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COLORED STONES AND ORGANIC MATERIALS

Blue dravite-uvite tourmaline from Koksha Valley, Afghanistan. Tourmaline is popular among gem and mineral enthusiasts for its extensive variety of colors. Blue, one of the most sought-after hues, is usually encountered as elbaite, a sodium- and lithium-containing species with the chemical formula $Na(Li_{1.5}Al_{1.5})Al_6(Si_6O_{18})(BO_3)_3(OH)_3(OH)$. While it has been reported that very limited quantities of dark blue tourmaline crystals are being mined in Afghanistan's Koksha Valley, we have found that this material appears to be a hybrid species of dravite-uvite tourmaline (figure 1).

Figure 1. This specimen of dark blue tourmaline on micaceous matrix, from the Koksha Valley of Badakhshan Province in Afghanistan, measures 28 × 25 × 17 mm. Photo by Kevin Schumacher.

Around a dozen blue crystals in pale green and brown micaceous matrix first surfaced in the gem markets of Peshawar, Pakistan, in late 2009, as confirmed by two sources (S. Khan and P. Slootweg, pers. comms., 2016). These crystals, reportedly from Badakhshan Province's Koksha Valley, were subsequently assumed to be a member of the tourmaline group based on their ditrigonal pyramidal habit. Since that time, only very small batches of these crystals have turned up; interestingly, a few of these specimens have been associated with sapphire in the same matrix (P. Slootweg, pers. comm., 2016). In 2010, while examining sapphire rough believed to be from a deposit near the Koksha Valley, GIA's Bangkok laboratory identified bluish green crystals present in some matrix specimens of sapphire as dravite tourmaline (Spring 2011 Lab Notes, pp. 53–54). While the Koksha Valley is most famous for extensive deposits of high-quality lapis lazuli near Sar-e-Sang, sapphire mining takes place near the village of Hazrat Saeed, 25 km north of Sar-e-Sang along the Koksha River (T.P. Moore and R.W.M. Woodside, "The Sar-e-Sang lapis mine," *Mineralogical Record*, Vol. 45, No. 3, 2014, pp. 280–336). The sapphire at Hazrat Saeed is recovered from mica-rich gneiss, and it appears that these green and blue tourmalines were uncovered as a by-product of sapphire mining operations.

Editors' note: Interested contributors should send information and illustrations to Stuart Overlin at soverlin@gia.edu or GIA, The Robert Mouawad Campus, 5345 Armada Drive, Carlsbad, CA 92008.

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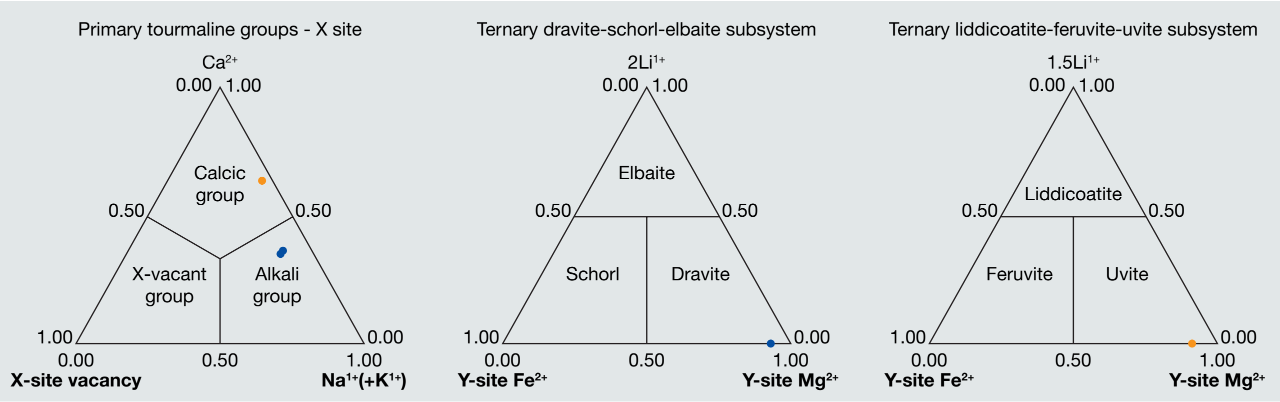

Figure 2. Left: Three laser spots were plotted in the ternary system for the primary tourmaline groups based on the dominant occupancy of the X site. Center: Two blue laser spots that belong to the alkali primary tourmaline group were further plotted in the ternary dravite-schorl-elbaite subsystem. Right: One orange laser spot that belongs to the calcic primary tourmaline group was further plotted in the ternary liddicoatite-feruvite-uvite subsystem. These findings show a range of composition consistent with the dravite-uvite series.

Laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS) was used to analyze the chemical composition of the dark blue tourmaline seen in figure 1. Three spots were measured and plotted (figure 2). Two of the spots showed that the tourmaline contained dravite; the third revealed the presence of uvite (D.J. Henry et al., "Nomenclature of the tourmaline-supergroup minerals," *American Mineralogist*, Vol. 96, No. 5–6, 2011, pp. 895–913). Dravite, $NaMg_3Al_6(Si_6O_{18})(BO_3)_3(OH)_3OH$, is a sodium- and magnesium-rich tourmaline typically encountered in brown, yellow, black, and rarely as intense green. Uvite, $Ca(Mg_3)MgAl_5(Si_6O_{18})(BO_3)_3(OH)_3(F/OH)$, is a calcium- and magnesium-rich tourmaline that is often brown, green, or deep red. Our analysis suggests that this blue tourmaline specimen is composed of a mixture of dravite and uvite. While fibrous blue dravite has been reported in the Czech Republic (M. Novak, "Blue dravite as an indicator of fluid composition during subsolidus replacement processes in Li-poor granitic pegmatites in the Moldanubicum, Czech Republic," *Journal of the Czech Geological Society*, Vol. 43, No. 1–2, 1998, pp. 24–30), this is the first large single-crystal blue dravite-uvite tourmaline the authors have encountered.

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Sapphire rush near Ambatondrazaka, Madagascar. In October 2016, a sapphire rush of an estimated 45,000 miners occurred at Bemainty, about 35 km east of Ambatondrazaka, Madagascar. Author VP was informed of the rush by Marc Noverraz, a Swiss gem merchant based in Ilakaka, Madagascar. According to Mr. Noverraz, some large, highly saturated blue sapphires were found at the rainforest site in late September. This attracted people from all over the island, as well as traders (mainly from Sri Lanka) who settled in Ambatondrazaka to buy gems.

Author RP gained access to the site from October 23 to 26. When she arrived, miners were working along either side of a river. The mining area was slightly more than 2.5 km long. The miners were digging for gem-rich gravels near the river or in the forest while washing took place in the nearby stream. The sapphires produced were mainly blue, varying from light to deep blue (figure 3). Many of the blue specimens were very slightly green; most were milky and would benefit from heat treatment. Particolored stones with pink/blue/colorless color zoning and pinkish orange sapphires (like those discovered at Mandraka near Toamasina in 2011) were also found.

This new rush area (figure 4) was clearly a secondary deposit. Miners had dug pits up to two meters deep in order to collect potentially gem-rich gravels for washing in the

Figure 3. A rough blue sapphire at the rush site at Bemainty, near Ambatondrazaka, Madagascar. Photo by Rosey Perkins.

Figure 4. Thousands of independent Malagasy miners work the sapphire deposit in the rainforest east of Ambatondrazaka in October 2016. Photo by Rosey Perkins.

stream using hand sieves. Life at the mining site was very basic, with some people living in huts but most in makeshift tents under a plastic roof. There was no sanitation, and clean water was not available. While some police were present to keep the peace, it is now believed they took greater control of the area, and the number of active miners seems to have decreased.

Author RP accessed the site from Ansevabe, a one-hour journey from Ambatondrazaka by motorbike, though many people were reaching the area by tractor, bicycle, or on foot (an 11-hour walk from Ansevabe). On her return to Ansevabe, RP estimated a thousand people traveling toward the mine. In Ambatondrazaka, she saw blue stones from the rush weighing up to 75 ct. Fine, clean blue stones over 100 ct and some attractive pinkish orange stones over 50 ct were also reported.

As rubies and sapphires have been discovered fairly regularly in this region since 2000, a new sapphire find was not a huge surprise. The region is part of the Ankeniheny-Zahamena-Mandadia Biodiversity Conservation Corridor and Restoration Project, which consists of Ankeniheny, Zahamena, and Mantadia National Parks. The rush site is therefore a protected area. Several sources in Madagascar have reported that by early November the authorities had started to control the foreign buyers, though stones continue to emerge from the mine.

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Trapiche-type sapphire from Tasmania. Trapiche and trapiche-type minerals are treasured for their beauty and unique patterns. The six-rayed spoke patterns occur in different minerals but are best known in emeralds. During a GIA field expedition to the Australian island of Tasmania, author VP was able to mine several sapphires (figure 5), including a black star, some small blue samples, and a 2.73 ct blue sapphire that showed a fixed six-ray pattern. Trapiche-type stones are found in almost all basalt-related sapphire fields, but they are considered exceptionally rare in Tasmania (B. Sweeney, "Interesting gems from north-east Tasmania," *Australian Gemmologist*, Vol. 19, No. 6, 1996, pp. 264–267).

The trapiche-patterned stone had a dark blue bodycolor and was translucent to opaque. Many inclusions were visible, as were iron-stained fractures and clouds of particles. Hexagonal growth and color zones could also be seen. The core of the sample appeared colorless. The trapiche pattern was expressed as a hexagonal core with six radiating arms

Figure 5. Production from one day of mining in Tasmania. The trapiche-type sapphire in the center weighs 2.73 ct. Photo by Vincent Pardieu/GIA.

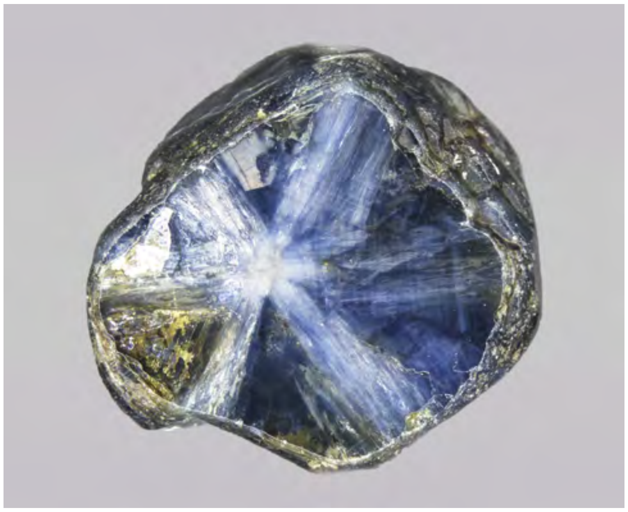

Figure 6. The polished section of the trapiche-type sample, as seen with fiber-optic illumination. The central white core and the six whitish particle-rich arms separated by blue areas are clearly visible. Photo by Victoria Raynaud.

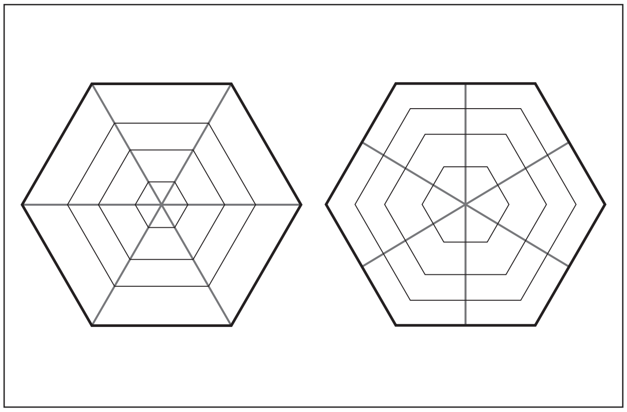

Figure 7. Trapiche (left) vs. trapiche-type (right) patterns in corundum.

(figure 6). These white reflective features stood out against the blue bodycolor. The stone weighed 2.54 ct after we opened a polished window, and it measured approximately 6.93 × 8.20 × 3.00 mm after fabrication.

The relationship of the trapiche arms to the color zoning is important for correctly identifying a sample as "trapiche" or "trapiche-type." In this case, it was obvious that the rays were perpendicular to the hexagonal color and growth zoning, and that the intersections were not located at the corners of the hexagonal pattern.

According to the recent literature, this pattern would not qualify as true trapiche, as seen in Muzo emeralds or some Mong Hsu rubies (G. Giuliani and I. Pignatelli, "'Trapiche' vs 'Trapiche-like' textures in minerals," *InColor*, Vol. 31, 2016, pp. 45–46). True trapiche minerals have equivalent, crystallographic sectors divided by heavily included zones, a pattern expressed as arms intersecting the growth patterns at the junctions (figure 7, left). In the Tasmanian sapphire, the included zones were perpendicular to the growth zones and did not divide the gem into crystallographic sectors (see figure 7, right). Thus, it was a "trapiche-like" mineral.

The sample's chemical composition was analyzed with laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS) on five different areas. The trace-element composition was analyzed in the white core, two arms at mid-length, one arm close to the core, and a blue area between the arms (again, see figure 6).

For most elements (Mg, V, Fe, Zr, Nb, and Ta), an increase in concentration is observed from the less included blue areas to the most included area, which was the core. Ti showed a different pattern, with higher concentrations in the arms and lower concentrations in the blue areas; concentrations were even lower in the core. Ga remained constant throughout the stone but was slightly elevated in the core. Be showed a similar pattern but was more variable outside the core.

The higher concentration of certain elements (V, Zr, Nb, and Ta) was most likely due to the presence of micro-inclusions. Ti was extremely low in the core, where there was no blue color; higher Ti concentrations in the other areas explained the blue color. The variation within the arms and the blue area may be explained by growth + color zoning, although the influence of Ti-rich particles should not be excluded. The Fe concentrations were probably caused by a combination of increased particle density and internal growth variations. It is notable, but not unexpected, that this natural trapiche-type sapphire contained some Be, albeit in very low quantities (V. Pardieu, "Blue sapphires and beryllium: An unfinished world quest," *InColor*, Vol. 23, 2013, pp. 36–43). The Be concentration was highest in the core, where the particle density was highest and the blue color was absent.

While trapiche-type sapphires are not particularly rare, it is unusual to find them in Tasmania. This sample has additional scientific value because it was mined by a field gemologist during a field expedition, giving it an extremely reliable origin.

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SYNTHETICS AND IMITATIONS

Two glass samples: Natural or man-made? During a March 2014 visit to Chanthaburi, Thailand, author VP was shown two faceted green samples (figure 8) that were reportedly moldavite, a natural glass formed from meteorite impact.

Figure 8. Face-up (top) and face-down (bottom) views of the imitation moldavite examined in this study. The sample on the left weighs 3.80 ct (9.48 × 9.30 × 6.93 mm); the specimen on the right is 3.76 ct (10.76 × 8.11 × 6.02 mm). Testing identified them as "soda-lime" glass. Photos by Nuttapol Kitdee.

He had serious doubts about their natural origin, based on the material's coloration and inclusions when viewed through a loupe, but purchased them for further study.

Standard gemological properties included a single RI reading of 1.520 and an SG value of 2.51 for both samples (moldavite has an SG of 2.32–2.38). Under the polariscope, the material exhibited an isotropic reaction with anomalous double refraction (ADR). The samples were inert under long-wave UV radiation but displayed a weak chalky yellowish green reaction under short-wave UV. Examination with a gemological microscope revealed numerous individual and clustered rounded gas bubbles of various sizes, mostly smaller, and flow structures (figure 9). FTIR spectra showed absorption peaks at approximately 2850 and 3520 cm^{-1}, features commonly found in man-made glass, whereas moldavite usually exhibits broad bands at approximately 3609 cm^{-1} (T.T. Sun et al., "Moldavite: Natural or imitation?" *The Australian Gemologist*, Vol. 23, No. 2, 2007, pp. 76–78).

We used laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS) for comparison with known samples, including "soda-lime" man-made glass, natural volcanic glass from Japan, and Vietnamese tektites. This analysis revealed that the two faceted samples shared very similar chemical compositions with the Na_2O- and CaO-rich man-made references examined, while the natural glass from Japan and tektite from Vietnam were noticeably richer in Al_2O_3 and possessed a much lower Na_2O and CaO content (figure 10).

Standard and advanced testing techniques showed that the material from Chanthaburi closely matched common "soda-lime" man-made glass. The higher SG corresponded to man-made glass. FTIR spectroscopy and chemical com-

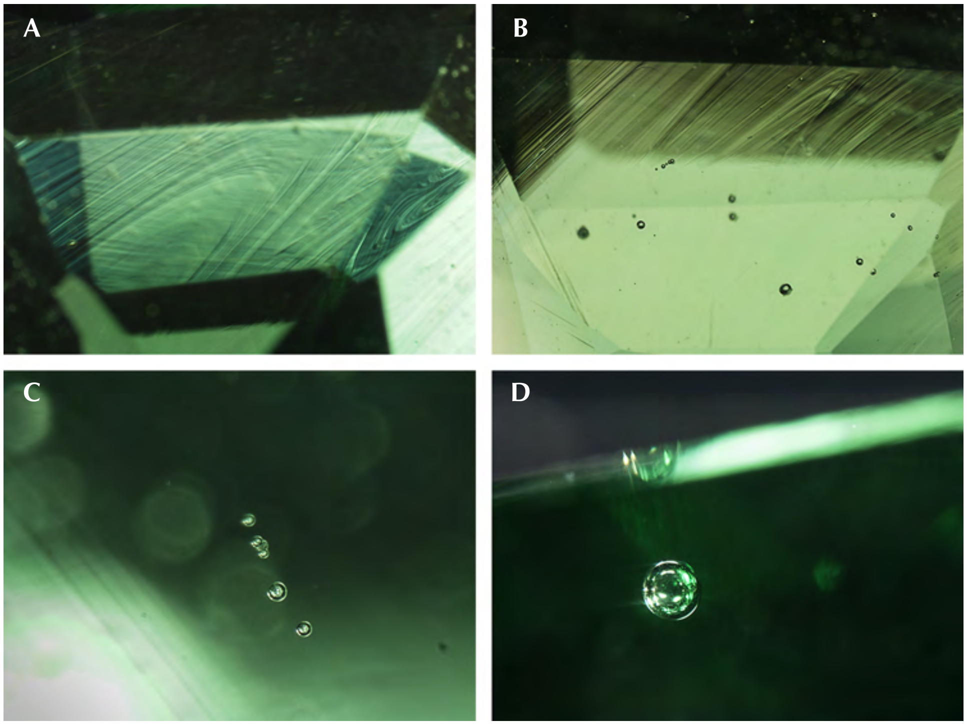

Figure 9. Magnification revealed flow marks (swirls) and rounded gas bubbles of various sizes. A: The characteristic flow structure usually observed in glass in brightfield illumination; field of view 5.20 mm. B: Flow marks and individual round gas bubbles in brightfield illumination with diffused lighting; field of view 6.30 mm. C: Round clustered gas bubbles in brightfield illumination; field of view 1.10 mm. D: A larger individual gas bubble in brightfield illumination; field of view 5.20 mm. Photomicrographs by Supharart Sangsawong.

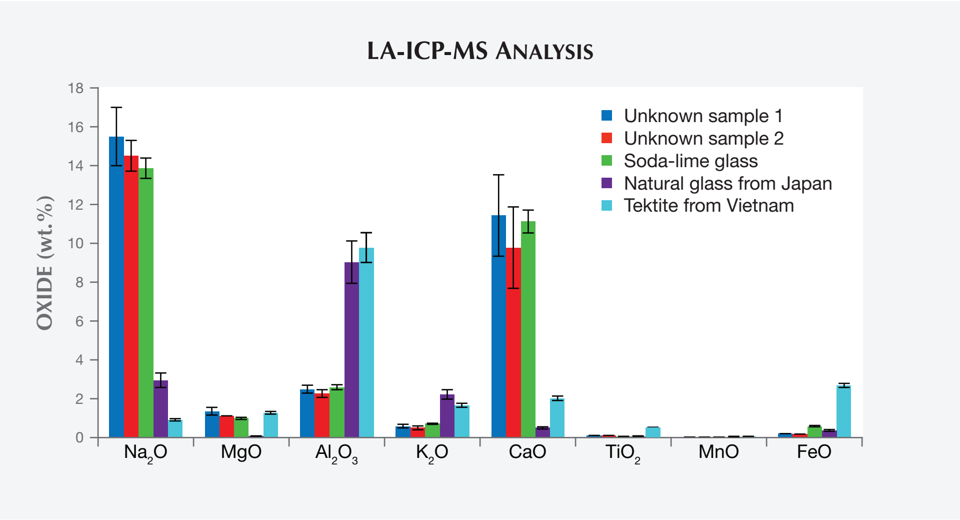

Figure 10. LA-ICP-MS results of the two glass samples are compared against those of known soda-lime glass, natural glass from Japan, and tektite from Vietnam. The black bars at the top of each column correspond to standard deviation (SD) obtained from three analyses.

position indicated that the samples were not moldavite. The study also demonstrates how these analytical techniques can be applied in separating glasses from different origins. High Na_2O and CaO content may be a useful aid for identifying "soda-lime" man-made glass in the future.

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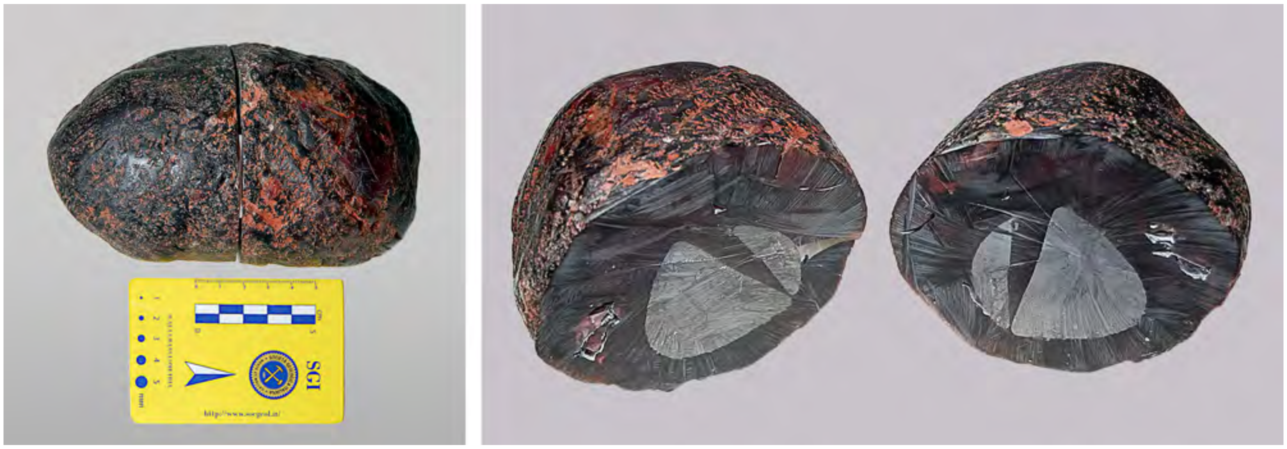
Imitation rubellite boulders. Recently, RAG Gemological Laboratory in Turin received two "boulders," weighing approximately 2.0 and 0.7 kg, reported to be rubellite tourmaline rough from Madagascar. The larger one was cut into two parts and found to be a resin imitation made heavier using a metal bar insert (figure 11). The smaller one was half of a boulder, again containing a metal insert. The resin matrix was colored bright cherry red and clearly noticeable in direct sunlight or using a small handheld light. The external appearance of both specimens was that of alluvial boulders that had floated and eroded over a period of time in riverbeds. The surface of each was rough with pits and fissures, and the voids were filled with material with an ochre appearance, very similar to clay and soils (figure 12). Due to the specimens' mass, the authors could not use an immersion balance, so an approximate density was determined by weighing the two parts of the larger boulder and weighing the corresponding amount of water displaced by immersion. The density was about 2.9, close to the specific gravity of natural rubellites (3.0–3.2).

During an examination of a thick slab (about 1 cm) taken from the larger boulder using a circular saw with a diamond blade, different phases of preparation of the boulder imitation were observed. These stages were suggested by the presence of differently colored resin blobs around the metal bar, enveloped by the outermost portion of plastic material with

Figure 11. Left: The two sections of the larger "boulder" were glued together to show the original size and form of the 2 kg imitation tourmaline rough. The length of the boulder was approximately 16 cm. Right: The boulder was cut, revealing the metal bar insert. Photos by Emanuele Costa.



a more intense cherry red color (figure 13). The resulting product was probably scarred on the surface, tumbled, and finally immersed in a mix of mud and clay. Infrared (IR) spectroscopy investigation indicated the material was styrene-based resin, with a phthalate compound added for hardening. The resin was very similar to that used for fiberglass preparation, and it is easily found on the market. The metal insert, analyzed with EDS, was ordinary lead.

Many features easily distinguished these imitations from natural rubellites. The surface hardness was very low, and the resin used for the imitation partially melted at a relatively low temperature; therefore, a hot needle was enough to confirm the organic character of the mass. Acrid and pungent smoke was released when the hot needle made contact with the red-hot metal. Moreover, the plastic mass contained air bubbles (figure 14) that were easily seen from a smooth portion of the surface when using a loupe with intense illumination.

These tests are not easily managed in the field, however. The provenance of these boulders was most likely Madagascar, but no other reliable information was provided. Such boulders are rumored to have been mixed in with batches of natural rubellite boulders from alluvial deposits. Such imitations, especially if wet and muddy, could go unnoticed and increase the total weight of a rough stone batch.

Figure 12. Details of the imitation boulder's surface, with pits, cavities, and fissures filled with a clay-like material. Photo by Emanuele Costa.

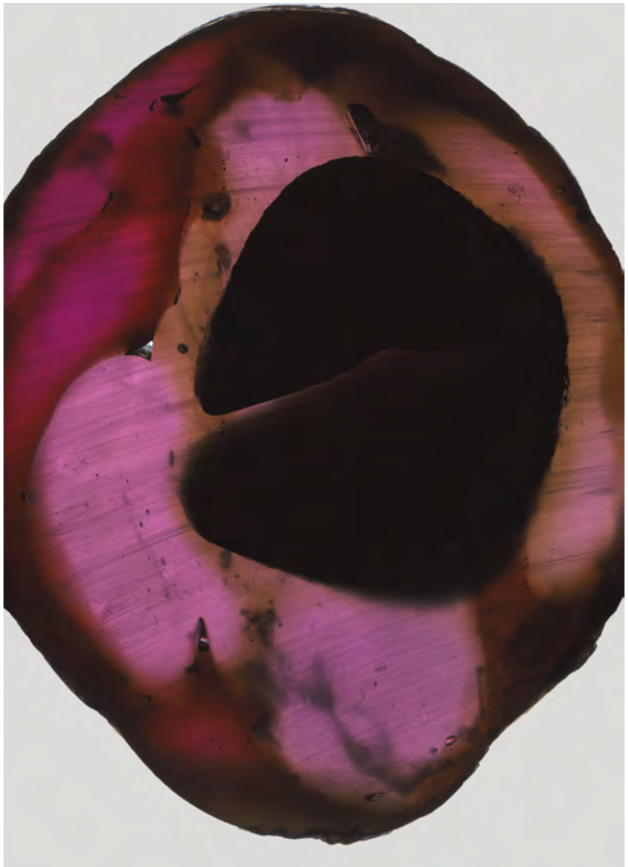


Figure 13. A transparency scan of an imitation boulder section; the black region is the metal insert. Color changes in different areas of the boulder suggest a multiple-step preparation involving various resin batches. The resins may have been worked in a semi-fluid or solid but malleable form, because some lack of adhesion—and the creation of voids—is noticeable. Photo by Emanuele Costa.

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Color-change glass as a Zultanite imitation. Diaspore, a relatively common mineral with the chemical formula AlO(OH), is found in metamorphic bauxite deposits (A.A. Calagari and A. Abedini, "Geochemical investigations on Permo-Triassic bauxite horizon at Kanisheeteh, east of

Figure 14. Air bubbles are randomly scattered in various portions of the resin matrix. Photo by Emanuele Costa.

Bukan, West-Azarbaidjan, Iran," *Journal of Geochemical Exploration*, Vol. 94, No. 1, 2007, pp. 1–18), and usually appears as a mineral inclusion in sapphire, ruby, and spinel (V. Pardieu, "Hunting for 'Jedi' spinel," Spring 2014 *G&G*, pp. 46–57; Spring 2016 GNI, pp. 98–100; Summer 2016 GNI, pp. 209–211). However, gem-quality transparent diaspore is rare and appears to be unique to the Ilbir Mountains area in southwest Turkey (M. Hatipoglu et al., "Gem-quality transparent diaspore (zultanite) in bauxite deposits of the Ilbir Mountains, Menderes Massif, SW Turkey," *Mineralium Deposita*, Vol. 45, No. 2, 2010, pp. 201–205). Zultanite is the trade name of diaspore that exhibits a color-change effect; the material appears yellow, pink, or green in different light sources. Zultanite has only been found in the Anatolian Mountains of Turkey (M. Hatipoglu and M. Akgun, "Zultanite, or colour-change diaspore from the Milas (Mugla) region, Turkey," *Australian Gemmologist*, Vol. 23, 2009, pp. 558–562).

The Gemological Institute of China University of Geosciences in Beijing recently received two samples, an unmounted 8.44 ct 10 × 12 mm faceted pear-shaped specimen and a ring with an 8 × 10 mm faceted oval, that displayed a color-change effect. The material was reportedly purchased from Turkey as Zultanite, a designation the client wished to confirm. Both samples were yellowish green in fluorescent light with a color temperature of 5500 K (figure 15, left) and brownish yellow in incandescent light (figure 15, right). The specimens were fairly clean, with no obvious inclusions and no obvious scratches on the surface. Facet junctions were generally smooth, with small chips. A series of absorption lines related to rare earth elements (REE) were observed by a handheld prism spectroscope. These properties, along with electron microprobe analysis, indicated that the two samples were not diaspore or any other natural material, but rather man-made glass. The infrared spectrum of the unmounted specimen, with peaks at 1037, 462, 443, and 430 cm^{-1}, confirmed the material was glass.

LA-ICP-MS data of three points on the loose sample are reported in table 1. The main trace elements were Nd (102,792 average ppmw) and Pr (68,500 average ppmw), both rare earth elements. Other REE included Gd (1473 average ppmw) and Ce (135 average ppmw). Nd and Pr are the

Figure 15. These glass imitations of Zultanite are shown in fluorescent (left) and incandescent light (right). The color-change effect is apparent when switching between the two illumination types. Photos by Xiaoyan Yu.

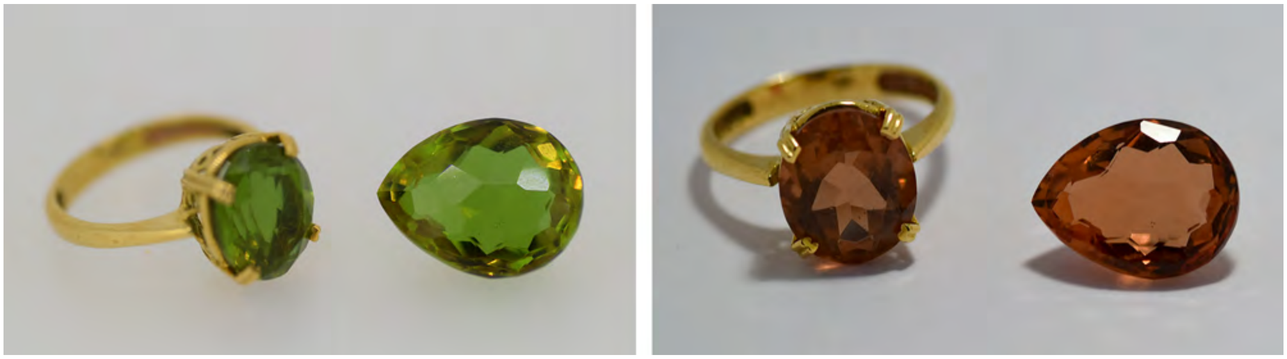

TABLE 1. LA-ICP-MS data of glass sample (ppmw).

Element	TG1-01	TG1-02	TG1-03
Ti	65.55	64.02	64.13
V	0.618	0.614	0.621
Cr	0.740	0.832	0.818
Mn	0.882	0.861	0.756
Fe	50.68	49.78	51.31
Co	0.0462	0.0444	0.0444
Ni	0.2291	0.2124	0.2062
Cu	13.14	12.80	13.02
Se	<0.75	<0.75	<0.71
Rb	3.63	3.51	3.50
Sr	68.23	66.01	66.26
Y	2.381	2.29	2.319
Cs	0.028	0.0273	0.028
La	4.78	4.55	4.56
Ce	**139.42**	**133.47**	**134.65**
Pr	**69,791.21**	**67,327.64**	**68,381.69**
Nd	**104,391.56**	**100,985.23**	**103,001.10**
Sm	0.307	0.311	0.301
Eu	0.372	0.356	0.353
Gd	**1482.77**	**1452.45**	**1480.22**
Tb	24.41	23.51	23.85
Dy	8.42	7.98	7.92
Ho	0.658	0.617	0.611
Er	31.30	30.25	31.00
Tm	bdl	bdl	bdl
Yb	0.2224	0.1979	0.2197
Lu	bdl	bdl	bdl

Rare earth elements are displayed in bold text. bdl = below detection limit.

chromophores that cause color change in material such as synthetic cubic zirconia (Fall 2015 GNI, pp. 340–341).

The visible-range absorption spectrum of the loose material (figure 16) showed a typical spectrum of glass with rare earth elements. This spectrum showed bands at 443, 479, 529, and 587 nm. The bands at 443, 479, and 529 nm indicate the presence of Pr^{3+}, which caused the green or yellowish green color. The brownish yellow color is related to the 587 nm absorption peak, which is induced by Nd^{3+}.

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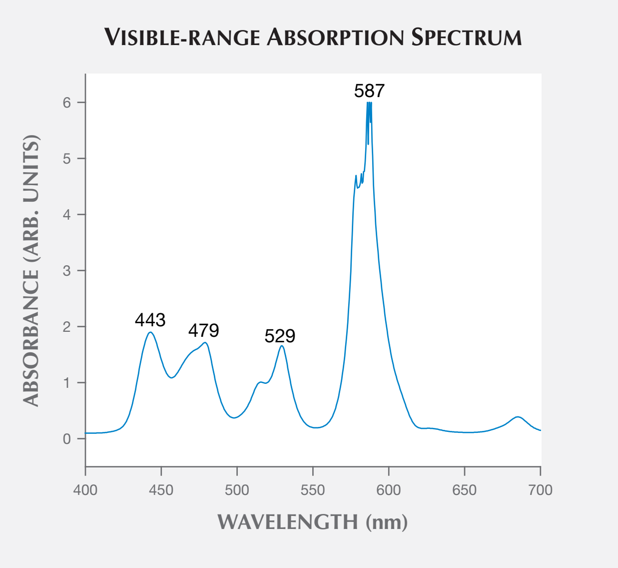

Figure 16. The visible absorption spectrum of the unmounted pear-shaped sample shows four absorption bands at 443, 479, 529, and 587 nm. The peak at 587 nm is associated with Nd^{3+}, while the bands at 443, 479, and 529 nm are attributed to Pr^{3+}.

TREATMENTS

"Decorated" jadeite jade in the Chinese market. Jadeite jade has long been popular in China, where it has profound cultural connotations. Fine-quality jadeite has the highest market value, especially the colorful and near-transparent pieces. Bright color zoning on a piece of jadeite will enhance its value; therefore, color-enhanced jadeite is available in the market. Filling and dyeing have been used for decades to modify jadeite's color, but these methods can damage the texture of jadeite and reduce its value. A new method, cementing small colored jadeite attachments on the surface of jadeite ornaments, recently appeared in the Chinese jade market. Because the method does little or no damage to the main jadeite's texture, we consider this an assembled stone.

Figure 17 shows three jadeite pendants decorated with small green and brown jadeite plates. These pendants were submitted to the Gem Testing Center of China University of Geosciences (Wuhan) for identification of species and treatment. They were tested by observation under microscope and ultraviolet lamp, infrared (IR) spectroscopy, and ultraviolet/visible (UV-Vis) absorption spectroscopy.

The background color and texture quality of the small plate attachments was similar to those of the main jadeite body, creating a harmonious overall appearance (again, see figure 17). The green color appeared to be floating on the surface and seemed to be detached from the base (figure 18, left), whereas the natural color zone of jadeite always changes gradually. Resin with accompanying bubbles was found in the space between the green attachments and the jadeite body (figure 18, right). Under the long-wave UV lamp, the resin in the contact region emitted strong blue-white fluorescence while the body did not fluoresce (figure 19).

Figure 17. A light-colored off-white jadeite pendant decorated with small green and brown jadeite attachments. Photo by Fen Liu.

The IR reflection spectra of the green attachments showed typical jadeite features (figure 20, left). However, the IR transmission spectrum of the contact zone revealed peaks at 3058 and 3037 cm^{-1}, indicating the stretching vibration of the benzene ring in resin (figure 20, right), which was used to attach the decoration. The blue trace in figure 20 is typical for jadeite without any treatment.

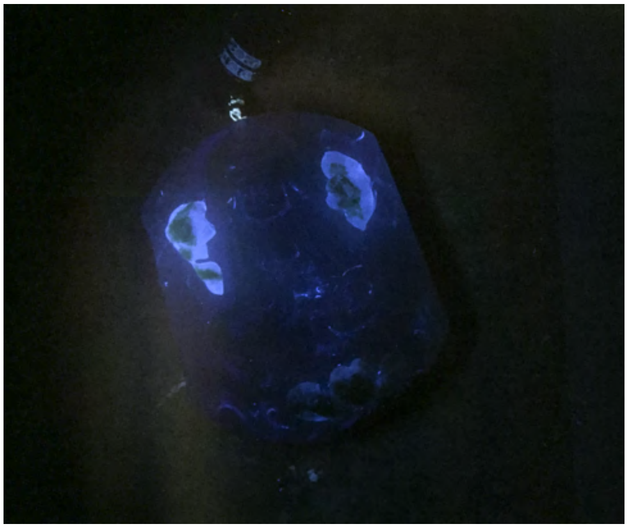

Figure 19. The resin in the contact region emits strong blue-white fluorescence under a long-wave ultraviolet lamp. Photo by Fen Liu.

The attachments all had a typical fibrous-granulous crystalloblastic texture without loosening or slagging. This implied they were natural jadeite that had not been subjected to acid washing or filling. The green color of the attachments was also natural, as shown by the UV-Vis absorption spectrum, which showed the 690 and 660 nm peaks induced by Cr^{3+}.

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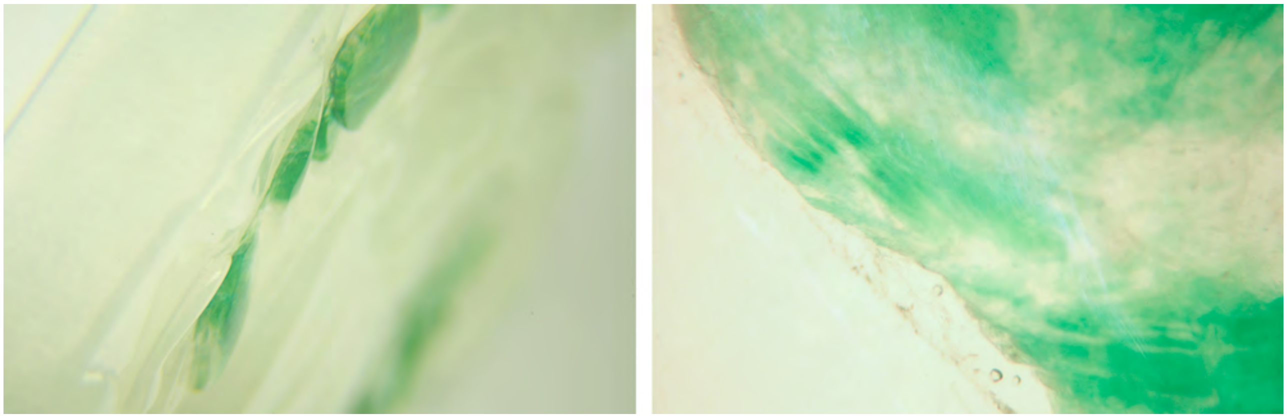
Durability of a broken glass-filled ruby. It is no secret that corundum is subjected to heating and fracture-filling treatments to alter its color and improve its clarity in order to increase the market value. Heat treatment in particular has

Figure 18. Left: The green color on this jadeite appears to float on the surface and has a clear boundary. Field of view 5.50 mm. Right: Resin with bubbles fills the space in the contact area. Field of view 16.8 mm. Photomicrographs by Shufang Nie.



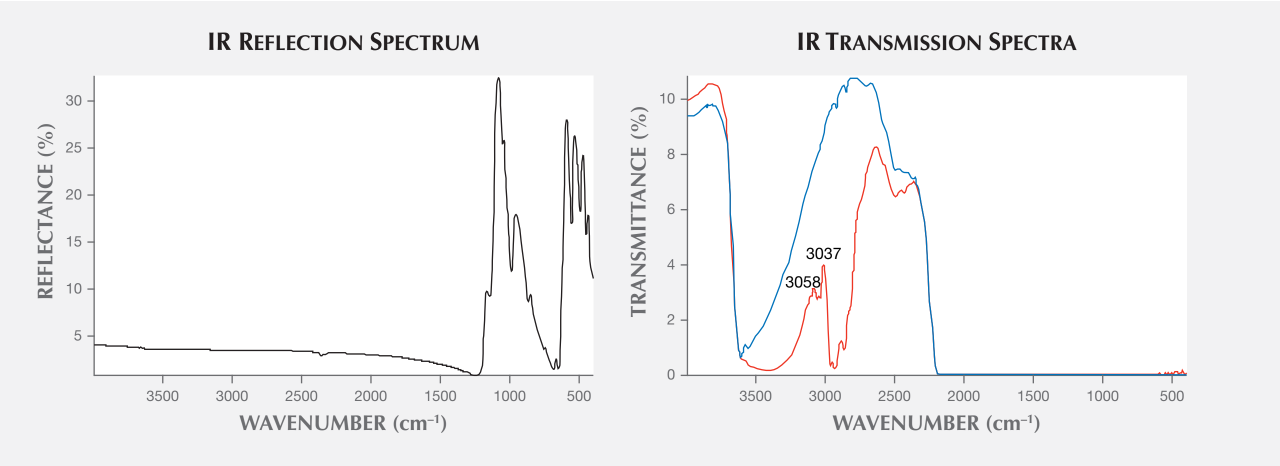


Figure 20. Left: The IR reflection spectrum of the jadeite decorations matches the typical spectrum for jadeite. Right: IR transmission spectra of the jadeite body (blue trace) and the green attachment zone (red trace). The blue trace is typical for natural jadeite without filling, while the 3058 and 3037 cm^{-1} peaks on the red trace are characteristic for resin, which was used to attach the colored jadeite plates.

become common practice and is generally accepted in the market, provided it is fully disclosed. The trade and end consumer are more concerned about the term "residue," what it means, and how it affects the stone. Many heat-treated stones are easy to detect with magnification, and a recent case submitted to the Lai Tai-An Gem Laboratory involving a broken ruby revealed how heat treatment applied to rubies can influence durability.

The client claimed that the ruby in question (figure 21) was broken into two pieces by a goldsmith who only applied standard pressure on the claws when setting the stone in a piece of jewelry. The ease with which the stone broke under these normal conditions caused the jeweler to submit the piece for examination.

The original ruby measured 8.2 × 5.7 × 4.1 mm and weighed 2.08 ct, while the two pieces weighed 1.10 ct and 0.98 ct after the damage. Identical RI readings of 1.762–1.770 were obtained and an SG of 4.00 was determined on each piece. Further observation under long-wave UV light revealed a weak red reaction, and FTIR and Raman spectra were indicative of ruby. The stone's natural origin was proved when extensive twinning, white acicular inclusions, and parting planes were observed through a gemological microscope. Some white flaky glass residues (figure 22) were also seen on broken surfaces, and numerous tiny gas bubbles were observed within some fractures. Flattened filler was also visible within the partially healed fractures (figure 23). When analyzed with a Micro-XRF M4 Tornado Bruker spectrometer, the filling material showed significant silica content.

DiamondView observations revealed that the residue within some fractures was more opaque (figure 24), confirming the existence of glass filler. While the application of heat treatment together with glass filler usually improves a ruby's clarity, some fractures may not heal completely.

Figure 21. Left: The two pieces of a glass-filled ruby were combined to demonstrate its appearance before breaking. Center and right: The two pieces that broke during the setting process. Photos by Lai Tai-An Gem Lab.

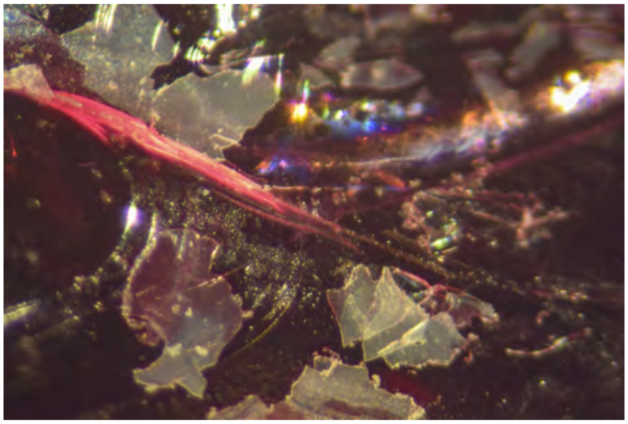


Figure 22. Visible white flaky "residue" seen on broken surfaces of the ruby. Photo by Lai Tai-An Gem Lab; field of view 4.25 mm.

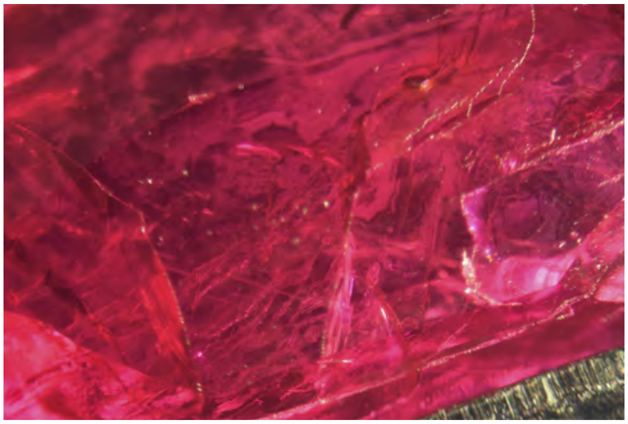


Figure 23. Areas of whitish filler were noted within some surface-reaching fractures. Photo by Lai Tai-An Gem Lab; field of view 4.8 mm.

Since the starting material is often of low quality, the industry and consumers should be alert to the potential risk of damaging stones during the mounting process. Careful inspection of any stone prior to setting is recommended.

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CONFERENCE REPORT

Fabergé Symposium. "The Wonder of Fabergé: A Study of The McFerrin Collection" was the title of the Fabergé Symposium held at the Houston Museum of Natural Sciences (HMNS) November 3–4. Comprised of over 600 objects (figure 25), the collection of Artie and Dorothy McFerrin is the largest privately owned assortment of Fabergé objects and Russian decorative art in the United States. (Worldwide, only the Fabergé Museum in St. Petersburg and Queen Elizabeth II have larger collections.) It has now been the focus of two Fabergé symposiums, the first in 2013. Photos from the McFerrin Collection were incorporated into all of the talks.

Researcher **Dr. Ulla Tillander-Godenhielm** (Helsinki) presented "Fabergé in the Light of 20th Century European Jewelry," which covered the years 1881–1915. In 1881, Carl Fabergé took over the family business from his father Gustav and, along with his younger brother Agathon, began building their brand. The Fabergé brothers opened shops in other cities and became court jewelers to Russia's imperial family, but 1915 marked the end of the successful enterprise. The outbreak of World War I in 1914 increased the cost of materials and sent many goldsmiths off to the front lines. In 1917, along with the end of the 300-year reign of

Figure 24. These images show the appearance of the white silica glass filler residue on some fracture surfaces under normal lighting conditions (visible light, left) and as opaque dark areas against the bright red ruby reaction in the DiamondView (right). Photos by Lai Tai-An Gem Lab.

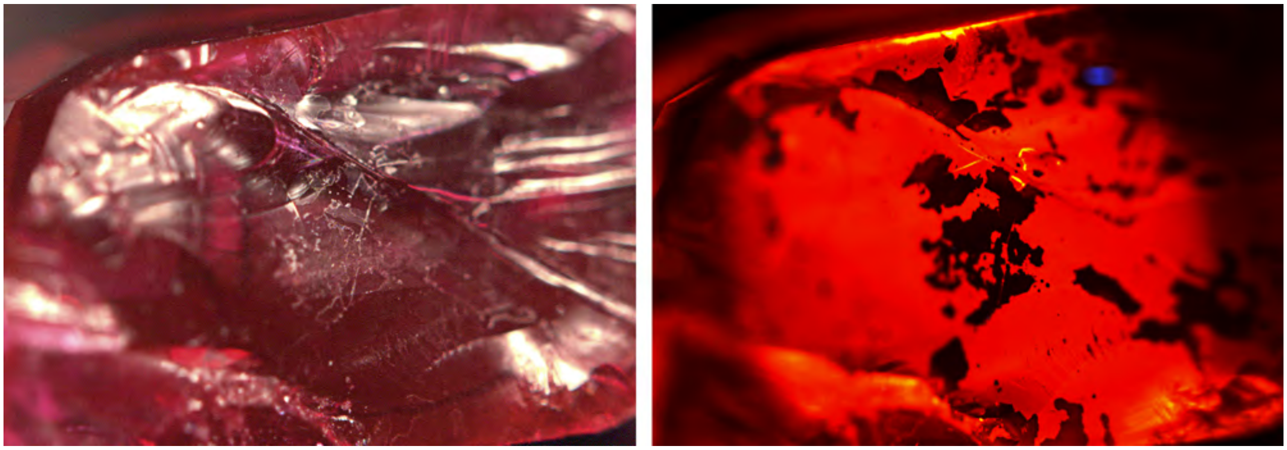

Figure 25. Fabergé's Kelch Rocaille Egg (1902), featuring green translucent enamel, diamonds, and yellow gold rocaille ornament, is part of the McFerrin Foundation Collection. Photo by Hank Gillette/CC BY-SA 4.0.

the Romanovs, the House of Fabergé was closed. Many of Fabergé's workmen and their families emigrated to Finland to work for the A. Tillander firm in Helsinki. The speaker came to know these individuals as a young girl.

Dr. Galina Korneva (Russia) spoke on "Imperial Gifts Created by Fabergé for the Coronation of Nicholas II: New Archival Research." Dr. Korneva and her sister Tatiana Cheboksarova have discovered and reviewed thousands of handwritten archival documents. The coronation of Nicholas II was celebrated May 6–26, 1896. Fabergé gifts from Nicholas II included a yellow and white diamond brooch in the shape of a rose given to his wife, Empress Alexandra Feodorvona; a brooch and the Lilies of the Valley basket for his mother, Dowager Empress Maria Feodorovna; 18 brooches in the shape of crowns for the Grand Duchesses; pectoral crosses for the clergy; plate and salt cellars; and bracelets, brooches, pins, snuffboxes, and cigarette cases for members of the imperial court and other dignitaries. Fabergé marked the occasion a year later with the Imperial Coronation Egg, which now resides in the Fabergé Museum.

Art historians **Timothy Adams** (San Diego, California) and **Christel Ludewig McCanless** (*Fabergé Research Newsletter*, Huntsville, Alabama) discussed "Fabergé Smoking Accessories: Materials and Techniques of a New Art Form." With the popularity of smoking in the first half of the 19th century and the demand for smoking accessories, the Fabergé firm had a production line for these items. In one studio, ten men made nothing but cigarette cases. These items were large, with a tinder cord and a vesta compartment that held matches, which were very expensive. The cigarette case became more streamlined with the invention of the cigarette lighter in the late 1800s, making the bulky tinder cord and vesta compartment unnecessary.

Researcher **Mark Moehrke** (New York City) lectured on "Fabergé Silver-Mounted Art Glass." These objects are both functional and decorative. Neo-classical in style, most of them are colorless cut glass, but they were also made from hardstones, metals, and ceramics with applied silver bases, handles, and stoppers. Included in the discussion were three objects from the McFerrin Collection: a Louis Comfort Tiffany favrile glass vase with Fabergé silver base, made by workmaster Victor Aarne; a Louis Comfort Tiffany favrile glass scent bottle with silver stopper, handles set with natural pearls, and a silver base; and a rectangular Lötz glass lamp with silver mounts, including a base of stylized dolphins and scrolls to imitate ocean waves, also by Victor Aarne.

In "Collector Tales," **Artie and Dorothy McFerrin** (Houston) described how they started accumulating Russian decorative arts. Their first purchase turned out to be an imposter egg, or "Fauxbergé," which is on display in the museum. They also discussed their favorite pieces and took questions from the attendees.

Dr. Wilfried Zeisler (Hillwood Estate, Museum & Gardens, Washington, D.C.) presented "From Canvas to Silver: Enameled and Repoussé 'Paintings' in Russian Jewelry at the Turn of the 20th Century." Dr. Zeisler used examples from both the Marjorie Merriweather Post and McFerrin collections to illustrate how paintings were reinterpreted as art objects. The subject of a painting would find its way onto small boxes, caskets, and cigarette cases by way of engraving, enameling, or lithograph. Feodor Rückert, an enamel master from Moscow, supplied such items to Fabergé from 1886 to 1917.

Mikhail Ovchinnikov (Fabergé Museum, St. Petersburg) discussed "Fabergé's Renaissance Style Objects in the Context of 19th Century European Revival Jewelry." Fabergé was inspired by the pieces exhibited at the museums he visited on his grand tour of Europe. Objects made using the *pietra dura* method influenced his hardstone figures. Fabergé also worked in the Hermitage examining and repairing ancient jewelry, which would influence his later designs.

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ERRATA

1. In the Fall 2016 Magaña and Shigley article on CVD-grown synthetic diamonds, the caption for figure 5 (p. 227) described the 5.19 ct brilliant examined in September 2016 as a round brilliant. The correct shape is cushion modified brilliant.

2. In the Fall 2016 Lab Notes entry on the treated pink type IIa diamond colored by red luminescence (pp. 299–301), the figure 5 caption misidentified the red and blue traces in the UV-Vis-NIR absorption spectra. The red trace actually represents the 4.29 ct natural diamond; the blue trace represents the 0.48 ct treated CVD synthetic used for comparison.