Gem Trade LAB NOTES

Transparent Green AUGITE

In the Fall 1988 Lab Notes section, we reported on opaque black augite that was offered in the trade as Chinese "onyx." Since then, the West Coast laboratory has been asked to verify the identity of a dark green, transparent 8-ct oval brilliant that was reported to be augite. We determined the following gemological properties for this stone: refractive indices of 1.682–1.702; biaxial positive optic character; specific gravity, estimated with heavy liquids, of approximately 3.20; and no reaction to ultraviolet radiation. In the spectroscope, a faint absorption line was visible at 500 nm. When the stone was examined with magnification, we noticed small, transparent, prismatic crystals arranged in a plane, as well as numerous fine short needles, both of unknown identity. The optical and physical properties were consistent with augite, but were still within the range of some other monoclinic pyroxenes. To determine the exact identity, we performed X-ray diffraction analysis; the pattern obtained matched the standard pattern for augite. Thus, the green oval brilliant was identified as augite, but it is a variety we had not seen before. *KH*

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

Figure 1. These three samples of covellite illustrate the varied appearance that this cupric sulphide mineral can show.

COVELLITE

The West Coast laboratory recently received a 24.91-ct cabochon that we identified as covellite. This is the first piece of covellite that the laboratory has been asked to identify in many years. However, every February, at the Tucson Gem & Mineral Show, there are several dealers selling covellite rough, cabochons, and faceted tablets (figure 1).

Covellite, an opaque submetallic cupric sulphide (CuS), is generally a very dark "indigo" blue, sometimes with a purple surface tarnish. It is frequently intergrown with small veins of a "brassy" metallic-appearing mineral such as pyrite and/or chalcopyrite. Covellite, like malachite, is essentially a "sight ID": Once you have seen it, you don't forget its unique appearance. Covellite shows a submetallic luster, a specific gravity of around 4.6, a shade or spot refractive index reading of 1.45, and a Mohs hardness of 1.5 to 2.

Covellite cabochons are inexpensive and are generally sold as a collector's curiosity. The material reportedly is difficult to cut because of its softness. The three covellite cabochons in figure 1 range in weight from 19.66 to 23.64 ct. *RK*

DIAMOND

Coated Diamonds Again Seen in the Trade

Diamonds in the very light to light yellow color range can be "improved" in color by the addition of a grayish or bluish material to the surface. For example a "J" or "K" color can be made to look like a "G" color. Such diamonds also can be treated by fluoride deposition in a manner similar to that used for lens coatings in optics. It has also been reported that this coating may be a flux, similar to that used to paint china. The first article in *Gems & Gemology* on this subject appeared in the Winter 1962–63 issue, pp. 355–364.

Fraudulent or deceptive treatment practices usually subside after they have been exposed by the laboratories or by jewelry organizations. Eventually, though, the trade forgets the warnings, so the practices almost always return. The East Coast laboratory has seen a number of coated diamonds recently. Figure 2 shows a circular mark on the surface of a 1.53-ct round brilliant-cut diamond where a coating dried unevenly; this provides a very typical means of detection. The dried coating can also be seen concentrated on the pavilion along the girdle; figure 3 shows this concentration as a dark line along the top of an indented natural in the girdle. The 1962–63 *Gems & Gemology* article contains many more photographs and is worth reviewing. *DH*

Figure 2. The circular spot on the surface of this diamond results from an unevenly dried coating; it is a common means of detecting such a treatment. Magnified 30×.

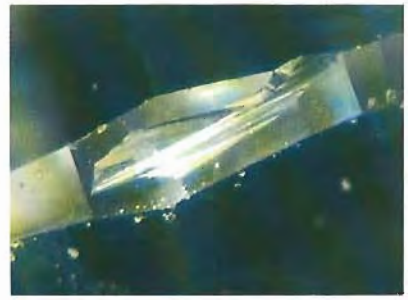


Figure 3. The dark line on the girdle of this diamond reveals the coating at the upper edge of the indented natural. Magnified 45×.

Unusual Inclusions in Diamond

Two diamonds recently seen in the East Coast laboratory were found to have some rather curious inclusions. A 1.06-ct greenish yellow round brilliant contained unusual parallel acicular inclusions (figure 4). These sets of unidentified "needles" formed an angle of approximately 90°.

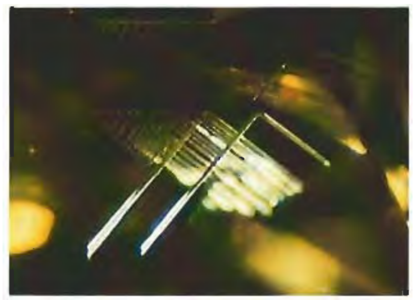


Figure 4. These sets of parallel "needles," which intersect at 90°, are unusual in diamond. Magnified 45×.

The other diamond was a laser-drilled 1.32-ct pear shape. With normal laser drilling, usually only one or two drill holes can be seen. Figure 5 shows what must have been an attempt to eliminate a very obvious inclusion through multiple entries. Numerous drill holes are seen concentrated in a confined area on the girdle of the stone. Figure 6 shows the many laser channels as seen through the crown of the stone; it appears that only one or two actually reached the inclusion. *DH*

Figure 5. Numerous laser drill holes are quite visible on the girdle of this 1.32-ct pear-shaped diamond. Magnified 45×.

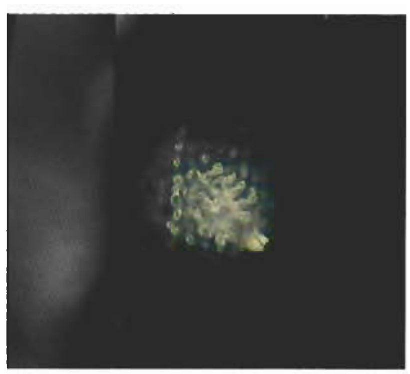
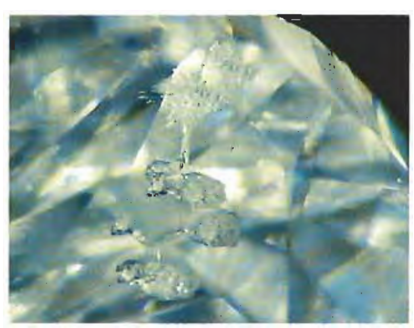


Figure 6. Only one or two of the laser drill holes shown in figure 5 actually reach the inclusion. Magnified 45×.



PEARL

American Freshwater Natural Pearls

The sentimental practice of engraving a date on the metal part of a jewelry gift, formerly quite common, has provided the East Coast laboratory staff with some useful observations. "November 30, 1858" was engraved on the circular gallery wire of the largest undrilled, natural freshwater pearl in a beautiful necklace of 32 undrilled, round freshwater pearls (figure 7). We were intrigued by this date, since the "modern" discovery of *Unio* pearls in American waters was in Paterson, New Jersey, only a year earlier – 1857. According to George Frederick Kunz, in his *Book of the Pearl,* the first undamaged pearl found at this location weighed 93 grains and was sold to Mr. Charles Tiffany (it later became part of the collection of Empress Eugénie of France); the stream is only 17 miles from the Tiffany store. There are 27 graduated pearls, ranging from 5.25 to 11.50 mm in diameter, in the necklace (the other five are in the clasp). The quality and quantity of these pearls suggests that they are American, because Scotland, the only other producing locality, was largely worked out by this time. The elegantly conceived enamel and gold galleries for each of the pearls indicate the respect that the designer had for them. *RC*

Figure 7. This antique necklace and clasp contain 32 undrilled, round freshwater pearls; the largest is 11.5 mm in diameter. They are believed to be American in origin.

Figure 8. The striated bead nucleus is clearly visible on the back of these 8-mm black 3/4 cultured blister pearls; the right pendant shows how the pearls appear from the front.

Cultured Black Pearl Mystery

A jeweler sent our West Coast laboratory a pair of yellow-metal pendants, each set with a cultured black pearl measuring approximately 8 mm in diameter. We were asked to determine what kind of damage the pearls had sustained, since part of the nacre seemed to be missing from the flattened back of each. Figure 8 shows the front of one, which is completely covered by nacre, and the back of the other, where most of the nacre is missing and the striated bead nucleus is visible.

When we examined these two cultured black pearls with magnification, we noticed that there was a heavier accumulation of conchiolin around the flat base of each in the area where the nacre accumulation begins. Furthermore, we could find no evidence that a nacreous layer had ever developed on top of the bead nucleus when the pearl was originally formed. Because this growth formation is characteristic of 3/4 cultured blister pearls, we concluded that this was such a blister pearl. The jeweler, however, claimed that nacre was present on the backs at one time, so we could only speculate that a nacreous backing of some sort was originally present in this area. It does seem strange, though, that the backing would become separated and lost from both pearls at the same time. There was no evidence of any residual glue on either back. *KH*

A Large PHOSPHOPHYLLITE Crystal

The East Coast laboratory was recently asked to identify the large blue-green mineral specimen shown in figure 9. Careful gemological testing indicated that the crystal was phosphophyllite. However, crystals of this material are usually small, whereas this specimen measured 7.8 × 5.7 × 2.7 cm and weighed approximately 220 grams (7.7 oz.). The largest phosphophyllites we are aware of are the two 13-cm crystals in matrix that are in the collection of the Smithsonian Institution and appeared in P. Bancroft's 1984 book, *Gem and Crystal Treasures.*

Usually there is no absorption spectrum visible when phosphophyllite is examined with a handheld spectroscope. This crystal, however, because of its mass and the depth of color, displayed a prominent absorption band at 448 nm that is probably related to Fe^{2+}, which contributes to the cause of color in phosphophyllite (*Gems & Gemology,* Summer 1988, p. 97). According to Robert Kane of our West Coast laboratory, George Rossman of the California Institute of Technology reports that "the major band which defines the color of phosphophyllite occurs in the infrared portion of the spectrum at 960 nm and tails down to the visible portion." This band would not be visible in a hand spectroscope.

Phosphophyllite, a zinc phosphate $[Zn_2(Fe^{2+},Mn)(Po_4)_2 \cdot 4H_2O]$, comes mainly from two localities: Potosí, Bolivia, and Hagendorf, West Germany. Its refractive indices are 1.595–1.616, specific gravity is 3.10, hardness is 3 to 3 ½, and reaction to short-wave U.V. radiation ranges from inert to strong violet. Because the material is heat sensitive and it fractures and cleaves easily, it does not lend itself to use in jewelry. This specimen was unusual not only for its large size but also for its attractive vivid blue-green color—usually phosphophyllite is near-colorless to light blue-green. *DH*

Figure 9. This 7.8 × 5.7 × 2.7 cm phosphophyllite crystal is unusually large.

RUBY, VERNEUIL SYNTHETIC with Needle-like Inclusions

Gemologists at the Gem Trade Laboratory sometimes encounter platinum needles in flux-grown synthetics. On rare occasions, we have observed straight twinning or even needle-like inclusions in flame-fusion blue or orange synthetic sapphire (see *Gems & Gemology,* Summer 1984, p. 111). Recently, however, we saw these phenomena in a flame-fusion synthetic ruby for the first time.

The stone in question, a 2.00-ct cushion antique mixed-cut Verneuil synthetic ruby, was examined at the East Coast laboratory. "Needle-like" inclusions, which are actually the edges of straight twinning planes, were readily visible with magnification (figure 10). The strong red fluorescence to short-wave ultraviolet radiation and the curved striae easily proved the material to be synthetic.

Figure 10. Straight twinning planes look like needles when viewed edge-on in this flame-fusion synthetic ruby. Magnified 45×.

It is interesting to note also that the stone was poorly cut and had been quench crackled to make it appear more natural. *DH*

SAPPHIRE

A Large Fine-Color Star

In the experience of the Gem Trade Laboratory, very large "blue" star sapphires are almost always bluish gray, or gray-blue at best. The East Coast laboratory recently identified a natural star sapphire of a "pure" dark blue color. The 204.39-ct translucent oval asteriated cabochon (figure 11) measured 34.40 × 29.15 × 17.34 mm; it is one of the largest star sapphires ever seen by the Gem Trade Laboratory. Pristine, undisturbed silk and the lack of any evidence indicating heat treatment or diffusion proved the stone was of natural color. As is to be expected with the cabochon cut of a star corundum, the uniaxial figure was self-resolving in the polariscope.

At 563.00 ct, the Star of India sapphire, which is in the collection of the American Museum of Natural History in New York, is the largest known gem-quality blue star sapphire in the world. *DH*

Figure 11. This "pure" dark blue star sapphire weighs 204.39 ct.

An Unusual Green Star

A 12.13-ct natural star sapphire of a most unusual grayish green color (figure 12) was recently submitted to the West Coast laboratory for examination. The locality origin of this particular stone is not known, although at the February 1988 Tucson Gem & Mineral Show several GIA employees examined two or three natural green star sapphires that were reportedly from Thailand. In the laboratory's experience, green natural star sapphires are rare.

As expected, a 1.76 spot refractive index was obtained. There was no reaction to short-wave ultraviolet radiation, but we observed very weak dull green fluorescence to long-wave U.V. when the stone was closely examined in a dark room. The presence of iron in this natural green stone was indicated by prominent absorption bands in the blue region of the spectrum. The observed spectrum was the same as the well-documented absorption spectra of dark blue, green, and yellow Australian sapphires described by Richard T. Liddicoat in *The Handbook of Gem Identification*, 12th ed., 1987, p. 142.

Examination with the microscope revealed the following features: strong angular growth zoning and dense concentrations of small particles in a hexagonal arrangement (many particles were also randomly oriented), various examples of "fingerprints" and "healed fractures," and small euhedral crystals of unknown identity. The characteristic absorption and these microscopic features easily proved natural origin. *RK*

Figure 12. The grayish green color of this 12.13-ct natural star sapphire is unusual.

Pink SPINEL From the USSR

The West Coast laboratory received an attractive slightly purplish pink 6.95-ct spinel (figure 13) for examination. This material reportedly came from a deposit in the Pamir Mountains in Tadzhikistan, USSR, the same general area where gem-quality clinohumite is recovered.

Some pink to purple natural spinels exhibit a color change when viewed under incandescent or fluorescent light (see *Gems & Gemology*, Winter 1984, pp. 232–233). This stone, however, did not show such a change. A single refractive index reading of 1.711 was obtained. When the stone was exposed to long-wave ultraviolet radiation, we observed a moderate orangy red fluorescence. The stone fluoresced a very weak orangy red to short-wave U.V. The polariscope revealed a singly refractive reaction with essentially no strain. When this attractive pink spinel was placed over the opening of the iris diaphragm on the spectroscope unit, a very weak red transmission luminescence was observed. The absorption spectrum was essentially the same as the well-known absorption spectrum of fluorescent pink spinels described by Liddicoat in *The Handbook of Gem Identification*, 12th ed., 1987, p. 151.

When this faceted spinel was examined with the microscope, the first impression was that the stone was very "clean." Careful examination revealed faint, tightly spaced, straight parallel growth features. Immersion in methylene iodide showed faint color zoning which appeared to be in alignment with the growth features discussed above. Also observed near the girdle were a few very small to moderately sized transpar-

Figure 13. This 6.95-ct pink spinel is reportedly from the USSR.

Figure 14. This 4.53-ct pink spinel crystal is reportedly from the same locality as the cut stone in figure 13.

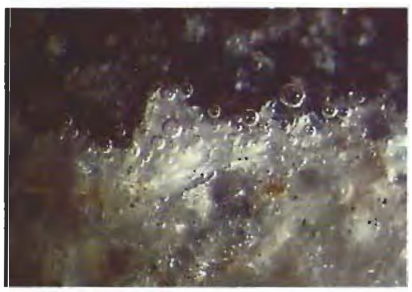


Figure 15. The effervescence to HCl proves that the whitish inclusions reaching the surface of the crystal in figure 14 are carbonates. Magnified 40×.

Figure 16. Mica inclusions were also noted in the 4.53-ct pink spinel crystal. Magnified 25×.

ent, near-colorless euhedral, highly birefringent crystals.

At the same time we examined this stone, the owner donated a 4.53-ct pink spinel crystal (figure 14) from the same locality to GIA's Dr. Byron C. Butler inclusion collection. John Koivula provided the following observations on the three distinct types of inclusions he observed in the crystal. The most obvious inclusions were irregular masses of a translucent whitish material with a fine-grained, almost sugary texture that was reminiscent of massive calcite. Because a small area reached the surface of the crystal, an acid test was carried out. A droplet of 10% hydrochloric acid solution was placed on the exposed portion and the reaction then viewed under the microscope. As shown in figure 15, the effervescence was quite obvious, thus proving the presence of a carbonate, possibly calcite. Another type of inclusion that reached the surface was a platy grouping of near-colorless to whitish crystals (figure 16) that looked like muscovite or a similar mica. These crystals did not react to acid, and when probed with a fine pointed needle, they had the distinctive flaky texture of a mica. Another, less conspicuous type of inclusion, which was not exposed at the crystal's surface, was also platy in habit. These inclusions were opaque and gray with a submetallic luster, and may be either graphite or hematite.

While the color of this material is unusual, all of the gemological properties determined and inclusions observed overlap those known for spinel from other localities.

RK

SYNTHETICS and Other "Modern" Substitutions in Period Jewelry and Reproductions

As we mentioned in the Winter 1988 issue of *Gems & Gemology,* the substitution of simulants for natural gemstones in jewelry has been going on for hundreds of years for a variety of reasons, some legitimate and some not. This matter is one of growing importance to the people concerned with period jewelry. Last issue we discussed (and illustrated) the importance of testing every stone in a piece. A knowledge of the dates when synthetics and various types of cultured pearls first appeared on the market can also be helpful. In addition, "period" pieces should be checked carefully to make sure that they are not just clever reproductions.

The natural-color black cultured pearls seen in figure 17 are clearly

Figure 17. The 12.5-mm long black cultured pearls in these Victorian-era earrings are modern-day substitutes.

substitutions in the attractive pair of Victorian pendant earrings, since natural-color black cultured pearls did not appear on the market until the 1970s. Recently, we also identified cultured pearls in an Art Nouveau necklace; these, too, are substitutions, since this type of cultured pearl was not available before the 1920s.

A synthetic blue sapphire was identified in what appears to be an antique ring made prior to World War I. Because synthetic blue sapphires did not become commercially available until after the war, either this stone is a substitute for the original or the ring is a more recent reproduction. All five of the lozenge-shaped step-cut synthetic blue sapphires shown in the brooch in figure 18 appear to be original stones set in a very convincing reproduction. The old diamond cuts and quality of workmanship give the piece a surprisingly authentic look, but the lack of evidence on the metal that any of the stones had been reset led us to conclude that the piece is a reproduction.

RC

Figure 18. This reproduction of an Art Nouveau pin is set with synthetic blue sapphires; the pin is about 7.5 cm long.

FIGURE CREDITS

Figures 1, 12–14, and the "Historical Note" photo are by Shane McClure. Figures 2–7, 10, 11, 17, and 18 were taken by Dave Hargett. Robert Weldon furnished figure 8. Figure 9 was supplied by Robert Kane. John I. Koivula provided figures 15 and 16.

A HISTORICAL NOTE

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

SPRING 1964

The Los Angeles laboratory discussed the effects of excessive heat on a diamond, as well as the effect that varying degrees of transparency can have on the brilliancy of a finished stone. A piece of jewelry set with a thin diamond crown over a hollow metal basket to simulate a larger stone is described; the facet junctions of the pavilion were simulated by engraved lines in the metal backing. The detection of cyclotron-treated diamonds, based on the appearance of the color zoning (confined to the surface), was also discussed.

SPRING 1974

Unfortunately, the special contents of this issue precluded a report from either New York or Los Angeles.

SPRING 1984

A number of unusual items appeared in this issue. Iridescent coatings on aquamarine and synthetic emerald were encountered in the Los Angeles lab. Other items described by the Los Angeles staff were a dyed blue, plastic-coated coral bead and a cat's-eye scapolite. New York examined magnetic hematite and a hollow natural pearl. An imitation red beryl crystal was manufactured from flame-fusion synthetic ruby; facets were arranged to simulate a hexagonal prism and then abraded or etched to resemble surface characteristics associated with natural beryl crystals. The prism had even been cemented into a brown sedimentary rock "matrix" that was removed before the crystal was sent to Los Angeles for identification.

This 10.96-mm-high imitation red beryl crystal is actually a flame-fusion synthetic ruby.