Gem Trade LAB NOTES

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A NOTE FROM THE EDITOR

Deadlines being what they are, it is necessary for me to turn in this column for the second issue of Gems & Gemology *in the new format before the first issue comes off the press. Regrettably, there has been no opportunity to receive any feedback from our readers. I would welcome comments from you so that I can continually strive to keep this column as informative as possible.*

In the last issue, heat-treated sapphires were mentioned. In addition to seeing more of these, the New York lab encountered a number of hydrothermal synthetic emeralds, as mentioned later in this column.

DIAMONDS

Colored Diamond Anomalies

The mossy patches on all surfaces of a green diamond seen in New York suggested strongly that the color was due to immersion of the stone in a radium bromide solution. When tested with a scintillometer or placed overnight on an X-ray film, however, the stone showed no radioactivity. This contrasts markedly with a similar "mossy-surfaced" diamond that completely fogged the film after a 15-minute exposure. Since the half-life of radium breakdown products is 32 years, we suspect that this nonradioactive stone must have been treated in some other manner.

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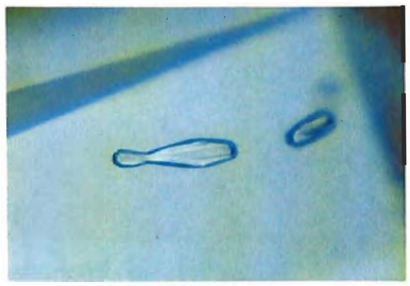

Figure 1. Olivine inclusions in diamond, dark-field illumination. Magnified 30×.

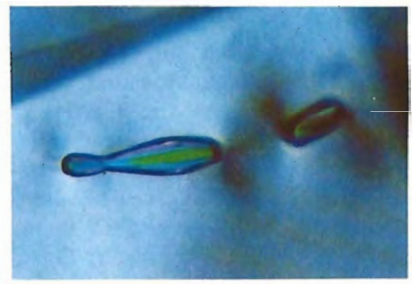

Figure 2. Same inclusions as in figure 1, but with polarized light. Magnified 40×.

Olivine in Diamond

Of the many inclusions that are sometimes present in diamond, olivine is among the most common. The transparent green, gem variety of olivine is known as peridot. In diamond, olivine occurs as transparent crystallites that appear almost colorless and rarely have a green tint. This lack of green coloration is due as much to the small size of the inclusion as it is to its composition. When olivine inclusions occur in diamond, they are composed of approximately 94% forsterite (the near-colorless, magnesium-rich olivine), with only about 6% fayalite (the green, iron-rich olivine). Figure 1 shows these inclusions as they appear under dark-field illumination. Figure 2 shows the distinct and vivid interference colors revealed by polarized light.

EMERALDS

A New Source of Synthetic Emeralds?

A lot of a dozen or more synthetic emeralds was seen recently in the New York trade. Because of their "cut in Colombia look," these synthetics were accepted by several dealers as natural stones. Low refractive indices, low birefringence, and color-filter reaction proved their synthetic origin, but their inclusions were unusual for a synthetic stone. In at least one of the stones examined, there appeared to be a light-colored seed crystal zone with spicules oriented at an angle to it, reminiscent of Linde hydrothermal synthetic emeralds. Unlike the Linde stones, however, no phenakite crystals were found at the head of the spicules, a combination that sometimes gives these diagnostic inclusions the appearance of nails. Figure 3 shows the spicules with the "nail head" as seen in the old Linde synthetic emeralds. Perhaps this lot of stones represents a new source of synthetic emeralds or a variation of the Linde process, the patent for which is now owned by Regency.

"Manufactured" Emerald Specimens

Figure 4 illustrates a handsome emerald-in-matrix specimen recently offered for sale in the trade. The emerald crystal was proved to be natural without question, and there was originally little doubt in our minds that it was a bona fide specimen. One slight question was raised, however, by the relatively reasonable price being asked. We have now been informed that the specimen is a fake and one of some two dozen similar specimens manufactured by a clever artist. Only when a bit of the white "matrix" near the crystal of another specimen was placed on the end of a knife blade and heated was the presence of a binding plastic proved. We are told that one buyer was so concerned that the specimen he had purchased was not real that he broke it out of the matrix, thus exposing a bed of epoxy. This drastic method had been suggested by the innocent seller, who had offered to refund the buyer's purchase price if the specimen was not genuine.

Figure 4. "Manufactured" emerald-in-matrix specimen. The emerald crystal measures approximately 2 cm in diameter.

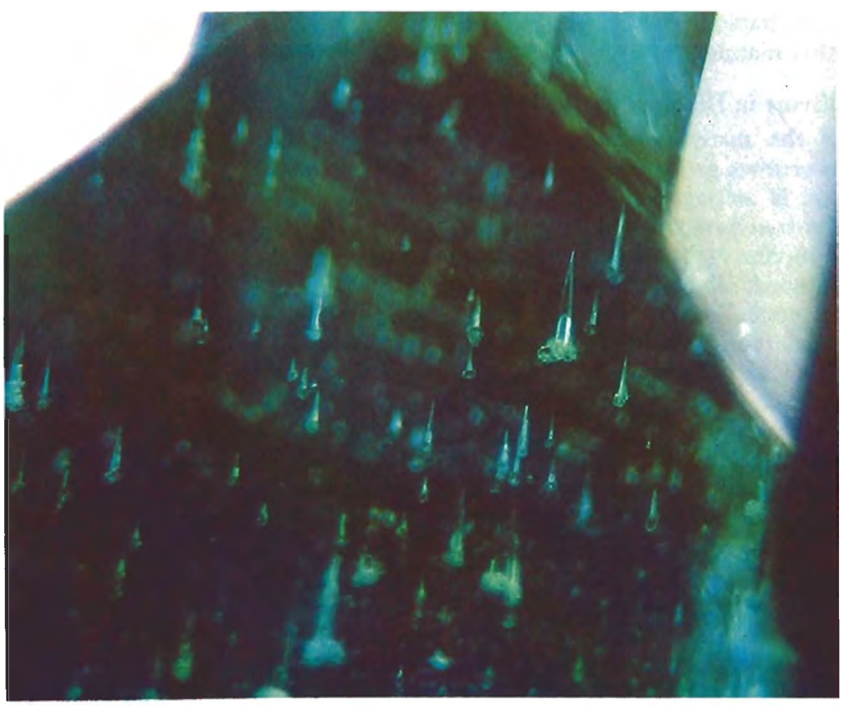

Figure 3. Spicule inclusions in Linde synthetic emerald. Magnified 63×.

JADE SUBSTITUTE

A variegated light- and dark-green snuff bottle with a yellow metal top was submitted to the Santa Monica lab for identification (see figure 5). Visual examination of the surface and especially the appearance of the green mottling in a curved flow line indicated that this bottle was made from a material different from what we usually encounter as a snuff bottle. The refractive index was 1.57. Under magnification, the material's structure did not appear to be that of a mineral, thus suggesting either glass or plastic as possibilities. A hardness test—in our case performed inside the neck of the bottle with the pin of the brushprobe so it would not be seen—revealed that

Figure 5. Plastic snuff bottle, approximately 7.5 cm high.

the material was very soft. We could then conclude that this bottle was made out of plastic, for jade a rare substitute indeed.

LAPIS LAZULI

Dyed and Wax-Treated Lapis Lazuli

The laboratory is often asked to determine whether or not articles of lapis lazuli have been treated. The evidence of treatment most commonly seen is a blue dye in fractures and in some porous areas. Another type of treatment that has been known for many years, but is seldom seen in the laboratory, is a wax coating on the surface of the lapis lazuli. The usual purpose for dying lapis is to impart color to whitish areas. Waxing may be done to hide the dye by preventing it from staining stone papers or clothing, or to conceal a poor polish.

Several months ago, a lapis-lazuli round-bead necklace was sent to the Los Angeles lab for identification. To the unaided eye, this necklace had an obviously dyed appearance. Specifically, there was an uneven distribution of intense blue and purple coloration. The beads were tested for dye in the usual manner, by lightly rubbing the material in an inconspicuous area with a cotton swab that had been immersed in acetone. Dyed lapis with as intense a color as these beads had should have produced a very noticeable blue stain on the cotton swab. These beads, however, did not produce any blue stain when the usual amount of pressure was applied. With vigorous rubbing, however, a very small amount of blue appeared on the cotton swab. Microscopic examination provided the answer: a wax coating was easily detected by its unevenness and its inability to permeate the stone in certain areas where calcite and pyrite were present. The wax coating was easily removed with a probe (see figure 6). When the bead was retested with acetone, the dye was easily detected in the area where the wax had been removed.

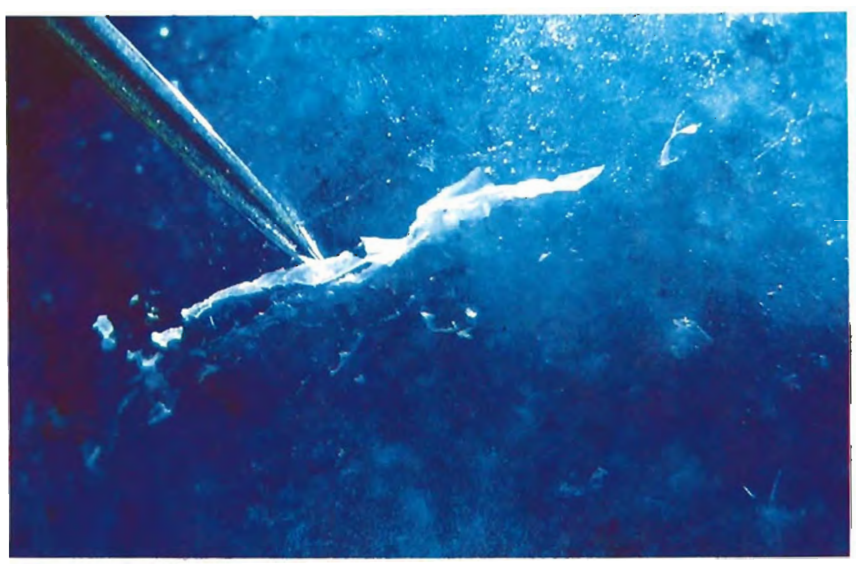

Figure 6. Brush probe reveals wax coating on treated lapis lazuli. Magnified 10×.

OPAL

Porous Opal

An unusual opal was brought to the Los Angeles lab by a recent GIA graduate. When this opal was immersed in water, its body color changed from the light brownish white that it was normally to an intense brown. This stone is similar in appearance to an opal seen in the New York lab and mentioned in the Summer 1967 issue of *Gems & Gemology*. The opal seen in the New York lab would lose all of its play of color and several prominent fractures would appear when the stone was placed in contact with moisture. The stone examined in Los Angeles was different in that although it became very dark when immersed in water, it retained its play of color. The first photo in figure 7 shows this opal as it appeared before it was placed in contact with water; the second photo shows the stone immediately after it was immersed. Returned to air for only a few minutes, the stone would revert to its original color.

This stone changes color when it is immersed in water because it is very porous. We do not know of

Figure 7. Left photo shows opal, probably from Jalisco, Mexico, dry. Right photo shows same stone partially wet.

any trade or "variety" name for this type of opal, but it is probably from the Jalisco mining district in Mexico. Because of its porosity, this is the kind of opal used for smoke treatment to produce a black-opal appearance.

PEARLS

Cultured Blister Pearls

In New York City, we recently had the opportunity to study and report on a new product that we have tentatively called cultured blister pearls. In appearance they look like large South Sea ¾ cultured pearls (figure 8). However, a mother-of-pearl insert can be seen at the base. An X-radiograph of the material showed that the mother-of-pearl nucleus measured nearly 14 mm in a 16 mm "pearl," with a very tight formation of nacre over the bead. A conchiolin ring around the bead was difficult to discern in the radiograph. These specimens later helped us determine the identity of a pearl set in a closed-back setting in a ring (figure 9), with only a bit of the worked area near the base visible. It could have been mistaken for a regular pearl, but never for a "Mabe," which is an assembled cultured blister pearl.

Figure 8. Cultured blister pearls.

In recent years, the term *blister* has been used to suggest a hollow cultured pearl, whereas before cultured pearls were known it referred to any pearl formed on the shell regardless of whether it was solid or hollow. In calling these items cultured blister pearls, we are using the term in its original sense.

Damaged Natural Pearls

Recently, the Santa Monica lab received a number of gray-to-black cracked and damaged beads ranging in diameter from approximately 7 mm to 1 mm. According to the jeweler, the owner of these beads claimed that they were pearls that had been damaged in a fire. For insurance purposes, their original identity needed to be established.

Figure 9. Ring set with a cultured blister pearl.

Sampling through the assortment, we found evidence of orient on some of the least damaged beads. This led us to believe that the beads indeed were pearls. An X-radiograph was taken to reveal their internal structure, which proved that the beads were natural pearls.

RUBY

A natural ruby that was recently sent to our Los Angeles lab for identification contained a rather strikingly beautiful inclusion. While we were examining this ruby under the microscope using dark-field illumination, we noted the inclusion shown in figure 10. Knowing the nature of this type of "thin-film" inclusion, we switched off the dark-field illumination and employed vertical illumination. The result was the multicolored inclusion shown in figure 11. Thin-film inclusions are not uncommon in many minerals; they appear in the form of ultrathin films (commonly 100 nm or less in thickness) composed of solids, liquids, gases, or any combination thereof.

A gemologist who knows how to recognize a thin-film inclusion and how to correctly illuminate it will not only discover a pleasing pattern, but may also learn something more about the stone that would normally have been overlooked.

Figure 10. Thin-film inclusion in natural ruby, dark-field illumination. Magnified 25×.

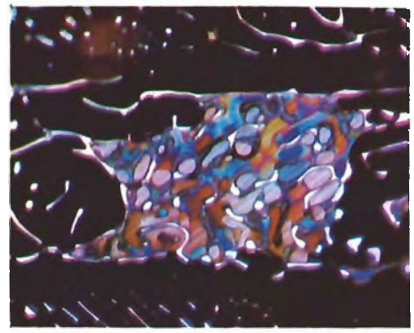

Figure 11. Same inclusion as in figure 10, but with vertical illumination. Magnified 50×.

SUGILITE

A small, thin slab of a new material from Africa was sent to Santa Monica for identification. Figure 12 shows the beautiful purple color and delicate bandings of this stone. In its relatively brief history, this material has been tentatively identified by several different sources as sogdianite, sugilite, and even leucophoenicite. Extensive testing on the sample we received, including X-ray diffraction and chemical analysis, proved it to be manganoan sugilite.

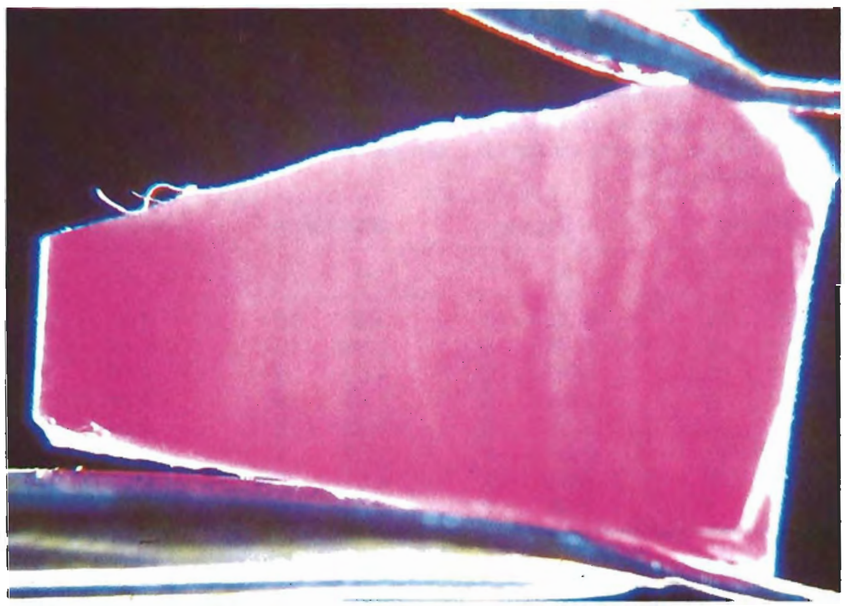

Figure 12. Banding in sugilite. Magnified 15×.

Table 1 compares the refractive indices and specific gravities of the sample we received with those of the three minerals named. Table 2

TABLE 1. Refractive indices and specific gravities of sugilite, sogdianite, leucophoenicite, and the GTL sample.

Material	Refractive index	Specific gravity
Sugilite	1.607–1.610	2.74
Sogdianite	1.606–1.608	2.82–2.90
Leucophoenicite	1.75–1.78	3.85
Sample	1.60[a]	2.75

[a]*Hazy due to poor polish.*

compares the eight strongest lines in the diffraction patterns for the four minerals.

Analysis by the energy dispersive system of the electron microscope in the GIA research department confirmed the presence of manganese in addition to potassium, sodium, iron, and silicon, all essential elements in sugilite. Zirconium is an essential element in sogdianite, and no zirconium was present in the sample tested. Leucophoenicite is a relatively simple manganese silicate hydroxide and would not have all these other elements.

The color of sugilite does change with the type of lighting. It is a bluish purple in daylight and a pleasing reddish purple under incandescent light. The diagnostic absorption spectrum as seen through a thin edge is shown in figure 13.

UNCLASSIFIED ODDITIES

A rather attractive polished slab came into the Santa Monica Lab for identification. The material consisted of small (1 to 2 mm) transparent to transluscent pink and green granules interspersed with larger areas of blue (see figure 14). The refractometer revealed that the pink-to-red material was corundum, the green was tourmaline, and the blue, kyanite. The hexagonal zoning in the corundum, together with the constant maximum birefringence readings of both the corundum and the tourmaline, indicates that these two constituents had grown so that their respective c-axes were parallel to each other and perpendicular to the polished face of the slab. The last time we encountered a similar material in our lab was in 1975. However, that particular sample did not have the kyanite present.

Figure 14. Slab containing a mixture of pink corundum, green tourmaline, and blue kyanite. Magnified 20×.

TABLE 2. d spacing and relative intensity (I) of the eight strongest lines in the diffraction patterns for the GTL sample, sugilite, sogdianite, and leucophoenicite.

Sample		Sugilite		Sogdianite		Leucophoenicite	
d	I	d	I	d	I	d	I
4.35	10	4.32	10	3.20	10	1.81	10
3.20	9	3.19	8	2.90	10	2.88	9
2.89	8.5	4.06	6	4.09	9	2.68	8
4.07	8	2.88	5	1.84	8	4.36	5
3.51	5	3.50	3	1.33	8	3.61	5
2.505	5	2.50	2	1.52	7	2.37	5
7.00	3	6.98	1	4.51	6	2.62	4
1.99	3	3.68	1	3.52	5	2.44	4

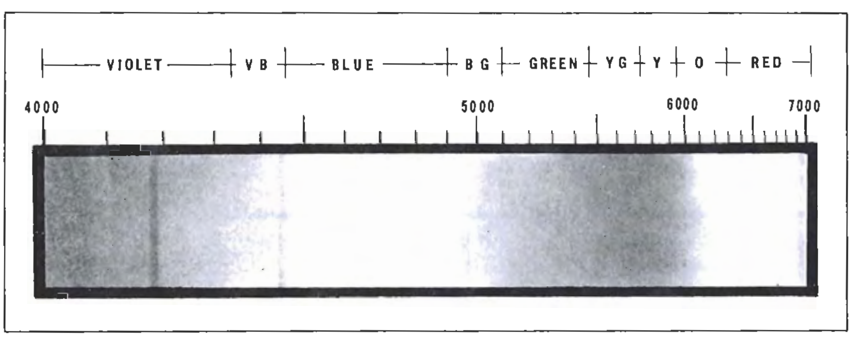

Figure 13. Drawing of absorption spectrum of sugilite.

ACKNOWLEDGMENTS

The photographs used in figures 1, 2, 5, 10, and 11 were taken by Robert E. Kane of the Los Angeles lab. Figures 4, 7, and 8 were supplied by Rene Moore in New York. In Santa Monica, Tino Hammid is responsible for figure 6, Mike Havstad for figure 9, and Chuck Fryer for figures 3, 12, and 14. Chuck Fryer also prepared the absorption spectrum diagram in figure 13.