Gem Trade LAB NOTES

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Devitrified GLASS

Cobalt-Bearing

Recently submitted to the Los Angeles laboratory for identification was the 2.89-ct black free-form cabochon illustrated in figure 1. Our client explained that it was representative of material being exported from Hong Kong as black "onyx" (dyed black chalcedony). When viewed with the unaided eye in sunlight or artificial overhead illumination, the piece appeared to be opaque and black. However, when examined under magnification with dark-field and fiber-optic illumination, the edges of the cabochon appeared to be semitransparent to translucent, and blue in color. Also very prominent was the dendritic structure (figure 2) that is characteristic of man-made devitrified glass. This pattern is well known to gemologists, as it is typical of the excellent devitrified glass imitation of jadeite jade that is known as "metajade." Patterns such as these, which are the result of devitrification (the partial change of a substance from an amorphous glassy structure to a crystalline, or partially crystalline, structure after solidification) should always alert the gemologist to the probability of glass.

A spot refractive index of 1.50 was obtained. The material was inert to long- and short-wave ultraviolet radiation. Since the cabochon was nearly opaque in most lighting conditions, no reaction was expected, or observed, in the polariscope. The specific gravity was estimated with heavy liquids to be approximately

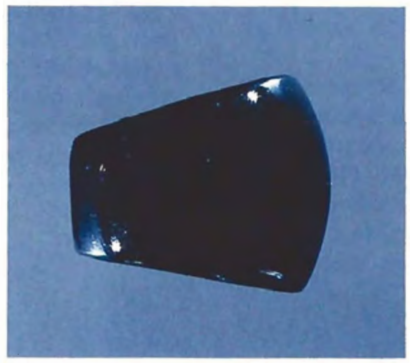

Figure 1. This 2.89-ct black free-form cabochon, represented as dyed black chalcedony, was found to be cobalt-bearing devitrified glass.

2.60. The hardness was estimated to be between 5½ and 6½ on the Mohs scale. When the cabochon was placed on the iris diaphragm of the spectroscope unit, or over the end of a fiber-optic light source, the entire stone "glowed" bright red because of the very strong red transmission.

To view the absorption spectrum, we placed a fiber-optic light tube directly behind the cabochon in order to pass enough light through this very dark material. With the spectroscope, we observed a strong cobalt spectrum that was essentially the same as that for cobalt-bearing flame-fusion synthetic blue spinel. However, the glass absorbed light up to nearly 480 nm and exhibited an overall dark absorption pattern, which is to be expected in stones that are extremely dark in color.

Although we have seen opaque black glass imitations colored with

Figure 2. At 20× magnification, the cabochon shown in figure 1 revealed a dendritic pattern typical of man-made devitrified glass. Oblique illumination.

major amounts of tin oxide and remelted with manganese oxide and "hammer slag" from the production of iron, this is the first time that we have encountered a black-appearing cobalt-bearing devitrified glass. Perhaps a major motivation for simulating dyed black chalcedony is that the devitrified glass can be molded into a particular shape, requiring repolishing only on the top. The back of the devitrified glass cabochon described here did show evidence of molding. *RK*

With an Unusual Inclusion

The New York laboratory recently examined two translucent green oval cabochons that were being represented as natural glass from Mexico.

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

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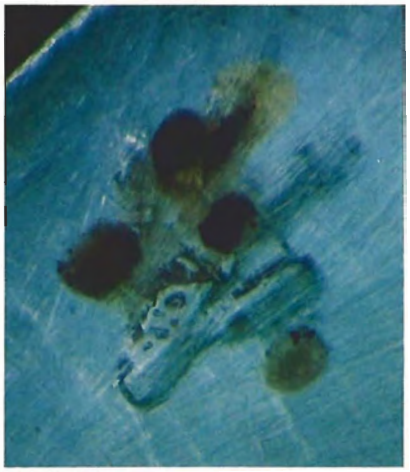


Figure 3. This distorted gas bubble in devitrified glass resembles a partly resorbed crystal, such as is found in natural glass. Magnified 35×.

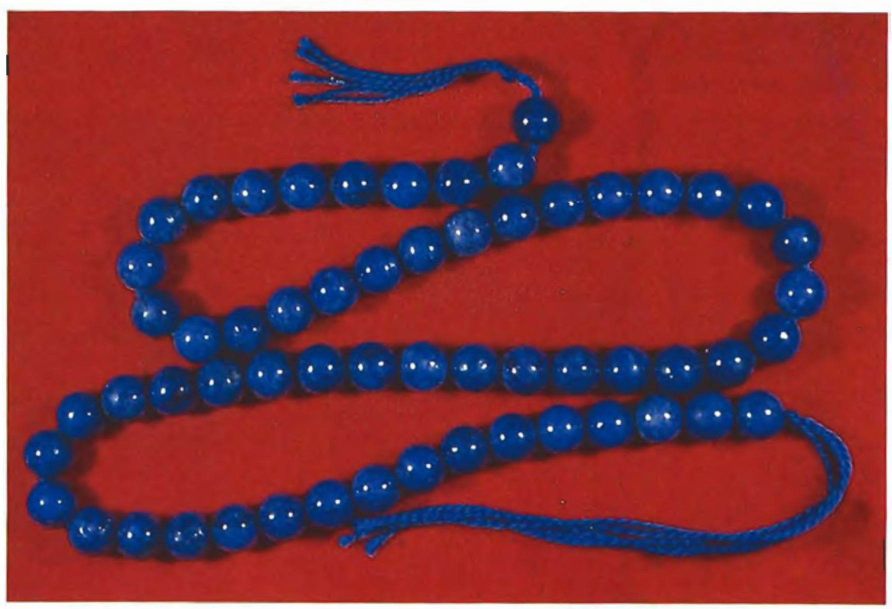
Yet the properties were the same as those for devitrified glass of this color, and the stones also showed the dendritic pattern typical of man-made glass.[1] However, there was an unusual inclusion (figure 3) near the surface on the back of one of the cabochons that resembled a partly resorbed crystal, suggestive of natural origin, although the high relief and the rounded ends raised the possibility that it might be a distorted gas bubble. Since the stones had been donated to the laboratory and the inclusion was so close to the surface, we scraped into the inclusion and found that it was hollow, proving that it was indeed only a distorted gas bubble. *RC*

LAPIS LAZULI, Dyed and "Sealed"

Over the years, the New York laboratory has been asked many times to check for dye and, more recently, for evidence of oil or paraffin in lapis lazuli (see, for example, Gem Trade Lab Notes section, Summer 1981 and Winter 1985). Heretofore, when acetone applied with a cotton swab has produced evidence of dye, the dye has been detected primarily in the cracks and porous areas of the stone. The effect of the dye is to darken light areas and provide a more uniform appearance. Some of the dyed stones are further "sealed" with some type of oil, wax, or the like. However, some paraffin-treated lapis (whether dyed or undyed) does "sweat" when tested with a thermal reaction tester.

Recently, a strand of 7-mm violet-blue beads known to be dyed (figure 4) was donated to the laboratory. Unlike most of the dyed lapis we have examined, however, these beads were so heavily saturated that they virtually owed their color to dye. When exposed to long-wave ultraviolet radiation, some of the beads showed a patchy red fluorescence; with short-wave, only about half showed the chalky green fluorescence characteristic of natural lapis lazuli. Surprisingly, the "swab" test was not as revealing with these beads as with the selectively dyed stones we have previously seen. However, the thermal reaction tester produced evidence of paraffin treatment, so it may be that the paraffin "seal" must be removed before the dye will stain the swab. Under magnification, a few of the beads showed purple dye in the cracks, while others showed the same unnatural purple color in patches not associated with cracks or otherwise obviously porous areas. Under a Chelsea color filter, the beads all appeared a definite brownish red, much brighter than any natural-colored specimens we have tested. *RC*

Figure 4. These 7-mm lapis lazuli beads were heavily dyed and then coated with paraffin.



OPAL

Assembled Opal Beads

Anthony de Goutière, a graduate gemologist in Victoria, B.C., Canada, thought our readers might be interested in an unusual opal bead necklace he examined (figure 5). The necklace is made up of cubic and roughly spherical opal beads (7-15 mm in diameter) separated by transparent colorless faceted rondelles. As figure 6 shows, however, the beads were actually assembled by attaching slices of opal to some sort of shaped backing material with black cement. These pieces were then cut and polished into shape.

The owners of the necklace could not supply any information regarding its history, but guessed that it dated to the 1930s. This manufacturing technique represents an inter-

Figure 5. The graduated (7-15 mm in diameter) opal "beads" in this necklace were found to be assembled.

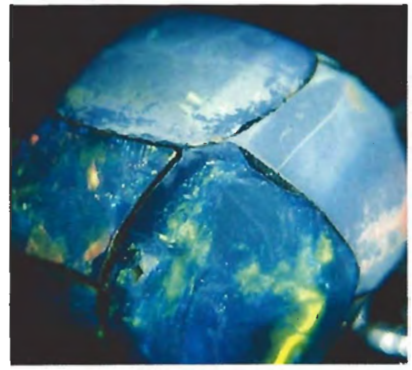


Figure 6. With 3× magnification, it is evident that a black cement was used to attach slices of opal to a shaped backing material to form the opal "beads" shown in figure 5.

esting way of using thin slices of opal to create relatively large beads. *CF*

Green Opal from Brazil

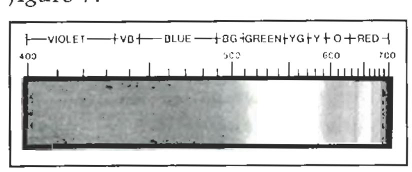
A stone dealer recently brought to the Los Angeles laboratory a selection of rough and cabochon-cut green opals from Brazil. Figure 7 shows the three sample stones (ranging from approximately 1 to 2 ct) that were donated to GIA. Both the rough and cut material was fairly translucent, and the color varied from light to dark yellowish green. Prominent dendritic black inclusions were easily visible to the unaided eye. At first glance, the material resembled translucent green grossularite garnet. The refractive index was determined to be 1.43 (spot reading). Hydrostatic determinations of all three stones were made, with the average specific gravity at 2.03±0.01. There was no reaction to either long- or short-wave ultraviolet radiation. The darkest cabochon showed a peculiar absorption spectrum (figure 8) that was visible only through the longer optical path provided by the length of the stone. There was general absorption up to 500 nm, an absorption band at 590–620 nm, two distinct lines at 640 nm and 670 nm, with a cut-off at 690 nm. *KH*

Figure 7. At first glance, these green opal cabochons (weighing 0.99, 2.22, and 1.84 ct, respectively) from Brazil resembled translucent green grossularite.

Cultured PEARLS, Miscellaneous Oddities

The New York laboratory recently examined the 13-mm cultured pearl shown in figure 9. At first it was thought that the peculiar circular area around the drill hole might be an insert. However, when viewed from the side, this circular area proved to be raised above the surface of the pearl. It seems to match the size and configuration of the mounting cup

Figure 8. The absorption spectrum for the darkest green opal cabochon shown in figure 7.



that the pearl was once attached to. It is possible that the area around the cup was eroded by skin acid during wear, although the luster of the pearl does not seem to have been harmed.

Some years ago, the New York laboratory was shown a group of pear-shaped pearls with oversized drill holes (figure 10). We subsequently proved that they were freshwater mantle-tissue–nucleated cultured pearls on the basis of their X-ray fluorescence and because a few still retained vestiges, seen in the X-radiograph, of the "void" caused by the mantle-tissue implant. Not all pearls in a freshwater tissue-nucleated pearl necklace will show a void—some of the voids may be eliminated by the drill holes. These pearls create a problem when they are offered as natural pearls, the seller hoping that the drill hole has eliminated the evidence of tissue nucleation. The laboratory has encountered such pearls in old jewelry from which the original natural pearls have been removed and these pearls substituted. *RC*

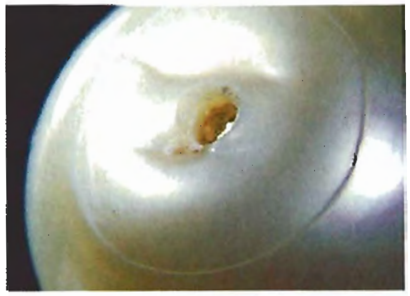


Figure 9. This unusual circular area around the drill hole of a 13-mm cultured pearl is actually raised above the surface of the pearl. Magnified 10×.

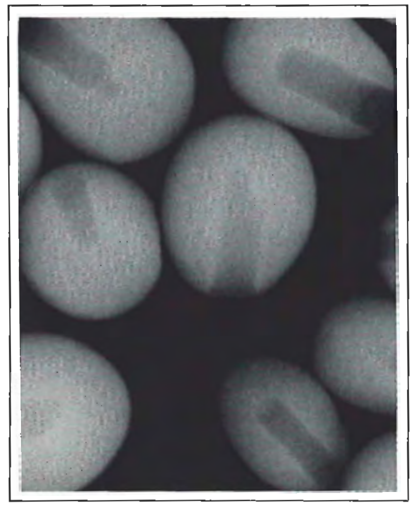


Figure 10. Oversized drill holes are often used to hide evidence of mantle-tissue nucleation in freshwater cultured pearls.

Cat's-Eye RUTILE

A local gemologist and dealer in pearls and rare gemstones asked the Research Department of GIA–Santa Monica to identify two cat's-eye stones (2.74 ct and 1.43 ct) that his firm had acquired in Sri Lanka. The stones were opaque and appeared to be black, although the sharp eyes in each were brown (figure 11). Gemological tests done by the client revealed the refractive index to be over the scale (greater than 1.81), and the specific gravity to be considerably heavier than the 3.32 liquid. The stone gave no reaction when exposed to either long- or short-wave ultraviolet radiation. The streak was brown and the hardness seemed to be about 6 or a little higher. The X-ray diffraction pattern obtained from a minute amount of powder scraped from the back of one stone matched that of rutile.

It is interesting to speculate on how this particular rutile manages to exhibit such a sharp cat's-eye. Since the material is essentially opaque, it is unlikely that the chatoyancy is the result of reflection of light from parallel acicular inclusions, as in chrysoberyl and other materials. Although, to our knowledge, rutile has not previously been reported to occur in a massive fibrous form, this would seem to be the only explanation for its ability to produce a cat's-eye effect. *CF*

Figure 11. This unusual cat's-eye rutile weighs 1.43 ct. Magnified 3×.

"Cobalt-Blue" SPINEL, an Update

The Los Angeles laboratory recently received for identification two natural blue "cobalt-colored" spinels. Figure 12 shows one of these stones, which weighs 2.21 ct and is an intense "cobalt blue." The other stone weighs 5.31 ct and is dark violetish blue. These two stones exhibit essentially the same gemological characteristics as the 2.56-ct natural spinel mentioned in the Gem Trade Lab Notes section of the Winter 1982 issue of *Gems & Gemology,* and the natural blue cobalt-bearing spinels discussed in great detail in an article by J. E. Shigley and C. M. Stockton that appeared in the Spring 1984 issue of *Gems & Gemology.* The absorption spectra of the stones Shigley and Stockton studied have characteristics that are generally attributed to cobalt and iron. The samples used in that study, which included both rough and cut stones, were reportedly from the Okkampitiya mining region of Sri Lanka. These unusual natural spinels represented a type that was new to most gemologists, in that blue coloration caused by cobalt was previously believed to occur only in synthetic, not natural, spinel.

Although this type of natural blue "cobalt-colored" spinel is very unusual and may be encountered only rarely by the jeweler-gemol-

Figure 12. A 2.21-ct natural "cobalt-colored" blue spinel.

ogist, it can be readily identified by its characteristic properties. The specific-gravity values for the two spinels that we recently examined were within the expected range for both natural and synthetic blue spinel. The refractive index, 1.720, is consistent with other natural blue spinels. The two spinels were inert to both long- and short-wave ultraviolet radiation. This is in contrast to flame-fusion synthetic "cobalt-blue" spinel, which often exhibits a strong chalky whitish green fluorescence to short-wave ultraviolet radiation and a strong red fluorescence to long-wave ultraviolet radiation. The color-filter reaction of this type of natural spinel (weak to strong red) can overlap with that of its flame-fusion synthetic counterpart. Examination of the two spinels with a polariscope revealed that they were singly refractive with very little, if any, anomalous double refraction. This is in contrast to the strong "cross-hatched" patterns and/or "snake-like" bands present in flame-fusion synthetic blue spinels. When the 2.21-ct spinel was placed over the opening of the iris diaphragm on the spectroscope unit, no colored transmission was observed, whereas a very weak red transmission was seen in the 5.31-ct stone. Examination of several other natural blue cobalt-bearing spinels has revealed that some may exhibit a strong red transmission, as do many flame-fusion synthetics of this color. With the spectroscope, we observed bands at approximately 434, 460, 480, 559, 575, 595, and 622 nm (for an illustration of a similar spectrum, see the article in the Spring 1984 issue of *Gems & Gemology*). The most diagnostic spectral features are the bands at 434, 460, and 480 nm, which do not occur in the synthetic material. The 2.21-ct spinel contained several well-formed transparent crystals which showed moderate interference colors under polarized illumination. These crystals had the same appearance as those observed in other natural "cobalt-blue" spinels. In addition, small cavities and fractures with yellow stains were also present. The 5.31-ct stone contained a group of white, irregular, thread-like inclusions along a heal-

Figure 13. Testing with a hot point revealed that the surface of this turquoise carving (12.4 × 11.0 × 8.6 cm) had been treated with paraffin.

ing plane; some were stained brownish yellow by iron. We have also observed this type of inclusion in other natural "cobalt-blue" spinels. *RK*

TURQUOISE, with Simulated Matrix

Recently brought to the Los Angeles laboratory for identification was the opaque greenish blue carving of two Oriental women illustrated in figure 13. Testing identified the carving as paraffin-treated turquoise. A hot point on a low setting caused the paraffin to melt profusely. When the piece was examined with magnification, both the color and structure were found to be typical of porous turquoise from China (porous turquoise from any locality can be paraffin treated). A spot refractive index of 1.58, which is low for turquoise, was obtained on most areas of the carving. We scraped away the paraffin on a small area at the base of the carving and obtained a refractive index of 1.61, which is typical for turquoise.

In addition to the colorless paraffin treatment, matrix was simulated by the use of a black dye in the paraffin (see figure 14). The black matrix was cleverly daubed on to many "flat" surfaces of the carving and was only rarely added to natural matrix depressions. *RK*

Figure 14. Black dyed paraffin was used on the turquoise carving shown in figure 13 to simulate natural matrix. Magnified 5×.

FIGURE CREDITS

The photos in figures 3 and 11 were taken by John I. Koivula. Shane McClure provided the photomicrographs used in figures 1, 2, and 12-14. Dave Hargett was responsible for figures 4 and 9, and Chuck Fryer took figure 7. Figures 5 and 6 are courtesy of Anthony de Goutière. Bob Crowningshield gave us figure 10, and Karin Hurwit prepared figure 8.