Gem Trade LAB NOTES

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Cultured CALCAREOUS CONCRETIONS

At the February 1990 Tucson Gem and Mineral Show, several staff members saw a number of concretions that had been found during the harvest of cultured black pearls from *Pinctada margaritifera* mollusks in the South Seas. These concretions, which averaged approximately 12 mm in diameter, were a fairly even dark brown to black in color, but lacked any nacreous deposits. The client asked us to investigate why in these instances the mollusk did not produce the expected cultured pearl but rather a concretion.

With magnification, all of the samples showed a cellular structure in the dark surface areas (figure 1) that is characteristic of most calcareous concretions. In one of the samples, we also noticed an underlying lighter colored area that had no structural characteristics (figure 2). This area did not fluoresce when exposed to long-wave ultraviolet radiation, although the outer layer with the cellular structure did fluoresce a faint yellow, similar in appearance to that seen in some areas of the prismatic calcite layer of the shell itself. An X-radiograph of the concretion revealed the bead nucleus surrounded by a heavy conchiolin layer, thus proving that the concretions were indeed the result of a culturing process. The mollusk had apparently started to build the different shell layers around the inserted nucleus, but had stopped before producing any nacreous layer. We could only speculate that the mantle-tissue graft inserted into the mollusk during the culturing process did not contain (probably by accident; i.e., the critical area was cut off) those cells crucial to the production of this nacreous layer. *KH*

Figure 1. The cellular structure characteristic of calcareous concretions is readily apparent in these dark surface areas. Magnified 20×.

Figure 2. The light-colored nucleus visible under the dark surface of this calcareous concretion has no apparent structure and thus cannot be a shell bead. Magnified 5×.

Figure 3. This 21.26-ct slab of imitation coral is comprised of barium sulfate, a plastic binder, and a coloring agent.

Imitation CORAL, Barium Sulfate

The West Coast laboratory recently received for identification the 21.26-ct orangy red, partly polished, sawed slab illustrated in figure 3. Routine gemological testing quickly identified the material as manmade, apparently intended to imitate coral. When viewed with overhead illumination, the slab appeared opaque, but when placed over an intense light source, it transmitted a moderate amount of light. To the unaided eye, the polished side appeared to be a fairly even orangy red with a waxy

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

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luster. However, with low (less than 20×) magnification and oblique illumination, a subtle inhomogeneous appearance was evident: an irregular, randomly oriented, whitish pink "veining" that somewhat resembles the "spiderweb" pattern seen in some imitation turquoise. Also observed were minute, opaque, metallic-appearing black inclusions.

The material showed an indistinct refractive index reading of around 1.58. The specific gravity, as determined by the hydrostatic method, was approximately 2.33. The hardness – tested in a discreet area – was estimated to be 2 1/2 to 3.

To determine the exact nature of the material, we used sophisticated testing methods. X-ray powder diffraction analysis produced a pattern that matched the standard pattern for barium sulfate. An infrared spectrum obtained to determine if a plastic-type binder was used revealed a strong, sharp peak at 1733 cm^{-1}, typical of a polymer. This absorption band has also been observed in plastic-treated (stabilized) turquoise and in some manufactured turquoise imitations (see "The Identification of Turquoise by Infrared Spectroscopy and X-ray Powder Diffraction," by Th. Lind, K. Schmetzer, and H. Bank, *Gems & Gemology*, Vol. 19, No. 3, 1983, pp. 164–168). *RK*

DIAMOND

Etch Channels in

Etching of a diamond crystal by chemical dissolution can take any of several different forms. The appearance of trigons was discussed in the Lab Notes section of the Spring 1990 issue of this journal, while the Winter 1988 Lab Notes mentioned laminar dissolutions on octahedral faces. Recently, the East Coast laboratory observed etch channels along the edges of octahedral faces on a 3.57-ct rough diamond (figure 4).

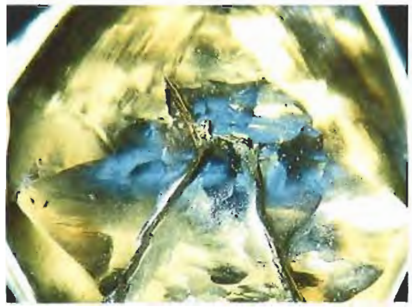


Figure 4. Etch channels are evident on the edges of this octahedral diamond crystal. Magnified 10×.

Figure 5. The color of this 1.04-ct modified bullet-shaped purple diamond is quite rare.

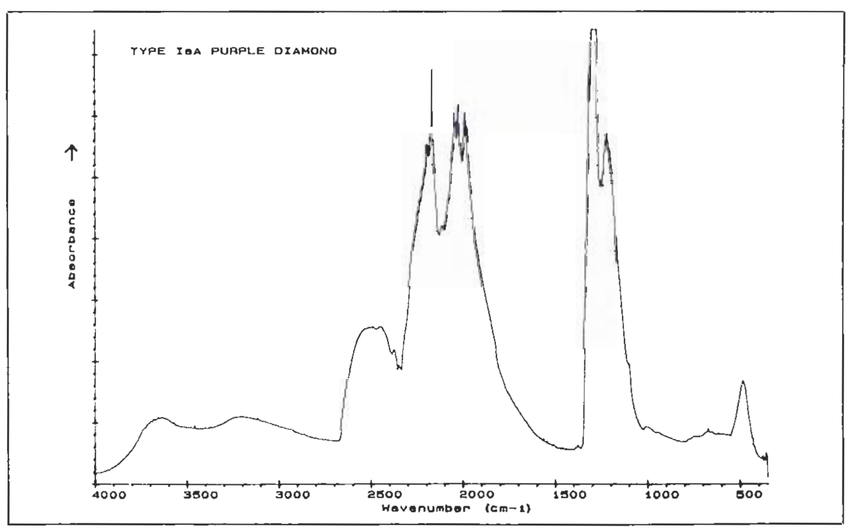
As stated in Orlov's *Mineralogy of Diamonds* (J. Wiley & Sons, New York, 1973, p. 82): "The internal structure of the crystal has considerable influence on the nature of the dissolution surfaces. Different kinds of defects, twinning, inhomogeneous internal structure, all reveal themselves on the surfaces and in the resulting diversity of striations and sculptures." *DH*

Another Purple Diamond

As mentioned in the Summer 1988 Lab Notes section, purple diamonds are rare. The 1.04-ct modified-bullet-shape brilliant cut shown in figure 5 was graded as fancy purple, natural color. The East Coast laboratory thought that the key color was closely matched by ColorMaster coordinates C-23/59/66, with a tone of 5.0 and a saturation of 1.0. Unlike the grayish purple diamond described in the 1988 entry, this stone had no discernible gray component when examined in the GIA Gem Trade Laboratory's standardized grading environment, using a Verilux daylight-balanced light source. Although this diamond did not display the 550-nm line in the hand-held spectroscope seen in other purple diamonds, it showed broad absorption in that area when tested with a Pye-Unicam U.V.-visible spectrophotometer. It was grained internally and had numerous surface grain lines as well.

The I.R. spectrum (figure 6), ob-

Figure 6. This infrared absorption curve shows that the purple diamond seen in figure 5 is a type IaA diamond.



tained using a Nicolet Fourier transform infrared spectrometer, shows that this stone is a type IaA diamond. Type IaA diamonds contain nitrogen in pairs. Unlike type IaB diamonds, in which the nitrogen is bonded in triplets, IaA diamonds do not display the classic Cape series of absorption lines. *DH*

Radioactive GLASS Egg

The 7-oz. (198-gram) glass egg shown in figure 7 was submitted for identification to the East Coast laboratory. It was found to be singly refractive, with the spherical bubbles and swirls typical of glass; it also fluoresced a very strong greenish yellow, similar to the fluorescence seen in some synthetic spinels with this body color.

Figure 7. This yellowish green glass egg, measuring approximately 68.50 × 47.85 mm, proved to be almost 10 times as radioactive as normal background.

Since the body color reminded the staff of that seen in the radioactive uranium glass once used for tableware, we tested this glass egg for residual radioactivity. We found it to be quite "hot," with measurements nearly 10 times that of our normal background radiation. In this respect, it approaches the radioactivity of the rough sample of uranium glass reported by Nassau and Lewand in their article about radioactive synthetic spinel and glass triplets, which appeared in the Winter 1989 issue of *Gems & Gemology.* *RC*

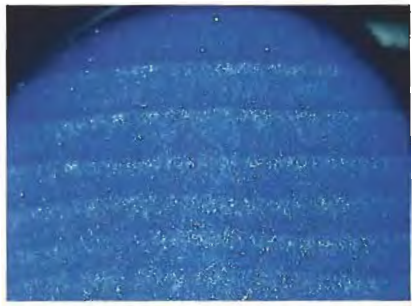


Figure 8. It is unusual to see a banded structure in lapis lazuli. Magnified 4×.

Banded LAPIS LAZULI

The Spring 1988 Lab Notes section described and illustrated a very unusual example of lapis lazuli. As our readers may recall, the distinctive characteristic was a striated structure that was easily visible to the unaided eye. Recently, our West Coast laboratory received for identification a 4-ct oval cabochon showing the same unusual structure (figure 8), with gemological properties almost identical to those of the material previously seen: R.I. (spot) 1.51 and S.G. (hydrostatic method) 2.85. With magnification and a strong overhead light, the unusual arrangement that produced the striated effect became easily visible: Dark blue grains closely packed in layers alternated with areas that contained both transparent near-colorless and opaque dark blue grains. X-ray diffraction analysis resulted in a pattern that showed a mixture of the major components that make up lapis lazuli: lazurite, haüyne, and mica (as well as another, undetermined mineral). We subsequently learned from our client that this banded material originates in Afghanistan; he could not provide information on the exact locality. *KH*

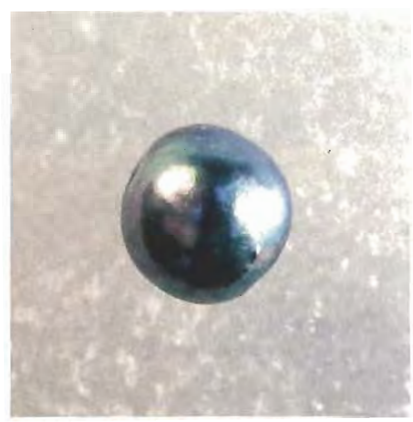
PEARLS

Gray Baroque Cultured Pearl

The dark gray baroque cultured pearl in figure 9, grown in a Japanese saltwater mollusk, was chosen for mounting as a tie tack because of its particularly lustrous appearance. Fortunately, X-radiographs were taken in the East Coast laboratory to locate the nucleus before the pearl was drilled. Had that not been done, it is quite possible that the drill would have missed the nucleus and subjected the very thin nacre to irreparable damage. Figure 10 shows X-radiographs taken from two different directions after the pearl was drilled and the tie tack assembled. It is easy to visualize what could have happened if the drill had missed the point of contact between the nucleus and the nacre. X-radiographs of such cultured pearls suggest that stringing them into a necklace can be quite risky.

Incidentally, people in the trade had mistaken this specimen for a natural-color gray Tahitian cultured pearl. However, the bead nucleus is only 7.5 mm in diameter, smaller than the nuclei customarily used in Tahiti. *RC*

Figure 9. This approximately 12 × 14 mm baroque dark gray cultured pearl was X-radiographed before it was drilled.



"Well-Worked" Pearl

The 22.70 × 15.60 mm natural baroque pearl recently seen in the East Coast laboratory (figure 11) is securely held in a custom-designed gold pendant that appears to be old. It

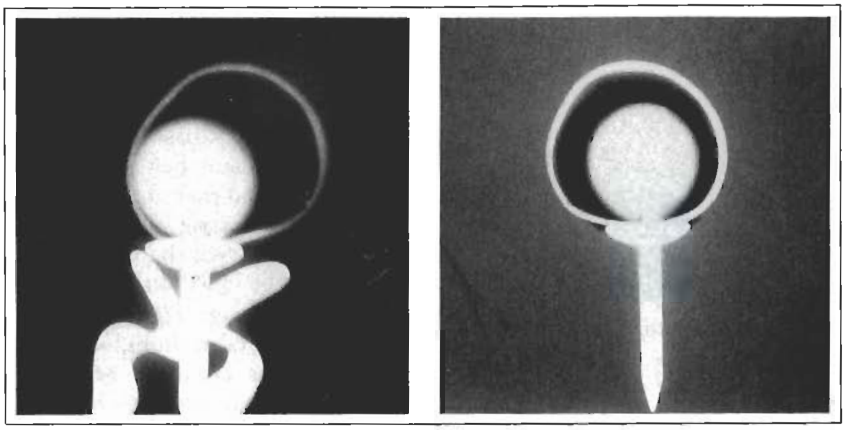


Figure 10. Two different X-radiographic views of the cultured pearl shown in figure 9 illustrate the importance of proper location of the drilling site. Note the large area between the nucleus and the nacre in the view on the left.

Figure 11. This attractively mounted 22.70 × 15.60 mm baroque pearl has been repaired in a number of areas; note the small pearl (on the side near the bottom) that has been used to plug an existing hole.

is an example of the lengths to which jewelers once went to use a rare gem material. The pearl has been half drilled in four places, unwanted areas have been judiciously removed, and other areas show signs of repair—one hole is even plugged with a small natural pearl. This pearl plug can be seen on one side about a third of the way up from the bottom of the pendant. *RC*

Unusual Gem-Quality SODALITE

Figure 12 shows part of an 11-strand hank of more than 2,000 semi-transparent blue beads, averaging approximately 2.0 to 2.5 mm, that recently came into the East Coast lab for identification. At first glance, because of their uniformity in color and appearance, they resembled some sapphire—actually, synthetic sapphire—beads we have seen. However, the spectrum seen with a hand-held spectroscope readily identified them as sodalite. It is surprising that a material with a relatively low refractive index (1.48 versus 1.76) and much lower hardness (5 to 6 versus 9) could so closely resemble corundum. Figure 13 illustrates the relative transparency and fine polish of these handsome beads. *RC*

Figure 12. These fine-quality 2–2.5 mm beads resembled natural or synthetic sapphire in appearance, but proved to be sodalite.

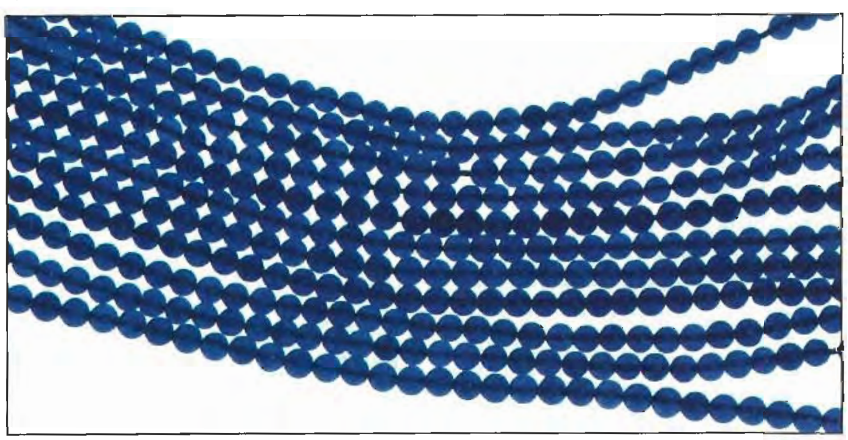
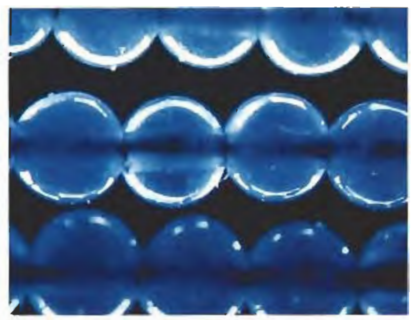


Figure 13. The transparency and fine polish of the sodalite beads shown in figure 12 are evident even at 10× magnification.



SPINEL from Tanzania

The West Coast laboratory recently received for identification the 2.28-ct purplish pink faceted pear shape illustrated in figure 14. Subsequent testing revealed that it was a natural

Figure 14. This 2.28-ct purplish pink spinel is reportedly from Tanzania.

Figure 15. With intense light, the spinel showed a strong blue transmission-type effect.

spinel (R.I. 1.714; singly refractive with very weak anomalous double refraction; S.G. by hydrostatic method of approximately 3.60; strong and very weak red fluorescence to long- and short-wave U.V. radiation, respectively; characteristic absorption spectrum). An interesting feature was noted, however: When the spinel was placed over the intense light emitted through a small opening of the iris diaphragm on the spectroscope unit, a moderate to strong whitish blue transmission-type effect was very evident (see figure 15). This phenomenon was also apparent to the unaided eye when the stone was held a few inches from either an incandescent or fluorescent light source. A faint bluish hazy cast was seen when the spinel was held at "arm's length" in sunlight. This is probably a scattering effect caused by minute inclusions, or dislocations, similar to the reaction seen in some other gem materials.

With the microscope, we observed that although the stone was slightly included, the parallel rows of tiny octahedra that are so frequently encountered in spinels from the classic localities of Burma and Sri Lanka were conspicuously absent. In addition to the "cloudy" transmission effect discussed above, the most prominent internal features were numerous "sheets" of polysynthetic twinning planes. These planes intersected in two directions throughout the gem, and in several areas they were associated with coarse needles or growth tubes. Immersion of the stone in methylene iodide revealed faint color zoning, which appeared to be in alignment with some of the twinning features discussed above. Also dispersed through most areas were densely packed clouds of what appeared to be exsolutions of tiny particles and needles oriented in three directions. A few small, thin, transparent, near-colorless tabular euhedral crystals were present.

The physical and optical properties, as well as color and visual appearance, of this spinel match those of spinels from a "new" deposit in Tanzania that were shown to the writer by Mrs. Eckehard Petsch during a recent visit to Idar-Oberstein. Tanzanian spinel was also available at the 1990 Tucson Show. The owner of the spinel described here reported that the stone was indeed from Tanzania. *RK*

SYNTHETICS and SIMULANTS in Period Jewelry

The East Coast laboratory again had the opportunity to examine some interesting period pieces. The blue stone in the pierced earring shown in figure 16 certainly appeared to be in good company, set in a silver top/gold back earring with near-colorless old-mine brilliants and Swiss cuts—a combination that was common before the turn of the century. The blue stone proved to be glass, with a refractive index of 1.57. It could well be the replacement for a stone lost from an original near-antique piece. However, an even greater mystery is in the markings on the gold (figure 17): the number 583, a quality stamp, and a symbol consisting of a five-pointed star within which is a hammer and sickle. The style was recognized as Russian by a member of our staff who is of Russian extraction. However, we have been unable to determine if this symbol was in use in pre-

Figure 16. This faceted blue glass, surrounded by old-mine- and Swiss-cut diamonds, probably replaced the original center stone in this period earring.

Figure 17. The unusual hallmarks on the gold post of the earring in figure 16 raise some questions as to when and where it was fashioned. Magnified 10×.

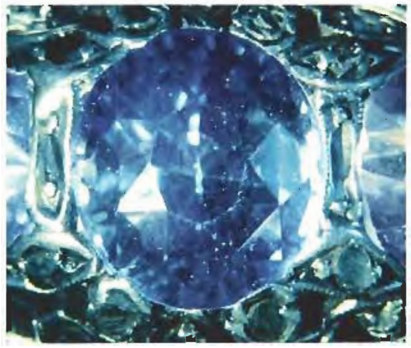


Figure 18. Since synthetic blue sapphires were not made before 1910, this ring may be a reproduction of an earlier piece, with diamond chips used to suggest the earlier dating.

revolutionary Russia, or even if the piece is indeed Russian. If the hammer and sickle came into use only after the 1917 revolution, then the piece would have to be considered a reproduction.

The ring shown in figure 18 contains three very deeply cut synthetic sapphires that resemble some Sri Lankan sapphires we have seen. The silver top and gold shank again suggest a turn-of-the-century dating for the ring. Of particular interest, and to us a rarity, is the fact that the near-colorless accent stones are completely unpolished diamond chips (again, see figure 18). The blue stones appear to be undisturbed in the setting and therefore are probably original. The earliest date for these synthetics would be 1910, so the piece could not have been made before then. RC

FIGURE CREDITS

The photomicrographs in figures 1, 2 and 8 are the work of John I. Koivula. Figures 3, 14, and 15 are by Robert Weldon. Dave Hargett is responsible for figure 4. Vincent Cracco took the photo for figure 5. The I.R. spectrum in figure 6 was produced by Ilene Reinitz. Nicholas DelRe provided figures 7, 9, 11–13, and 16–18. The X-radiographs reproduced in figure 10 were taken by Robert Crowningshield.

A HISTORICAL NOTE

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

SUMMER 1965

The New York lab commented on seeing for the first time a gray-blue kornerupine set in jewelry. They also mentioned a color-change sapphire, two cat's-eye apatites, and a number of painted diamonds that were being fraudulently sold as natural color by a 47th-Street jeweler.

The Los Angeles lab reported on a beautiful aquamarine that was faceted on the pavilion but had a buff top carved with the head of a lady who was wearing a heavy bead necklace and a hair ornament. They also described and illustrated a badly damaged diamond ring. The owner remembered hitting the side of the swimming pool a few times with it, but didn't realize the damage caused. The stone had chips extending from the girdle to the culet on all four sides between the prongs of the setting.

SUMMER 1975

Several examples of very beautiful scrimshaw work on sperm whale teeth were examined and illustrated by the Los Angeles laboratory. An unusual occurrence of corundum in pinite was discussed and shown by reflected and transmitted light, with the difference in hardness of the two materials readily apparent from the difference in luster. Another rare item was a snuff bottle carved from the beak of a hornbill. The red color of the casque on the bill was evident as a darker rim on the edges of the bottle.

The New York lab saw first-hand the effects of too much heat on a diamond. The ring in which the stone was set had been repronged with the stone in place and no effort made to protect it. As a result, the diamond was burned beyond recognition, with all of the facets destroyed.

The color changes that can occur in GGG (gadolinium gallium garnet) when it is exposed to ultraviolet radiation and then heated were covered in detail. The stones turn brown when exposed to U.V. radiation but return to their original color on heating. A "Mood Stone" was examined and found to be a quartz cabochon backed with an unknown material that changes color as the temperature changes. The color-change effect is very similar to that of the liquid crystal thermometers that change color with variations in temperature.

SUMMER 1985

Different cat's-eyes were discussed and illustrated, with the various gemological properties listed. These included specimens of zircon, quartz, a 52.97-ct green-brown scapolite, and a rare 1.86-ct hexagonite (the pink variety of tremolite, found in St. Lawrence county, New York). Also illustrated was the damage incurred when a fluorite carving was placed in dilute sulfuric acid to remove traces of soldering flux and tarnish from a gold bail. An unusual synthetic opal and a radioactive natural opal from Mexico were discussed and illustrated.