Gem Trade LAB NOTES

EDITOR
Chuck Fryer
GIA, Santa Monica

CONTRIBUTING EDITORS
Robert Crowningshield
Gem Trade Laboratory, New York
Karin N. Hurwit
Gem Trade Laboratory, Santa Monica
Robert E. Kane
Gem Trade Laboratory, Los Angeles

A NOTE FROM THE EDITOR

This is the first Gem Trade Lab Notes column under the new format of Gems & Gemology. *Although the general style of the former columns will be retained, a few improvements have been made, including the use of more color photos.*

Previously, there were separate columns for the New York, Los Angeles, and Santa Monica branch labs. It will be my job to combine the information supplied by each branch into one column. The New York correspondent will continue to be Bob Crowningshield, vice president of GIA and director of the colored stone section of the Gem Trade Lab. Bob Kane will keep the data from Los Angeles coming in, while Karin N. Hurwit supplies the items of interest from Santa Monica.

Perhaps the most important long-range improvement is the arrangement of the material in alphabetical order, by variety. Such an arrangement makes it easier to provide an annual index of the stones coming into the labs and aids the reader in his or her search for more information on particular stones.

Please note that all magnifications given refer to the power of the microscope at which the photograph was taken, not necessarily the final magnification of the printed image.

AQUAMARINE

Trapiche Aquamarine?

An unusual stone came into the New York lab for identification. Figure 1 illustrates the green-blue melon-cut drop that appeared at first to be merely a drilled aquamarine bead. In reality, this stone has been cut from a trapiche-like crystal with six separations (apparently carbonaceous) and a clear central hexagonal area, as shown in figure 2. Although the stone displayed evidence of chromium in its absorption spectrum, its color was unlike that of any trapiche emerald crystals we have seen. However, the chalcedony-like translucency and the black inclusions seen in figure 2 do resemble characteristics common to trapiche emerald.

Figure 1. Melon-cut aquamarine, approximately 35 cts.

Figure 2. End view of the melon-cut aquamarine in figure 1. Magnified 10×.

DIAMONDS

Cyclotron-Treated Diamonds

Diamonds were first treated in a cyclotron to produce color nearly 40 years ago. A color then seen somewhat frequently in treated diamonds, but seldom seen today, is a pleasing orange-brown. However, cyclotron treatment, which imparts a shallow penetration of color, is an expensive and troublesome process. For these reasons, other methods of artificially inducing color in diamonds have been developed, including atomic-pile treatment. Atomic-pile treatment penetrates the diamond completely, resulting

Figure 3. Cyclotron-treated diamond. Left = crown facets viewed through the pavilion, magnified 40×. Center = culet area viewed through the table, magnified 30×. Right = culet area and brown graining, magnified 12×.

in even color throughout the stone. This process has largely replaced cyclotron treatment, and we seldom see cyclotron-treated diamonds in the laboratory today.

Several months ago, however, a cyclotron-treated diamond was submitted to the Los Angeles lab for determination of the origin of color. Since the color penetration was shallow, this particular diamond did not exhibit the usual absorption spectrum with the typical 5920 Å line.

The fact that the color is shallow and confined to a layer near the surface makes cyclotron treatment easily detectable when the stone is examined under magnification. As seen in the three sections of figure 3, this diamond displayed a surface layer of intense color paralleling the edges of facets on the crown and around the culet that is very typical of cyclotron-treatment. The first photo in figure 3 shows crown facets viewed from the pavilion. The area around the culet is seen in figure 3 center as viewed through the table. The final pose in figure 3 shows, at lower magnification, the treatment-layer zone at the culet, as well as brown graining.

It should be noted that natural-color diamonds frequently display brown graining. Light brown diamonds with brown graining are sometimes treated to darken their color and thus improve their appearance; the graining, of course, is still present.

A dark blue-green diamond examined in both California and New York appeared watery when viewed from the side, which suggested that it was surface treated. However, it did not show the umbrella around the culet or dark penetration zone around the table and star facets which are typical of such treatment. Finally, with immersion and later in air we were able to determine that the stone was treated on one side of the pavilion only, where a grid-like penetration zone appeared when the diamond was viewed through the upper girdle and bezel facets (see figure 4). We have heard that in the early days of cyclotron treatment if a stone fell from its fire-resistant holder, operating procedures did not allow stopping the equipment to right it. It is rumored that just such an accident led to the discovery that overexposed dark green stones could be heated to turn them brown, orange, or yellow.

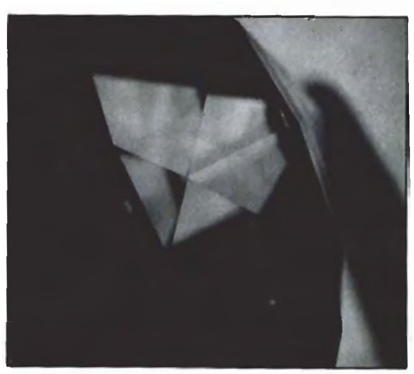


Figure 4. Grid-like color zoning in a cyclotron-treated diamond. Magnified 40×.

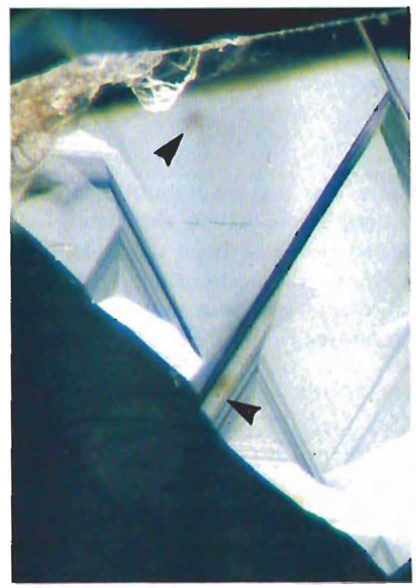


Figure 5. Radiation stains on a natural of a near-colorless diamond (see arrows). Magnified 45×.

Natural Radiation Stains

Radiation stains on diamond naturals are often associated with green stones, but they can occur on diamonds of any color. In the Fall 1979 issue of *Gems & Gemology*, we mentioned a G-color round brilliant with radiation stains on both of the two naturals. Since that time, we have seen several diamonds, not green, that had this feature. Figure 5 shows a near-colorless diamond with two such small brown stains on a natural. Another diamond, of M to N range in color, was also observed to have a stain on a natural. Directly across from the natural

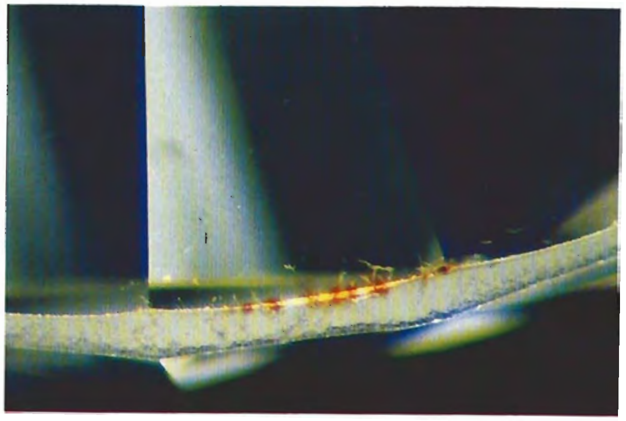


Figure 6. Radiation stain in a diamond natural. Magnified 50×.

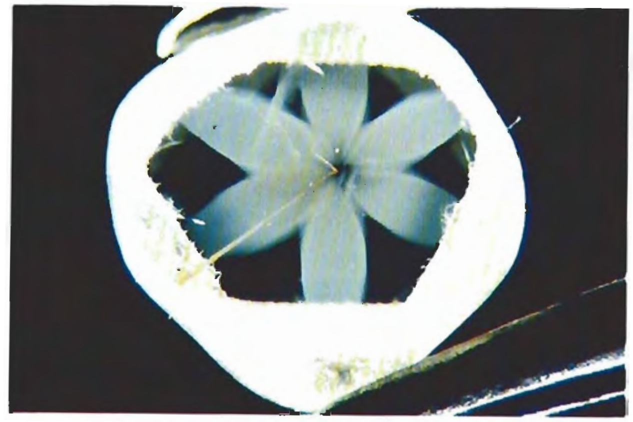


Figure 7. Flower-like inclusion in a diamond. Magnified 15×.

there was a stain remaining in the bruted girdle where the rough diamond skin had been removed. The stain in the natural is intense in color and penetrates deep into the stone (see figure 6).

Inclusions

The cover of the Spring 1952 issue of *Gems & Gemology* featured a windowed diamond crystal with a beautiful flower-like inclusion that shows both petals and sepals. This year we were shown a similarly windowed crystal with a flower-like inclusion that has a brown tubule which looks ever so much like a stem or the stick for a pinwheel (see figure 7).

Figure 9. A uniquely glassy diamond natural. Magnified 35×.

Figure 8. Irregular tube-like inclusions in a diamond. Magnified 18×.

We are at a loss to explain the unusual inclusions in the round-brilliant cut diamond shown in figure 8. On examination under the microscope, they appeared to be hollow tubules, some brown or filled with a brown material.

An Unusual Natural

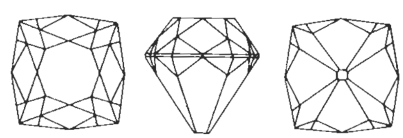
The unique natural on a diamond brought into the Santa Monica lab warrants a description. The surface of this natural was very smooth and glass-like (see figure 9), almost as if it had melted! There was absolutely no evidence of any growth or etch marks on the surface of the natural. No one in the Gem Trade Lab remembers ever before seeing a diamond natural with this appearance.

Notes on Diamond Cutting

We admire the cutter of the orange cube diamond seen recently in New York (see figure 10). Gem-quality cube-shaped diamond crystals are almost unknown, so in retaining the cube shape with very symmetrical beveling of the edges the cutter has

Figure 10. Cube-cut diamond, 1.13 cts.

Figure 11. Top view of a Peruzzi-cut diamond, 2.00 cts.



Peruzzi cut.

Figure 12. Diagram of the Peruzzi cut. (Diagram courtesy of Robert A. P. Gaal, Diamond Dictionary, *2nd ed., Gemological Institute of America, Santa Monica, CA, 1977.)*

captured the stone's beauty and rarity.

Rare outside museums or royal collections are Peruzzi-cut diamonds. We were privileged to receive for grading and photographing such a stone weighing more than 2.00 cts. (see figure 11). Presumably this style of cutting, detailed in figure 12, was first employed by a Venetian cutter in the 17th century, and it led to the old-mine cut, the old-European cut, and finally the modern brilliant. The stone we graded had no culet, had a table percentage of 46, and showed a depth percentage of 97.9.

II_B or Not II_B

Type I diamonds are opaque to short-wave ultraviolet (UV) light, while type II are transparent. Type II_A diamonds are not electroconductive, but type II_B are. Normally we check for a type II diamond in the darkroom, using short-wave ultraviolet light and a piece of scheelite placed behind a porthole. Only UV light that has passed through the stone can affect the scheelite. If the scheelite glows, we test the stone further for electroconductivity to determine whether it is type II_B. Of course, there is no permanent record of these UV transparency tests. To obtain a permanent record, place the stones table down on the emulsion side of photographic paper and expose them for a very short time (two seconds) with the ultraviolet lamp perhaps a foot away. Figure 13 shows the transparency difference between a type I yellowish marquise and a type II_A pear-shaped diamond.

Figure 13. Ultraviolet transparency of a type I marquise compared to a type II pear-shaped diamond.

EMERALD

An emerald sent to Santa Monica for identification showed quite unusual structural characteristics. First, we were surprised to see a significant difference in transparency when the stone was viewed from different angles. As we looked at the stone through the table, the emerald was almost transparent; yet when we looked sideways at the pavilion facets, the stone was only translucent, having the appearance of dyed green chalcedony. Magnification of this stone revealed a peculiar structure: straight, colored growth lines were crossed by lightly curved, wave-like bands (see figure 14). The stone was of natural origin, possibly cut from a trapiche-type crystal.

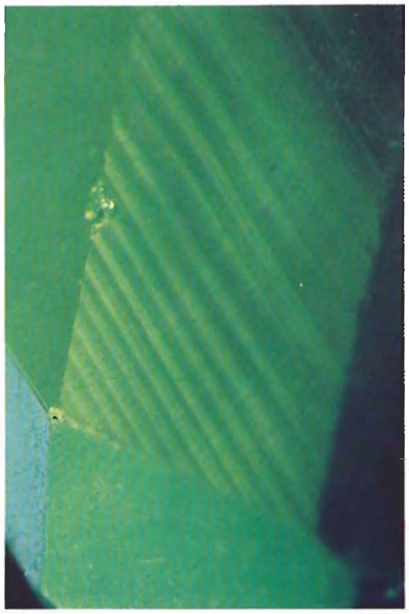


Figure 14. Unusual growth lines in an emerald. Magnified 63×.

The New York lab encountered a synthetic emerald, reportedly of Russian manufacture, with a refractive index of 1.560–1.563 and a low specific gravity. The stone transmitted red on the spectroscope light but showed only weak long-wave ultraviolet fluorescence. The stone had fairly typical flux fingerprints and even contained a platinum crystal in the girdle. What was particularly unusual was the presence of long needles, which we have always felt indicated natural origin. Nearly as disturbing was the discovery of a cavity filled with yellow liquid in this otherwise obviously synthetic emerald (see figure 15). Elsewhere in the stone, the "Venetian blind" banding that is typical of a synthetic was visible (fig. 16).

Figure 15. Yellow inclusion in a synthetic emerald. Magnified 25×.

Figure 16. "Venetian blind" banding in synthetic emerald. Magnified 10×.

MALACHITE

A malachite carving of an oriental lady holding a flower basket was sent to the laboratory for a damage report. Part of the flower basket and the right hand of the lady had been broken off, leaving a surface remarkably like a cleavage that astonished us (see figure 17). Although malachite has one perfect cleavage direction, massive material usually does not show it. What had happened? This particular piece of malachite apparently was formed by the process of sedimentation. When the carving was damaged, the separation occurred between bedding planes in the stone and produced a flat, smooth break.

Figure 17. Damaged malachite carving showing separation between bedding planes; 2.5 cm × 7.5 cm × 10.5 cm high.

PEARLS, Cultured

The Santa Monica lab had the opportunity to examine a necklace consisting of bluish-gray cultured pearls with one "oddball" in the strand. The layered structure of shell was apparent in this single bead (see figure 18). Notice also the concentration of dye at the drill hole. It would seem that at one time this pearl was crushed or received a blow that caused the nacreous outer layer to fall off, exposing the nucleus.

A "faith-shaker" was a pair of earrings set with a bronzy-black, drop-shaped pearl and a similarly shaped white pearl. Both were cultured. However, the black pearl fluoresced reddish brown—much stronger than any known Tahiti black cultured pearl we have seen. The history of the earrings precluded the possibility that the black pearl could have been cultured in Tahiti waters. Incidentally, it is reported that a much wider range of hues has been produced in the current harvest there, so we may see colors other than the usual black, dark gray, and light gray.

Figure 19 illustrates a necklace set with bronzy-colored dyed cultured pearls. The shapes too are unusual.

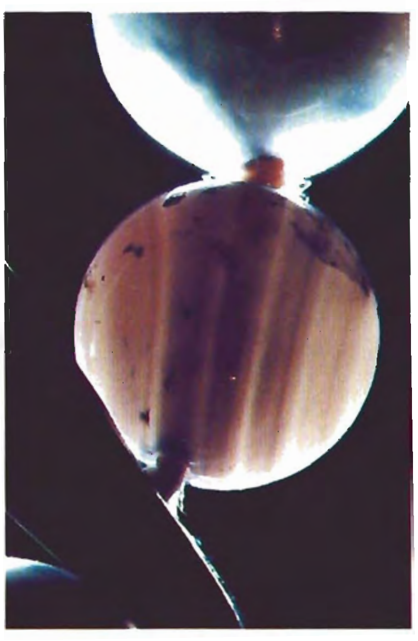


Figure 18. Shell nucleus of a cultured pearl. Magnified 10×.

Figure 19. Necklace of unusual bronze-colored dyed cultured pearls.

RUBY

Synthetic stones examined in the New York laboratory recently have been cause for alarm. The first was a flux-grown synthetic ruby reportedly of recent Chatham manufacture. It weighed more than 5 cts. and had fine flux fingerprints fairly well distributed with only one area of typical coarse flux. The alarming characteristic was angular, silk-like banding visible to the unaided eye (see figure 20). Individual needles could not be discerned; rather, we observed precisely the effect we have seen when a Burma star ruby has been heat treated and the rutile needles are not quite absorbed. Mounted, it could readily be misidentified, since the silk-like bands are not expected in synthetic stones. The stone was highly fluorescent and was obviously not cut in the Orient. Whether this stone indicates a change in the Chatham product or a one-time "fluke" has not been established.

Figure 20. Angular banding in a flux-grown synthetic ruby. Magnified 30×.

We have mentioned previously the process whereby ordinary synthetic blue sapphires are heated in crucibles with an unknown liquid that is then incorporated within induced fractures to produce very believable fingerprint inclusions. It was therefore more expected than alarming to receive for identification a synthetic Verneuil ruby showing both curved striae and "fingerprints" (see figure 21).

Figure 21. Curved striae and "fingerprint" inclusions in synthetic ruby. Magnified 30×.

SAPPHIRES

Induced Surface Coloration of Natural Sapphires

The shortage of Sri Lankan sapphire rough suitable for heat treatment in Bangkok has evidently led to the use of cut stones that are heated after packing in chemicals to diffuse color into the surface. The method reportedly is a variation of the one outlined in U.S. Patent 3,897,529, issued to Union Carbide Corp. in 1975. We first encountered such stones a year ago in the form of an orange sapphire, reported in the Fall 1979 issue of *Gems & Gemology*. Since then we have seen a number of parcels containing variously colored treated stones.

Under short-wave ultraviolet light, most of the stones treated by induced surface coloration show a patchy fluorescence where the diffused color was removed when repolished. However, a stone sent to New York by the Los Angeles lab did not fluoresce. When the stone was immersed, all facets showed color except the girdle, which had been repolished and all diffused color removed (see figure 22).

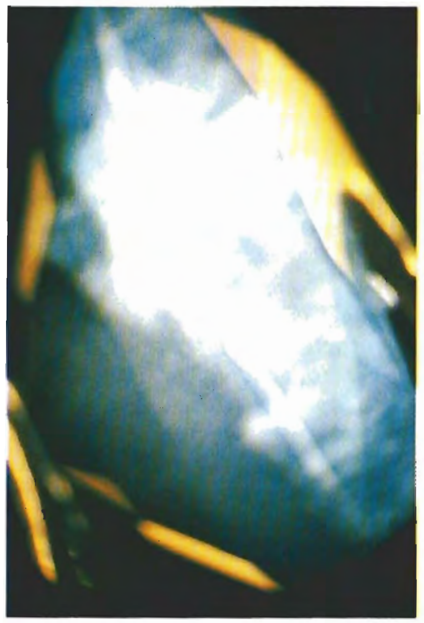


Figure 22. Loss of color in the repolished girdle of a color-treated sapphire. Magnified 10×.

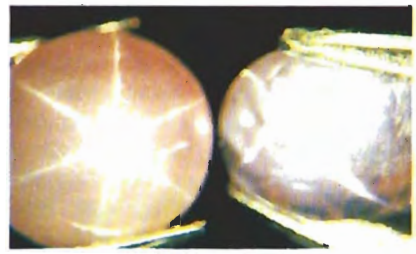


Figure 23. Star spinels. Magnified 10×.

SPINEL

It is not often that one has the opportunity to see a star spinel. Imagine our surprise when two of them arrived at the Santa Monica lab at the same time. We were especially pleased when it was apparent that one of the stones showed a four-ray star, while the other star had six legs (see figure 23).

ACKNOWLEDGMENTS

The photographs in figures 1, 2, 4, 8, 13, and 21 were taken by Bob Crowningshield in New York. Al Roditi, also in New York, took the photographs in figures 7, 10, 11, 15, 16, 19, 20, and 22. Shane McClure of the Gem Trade Lab in Los Angeles did the photography for figure 5, while Bob Kane was responsible for the photos used in figures 3 and 6. The specimens examined in the Santa Monica lab were photographed by John Koivula (figures 9, 14, and 18), Mike Havstad (figure 17), and Chuck Fryer (figure 23).