Gem Trade LAB NOTES

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DIAMOND, Unusual Inclusion

A gemologist from Victoria, British Columbia, brought to our attention a very unusual loose diamond crystal inclusion in a 0.02-ct single-cut diamond. As figure 1 indicates, the crystal sometimes may be seen to project from the face of the stone; with the stone oriented differently, however, the crystal falls below the surface. The inclusion is quite irregular in shape. It apparently was attached at one time in its cavity, since one end is polished, indicating that it once lay in the same plane as the crown facet. *C.F.*

EMERALDS, Natural and Imitation

Submitted to the Los Angeles laboratory for identification was a segmented, reversible necklace typical of the style commonly manufactured in India. One side of the necklace was enameled with a floral motif (figure 2). The other side (figure 3) was bezel set with 17 transparent green carved heart-shaped cabochons (the largest measuring approximately 20.6 × 21.8 mm) and numerous small, transparent, near-colorless, rose-cut stones. Suspended from the main necklace were 36 transparent green drilled oval beads. Subsequent testing revealed that the beads were natural emeralds. However, the carved heart-shaped cabochons showed a refractive index spot reading of 1.54, slight doubling, and a number of large two-phase hexagonal negative crystals. When viewed with darkfield and fiber-optic illumination, the heart-shaped cabochons were determined to actually be colorless, but with a green backing. The heart-shaped cabochons were thus identified as rock crystal quartz, with the color due to a green backing. Because of the closed-back mounting, the nature of the backing could not be determined. The large center stone, in particular, in figure 3 shows a partial separation between the colorless quartz and the green backing; note especially the deeper color toward the bottom of this stone where the backing is still attached. This type of emerald substitute was commonly used many years ago. *R.K.*

Figure 1. Profile of a 0.02-ct single-cut diamond, with a diamond crystal protruding from one of the crown facets. Magnified 9×.

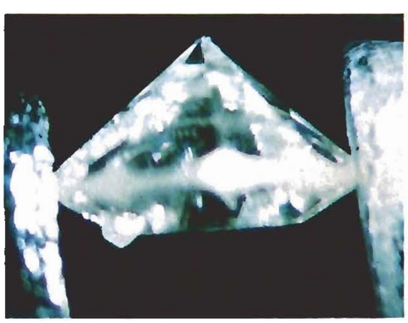


Figure 2. Enamel floral motif on one side of an emerald-and-simulated emerald necklace.

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

Figure 3. Carved, simulated emeralds on the other side of the necklace shown in figure 2. The large stone at the bottom illustrates well how light the carved rock crystal is in those areas of the stone where it has separated from the backing material, compared to the deep green area at the bottom of the stone where the backing is still attached.

OPAL, Oolitic vs. Sugar-Treated

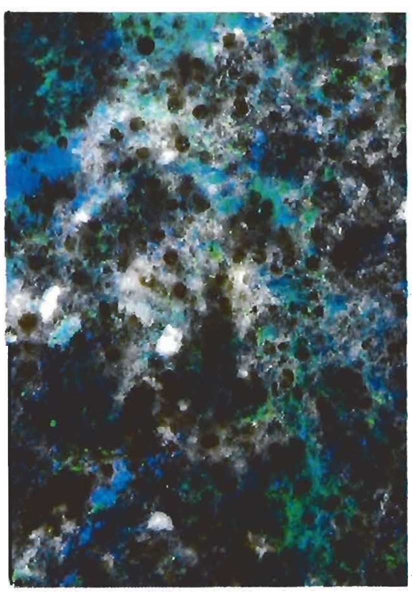
We recently examined a polished opaque slab of opal exhibiting a patchy play of color. Because the entire surface was peppered with tiny black spots, sugar-treated opal was immediately suspected. Examination with the microscope, however, revealed the structure of oolitic opal (figure 4), a rare form of natural opal that shows an unusual dark, circular, spotted appearance under magnification. When oolitic opal is observed without magnification, it closely resembles and can be easily mistaken for the much more common sugar-treated opal. For comparison purposes, a sugar-treated opal is shown in figure 5. This is the first oolitic opal encountered since 1982 (*Gems & Gemology,* Summer 1982, p. 104). *John Koivula*

PEARLS

Dyed Cultured Pearls

The Los Angeles laboratory received for identification a strand of 7.4-mm bluish black pearls that had been represented to be Tahitian black pearls. The X-radiograph revealed the internal structure that identified them as cultured pearls. When we exposed the beads to ultraviolet radiation, we noticed a chalky white fluorescence that was stronger to short-wave than to long-wave. Natural-color black pearls fluoresce reddish to long-wave ultraviolet radiation. Most of the pearls appeared to be fairly even in color, but in a few the color was concentrated around the drill hole, with distinct colored veins originating from this area spreading around the pearls in a peculiar fashion (figure 6). A cotton swab that had been dipped in a 2% nitric acid solution picked up some bluish color from areas inside the drill hole, proving that these pearls had been dyed to simulate the appearance of black pearls. Apparently, dye had been introduced to these drill holes and spread inside the pearls, creating the web-like pattern. *K.H.*

Figure 4. Circular black spots identify oolitic structure in opal. Magnified 20×.



First American Freshwater Cultured Pearls from Tennessee

Both the New York and Los Angeles laboratories had the opportunity to

Figure 5. While to the naked eye this sugar-treated opal closely resembles its natural oolitic counterpart, with 45× magnification as shown here the separation is easily made.

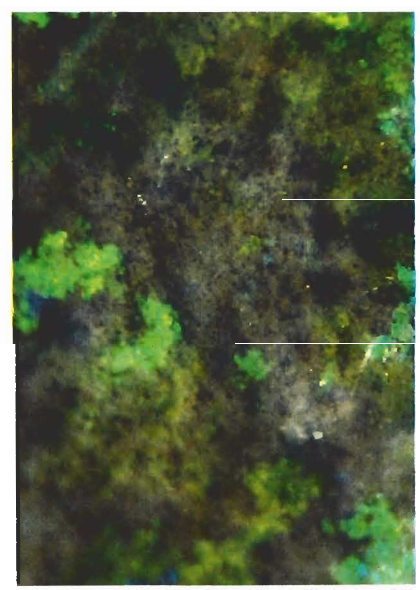


Figure 6. Dye is evident around the drill holes of these 7.4-mm cultured pearls. Note also the web-like veins emanating from the dye area in the center pearl.

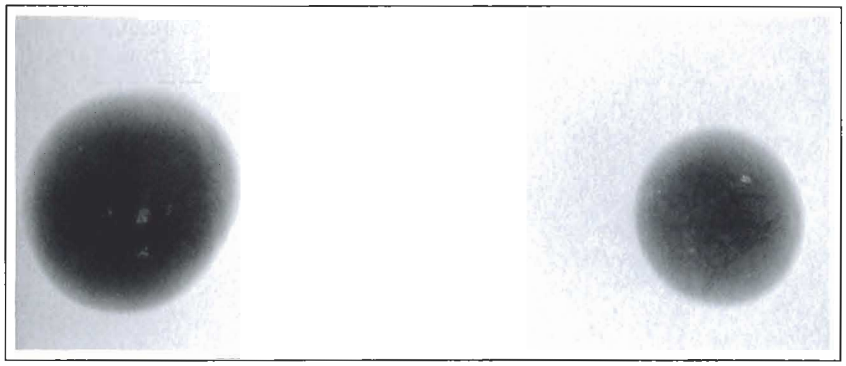


Figure 7. This X-radiograph shows two of the American freshwater cultured pearls examined in the New York and Los Angeles laboratories. The irregular nucleus characteristic of mantle-tissue nucleation is prominent in the pearl on the left and less obvious, though clearly visible on film, in the one on the right.

examine a lot of 11 pearls sent by an American firm in Camden, Tennessee. According to the owner, this lot represented samples of the first freshwater pearls that had been successfully cultivated in Tennessee over a period of some years (see the article on freshwater pearl cultivation in the Fall 1984 issue of *Gems & Gemology*). These pearls have been produced in a variety of shapes, sizes, and colors (figure 10, p. 138, Fall 1984 issue of *Gems & Gemology*). The group included five small (approximately 4.5 mm in diameter) almost round pearls and five larger pearls that were more oval in shape; all of these pearls were primarily white, although some showed a very slight rosé overtone. The largest pearl in this group (measuring approximately 12 × 9 × 4 mm), although oval in shape, was quite flat on one side. A similar, smaller pearl had the extremely high luster that is sometimes seen in natural freshwater pearls. This same pearl also showed a very unusual purple fluorescence to X-rays that we noticed, though less pronounced, in the smaller (4.8 mm) round brownish pink pearl as well. All the other pearls fluoresced very strong yellowish white to X-rays, indicating freshwater origin. The X-radiographs of all the pearls showed the typical irregular voids that prove mantle tissue nucleation (see figure 7). *C.F.*

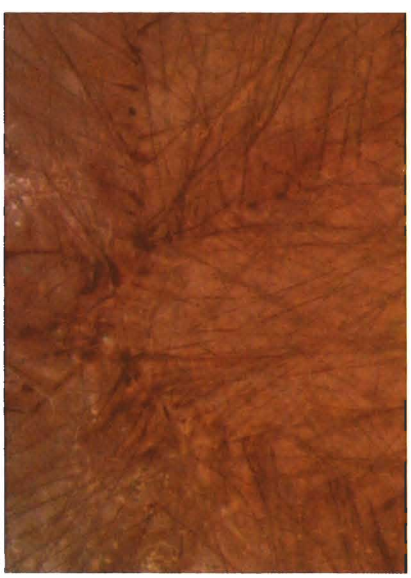
Pseudo Star QUARTZ

Most gemstones that exhibit asterism owe the star effect to tubular or needle-like inclusions that are oriented in the correct crystallographic directions so that when the stone is cut *en cabochon*, reflected or transmitted light will reveal a star

Figure 8. The star-like pattern in this 27-ct "strawberry" quartz cabochon is caused by modified goethite needles.

pattern. However, the Los Angeles laboratory recently identified a 27-ct reddish brown oval quartz cabochon that displayed a star effect that was not due to true asterism, but to a dark growth formation (figure 8). Microscopic examination of the cabochon showed that the quartz was densely crowded with long reddish brown needles of goethite that caused not only the color, but also the star. These prismatic needles were oriented along the directions of the three horizontal crystallographic axes and met at the junctions between the major and minor rhombohedral faces of the host quartz. Some, but not all, of the needles displayed a morphological change from acicular goethite to the flat, plate-like form known as lepidocrocite (figure 9). This denser accumulation of inclusions causes the rhombohedral junctions to appear dark reddish brown in color, and, when the material is properly cut and viewed parallel to the c-axis, gives the appearance of the six dark intersecting rays of a star. A similar effect is seen in some trapiche emeralds where carbonaceous inclusions collect along the horizontal axes. In the trade, this type of material has been referred to as "strawberry" quartz. It was first discovered in Sonora, Mexico, about 15 years ago. *K.H.*

Figure 9. Goethite needles partially altered to lepidocrocite in the "strawberry" quartz cabochon shown in figure 8. Magnified 45×.



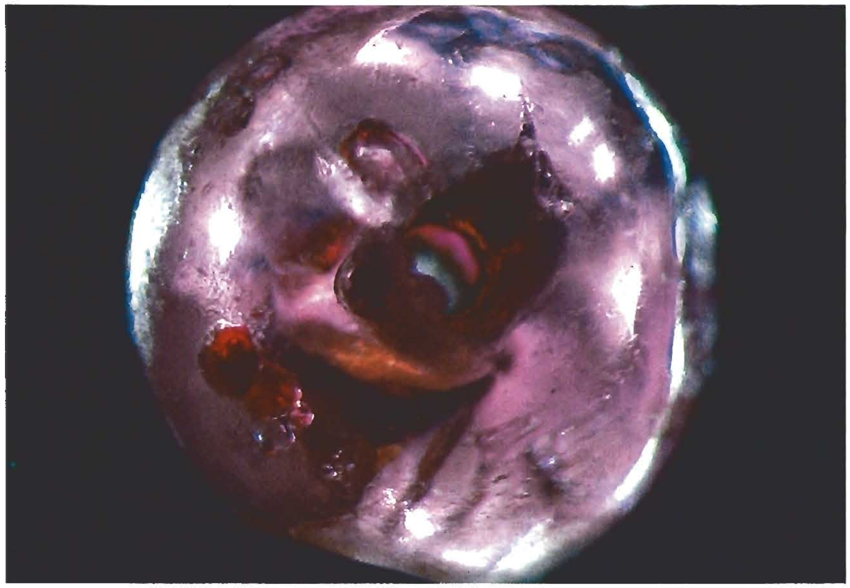


Figure 10. Unidentified red coating in the drill hole of a 4-mm corundum bead. Magnified 15×.

RUBY SIMULANTS

Color-Enhanced Corundum Bead

A small (4 mm in diameter) natural corundum bead recently examined in the GIA Applied Gemology Department probably owes most of its purplish pink body color to the red substance that was found to be lining the drill hole (figure 10). In the past, we have frequently seen near-colorless corundum beads take on a pinkish cast when they were strung on a red cord, but this is one of the few times we have encountered a color-coated drill hole. Of course, it is impossible to judge the true colors of such items without removing the coating in the drill hole.

John Koivula

Spinel and Synthetic Ruby Doublet

Figure 11 illustrates an attractive cluster ring that came into the New York lab for identification. The ring was set with an impressive number of diamonds and what appeared to be a large (approximately 20 ct) ruby. Unfortunately, the "ruby" turned out to be an assembled stone consisting of a colorless synthetic spinel top cemented to a Verneuil synthetic ruby back. Figure 12 shows the bubbles in the rather poor cement plane as well as the curved striae in the synthetic ruby pavilion. This is the first time we have seen such a combination of materials in an assembled stone, and we cannot understand the reasoning behind it. *R.C.*

SAPPHIRE, More Colors of Heat-Treated Stones

Heat treatment is commonly known to produce blue and shades of yellow to orange-brown sapphires from milky lighter colored sapphires and to enhance rubies by minimizing their blue component. Recently, however, the New York lab encountered heat-treated stones in colors they have not seen previously. The strain discs evident in the beautiful 4-ct red-purple sapphire shown in figure 13 suggest

Figure 11. Ring set with diamonds and an approximately 20-ct synthetic spinel and synthetic ruby doublet.

Figure 12. Bubbles in the cement plane, and curved striae in the synthetic ruby pavilion, of the doublet shown in figure 11. Magnified 15×.

Figure 13. Strain discs strongly suggest that this sapphire has been heat treated. Magnified 63×.

that the stone owes its color, at least in part, to heat treatment. But the zones of chalky fluorescence that appeared when the stone was exposed to short-wave ultraviolet radiation are proof positive that the stone has been heat treated.

Figure 14 shows a 9-ct oval pinkish orange sapphire that the owner believed to be the best padparadscha he had ever seen. When exposed to short-wave ultraviolet radiation, however, it too revealed the zones of chalky fluorescence characteristic of heat treatment. We subsequently learned that heat treatment can cause some sapphires to turn a pinkish orange, presumably if the stone contains enough chromium in addition to iron to give the necessary balance. It is possible that the refinement of heating techniques with sophisticated ovens will begin to produce an abundance of sapphires of this color, which heretofore have been so rare as to be virtually unavailable. If this comes to pass, it will be interesting to see if these stones get the same reception from the trade as the bulk of blue heat-treated sapphires have received. *R.C.*

SPINEL, Color Change

Among a selection of gemstones reportedly from Burma that were recently submitted to the Los Angeles laboratory for identification was a very attractive pinkish purple oval mixed-cut stone that weighed 7.23 ct. Subsequent testing revealed that the stone was a natural spinel exhibiting a color change from pinkish purple when viewed with fluorescent illumination (figure 15) to purplish pink under incandescent lighting (see figure 16).

A single refractive index reading of 1.716 was obtained with a monochromatic light source equivalent to sodium vapor. When viewed with the microscope, this stone provided an interesting display of inclusions: short, thin intersecting needles; relatively large euhedral crystals of various habits; fingerprints; and healed fractures. Figure 17 shows the absorption curve as recorded with a Pye

Figure 14. Pinkish orange color of a heat-treated 9-ct sapphire. Magnified 10×.

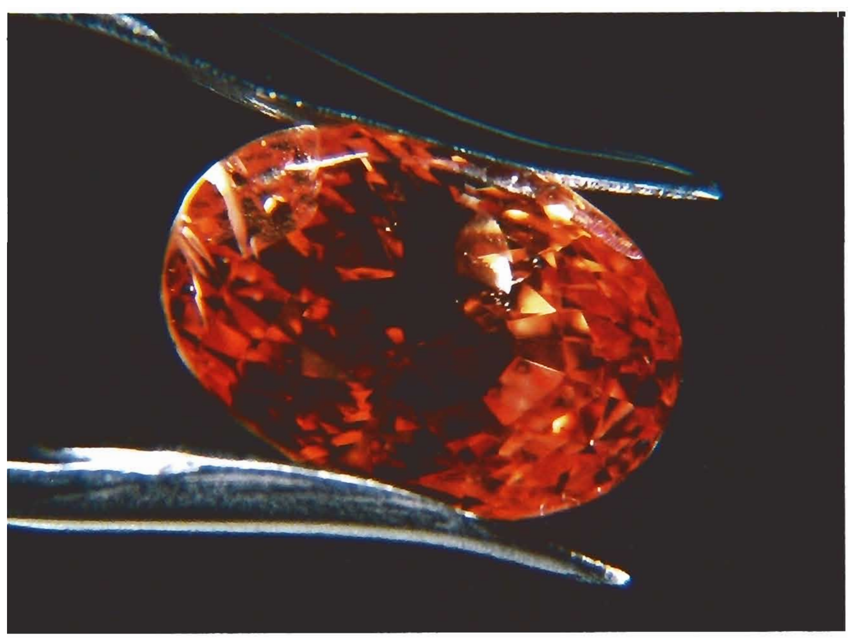


Figure 15. This 7.23-ct spinel shows pinkish purple in day or fluorescent light.

Figure 16. Under incandescent light, the color-change spinel shown in figure 15 turns purplish pink.

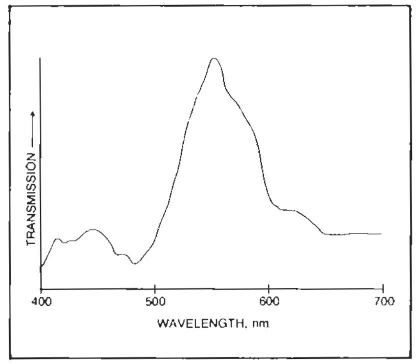


Figure 17. Absorption curve of the color-change spinel.

Unicam PU 8800 UV-VIS spectrophotometer. When exposed to long-wave ultraviolet radiation, this attractive color-change spinel exhibited a moderate chalky yellowish green fluorescence, an unusual and unexpected reaction. It was inert to short-wave ultraviolet radiation.

R.K.

Treated TOURMALINE

Routine microscopic examination of a brownish gray oval cat's-eye tourmaline showed that the larger growth tubes running parallel to the c-axis had been filled and sealed by a foreign substance. Some of these filled tubes, as shown in figure 18, were easily spotted because they contained two or more gas bubbles in the same channel. The odor from a carefully applied hot point indicated that the filling material was probably a plastic. Such voids are usually filled to prevent the detritus caused by the cutting process from entering them. Shellac is normally used for this purpose, because it can be easily removed with alcohol after the cutting and polishing process is finished. Because of the relatively large size of the tubes, plastic may have been used in this instance to achieve a more permanent seal.

John Koivula

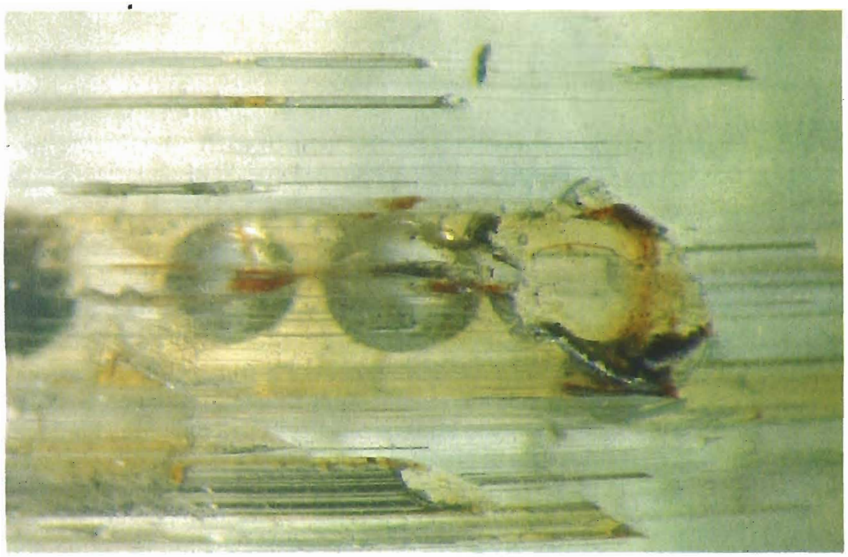


Figure 18. Gas bubbles indicate that the large growth tubes in this tourmaline had been filled. Magnified 25×.

PHOTO CREDITS

Ricardo Cardenas took figures 11, 12, 13, and 14. John Koivula photographed figures 4, 5, 9, 10, and 18. A. de Goutière furnished figure 1. Shane McClure provided figures 2, 3, 6, 8, and 15. Tino Hammid supplied figure 16. Karin Hurwit contributed figure 7, and Jim Shigley provided figure 17.