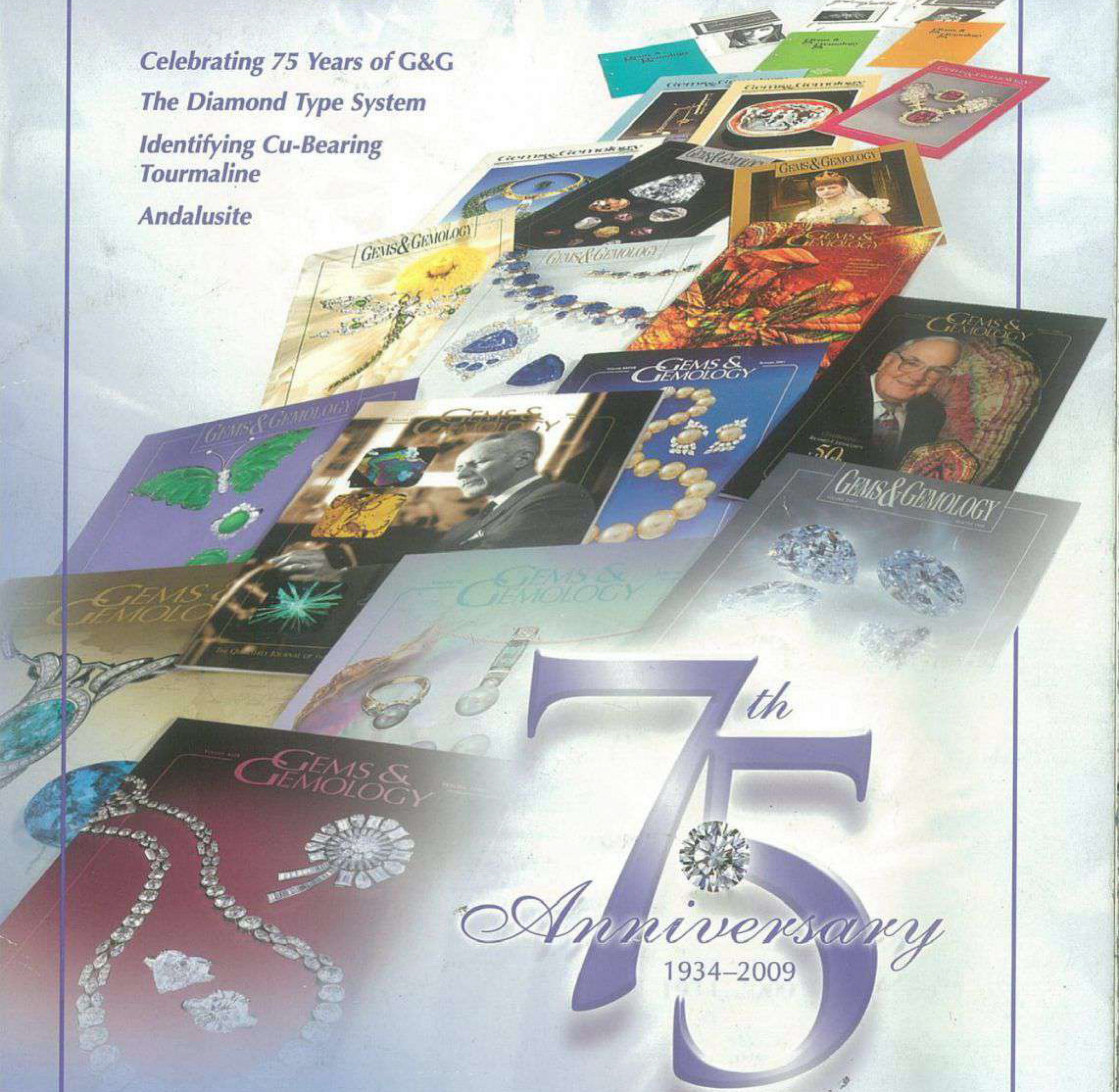
GEMS & GEMOLOGY

Celebrating 75 Years of G&G

The Diamond Type System

Identifying Cu-Bearing Tourmaline

Andalusite



THE QUARTERLY JOURNAL OF THE GEMOLOGICAL INSTITUTE OF AMERICA

ent as IaA aggregates. Type Ib singly substituted nitrogen rarely occurs in natural diamonds. When present in natural stones, it can cause an orange-yellow ("canary") color, occasionally with brownish or, rarely, reddish modifiers (e.g., Fall 2008 Lab Notes, pp. 255–256). This bicolored diamond contained both type Ia aggregated nitrogen and type Ib isolated nitrogen. While it is not unusual for a diamond to contain different forms of nitrogen aggregates, the sharply defined distribution of these defects with respect to the distinct color zones is unusual.

DiamondView imaging indicated that this stone may have crystallized during two different periods of growth and in two different growth environments (figure 2). Distinct differences in defect configuration between the two sections also suggest that the nitrogen aggregation process after diamond crystallization in the mantle may have been affected by factors (e.g., occurrence of other lattice defects) in addition to temperature and duration.

Erica Emerson, Paul Johnson, and Wai Win

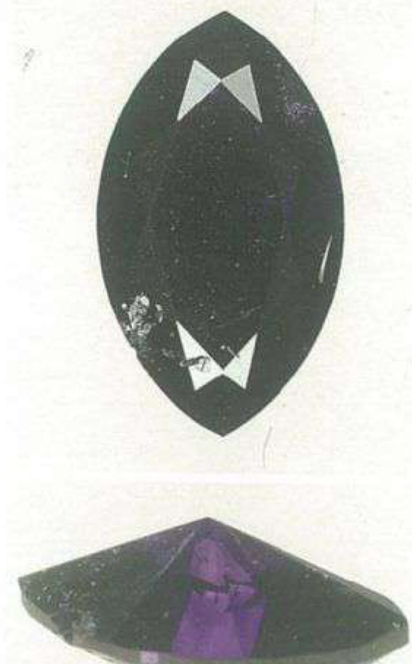


Figure 3. This 0.4 ct diamond was graded Fancy black. When viewed through the pavilion (bottom), the stone shows deep violet color.

"Black" Diamond with Deep Violet Color

Black diamonds are not uncommon in the gem trade, but naturally colored examples are relatively rare. Most black diamonds currently in the market are produced by the heating of fractured diamond to high temperatures in a vacuum to induce graphitization of the feathers and inclusions. The result is a nearly opaque stone that contains so much graphite that the diamond will conduct an electric current. In the past, treatments involving heavy-dose irradiation or irradiation plus annealing have also been used to produce black diamonds that are, in reality, very dark green when viewed with strong fiber-optic illumination. On occasion, we have seen other very dark colors, such as orange and blue. Naturally colored black diamonds typically contain abundant dark inclusions (sometimes graphite) that cause the stones to appear black when viewed face-up. Dense, dark-colored hydrogen clouds have also been reported as a natural cause of black color in diamonds (see Lab Notes: Fall 2008, p. 254; Spring 2009, pp. 54–55).

Recently, we examined an interesting 0.4 ct marquise brilliant in the Carlsbad laboratory. The tone of the diamond was so dark when it was viewed face-up that the stone was graded Fancy black (figure 3, top). Table-down examination in a white tray, however, revealed that the bodycolor of the diamond was in fact a very deep violet (figure 3, bottom). This is remarkable because we had not previously seen a violet diamond with such a dark tone.

The diamond's infrared absorption spectrum (see the *G&G* Data Depository at www.gia.edu/gandg) showed that it was type Ia with very high concentrations of nitrogen and hydrogen impurities. As is typical of natural hydrogen-rich violet diamonds, the stone contained shallow etch pits and cavities, and fluoresced yellow to both long- and short-wave UV radiation (C. van der Bogert et al., "Gray-to-blue-to-violet hydrogen-rich diamonds from the Argyle mine, Australia," Spring 2009 *G&G*, pp. 20–37).

This marquise cut represents an extremely rare type of black diamond. It was issued a "natural" color origin report.

Christopher M. Breeding and Kimberly M. Rockwell

Carved Diamond Crucifix

It is not unusual to see carved diamonds submitted to the laboratory for identification. Over the years, they have come in many forms, such as carved fish (Spring 1983 Lab Notes, p. 73) or dice (Fall 1985 Lab Notes, p. 172). Carved diamonds with religious themes have also been submitted, including one fashioned as a Hamsa, symbolizing the protective hand of the creator (Fall 2001 Lab Notes, p. 214), and another cut in the image of the Buddha (Fall 1996 Gem News, p. 215). In reviewing our records, however, it does not appear that we have previously examined a crucifix such as the one shown in figure 4.

This piece consisted of a carving of Christ on a white metal cross; the Christ figure was determined to be diamond by Raman analysis. The grayish appearance of the diamond was due to numerous graphite-containing fractures. There was also evidence of the rough diamond crystal at one point on the carving, a corner of a trigon and some striations.

While many diamond carvings today are created using lasers, the client stated that this crucifix had been fashioned by a now-deceased Indian master carver using just hand tools. Only a skilled craftsman with exceptional patience could perform this type of carving, in this detail. To our knowledge, this diamond crucifix is unique.

Garry Du Toit

Figure 4. This unique crucifix (27.12 × 7.24 × 4.25 mm) consisted of a carved diamond set on a white metal cross.

spectroscopy revealed features observed in other natural type IIb diamonds. No evidence of artificial irradiation was detected. However, some unusual features were observed in the ultraviolet-visible–near infrared region (see the spectrum in the *G&G* Data Depository at www.gia.edu/gandg). In contrast to typical blue IIb diamonds, which often show a uniform increase in absorption from the UV toward the lower energy/longer wavelength side, this diamond displayed increasing absorption from ~500 nm toward the higher energy/shorter wavelength side. As a result, a transmission window was created from ~500 to 525 nm, leading to the dominant green hue. This increase in absorption from ~500 nm to shorter wavelengths is very likely caused by plastic deformation of the crystal lattice, a common feature in many natural diamonds.

A natural type IIb diamond with a dominant green hue is extremely rare. This unusual color is a result of the right combination of boron concentration, intensity of plastic deformation, and influence of the cut style.

Paul Johnson and Jason Darley

Rare Type IIb Gray-Green Diamond

Natural type IIb diamonds are very rare. Among those we have examined in the GIA Laboratory, only about half showed a pure blue color, with the other half displaying an additional gray component due to varying levels of saturation. Two of the most famous type IIb diamonds, the Hope and the Wittelsbach, were color graded Fancy Deep grayish blue. Occasionally, brown diamonds with type IIb characteristics have also been seen (e.g., Summer 1977 Lab Notes, p. 307; Winter 2008 Lab Notes, pp. 364–365). Recently, staff members in the New York laboratory had the opportunity to examine an extremely rare type IIb diamond for which the dominant color was green.

The 5.41 ct marquise brilliant cut in figure 5 was color graded Fancy Dark gray-green. With magnification, the diamond showed only minor fractures reaching the surface. It had no reaction to either long- or short-wave UV radiation, which is characteristic of type IIb diamonds. When examined under the strong short-wave UV radiation of the DiamondView, it showed moderately strong blue florescence and weak red phosphorescence.

Infrared and photoluminescence

Figure 5. This highly unusual Fancy Dark gray-green diamond (16.54 × 9.13 × 5.87 mm) proved to be type IIb.

Unconventional Diamond Cuts

In March, the New York lab received a number of diamonds with unusual and unconventional facet distributions. They ranged in shape from round and cushion to pear and rectangular, but all had one feature in common: a fully faceted dome-shaped crown, with either no table at all or only a tiny "culet"-style facet in the center of the crown (figure 6). We were surprised to see these experimental cuts being applied to fairly large diamonds, most of them between 2 and 7 ct, as well as to diamonds of different colors.

Diamond cuts that lack a table facet invariably pose challenges for calculating overall dimensions and crown and pavilion angles, since typically the table serves as the basic reference plane against which these angles are measured. The cut description (shape and cutting style) also becomes more difficult, because none