

Gem Trade LAB NOTES

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Imitation Dyed Black CHALCEDONY Beads

The West Coast laboratory received for identification a broken strand of black beads. Our client was curious as to why some of the beads had retained their high luster, while others had turned dull (figure 1). Spot refractive index readings of 1.54 on both the lustrous and the dull beads indicated that they might consist of the same material. Examination with overhead illumination showed the same small dull surface fractures, especially around the drill holes, in quite a few beads of both types. In strong transmitted light, however, the duller beads were semi-translucent with a brownish gray body color, while the lustrous beads remained opaque black. In the duller beads, transmitted light also revealed the parallel banding that is characteristic of the agate variety of chalcedony, as well as a very thin black layer that was missing in some areas. When tested with a cotton swab soaked with acetone, the black layer was easily removed.

Apparently these agate beads had been enhanced with a colored surface coating so that they closely resembled the dyed black chalcedony beads on the strand. Because this coating was susceptible to abrasion, some of these beads had lost their apparent luster and turned dull.



Figure 1. Some of the beads in this 6-mm strand are dyed black chalcedony; the rest are brown agate that has been given a colored coating.

As is to be expected with dyed black chalcedony, no dye could be removed from the lustrous beads. KH

DIAMOND

Imitation Crystal

Separating cut and polished cubic zirconia from diamond is usually accomplished in a straightforward manner using standard tests. On occasion, the Gem Trade Laboratory examines cubic zirconia that is fash-

ioned in the form of octahedral diamond crystals. Usually these imitations have an unnatural "sand blasted" appearance (see *Gems & Gemology*, Fall 1982, p. 169).

These clever cubic zirconia imitations (figure 2) were a puzzlement to one East Coast dealer. In fact, the dealer's cutter became alarmed at the rapid abrasion after he put one of the stones on the wheel. Careful fashioning of the material had produced "crystals" that appeared at first glance to have the morphology of diamond. They were excellent reproductions, especially with the "striations produced by laminar dissolutions of faces of an octahedron" (see Orlov, *Mineralogy of the Diamond*, John Wiley & Sons, New York, 1973, p. 91). However, standard gemological tests—including magnification, a specific gravity of approximately 5.85, and a typical fluorescence to long-wave ultraviolet radiation—proved that the two simulated crystals in figure 2 were actually cubic zirconia, a manufactured product.

DH

With Radiation Stains

An approximately 0.75-ct round brilliant-cut diamond submitted to our West Coast laboratory for a quality grading report turned out to be one of the most unusual diamonds we have seen. This very pale, slightly yellowish green diamond showed numerous brown radiation stains in several prominent positions: one small one at the culet, two others at the girdle, almost exactly opposite each other, and the most remarkable ones

Editor's Note: The initials at the end of each item identify the contributing editor who provided that item.

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Figure 2. Cubic zirconia has been very cleverly fashioned to imitate rough diamond crystals. These two samples measure $10.21 \times 7.88 \times 7.38$ mm and $8.50 \times 7.30 \times 6.96$ mm, respectively, with a total weight of 15.19 ct. Magnified $10\times$.

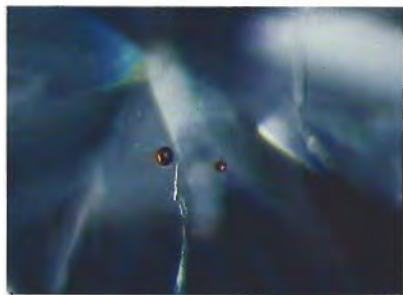


Figure 3. It is very unusual to encounter brown radiation stains on the table of a diamond. Note also the white void in the center of each stain. Magnified $50\times$.

slightly off-center in the table (figure 3). The presence of stains in the table is what makes this stone so unusual.

At first glance, the two table stains resembled dark red garnet inclusions. When the stone was examined with higher magnification, however, both stains revealed cube-shaped white granular voids in their centers, with prominent drag lines



Figure 4. Drag lines originating from the stains shown in figure 3 indicate that there probably were included crystals in these areas that were pulled out during cutting.

strain halos, which usually accompany included crystals, became visible. These findings led us to conclude that the white voids had been crystals, possibly knots in the diamond, that were removed during the cutting process. The presence and cause of color of the stains remains a mystery.

Since radiation stains *per se* are an indication of irradiation, but not proof of whether the irradiation is

natural or artificially induced, the origin of color of this diamond is currently undeterminable.

KH

Mysteriously Damaged

The Gem Trade Laboratory is frequently asked to determine if a flaw in a diamond is the result of recent damage to the stone. Usually, we examine fractures, chips, indented naturals, or similar questionable flaws. Occasionally, we are asked to report on a burned diamond. The burning of facets, which is usually caused by the use of a jeweler's torch on a dirty diamond or by excessive heat generated by the polishing wheel, will leave a very thin whitish area on the stone that is easily polished off with minimal weight loss. Damage resulting from exposure to a house fire is usually more severe.

The East Coast laboratory was recently asked to report on a 0.88-ct burned diamond. The 415-nm absorption line, medium blue fluorescence to long-wave ultraviolet radiation, and a positive reaction to the thermal reaction tester, all easily proved that this translucent white stone was diamond.

We have seen a large number of burned diamonds over the years, but never before had we seen anything quite like this. Although the heat damage permeated the entire stone, some of the original facets were still faintly visible. In addition, a circular indentation (figure 5) appeared to

Figure 5. There appears to be a "melted" indentation on the crown of this 0.88-ct burned diamond. Magnified $20\times$.



have been melted into the crown. Since diamond has only been observed to melt under very special and extremely difficult to achieve conditions, the real mystery is how to account for the depression in this stone. *DH*

Dyed GROSSULARITE

Among the dyed green gemstones frequently encountered as jadeite imitations are materials such as quartzite, chalcedony, serpentine, nephrite, and calcite. Off-color jadeite may also be dyed to improve its appearance. The green dye is easily identified with a spectroscope by the presence of a broad absorption band from approximately 630 nm to 670 nm. Green aniline dyes also usually produce a red color filter reaction.

Occasionally, we encounter the translucent naturally green (chrome-bearing) variety of grossularite garnet represented as jadeite. Recently, however, the East Coast laboratory was asked to identify a stone purchased as jadeite that proved to be dyed grossularite (figure 6). It showed



Figure 6. This unusual 11.25 × 16.28 mm grossularite cabochon was dyed to imitate jadeite.

the absorption band and color filter reaction characteristic of the usual dyed imitations. The refractive index of 1.72, the hydrostatic specific gravity of 3.70, and the orange X-ray fluorescence of the 6-ct oval cabochon proved that it was grossularite. *DH*

Walrus IVORY

A GIA staff member brought to our West Coast laboratory a 3 1/2 inch



Figure 7. This chess piece was carved from walrus tusk.

Figure 8. The entire chess set was represented to have been carved from mammoth ivory.



(approximately 9 cm) high, slightly brownish yellow, artistically stained carving (figure 7). This carving, part of a complete chess set (figure 8), was supposedly made from mammoth ivory. We were asked to verify its identity.

Standard gemological testing methods readily identified the material as ivory. When we examined the piece closely, however, we noted that the basal surface showed the appearance of a cross-section of tusk and that the characteristic engine-turned effect present in all elephant ivory

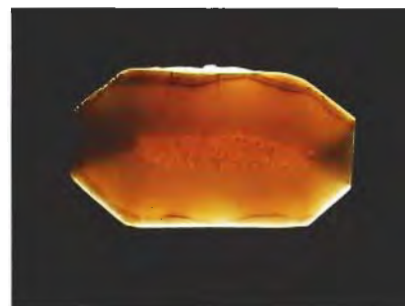


Figure 9. The base of the carving in figure 7 reveals the characteristic structure of walrus ivory.

was missing. In addition, very fine parallel layers of dentine surrounded a central area of spongy dentine that closely resembled the clot-like lacunae and canals in bone (figure 9). According to *Pictures of Ivory and Other Animal Teeth, Bone and Antler*, by T. K. Penniman (Pitt River Museum, Oxford, England), this cross-section is characteristic of walrus tusk. KH

CULTURED PEARLS

Irradiated

An unusually well matched rope of 9-mm gray saltwater cultured pearls (figure 10) was submitted to the East Coast laboratory to determine whether the color was natural or



Figure 10. The well-matched 9-mm black cultured pearls in this rope necklace were colored by irradiation.

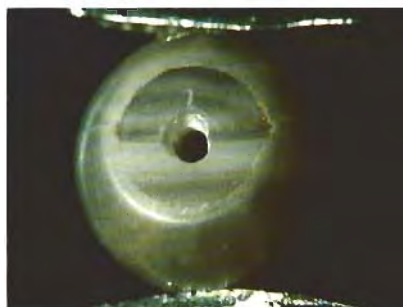


Figure 11. The darkened bead nucleus of this irradiated saltwater cultured pearl provides the color; the nacre is unaltered. Magnified 10 $\times$.

Figure 12. Irradiation seems to enhance the orient of freshwater tissue-nucleated cultured pearls.



treated. The X-radiograph was normal, showing no evidence of dye. When we looked down the drill holes, however, we could see that the nuclei were dark, which proved irradiation.

As mentioned in the Fall 1986 Lab Notes section, irradiation darkens freshwater shell, but not shell or nacre grown in saltwater. Figure 11 shows a loose saltwater cultured pearl that was exposed to gamma-ray irradiation. Notice the darkened freshwater shell nucleus, as

compared to the unaltered color of the saltwater nacre.

The irradiation of freshwater tissue-nucleated cultured pearls results in a wide range of colors from blue-gray to black. Figure 12 shows that, in addition to imparting the dark body color, irradiation markedly enhances the orient in some cases. This effect contrasts with the fairly monotonous appearance of the dyed tissue-nucleated freshwater cultured pearls in figure 13. RC

Figure 13. The monotonous tones and orient of these dyed freshwater tissue-nucleated cultured pearls contrast sharply with their irradiated counterparts in figure 12.



Pear-Shaped, Saltwater

Rarely has the Gem Trade Laboratory identified saltwater nucleated cultured pearls that were grown using other than round shell bead nuclei. On one occasion we were able to confirm the use of round plastic bead nuclei, which caused the pearls to feel light in weight; these cultured pearls evidently were grown experimentally and were never commercially produced. We also can recall two incidents many years ago when the nuclei of button, or lentil-shaped, cultured pearls proved to be lentil shaped. One can appreciate our surprise, then, when we determined that each of 10 pear-shaped cultured pearls spaced along a chain necklace had a pear-shaped nucleus. The nacre on some of the pearls was so thin that

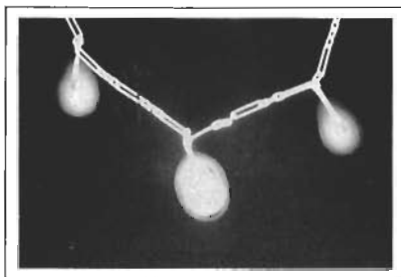
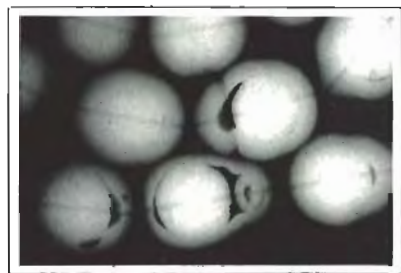


Figure 14. It is unusual to encounter pear-shaped nuclei in pear-shaped cultured pearls (here, approximately 9–10 mm long).

Figure 15. This X-radiograph shows both the nuclei normally found in pear-shaped cultured pearls and a rare tissue-nucleated growth that caused the nacreous layer to form a pear shape.



the straight bands of the shell bead could be seen easily by candling. The X-radiograph in figure 14 shows this rarity in three of the pearls.

We have been told that the mortality rate of the host mollusks is greatly increased with the use of other than round nuclei. Another factor may be the added cost of manufacturing shell nuclei in lentil or pear shapes.

Ordinarily, pear-shaped saltwater cultured pearls have either a void or a concentration of conchiolin at the point. Less common are pear shapes without a void where the shape is caused by concentration of the nacre itself. The X-radiograph of another necklace that was also seen in the East Coast laboratory (figure 15) illustrates these types of pear shapes, as well as yet another cause of pear-shaped growth we had not seen before: what appears to be a large bead nucleus with a tissue-nucleated entity that has grown to form the point.

RC

Large Flux-Grown Synthetic RUBY

Recently seen in the East Coast laboratory was an oval mixed-cut flux-grown synthetic ruby that weighed more than 17 ct. Previously, the largest cut stone of this material we had identified was about 12 ct. Assuming that, at best, recovery from flux-grown crystals would be 50%, this stone must have been cut from one weighing at least 30 ct. We have no record of the largest flux-grown synthetic ruby crystal produced to date, but this certainly would have to be considered for the title.

RC

Synthetic SPINEL Represented as Topaz

It is not surprising to encounter synthetic spinel offered as a substitute for aquamarine or blue sapphire. Indeed, it has been used to imitate a number of stones.

A manufacturer recently pur-



Figure 16. Both of these synthetic spinels were originally sold as topaz. The stone set in the ring measures 11.0 × 6.8 × 7.5 mm; the loose preform measures 15.0 × 10.0 × 10.0 mm.

chased a large quantity of blue "topaz," which he subsequently cut into preforms and then into cushion-shaped bent-top stones that he had mounted into yellow metal rings (figure 16). When a friend mentioned that the stones did not look "right," the manufacturer submitted them to the East Coast laboratory for identification. The "topaz" turned out to be synthetic spinel. The identification of synthetic spinel is relatively easy, with its very distinctive long- and short-wave ultraviolet luminescence, anomalous double refraction, and a refractive index of 1.728.

DH

SYNTHETICS and "Modern" Gems in Period Jewelry

Over the years, synthetics have been set in jewelry for a variety of reasons. People who could not afford natural stones could at least enjoy the beauty of the less costly synthetics. Synthetics or other simulants have been used to replace more valuable stones that were either lost or removed to use the cash value when needed. At one time, synthetics were even set into fine jewelry as a proud symbol of scientific progress.

The fine platinum and diamond bracelet shown in figure 17, seen in our East Coast laboratory, was probably made during the 1920s. It is set



Figure 17. This 1920s-era diamond bracelet is set with synthetic as well as natural rubies.

with flame-fusion synthetic rubies as well as with fine natural rubies with Burma characteristics. We do not know why synthetic and natural stones were mixed in this piece, but because of the ever-present possibility of mixed stones, it is always necessary to test all of the stones, even in an antique setting.

Evidence of tampering with a

setting is the most common indication that a synthetic was used as a replacement stone. The stone shown in figure 18 was set in a lady's ring that also was submitted to our East Coast laboratory. Engraved in the shank of the ring is the date October 15, 1922. Although it is possible that this date could have been inscribed recently, it is not likely. As



Figure 18. Flux inclusions prove that this 6.9-mm "ruby," set in a ring inscribed with a 1922 date, is synthetic. Magnified 30 $\times$.

indicated by the reworked prong tip, as well as the flux inclusions shown in figure 18, a modern flux-grown synthetic ruby has been reset in this period ring. DH

FIGURE CREDITS

Figure 1 was taken by Shane McClure. David Hargett supplied the photos used in figures 2, 5, 6, 10, and 16–18. John I. Koivula is responsible for the photomicrographs in figures 3 and 4. The pictures used in figures 7–9 were provided by Robert Weldon. Robert Crowningshield took the photos of the X-radiographs that were used in figures 14 and 15. Clayton Welch did the photography for figure 11. Figures 12 and 13 were taken from the photo library on the West Coast. The photo of the dendritic diamond in the Historical Notes section was taken by Andrew Quinlan, while Mike Havstad supplied the photo of the eroded pearl.

A HISTORICAL NOTE

Highlights from the Gem Trade Lab 25, 15, and five years ago

WINTER 1963

The New York lab discussed the bleaching and dyeing of both cultured and natural pearls. An explanation was offered for the several angled drill holes originating from the main drill hole on some pearls, that is, that they facilitate the treatment of certain areas between the nacre and the nucleus that can be reached through the drill hole. Also covered were the numerous variations on the standard

brilliant cut that are commonly seen on fancy-shaped diamonds.

The Los Angeles lab was asked to identify some rough diamond fragments that the client hoped would prove to be synthetic. The material had been represented to be synthetic diamond made by a new process that could produce larger rough than had previously been manufactured. Examination with a microscope together with other tests revealed that

the samples were natural bort.

This issue also included a detailed discussion of the methods used to estimate the weight of a damaged diamond, both before it was damaged and after recutting. By using table reflection size, crown angles, girdle thickness, and whatever other measurements are possible, one can arrive at a very close estimate of the weight of the stone before damage. Measuring the present size of the

diamond will enable calculation of the size of stone that can be cut from it. Application of the appropriate weight estimation formula will lead to the estimated weight of the recut stone.

WINTER 1973

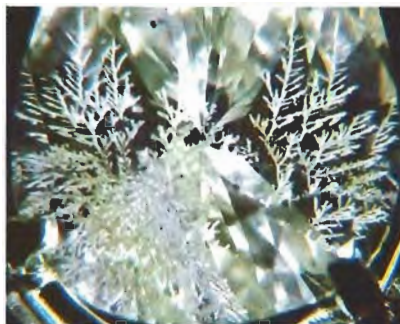
Laser drill holes in diamond, as well as the different types of damage that can occur as a result of improper setting, were covered by the New York lab. The section also included an account of the difficulties of testing carvings, as well as illustrations of several beautiful carvings.

The Los Angeles lab reported on a very unusual ring that could be turned to reveal a textured gold surface in one position and a lovely chrysoprase in the other. Other oddities discussed include pieces of amber imbedded in plastic, a coarse jadeite crystal as an inclusion in a cut stone, and some unusual glass beads. The appearance of two six-ray stars side-by-side in a star ruby was believed to be the result of the usual inclusions forming one star and twinning causing the second star.

WINTER 1983

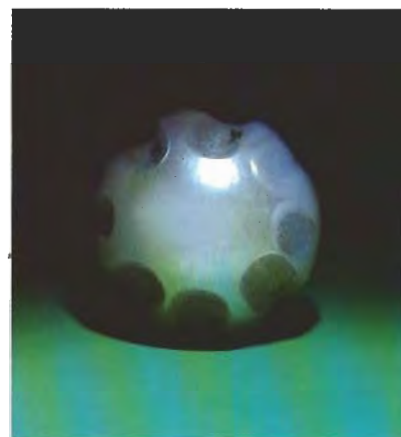
A very unusual dendritic diamond, mounted in an attractive pin, was encountered in New York. The inclusions were reflected throughout the 4-ct stone. The New York lab also saw a most unusual comet-design brooch set with numerous fancy yellow to yellow-brown diamonds, all of which fluoresced to ultraviolet radiation. The effect when seen by UV was one of a brilliant comet flashing across the night sky.

The dendritic pattern of this 4-ct diamond can clearly be seen. Magnification here is 12×.



Another item of interest was a severely eroded pearl, originally set in a ring, that was seen by the Santa Monica lab. The owner must have had an extremely acidic skin condition to cause this kind of damage. This should serve as a warning to all who wear pearls that they should clean them on a regular basis.

Severe erosion, probably caused by extremely acidic skin, has damaged this 8.5-mm pearl.



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