# Gem Trade LAB NOTES

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## A CORAL SUBSTITUTE, DYED MARBLE

The Santa Monica laboratory recently encountered some loose drilled beads that looked like reddish-orange coral to the unaided eye. A microspot hydrochloric acid test revealed effervescence, a typical carbonate reaction. High birefringence by the spot method was also indicative of a carbonate. Under the microscope, however, the structure associated with coral was not seen. Instead, the material had the somewhat granular, almost sugary, texture indicative of marble. In addition, surface fractures could be seen to contain concentrations of a reddish-orange dye (see figure 1).

*Figure 1. Concentrations of dye in a marble bead. Magnified 6×.*

If a gemologist were to examine this type of material without checking structure and allow the color and birefringence to influence his judgment, he could easily mistake these dyed marble beads for true reddish-orange coral.

## DIAMOND

### Angular Grooves on Diamond

While visiting Japan, a New York dealer acquired a diamond that showed very unusual features. As can be seen in figure 2, small marks extend from the girdle up across two upper girdle facets into a bezel facet. They outline the shape of an angle. This same outline was found in different places in the crown area. The Santa Monica laboratory had not previously seen a diamond with these characteristics. We still have no explanation for how these grooves might have occurred. Perhaps one of our readers can solve this mystery.

*Figure 2. Unusual marks on a diamond. Magnified 16×.*

### Burned Diamond

Burned diamonds are occasionally submitted to the laboratory for the purpose of estimating fire damage and the approximate weight loss to be anticipated in recutting. Sometimes these stones have suffered no permanent damage. Most diamonds that are mounted in jewelry and worn frequently accumulate foreign substances such as oils and soaps, particularly on pavilion surfaces. When they are placed in contact with high heat, such as that which would be encountered in a fire or in retipping a prong, the foreign substances often become charred. While this charred residue is usually difficult to remove, in many cases boiling the stone in an acid bath will clean the offensive coating.

Other diamonds may be damaged more severely and may have suffered surface erosion as a result of oxidation. These stones require repolishing to repair the damage. Recently submitted to the Los Angeles laboratory was a yellow pear-shaped diamond that was reportedly burned in a house fire (see figure 3). This stone was burned so severely that none of the facets remained and large cavities appeared on both the

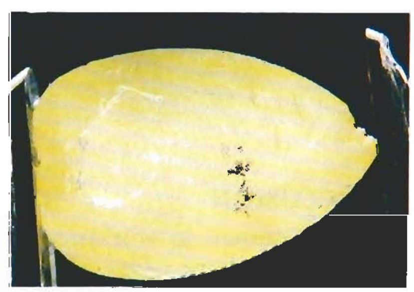


*Figure 3. Badly burned diamond. Magnified 18×.*

crown and pavilion surfaces. Since the color of this diamond proved to have resulted from artificial irradiation, the client decided not to have the stone recut.

### "Chameleon" Diamond

Some of the rarest fancy color diamonds are the medium dark, yellowish- to grayish-green stones known as "chameleon" diamonds because they will temporarily change color and become yellow after a period in darkness. They will also turn yellow when heated mildly. Most return to their green color after only a short exposure to light. All such stones that we have encountered may be recognized by the strong yellow fluorescence and phosphorescence. Diamond polishers recognize them by the intense red glow they emit while on the wheel.

Recently, in our New York laboratory, we encountered two very pale grayish-green stones that we were about to dismiss with the statement, "Color origin undetermined," when the yellow phosphorescence was noted. On a hunch, we checked the color before and after mild heating in an alcohol flame. As we suspected, when the stone was heated all traces of green disappeared, leaving a pleasant light yellow color. The green returned after about five minutes in the Diamondlite.

By coincidence, the next day we received two slightly darker grayish-green "chameleons." According to the cutter, both came from the same rough and glowed red while on the wheel.

The greatest coincidence occurred later that day when we received a pear-shaped, typical dark gray-green stone that turned to an intense orange-yellow when heated. It too returned to green after about five minutes in the Diamondlite. A faint absorption line at about 4190 Å could be seen in the hand spectroscope—one of two absorption peaks in the area that were observed more readily with the recording spectrophotometer.

### Green Diamonds

Occasionally, we encounter other pale green diamonds with green or brown spots on their naturals or faceted girdles (figure 4). This suggests—but does not prove—that the stones have been exposed to natural irradiation, which often produces green-skinned and brown-skinned rough crystals (see figure 5).

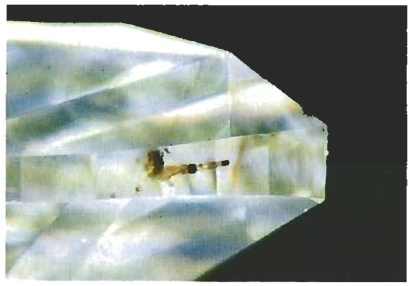


*Figure 4. Brown spots on the faceted girdle of a diamond. Magnified 20×.*

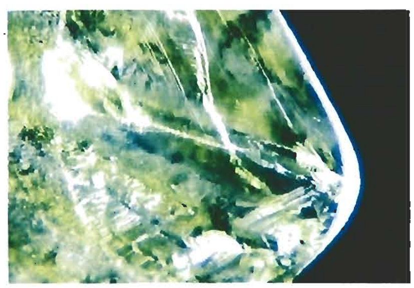
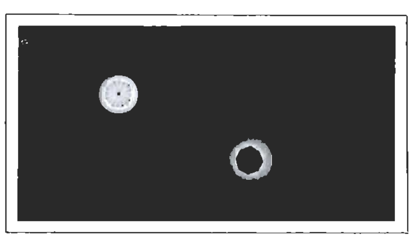


*Figure 5. Green skin on a naturally irradiated rough diamond crystal. Magnified 15×.*

*Figure 6. Short-wave ultraviolet transparency test of type $\text{II}_\text{A}$ (left) and type I (right) diamonds.*



Other pale bluish-green diamonds seen recently in the New York laboratory were determined to be type $\text{II}_\text{A}$ stones, which are transparent to short-wave ultraviolet light. The dark-centered stone on the left in figure 6, a short-wave transparency test photo, is type $\text{II}_\text{A}$; the other stone is type I. Although the color could be due to irradiation, type $\text{II}_\text{A}$ crystals that have this color naturally have been recorded. The questions arise: Can the color green in diamonds ever be due to factors other than irradiation, either natural or man induced? What caused the color of such famous green diamonds as The Dresden Green?

Figure 7 illustrates a dark green round brilliant with mossy color patches over the entire surface. Such an appearance immediately suggests radium treatment. However, the stone neither reacted to the scintillometer (Geiger counter) nor "took its own picture" from radioactivity when placed on a film overnight. Every indication points to a treated stone, but we do not know what treatment method was used.

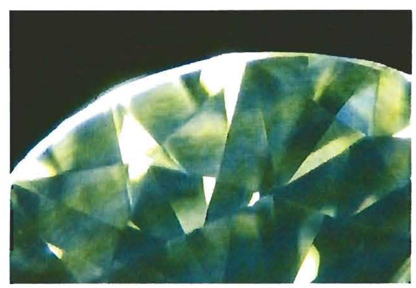


*Figure 7. Mossy color patches on what appears to be a treated green diamond. Magnified 15×.*

## EMERALD

### Emerald Substitute, Dyed Beryl

A cabochon set in a yellow metal mounting was recently submitted to the Santa Monica laboratory for identification. Testing proved it to

*Figure 8. Dyed beryl cabochon in a ring. Magnified 6×.*

be a whitish beryl that had been partially dyed green to resemble an emerald (see figure 8). We often see pale emeralds dyed to improve their appearance, but this stone was an example of complete color alteration from white to green through dying.

A similar situation occurred when a lot, consisting of transparent green emerald-cut stones ranging in size from one to two carats, was brought to the Los Angeles laboratory. The client explained that these stones had been stored in a gem paper for several years and had lost a significant amount of their green color. Three of the stones were selected from the lot for identification. Two of these proved to be emeralds oiled in the manner that seems to be typical. These two stones apparently lost some oil over the years so that the color subsequently appeared lighter.

When the third stone was viewed with the unaided eye in overhead lighting, it appeared to be a medium-dark green with just a few near-colorless areas. Figure 9 shows how this stone appeared in dark-field illumination. When the stone was placed on translucent white plastic over transmitted light, however, it proved to be a near-colorless beryl with green and minor amounts of yellow dye present in numerous surface fractures (see figure 10). The client stated that this stone had lost more color than the rest of the stones in the lot.

*Figure 9. Dyed beryl as seen with normal, dark-field illumination. Magnified 10×.*

The use of translucent white plastic over an intense light source, as in this case, and examination of the stone under a microscope using transmitted light are the easiest ways of detecting this type of treatment. The former technique, in particular, is an excellent, simple alternative to immersing the stone in a heavy liquid, which carries the risk of removing dye, oil, cement, and the like.

### A Remarkable Three-Phase Inclusion

The Santa Monica laboratory had the welcome opportunity to examine a Colombian emerald crystal that played host to one of the largest three-phase inclusions ever encountered. The crystal measured approximately 22.8 mm in length by 11.3 mm in largest diameter and weighed 24.07 cts.

The fluid inclusion in the crystal was easily visible to the unaided eye. The gas bubble measured approximately 5.0 mm in its longest dimension, and as the crystal was tilted it moved back and forth quite readily in its liquid-filled chamber. Note the position change of the gas bubble in figures 11 and 12. Also trapped within the inclusion, suspended in the liquid phase and adhering to the surface of the gas bubbles, were a countless number of tiny white crystals that appeared to be calcite. A black opaque material thought to be shale and metallic, brass-colored crystals of pyrite were also present.

*Figure 10. Dye concentration visible in the stone shown in figure 9 when viewed over diffused transmitted light. Magnified 10×.*

*Figure 11. Large bubble in a three-phase inclusion in emerald. Magnified 6×.*

*Figure 12. Movement of the bubble in emerald from the position shown in figure 11. Magnified 6×.*

## PEARLS

### Natural Pearls Worn Out

The natural pearl necklace in figure 13 was more worn than any previously seen in the New York laboratory. Many of the small pearls that undoubtedly touched the wearer's

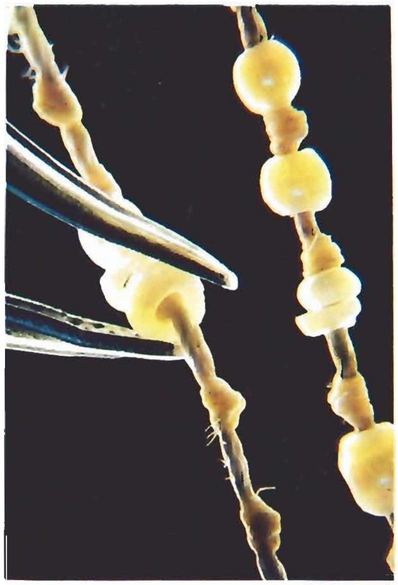


*Figure 13. A pearl necklace showing extreme wear. Magnified 10×.*

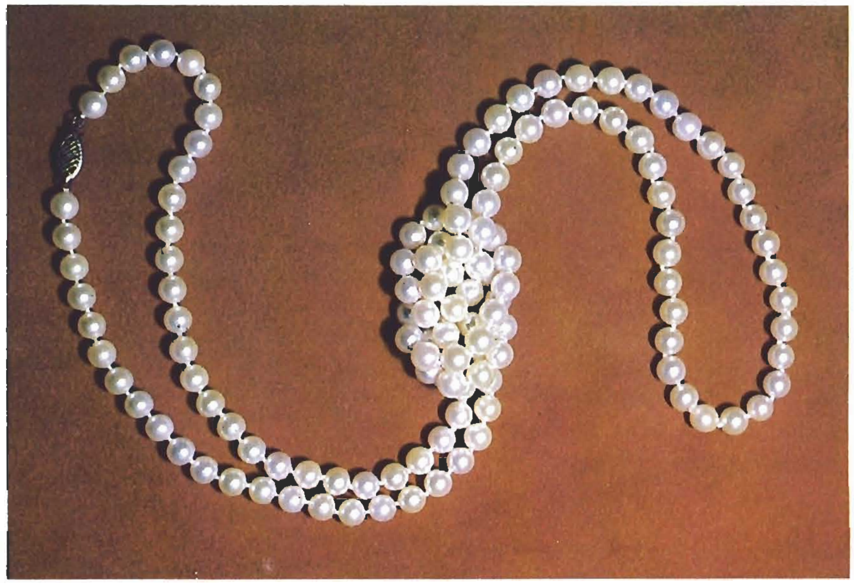


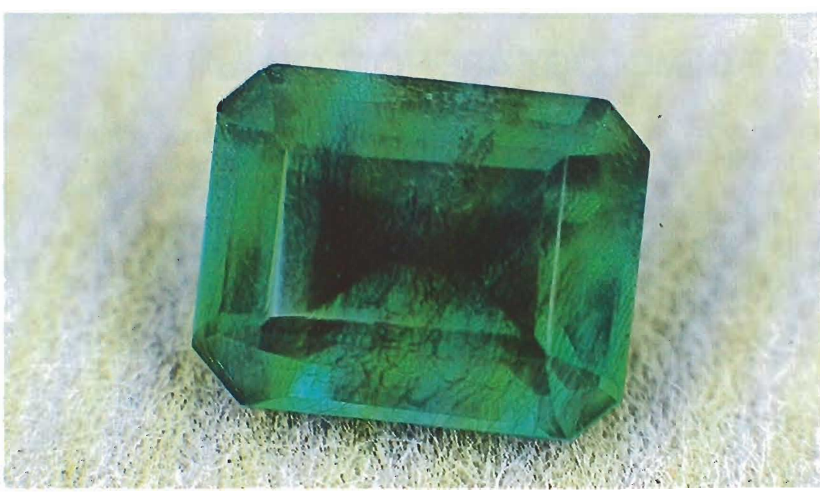
*Figure 14. A rope necklace of 7½-mm mother-of-pearl beads.*

neck were either gone entirely or reduced to fragments. The one held by the stoneholder in this photo could be passed over all the knots in its area. The mystery is that the string still appeared to be relatively strong. Although such damage is not a common occurrence, people with an acid skin condition should be cautioned not to wear pearls constantly against the skin or should be advised to rinse them in water after wearing.

**Pearl Simulant**

Figure 14 illustrates a not-unattractive rope necklace of mother-of-pearl beads with a lacquer coating that was seen in New York. We could not substantiate the client's claim that these are very thin-nacre ("immature") cultured pearls with a nearly clear lacquer as a protective coating. When a commercial fingernail polish remover dissolved the lacquer on a small spot near the drill hole of one bead, we could see no evidence of nacre.

*Figure 15. Dyed "crackled" green quartz, 0.96 ct.*



## QUARTZ

**Dyed "Crackled" Quartz**

The Los Angeles laboratory recently received for identification one intense green, emerald-cut stone and one bright red, oval, modified-brilliant-cut stone. To the unaided eye, these stones had an obvious "crackled" appearance (figure 15). Magnification revealed dense concentrations of dye in intertwined surface fractures that extended deep into the stone (figure 16). When examined in the polariscope, in conjunction with a condensing lens, both stones exhibited bull's-eye uniaxial interference figures, thus proving that they are quartz. The "crackling" (by heating) and subsequent dying of colorless and near-colorless quartz

*Figure 16. Dyed "crackled" red quartz. Magnified 38×.*

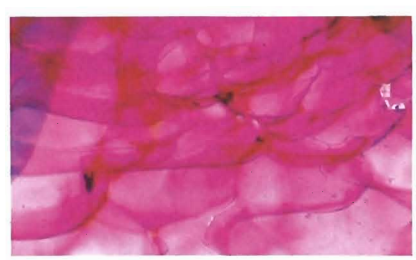


*Figure 17. An 8.70-ct. bluish-gray star quartz cabochon.*

has been practiced for many years and is usually intended to imitate gemstones other than quartz. In the early 1940s, dyed green "crackled" quartz was represented on the market as "Indian emerald."

It has been quite a while since dyed "crackled" quartz was last seen in this laboratory. These two stones serve as a reminder of the many treatments and imitations that have been known for many years, but may seldom be encountered today.

**Star Quartz**

The 8.70-ct. light bluish-gray star quartz seen in figure 17 was recently sent to the Los Angeles laboratory. The phenomenon of asterism in quartz is usually associated with rose quartz. Asteriated rose quartz often exhibits a weak star and is frequently backed with a foil mirror to improve and accentuate the asterism. Colored foil backings are also used to imitate star corundum. Some star quartz, and particularly the very light gray and bluish-gray quartz from Brazil, exhibits a fairly strong asterism when cut *en cabochon*, like the stone illustrated here which is presumably from Brazil.

Asterism in star quartz appears to be confined almost entirely to the surface of the stone, rather than emanating from the interior as is the case with star rubies and sapphires. Most star quartz contains microscopic needles of rutile oriented in definite crystal directions. These rutile needles produce asterism when the cabochon is viewed with the light coming through the optic axis direction, called diasterism, or with a strong overhead reflected light, called epiasterism.

## SAPPHIRE

### Heat-Treated Yellow-Orange Sapphires

The latest suspect encountered in New York in the ongoing battle to detect corundum treatment methods is a lot of unusually bright, yellow-orange natural sapphires that show no iron absorption in the hand spectroscope and only a weak red fluorescence in long-wave ultraviolet light, both clues that indicate unnatural color. Inspection of more than 50 stones that were almost identical in color showed evidence of high-temperature treatment. Several had internal stress fractures, and many showed surfaces that had not been completely repolished. Most showed multiplane girdles (figure 18).

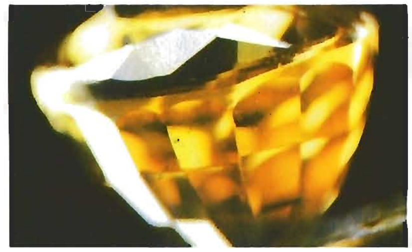


*Figure 18. Multiplane girdle, thought to be typical of treated sapphire. Magnified 12×.*


*ACKNOWLEDGMENTS*

*The photos that appear in figures 1, 2, 8, 11, and 12 were taken by John Koivula in the Santa Monica laboratory. Bob Kane of the Los Angeles laboratory is responsible for figures 3, 9, and 10. Shane McClure, also associated with the Los Angeles laboratory, photographed the stone in figure 16. All of the photographs that originated from the New York laboratory—figures 4, 5, 6, 7, 13, 14, and 18—were taken by Rene Moore. Tino Hammid, of the Gem Media Department at GIA, photographed the stones in figures 15 and 17.*