Gem Trade LAB NOTES

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DIAMOND with Phantom Growth Plane

The Los Angeles laboratory recently received a 2.10-ct brilliant-cut marquise diamond for quality analysis. This diamond was graded imperfect because it contained a number of crystals, feathers, clouds, pinpoints, and laser drill holes. These inclusions are all typically observed in diamonds. However, this diamond also contained an unusual, large, phantom growth plane. The photomicrograph in figure 1 shows some of the particularly notable patterns within this plane. *R.K.*

Figure 1. Phantom growth-plane patterns in diamond. Magnified 63×.

DIAMOND Simulant, Inclusions in Cubic Zirconia

Cubic zirconia is frequently submitted for identification to both the Los Angeles and the New York laboratories. Although cubic zirconia, grown by the skull-melt technique, can have inclusions, the faceted CZ that we have examined is generally devoid of visible inclusions and internal textural growth features. However, the Los Angeles laboratory recently examined a 0.90-ct round brilliant-cut cubic zirconia that exhibited somewhat unusual irregular "swirled" growth features (figure 2). If hastily examined, these growth features might be mistaken for the "phantom" type of graining that is commonly observed in diamonds. However, the true identity of this man-made material is quickly ascertained by considering its many other typical visual characteristics, in addition to its excessively high specific gravity (5.80 ± 0.20) when compared to that of diamond (3.52). Although the facet junctions on a well-cut cubic zirconia may appear nearly as sharp as they do on diamond, this particular cubic zirconia exhibited very rounded facet junctions.

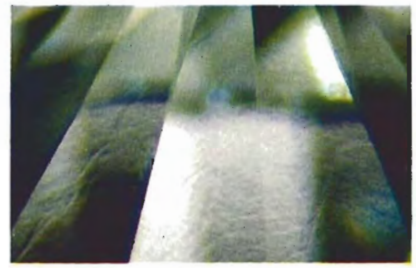


Figure 2. Swirled "graining" in cubic zirconia. Magnified 40×.

Several weeks after we examined the 0.90-ct stone discussed above, we received the heavily included 1.62-ct cubic zirconia shown in figure 3. The numerous, nearly spherical inclusions (oriented in subparallel lines) in this stone, although rare, are an excellent example of what can be encountered by the gemologist. When examined under the microscope, these inclusions were determined to be negative crystals, but the voids appeared to be lined, or partially lined, with a white substance that is probably undissolved zirconium oxide (ZrO_2). Some of the negative voids were large enough to reveal well-formed, somewhat angular growth patterns. *R.K.*

EMERALD Substitute

Dyed Beryl

A translucent green brilliant-cut stone (figure 4), weighing 0.23 ct, came into the New York laboratory for testing. A refractive index of 1.57–1.58 identified the material as beryl. Examination under magnification easily revealed the presence of green dye in the numerous fractures. The absorption spectrum is similar to that of dyed green jadeite except that the red end of the spectrum is transmitted slightly beyond 7000 Å (700.0 nm). *R.C.*

Lechleitner Synthetic Overgrowth

In 1959, J. Lechleitner of Innsbruck, Austria, announced the production of an emerald substitute that con-

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

Figure 3. Unusual number and variety of inclusions seen in a 0.90-ct faceted cubic zirconia.

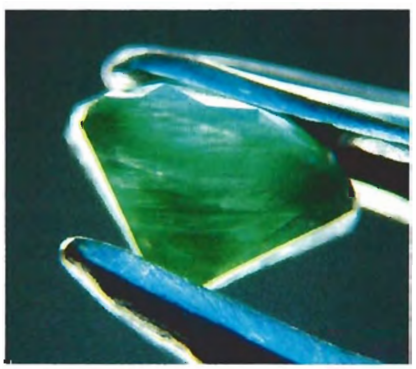


Figure 4. A translucent, dyed green brilliant-cut beryl. Magnified 20×.

sisted of a faceted colorless, or very lightly colored, natural beryl "seed" that was completely coated with a thin layer of synthetic emerald. This unique emerald substitute is frequently referred to simply as Lechleitner synthetic emerald, but is more correctly called Lechleitner synthetic emerald overgrowth.

The hydrothermal synthetic emerald coating is generally only a few tenths of a millimeter thick. To remove surface irregularities developed during the crystallization of the synthetic coating, all, or nearly all, of the facets are repolished, which considerably reduces the thickness of the synthetic overgrowth. As a result, the polished stones often have a lighter color and a greater transparency than the unpolished material. In some instances, repolishing may even remove all of the overgrowth on a few facets.

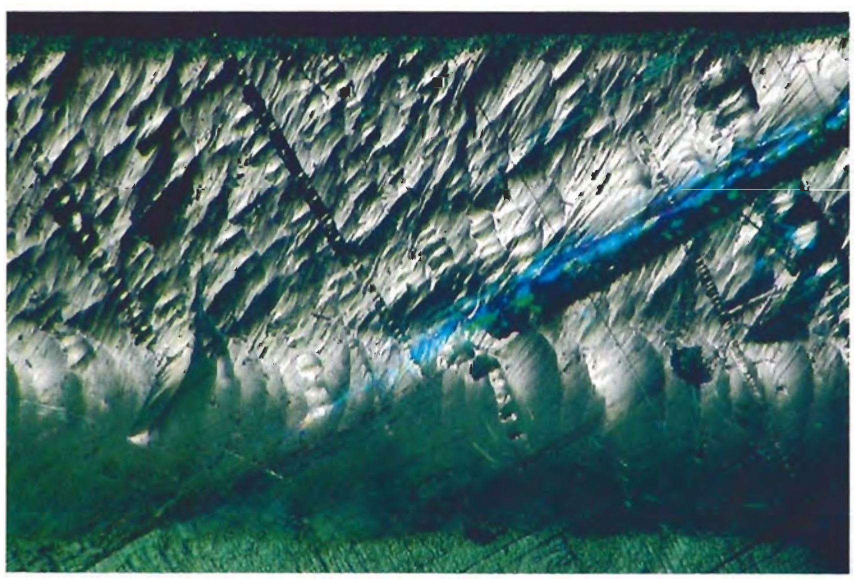
Occasionally some facets are not repolished, thus leaving the "rough" synthetic surface. The Los Angeles laboratory recently received such a stone for identification. Figure 5 shows this rough surface as viewed in reflected light. Figure 6 shows an adjacent facet viewed with dark-field illumination, which reveals the internal stress cracks that occur in the contact zone between the natural "seed" and the synthetic overgrowth layer. These stress cracks (which do not break the surface) are typical of the overgrowth process and immediately identify this material.

R.K.

ENSTATITE, Near Colorless

One of our clients recently purchased a 7.54-ct rough piece of what was purported to be a very rare mineral, ekanite. To conclusively identify the material, he sent the near-colorless crystal fragment (figure 7) to the Los Angeles lab. We were only able to obtain a vague refractive index spot reading of 1.66, with low

Figure 5. Surface characteristics of unpolished Lechleitner synthetic emerald overgrowth in reflected light. Magnified 35×.



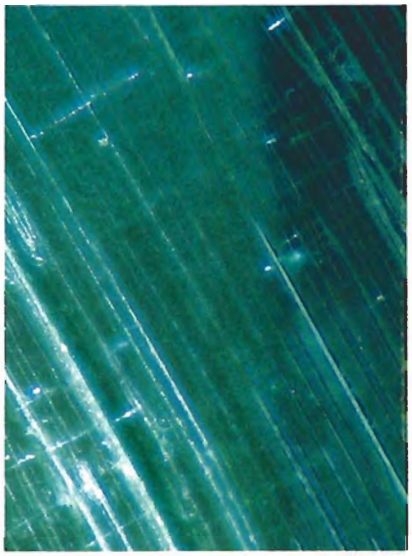


Figure 6. "Stress" cracks at the interface of the synthetic overgrowth and the natural seed of a Lechleitner "synthetic emerald." Dark-field illumination, magnified 25×.

birefringence, on one slightly concave polished surface. A biaxial optic figure was revealed in the polariscope with the help of immersion. Specific gravity was determined with heavy liquids to be approximately 3.10. In the spectroscope, we noticed the very sharp absorption line at 5060 Å (506.0 nm) that is characteristic of enstatite. Numerous inclusions were evident, but we could not identify them.

Figure 7. Near-colorless enstatite crystal fragment measuring approximately 16 × 10 × 8 mm.

Pure enstatite is a colorless magnesium silicate. It forms a continuous series grading into hypersthene as iron replaces some of the magnesium. Increasing iron results in an increase in the properties of the material, as well as a darkening of the color to yellowish green, brownish green, and brown. X-ray diffraction confirmed that the stone was enstatite. We had not previously encountered material this pure in the labs. *K.H.*

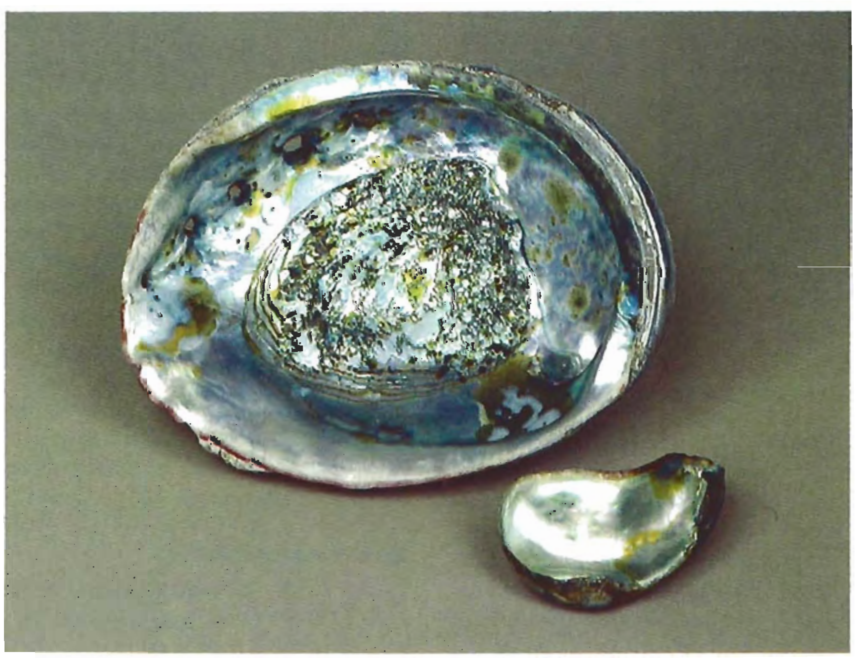
PEARLS

Abalone Pearl

We occasionally have the opportunity to examine a variety of calcareous concretions from various mollusks. The majority of them, including those from abalone, have nacre with orient and are therefore pearls. However, some have no nacreous layers or orient and so are not considered true pearls in the jewelry industry.

A few months ago, the Santa Monica and Los Angeles GTL staff were shown a Haliotis, or abalone, shell found off the northern Pacific coast at a depth of about 13 m (40 ft.). The shell, which measured approximately 17.5 cm in length, contained a multicolored baroque-shaped pearl (figure 8). The entire surface of the pearl (approximately 78 × 46 × 12 mm) was made up of nacreous layers that had an almost metallic luster, with the high orient that is very characteristic of an abalone pearl. An X-radiograph of the concretion was taken to reveal its internal structure; numerous concentric layers which closely followed the external baroque shape of the concretion confirmed its identity. *K.H.*

Figure 8. Abalone shell, 17.5 cm long, with the large pearl that it produced.



Accidental, or "Keshi," Pearls?

A strand of oval pearls reported to be "Keshi" came into the New York Gem Trade Lab for identification (figure 9). The pearls, which measured approximately 3.30 mm × 2.15 mm, were determined to be of saltwater origin by their lack of X-ray fluorescence. Their uniformity suggests that they are not "accidental," but the product of mantle-tissue implantation, probably in Australia. The X-radiograph in figure 10 shows that they are tissue-nucleated cul-

Figure 9. A strand of cultured pearls, represented as "Keshi." Average size is approximately 3.3 × 2.15 mm.

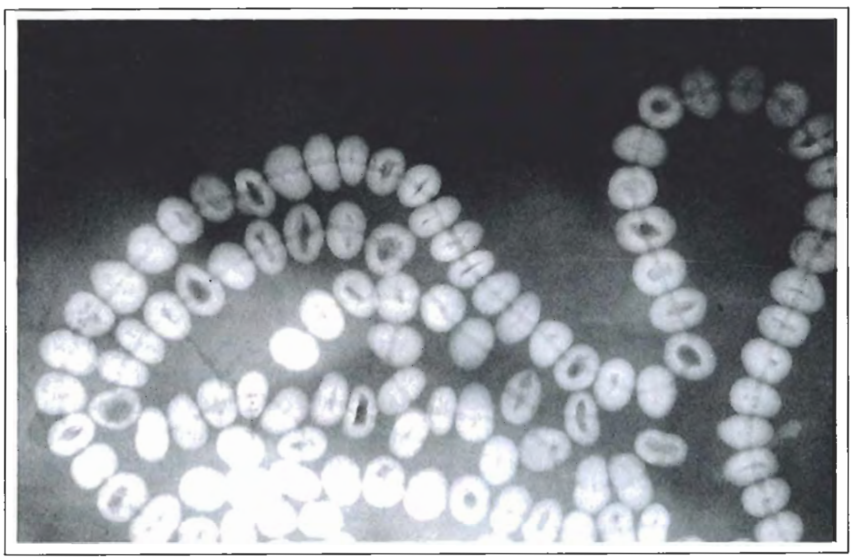


Figure 10. This X-radiograph of the necklace in figure 9 shows that they are tissue-nucleated cultured pearls.

tured pearls. Occasionally, however, a group of apparently tissue-nucleated cultured pearls will include some pearls that do not show on the X-radiograph the void that is evidence of tissue nucleation. Thus they are indistinguishable from natural pearls. Some people have reserved the term *Keshi* for these so-called "accidental" pearls. However, the original meaning of the term *cultured* or *cultivated,* taken from the French *perle de culture,* meant product of cultivating the pearl oysters. By this definition, any product of oyster cultivation is a cultured pearl—whether it is identifiable as cultured or not. In practice, though, if X-rays cannot separate an "accidental" from a natural pearl, the pearl is identified as natural. *R.C.*

Cultured Pearl Mystery

If an experienced gemologist were asked to give an opinion based on the X-radiograph shown in figure 11, he might say that the item appears to be a silver-dyed black cultured pearl necklace. His opinion would be based on the presence of white areas along the drill holes which are the result of silver from the dye having been deposited there. Since silver is opaque to X-rays, the film under it would not be exposed. However, the necklace that came into the New York lab for identification consisted entirely of normal-appearing white cultured pearls. We were at a loss to explain the white areas along the drill holes and within the conchiolin layers of some of the pearls. Perhaps a reader can suggest some explanation to us. *R.C.*

Imitation "Rice Grain" Biwa Cultured Pearls

If imitation is the sincerest form of flattery, then the costume jewelry trade has acknowledged the continuing interest in baroque forms of tissue-nucleated freshwater cultured pearls. Figure 12 shows a bracelet of imitation Biwa cultured pearls recently examined in our New York lab. The bracelet has been cleverly assembled to show the beads in different aspects, thus effectively imitating the variations one expects in Biwa freshwater cultured pearls. The appearance and symmetry of the beads suggested that they might be coated glass. We were surprised to learn, though, when the "essence de orient" was removed from one end of the beads (figure 13), that they were mother-of-pearl shell. *R.C.*

More Imitation Pearls

Figure 14 shows what appeared to be a 36-inch (90 cm) long twisted 20-strand necklace of seed pearls that

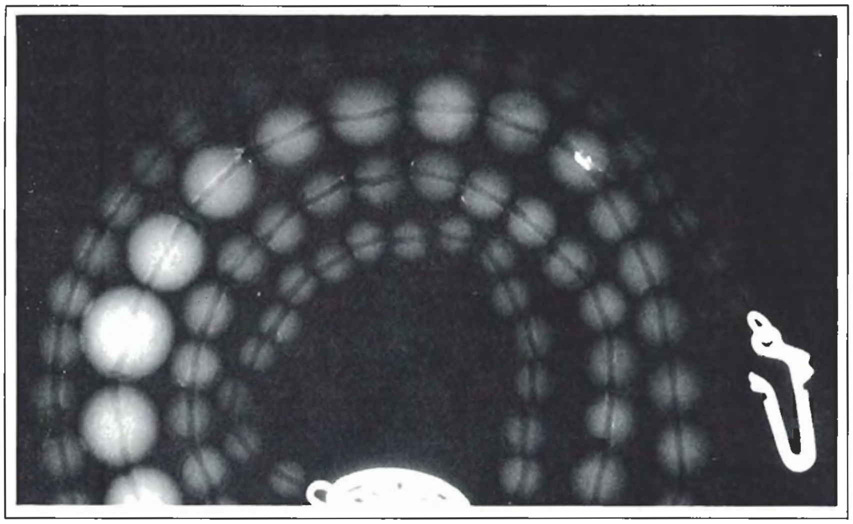


Figure 11. X-radiograph showing mysterious white areas in the drill holes of some white cultured pearls.

Figure 12. Imitation Biwa cultured pearl bracelet.

Figure 13. A single bead from the bracelet illustrated in figure 12 with the "essence de orient" partially removed to expose the mother-of-pearl center. Magnified 10×.

was sent to the New York GTL for identification. On close examination, the beads proved to be glass. An X-ray of the pearls (figure 15) shows the remarkable uniformity of size of the drill holes. Since drilling such small beads seems to be an almost superhuman task, we believe that the beads may have been made on a wire that was either later dissolved in acid, or was simply stretched to release them. *R.C.*

Natural Seed Pearls and Glass Imitations

Recently sent to the Los Angeles laboratory for identification was the

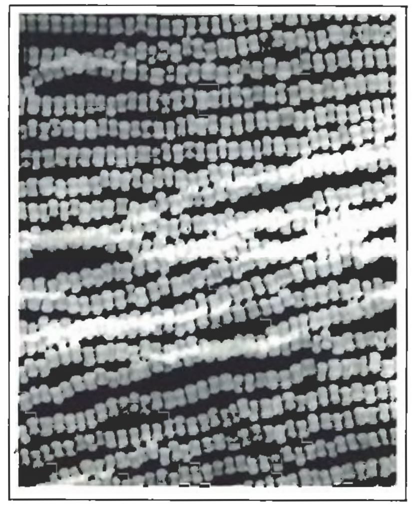


Figure 15. This X-radiograph of the imitation seed pearls shown in figure 14 reveals the similarity of drill hole size.

Figure 14. A 20-strand imitation seed pearl necklace.

necklace shown in figure 16. The necklace consisted of a natural-color, mottled green-and-white jadeite jade pierced carving suspended from a double-strand pendant composed of numerous translucent, white, round drilled beads set with one translucent white glass bead and one brownish pink tourmaline bead. The pendant was in turn suspended from a natural seed pearl necklace. Interestingly, although the double-strand white bead pendant predominantly consisted of natural seed pearls, these were interspersed with glass imitation seed pearls. The imitations were easily detected with microscopic examination. The string of the center pendant where the glass imitation seed pearls were appeared to have been damaged (again, see figure 16); perhaps this area had been broken and the glass beads added to replace some lost pearls. *R.K.*

Figure 16. Jade and pearl pendant suspended from a natural seed-pearl necklace. Some of the "pearls" in the pendant were subsequently identified as glass imitations.

TURQUOISE
"Hidden" Treatment

Presume that as a gemologist you are testing the blue cabochons set in the necklace illustrated in figure 17. The refractive index spot reading is 1.61, an iron line of moderate intensity centered near 4320 Å is observed through the spectroscope using the external reflection technique. Microscopic examination reveals a natural-appearing structure when viewed with overhead illumination. When tested with the thermal reaction tester, no evidence of paraffin or plastic stabilization is discovered, and no evidence of dye in matrix areas is detected when the cabochons are tested with an acetone-soaked cotton swab. All of your tests indicate that the material is natural turquoise. However, would you identify and/or appraise this material as completely natural untreated turquoise? Could these turqouise cabochons have been treated in a way that your testing did not reveal? Any closed-back bezel-set mounting such as is typical of "Indian" or "Southwestern" turquoise jewelry, as well as many other types of jewelry, can prevent complete viewing and testing of the gem material, and thus can conceal treated or assembled areas.

Since turquoise is a secondary mineral, it is often deposited as thin veins in various types of rock matrix. The view on the top left in figure 18 shows this thin formation with the matrix partially polished away to reveal the natural beauty of the turquoise. Veins of turquoise that are too irregular, or too thin to be fashioned into cabochons, are frequently backed with a metal-loaded epoxy cement mixture (figure 18, top right), which adds thickness, strength, and weight to the shaped and polished cabochon (figure 18, center). The

Figure 17. Turquoise cabochons in a closed-back bezel-set mounting.

Figure 18. Top left: a thin layer of turquoise in matrix. Top right: turquoise backed by a metal-loaded epoxy cement. Center: finished backed cabochon.

backed turquoise is then bezel set in a closed-back mounting, thus hiding the backing. This type of turquoise treatment is generally accepted among turquoise dealers. However, the price of backed turquoise is generally much lower than unbacked turquoise of equal quality. Therefore, this type of treatment should be disclosed.

It is suggested that any identification report or appraisal of a gemstone that is bezel set in a closed-back mounting and cannot be removed from that mounting be adjusted to reflect the fact that testing was done only to the extent that the mounting permitted. This should be considered with any gemstone that may be commonly treated or assembled. For example, a bezel-set closed-back mounting can conceal the separation plane of an opal doublet or hide an artificial filling in the cavity of an opal (see *Gems & Gemology*, Fall 1983, pp. 162–164).

R.K.

PHOTO CREDITS

Ricardo Cardena took the pictures in figures 4 and 9–13. Shane McClure is responsible for figures 1, 3, 7, and 16. Robert Kane is credited with figures 2, 5, 6, and 17. Figures 8 and 18 are the work of Michael Havstad. Andrew Quinlan took the photos in figures 14 and 15.