NOTES
· AND ·
NEW TECHNIQUES

THREE NOTABLE FANCY-COLOR DIAMONDS: PURPLISH RED, PURPLE-PINK, AND REDDISH PURPLE

By Robert E. Kane

Three fancy-color diamonds were recently sold at auction by Christie's, the largest – a 0.95-ct purplish red – for $880,000. These diamonds are notable for their unusual colors, of which the purplish red is the rarest. This article provides a comprehensive description of the visual appearance and gemological properties of these three diamonds.

On April 28, 1987, at Christie's in New York, a 0.95-ct fancy purplish red round brilliant–cut diamond was sold for $880,000. This extraordinary sale set a new world record per-carat price, at auction, for any gem: $926,000. The previous world record per-carat price for a diamond sold at auction was $127,000, for a 7.27-ct pink stone (Christie's, May 14, 1980). Also sold at the recent auction were a 0.54-ct fancy reddish purple diamond ($65,880; $122,000 per carat) and a 0.59-ct purple-pink diamond ($135,000; $229,000 per carat).

The three fancy-color diamonds (figure 1) were put up for auction by the heirs of a Montana collector, who reportedly bought the 0.95-ct stone in 1956 for $13,500 (Arnold Baron, pers. comm., 1987). According to Mr. Baron, the "0.95-ct round red diamond" was "found in a Brazilian collection of fancies" he had purchased in the 1950s; the other two diamonds described here were also part of the same "Polychrome" collection. These stones were assembled by a Brazilian cutter from rough purchased at various mines in Brazil.

In August 1986, these three diamonds were submitted by Christie's to GIA's Gem Trade Laboratory, Inc., in Los Angeles for origin-of-color reports. Christie's also gave the laboratory and the GIA Research Department the opportunity to study and photograph them. The purpose of this article is to document the gemological characteristics of these three extremely rare fancy-color diamonds (see table 1).

COLOR

The three fancy-color diamonds were quite saturated in hue, and dark enough in tone to surpass easily the "fancy light/fancy" color grade distinction, and were all given the "fancy" grade. The following grades were assigned to these three round brilliants:

0.95 ct – Fancy purplish red
0.59 ct – Fancy purple-pink
0.54 ct – Fancy reddish purple

Although intense pink diamonds are rare (Hofer, 1985), a color description that includes "red" is even more rare, especially where red is the primary hue, such as purplish red. Rarest of all is pure red with no secondary hue. For the few descriptions in the literature of such stones, see

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All photomicrographs are by the author.

Figure 1. These three round brilliants are among the rarest of fancy-color diamonds. They are, from top to bottom: a 0.95-ct purplish red, a 0.59-ct purple-pink, and a 0.54-ct reddish purple diamond. Courtesy of Christie's; photo © Tino Hammid.

Kunz (1925 and 1928), Shepherd (1934), Ball (1935), and Gaal (1977). In the almost 30 years of records of Gem Trade Laboratory reports available, there is no mention of a diamond with "red" as the only descriptive term.

SPECTRAL ANALYSES

The visible-light absorption spectra (400 to 700 nm) of the three fancy-color diamonds were examined using a "hand-held" type spectroscope, first at room temperature and then at low temperature (around –65°F/–54°C), cooled by an aerosol refrigerant. At room temperature, the 0.95-ct purplish red diamond exhibited a moderate to strong 415.5-nm line, which is very common in diamonds, including some in the pink to red and purple color range (figure 2). This absorption became extremely intense when the diamond was cooled. No 415.5-nm line was observed in the 0.59-ct and 0.54-ct diamonds at room temperature. However, the 0.59-ct diamond showed an extremely weak, and the 0.54-ct a weak, 415.5-nm line when they both were cooled. All three diamonds showed almost total absorption below 410 nm, both at room temperature and when cooled.

The 0.95-ct purplish red diamond also exhibited a broad, diffuse band of moderate intensity from approximately 530 to 590 nm, and a weak band from approximately 495 to 510 nm. Unlike the 415.5-nm line, these absorption features were much weaker at low temperature than at room temperature. The two smaller diamonds exhibited

TABLE 1. The gemological properties of three notable fancy-color diamonds.

Properties	0.95-ct Diamond	0.59-ct Diamond	0.54-ct Diamond
Color	Fancy purplish red	Fancy purple-pink	Fancy reddish purple
Absorption spectrum[a] (400–700 nm)	Moderate to strong 415.5-nm line; weak band at 495–510 nm; broad, diffuse band of moderate intensity at approx. 530–590 nm	Very weak band at 495–510 nm; weak, broad, diffuse band at approx. 530–590 nm[b]	Very weak band at 495–510 nm; weak, broad band at approx. 530–590 nm[b]
Transmission luminescence	Weak to moderate whitish blue	Strong blue	Very weak chalky blue-white
Long-wave U.V. radiation	Distinctly zoned, weak chalky pink and chalky bluish white fluorescence	Patchy, slightly chalky, moderate blue fluorescence	Opaque, chalky, moderate bluish white fluorescence
Short-wave U.V. radiation	Essentially the same fluorescent colors as long-wave but intensity very weak	Essentially the same fluorescent colors as long-wave but intensity very weak	Essentially the same fluorescent colors as long-wave but intensity weak
X-rays	Moderate chalky bluish white	Moderate chalky bluish white	Moderate chalky bluish white

[a]*As observed at room temperature through a GIA GEM Instruments spectroscope unit with a Beck prism spectroscope.*
[b]*When cooled with an aerosol refrigerant, the 0.59-ct stone showed an extremely weak, and the 0.54-ct stone a weak, 415.5-nm line.*

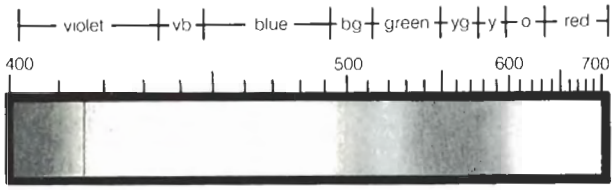


Figure 2. The absorption spectrum of the 0.95-ct purplish red diamond as viewed at room temperature on a GIA Gem Instruments spectroscope unit with a Beck prism spectroscope.

the same temperature-dependent behavior, but the absorption in the same areas was much weaker.

TRANSMISSION LUMINESCENCE

When the diamonds were placed over a strong light source from the opening of the iris diaphragm on the spectroscope unit, all three displayed a luminescence often seen in various fancy-color diamonds, which is frequently referred to as "transmission." This phenomenon is most evident when the diamond is placed table-down over the concentrated beam of light. If the luminescence is strong enough, it will be visible even in sunlight (or any artificial light), as was the case with the 0.59-ct purple-pink diamond.

The 0.95-ct purplish red diamond displayed a weak to moderate whitish blue luminescence, the 0.59-ct purple-pink diamond transmitted a strong blue (figure 3), and the 0.54-ct reddish purple

Figure 3. Transmission luminescence was readily visible in the 0.59-ct purple-pink diamond.

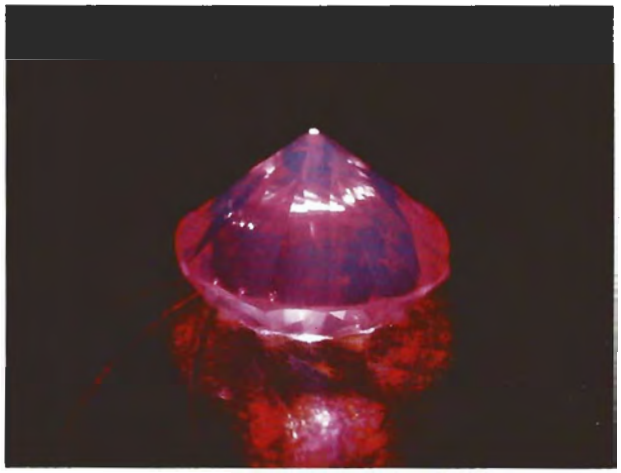


Figure 4. All three diamonds—from left to right here, the 0.59-ct, 0.95-ct, and 0.54-ct stones—fluoresced to long-wave ultraviolet radiation. Photo by Shane McClure.

diamond exhibited a very weak chalky blue-white uneven luminescence of moderate intensity. When this last diamond was positioned table-down toward the edges of the concentrated beam of illumination, a slight, dull green, "oily" appearance was also observed.

REACTION TO ULTRAVIOLET RADIATION AND X-RAYS

The three diamonds were exposed to long-wave (366 nm) and short-wave (254 nm) ultraviolet radiation in a completely darkened room. When exposed to long-wave U.V. radiation, the 0.59-ct purple-pink diamond fluoresced a patchy, slightly chalky, moderate blue; the 0.95-ct purplish red diamond fluoresced a distinctly zoned, weak chalky pink and chalky bluish white; and the 0.54-ct reddish purple diamond fluoresced an opaque, chalky, moderate bluish white (figure 4). The three diamonds reacted essentially the same to short-wave U.V. radiation, except that the intensity was very weak for the 0.95-ct and 0.59-ct diamonds, and weak for the 0.54-ct diamond. None of the stones showed phosphorescence.

When exposed to X-rays for a few seconds, all three diamonds fluoresced a fairly even chalky bluish white of moderate intensity. Again, no phosphorescence was observed.

OBSERVATIONS WITH THE MICROSCOPE

When examined with polarized light in a binocular gemological microscope (see Kane, 1982, for a description of this technique), all three diamonds showed second-order (bright and vivid) interference colors. The 0.95-ct purplish red diamond showed strong linear banded strain patterns, as well as strong mottled strain patterns (figure 5). The strong linear banded strain patterns intersected in two directions in some areas to form a cross-hatched pattern. Such a pattern is frequently referred to as the "tatami" type of birefringence pattern because of its resemblance to the Japanese woven mat of that name (Orlov, 1977; for illustrations, see Kane, 1982). The mottled birefringence areas are irregular patterns that appear to undulate as the diamond is moved within the field of view, or as one Polaroid is rotated.

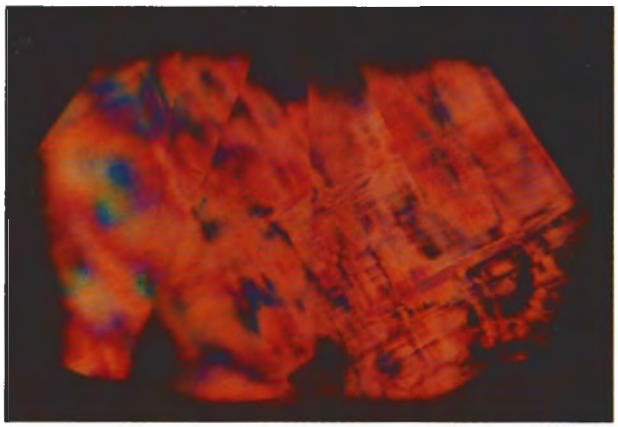


Figure 5. When the 0.95-ct purplish red diamond was examined at 25× magnification with polarized light, strong linear banded (as well as mottled) strain patterns were evident in some areas. Cross-hatching of the linear banded strain patterns forms a "tatami" pattern.

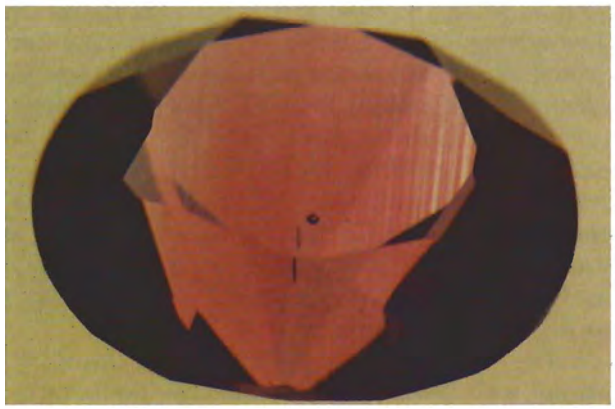
The 0.59-ct purple-pink diamond exhibited strong, well-defined, linear banded strain patterns, which correspond directly to the prominent color

Figure 6. In the 0.59-ct purple-pink diamond, the strong linear banded strain patterns observed with polarized light (left, magnified 30×) correspond directly to the color zoning and graining evident with darkfield illumination (right, magnified 25×).

zoning and color graining visible with darkfield illumination (figure 6). In addition, localized strain patterns around two crystal inclusions (probably olivine) were observed. The 0.54-ct reddish purple diamond also exhibited "tatami" birefringent strain patterns when viewed under crossed polars. Also present throughout this diamond were strong mottled and localized strain patterns, which are undoubtedly related in part to the numerous inclusions of various types in this diamond.

When viewed with darkfield illumination, all three diamonds were found to contain significant quantities of easily visible graining. Although the specific causes of color in diamonds in this color range are not entirely understood, current explanations involve defects in the atomic structure that result from gliding (the slight movement of atoms along the octahedral direction) as a result of plastic deformation (Orlov, 1977). This is readily apparent through the microscope as graining and color zonations within the graining (which can vary from weak to quite prominent). The three diamonds examined in this study exhibit closely spaced red and pink graining and color zoning (see figure 7). Considered in conjunction with the author's experience with numerous pink and purple diamonds of somewhat low tonal values (much lighter in color than the diamonds discussed here), this suggests that the tightness of the spacing and intensity of color in the graining is directly correlated to the intensity of the "face-up" color of such diamonds.

Figure 7. The closely spaced red and pink graining and color zoning seen in the 0.59-ct purple-pink diamond (here immersed in methylene iodide) were evident in the other two fancy-color diamonds as well. Diffused light; magnified 15×.



The "tatami" pattern was also easily visible as color graining in the 0.54-ct diamond in darkfield illumination, with the grain planes intersecting at approximately 45°. The two directions of color graining were also present in the 0.95-ct purplish red and the 0.59-ct purple-pink diamonds, but were very subtle and somewhat difficult to observe. In these two diamonds, one direction of graining was significantly stronger than the other.

In addition to the graining features discussed

Figure 8. A deep cavity is evident in the table of the 0.95-ct diamond. When viewed from the pavilion, parallel angular growth steps can be seen. Darkfield illumination, magnified 35×.

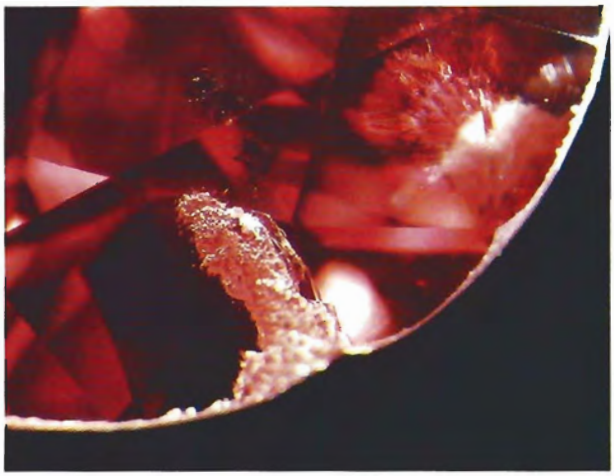


Figure 9. A second cavity in the 0.95-ct diamond begins at the girdle plane. Note the frosted appearance in reflected oblique illumination. Magnified 25×.

above, all three diamonds contain other inclusions. The 0.95-ct stone contains a large, deep cavity in the table (figure 8), with numerous parallel angular growth steps that are most evident when viewed from the pavilion. A second cavity—long, narrow, and irregularly shaped—begins at the girdle plane and extends onto the crown to the star facet. It is interesting to note that the highly irregular surface of this second cavity was transparent and glossy in darkfield illumination, in contrast to the white frosted appearance seen with reflected oblique illumination (figure 9). The slightly iridescent fracture seen extending inward from the girdle is aligned precisely with one of the tightly spaced graining planes easily visible through the pavilion. There are three naturals: one is a deep V-shape with sharp angular parallel growth steps, while the other two have a subtle irregular glossy texture reminiscent of alluvial diamond rough. The 0.95-ct diamond also contains both randomly oriented and intersecting groups of small, black, acicular crystals.

The two smaller diamonds were found to contain naturals, fractures, and clouds of pinpoint inclusions (probably olivine). The 0.59-ct stone contains two crystal inclusions (also probably olivine). The 0.54-ct stone contains several small, and some very large, graphite inclusions.

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