# Gem Trade LAB NOTES

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## A NOTE FROM THE EDITOR

*The strength of the Gem Trade Lab Notes column lies in the willingness of so many members of the gemological community to bring unusual items to the attention of the GIA Gem Trade Laboratory and allow us to publish our findings. The following individuals and firms were particularly helpful during the past year: Marvin Bankoff, Alan Bronstein, Tom Chatham, W. L. Cotton, Colin Curtis, Jim D'Andrea, Pravin Davé, Robert Dunnigan, Sy Ellerhorn, Pete Flusser, Gem Mart, Kaiser Habib, Roger Krakowski, Bill Larson, John R. Latendresse, Reginald Miller, Fred Montezinos, Mary Murphy, Kurt Nassau, Carol O'Baugh, Judith A. Osmer, Rima Investors Corp., Gerald Rogers, Howard Rubin, Maurice Shire, and E. F. Watermelon Co.*

## Glass Imitation BERYL

In this era of space-age technology, which has produced sophisticated synthetics that often require equally sophisticated skills to detect, some jewelers and gemologists often fail to consider one of the oldest gem substitutes known to man: glass. Although some glass imitations look unnatural and so can be identified with little more than a "sight i.d.," others are deceptively realistic and require standard gemological testing.

The Los Angeles laboratory recently encountered one of these realistic glass imitations. The 43.24-ct light green emerald cut shown in figure 1 was submitted for identification. A single reading of 1.529 was obtained on the refractometer. Examination with a polariscope produced a singly refractive reaction, but with strong anomalous double refraction that was generally oriented in a straight, parallel pattern (figure 2). This strain pattern corresponded directly to the straight, parallel features that were easily visible when the piece was examined with a microscope in dark-field illumination. No other inclusions were observed. The piece fluoresced very weak dull yellow to long-wave ultraviolet radiation and very weak chalky greenish yellow to short-wave U.V. radiation. No bands or lines were visible when it was examined with a hand spectroscope. On the basis of these findings, we identified the material as glass.

*Figure 1. This 43.24-ct (23 mm long) green beryl imitation proved to be glass.*

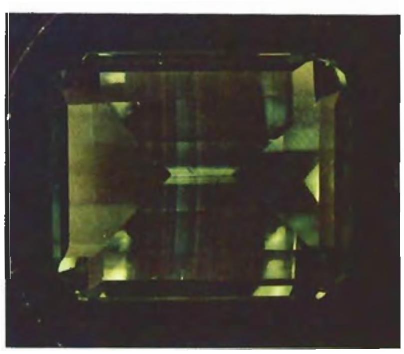


*Figure 2. The glass shown in figure 1 reveals a straight, parallel strain pattern when observed between crossed polaroids.*

To the unaided eye, this piece of glass very closely resembles a light green beryl, or an aquamarine that has not yet been heat treated. Since the piece is quite large, it could easily be hefted to estimate the specific gravity, which seemed to be close to the beryl it resembles. Testing with heavy liquids revealed that the specific gravity, approximately 2.50, is indeed relatively close to that of beryl. Even an experienced gem dealer could mistakenly purchase such a piece as beryl if he did not test it.

We are often told of such things happening, for example, light blue glass being represented as aquamarine, or purple glass being offered as amethyst. In fact, some time ago a Brazilian dealer of fine amethyst purchased a parcel of 5,000 ct, only to discover that a large percentage of the pieces were glass. *RK*

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

*Figure 3. Bright green crystals of unknown identity are easily seen in this diamond. Magnified 10×.*

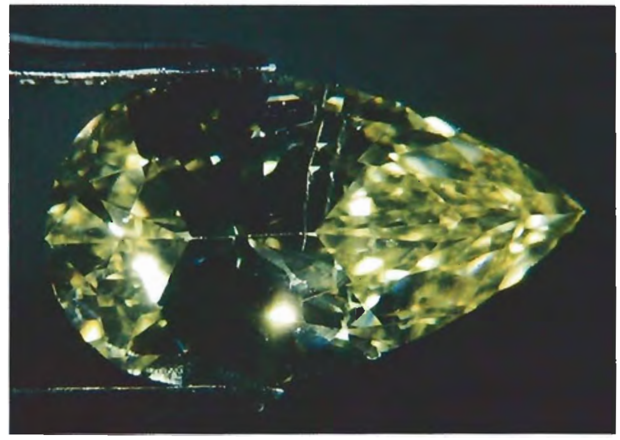


*Figure 4. Note the very unusual rectangular knot in the pavilion of this 1.96-ct yellow diamond. Magnified 10×.*

**DIAMOND with Interesting Inclusions**

Two diamonds with interesting inclusions were recently seen in the New York laboratory. The first stone, shown in figure 3, contains several bright green, transparent, nearly euhedral included crystals. Because the crystals are completely enclosed in the diamond, we could not perform the tests needed for definitive identification. However, these inclusions are almost certainly chromium-bearing minerals in the pyroxene group, probably diopside or enstatite.

The second noteworthy inclusion is a knot in the 1.96-ct yellow pear-shaped diamond shown in figure 4. This knot is in the unusual form of an irregular rectangular prism that extends from the pavilion near the keel (approximately one-third of the distance to the girdle), across the keel plane, to the edge of the table. It is most unusual for a thin columnar knot such as this to extend through the stone in this manner.

*Clayton Welch*

**Synthetic DIAMOND**

On February 18 of this year, two small diamonds were submitted to the New York lab for origin-of-color reports. The 0.46-ct stone was identified as a fancy brown natural-color diamond. However, the yellow 0.23-ct square emerald-cut stone fluoresced medium chalky yellow-green to short-wave ultraviolet radiation, but was inert to long-wave U.V. No absorption lines or pattern were observed with the spectroscope. An hourglass graining pattern was easily seen through the pavilion. These characteristics are typical of those observed in the new Japanese synthetic diamonds described in the Winter 1986 issue of *Gems & Gemology*. The stone reacted positively to the thermal inertia tester, as would be expected of a diamond. Congratulations to Kathleen Knox, who identified the stone, since this is the first time we have encountered a true gem-quality synthetic diamond in the trade and not just in the research laboratory. *CF*

**DIASPORE, A Rare Gem Material**

In the Fall 1983 issue of *Gems & Gemology* (pp. 172–173) we reported on a rare faceted gem material, diaspore. This 1.24-ct square step-cut stone showed a moderate color change from light greenish yellow in daylight to light pinkish yellow in incandescent light. In 1985, the Los Angeles lab had the opportunity to examine two other faceted diaspores (157.66 ct and 26.97 ct) as well as two large crystals. These four specimens reportedly came from a locality in Turkey (see *Gems & Gemology*, Spring 1985, p. 59).

Recently, the Los Angeles laboratory identified a 3.68-ct octagonal mixed-cut diaspore that exhibited a distinct color change from yellowish green in daylight to yellow-brown in incandescent light. Although only rarely encountered by the gemologist, diaspore is relatively easy to identify. The 3.68-ct stone shown in figure 5 revealed typical properties: refractive indices of $\alpha = 1.702$, $\beta = 1.722$, and $\gamma = 1.750$, with a corre-

*Figure 5. This rare 3.68-ct faceted diaspore exhibits a distinct color change from yellowish green in daylight to yellow-brown in incandescent light.*

sponding birefringence of 0.048; biaxial positive; specific gravity (with heavy liquids) of approximately 3.40; and weak pleochroic colors of yellowish green, orange-brown, and near-colorless. Examination with a spectroscope unit revealed a very weak absorption band from about 4500 to 4600 Å; an extremely weak, vague line centered at 4710 Å; some absorption in the far red portion of the spectrum; and moderate absorption in the violet area, which gradually tapered off at around 4250 Å. Examination with the microscope revealed several thin white needles and a few small crystals. *RK*

**GOETHITE?**

On several occasions, South American diamond dealers have submitted opaque black, apparently water-worn, pebbles to the New York laboratory for identification (see, for example, figure 6). They claim that the pebbles are found in the same riverbeds as the diamonds.

Examination with overhead illumination revealed that the true color of the 6.72-ct pebble (reportedly from Venezuela) shown in figure 6 is a very dark variegated brown with a few black veins. Standard gemological tests gave the following information:

*Figure 6. This tumbled stone, found in the diamond-bearing riverbeds of South America, appears to be a rock that is altering to goethite. Magnified 10×.*

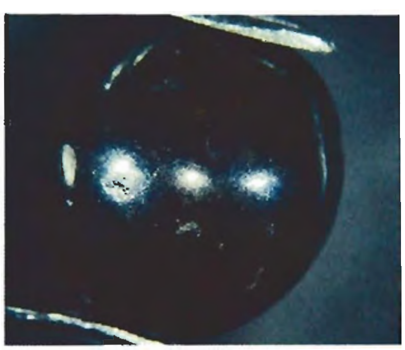


*Figure 7. This faceted table-cut lodestone measures approximately 9.97 × 7.95 × 2.00 mm.*

a refractive index over the limits of the refractometer, a specific gravity of approximately 3.50, and a hardness of about 6½–7 on the Mohs scale. The stone gave a brown streak and did not react to either hydrochloric or sulfuric acid. At this point, we decided to use X-ray diffraction. The diffraction pattern matched that of the mineral goethite, which is an iron hydroxide. However, the properties of goethite (S.G. of 4.28, hardness of 5–5½) do not match those of the material in question. We can only speculate that this is perhaps some mineral or rock that is in the process of altering to goethite.

*Dave Hargett*

**MAGNETITE, Lodestone**

The New York lab was asked to determine whether the 2.55-ct faceted stone shown in figure 7 is hematite. We routinely test suspected hematite for magnetism with a small horseshoe magnet. In this case, we found that placing the stone on a piece of paper and moving the magnet around under the paper caused the stone to move and to flip over, proving its strong magnetic polarity. This fact, together with the results of other standard tests, indicates that this material is probably the polarized form of magnetite known as lodestone. Although hematite can sometimes be weakly magnetic, it certainly is not as strongly polarized as lodestone. Magnetite is a ferrous and ferric iron oxide in the spinel group that can change to hematite when heated in an oxidizing atmosphere. It can also alter in a normal atmosphere over a period of time, but what effect, if any, this would have on surface appearance, especially luster, is not known.

*Clayton Welch*

**NEPHRITE Imitation**

The New York lab recently received for testing a strand of dark green 10-mm beads that were being represented as imitation nephrite (figure 8). Although dark green nephrite is relatively inexpensive and readily available, there is apparently enough of a demand for this even less expensive imitation to create a market.

A refractive index of 1.55, Mohs hardness of 7, specific gravity of approximately 2.65, and a crystalline aggregate structure (as seen with magnification) proved the beads to be quartzite. A broad absorption band at 6500 Å was visible in the hand spectroscope, and a positive color filter reaction proved the presence of dye. Green color concentrations in the interstices were also seen when the stone was examined with magnification (figure 9). *Dave Hargett*

**PEARLS**

**An Unusual Clam "Pearl"**

A jeweler from northern California sent a round, very dark, approximately 11-mm purple bead to the Los Angeles laboratory for identification. Since this bead had been found in a clam, which is a bivalve mollusk, he questioned whether it could not be called a black pearl. As shown in figure 10, the dark purple bead obviously lacks the characteristic orient required for it to qualify as a pearl. A sheen-like effect was visible

*Figure 8. The 10-mm imitation nephrite beads in this strand proved to be dyed quartzite.*

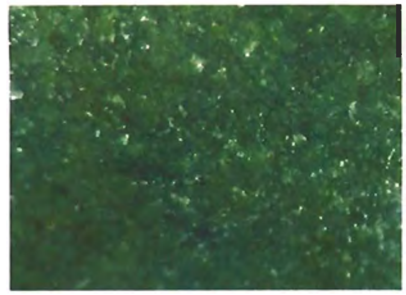


*Figure 9. The concentration of dye can be seen in the interstices of the quartzite grains in the beads shown in figure 8.*

to the unaided eye, but it was confined to certain areas. Between those distinct areas, a flow, or flame-like, pattern was visible with magnification (figure 11). The whole bead resembled a type of *Hexagonaria* coral. The high birefringence and the relative softness of the material indicated that the bead was a carbonate. When exposed to long-wave ultraviolet radiation, the bead showed a very faint orangy red fluorescence similar to that of some natural-color black pearls. The X-radiograph revealed a quite homogeneous structure with one faint circular growth line just beneath the surface. This proved the bead to be a calcareous concretion, but with a unique appearance not previously encountered in our laboratories. *KH*

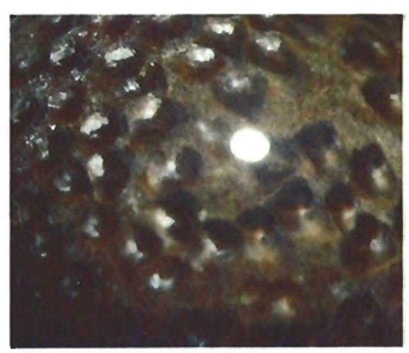
**Pearls and Their Apparent Colors**

An article in the September 1986 issue of *Scientific American* stated that human color vision is not simply a reaction to specific wavelengths of light, but rather that it responds to changes in color across boundaries. Put simply, this means that an object's apparent color can change depending on its surroundings, or color environment. This phenomenon is the basis for many popular optical illusions, but more importantly to the jeweler, it explains in part why pearls look different on different skin tones, why stones look better on certain color papers, and why jewelry looks best on certain color pads.

A short time ago, while preparing a pearl choker for X-radiography in New York, we inadvertently demonstrated this phenomenon in a very dramatic manner. Part of the choker lay on some papers and part lay on the brown desk top. Our attention was attracted because the pearls on the papers appeared to be cream colored, while those on the brown desk looked white (figure 12). Because pearls are so strongly affected by background color, they are usually displayed on a light beige surface to show their best color, and are graded on a light gray surface to show their true color. *Clayton Welch*

*Figure 10. This 11-mm calcareous concretion was thought to be a black pearl.*

*Figure 11. The unusual surface of the concretion shown in figure 10 is evident in this 6× magnified view.*



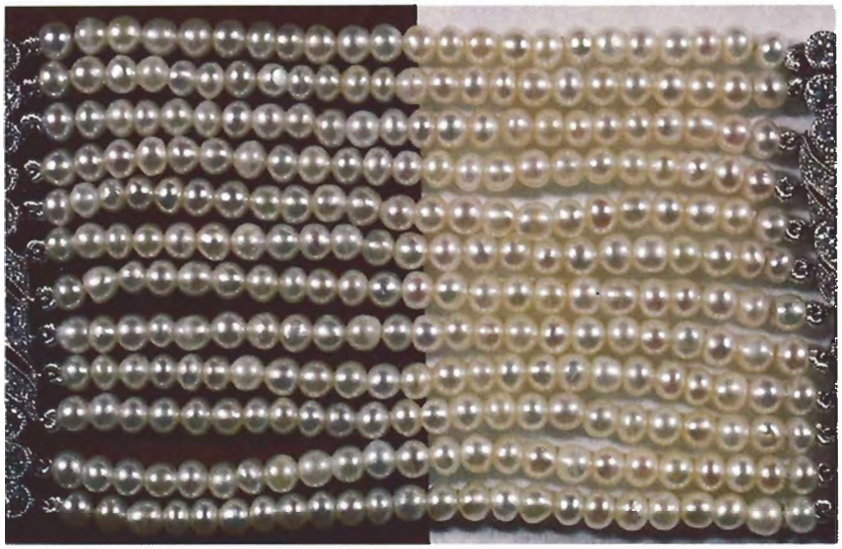


*Figure 12. Note how different in color these pearls appear on the different-colored backgrounds.*

## QUARTZ

### Fossiliferous Chalcedony

The fossiliferous chalcedony cabochon shown in figure 13 was donated to the New York laboratory. Figure 14 shows the numerous smaller fossils concentrated in each of the larger fossils in this stone. At first glance, this material appears to be one of the various decorative marbles that are used as building facings or table tops. Marble is a metamorphosed limestone and, as a carbonate, should effervesce when a small drop of acid is applied to it. However, this stone did not react to acid. Routine gemological tests proved this material to be a type of chalcedony that is commonly known as Turritella agate. Undoubtedly the limestone was replaced with quartz over time by the action of siliceous ground water. When magnified, this particular piece showed the presence of gold in the form of numerous sectile yellow metallic inclusions. Such gold is often found in secondary quartz deposits, but it is not normally associated with limestone.

*Clayton Welch*

*Figure 13. This small chalcedony cabochon showing fossil shells is a Turritella agate.*

### Phenomenal Quartz

Figure 15 shows a trio of quartz cabochons, ranging from 17.84 to 45.45 ct, that all display phenomena. The star quartz on the right was featured in both the Summer 1977 and Summer 1984 Lab Notes sections, and is actually a multi-star stone. The other two stones were submitted together to the New York laboratory for identification.

Stones like the transparent dark brown cat's-eye shown on the left in figure 15 are rarely seen in the lab. As with all brown quartz, the possibility exists that the color has been enhanced by irradiation, which cannot be detected by standard gemological tests. The star in the middle stone is particularly interesting because two of its arms are significantly stronger than the other four. In many lighting conditions, this stone actually appears to be a cat's-eye (figure 16). Such a stone should probably be identified simply as phenomenal quartz, since it can appear either as a cat's-eye or a star, depending on the viewing conditions.

*Clayton Welch*

*Figure 14. At 10× magnification, the cabochon in figure 13 shows numerous small shells inside the larger shells.*

## RUBY

### Natural Ruby Doublet

When a jeweler damaged a customer's ruby recently, he agreed to replace the stone. However, when the replacement stone was submitted for appraisal, the appraiser suspected that the stone might be a doublet.

Examination in the New York lab proved that although the stone is a doublet, it is no ordinary doublet: it consists of a natural ruby crown and a natural ruby pavilion. In *Gems, Their Sources, Descriptions and Identification,* Webster referred to these stones as "true doublets." Shipley called them "genuine doublets." Although they are very rarely seen in the labs, one Far Eastern gem dealer informed us that these stones have been seen in Thailand. Fine rubies over one carat are rare. If the potential fraud went undetected, a true doublet weighing one carat could be sold for much more than the value of two half-carat stones. A bezel setting could make the separation plane very difficult to detect.

*Figure 15. These cat's-eye and star quartz cabochons range from 17.84 to 45.45 ct.*

*Figure 16. The star quartz shown in the middle of figure 15 appears to be a cat's-eye when viewed under different lighting conditions.*

When we received this 1.18-ct stone for testing, it was unmounted. Overhead vertical illumination easily revealed the separation plane just below the girdle (figure 17). Immersion in methylene iodide showed that the twinning plane present in each piece did not meet. Natural inclusions and standard gemological tests proved that both crown and pavilion are natural ruby. *Dave Hargett*

**With Unusual Cavities**

In recent months, the New York laboratory has noted an increasing number of heat-treated rubies with oval to circular surface cavities (figure 18), especially on the pavilion. They appear to be areas of spalling, probably caused by the heating. The interior surface of the cavities is not fire skinned (partly melted), which suggests that the spalling took place at the end of the heating process. Also, the cavities are smooth at the bottom, with no evidence of a crystal or negative crystal as a contributing factor. Seven of 14 natural rubies in a lot submitted recently had these spall cavities. Although these were the first we noticed, last year we saw several glass-filled cavities that could have been filled spall cavities. *RC*

**Heated SAPPHIRE**

In the ongoing controversy regarding disclosure, perhaps one of the greatest concerns is heat-treated corun-

*Figure 17. A separation plane can be seen just below the girdle of this doublet, which consists of a natural ruby crown and a natural ruby pavilion. Magnified 20×.*

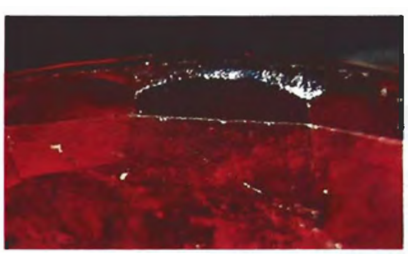
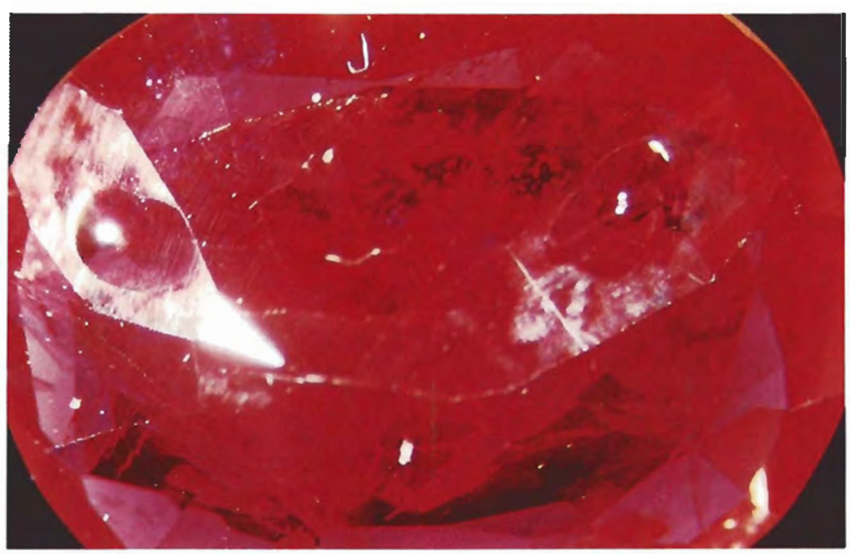


*Figure 18. These oval cavities were caused by spalling in a heat-treated ruby. Magnified 10×.*



dum. Many dealers are becoming adept at recognizing characteristics associated with heat treatment. One of them sent the stone shown in figure 19 to the New York lab for examination. Although a reworked girdle is a common feature of heat-treated corundum, the zone of brown color evident in this stone is rarely seen. The lack of a spectrum indicates that this stone is not Australian. It was probably originally a "geuda," the whitish, translucent Sri Lankan corundum that is most frequently used in heating; we have seen such a brown color zone a few times before in geuda material that has been heated.

*Figure 19. Brown color zoning is a rare occurrence in heat-treated sapphire. Magnified 10×.*

One heat treatment that usually cannot be detected is the lightening of dark blue Australian sapphire. The stones are not heated to the extent that they need repolishing, so surface evidence of treatment is lacking. Unlike the heated "geuda" sapphires, which show no iron lines in the spectroscope, the heated Australian stones display distinct to strong iron lines both before and after treatment. The trade should be aware that a great deal of heated Australian material is sold mixed in with Thai stones. *RC*

*FIGURE CREDITS*

*Figures 1, 2, 5, and 10 were furnished by Shane McClure. Clayton Welch took the pictures used for figures 3, 4, 7, 12–16, and 18. Dave Hargett supplied figures 6, 8, 9, 17, and 19. John Koivula provided the photomicrograph in figure 11.*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