Gem Trade LAB NOTES

Phenomenal CHRYSOBERYL

The West Coast laboratory recently identified a 20.12-ct dark greenish brown cat's-eye chrysoberyl that displayed unusual phenomena. The gemological properties of this gemstone were typical of cat's-eye chrysoberyl: 1.75 spot refractive index, inert to long- and short-wave ultraviolet radiation, and the strong absorption spectrum typical of a "rich brown" chrysoberyl. Characteristic chrysoberyl inclusions were also observed.

The phenomena displayed by this stone, however, were not typical. When the cabochon was placed flat on its base and viewed from directly above, illuminated by a single overhead light source, a strong chatoyant band (cat's-eye effect) was observed. Yet, when the stone was viewed at an oblique angle from the apex, an additional weaker ray could be seen crossing the chatoyant band to form a four-ray star (figure 1). *RK*

Figure 1. This 20.12-ct cat's-eye chrysoberyl shows a very unusual four-ray star when viewed at an oblique angle.

DIAMOND

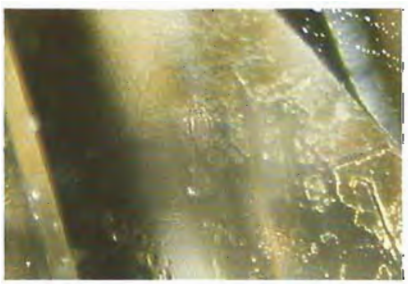
"Coated" Diamond

A jeweler asked the East Coast laboratory to determine why his customer's very light pink diamond, set in a ring, had apparently turned brown. Using magnification with an overhead light source, we observed a brownish residue (figure 2) on the diamond.

The jeweler mentioned that neither steam nor ultrasonic cleaning would remove the offending material. In fact, this diamond had changed color once before and had been sent to a diamond cutter to be repolished. We recognized that this "coating" was the result of the ring being worn in an area that has hard water.

Concentrated sulfuric acid will remove the coating. A similar case was reported in the Summer 1976 issue of *Gems & Gemology* (p. 182). *DH*

Figure 2. Exposure to hard water has resulted in brown chemical deposits on the surface of this pink diamond that cannot be removed by either steam or ultrasonic cleaning. Magnified 45×.



Diamond Cube with Cloud-like Inclusion

The Summer 1976 issue also showed a polished cube of diamond with a central symmetrical cloud (p. 181). At the time, we were disappointed that the photo did not reproduce clearly the cross that could be seen within the cloud. However, it did suggest the fact that the cross could be seen in every face of the cube.

We are indebted to the owner for allowing our East Coast laboratory to rephotograph the cube. Figure 3, taken directly through one of the faces, also clearly shows the ghostly frame around the cloud, which the original photograph failed to record. A more magnified view of the cross (figure 4) illustrates its needle-like composition. Note, too, that the weight was reported incorrectly in the earlier article; the cube actually weighs 8.70 ct. *RC*

Fancy Intense Yellow Diamond with a Green Irradiation Stain

The East Coast laboratory recently examined a 1.68-ct fancy intense yellow, natural color, cushion octagon-shaped modified brilliant-cut diamond. The green irradiation stain on the pavilion (figure 5) is the first such

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

Figure 3. A cross can be clearly seen in this unusual cloud inclusion observed in an 8.70-ct diamond cube.

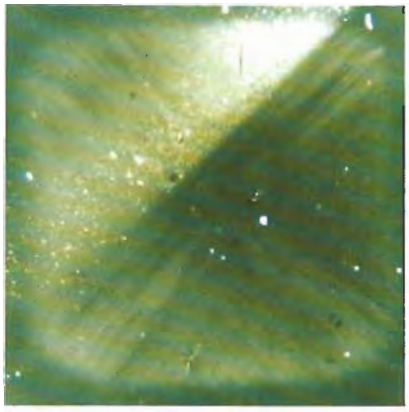


Figure 4. Magnification (here, at 45×) reveals the needle-like composition of the cross shown in figure 3.

Figure 5. A green irradiation stain visible at 60× magnification on this facet junction is a good indication that the color of this fancy yellow diamond is natural.

stain this lab has seen on a naturally colored fancy yellow diamond.

With the Beck "hand-held" spectroscope unit, the diamond displayed a rich cape series spectrum. It also displayed a fine absorption line at about 520 nm. This line is occasionally observed in intense yellow cape-series diamonds. The diamond showed no evidence of irradiation in its spectrum, and the fact that the irradiation patch was still green is another indication of natural color. If irradiation patches were present on a treated yellow diamond, the heat from the annealing process that must be used to create an artificial yellow color would cause them to turn brown. Brown irradiation stains also occur, if rarely, on natural yellow diamonds. *DH*

Naturally(?) Irradiated Diamond Rough

From time to time, dealers will submit unusual rough diamonds to the laboratory for examination. One such diamond, seen recently by the East Coast staff, is an irradiated cubic crystal that had been sawed into two pieces. The larger, 24.45-ct piece of the crystal is still green, while the smaller, 4.85-ct piece is now near colorless (figure 6).

Both pieces of rough had brown irradiation stains (figure 7). Such irradiation stains occur on natural diamond rough; however, subsequent laboratory irradiation is always possible. Figure 7 also shows the irregular coloration of the larger stone. *DH*

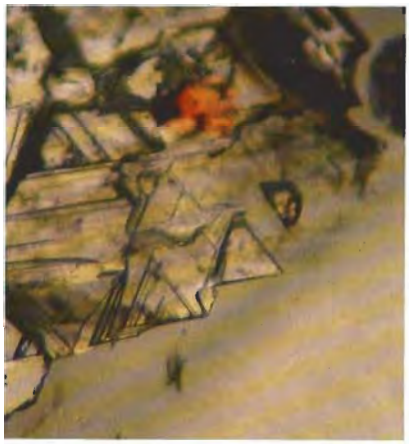


Figure 7. Brown irradiation stains, as seen here in the larger diamond in figure 6, were present in both stones. Note also the irregular green color zoning. Magnified 60×.

Figure 6. The larger (16.7 × 16.1 × 11.6 mm) of these two sawed sections from the same diamond crystal is still green, while the smaller one (15.7 × 10.8 × 4.2 mm) is near colorless.

EMERALD, with Plastic-like Filling

A number of items have been published on natural rubies—and, rarely, sapphires—with glass-like fillings. Recently, we identified an approximately 33-ct natural emerald that showed a similar type of "repair" (figure 8). Even though the emerald was heavily included, a group of small gas bubbles became visible under low magnification in a small area close to the pavilion, showing where the cavity had been filled. When the stone was exposed to long-wave U.V. radiation, the same area fluoresced a strong bluish white. Although we did not determine the exact identity of the filling, the fact that it could be indented easily with a pin probe suggests that the filler is a plastic-like substance. Strong yellow fluorescence in all the fractures indicated that the emerald was also heavily oiled. *KH*

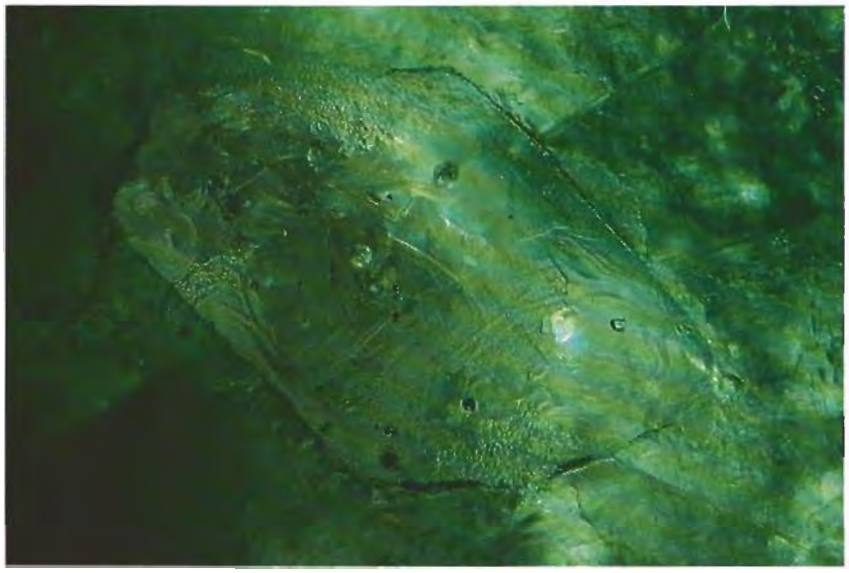


Figure 8. Bubbles are evident in this soft, plastic-like filling in a 33-ct emerald. Magnified 10×.

Imitation
LAPIS LAZULI
Dyed Blue Calcite Marble

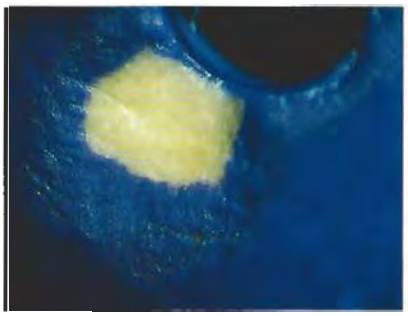
The West Coast laboratory was asked to identify a single-strand necklace with uniform beads that were purported to be lapis lazuli. The 68 opaque blue round drilled beads averaged approximately 10.4 mm in diameter (figure 9). There was no reaction to long- or short-wave U.V. radiation. With the microscope, we noted a slightly mottled appearance. Using the refractometer for a spot test on several beads, we obtained vague R.I.'s from around 1.4 to 1.6, with a blink suggesting a carbonate.

Care must be taken when testing for a carbonate reaction with a weak HCl solution. Because this is a destructive test, it should be performed only in an inconspicuous area, under magnification. Effervescence did occur when a tiny droplet of 10% HCl solution was applied to one of the beads, thus confirming that the material is a carbonate.

Magnesite was ruled out here because it does not react to room-temperature 10% HCl solution. However, one of the beads had a chip near the drill hole that not only revealed the shallow penetration of blue dye, but also showed the true pale yellow color of the material and its structure (figure 10). Incidentally, when we tested this bead for dye with an acetone-soaked cotton swab, no stain was produced, but when a 10% HCl solution was used, a light blue stain appeared on the cotton. The structure appeared to be too fine for dolomite, but did match known samples of dyed calcite marble (see the Fall 1985 issue of *Gems & Gemology*, p. 172). X-ray diffraction analysis provided a pattern that matched that of calcite. *RK*

Figure 9. The approximately 10.4-mm beads in this necklace were believed to be lapis lazuli, but proved to be dyed calcite marble.

Figure 10. A chipped area near the drill hole in one of the beads shown in figure 9 reveals the shallow penetration of the dye as well as the internal structure and natural yellow color of the calcite. Magnified 25×.



X-ray Transparency Separates Two Imitations

Only occasionally does the laboratory use X-radiography for a purpose other than pearl determinations. One feature that we occasionally do test for is transparency to X-rays. For example, no transparent stone resembling diamond is as transparent to X-rays as diamond itself is.

Recently, the East Coast laboratory decided to use this X-ray comparison test on a handsome necklace of opaque blue beads with yellow metal spacers. The jeweler's client had complained that the necklace was staining her skin, so dyed lapis was suspected. The lack of U.V. fluorescence suggested dye, but the R.I. and overall appearance of the beads eliminated lapis. In fact, the beads did not all have the same appearance. Twenty-one proved to be dyed calcite, and 43 were so-called "Swiss lapis" (dyed jasper). With the X-ray transparency test, it was possible to separate the two types of beads quickly. As figure 11 demonstrates, the dyed calcite shows up whiter (less transparent) than the dyed jasper. This transparency to X-rays of different gem materials and gem simulants is discussed briefly in R. Webster, *Gems*, 4th ed., 1983, pp. 865–867. *RC*

Figure 11. With an X-ray transparency test, calcite (the whiter beads in the photo) can be separated from jasper, which is less opaque.

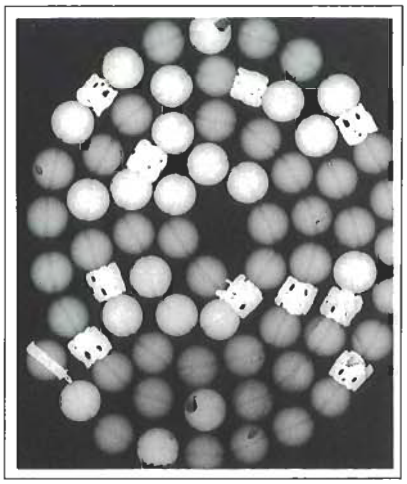


Figure 12. The color of this attractive 15-mm button-shaped pearl is one indication that it originated in a cherrystone clam.

Cherrystone Clam "PEARL"

Our West Coast laboratory recently examined a very attractive 15-mm button-shaped pinkish purple calcareous concretion that was set in a yellow metal lady's ring (figure 12). With magnification we noticed a faint, but distinct, alveolar (pitted, honeycomb-like) structure. The color and this structure indicate that the concretion had been formed in a cherrystone clam rather than in a Conch or Tridacna. Concretions formed in either of these mollusks would show a characteristic flame-like pattern, as has been described in earlier *G&G* Lab Notes, Fall 1982 and Winter 1987. *KH*

RUBY, Natural Color

The West Coast laboratory recently received for identification a beautiful 3.02-ct natural-color ruby, reported to be of Burmese origin. The refractive indices were typical of ruby, 1.762 and 1.770, with a corresponding birefringence of 0.008. The chromium-rich nature of this ruby was evident not only in the magnificent color, but also in the characteristic absorption spectrum and the strong red fluorescence when exposed to long-wave U.V. radiation.

When examining this stone under the microscope, we observed a classic inclusion scene. In this day and age when heat-treated rubies and sapphires are the rule rather than the exception, it is a rare treat for the gemologist to see the unaltered characteristic inclusions that indicate a natural-color Burma ruby. Easily visible with darkfield illumination were several euhedral calcite crystals entangled within a dense concentration of color swirls, commonly referred to as the "treacle effect" (figure 13). When oblique illumination was added via a fiber-optic light unit, a small "nest" of intersecting short, thin rutile needles was observed (figure 14). *RK*

Figure 13. Euhedral calcite crystals in a dense concentration of color swirls represent a characteristic inclusion scene for rubies from Burma. Darkfield illumination, magnified 30×.

Figure 14. With fiber-optic illumination, a characteristic "nest" of short rutile needles can be seen in the same 3.02-ct ruby shown in figure 13. Magnified 30×.

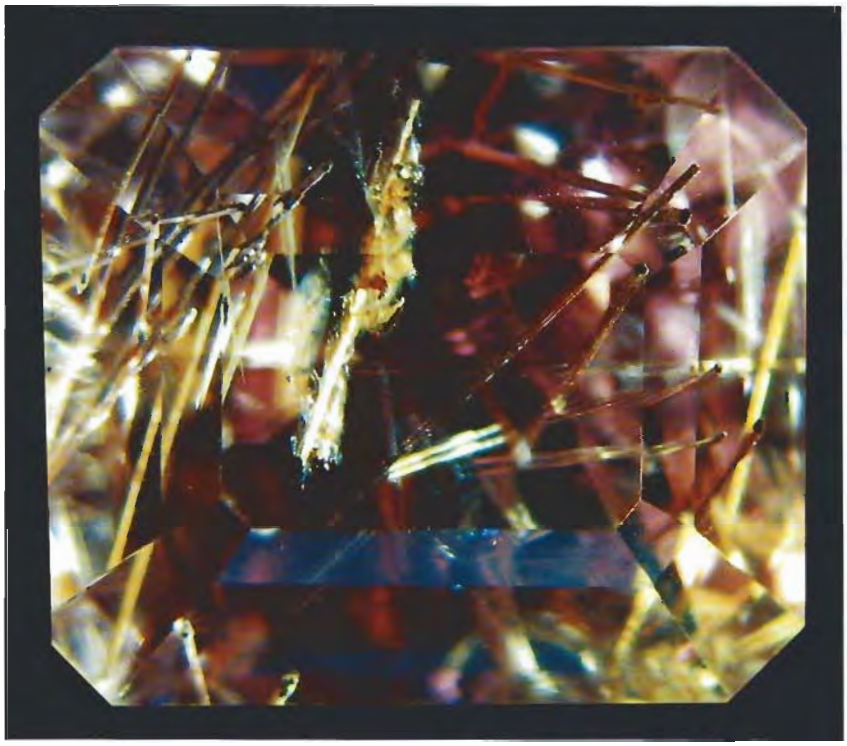


Figure 15. These inclusions in a zircon from Orissa, India, appear to be intermixed rutile-hematite. Darkfield and oblique illumination; magnified 3.5×.

An Unusual ZIRCON

A zircon recently sent to us for examination in Santa Monica proved to contain some rather interesting inclusions of a type we had not encountered in zircon before. The gem itself was a transparent pinkish purple emerald cut that weighed 3.50 ct and measured approximately 8.00 × 6.70 × 5.55 mm. It was reported to have come from Orissa State, in India, and was interlaced with a number of eye-visible acicular inclusions with a dark brown to orangy yellow color (figure 15). With the microscope, we observed that the needle-like inclusions were actually an almost black, submetallic brown, and the yellow color, wherever it was present, was a thin surface coating that apparently resulted from alteration of the underlying inclusion. In cross-section, the inclusions had either an almost circular, or a stretched pseudohexagonal, habit that made them appear to be either tetragonal or possibly orthorhombic.

Several of these inclusions reached the surface of the stone, so they were ideally suited for X-ray diffraction analysis. A diamond-tipped scraper was used to remove a minute amount of powder from one of the inclusions. This powder was mounted on a glass spindle, placed in a Debye-Scherrer powder camera, and run for seven hours in an X-ray beam generated from a copper target tube at 46 kV and 26 mA. The results showed the presence of three different mineral compounds: rutile, hematite, and zircon.

The zircon was undoubtedly from contamination by the host. This left the rutile and hematite. The yellowish iron staining observed on the inclusions indicates the presence of iron. Iron is a necessary component of hematite, and rutile can also contain significant amounts of iron. If a polishing compound containing any iron oxide had been used on the stone, this might account for the hematite, leaving only rutile. It is more likely, however, that the acicular inclusion tested is an intermixed crystal of both hematite and rutile.

John I. Koivula

FIGURE CREDITS

Figures 1, 9, 12, and the Historical Note photo are the work of Shane McClure. Figures 2-7 were taken by Dave Hargett. The photomicrograph in figure 8 is by John I. Koivula. Figure 11 is by Robert Crowningshield. Robert E. Kane supplied figures 10, 13, and 14. Figure 15 is © Anthony de Goutière.

A HISTORICAL NOTE

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

SUMMER 1964

The New York laboratory reported seeing synthetic emerald overgrowth on beryl. There also was some discussion regarding chrysoprase versus dyed green chalcedony, including the mention of a ruling by a New York City court that two retail jewelers were guilty of misrepresentation in the sale of dyed green chalcedony as chrysoprase. Other items of interest were dumortierite in quartz, a beautiful green enstatite, and some diamond doublets set in a pin.

Two items of particular importance were seen in Los Angeles. The first was a rope consisting of nine interwoven strands of small natural pearls. The rope was over 50 in. (125 cm) long and probably contained 7,500 to 8,000 individual pearls. Since an X-radiograph could not be taken without disassembly of the piece, a qualified identification of natural origin was made based on the lack of fluorescence to X-rays and the appearance of the pearls under magnification.

The second item was a pleasant surprise: Four small pieces of rough submitted as diamonds by the person who found them actually were diamonds. Most such pieces found by clients and thought to be (actually hoped to be) diamonds usually turn out to be quartz. These stones ranged in size from 0.06 to 0.22 ct. The owner reported that they were from an area (which he would not name) that was not known to have previously produced diamonds.

SUMMER 1974

A number of emerald imitations were discussed by New York lab personnel, including some clever imitation crystals in fake matrix. The opportunity to examine the largest taaffeite then known was an exciting one, as was the chance to see the 12.42-ct Uncle Sam diamond, the largest from the Arkansas diamond pipe.

Differences in ultraviolet fluorescence and phosphorescence between Gilson synthetic opal and natural opal were discussed by the Los Angeles lab. The lack of phosphorescence in the Gilson product is indicative of its synthetic nature. An expanding movable gas bubble in a natural ruby was photographed in three different stages of expansion caused by heat from the substage light in a Gemolite microscope.

SUMMER 1984

Several types of pearls—imitation, mabe, and cultured—were mentioned in this issue. X-radiographs illustrated the use of lenticular nuclei to produce flattened cultured pearls. Dimples in another cultured pearl suggested that a drilled bead might have been used as the nucleus; the X-radiograph proved that this was indeed the case.

An asteriated quartz with multiple stars was illustrated with photos showing the appearance of a single star when the stone was viewed from the top and multiple stars when the stone was viewed from an oblique angle. A large nephrite carving (see photo) illustrated the use of artistic staining. No attempt was made to alter the main body color of the jade, only to highlight the details in the carving.

This 23.4 × 7.2 × 9.5 cm nephrite carving has been artistically stained to enhance the detail.