GEM TRADE LAB NOTES

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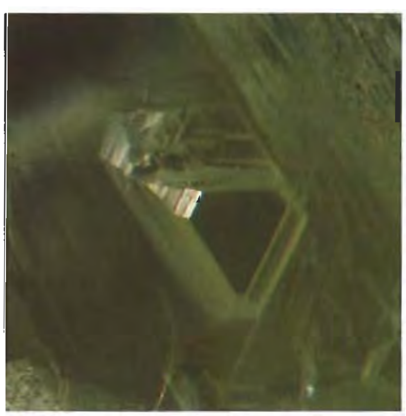
DIAMOND

With Hexagonal Indented Natural

Triangular depressions (usually referred to as trigons) that are sometimes present on the octahedral faces of diamond crystals can occur in two orientations: They are referred to as "positive" when they point in the same direction as the crystal face and "negative" when they point opposite the crystal face. Numerous studies and observations have proved that both types of trigons can result from either the growth process or from chemical etching (see, e.g., "Etch Pits on Diamond Surfaces," by A. R. Patel and S. Ramanathan, *Philosophical Magazine,* Vol. 7, No. 80, 1962, pp. 1305–1314). If the temperature and/or composition of the surrounding solution varies during formation of the trigons, a reversal in orientation is possible. Thus, both positive and negative depressions can occur in separate areas of the same octahedral plane, or they may be superimposed in such a way that features with a distinctly hexagonal outline develop. In the latter case, either the positive or the negative form will usually dominate, creating mostly cut-cornered triangle shapes (figure 1). However, if the reversal is equal in extent, a perfectly symmetrical hexagon can occur.

Figure 1. This 1.35-ct light greenish yellow diamond crystal shows a predominantly positive trigon that has been modified by a negative trigon, thus creating a cut-cornered triangular indented natural on the octahedral face. Magnified 35×.



A striking example of this was recently seen in the West Coast laboratory: Examination of a 1.55-ct fancy gray-yellow pear-shaped diamond with magnification revealed an indented natural that displayed a hexagonal outline where it reached the surface of a bezel facet on the tip of the stone. What was so extraordinary was the combination of symmetry and depth that resulted in a hollow hexagonal column extending deep within the stone (figure 2). Shallow geometric features are common on the surfaces of rough crystals and sometimes appear as naturals on cut stones, but an example as dramatic as this is rarely seen in a faceted stone.

Christopher P. Smith

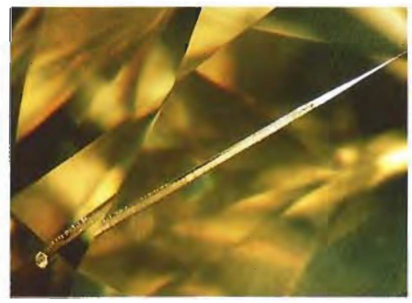


Figure 2. The hexagonal outline of a columnar indented natural is readily visible in the bezel facet of this diamond. The striations seen across the width of the inclusion, running down the entire length of the column, are parallel to the octahedral faces and indicate the orientation of the faceted stone to the original crystal. Magnified 20×.

Type IIb with Natural Irradiation Stains

In the laboratory, we often observe natural irradiation stains on rough and sometimes even polished diamonds. They are thought to be caused by the proximity of the diamond crystal to a natural source of radiation. Although such stains may be green, they are usually brown because of exposure to heat either in the earth or during fashioning.

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

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Figure 3. Irradiation stains can be seen on the girdle of this type IIb fancy blue diamond. Magnified 60×.

These stains have been seen on some type Ia and IIa diamonds and, rarely, on type Ib diamonds (for a brief discussion of diamond types, see *Gems & Gemology,* Winter 1986, Vol. 22, No. 4, p. 197). Recently, the East Coast laboratory observed brown irradiation stains on a type IIb fancy blue diamond. Figure 3 shows several small stains on the girdle of this 0.40-ct old European–cut brilliant. To our knowledge, this is the first time irradiation stains have been reported on a type IIb diamond.
DH

PEARLS

Cultured Pearl, Accidentally Tissue-Nucleated

To the best of our knowledge, there is no commercial operation to tissue nucleate saltwater mollusks for the production of cultured pearls. Therefore, when we identify such a tissue-nucleated pearl, we assume that it is the result of bead-nucleus rejection or some other mishap in the nucleation process.

The East Coast lab recently examined what may be the largest such "accidental" saltwater tissue-nucleated cultured pearl we have yet encountered: At 12 mm × 10.50 mm, this baroque cultured pearl weighed 15.17 ct. The X-radiograph (figure 4) clearly shows a void that is typical of tissue nucleation. *GRC*

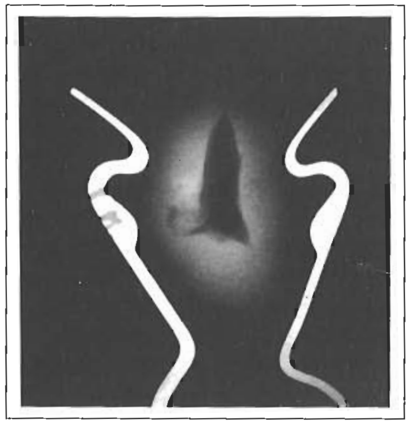


Figure 4. This X-radiograph clearly shows the void typical of tissue nucleation in this unusually large (15.17 ct) "accidental" saltwater tissue-nucleated cultured pearl.

Green-Dyed Natural Pearls

Most jewelers and gemologists are familiar with the wide range of colors seen in dyed freshwater cultured pearls, most commonly green, yellow, purple, and blue. Dyed saltwater natural pearls, however, are typically gray to black and "bronzy"; other strong colors are virtually unknown.

Figure 5. All of the 111 natural pearls in this necklace—ranging from 3.40 to 7.05 mm in diameter—had been dyed green.

We at the East Coast laboratory were, therefore, somewhat surprised to identify as natural a long necklace of graduated saltwater pearls with a decidedly unnatural green to gray-green appearance (figure 5). Magnification revealed green dye concentrated around the drill holes and distributed just below the surface in conjunction with iridescent rings.
GRC

Natural- and Treated-Color Black Cultured Pearls in the Same Necklace

The East Coast laboratory examined a fine necklace of what appeared to be 39 black pearls graduated from 9.75 to 13.25 mm. X-radiography not only proved that all of the pearls were cultured, but it also indicated that, because two of the pearls showed lower contrast on the film between the shell bead and the nacre, they were probably treated. While the necklace was being prepared for X-radiography, the same two pearls had appeared browner in the immersion fluid (figure 6), thus providing another useful clue to their true nature.

Figure 6. Immersed in film cleaner in preparation for X-radiography, the two dyed cultured pearls appear brown when compared to the others in this necklace.

Natural-color black pearls appear a faint brownish red when exposed to long-wave ultraviolet radiation, while dyed pearls appear chalky green. As expected, these two pearls turned chalky green when exposed to long-wave U.V.

This particular necklace emphasizes the importance of careful examination and testing because, be-

Figure 7. It is impossible to detect a difference in color between the two dyed cultured pearls (arrows) and their natural-color counterparts.

fore testing these two treated-color cultured pearls looked just like their natural counterparts (figure 7).

Nicholas DelRe

Remarkable Cultured Pearl

The East Coast laboratory received a very unusual pearl for identification.

Figure 8. This "hollow" bullet-shaped natural-color cultured pearl measures approximately 11.6 to 12 × 11.3 mm and weighs 9.62 ct. Note the opening in the base.

The hollow, partly worked, gray bullet-shaped cultured pearl shown in figure 8 proved to be of natural color and is probably from the Tahiti area. Looking through the base of the pearl (figure 9), however, we saw a black round cultured pearl nearly filling the hollow space. The X-radiograph (figure 10) shows that the nacre of the round pearl is unusually thin for natural-color cultured pearls from this area.

It is intriguing to speculate how this specimen grew. Probably, the round pearl started growth normally in a pearl sac. If it was somehow ejected from the pearl sac and became lodged on the shell, then the resulting bullet-shaped pearl would be considered a blister. However, how such a blister would have the round pearl at the apex of the dome rather than at the base is puzzling. One possible explanation is that the blister pearl formed on the upper shell of the mollusk, and gravity caused the round pearl to somehow fall free of the shell and thus become part of the inside of the rounded part of the blister. *GRC*

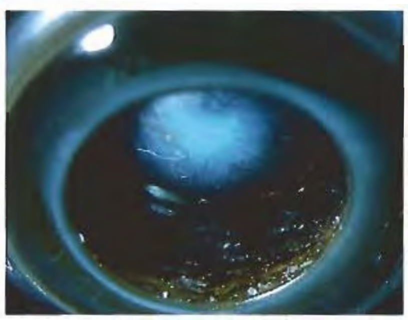


Figure 9. The "hollow" cultured pearl in figure 8 was found to contain a mysterious round black cultured pearl, seen here toward the apex of the dome. Magnified 10 ×.

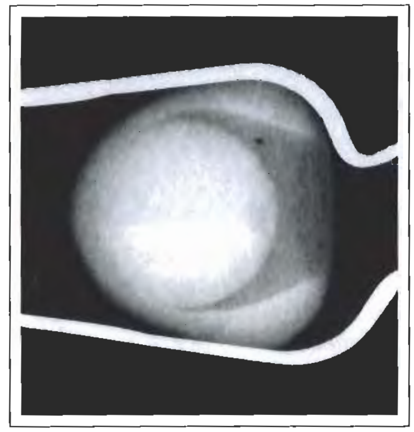


Figure 10. The X-radiograph of the cultured pearl in figure 8 shows the very thin nacre on the round pearl inside.

A "Teething" Problem

Informal testing methods may lead to inaccurate conclusions if not backed up with more rigorous tests. A good gemologist usually relies on several tests to arrive at an accurate identification.

The East Coast laboratory received for identification the beautiful pendant earclip shown in figure

Figure 11. The 17.65-mm cultured pearl in this earclip was first thought to be an imitation because it felt smooth when rubbed carefully along the edge of a tooth.

11. It was set with what appeared to be a half-drilled pearl measuring approximately 17.65 mm in diameter. A cursory examination of the color and luster with the unaided eye and a "tooth test" initially led us to believe that this was an imitation pearl. The tooth test indicated that the surface was smooth, a characteristic of imitation pearls. A natural or cultured pearl will almost always feel gritty when carefully rubbed along the edge of a tooth.

An X-radiograph followed by closer examination with magnification revealed that this was a cultured pearl with a worked surface. Polishing lines could be seen running across the nacre. Undoubtedly, the worked surface caused the smooth "tooth test reaction," falsely indicating that the pearl was imitation.

Nicholas DelRe

"Treated" Mabe Pearls

At the February 1991 Tucson show, several staff members noticed an abundance of quite attractive, but relatively inexpensive, white mabe assembled blister pearls. The majority measured between 15 and 20 mm in diameter, displayed a very high luster, and showed very strong pink overtones. However, some of them showed a slightly spotty, uneven color distribution that raised suspicion that they had undergone some kind of enhancement.

Figure 12. When one of these two 15.5-mm mabe pearls was sawed in half, the mother-of-pearl base, plastic dome, and very thin nacre layer were evident (left). Note also the coating on the plastic dome (right).

Subsequently, the West Coast laboratory received a few samples from a gem merchant who wanted to share his observations regarding this type of mabe pearl. Out of curiosity he had cut one mabe pearl in half to expose the interior. Figure 12 shows the two halves together with another "whole" mabe pearl. The three layers that make up this mabe assemblage – mother-of-pearl base, plastic dome, and outer layer of nacre – are clearly visible in the half on the left.

It was interesting to note that the nacre layer was extremely transparent and ultrathin (measured to be approximately 0.25 to 0.30 mm). In spite of the layer being so thin, our client succeeded in separating it from the plastic dome. We could now see that a very fine, highly reflective coating had been applied to the plastic dome (the sample on the right in figure 12). The texture of this layer reminded us of the "pearl essence" commonly used for imitation pearls. The GIA Research Department obtained an infrared spectrum on this layer and determined that it was just a lacquer, rather than the true, organic "pearl essence." It was obvious, though, that the lacquer improved luster and overtone on these mabe pearls. *KH*

Two Different Mabe Pearls

The East Coast laboratory received a pair of loose mabe assembled blister pearls, with the request that we "determine if they are natural." Both were of very similar outward appearance and weight. Although a mabe pearl by definition is never "natural," the X-radiograph (figure 13) did reveal that the two samples were constructed quite differently. It shows that one is a typical mabe with thin nacre and a shell hemisphere insert, while the other mabe lacks a shell bead insert, but seems to be filled with a substance that is relatively transparent to X-rays and approximates the specific gravity of shell, since the two mabes weigh approximately the same. A layer that is opaque to X-rays appears to line the inside of the nacre in both mabe pearls. *GRC*

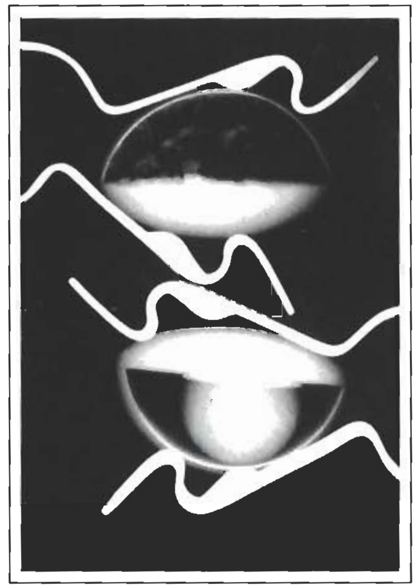


Figure 13. Although these two mabe pearls are similar in outward appearance, X-rays reveal that one has a shell bead insert and the other does not.

Early SYNTHETIC RUBIES

Staff members in the East Coast laboratory were particularly excited to examine the ruby and diamond pendant shown in figure 14. Only eight of the 94 calibre-cut red stones (each approximately 3–4 mm long) are natural rubies; the balance are synthetics, possibly of the early type known as "Geneva rubies." Judging from the cut of the diamonds and the design and workmanship of the pendant, the piece could well have been manufactured before the turn of the century.

This was a very trying time for the jewelry industry, as it was being faced with two of the most difficult identification problems in its history. The introduction in 1895 of the solid cultured blister pearls grown by Mikimoto and sold as "Japanese" pearls presented a new challenge in identification. At about this same time, "Geneva rubies" began to appear in the gem industry. These were pro-

Figure 14. This pendant was determined to contain diamonds and eight natural rubies together with 86 synthetic rubies that appear to be of early manufacture.

duced as small, "shoe button"–shaped boules from approximately 1884 until 1904, when Verneuil's larger, more practical product became available. "Geneva rubies" were characterized by very tightly curved striae, prominent gas bubbles, strain cracks, and colorless areas, as well as by areas of black-appearing foreign material. These features must really have confused a jeweler a hundred years ago. One could almost say that modern gemology started then, with these products of "modern" technology.

The "Geneva rubies" had been identified as "artificial" as early as 1886, and the French Syndicate of Diamonds and Precious Stones ruled that they must be sold as man-made. It is likely, though, that their availability in small sizes may have influenced their use in items such as the pendant shown in figure 14 more than their cost.

Figure 15 (taken through the pavilions of the stones) shows a natural ruby on the left and a synthetic on the right. The natural ruby has a low-relief, subhedral crystal and prominent color zoning. The synthetic also has color zoning, including colorless areas, as well as large, irregular gas bubbles—an appearance very similar to that of the natural stone. However, the synthetic rubies had a characteristically stronger fluorescence to short-wave U.V. radiation. Most of the other synthetics also had color zoning, as well as gas bubbles; magnification revealed a black foreign material in some of the synthetic rubies (figure 16). Such black material is occasionally seen in modern Verneuil synthetics; a Swiss manufacturer reports that this is actually unmelted alumina. We did not observe curved striae in any of the stones, but microscopic examination was restricted due to the settings.

GRC

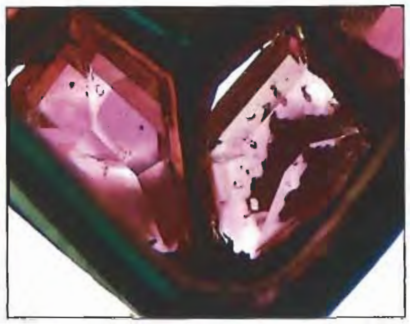
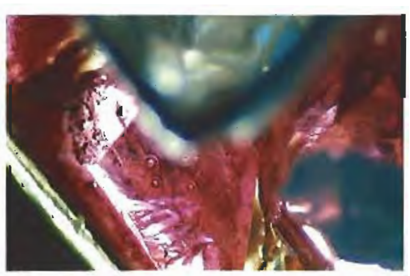


Figure 15. The apparent internal similarities between the natural ruby on the left and the synthetic ruby on the right, both from the pendant shown in figure 14, illustrate the difficulty jewelers must have had identifying these synthetics when they first appeared. Magnified 30×.

Figure 16. Spherical gas bubbles and a black material are clearly seen in the synthetic ruby on the left. (The smudge on the stone on the right was used to indicate for the client that it is natural.) Magnified 45×.



Diffusion-Treated SAPPHIRES in Fine Jewelry

Around 1979, diffusion-treated sapphires were encountered frequently in the trade and a number were submitted to the GIA Gem Trade Laboratory for identification. The first Lab Note regarding diffusion-treated sapphires appeared in the Fall 1979 issue of *Gems & Gemology* (p. 195). Although the first one we saw in the East Coast laboratory was red-orange, practically all of the diffusion-treated sapphires we subsequently examined were blue. That initial influx of diffusion-treated blue sapphires was short-lived, and in time we saw fewer and fewer of them in the trade.

It is important to remember that some treatments appear to be cyclical. At one point they are widespread, and then they seem to all but disappear, only to reappear at a later date. Diffusion-treated blue sapphires seemed to reemerge in the trade at the 1990 Tucson Gem Show; an in-depth article on this treatment process and recent developments was published by R. Kane et al. in the Summer 1990 issue of *Gems & Gemology.*

Over the last year, the laboratories on both coasts have seen a strong comeback for diffusion-treated sapphires and some dramatic examples of how they are being used. The East Coast laboratory recently saw an important gold and diamond necklace that was set with five rather large (4–5 ct) diffusion-treated sapphires, as well as a matching ring set with an even larger diffusion-treated stone. Within the same time frame, the West Coast laboratory received matching sapphire earrings (each 5–6 ct) and a ring (approximately 10 ct) set in gold with diamonds. Again, the large stones were found to be diffusion treated.

This jewelry could be a glimpse of what is to come. Care must be taken by the jeweler when examining all sapphires, since any natural inclusions that might be seen with the microscope will not distinguish a stone that has simply been heat treated from one that has been diffusion treated. Immersion, as described in the above-mentioned article, is still the best method to identify diffusion treatment whether the stone is mounted or unmounted. *DH*

FIGURE CREDITS
Figure 1 was taken by Robert Kane. Shane McClure is responsible for figure 2. Dave Hargett took figure 3. The pictures in figures 5-9, 11, and 14-16 were supplied by Nicholas DelRe. Robert Crowningshield produced the X-radiographs in figures 4, 10, and 13. William Videto furnished figure 12. Tino Hammid took the photo used in the Historical Note section.

A HISTORICAL NOTE

Highlights from the Gem Trade Lab 25, 15 and five years ago

FALL 1966

The New York lab discussed various types of synthetic growth processes, from hydrothermal overgrowth on Lechleitner stones to flux-grown synthetic ruby. Several photos illustrated the difference in transparency to short-wave ultraviolet radiation that is still a valid test to separate natural (more opaque) and synthetic (more transparent) stones. A diamond that had been presented as the finest natural-color green diamond next to the Dresden Green revealed an umbrella-like color zoning around the culet that proved that it had been cyclotron treated.

With the technology provided by laser sawing, fanciful cuts such as this 12-mm sailboat and tennis racket can be obtained from otherwise difficult-to-cut pieces of rough.

FALL 1976

The Santa Monica lab had the opportunity to examine a snuff bottle reportedly carved from rare hornbill ivory. Our examination revealed that the bottle had been assembled from different parts of hornbill, rather than carved from a single piece. This lab also noted unusual devitrification around a spherical gas bubble in glass.

The New York lab illustrated various materials used to simulate emerald, as well as selectively dyed, fine-grained calcite used to imitate jadeite jade. Even today, we still encounter such material, which has been dyed to represent multicolored jadeite – green and white, purple and white, or even all three colors in the same piece.

FALL 1986

Diamonds laser cut in the unusual shapes of a sailboat and a tennis racket were illustrated. A rather complete discussion of light green diamonds and what might be the reason for the color was given. We recommend that the reader review this item in particular (p. 171), as it is still important today. The 10- to 12-mm gray cultured pearls in an attractive brooch and earring set were of interest because their centers were determined to be filled with a white material resembling French pearl cement. There was no bead nucleus.