Gem Trade LAB NOTES

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AMETHYST, Heat Treated

The fact that the color of some amethyst is unstable to prolonged exposure to sunlight is well known to amethyst miners. Amethyst rough waiting for shipment to cutting factories is frequently shielded from the heat and ultraviolet rays of the sun. Moreover, the color of some amethyst may also be unstable to other sources of heat, such as that produced by a jeweler's repair torch. Using this potential color instability to their advantage, some amethyst dealers occasionally subject very dark faceted amethysts to heat treatment in order to lighten the color. In Brazil, as well as in other world gem centers, it is reportedly a common practice to place dark amethysts in a test tube and heat them over an alcohol flame for several minutes (see figure 1).

Figure 1. Amethyst being heated over an alcohol flame to lighten.

The heat treatment of amethyst may cause various other color changes, depending on such variables as the locality of origin, the chemical composition of the amethyst, the temperature of the heat treatment, and the length of exposure to such treatment. Besides lightening the tone of the purple, heat treating amethyst may change the color to green (see *Gems & Gemology*, Summer 1983, p. 116), reddish brown (*Gems & Gemology*, Winter 1983, p. 236), near-colorless, or other hues of yellow and brown.

The Los Angeles laboratory recently had the opportunity to examine the 55.65-ct faceted quartz shown in figure 2. The owner of the stone explained that after faceting, his dark but otherwise attractive amethyst had been subjected to heat treatment in an attempt to lighten the color. The large amethyst was inadvertently left in the furnace for an extended period of time (the client did not indicate the precise amount), resulting in a complete change of the purple amethyst color to a brownish yellow citrine color. Instead of increasing the value of the stone by lightening it, the unsuccessful attempt to lighten the color by heat treatment produced a citrine worth considerably less than the original amethyst. R.K.

Figure 2. A dark 55.65-ct amethyst was altered to this brownish yellow citrine by an unsuccessful attempt to lighten the original color.

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

GARNET

Almandite, Exhibiting both Chatoyancy and Asterism

The Los Angeles laboratory recently identified a 7.49-ct garnet that displayed an unusual phenomenon. The gemological properties of the stone were typical of a star garnet: a 1.76 spot refractive index, inert reaction to long- and short-wave ultraviolet radiation, and the strong absorption spectrum of almandite garnet. Besides the inclusions causing the phenomenon, some other typical garnet inclusions were observed as well. The unusual characteristic of this stone was the orientation of the apex of the cabochon to the inclusions causing the phenomenon. Although the cabochon was cut so that a cat's-eye was seen on the apex of the stone (as shown in figure 3), a star effect was visible when the cabochon was viewed from its end (see figure 4). If the cabochon had been oriented so that the asterism was evident on the apex, it would have been considered a star garnet. *R.K.*

Figure 3. The apex of this 7.49-ct almandite garnet displays a prominent cat's-eye.

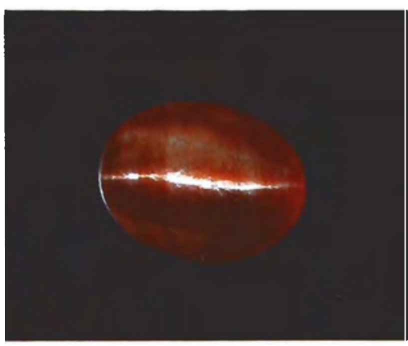
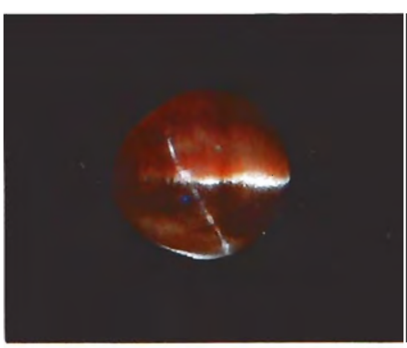


Figure 4. Asterism is visible when the stone in figure 3 is examined on its end.



Massive Grossularite Carving

An intriguing carving of two dragons holding a ball (7 × 6 × 2 cm) was sent to the Los Angeles laboratory for identification. The carving, shown in figure 5, was predominantly semitranslucent and mottled green in color, but had an opaque, dark gray area on the back. Although only a limited number of gemological tests could be performed on the massive material, the results allowed us to make a preliminary determination of its identity.

We were able to obtain a refractive index reading of 1.72 on the fairly well polished base. The specific gravity was estimated with heavy liquids to be approximately 3.5, since the carving sank moderately fast in methylene iodide (S.G. 3.32). These properties, along with the appearance of the main green portion, indicated translucent green grossularite garnet. Because this type of garnet shows a characteristic yellowish orange fluorescence to X-radiation, we tested the carving in an X-ray fluorescence unit. A faint orangy glow was observed in the translucent green area. Lastly, X-ray diffraction performed on a small scraping taken from the green portion of the carving confirmed that the material was grossularite garnet. Massive grossularite garnet of this size is extremely rare. *K.H.*

Figure 5. Grossularite garnet carving measuring 7 × 6 × 2 cm.

PEARLS

Damaged Mabe

Assembled cultured blister pearls, known as Mabe pearls, are composed of three or four pieces: a thin nacre blister pearl top and a wax-type filler (with or without a mother-of-pearl bead) cemented to a mother-of-pearl base (see figures 6 and 7). The combination of what in some cases is an extremely thin nacre top and the soft wax-like filler does not always make for a very durable product.

Figure 6. *Profile of a Mabe pearl showing nacre shell cemented to a mother-of-pearl base.*

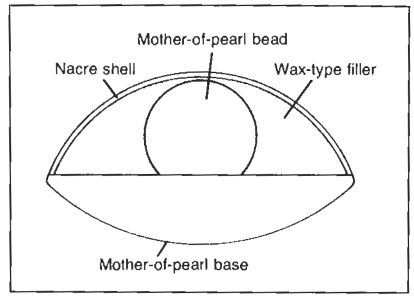


Figure 7. *Diagram showing the construction of a Mabe pearl.*

The Los Angeles laboratory had the opportunity to examine the damaged Mabe pearl illustrated in figure 8. Our client had purchased this pendant believing that it was set with a cultured pearl. However, when the pearl became damaged, our client was surprised to learn that it was in fact a Mabe pearl. Jewelry manufacturers and buyers alike should be aware of the fragile nature of Mabe pearls. The recently introduced cultured 3/4 blister pearls should provide a much more durable product (see *Gems & Gemology*, Spring 1982, p. 38). *R.K.*

Figure 8. A damaged Mabe pearl (approximately 14 mm) with a very thin nacre shell over a wax-type filler.

Pearl Simulants, Shell Hinges

At one time, a number of items of jewelry appeared in the New York market advertised as being set with "French River Pearls." More recently, some items have been fraudulently sold as baroque freshwater pearls. Certain species of both fresh- and saltwater bivalve mollusks have hinges that, when carefully sawed out, have been used to create these inexpensive pearl substitutes. Figure 9 illustrates two worked saltwater hinges from the same valve. The worked backs and characteristic shape are strong clues to their identity.

We were recently provided with complete shells of one rare mussel that has large nacreous hinges. The right hinge protuberance actually forms a better pearl substitute than the double left hinge. These shell hinges have occasionally been offered as "hinge pearls"—a misnomer since that term has traditionally been used for elongated sac pearls found growing near the hinge. Figure 10 shows the left valve, with its double hinge, of a mussel (a member of the Lampsilis group, Unio family) known as the "thick mucket." Figure 11 shows a right hinge that has been worked to resemble a baroque pearl. *R.C.*

Figure 9. These right and left hinges from one valve of a saltwater pearl-producing mollusk have been worked to resemble baroque pearls.

QUARTZ, Multi-Star

The New York lab recently had the opportunity to examine a very unusual large (approximately 25 mm) blue-gray, multi-star quartz from eastern Alabama. We also received a gift of several preforms of the same material for our collection. When the stone is viewed in the direction of the optic axis, it exhibits a 12-ray star (figure 12). Figure 13 shows that the same stone has secondary stars as well, a phenomenon that until now had only been known to occur in quartz from Sri Lanka (see *Gems & Gemology*, Summer 1984, pp. 110–111). Whether the asterism is

Figure 10. The double hinge from the left valve of a pearl-producing mollusk.

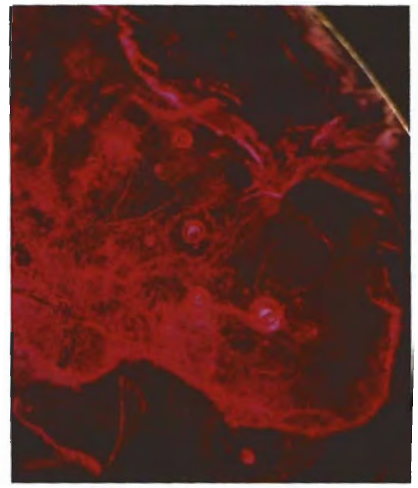


Figure 14. These negative crystals included in ruby are typical of stones of Thai origin, although at first glance they were thought to resemble the gas bubbles often seen in glass-filled cavities. Magnified 15×.

Figure 11. The right hinge (approximately 20 mm) of a mollusk similar to that shown in figure 10 has been worked to resemble a baroque pearl.

due to sillimanite, as is the case with the star quartzes from Sri Lanka, is unknown. In addition to the inclusions causing the asterism, several of the preforms contained coarse, unoriented, blade- or needle-like inclusions that resemble rutile. *R.C.*

RUBY, with Unusual Inclusions

Recently in the New York lab we have noted several natural rubies with unique inclusions. One ruby in particular exhibited an irregular plane with numerous bubble-like inclusions that, at first glance, resembled the gas bubbles in a glass-filled ruby. However, on closer inspection, the triangular "faces" visible in the larger "bubbles" (figure 14) indicated that the inclusions were negative crystals typical of Thai rubies. *R.C.*

Figure 12. A 12-ray star is evident in this approximately 25-mm quartz cabochon from Alabama.

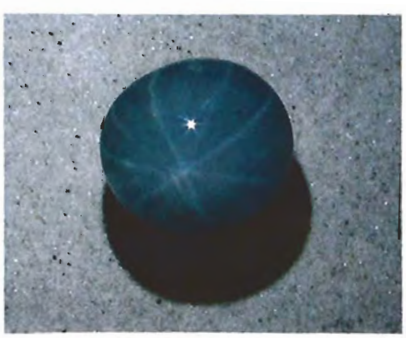
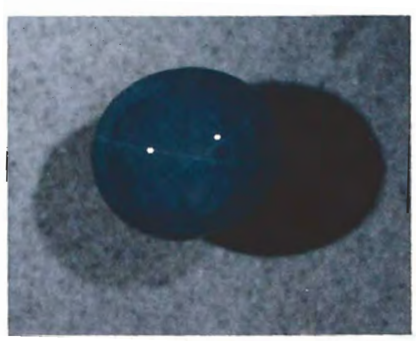


Figure 13. Secondary multiple stars are visible in the star quartz shown in figure 12 when it is viewed from a different orientation.



SAPPHIRE Simulant, Synthetic Green Spinel and Synthetic Blue Sapphire Doublet

The Los Angeles laboratory received for identification the 6.73-ct dark blue oval mixed cut shown in figure 15. Examination of the stone with the microscope revealed a separation plane at the girdle with flattened gas bubbles and an irregular waxy contact zone parallel to the table. We frequently encounter blue sapphire simulants in the form of doublets consisting of a natural green sapphire crown and a synthetic blue sapphire pavilion. However, when examining this stone with the microscope, we also observed in the crown an irregular cluster of gas bubbles, typical of those formed in some synthetic spinels. Further testing proved that this particular stone consisted of a

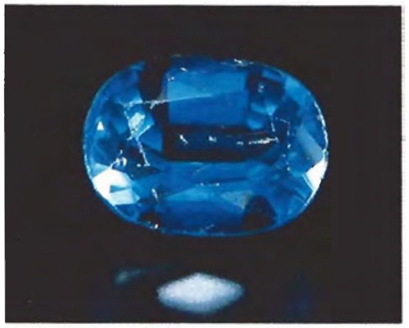


Figure 15. A 6.73-ct assembled stone with a synthetic green spinel crown and a Verneuil synthetic blue sapphire pavilion.

synthetic green spinel crown and a Verneuil synthetic blue sapphire pavilion. Table 1 summarizes the characteristics observed in both portions of this doublet.

Closer examination with the microscope using dark-field illumination, fiber-optic illumination, and immersion in methylene iodide failed to reveal the type of cement layer that is typical of most assembled stones. It is unlikely that the two materials were fused together by heat because of the very high melting temperatures of synthetic spinel (2135°C) and synthetic sapphire (2050°C). Therefore, this stone was probably assembled with a type of cyanoacrylate cement layer that is commonly marketed under several different trade names, including Krazy Glue and Super Glue.

This is the first assembled stone consisting of a synthetic green spinel crown and a Verneuil synthetic blue sapphire pavilion that we have encountered, although the New York Gem Trade Laboratory reported in the Winter 1984 issue of *Gems & Gemology* on a large doublet that consisted of a colorless synthetic spinel crown cemented to a Verneuil synthetic ruby pavilion. *R.K.*

TURQUOISE Simulant, Dyed Magnesite

Recently sent to the Los Angeles laboratory was the single-strand neck-

Figure 16. Dyed magnesite beads (10 mm in diameter) were used to simulate turquoise in this necklace.

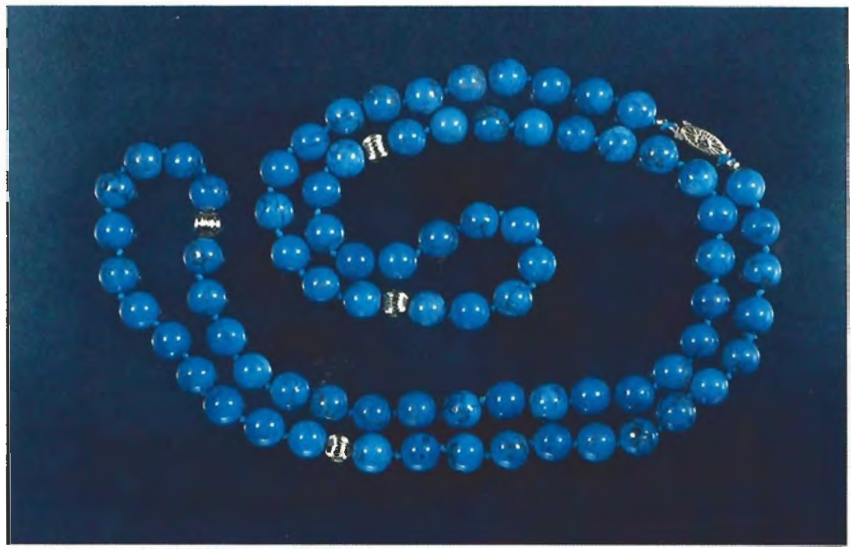


TABLE 1. Gemological characteristics of a synthetic spinel and Verneuil synthetic sapphire doublet.

Material and area tested	R.I.	Luminescence: Long-wave U.V. radiation	Luminescence: Short-wave U.V. radiation	Luminescence: X-rays	Absorption spectrum[a] (400nm–700nm)	Magnification
Synthetic green spinel crown	1.728	Moderate chalky red	Strong chalky whitish green	None visible	No bands or lines	Various sizes of spherical and thread-like "gas bubbles." One large cluster of intertwined irregular "thread-like" gas bubbles.
Synthetic blue sapphire pavilion	ϵ = 1.760 ω = 1.768	Inert	Weak chalky whitish blue	Patchy moderate chalky orange; no phosphorescence	No bands or lines	Prominent curved color banding; flattened circular gas bubbles at the separation plane; numerous parallel and randomly oriented fractures of various shapes extending from the separation plane slightly into the synthetic sapphire. Irregular, melted-appearing contact zone visible only from the pavilion.

[a]*The visible-light absorption spectrum as observed through a normal "hand-held" type of gemological spectroscope.*

lace shown in figure 16, which consisted of 78 uniform, opaque, blue round drilled beads averaging approximately 10 mm in diameter. Also submitted were two loose beads from the same lot that was used to make the necklace. All of these blue beads had been sold as untreated turquoise. However, damage to one of these beads had revealed that the blue color was confined to an area near the surface (figure 17), so our client asked the laboratory to identify the material. When the broken surface of the bead was examined with the unaided eye or with magnification, it was obvious that the bead was made from a heavily dyed, porous material. The structural appearance of the bead's broken portion (the existence of both white and colorless areas) suggested the possibility that the bead consisted of two different minerals, and the overall appearance and lack of color in the center portion indicated that the bead was not made of turquoise, or even dyed turquoise.

After receiving permission from the client, we polished a portion of the broken bead to test for the refractive index; readings of approximately 1.51 and 1.70 were obtained. The extremely high birefringence

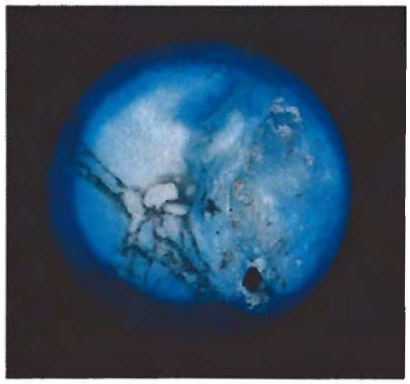


Figure 17. Note the penetration of the dye in this polished cross section of one of the beads shown in figure 16.

(0.19) suggested a carbonate. Magnesite, calcite, and dolomite are all substances that, when they occur in massive form, are soft and porous; all three materials have been known to be dyed blue for use as turquoise substitutes. However, a specific gravity measurement of approximately 3.0 obtained by the hydrostatic method was too high for calcite (2.71) or dolomite (2.85). Additional testing revealed that the bead was inert when exposed to X-rays or long-wave ultraviolet radiation (366 nm). However, when exposed to short-wave ultraviolet radiation (254 nm), the dyed portion of the bead remained inert but the undyed center exhibited a weak dull violet fluorescence.

When a drop of room-temperature 10% hydrochloric acid (HCl) solution was placed on the undyed portion of the magnesite, no reaction was observed. If the acid is slightly warmed, however, the magnesite will effervesce; this is typical of magnesite. When the dyed portion was rubbed with a cotton swab soaked in either acetone or a 10% hydrochloric acid solution, none of the dye could be removed. Using hardness points, we estimated the hardness to be approximately 4½ on the Mohs scale. X-ray diffraction analysis performed on both the white and the colorless portions of this bead confirmed that it was magnesite. *R.K.*

PHOTO CREDITS

Shane McClure took the photos in figures 1–5, 9–11, and 15–17. Tino Hammid is responsible for figures 6 and 8. Ricardo Cardenas supplied figures 12–14. Susan Kingsbury did the artwork for figure 7.