

Gem Trade LAB NOTES

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Synthetic ALEXANDRITE

With the recent influx of material from Brazil, the New York laboratory has identified more natural alexandrites in the past few months than it had in the last several years. Because of the new public awareness of natural alexandrite, an expanded marketing effort for synthetic alexandrite has also developed. A New Jersey distributor of synthetic gems is now selling a Czochralski-grown synthetic alexandrite and recently submitted six samples to the New York laboratory for examination. Two of these stones (1.50 ct each) are shown in figure 1 as seen in incandescent light. In daylight or fluorescent light they are blue-green with areas of purple. The color change is very similar to that of the natural Brazilian material.

As was to be expected of the synthetic material, all six samples fluoresced a very strong bright red to both long- and short-wave ultraviolet

Figure 1. These two 1.50-ct synthetic alexandrites have a color change very similar to that of natural Brazilian alexandrite. Here they are seen in incandescent light.



radiation; in contrast, most natural alexandrites display only a moderate to weak red fluorescence to both types of radiation. The synthetic stones appeared to be without inclusions or any other internal characteristics, which is consistent with the Czochralski method of manufacture. *David Hargett*

Artistically Stained CHALCEDONY

Recently submitted to the Los Angeles laboratory for identification was the scenic stone ring shown in figure 2. Subsequent testing identified the stone as chalcedony that had been stained with a black dendritic design on the top surface.

Microscopic examination revealed that the design had an extremely shallow penetration; it also revealed faint agate-like banding in the stone. As would be expected with dyed chalcedony, no dye was removed when the stone was tested with a cotton swab dipped in either acetone or a 10% hydrochloric acid solution.

Exposure to long-wave ultraviolet radiation revealed a very weak to weak patchy, dull, chalky yellow fluorescence aligned with the agate-like banding. Of interest was a very thin (0.2–0.3 mm) layer of moderate to strong dull, chalky yellow fluorescence that was confined to the top of the tablet. No phosphorescence was observed. Exposure to short-wave ultraviolet radiation revealed much the same reaction, except that the fluo-

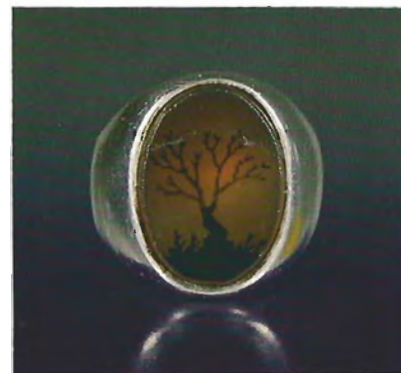


Figure 2. The dendritic pattern on this 18.5 × 13.6 × 2.1 mm chalcedony cabochon is actually a stain that was painted on the stone.

rescence was much weaker and had a greenish cast. *RK*

CLINOHUMITE

The Santa Monica laboratory recently identified another rare gem-quality clinohumite (see p. 236 of the Winter 1986 issue of *Gems & Gemology* for an earlier report on this material), a brownish yellow round brilliant-cut stone that weighs approximately 0.5 ct (figure 3). The laboratory determined that this particular stone has refractive indices of 1.630 and 1.668, with a corresponding birefringence of 0.038, and is

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

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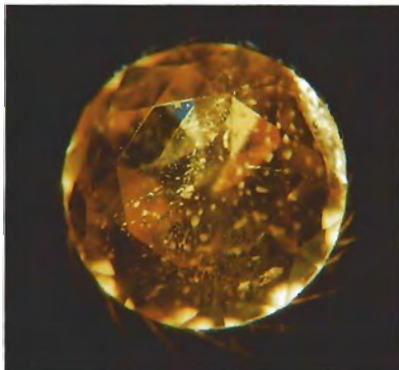


Figure 3. This 0.5-ct stone is a rare faceted clinohumite.

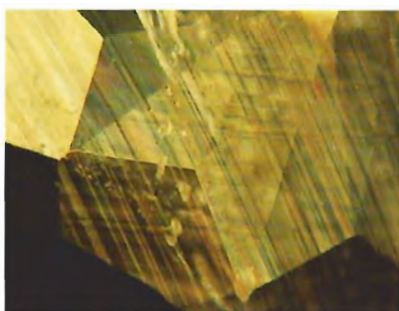


Figure 4. The numerous intersecting twin lines in the clinohumite shown in figure 3 are readily apparent in polarized light. Magnified 63 $\times$.

biaxial positive. The specific gravity, estimated with heavy liquids, is approximately 3.18. There was no distinctive absorption spectrum. Although the stone did not fluoresce to long-wave ultraviolet radiation, it did fluoresce a very strong orange yellow

to short-wave U.V. The stone had a fine fingerprint inclusion, several three-phase inclusions, and an acicular inclusion of unknown identity. In addition to being heavily included, the stone was also highly twinned, with numerous intersecting twin lines (figure 4). This material is reportedly from the USSR. KH

DIAMOND

Cyclotron-Treated

The New York laboratory recently received for identification a 20.22-ct yellowish brown emerald-cut diamond. The "umbrella effect" that is typical of a cyclotron-treated diamond was readily apparent (figure 5). (In an emerald-cut diamond, there is a strong color band parallel to the elongated culet; the term *umbrella effect* originates from the appearance of this phenomenon as seen in a round brilliant cut, where it does indeed resemble an umbrella.)

Also in keeping with cyclotron treatment, this stone displayed a 594-nm absorption line. Interestingly, though, it was also a "green transmitter"; that is, it luminesced green when exposed to visible light with wavelengths of 503 nm or shorter. Green transmission is usually encountered in natural-color diamonds, but as evidenced here, it is occasionally seen in treated ones as well. In the latter case, it can be present either naturally prior to laboratory irradiation or can arise as a result of that treatment. The green

luminescence in this diamond (figure 6) is clearly the result of the cyclotron treatment, inasmuch as it, too, shows the umbrella effect.

Clayton Welch

Damaged

Unfortunately, the laboratory occasionally still sees diamonds that have been needlessly damaged by hardness tests. The 0.80-ct round brilliant-cut diamond shown in figure 7 was recently submitted to the Los Angeles laboratory for grading. A hardness test that had been performed on the table lowered the clarity grade from VVS₁ to VS₂. A series of feathers and bruises along the scratch extend deep into the stone.

Whenever we have encountered this kind of damage in the past, it invariably was caused by an uninformed person testing the stone to see if it is a diamond or a simulant. Such people operate on the mistaken

Figure 7. Even diamonds can be damaged by scratch hardness tests, as this 0.80-ct stone proves; its clarity went from VVS₁ to VS₂. Magnified 20 $\times$.



Figure 5. The "umbrella effect" characteristic of cyclotron-treated diamonds is evident as a line of darker color parallel to the culet (here, at the top of photo) in this emerald-cut diamond. Magnified 30 $\times$.



Figure 6. Green transmission and the "umbrella effect" proved that this diamond had been cyclotron treated. Fiber-optic side lighting; magnified 30 $\times$.

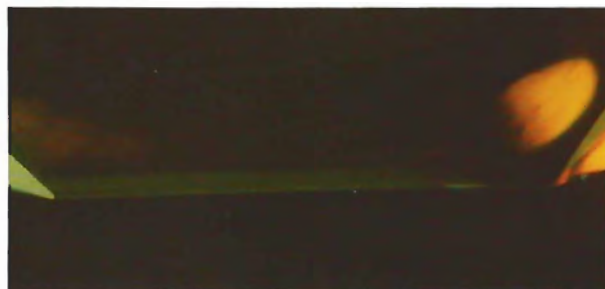




Figure 8. This 4.5-ct lapis lazuli cabochon has unusual straight parallel banding.

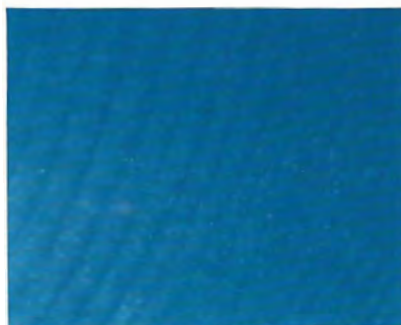


Figure 9. Parallel banding in the lapis lazuli cabochon shown in figure 8 conforms to the cabochon cut. Magnified 6x.



Figure 10. Banding is also evident in this thin section of the lapis cabochon shown in figure 8. Magnified 80x.

belief that a "real" diamond cannot be scratched, even by another diamond. Needless to say, a diamond should never be used for a hardness test. Rapid methods for identifying diamonds and their simulants exist, with many tests requiring only a trained eye. An exceptional article on this topic by Jill Hobbs, "A Simple Approach to Detecting Diamond Simulants,"¹ was published in the Spring 1981 issue of *Gems & Gemology*. RK

Banded LAPIS LAZULI

The Santa Monica laboratory received an opaque blue oval cabochon for identification. The approximately 4.5-ct stone appeared to be top-quality lapis lazuli (figure 8). Preliminary testing seemed to verify the initial thoughts. The refractive index was determined (by the spot method) to be 1.51; the specific gravity, estimated by heavy liquids, was approximately 2.85; and there was a distinct rotten-egg odor when a small drop of hydrochloric acid was applied to the back of the stone. Although the stone was inert to short-wave ultraviolet radiation, it fluoresced a chalky greenish yellow to long-wave U.V.

Magnification revealed a structure quite unlike the usual granular appearance of the components that make up lapis lazuli. Straight parallel banding was seen, some of which appeared curved as a result, no doubt, of the cabochon cut (figure 9). When

strong light was passed through a thin edge of the cabochon, the material did indeed show a granular structure. There seemed to be at least two different constituents: near-colorless grains surrounded by opaque blue grains. The grains were arranged in such a way, however, that they produced a striated, or banded, effect.

We were given permission to have a thin section made in order to document further the unusual structure (figure 10). X-ray diffraction revealed a pattern consistent with lapis, showing a mixture of lazurite, hauyne, mica, and another undetermined mineral. This is a most unusual piece of lapis. It is unfortunate that the source of the material is not known. KH

PEARLS

Early "Japanese" Pearls

In the Lab Notes section of the Summer 1983 issue of *Gems & Gemology*, a lattice-work necklace of cultured blister pearls was illustrated. It was surmised then that these blister pearls might be of the type cultivated in Japan as early as 1890, before whole cultured pearls became available. Recently at the New York laboratory, we received a pair of earrings that we believe even more convincingly indicate manufacture before 1900. The blister pearls are button shaped with the mother-of-pearl nucleus clearly exposed on the back (figure 11). The X-ray shows that one

blister pearl is very similar to that illustrated in the 1983 issue (p. 116), with a rectangular mother-of-pearl insert. The other three do not have this type of insert, but their backs seem to resemble those of modern Mabe pearls. The fact that these cultured blister pearls, like those in the lattice-work necklace, did not fluoresce to X-rays indicates that the nuclei are of saltwater shell, rather than the freshwater shell used in most whole cultured pearls today.

Figure 12, from G. F. Herbert Smith's ninth edition (1940) of *Gemstones*, illustrates the method by which most of these so-called "Japanese" pearls were produced. This is one of the few references in the

Figure 11. The early "Japanese" cultured blister pearls in this and the matching earring measure 7 1/2 mm in diameter; the nucleus is clearly exposed on the back of each pearl.



literature to a once-flourishing practice that gave way to an even more vigorous whole cultured pearl industry. In view of the fact that these blister pearls were produced at the rate of more than 50,000 a year beginning in 1890 [Kokichi Mikimoto was the principal producer, with over 1,000 acres of leased seabed], it is surprising that the Gem Trade Laboratory has only encountered them mounted in jewelry in these two instances. RC

Natural Pearl and Diamond Tiara

The impressive diamond and pearl tiara in figure 13 was brought to the Santa Monica laboratory for identification of the pearls. The tiara measures approximately 5 1/2 inches long and 2 1/2 inches high (14 cm × 6.3

Figure 12. This illustration from G. F. Herbert Smith's Gemstones (9th ed., 1940) shows how most of the "Japanese" pearls were cultured. Top = in the oyster; bottom = finished "pearl." A = nacre; B = shell; C = outer shell of oyster; D = mother-of-pearl back added.

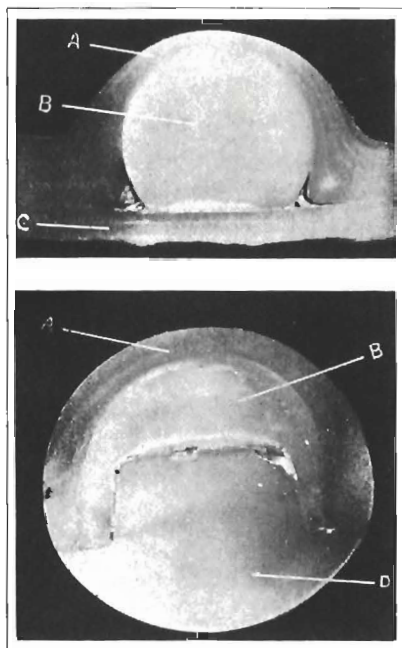


Figure 13. The largest pearl in this tiara of natural pearls and diamonds measures 10 × 18 mm long.

cm). There are a total of seven rows of pearls: five rows of round drilled pearls of various sizes, one of round and drop-shaped pearls, and a top row of all drop-shaped pearls ranging from approximately 3 mm to 10 mm in diameter and up to 18 mm long. The pearls are all well matched for color, are fairly lustrous, and, considering the apparent age of the piece, show very little wear. At the client's request, only the three center drop-shaped pearls and the five in the row underneath and between them were identified. None of these showed any fluorescence to X-rays and, since the radiograph revealed a natural structure, the pearls were identified as saltwater natural pearls. The piece also included numerous near-colorless rose-cut diamonds in white metal settings. The open setting of the diamonds in what appeared to be

silver mountings on yellow gold indicates that the tiara dates to the early 19th century, when this type of stone setting was popular. KH

SAPPHIRE

Color Zoned

A 1.06-ct blue sapphire was submitted to the New York laboratory for identification. A spall cavity, the fire-skinned surface, and discoid fractures easily proved that the stone had been heat treated. However, the dark blue hexagonal color zoning seen through the table (figure 14) is unusual. It appears that a "phantom crystal" within the sapphire was affected by the heat treatment, leaving the edges fuzzy and partially diffused into the stone. When the stone was viewed with a Beck hand-held type of spectroscope, the 450-nm (iron) line

was quite strong. Perhaps this was originally a very dark sapphire that had been heated to lighten the color, with the perimeter of the "phantom crystal" remaining dark in spite of the treatment. *David Hargett*

With Needles

One of the characteristics that proves that a sapphire has not been heat treated is the presence of coarse, well-formed, undisturbed needle-like inclusions and/or their shorter wedge-shaped relatives. Such inclusions often light up with spectral colors when illuminated by a strong overhead or fiber-optic light source, as seen in the approximately 40-ct sapphire shown in figure 15, which was submitted to the New York laboratory for identification. These needles produce asterism when the stone is cut en cabochon. An interesting trick is to place a small drop of methylene iodide (the 3.32 specific gravity liquid) on the surface of a faceted stone and observe the star effect in the bead of liquid (figure 16).

Clayton Welch

TOURMALINE from Nepal

The Los Angeles laboratory had the opportunity to examine four faceted tourmalines that were reported to be from Nepal: a 5.69-ct light pink, a 4.73-ct dark purplish red, and two yellow stones of 5.16 and 5.61 ct (figure 17). Tourmaline crystals from



Figure 17. These four tourmalines, which range from 4.73 ct for the purplish red emerald cut to 5.48 ct for the pink oval mixed cut, are reportedly from Nepal.

Figure 14. The strong blue hexagonal color zoning in this heat-treated sapphire is not common. Magnified 30 $\times$.

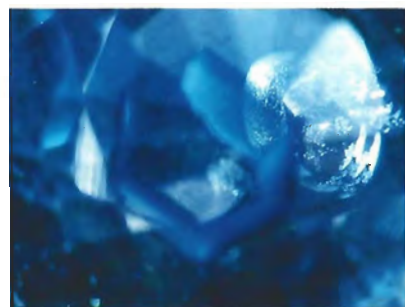


Figure 15. Needles and wedge-shaped inclusions in a sapphire prove that it has not been heat treated. Magnified 30 $\times$.

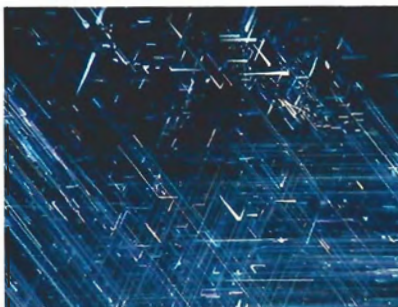


Figure 16. Drops of methylene iodide on a faceted needle-filled natural sapphire can produce a star effect. Magnified 10 $\times$.

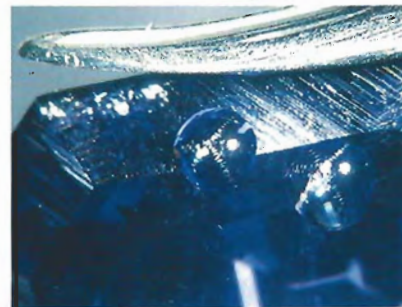




Figure 18. This imitation turquoise necklace is actually gibbsite; the beads range from 5.7 to 14.5 mm in diameter.

Nepal first began to appear in the 1960s. They occur in a wide variety of colors, the most distinctive and most common of which are the bright greenish yellow to brown-yellow, pink, "lemon-yellow," green tricolored, and watermelon crystals which are well terminated and measure up to 20 cm (8 in.) in length. Collector crystals remain quite rare, as nearly all of the material has gone to India for faceting. In addition, there reportedly has been little production during the 1970s and 1980s. Although more than two dozen pegmatites are known to exist in Nepal, virtually the entire tourmaline production comes from only two sources: the Hyakule mine and the Phakuwa mine. Since the discovery of the Hyakule mine over 50 years ago, estimates put the yield of gem tourmaline at just over 1,300 kg (2,800 lbs.) with only about 10% of gem quality. Now, mining has virtually ceased, primarily due to the landslides that occur every summer during the heavy monsoon rains. For more information, see the excellent

1985 article by A. M. Bassett, "The Tourmalines of Nepal," in the *Mineralogical Record*, Vol. 16, No. 5, pp. 413-418.

The gemological properties of the four stones we examined are as follows: refractive indices range from 1.619 and 1.637 for the pink, to 1.620 and 1.648 for the greenish yellow, with birefringences from 0.018 to 0.028. The absorption spectra were typical for their respective colors, except that the yellow showed only a weak general absorption up to 410 nm, with no distinct lines or bands. The red and the two yellow stones were inert to both long- and short-wave ultraviolet radiation; the pink tourmaline had a very slight suggestion of a blue fluorescence to long-wave U.V. and fluoresced a moderate chalky violetish blue to short-wave U.V. The inclusions are typical of tourmaline: thin needles, growth tubes, "fingerprints" composed of gaseous and fluid inclusions, and small transparent, colorless, birefringent, euhedral crystals.

RK

Imitation TURQUOISE with "Veins" and Pyrite

A quite attractive turquoise-colored necklace (figure 18) was sent to the Santa Monica laboratory for identification. At first glance, the beads appeared to be fashioned from fine-quality turquoise; most were evenly colored, some had characteristic "matrix" veins, and many also showed readily visible pyrite inclusions.

A spot refractive index reading of 1.55 was obtained with a standard gemological refractometer. Even though this figure is too low for natural turquoise (1.61), it is still within the range for treated material. Under magnification, the beads had a sugary, speckled appearance that is often seen in treated turquoise. The application of the thermal reaction tester (hot point) inside the drill hole of a bead produced a reaction characteristic of plastic treatment. However, the absorption line at 432 nm that is usually seen in turquoise was not evident. It was decided that X-ray diffraction would be needed to identify this material conclusively.

A minute amount of powder was scraped from inside the drill hole of one of the beads. The pattern produced matched that of gibbsite, a clay-like aluminum hydroxide. Gibbsite is encountered fairly frequently as a substitute for turquoise, but these particular beads—plastic treated and with pyrite inclusions—represent one of the most authentic-looking turquoise imitations our staff has ever seen.

KH

FIGURE CREDITS

The photos used for figures 1 and 14 were taken by David Hargett. Chuck Fryer is responsible for figures 3, 4, and 18. Figure 2 was produced by Shane McClure. Robert E. Kane furnished figure 7. Clayton Welch supplied figures 5, 6, 11, 15, and 16. Scott Briggs photographed figure 8. John I. Koivula took the photomicrographs for figures 9 and 10. Figure 12 is reproduced from page 361 of G. F. Smith's book *Gemstones*, (9th ed., 1940). Figures 13 and 17 are © Tino Hammid.

A HISTORICAL NOTE

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

SPRING 1963

The Los Angeles laboratory received a large stone that was represented to be diamond but lacked transparency and brilliance. Testing proved that it was indeed a diamond, in spite of its appearance. A pair of earrings and a matching brooch with diamonds and green stones set in platinum were submitted for identification of the green stones. The large one in the brooch was natural emerald, but the green stones in the earrings were glass.

Reports of new finds of gem materials include brown topaz from San Luis Potosi, Mexico. The green material found at what was believed to be a new locality (unidentified) for emerald proved to be fluorite. Rare materials encountered and identified include scoxodite, translucent lapis, transparent staurolite, a greenish blue phenakite, clinozoisite, proustite, scheelite, and zincite.

In the same issue, the New York laboratory reports on shallow emeralds set with dark green aventurine quartz behind them to enhance the color, orthoclase cat's-eyes, massive pink grossularite garnet, a natural-color brown diamond, and a cyclotron-treated green diamond.

SPRING 1973

The New York laboratory discusses the imitation jade "Inamori stone" or "Meta-jade," as it is sometimes called. It is actually a devitrified glass, that is, a glass that partially crystallized in a dendritic pattern as it cooled. Several different stones were submitted for identification at different times. Some fine natural jadeite was also seen. A glass cat's-eye material examined contains what resembled fiber-optic bundles when viewed from the side of the stone. This material is known by the

trade name "Cat's-eyte." Other items of interest seen in New York were a 13-ct diamond with a nicely faceted girdle, some synthetic emeralds, an unusual agate, and a diamond that had a somewhat squarish cross section which contained some erratic tubules that meandered through the stone near one side.

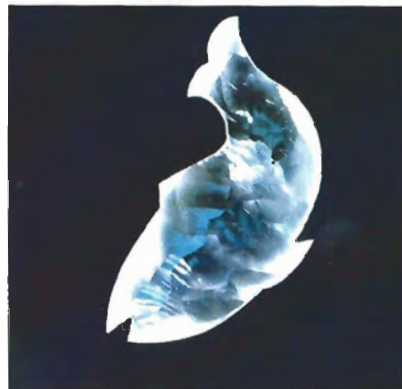
The Los Angeles laboratory discusses and illustrates various aspects of laser drilling of diamonds. A cabochon of "emerald turquoise" was submitted for identification. The stone seemed to have all the gemological properties of normal blue turquoise except its color. An X-ray powder diffraction pattern was the same as that of turquoise, but a spectrochemical analysis revealed the presence of over 4% zinc. This led to its identification as faustite, the zincian analogue of turquoise where zinc replaces some of the copper normally found in turquoise. Other items of interest include several trapiche emeralds, a synthetic ruby with an unusual pattern of bubbles, a large parasite crystal, Umba River corundums, and a quartz crystal with a movable bubble in a two-phase inclusion.

SPRING 1983

The Santa Monica laboratory reports on a beautiful 4.02-ct cat's-eye alexandrite, with a very good color change and a fine eye. An alexandrite-like spinel and a fine 19-ct cat's-eye quartz were also seen. The most unusual item was a broken semitranslucent concretion that was found in a can of tuna fish. At the time the column was written, we did not have any idea what the item might be. However, a student subsequently provided information and an example indicating that it was probably the eye of a tuna.

Speaking of fish, the New York

laboratory had the opportunity to examine a 2.87-ct diamond carved in the shape of a fish. The natural surface skin that was left on the carving even resembled fish scales. In addition, several pink diamonds are discussed, as are tubular inclusions in a flux-grown synthetic emerald, a fluorite and quartz necklace, several different types of pearls, a cat's-eye opal, and some assembled stones.



Carved fish-shaped diamond. The stone weighs 2.87 ct and measures 18.38 mm × 8.95 mm × 2.26 mm thick.

A matched suite of jewelry, consisting of a necklace, earrings, and a combination ring and pendant, all set with what appeared to be emeralds and diamonds, were submitted to the Los Angeles lab when it was discovered that the green stone in the ring/pendant combination seemed to lose color when it was steam cleaned. The stone in question proved to be natural beryl with a green coating. The other green stones proved to be natural uncoated emeralds. A word of warning should be repeated here: NEVER, NEVER steam clean emeralds. The thermal shock can easily fracture natural stones (and remove the color from coated ones).