

Gem Trade LAB NOTES

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ALEXANDRITE

An unusual feature was noted during the examination of an 8.12-ct natural alexandrite in our Los Angeles lab. When this stone was viewed with the microscope, the number 15 was seen, scratched on a pavilion facet (figure 1). This questionable method of marking is employed by some private collectors, institutions, and even museums to catalogue their collections of gemstones and carvings. Fortunately, it is rare that we in the laboratory see stones marked this way. Surely an accurate description, together with three measurements to the nearest hundredth of a millimeter and the weight to the nearest point, would serve to positively identify a stone. There is no need to damage it by such inscriptions.

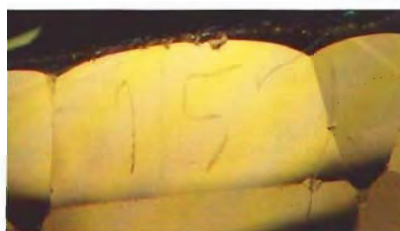


Figure 1. Identifying numbers scratched on a pavilion facet of an alexandrite. Magnified 25×.

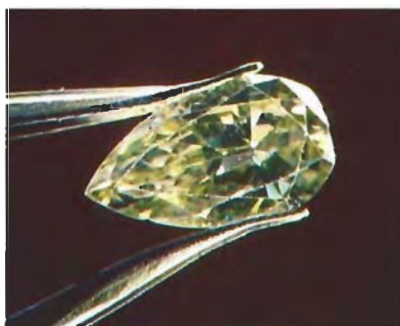


Figure 2. A cyclotron-treated diamond of unusual color. Magnified 10×.

DIAMOND

Gem testers must remember to look for evidence of cyclotron treatment in fancy-shaped stones, especially if the color of the stone does not appear to be treated. For example, the yellow-green of the pear-shaped diamond seen in figure 2 is a color not normally expected of cyclotron treatment. All fancy orange-brown diamonds should routinely be examined for evidence of top-only cyclotron treatment since this color is frequently encountered in stones treated by this method. When the

stone is viewed through the pavilion, this type of treatment shows up as a line of color just in from the table and star facet edges. In most cases, no spectroscopic evidence is present in these top-treated stones. If such a stone is mounted, particularly in a gypsy setting, it is entirely possible to overlook the tell-tale evidence and pronounce the stone naturally colored in the absence of an identifying absorption spectrum.

It should come as no surprise to gemologists who have been keeping up with advances in diamond irradiation and annealing to occasionally see treated brown or yellow stones that lack the 592 nm* absorption line in the spectrum at ordinary room temperature.

EMERALD FAKES

Some time ago a small lot of emeralds was submitted to the Los Angeles laboratory for identification. Subsequent testing showed all but one of the stones to be natural emeralds with minor amounts of oil present. The exception proved to be a natural beryl that was coated with a green substance that imparted most, if not all, of the color to the stone.

This treatment was seen very easily under magnification when the gemologist looked through the stone and examined the opposite surface, as shown in figure 3. The areas where the coating has worn off reveal the near-colorless nature of the original stone, whereas the green areas indicate where the treatment still remains.

*In accordance with standard international practice, GIA has adopted the use of nanometers (nm) in place of angstrom units (Å) for the measurement of wavelengths in the visible light region of the electromagnetic spectrum. Note that the conversion is 1 nm = 10 Å.

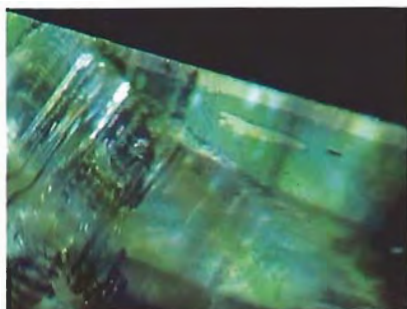


Figure 3. Green coating on near-colorless beryl, imitating emerald. Magnified 36 $\times$.

The green coating flaked off very easily with the pin end of the brush probe, and it melted when checked with a thermal reaction tester. When the stone was then tested with a cotton swab saturated with acetone, a very noticeable green stain appeared on the cotton swab. The indications are that the coating is some type of paint (like that used on glass) although similar results have been obtained with green cement or plastic.

Several months after this cut stone was tested, we had the opportunity to examine two rough beryl crystals (weighing 15.1 and 10.91 ct, respectively) that had been treated in a very similar manner (figure 4). On these crystals the green coating had been partially removed from the flat surfaces and was present mostly in surface fractures, cavities, and depressions. As with the cut stone described above, the coating flaked off with the brush probe, stained the acetone-soaked swab, and melted in response to a thermal reaction tester.



Figure 4. Beryl crystals treated in a manner similar to the stone illustrated in figure 3.



Figure 5. Strand of pink and green grossularite beads, each approximately 9 mm in diameter.

GROSSULARITE GARNET

We had nearly forgotten that translucent grossularite garnet occurs in pink as well as green until a beautiful strand of the material, with alternating green and pink beads approximately 9 mm in diameter, was submitted to the New York laboratory for testing (figure 5). It had been offered to the client as "rare jade."

JADEITE, Dangers of Heating during Jewelry Repair

The Los Angeles laboratory received for identification a lady's ring set with a 14.95 $\times$ 10.85 $\times$ 2.80 mm mottled white-and-green oval cabo-

chon center stone and several diamond side stones (see figure 6). The client explained that the center stone had changed color, in this case from a relatively even medium green to predominantly white with splotches of green, while the ring was being



Figure 6. Loss of color in heat-damaged jadeite ring. Stone measures $14.95 \times 10.85 \times 2.80$ mm thick.

repaired with a torch. Subsequent testing proved the stone to be natural-colored jadeite. This accident could have been prevented if the jeweler had possessed a fuller understanding of the effects of heat on jadeite.

To circumvent unnecessary accidents such as these, a good rule of thumb to follow is never to heat any gemstone other than diamond and then only when the proper precautions have been taken, such as cleaning the diamond thoroughly and giving it a protective coating. Most diamonds that are in frequently worn jewelry accumulate foreign substances, such as oils and soaps, particularly on pavilion surfaces. When they are subjected to high temperatures, such as would be encountered in retipping a prong, the foreign substances often become charred. These charred surfaces usually have to be boiled in a sulfuric acid bath to be removed; in more severe cases, where the surface of the stone is oxidized, the diamond must be repolished.

KORNERUPINE with Apatite Inclusions

The Santa Monica laboratory examined a 1.68-ct grayish-green, oval, mixed-cut korerupine. The gem contained numerous slightly rounded, transparent, near colorless-appearing hexagonal prisms (see figure 7)

that looked very similar to the apatites often found as inclusions in almandine garnet. One of the larger crystals came to the surface of the gem's pavilion; it was possible to scrape this inclusion and obtain enough powder to make a spindle for X-ray powder diffraction. The diffraction pattern showed that the inclusions were in fact apatite.

OPAL

Flow Structure in Opal

A large, natural, transparent to semitransparent, brownish-orange opal double cabochon brought to the Santa Monica laboratory for identification proved to be quite interesting. The central portion of the opal contained a large, semitranslucent, white subspherical inclusion, which occupied approximately 50% of the entire volume of the opal. Trailing down the sides of the white inclusion were numerous smoke-like dark brown to black steamers, as shown in figure 8. The central white inclusion could possibly be cristobalite, another form of silica, but no tests could be carried out to prove its nature. The smoky veiling could possibly be explained as remaining traces of the original flowing in the once-fluid silica.

Oolitic Opal

The Santa Monica laboratory recently tested a semitranslucent-to-

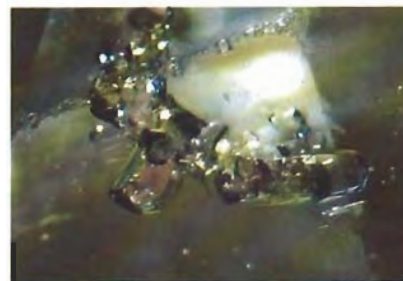


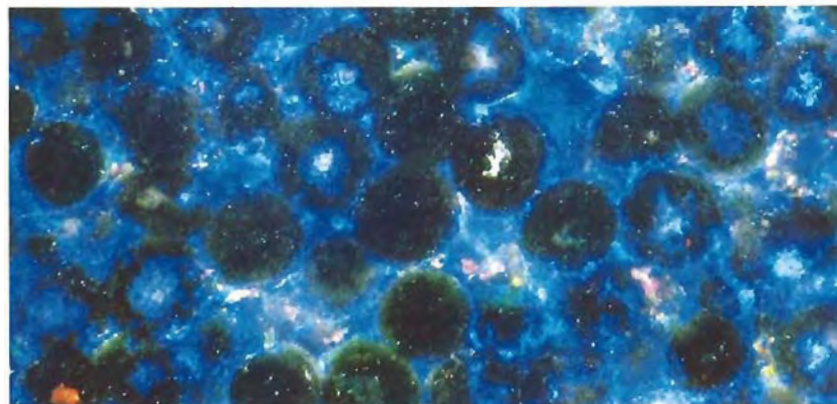
Figure 7. Apatite crystals in korerupine. Magnified $40\times$.



Figure 8. Dark streamers in opal. Transmitted light, magnified $50\times$.

opaque polished slab that showed a play of color and proved to be a rare variety of natural opal called oolitic opal. This type of opal shows an unusual circular structural appearance under magnification, as illustrated in figure 9. Some people have put forth the hypothesis that it might be the result of opalization of a calcar-

Figure 9. Oolitic opal structure. Magnified $25\times$.



eous ooze or an oolitic limestone. At first glance, oolitic opal can easily be mistaken for sugar-treated opal, but under magnification the distinctive circular structure will serve to identify it. Also observed in this gem were what appeared to be a number of opaque, white to brownish white, rhombohedral-shaped included crystals that appeared to have the external morphology of calcite or some similar carbonate.

Opal Doublet

A 6.12-ct baroque-shaped opal cabochon was submitted to the Los Angeles laboratory for identification. When the stone was viewed with the unaided eye, a very attractive play of color was seen on the top of the stone and the typical ironstone matrix was observed on the back, leading one to believe that it might be a boulder opal.

Closer examination with the microscope revealed an assembled stone that had a thin brown layer with several very small patches showing play of color in the layer between the opal top and the matrix back. This layer was very soft and had several hemispherical cavities, probably formed by air bubbles (see figure 10). To minimize damage to the area, we scraped off a very small amount with a razor blade for testing with the thermal reaction tester. The substance melted easily when the hot point was applied, thus proving it to be some type of ce-

Figure 10. Hemispherical cavities in the cement layer of an opal doublet. Magnified 12×.

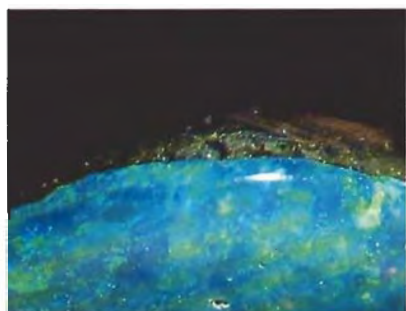


Figure 11. Shells approximately 38 to 52 mm long that contain blister pearls.

ment, formulated to resemble the ironstone backing.

Although somewhat infrequently, we have seen this type of assembled opal before. One interesting feature of this imitation ironstone cement is that it usually contains small patches showing play of color. This is apparently accomplished by adding very small pieces of crushed opal to the cement.

PEARLS

Mysterious Pearls in Shells

The New York laboratory received for testing several small (38 to 52 mm long) nacreous shells, of an unknown species, in which a pearl or blister pearl appeared near the adductor muscle scar (figure 11). The lab was unable to determine whether the "pearls" occurred naturally or were induced by man. X-ray photographs indicated natural pearls. Many of the "pearls" in the shells were not completely attached to the shell, and one appeared to be cemented to the shell. The client could not provide any information about these mysterious objects.

Unusual Natural Pearl

A large (26 mm), undrilled, baroque-shaped pearl was brought into the Santa Monica laboratory for X-ray identification. For its size, the pearl was extremely light in weight and had a distinct, rather strong, disagreeable odor. X-radiography revealed that the pearl was natural and completely hollow, with only a very thin surface shell, approximately 1-3 mm thick. The pearl appeared extremely delicate and would probably be difficult to set. The odor suggests that the irritant that caused the pearl was perhaps an organic fleshy material that did not appear on the X-ray but was in the process of decaying.

RUBY, Synthetic Star

GIA's faceting instructor, Bill Kerr, had in his possession a boule of German-produced synthetic corundum. After rounding the larger end and polishing same, he noticed how the three rays crossed each other to form the expected 6-ray star and then extended down the sides of the rough boule still attached. This inspired

the attempt to cut a cat's-eye stone oriented 90° to the c-axis of the boule that created the 6.23-ct synthetic cat's-eye ruby shown on the left in figure 12. On the right of this double-exposure photograph is the same stone viewed on the end and parallel to the c-axis. One-half of the star is now visible.

Another section of the same boule (toward the bottom) that was later worked into a stone contained part of the transparent seed crystal with a shallow overgrowth of the asteriated material. This material when cut produced a weak star with an open center caused by the non-asteriated seed-crystal section, a very unusual stone indeed (see figure 13).

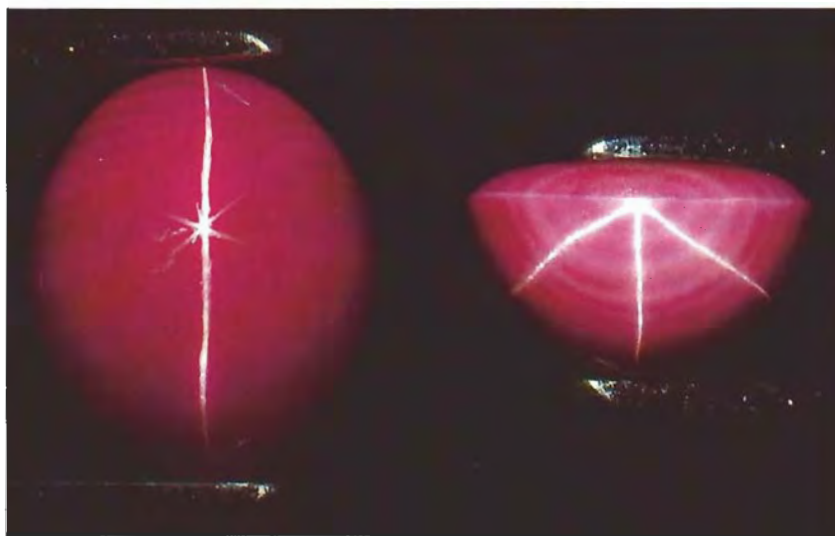


Figure 12. Unusual cat's-eye synthetic ruby, 6.23 ct. View on left shows the sharp eye on the top of the stone; view on right shows the end of this cabochon and half of the would-be star.

SAPPHIRE

Dangers of Heating Sapphires during Jewelry Repair

Several months ago a client sent to the Los Angeles laboratory a man's ring set with an 11.20 × 9.10 × 7.08 mm light yellow, oval, mixed-cut center stone and numerous diamond side stones. The client explained that during the resizing process the stone had changed color from a beautiful intense yellow to a light greenish yellow (see figure 14). The client was very puzzled by this change of color due to heating and questioned whether the stone was in fact a natural yellow sapphire. Testing, however, did prove it to be a natural sapphire.

Unfortunately, we hear of cases like this quite often (see "Jadeite" above for another example). The fact that sapphires and many other gemstones may lose or change color if heated, or even worse may fracture or break, is not fully understood by some jewelers and repairpeople.

Occasionally, we see rubies or sapphires that have etched surfaces. These damaged surfaces occur when repair work is done on an article of jewelry without removing the corundum from the setting. Damage results from the stone coming into contact with the usual fluxes con-



Figure 13. Synthetic star ruby (4.22 ct) cut from a piece near the bottom of the boule from which the stone in figure 12 was cut. Note that the rays of the star do not meet in the center of the stone.

taining boron, in which corundum is soluble. Under high temperatures these fluxes, whether they are used as protective coatings or in pickling acids, become more active and may seriously attack and partly dissolve the surface of the stone. To prevent etched surfaces, the safest precaution is to remove the corundum before the mounting is repaired or pickled.



Figure 14. Heat alteration to greenish yellow in a natural yellow sapphire, 11.20 × 9.10 × 7.08 mm.

Natural Sapphire with Heat-Induced Star

Figure 15 shows the first induced-star sapphire submitted to the New York lab since the Linde Air Products Co. last submitted stones in 1968. This stone was evidently a product of the Linde patent no. 2,690,630 issued in 1954. Now that this patent and others are owned by a Hong Kong consortium, the induced-star sapphires are evidently going to become commercially available once again. In May of 1981, three such heat-induced star sap-

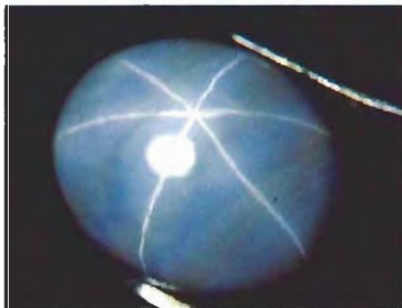


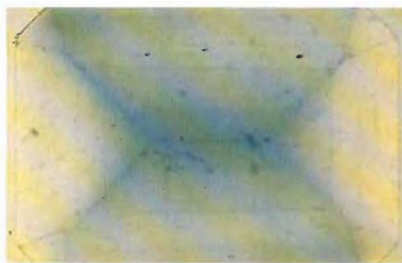
Figure 15. Heat-induced star in a 4-ct natural sapphire.

phires were submitted to the Los Angeles lab. In addition to the induced star, these three stones had evidence of surface-induced color as well.

Treated Synthetic Sapphire

Recently encountered in the Santa Monica laboratory was a very well cut 14+-ct flame-fusion synthetic sapphire that had been heat treated by the diffusion process. The gem had the refractive index and optic character of corundum and showed a chalky yellowish-white short-wave ultraviolet fluorescence typical of synthetic sapphire. Under magnification, a few tiny gas bubbles could be resolved, and only by very careful manipulation of the stone could any of the curved color zoning typical of flame-fusion blue synthetic sapphires be observed. Because the color zoning was so difficult to detect, the decision was made to immerse the stone in methylene iodide. Immersion showed that the stone had obviously been diffusion treated, in-

Figure 16. Color zoning in a diffusion-treated synthetic sapphire. Magnified 6×.



asmuch as the two sides of the pavilion were blue and the two ends were essentially colorless by comparison (figure 16). The entire crown of the stone appeared near colorless as well. Why someone would take the time to diffusion treat a synthetic sapphire is difficult to understand. Perhaps it was in with a group of stones that were being routinely treated and its synthetic nature was not known. Possibly, it was knowingly treated to hide its very elusive curved color zoning in an attempt to represent it as a treated natural sapphire.

SPINEL, Inclusions

Pink spinels and red spinels have become much better known to the consumer and are being seen much more frequently in the trade both here and in the Orient. The New York lab has had the opportunity to examine several lots of stones totaling hundreds of carats. Among the collections were two stones that had unique inclusions. Figure 17 illustrates some root-like inclusions resembling those we have seen in another cubic mineral—diamond (see *Gems & Gemology*, Fall 1974, p. 332, and Fall 1979, p. 199). Figure 18 shows a series of frosted-appearing "tennis balls," which in reality are negative "crystals" that resemble the gas bubbles seen in slag glass. Figure 19 illustrates some of the more normal spinel inclusions, including octahedrons, seen in a handsome red spinel.

TOURMALINE, Cat's-Eye

Among the many gemstones sent to the Los Angeles laboratory for identification, cat's-eye tourmalines are sometimes seen. The most common colors are various shades of pink, red, green, and blue. In the majority of these stones, tubes or needle-like inclusions throughout the entire stone give rise to chatoyancy when the stone is cut en cabochon. Figure



Figure 17. Unusual root-like inclusions in natural spinel. Dark-field illumination, magnified 20×.

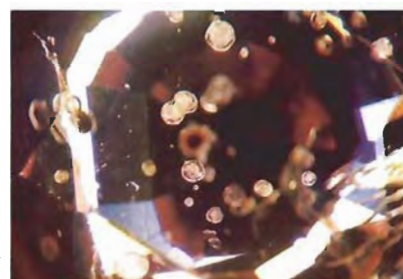


Figure 18. Negative "crystals" in natural spinel. Dark-field illumination, magnified 30×.

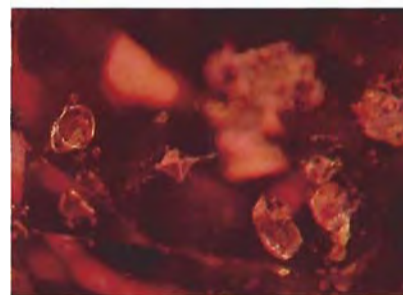


Figure 19. Common inclusions in natural spinel. Dark-field illumination, magnified 30×.

20 shows an exceptional 258.08-ct green tourmaline with a sharp eye.

Occasionally, we see cat's-eye tourmalines in which the inclusions are concentrated at the bottom of the cabochon, thus imparting a greater clarity and transparency to the stone than is seen in stones with inclusions throughout.



Figure 20. Exceptional green cat's-eye tourmaline, 258.08 ct.

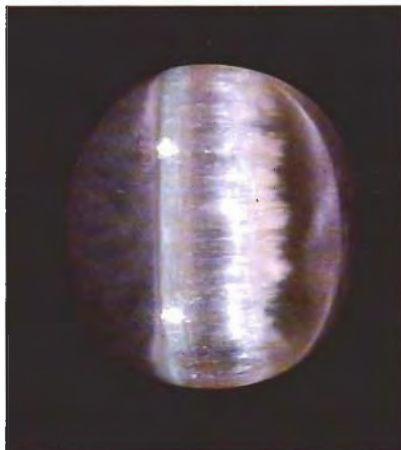


Figure 21. Band of inclusions that does not completely cross the width of this 17.45-ct cat's-eye tourmaline.

Recently submitted to the Los Angeles laboratory were two cat's-eye tourmalines that were slightly different from those that we usually

encounter. Each of these stones had a band of needle-like inclusions that was positioned down the center of the stone. When these stones were

examined with the unaided eye under a single light source and moved slightly, a strong chatoyant band was observed to move within the restricted width of its zone of inclusions. The areas on both sides of the band of needle-like inclusions were relatively free of inclusions. One of these stones, weighing 17.45 ct, is shown in figure 21.

ACKNOWLEDGMENTS

Photos from the Los Angeles laboratory were supplied by Bob Kane (figures 1, 3, and 10), Mike Havstad (figure 20), Tino Hammid (figures 4, 12 and 13), and Shane McClure (figures 6, 14, and 21). René Moore in New York took the photos in figures 2 and 11, and Andrew Quinlan from the same lab gave us figures 5, 15, 17, 18, and 19). John Koivula of Santa Monica was responsible for the photos in figures 7, 8, 9, and 16, as well as being a special guest writer for some of the contributions from the Santa Monica lab.

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