

Editor

Brendan M. Laurs (blaurs@gia.edu)

Contributing EditorsEmmanuel Fritsch, *CNRS, Team 6502, Institut des Matériaux Jean Rouxel (IMN), University of Nantes, France* (fritsch@cnrs-imn.fr)Michael S. Krzemnicki, *Swiss Gemmological Institute SSEF, Basel, Switzerland* (gemlab@ssef.ch)Franck Notari, *GGTL GemLab–GemTechLab, Geneva, Switzerland* (franck.notari@gemtechlab.ch)Kenneth Scarratt, *GIA, Bangkok, Thailand* (ken.scarratt@gia.edu)**COLORED STONES AND ORGANIC MATERIALS**

Burmese amber update. Amber from Myanmar's Hukawng Valley, also called Burmite, has been produced intermittently in commercial quantities from the 20th century to the early part of the 2000s (Summer 2001 Gem News International [GNI], pp. 142–143). In March 2012, Mark Smith (Thai Lanka Trading Ltd., Bangkok) informed GIA about a surge in this amber's availability in the Bangkok market since early 2011, notably as clean faceted stones. The color ranges from light yellow to orange and rarely red, which is most valued by the Burmese. However, the yellow material is appreciated for its strong fluorescence to long-wave UV radiation (figure 1). Mr. Smith indicated that most of the faceted stones weigh 5–20 ct, although the largest he obtained was 32 ct and he knew of samples weighing 40–50 ct. Considering the low specific gravity of amber, pieces of this weight are quite large. Mr. Smith estimated that several thousand carats of faceted stones have been cut since early 2011. The material is polished in both Myanmar and Bangkok.

Burmite is known for the presence of insects and other biological materials, which indicate a Cretaceous age of ~100 million years (see Summer 2001 GNI entry). While most of the recent production is fairly clean, some stones contain ~1 mm spheres that are probably composed of plant matter, and a few have insect inclusions. Mr. Smith obtained one notable example: a 27.55 ct cabochon with a well preserved scorpion (~8 mm long) and various insects resem-



Figure 1. These two faceted pieces of Burmese amber (4.80 ct total weight) show the range of color of the material seen recently in the Bangkok market (top). The lighter colored amber shows strong fluorescence to long-wave UV radiation (bottom). Photos by Prasit Prachagool.

Editor's note: Interested contributors should send information and illustrations to Brendan Laurs at blaurs@gia.edu or GIA, The Robert Mouawad Campus, 5345 Armada Drive, Carlsbad, CA 92008.

GEMS & GEMOLOGY, Vol. 48, No. 2, pp. 142–155,
<http://dx.doi.org/10.5741/GEMS.48.2.142>.

© 2012 Gemological Institute of America

bling wasps, ants, and a tick; some of these are visible in figure 2. Although faked specimens consisting of molded amber or acrylic with modern scorpions are common, genuine scorpions are extremely rare in Burmese amber; Mr. Smith knew of only a few documented specimens.

Brendan M. Laurs



Figure 2. This 27.55 ct cabochon of Burmese amber contains a complete scorpion (on the left) and a variety of insects. Photo by Prasit Prachagool.

Aquamarine from San Bernardino County, California.

Southern California's gem pegmatites are world-famous for their production of tourmaline, beryl, spodumene, quartz, and other minerals since the late 19th and early 20th centuries. The pegmatites are associated with the Peninsular Ranges Batholith, and extend from Riverside County into northern Baja California (e.g., J. Fisher, "Mines and minerals of the Southern California pegmatite province," *Rocks & Minerals*, Vol. 86, 2011, pp. 14–35, <http://dx.doi.org/10.1080/00357529.2011.537167>). Further north, San Bernardino County is not known to host many pegmatites, although two localities containing uranium-bearing minerals were documented several decades ago (D. F. Hewett and J. J. Glass, "Two uranium-bearing pegmatite bodies in San Bernardino County, California," *American Mineralogist*, Vol. 38, 1953, pp. 1040–1050). However, no gem mineralization has been noted from those pegmatites in the literature.

It was quite a surprise, then, when in 2006 a local prospector named Dave Schmidt found an aquamarine-bearing pegmatite on BLM (Bureau of Land Management) land north of Yucca Valley in San Bernardino County. He filed a claim, calling it the California Blue mine. He worked the ~1 m thick dike by hand and collected many loose crystals of aquamarine and topaz, but few matrix specimens. In November 2011, he partnered with mineral collector Paul Geffner to mine the deposit for a one-week period using an excavator. They found four aquamarine-bearing cavities that yielded matrix specimens (figure 3) and loose crystals of gem-quality aquamarine (bluish green to greenish blue), topaz (colorless and rarely pale blue), and quartz (colorless to smoky), as well as non-gem spessartine, fluorite, albite ("cleavelandite"), and microcline.

Rough and cut specimens of the aquamarine were exhibited at the 2012 Tucson gem shows by Rick Kennedy

(Earth's Treasures, Santa Clara, California). He indicated that since the California Blue mine has been worked primarily for mineral specimens, fewer than 10 aquamarines have been faceted so far. The best cut stone weighed 7.35 ct and showed an attractive greenish blue color (again, see figure 3). A few pieces of smoky quartz have also been cut.

In March 2012, another one-week mining project at the California Blue mine yielded several more aquamarine crystals of good color and clarity, as well as ~80 g of facet/cabochon-quality aquamarine and ~40 g of colorless facet-grade topaz. Mr. Schmidt will continue developing the mine in the near future, and also plans to host fee digging on the property within the next year.

Brendan M. Laurs

Trapiche aquamarine from Namibia.

In August 2010, GIA was informed about a new find of trapiche aquamarine from the Erongo Mountains in Namibia by Jo-Hannes Brunner (Pangolin Trading, Windhoek, Namibia). The material was reportedly recovered from a small pocket that contained matrix specimens and crystal clusters, as well as a few loose crystals up to 10 cm long. The crystals were typically semi-transparent with etched prism faces, but they displayed a variety of interesting patterns when sliced parallel and perpendicular to the c-axis (e.g., figure 4). Mr. Brunner subsequently donated several rough and cut samples to GIA, and four specimens were examined for this report.

The samples consisted of a crystal (43.60 mm long), an oval cabochon (6.13 ct), a rectangular step cut (8.20 ct), and

Figure 3. These rough and cut aquamarine specimens are from a new find in San Bernardino County, California. The cut stone weighs 7.35 ct and the specimen is 7.9 cm wide. Photo by Jeff Scovil.



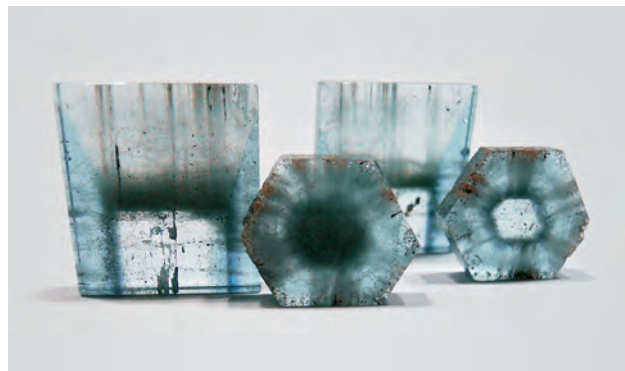


Figure 4. Interesting patterns are created by dense crystallographically oriented clouds in these slices of aquamarine (20–30 mm wide) from Namibia's Erongo Mountains. The rectangular slices are cut parallel to the *c*-axis, while the hexagonal plates are sliced perpendicular to the *c*-axis and display trapiche structure. Photo by Jo-Hannes Brunner.

a hexagonal tablet (8.84 ct). They were semitransparent to transparent, and ranged from grayish blue to bluish grayish green. Basic gemological testing identified them as beryl, and this was confirmed by Raman spectroscopy.

The tablet showed an interesting trapiche structure formed by distinct hexagonal color zoning and some subtle radial arms (figure 5, left); two of them extended all the way from the core to the surface. The arms were composed mostly of clouds of minute crystals and particles (figure 5, right). Also present were negative crystals close to the surface, as well as grayish material in surface cavities that consisted of residue from the polishing compound.

Trapiche aquamarines have been reported previously from the Erongo Mountains (Fall 2008 GNI, pp. 275–276), but those samples had a much stronger radial pattern and lacked the hexagonal zoning shown by the present samples.

Trapiche growth structure, though best known in emerald, has also been documented in ruby, sapphire, tour-

maline, quartz, and andalusite. In both beryl and corundum, the trapiche phenomenon has been attributed to skeletal (dendritic) growth, in which the edges and corners grow faster than the adjacent crystal faces (I. Sunagawa, *Crystals—Growth, Morphology and Perfection*, Cambridge University Press, Cambridge, UK, 2005).

Riccardo Befi (rbefi@gia.edu)
GIA, New York

Champagne/Imperial garnet from Lindi Province, Tanzania.

The Lindi Province in Tanzania is well known as a source of pyrope-spessartine and almandine-spessartine (see Spring 2006 GNI, pp. 66–67, and Summer 2008 GNI, pp. 165–166). A new deposit in the same area recently yielded some additional production, marketed as Champagne or Imperial garnet at the 2012 Tucson gem shows. Several samples were loaned to GIA by Michael Puerta (International Gems H.K. Ltd., Hong Kong; see figure 6, left), who visited the Lindi area with Farooq Hashmi (Intimate Gems, Glen Cove, New York) in late 2011. According to them, this new garnet has been mined since mid-2011, and they know of one Tanzanian supplier who exported 360+ kg of rough material after one month of mining. The garnet is similar to the previous Lindi pyrope-spessartine except for being slightly darker and available in smaller pieces. They reported that it was produced as a byproduct of placer gold mining near the town of Ruangwa, where they obtained 15–20 kg of rough material. Additional samples were loaned and donated to GIA by Steve Ulatowski (New Era Gems, Grass Valley, California; see figure 6, right). At the Tucson show he had 22 kg of the new garnet, in pieces that mostly ranged from 1 to 3 g, and ~2,000 carats of faceted stones weighing 1–8 ct. He noted that during his buying trips to Tanzania since December 2011, he has seen bigger and better pieces of this garnet, and in greater quantities.

The samples loaned by Mr. Puerta were characterized for this report. The garnets were light reddish orange in daylight-equivalent light and orangy red under incandescent light. Color was evenly distributed. The samples had RIs ranging from 1.750 to 1.755 and hydrostatic SGs of

Figure 5. This hexagonal tablet of aquamarine displays an indistinct trapiche structure (left, magnified 10×). A closer view shows two of the trapiche arms (consisting mainly of clouds of minute particles) that radiate outward from the more transparent central core (right, 15×). Photomicrographs by R. Befi.

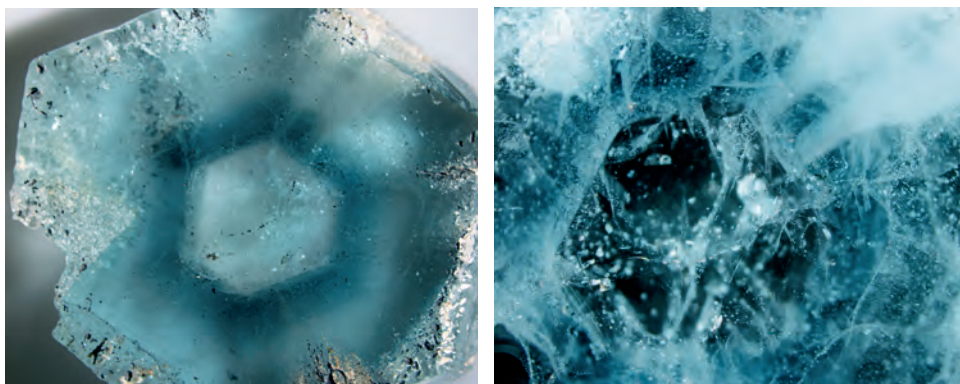




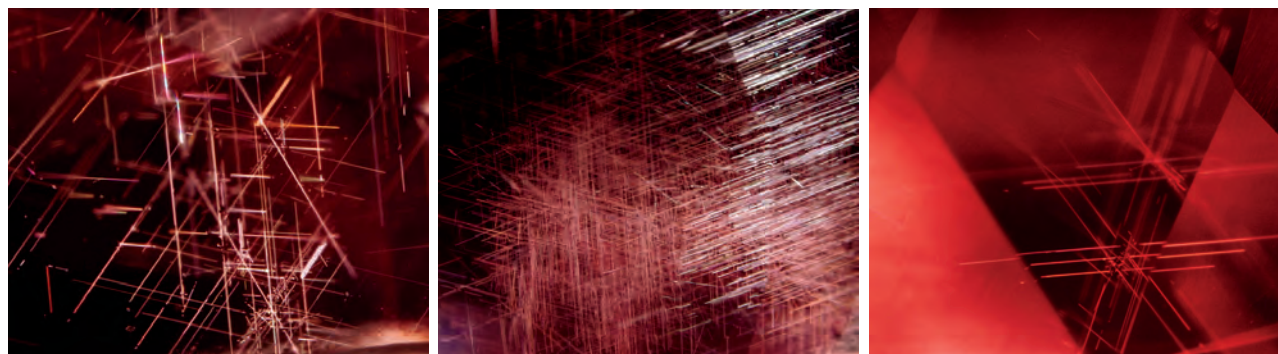
Figure 6. Pyrope-spessartine from Lindi Province, Tanzania, was available at the 2012 Tucson gem shows. The left photo shows examples from the new production (2.64–9.59 ct, faceted, courtesy of Michael Puerta; photo by Robert Weldon). The samples in the right photo (some donated to GIA by Steve Ulatowski; GIA Collection nos. 38516–38518; photo by Jeff Scovil) consist of material from older production, except for the cut stones in the center and right (7.38 and 2.23 ct), which are from the new mine.

3.77–3.83, and they were inert to long- and short-wave UV radiation. These properties are consistent with pyrope-spessartine, although slightly different from the previous Lindi pyrope-spessartine reported in the Spring 2006 GNI entry (which was pink in both incandescent light and daylight, with RI of 1.756 and an SG of 3.85). Microscopic examination showed three-dimensional networks of oriented needles, a few of them iridescent (figure 7, left). In some samples these needles formed dense concentrations (figure 7, center), while others had star-like arrays (figure 7, right). Raman analysis identified these needles as rutile, and they were often associated with clouds. In addition, short, reflective ribbon-shaped films were seen in all samples (figure 8); a long ribbon in one stone appeared brownish in certain orientations. A few unidentified dark crystals were

observed in another sample. A banded strain pattern was visible in cross-polarized light.

Quantitative chemical analyses of three of the samples by laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS) correlated to a compositional range of $\text{Prp}_{45-51}\text{Sps}_{22-26}\text{Alm}_{16-23}\text{Grs}_{8-10}$, and also showed the presence of several trace elements, including Ti, V, Cr, Zn, Ga, Ge, Sr, Zr, Cd, and several rare-earth elements. Vis-NIR absorption spectra were very similar to malaya garnets (pyrope-spessartine) reported from Madagascar a decade ago (see K. Schmetzer, “Pink to pinkish orange malaya garnets from Bekily, Madagascar,” Winter 2001 *G&G*, pp. 296–308), with features associated with Mn^{2+} , Fe^{2+} , Fe^{3+} , and V^{3+} . Mid-IR spectroscopy showed bands related to Fe^{2+} and hydrous components. (For additional photomicrographs and

Figure 7. Three-dimensional networks of oriented rutile needles were common in the Lindi garnets; a few needles appeared iridescent (left, magnified 75×). The needles were also present as dense concentrations (center, 23×) and in star-like patterns (right, 65×). Photomicrographs by K. S. Moe.



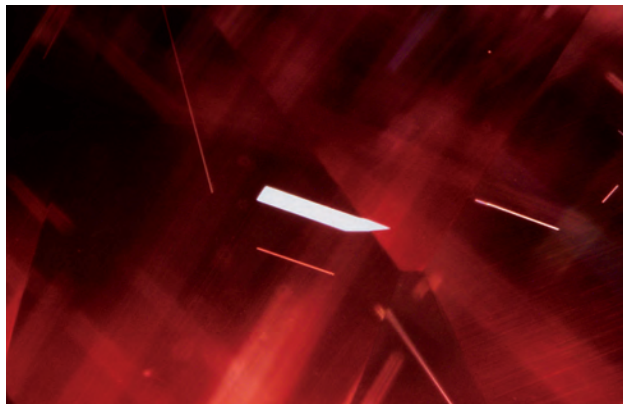


Figure 8. Short reflective ribbon-shaped films were seen in many of the garnets. Photomicrograph by K. S. Moe; magnified 63x.

the mid-IR and Vis-NIR spectra of the new and old Lindi garnets, see the *G&G* Data Depository at gia.edu/gandg.)

Kyaw Soe Moe (kmoe@gia.edu)
GIA, New York

Rainbow moonstone from Zambia. During the 2012 Tucson gem shows, Scott Davies (American-Thai Trading, Bangkok) displayed some new transparent rainbow moonstone that was reportedly mined in Zambia (e.g., figure 9). Since he first saw the rough material in August 2011, Mr. Davies has cut about 1,000 carats of it, as both faceted stones and cabochons. Although large cabochons of this moonstone can be very colorful, loupe-clean faceted stones have been more in demand by his customers. The largest such stone he cut weighed 2.65 ct, and it remains difficult to facet loupe-clean material larger than 1 ct. Mr. Davies donated eight specimens to GIA, consisting of four cabochons ranging from 2.08 to 4.24 ct, three faceted samples weighing 0.61–0.71 ct, and one partially faceted 8.33 ct sample.

Gemological testing of the eight stones gave the following properties: color—near-colorless with strong blue, orange, yellow, green, violet, and pink adularescence; RI—1.55 (spot) for the cabochons and 1.554–1.560 for the faceted samples; hydrostatic SG—2.66–2.70; and fluores-

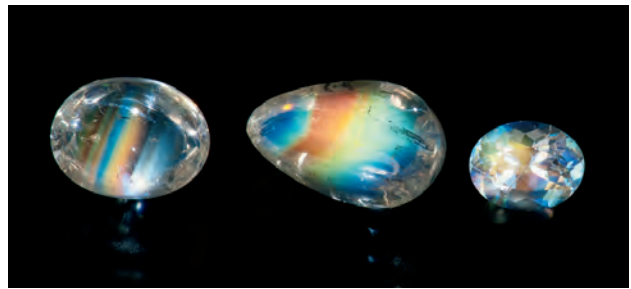


Figure 9. These rainbow moonstones are reportedly from Zambia; the largest weighs 2.82 ct. Gift of Scott Davies; GIA Collection nos. 38521–38523. Photo by Robert Weldon.

cence—inert to weak blue to long-wave UV radiation and weak red to short-wave UV. Energy-dispersive X-ray fluorescence (EDXRF) analyses revealed major amounts of Al, Si, and Ca, and traces of Na, Cr, Fe, Ga, and Sr. These properties are generally consistent with plagioclase (M. O'Donoghue, Ed., *Gems*, 6th ed., Butterworth-Heinemann, Oxford, UK, 2006, pp. 238–258). LA-ICP-MS chemical analysis of a faceted sample gave a compositional range of $Ab_{45.9-51.5}An_{53.0-47.3}Or_{1.2-1.2}$ (expressed as mol. % albite:anorthite:orthoclase), which falls near the border between andesine and labradorite in the plagioclase series.

Microscopic examination showed polysynthetic twinning—which is commonly seen in plagioclase—in all the samples. Parallel arrays of ribbon-like inclusions with jagged edges were spatially oriented along the twin planes (e.g., figure 10, left). These ribbons showed intense blue or green iridescence in certain directions. One sample also contained two dark green crystals that were identified by Raman spectroscopy as actinolite (e.g., figure 10, right).

The moonstones' rainbow adularescence was best seen when looking parallel to the lamellar twin planes (figure 11, left). In addition, darkfield lighting illuminated narrow bands of sharply defined blue adularescence that were parallel to the polysynthetic twin lamellae (figure 11, center). These bands were defined by thin planes of fine particles. When the viewing direction was shifted, thicker areas between the polysynthetic twin planes showed fuzzy blue

Figure 10. Parallel arrays of ribbon-like inclusions with jagged edges showed iridescence in certain directions (left, 45x). Dark green actinolite inclusions (right, 90x) were observed in one of the samples. Photomicrographs by K. S. Moe.



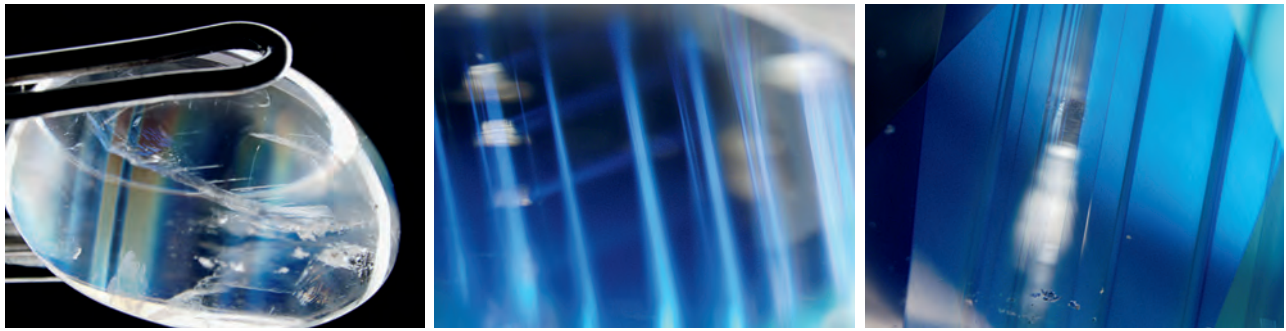


Figure 11. The rainbow phenomenon was best seen parallel to the lamellar twin planes (left, 15 \times). Thin, sharp blue bands (center, 50 \times) and thick, fuzzy blue bands (right, 60 \times) were observed from different viewing directions with fiber-optic lighting. Photomicrographs by W. L. Win.

adularescence (figure 11, right). The adularescent blue glow in these thicker layers was apparently caused by reflection of light between the thin planes of fine particles.

Wai L. Win (wwin@gia.edu) and Kyaw Soe Moe
GIA, New York

Morganite from Ethiopia. At the 2012 Tucson gem shows, Hussain Rezayee (Rare Gems & Minerals, Beverly Hills, California) showed GIA several faceted morganite samples (e.g., figure 12), reportedly mined near the town of Shakiso in southern Ethiopia. The stones ranged from light pink to orangy pink, and included two large ovals weighing 146.58 and 110.65 ct. Nine of the morganites were selected for examination at GIA based on their internal features, and Mr. Rezayee kindly donated them to the GIA Collection.

The samples weighed 1.10–7.75 ct, had RIs of 1.585–1.600, SG values of 2.73–2.80, and were inert to long- and short-wave UV radiation. Microscopic examination revealed two-phase fluid inclusions typical of morganite, along with a few solid and negative crystals. Raman analysis identified the solid crystals in a 2.65 ct specimen (figure 13) as mica and plagioclase (showing polysynthetic twinning). Numerous shapes of fluid inclusions were observed, including long curved inclusions with tails and well-formed hexagonal crystals (figure 14, left and center). The 2.65 ct stone contained a movable bubble filled with CO₂ (identified by Raman analysis). Also observed were negative crystals, with or without CO₂, and fluid inclusions associated with a roiled growth structure. A 4.75 ct sample contained a fluid inclusion that homogenized during photomicrography due to the heat from the microscope's lamp. The heating caused the gas bubble to disappear, and then it reappeared a few seconds after the lamp was switched off. Bands of clouds and needles were also found in many samples (figure 14, right). Some possessed partially healed feathers associated with wispy clouds. All nine morganites showed high-order interference colors in cross-polarized light.

Raman spectroscopy confirmed these specimens as beryl, and detected the presence of H₂O at 3600 and 3660 cm⁻¹ (types I and II, respectively). The mid-IR spectrum re-

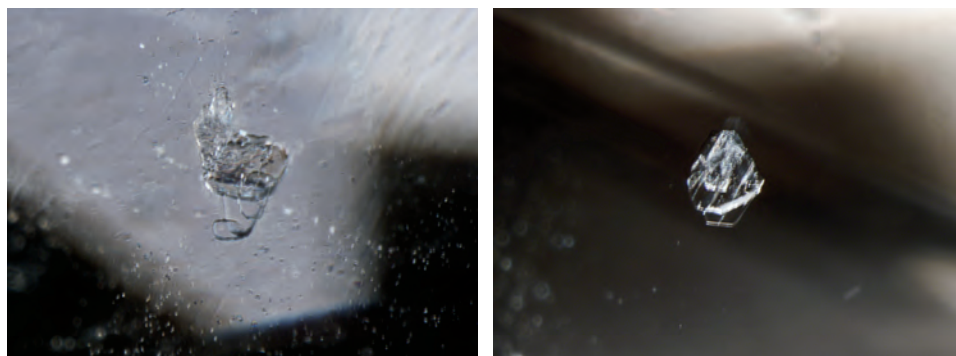
vealed a 7060 cm⁻¹ band caused by type II H₂O molecules. These and other unassociated water molecules also caused OH-stretching bands in the 4500–3000 cm⁻¹ region. Bands in the 5700–5000 cm⁻¹ range were caused by type I and II water molecules, while a small band at 2672 cm⁻¹ was related to deuterated water, and a relatively strong absorption at 2356 cm⁻¹ was due to CO₂.

Manganese is the chromophore in pink beryl, and a high-resolution UV-Vis-NIR spectrum showed Mn²⁺-related broad bands with absorption maxima at 490 and 540 nm (see, e.g., D. L. Wood and K. Nassau, "The characterization of beryl and emerald by visible and infrared absorption spectroscopy," *American Mineralogist*, Vol. 53, 1968, pp. 777–800). A 370 nm band near the spectral cutoff was caused by Fe³⁺, a common characteristic of beryl. Additional absorption bands were detected at 834, 920, 937, 956, and 978 nm. EDXRF spectroscopy showed the expected Al and Si as major elements, along with minor V, Cs, Fe, Zn,

Figure 12. These morganites were reportedly mined near the town of Shakiso in southern Ethiopia. The large ovals weigh 146.58 and 110.65 ct, and the small oval on the far right is 3.60 ct. Photo by Robert Weldon.



Figure 13. These inclusions, observed in the 2.65 ct morganite, were identified as mica (left, magnified 90×) and plagioclase (right, 110×). Photomicrographs by K. S. Moe.



As, and Rb, and traces of Mn, Ga, and Ti. (For additional photomicrographs and mid-IR and UV-Vis-NIR spectra, see the *G&G* Data Depository at gia.edu/gandg.)

Mr. Rezayee estimated that since 2010, approximately 200–300 kg of the rough Ethiopian morganite have been processed into cabochons and carvings. He also knew of about 1,000 carats that have been faceted in sizes up to ~150 ct. The morganite is reportedly being produced by artisanal miners from the same region of southern Ethiopia that yields emerald, tourmaline, and aquamarine.

Kyaw Soe Moe

Large natural-color freshwater cultured pearls with drilled beads. Since mid-2011, the Gübelin Gem Lab has received several high-quality necklaces and undrilled freshwater cultured pearls (FWCPs) for grading that were near round to round and averaged 12–18 mm. These resembled the “Ming” and “Edison” FWCPs described in recent reports (e.g., H. A. Hänni, “Ming pearls: A new type of cultured pearl from China,” *Journal of the Gemmological Association of Hong Kong*, Vol. 32, 2011, pp. 23–25; Spring 2012 GNI, pp. 54–55).

The samples’ bodycolor ranged from grayish violet to violet-gray (e.g., figure 15); some displayed strong pink and green overtones. All had a nacreous appearance, either clean or with slight blemishes. Some had a “hammered” effect, while others showed polish lines in the microscope.

Each FWCP was inert to UV radiation as well as X-rays.

EDXRF analysis indicated an MnO concentration above 300 ppmw in most of the FWCPs (but as low as ~100 ppm in some samples) and a relatively low SrO concentration (<0.1wt.%). The SrO/MnO ratio of <12 identified them as freshwater products. Unlike the vast majority of FWCPs, which are cultured without a bead, X-radiographs showed nuclei composed of drilled beads (figure 16). Drilled beads have also been used in the cultivation of some Japanese FWCPs (i.e., Kasumiga cultured pearls). The nacre thickness varied from 1.0 to 2.5 mm or more.

UV-Vis-NIR diffuse reflectance spectra revealed bands similar to those observed in some FWCPs from *Hyriopsis sp.* (S. Karampelas et al., “Role of polyenes in the coloration of cultured freshwater pearls,” *European Journal of Mineralogy*, Vol. 21, No. 1, 2009, pp. 85–97, <http://dx.doi.org/10.1127/0935-1221/2009/0021-1897>). Raman (figure 17) and photoluminescence spectra showed bands due to aragonite and polyenic pigments known as parrodiene. Raman spectroscopy also detected vaterite, a CaCO₃ polymorph previously reported in some FWCPs with low luster (A. Soldati et al., “Structural characterization and chemical composition of aragonite and vaterite in freshwater cultured pearls,” *Mineralogical Magazine*, Vol. 72, No. 2, 2008, pp. 579–592, <http://dx.doi.org/10.1180/minmag.2008.072.2.579>, and references therein). In these samples, however, the luster was very good.

Figure 14. Various fluid inclusions were found in the morganite samples. Two-phase inclusions containing CO₂ bubbles showed long curved shapes (left, magnified 50×) and hexagonal forms (center, 85×). Also seen were bands of clouds (right, 25×). Photomicrographs by K. S. Moe.

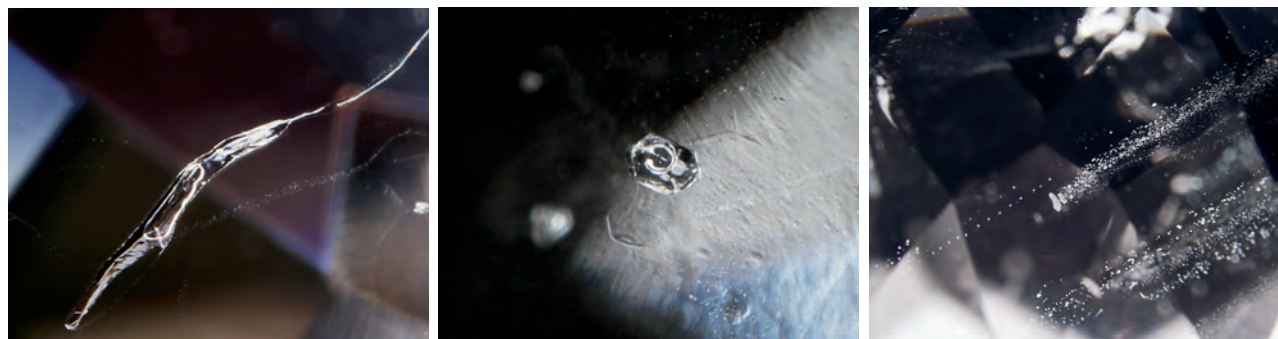




Figure 15. These undrilled violet-gray freshwater cultured pearls contain drilled bead nuclei. The largest measures 15.4 mm. Photo by S. Karampelas.

Some Chinese traders have indicated that such goods are produced from a crossbred mollusk in China that is probably similar to that used for the Kasumiga FWCPs, and their cultivation lasts more than one year and sometimes up to three. They also added that the new large, high-quality Chinese FWCPs can fetch more than US\$1,000 per piece, but their supply is still very limited.

Stefanos Karampelas (s.karampelas@gubelingemlab.ch)
Gübelin Gem Lab, Lucerne, Switzerland

Figure 16. Digital X-radiography of one of the cultured pearls in figure 15 reveals a drilled bead 11 mm in diameter, and a nacre thickness of 2.2 mm. Image by S. Karampelas.

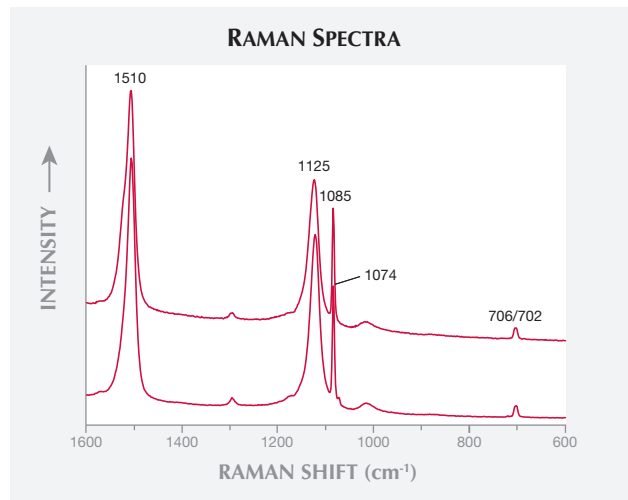
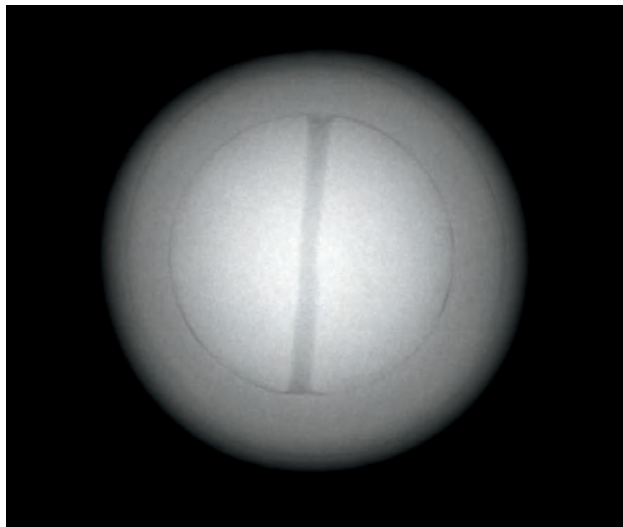


Figure 17. Raman spectra of two FWCPs from 1600 to 600 cm^{-1} (using 514 nm laser excitation) show bands due to simple polyenes at ~ 1510 and 1125 cm^{-1} . Aragonite bands are present at $\sim 1085 \text{ cm}^{-1}$ and at $706/702 \text{ cm}^{-1}$ (displayed as a single band at about 704 cm^{-1} due to the resolution). Small features are present at ~ 1295 , 1175 , and 1010 cm^{-1} , and an additional small band (probably due to vaterite) is observed in the bottom spectrum at $\sim 1074 \text{ cm}^{-1}$. Spectra are shifted vertically for clarity.

Ruby and sapphire rush near Didy, Madagascar. In April 2012, a gem rush occurred in northeastern Madagascar at coordinates $18^{\circ}20'16'' \text{ S}$, $48^{\circ}33'53'' \text{ E}$, located $\sim 25 \text{ km}$ south of Didy village, which is situated 50 km south of Ambatondrazaka. The authors investigated the new find on April 18–27.

The rush began after some parcels of fine blue sapphires were sold into the local market in early April in Moramanga, Ambatondrazaka, and subsequently in the capital city of Antananarivo by gold miners and people working for a local logging company in the area. The deposit appears to be situated inside the Ankeniheny–Zahamena corridor, a temporary protected area where mining is not allowed. However, thousands of Malagasy miners and hundreds of buyers rushed to the area, and the government was unable to control illegal mining in this jungle region.

The drive from Ambatondrazaka to Didy was made challenging by patches of deep mud. Soon after our arrival in Didy, we were notified by local security forces that all foreigners had to return to Ambatondrazaka in an effort “not to motivate the local population to work on the illegal mining site.” One of us (NR) continued to the mining area. From Didy, the journey started with a three-hour boat trip up a local stream, followed by 10–15 hours’ walk through dangerous and dense jungle terrain.

The mining site was inhabited by an estimated 5,000–10,000 people. Miners worked the gem gravels with hand tools in shallow pits (figure 18). The gravels were localized along a stream at a depth of $<1 \text{ m}$. Gems were also report-



Figure 18. Malagasy miners dig shallow pits in a streambed surrounded by thick jungle in search of sapphires and rubies. Photo by N. Rakotosaona.

edly found on the adjacent hillside. Most of the production consisted of blue sapphire (figure 19), without any milky or geuda-type material that is commonly found at other Malagasy deposits. The new deposit also was producing orangy pink sapphires and orangy red rubies, often containing some blue areas that are reminiscent of corundum from Winza, Tanzania.

More than 400 foreign buyers (mostly from Sri Lanka) opened buying offices in Ambatondrazaka. Both in that town and in Didy, we saw several clean and attractive blue sapphires weighing up to 4 g, and heard about fine stones approaching 30 g. We also saw some clean orangy red rubies up to 3 g and were told about fine rubies weighing 5 g. Local and foreign gem merchants were excited by the prospect of obtaining this attractive new material, and prices escalated quickly due to fierce competition among the buyers. Several

Figure 19. These sapphires and rubies (up to 2.4 g) were seen in Didy village. Photo by V. Pardieu.



samples are currently being studied by GIA and their gemological properties will be published in the near future.

Vincent Pardieu (vpardieu@gia.edu)
GIA, Bangkok

Nirina Rakotosaona
Soci t  Mini re du Cap Ltd., Antananarivo, Madagascar

Marc Noverraz
Colorline Ilakaka Ltd., Ilakaka, Madagascar

Lou Pierre Bryl
Senoble   Bryl Ltd., Gaspe, Canada

Beryllium-bearing nano-inclusions identified in untreated Madagascar sapphire. Cloud-like inclusions are the main cause of the velvety appearance of the famous Kashmir sapphires. Similar cloudy inclusions have also been found in unheated sapphires from Ilakaka (Madagascar) and other localities. The clouds in Ilakaka samples are unusual because they are associated with traces of beryllium (Be), niobium (Nb), and tantalum (Ta), as well as light rare-earth elements and thorium (see, e.g., Fall 2011 Lab Notes, pp. 232–233). The uneven distribution of these elements in unheated sapphires indicates that they have a natural origin (A. Shen et al., “From the GIA Laboratory—Beryllium in corundum: The consequences for blue sapphire,” *GIA Insider*, Vol. 9, No. 2, January 26, 2007; and the Lab Note referenced above). Yet the nature of the clouds has never been clear—are they composed of particles of a single mineral phase or an assemblage of minerals?

To identify the phase that contains the trace elements of interest—Be, Nb, and Ta—we studied an unheated rough sapphire from Ilakaka with a flat polished window (figure 20). Analysis with LA-ICP-MS revealed the following composition: Be—from below detection limit (BDL) to 2 ppmw, Nb—from BDL to 3 ppmw, and Ta—from BDL to 1.5 ppmw. The higher Be-Nb-Ta contents corresponded to the cloudy parts of the sample (i.e., the top and bottom areas in figure 20). These areas were then analyzed by a focused-ion beam system and a high-resolution transmission electron microscope (HRTEM) at the GFZ German Research Centre for Geosciences in Potsdam.

TEM study of sapphire inclusions is nothing new. A series of papers was published in the mid-1980s by A. R. Moon and M. R. Philips that examined various inclusions in sapphires from Australia, Sri Lanka, and Thailand. In one of their articles (“Inclusions in sapphire and heat treatment,” *Australian Gemmologist*, Vol. 16, No. 5, 1986, pp. 163–166), they identified the inclusions in milky blue Australian sapphires and Sri Lankan “geuda” stones as twinned rutile (TiO₂). Since then, almost every gemological publication has ascribed such milky clouds to rutile.

Our research revealed that the clouds in the Ilakaka sapphire consisted of a single Ti-rich phase that formed nano-inclusions 20–40 nm long and 5–10 nm wide; some of these crystals were twinned. We could not match the diffraction patterns to rutile, however. Instead, we found



Figure 20. This 0.25 g untreated sapphire from Ilakaka, Madagascar, has cloudy areas containing traces of Be, Nb, and Ta. Photo by Shane F. McClure.

an excellent match with an unnamed high-pressure mineral that has the same composition as rutile but has the crystal structure of scrutinyite (α -PbO₂). While rutile is a tetragonal mineral, this unnamed phase is orthorhombic with the Ti and O atoms arranged in the same way as the Pb and O in scrutinyite.

This unnamed mineral was first identified in laboratory studies when scientists subjected pure TiO₂ to very high pressures. It was later found in other Ti-bearing minerals (such as garnets) as nano-inclusions. Because it occurs in extremely small sizes in nature, it has not been approved as a new mineral by the International Mineralogical Association's Commission on New Minerals, Nomenclature and Classification.

Further details of this study will be documented in a future article.

Andy H. Shen (andy.shen@gia.edu)
GIA, Carlsbad

Richard Wirth
GFZ German Research Centre for Geosciences
Potsdam, Germany

Blue sapphire discovery near Kataragama, Sri Lanka. In February 2012, Shamil and Armil Sammoon of Sapphire Cutters Ltd. (Colombo, Sri Lanka) informed GIA's Bangkok laboratory about a new find of blue sapphires in the Thammannawa area located southwest of Kataragama, near the Yala National Park on the southeastern coast of Sri Lanka. The stones were reportedly discovered on February 14, on a road construction site between Kataragama and Lunugamwehera. The soil used to cover the road reportedly came from a small farm nearby that belonged to a Mr. Ranga. As news of the discovery spread, thousands rushed to the area. The Sri Lankan authorities responded swiftly and secured the site within days, transferring 1.4 hectares of land around

Mr. Ranga's farm from the Forest Conservation Department to the National Gem & Jewellery Authority (NGJA). The NGJA organized a February 24 auction in Kataragama for one-year mining rights on 49 individual lots. According to the NGJA's chairman, 40% of the proceeds from that auction will be given to the landowners.

In early March, with the support of the NGJA and some local traders, these authors visited the sites to collect samples for the GIA reference collection. Upon reaching the deposit, located at 06°22'16"N, 81°17'18"E, we saw that it was being prepared to host an estimated 500 miners. Within hours the miners began arriving at their claims, and camps sprang up from the cleared land (figure 21). Miners loaded the potentially sapphire-rich soil into bags to be taken away for washing. Only hand tools were allowed at that time (figure 22), as mechanized mining with excavators was prohibited in Sri Lanka. Subsequently, in mid-2012, mechanized mining was permitted at the deposit.

At the time our expedition ended on March 9, we were unable to see any sapphires produced from the new diggings around Mr. Ranga's house. However, we studied numerous samples obtained from local people that reportedly were found at the road construction site. The sapphires occurred as fine crystal specimens or broken pieces with sharp edges and no indication of alluvial transport (e.g., figure 23). Fissures and cavities were filled with a white powdery material.

The sapphires from the new find are notable for their size. We saw several specimens up to 150 g and heard reports of fine crystals as large as 300 g. Unfortunately, the material often contained numerous fissures as well as graphite, mica, and feldspar-like inclusions. Nevertheless, highly transparent areas were visible in the pieces exam-

Figure 21. This view shows a portion of the potentially sapphire-bearing area auctioned in 52 lots by Sri Lankan authorities. Photo by V. Pardieu.





Figure 22. Sri Lankan miners work the sapphire deposit with hand tools. Photo by V. Pardieu.

ined, and we expect to see clean faceted gems weighing more than 20 ct. Many of the crystals showed distinct color banding (with strong blue-violet to blue-green dichroism) associated with layers of minute particles. Several gem merchants onsite were excited by such Kashmir or Burma-

Figure 23. These rough and cut sapphires are reportedly from the new Kataragama deposit. The faceted stone weighs 14 ct, and the crystal fragments weigh 4.4 and 5.4 g. Photo by V. Pardieu.



like new material, and at the time of our visit the asking prices were already remarkably high.

Overall, the external appearance of these sapphires is similar to those from Andranondambo (Madagascar), Avisawella (Sri Lanka), and Kashmir, but preliminary chemical analyses have shown that their iron content is higher. So far relatively few faceted stones from this deposit have appeared in the market (again, see figure 23), and we expect that the combination of dichroism, color banding, and limited transparent areas will present challenges to cutters. More information on this new deposit and the properties of these sapphires is available at gia.edu/research-resources/news-from-research.

[Editor's note: See a full article on this deposit on pp. 98–107 of this issue of *G&G*.]

Vincent Pardieu and Lou Pierre Beryl
 Andrea Heather Go
 Vancouver, Canada

Sapphire and ruby carvings from Vietnam. At the 2012 Tucson gem shows, Steve Ulatowski had some sapphire carvings that were notable for their detailed forms and well-executed polish. His supplier indicated that about 20 carvings per month have been produced in mid-2011 by four carvers in a small factory in Vietnam. Of the approximately 210 carvings that have been completed, most consist of opaque blue, pink, white, or dark gray sapphires (or combinations of these colors; figure 24) that were mined from various parts of Vietnam. Some of the pieces show asterism. Rubies from Thailand and Tanzania (Longido) have also been carved. The carvings feature Asian themes and deities, and range from 2 to 10 cm tall.

Although such figurines are typically carved from jade and other (softer) materials, the very good polish covering the complex curves and depressions is notable for carvings made of corundum.

Brendan M. Laurs

Figure 24. These Vietnamese sapphire carvings range from 4.6 × 5.0 cm to 7.4 × 3.9 cm in dimension. Photo by Robert Weldon.





Figure 25. Calibrated zoisites from Merelani, Tanzania, display a variety of colors. The loose stones are 4.5 mm in diameter (gift of Steve Ulatowski; GIA Collection no. 38497) and the pendant contains 5.5 mm zoisites that are set with diamonds. Photo by Robert Weldon.

Color suites of zoisite from Tanzania. The mines at Merelani, Tanzania, are world famous for being the world's only commercial source of tanzanite, as well as supplying a variety of other gems and minerals (see, e.g., W. E. Wilson et al., "Famous mineral localities: The Merelani tanzanite mines, Lelatema Mountains, Arusha region, Tanzania," *Mineralogical Record*, Vol. 40, No. 5, pp. 346–408). Other colors of zoisite are occasionally produced and find their way to the market as cut stones that are popular with gem collectors (e.g., D. M. Dirlam et al., "Gem wealth of Tanzania," Summer 1992 *G&G*, Vol. 28, No. 2, pp. 80–102). At the 2012 Tucson gem shows, Steve Ulatowski had calibrated sets of Merelani zoisite that were prepared specifically for jewelry use. The round brilliants (figure 25) were assembled into boxed sets consisting of a variety of colors, all untreated, in singular sizes ranging from 2 to 5 mm in diameter. Each box contained from 8 to 40 stones. The material was cut from smaller-sized rough that he had gathered over the past five years, and he has cut enough to produce 100 boxes.

Mr. Ulatowski also had a few jewelry pieces that showcased the color spectrum of these zoisites (again, see figure 25).

Brendan M. Laurs

SYNTHETICS AND SIMULANTS

Partially devitrified glass imitation of hemimorphite. In mid-2010, GIA was informed about an attractive new blue-to-green gem by Brad Payne (The Gem Trader, Cave Creek, Arizona). He had obtained some samples of the material at a local gem show, where they were represented as opalized hemimorphite. Reportedly 1,000–2,000 carats of cabochons had entered the market from Chinese fossil dealers. Mr. Payne was intrigued by the white snowflake-like inclusions in this material, as well as the color zoning shown by some of the pieces, and he loaned four samples to GIA for examination.

The cabochons weighed 10.55–31.99 ct, and were greenish blue except for two samples that ranged into yellowish green (figure 26). Microscopic examination revealed radiating clusters of fine blade-like crystals that formed a fibrous texture, along with randomly distributed clusters of white dendritic inclusions. Spot RI values were 1.50–1.51, and the hydrostatic SG ranged from 2.48 to 2.52. By contrast, hemimorphite has RIs of 1.614–1.636 and an SG of 3.45 ± 0.05 . When exposed to short-wave UV radiation, the samples fluoresced very weak chalky blue and greenish yellow to pale green; they were inert to long-wave UV. No absorption lines were visible with a desk-model spectroscope. These properties ruled out the possibility of hemimorphite, but were suggestive of partially devitrified glass, which was confirmed by Raman analysis. EDXRF spectroscopy showed major amounts of Cu, Ca, Si, and Fe, and traces of Sn, Zr, and Cr.

Partially devitrified glasses are more commonly seen imitating jade (e.g., "Meta Jade"; see Summer 1995 GNI, p. 137). However, as these specimens demonstrate, we are now seeing imitations manufactured to replicate even the more obscure gem materials.

Jason Darley (jdarley@gia.edu) and Erica Emerson
GIA, New York

Figure 26. These partially devitrified glass samples (10.55–31.99 ct) were sold as opalized hemimorphite. The largest sample is a gift of Brad Payne; GIA Collection no. 38519. Photo by Brad Payne.





Figure 27. This 22.99 ct purplish pink bead resembled rubellite tourmaline but was identified as coated quartz. Photo by G. Choudhary.

Coated quartz imitation of rubellite tourmaline. Coating is one of the most common treatments performed on gemstones, especially on colorless materials such as rock crystal and topaz. Iridescent coating has become particularly popular among jewelers, designers, and consumers alike. In addition to this advanced coating method, traditional forms still exist, not only to create unusual material but also to imitate well-known gems such as emerald (see Spring 2011 GNI, pp. 71–72). A similar imitation of rubellite tourmaline (figure 27) was brought to our attention by Kashish Sachdeva during the Jaipur Jewellery Show in December 2011.

The purplish pink sample, fashioned as a tumbled bead, weighed 22.99 ct and measured approximately $21.41 \times 15.39 \times 11.29$ mm. The bead's color initially suggested rubellite tourmaline, but its relatively dull luster raised some suspicion of a coating. To the unaided eye, no features associated with coatings were visible. We then viewed it with a microscope, particularly around the drill

Figure 28. No chipping of the coloration was seen around the drill holes of the bead, making it quite difficult to detect the coating. Photomicrograph by G. Choudhary; magnified 20x.



hole, which is the best place to find chipped-off areas in a coated specimen. No chipping was seen; rather, some abrasions typical of natural stones were observed (figure 28). These features seemed to eliminate the possibility of a coating. However, the bead did display some large internal films with a brownish epigenetic appearance, and it lacked the growth tubes and liquid reflecting films typically associated with tourmaline (although some crystalline and fluid inclusions were present). These observations prompted us to conduct further testing.

The stone displayed a vague shadow edge at ~ 1.54 on the refractometer and had a hydrostatic SG of 2.60. It gave a weak orange reaction to short-wave UV radiation and was inert to long-wave UV. With the desk-model spectroscope, it displayed two strong bands in the yellow and red regions at ~ 580 and 650 nm; a weaker band was also visible at ~ 540 nm in the green region. This absorption pattern is associated with red and blue dyes, and the combination of gemological properties ruled out tourmaline and suggested artificially colored quartz instead.

Further microscopic examination with transmitted light revealed color bleeding and blotchiness near some pits and cavities (figure 29, left), evidence of surface-related artificial coloration. Also seen were some tiny blue and orange red spots from the dye (figure 29, right), indicating that a combination of these colors was used to produce the purplish pink coating substance. These colored spots appeared to be confined to the surface, another sign of coating.

The sample was confirmed as quartz by infrared spectroscopy, which also showed polymer-related bands at ~ 3070 , 2958 , 2927 , 2858 , 1750 , and 1270 cm^{-1} . Such imitations are a concern for dealers who are equipped only with a loupe, especially when they have to make quick buying decisions.

Gagan Choudhary (gagan@gjepcindia.com)
Gem Testing Laboratory, Jaipur, India

CONFERENCE REPORTS

10th Annual Sinkankas Symposium—Topaz. Co-hosted by GIA and the San Diego Mineral and Gem Society, this annual symposium in honor of John Sinkankas took place April 21, 2012, at GIA in Carlsbad. This year's event featured topaz, and was attended by 124 people. Each attendee received an 88 pp. handout with presentation summaries as well as outside contributions; additional copies are available for \$20 plus shipping from convener **Roger Merk** (Merk's Jade, San Diego, California; merksjade@cox.net).

Dr. Don Hoover (Springfield, Missouri) reviewed historical references to topaz in the literature. Many, but not all, references to topaz in the ancient texts actually refer to peridot from Zabargad Island (Egypt). The first actual topaz locality documented in the literature was probably the Saxony region of Germany, where yellow crystals were produced in conjunction with tin mining. **Robert Weldon** (GIA, Carlsbad) described how *bandeirantes* (Portuguese

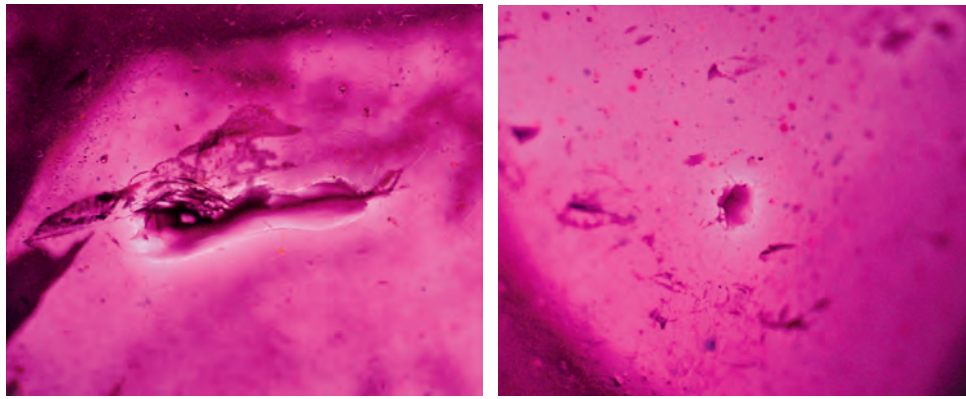


Figure 29. A few cavities on the coated quartz displayed color bleeding and blotchiness, suggesting surface-related artificial coloration (left, magnified 45×). Orangy red and blue spots from the dye showed that these colors were used in the purplish pink coating (right, 60×). Photomicrographs by G. Choudhary.

explorers) helped locate various gems in Brazil during the 1600s, which eventually led to the important discovery of the Imperial topaz deposits near Ouro Preto.

Dr. James Shigley (GIA, Carlsbad) covered the geology and localities of topaz deposits, which can be classified into magmatic, hydrothermal, and pneumatolytic types, and he offered to send a complete reference list of localities to anyone who requests it. **Dr. William “Skip” Simmons** (University of New Orleans) focused on crystal structure and mineralogy. Natural topaz shows a limited substitution of OH for F, and nearly all specimens are therefore fluorine dominant. Small amounts of Cr³⁺ and Fe³⁺ may substitute for Al³⁺ in the mineral’s structure. The causes of coloration in topaz were reviewed by **Dr. George Rossman** (California Institute of Technology, Pasadena). While pink is the only easily explained color (due to Cr³⁺), brown, yellow-to-red, and blue colors involve exposure to radiation (natural or in the laboratory), but there is no consensus on the particular mechanisms involved.

Important sources of collectable-quality topaz were described by **Bill Larson** (Palagems.com, Fallbrook, California). These include Brazil (Ouro Preto and Teófilo Otoni), California (San Diego County), Nevada (Zapot mine), Idaho (Sawtooth Mountains), Namibia (Klein Spitzkoppe), Pakistan (Gilgit-Skardu area), and Myanmar (Sakhangyi). **Meg Berry** (Mega Gem, Fallbrook, California) examined the carving topaz. In light of the mineral’s perfect cleavage direction, she suggested polishing at an orientation of at least 5° from this plane, using Linde A on a tin lap. However, for an attractive frosted look, carvings can be finished with 260 grit diamond (mixed with Vaseline) on a felt wheel; this will also save a lot of polishing time.

Shane McClure (GIA, Carlsbad) covered topaz treatments, which can be classified into irradiation ± heating, coating, and possibly diffusion. The latter treatment has been used to produce blue-to-green color but is difficult to classify since the coloration is associated with Co impurities that only penetrate 50–100 nm into the stone. Microscopic features of topaz were discussed by **John Koivula** (GIA, Carlsbad), including fluid and mineral inclusions, structural irregularities, and surface (dissolution) features.

He showed a specimen of topaz containing an inclusion of monazite with an associated cleavage disc that was particularly impressive for its size and beauty.

The theme of next year’s Sinkankas symposium will be ruby.

Brendan M. Laurs

MISCELLANEOUS

Myanmar Gem Emporium and GEO Myanmar 2012. The 49th annual Myanmar Jade, Gems & Pearl Emporium’s first session for 2012 was held March 9–18 in the capital city of Naypyidaw. According to China’s Xinhua News Agency, sales totaled \$702.66 million, a sharp decline from the March 2011 session’s earnings of \$2.8 billion. The event was attended by some 6,000 gem traders, half of them from other countries throughout Asia. In all, 9,762 Burmese jade lots were sold through tender or bidding, as well as 227 gem lots and 8,367 lots of cultured pearls from Myanmar.

The emporium’s mid-year session will take place in July, followed by a third sale at the end of the year. In total, the 2011 emporium took in more than \$4 billion.

The GEO Myanmar 2012 conference was held on March 1–2 in Yangon. Three of the presentations pertained to gems: “The economic impact in treating Myanmar gemstones” by Ted Themelis, “Prediction of exploration target areas for gem deposits in Mogok Stone Tract by integrating remote sensing and geoscience data” by Tin Ko Oo, and “Geological characteristics of ruby from Myanmar and Thailand” by Y. Ahn et al.

*U Tin Hlaing
Dept. of Geology (retired)
Panglong University, Myanmar*

ERRATUM

Page 21 of the Spring 2012 article by J. E. Shigley et al. on Diamantine incorrectly reported the beam diameter of the SIMS analyses. The correct diameter is 50 µm.