GEM NEWS International 2005

EDITOR
Brendan M. Laurs (blaurs@gia.edu)

CONTRIBUTING EDITORS
Emmanuel Fritsch, *IMN, University of Nantes, France* (fritsch@cnrs-imn.fr)
Henry A. Hänni, *SSEF, Basel, Switzerland* (gemlab@ssef.ch)
Franck Notari, *GIA, Geneva, Switzerland* (franck.notari@gia.edu)
Kenneth V. G. Scarratt, *GIA, Bangkok, Thailand* (kscarratt@aol.com)
Christopher P. Smith, *GIA Laboratory, New York* (chris.smith@gia.edu)

DIAMONDS

Gem mosaics of faceted diamonds. Mosaic artwork constructed from gem materials has typically used rough fragments or tumbled/polished pieces of colored stones. However, until now this contributor was unaware of the use of faceted fancy-color diamonds to create gem mosaics. During a recent trip to Brazil, several examples of this new artwork, referred to as Diamond Craft (figure 1), were shown to her by Jorge Brusa (Bristar, Sao Paulo).

Mr. Brusa began experimenting with the concept in 2002. His first prototype consisted of placing the diamonds between glass and fabric and holding them together with a frame, but he experienced difficulties keeping the diamonds in place. In 2003, he experimented with securing the diamonds with a type of spackling paste, but that method also had problems. However, he recently developed a proprietary process that has proved successful in holding the stones.

Figure 1. This Diamond Craft gem mosaic after one of Vincent van Gogh's "Bedroom" paintings measures 10 × 10 cm and was created with 5,482 fancy-colored faceted diamonds, with a total weight of 46.32 ct. Courtesy of Bristar.

To create the mosaics, the melee diamonds are carefully situated table-down on a piece of glass placed over the artwork. To date, eight different images have been used as models for the mosaics—two by Vincent van Gogh, one by Paul Klee, and five of his original designs. The diamonds consist of a mix of natural colors (yellows, browns, and near-colorless) and treated colors (pinks, blues, and greens), all purchased in India. Mr. Brusa indicated that the most difficult part is selecting diamonds that have a uniform depth, which is required for the process to work successfully.

The largest mosaic completed to date measured up to 13 × 10 cm before framing, and contained up to 10,800 diamonds with a total weight of 102 carats.

Patricia Syvrud (patricia.syvrud@gia.edu)
GIA, Carlsbad

Editor's note: The initials at the end of each item identify the editor or contributing editor who provided it. Full names and affiliations are given for other contributors. Shane F. McClure, Dr. Mary L. Johnson, and Dr. James E. Shigley of the GIA Laboratory in Carlsbad are thanked for their internal review of the Gem News International section.

Interested contributors should send information and illustrations to Brendan Laurs at blaurs@gia.edu (e-mail), 760-603-4595 (fax), or GIA, 5345 Armada Drive, Carlsbad, CA 92008. Original photos will be returned after consideration or publication.

GEMS & GEMOLOGY, Vol. 41, No. 3, pp. 264–278

COLORED STONES AND ORGANIC MATERIALS

An unusual emerald with conical growth features. Recently, a 5.37 ct emerald was submitted to the Gem Testing Laboratory in Jaipur, India, for identification. Initial observation with a gemological microscope showed strong color zoning in parallel layers, and some of the planes contained conical growth features that resembled those seen in hydrothermal synthetic emeralds. This prompted a more detailed examination of the sample.

Refractive indices taken from the table, crown, and pavilion facets yielded similar values, between 1.580 and 1.590, with a birefringence of 0.008–0.009. Specific gravity (measured hydrostatically) was 2.72. This S.G. is consistent with the values reported for natural and hydrothermal synthetic emeralds, but the refractive indices were slightly higher than those for hydrothermal synthetics and some natural emeralds (see, e.g., J. I. Koivula et al., "Gemological investigation of a new type of Russian hydrothermal synthetic emerald," Spring 1996 *Gems & Gemology*, pp. 32–39).

Microscopic examination revealed "fingerprints" and scattered whitish clouds of crystals that crossed the color and growth zones. Similar features also were observed in some Russian hydrothermal synthetic emeralds by Koivula et al. (1996), although they were of a reflective nature, while the particles reported here typically appeared sugary. To better observe the growth features, we immersed the sample in bromoform. Conical growth features were seen along almost all the boundaries between the green and colorless zones (figure 2). However, the individual cones were not restricted to a single plane, and they varied in size. None of the chevron-type growth patterns that are characteristic of hydrothermal synthetic emerald were observed in the stone.

With fiber-optic light, the emerald exhibited a sheen effect caused by iridescent, roughly hexagonal platelets that formed along planes in the green color zones near the colorless boundaries (figure 3). By comparison, a few black opaque hexagonal plates (not iridescent) were reported in Russian hydrothermal synthetic emeralds by Koivula et al. (1996). In certain orientations (i.e., nearly parallel to the color bands), the platelets documented in the present stone appeared silvery and reflective (figure 4). Such inclusions have not been reported previously in any natural or synthetic emeralds.

FTIR spectra taken in various directions all exhibited a pattern indicative of natural emerald (figure 5). Compared

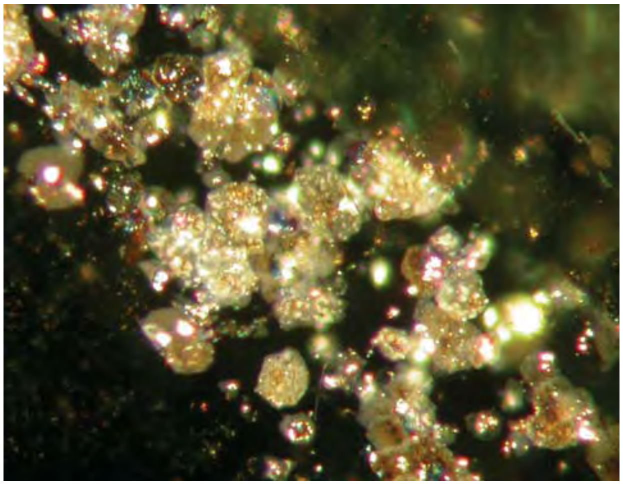


Figure 3. Planes of brownish hexagonal iridescent plates also were seen in the unusual emerald. Photomicrograph by G. Choudhary; magnified 40×.

Figure 2. Microscopic examination of a 5.37 ct emerald showed alternating color bands with subtle conical growth features on the edges of the color zones. Photomicrograph by G. Choudhary; magnified 35×.

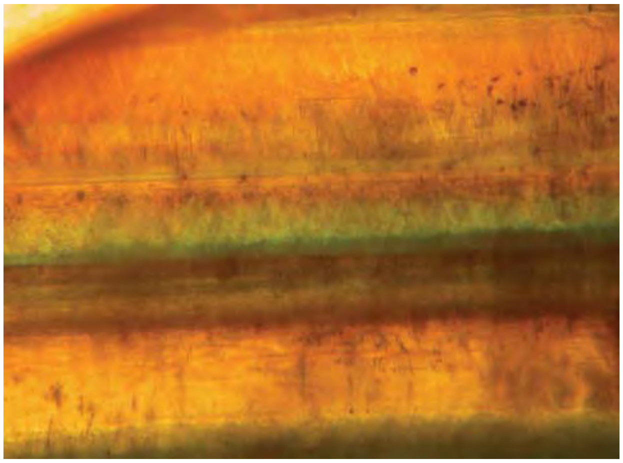
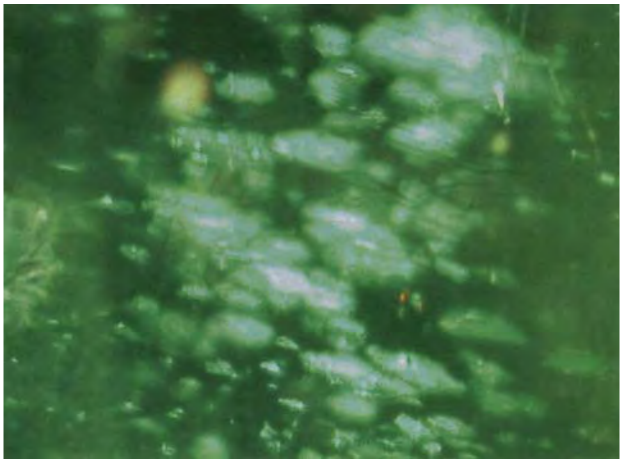


Figure 4. When viewed in certain orientations in darkfield illumination, the iridescent plates showed silvery reflections. Photomicrograph by G. Choudhary; magnified 45×.



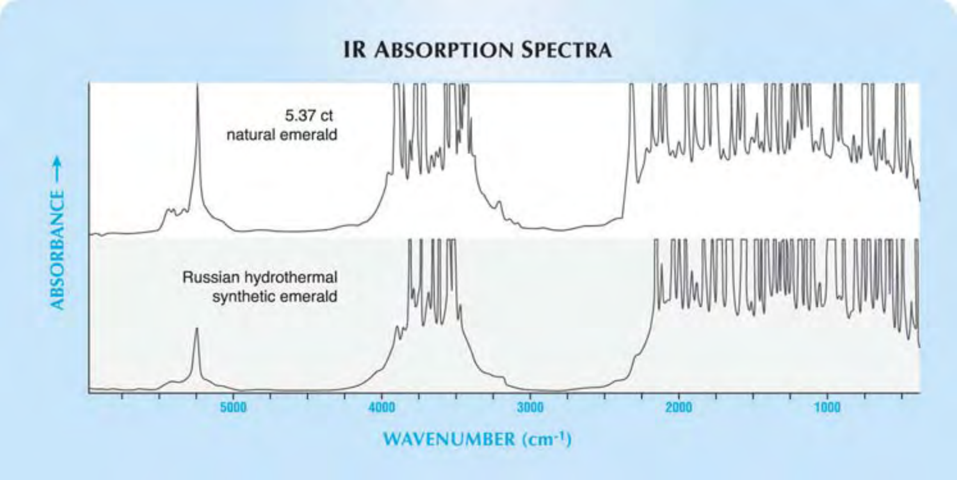


Figure 5. A comparison of the infrared spectrum of the 5.37 ct emerald with that of a Russian hydrothermal synthetic emerald shows differences in the absorption bands between 4000 and 3000 cm^{-1} and in the intensity of the peak at around 5270 cm^{-1}. The IR absorption features shown by the 5.37 ct emerald are indicative of natural origin.

to hydrothermal synthetic emeralds, there were significant differences in the intensity of the absorption features due to type II water between 4000 and 3000 cm^{-1}. Another major difference was the intensity of the peaks at around 5270 cm^{-1}, which were much stronger in the natural emerald reported here.

Although the stone contained some unusual internal features, the FTIR spectra led us to conclude that it was a natural emerald.

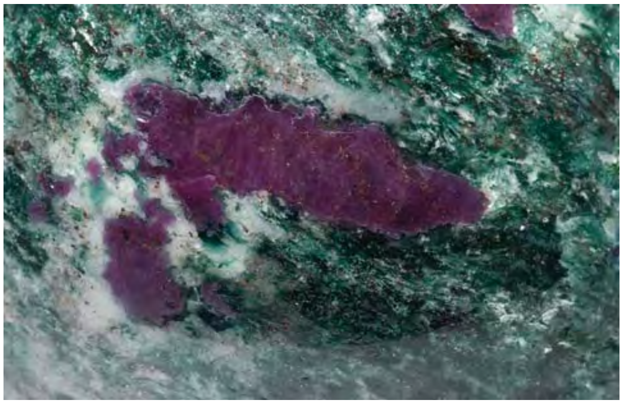
Gagan Choudhary (gtljpr_jp1@sancharnet.in)
Gem Testing Laboratory, Jaipur, India

Figure 6. This sphere (5.4 cm in diameter) was cut from a rock consisting of fuchsite, corundum, and alkali feldspar. The material comes from a new deposit in Bahia, Brazil. Photo by C. D. Mengason; GIA Collection no. 32380.

Fuchsite-corundum rock from Bahia, Brazil. Green quartzite, or aventurine quartz, is widespread in the Precambrian terranes of Brazil. It is found in small deposits from the southern tip of Minas Gerais to northern Bahia and western Goiás. The material is composed mainly of fine- to coarse-grained quartz and fuchsite mica (chromian muscovite). The amount of fuchsite in the rock may be quite variable, from a few percent up to, rarely, 100%. Although the origin of these Cr-rich rocks is not yet well understood, it seems likely that they formed through the metamorphism of Cr-bearing sedimentary strata.

In January 2005, a new occurrence of fuchsite with corundum and feldspar was found near Serra de Jacobina, northern Bahia State. Preliminary characterization of several samples with a microscope and powder X-ray diffraction

Figure 7. A closer view of the sphere in figure 6 shows blebs of corundum (here, up to 1.9 cm wide) that are surrounded by intergrowths of fuchsite and alkali feldspar. Tiny grains of reddish orange rutile are disseminated throughout the rock and also form inclusions in the corundum. Photo by C. D. Mengason.



showed that the rock consists of coarse-grained fuchsite with blebs of opaque pinkish purple corundum and irregular pods and interstitial areas of white alkali feldspar (figure 6). Also present were tiny grains of reddish orange rutile (figure 7) that showed a submetallic luster. No quartz could be found in the rock. The various textures and color combinations created by the minerals are particularly attractive when polished into spheres (again, see figure 6).

The association of fuchsite and corundum, together with kyanite, is also known from India, Zimbabwe, and South Africa (see Winter 2004 Gem News International, pp. 338–339, and the reference therein). These mineral associations are formed by prograde metamorphism at high temperature and pressure. The formation of the Brazilian occurrence may be explained by the following reaction: mica ↔ corundum + feldspar + H_2O. At the other occurrences, the initial presence of quartz may be responsible for the additional formation of kyanite in the rock: mica + quartz ↔ kyanite/corundum + feldspar + H_2O.

So far, about 150 kg of the fuchsite-corundum rock have been recovered from the Brazilian deposit. The geology of the deposit suggests that additional production is likely in the future.

Rainer Aloys Schultz-Güttler (rainersg@usp.br)
Institute of Geoscience, University of São Paulo

Pen shell pearls—nacreous and non-nacreous. The Winter 2003 Gem News International section (pp. 332–333) reported on pen shell pearls from the Pacific Coast of Baja California, Mexico. Pen shells from this area (i.e., *Pinna sp.* and *Atrina sp.*) have a nacreous layer on their interior that grows on top of, and is distinctly different in composition from, the underlying non-nacreous portion of the shell. Because the bond between these layers is weak, they readily separate after the death of the mollusk (figure 8).

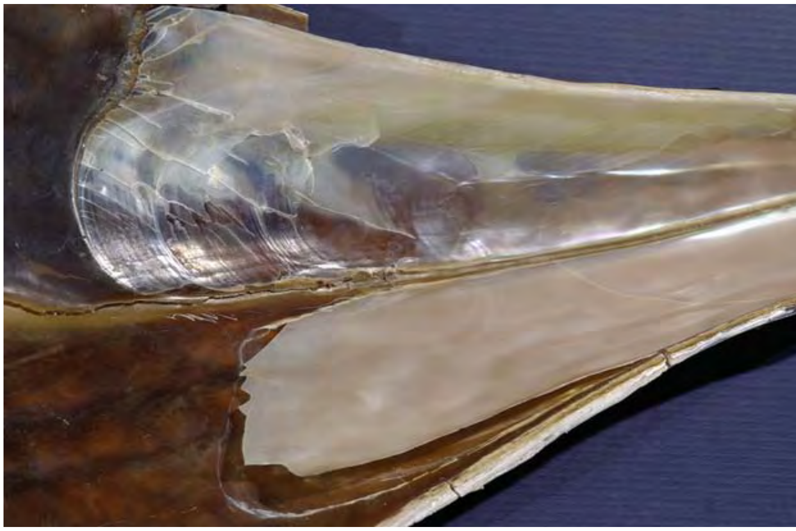


*Figure 8. The interior of the rugose pen shell (*Pinna rugosa*) from Baja California has a light-colored nacreous layer that readily separates from the non-nacreous dark brown base layer. This shell is approximately 35.5 cm long. Courtesy of Oasis Pearl; photo by C. D. Mengason.*

Since the pearly layer covers only part of the shell's interior, the mollusk could conceivably host a nacreous pearl and a non-nacreous concretion simultaneously within the same shell. A nacreous and a non-nacreous sample (2.29 and 17.83 ct, respectively) were recently donated to GIA by Jeremy Norris of Oasis Pearl, Albion, California (figure 9). Although they did not come from the same mollusk, both reportedly originated from the same species of Baja California pen shell, identified as *Pinna rugosa* by Mr. Norris and confirmed by consulting shell experts Scott Rugh (San Diego Natural History Museum) and Paul Valentich-Scott (Santa Barbara Museum of Natural History). As shown in the Winter 2003 GNI entry, nacreous pen shell pearls can be quite attractive, and although the non-nacreous "pearls" would not be suitable for jewelry use because of their tendency to dry out and crack over time, concretions such as these can make interesting collectors' items.

Further characterization with UV-Vis reflectance spectroscopy was performed on both samples and on the different sections of the pen shell supplied by Mr. Norris. The spectrum for the nacreous pearl was distinctly different from that of the non-nacreous "pearl," and their spectra were similar to those of the corresponding sections of the pen shell. Although the spectral data suggest that both samples originated from the pen shell, given the limited data available, further research is necessary to establish the significance of the spectral matches between the pearl/concretion and their respective portions of the shell.

Cheryl Y. Wentzell (cwentzell@gia.edu) and Shane Elen
GIA Laboratory, Carlsbad

Figure 9. The light brown nacreous pearl on the left (7.8 × 6.9 × 5.6 mm) and the dark brown non-nacreous "pearl" on the right (17.3 × 13.5 mm) both originated in rugose pen shells from Baja California, Mexico. Their dissimilar appearance and structure is the result of growth in compositionally different sections of the host shells. GIA Collection nos. 31758 (pearl) and 31759 (concretion); photo by C. D. Mengason.

Figure 10. A new deposit in Tamil Nadu, India, is the source of these sapphires (0.36–2.01 ct). Courtesy of Dudley Blauwet Gems; photo by C. D. Mengason.

New sapphires from Tamil Nadu, India. In early August 2005, gem and mineral dealer Dudley Blauwet (Dudley Blauwet Gems, Louisville, Colorado) informed these contributors about a new find of pinkish orange to purple sapphires from India. According to his supplier, the material comes from the Kurur area of Tamil Nadu State, and much of it has been collected by farmers from near-surface secondary deposits. Mining has been hindered by the lack of available water to wash the soil, but rough parcels weighing 200–300 grams occasionally have been obtained by a few local dealers.

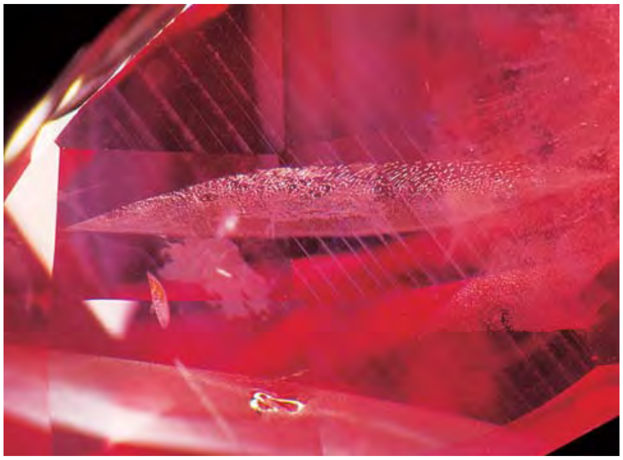
The rough is recovered as broken fragments, some of which are rather large (i.e., up to 12–20+ grams). However, most of the material is extensively fractured, so typically the cut stones weigh up to 1–3 ct. Nevertheless, the largest faceted stone that Mr. Blauwet was informed about weighed approximately 30 ct.

Most of the sapphire is found in shades of lavender and pink, and is heated to 1,100°C in Sri Lanka. The resulting coloration typically ranges from orange to amethyst-like purple colors, commonly with strong color zoning (figure 10). The blue component has proved difficult to remove from the "silky" lavender rough, but heating to higher temperatures is avoided due to the risk of causing more fractures in the material.

Mr. Blauwet donated one unheated and two heated sapphires to GIA, and also loaned 14 heated sapphires for examination (0.36–3.87 ct). Gemological examination of six representative stones (0.36–1.70 ct) revealed the following properties: color—purplish pink to orangy pink, with one stone being a brownish pinkish purple and another being distinctly bicolored reddish purple and reddish orange face up; pleochroism—red-to-orange or red-to-purple; R.I.—1.760–1.769, with a birefringence of 0.008–0.009; and S.G.—4.0. When viewed with a gemological microscope, the samples displayed uneven coloration in zones or bands, as well as groups of short, fine rutile needles, fine-grained clouds (figure 11), lamellar clouds (figure 12), clouds of tiny reflective platelets sometimes interspersed with rutile needles (figure 13), and

Figure 11. Some of the sapphires from Tamil Nadu contained fine-grained clouds. Photomicrograph by S. F. McClure; magnified 17×.

Figure 12. This sapphire from Tamil Nadu contains lamellar clouds and conspicuous "fingerprints." Photomicrograph by S. F. McClure; magnified 21×.



"fingerprint" inclusions. They exhibited weak-to-moderate red fluorescence to long-wave UV radiation, and weak red or no fluorescence to short-wave UV. Typical features seen with a desk-model spectroscope included a weak absorption band at 460 nm, a 475/480 nm doublet, and a band at 670 nm.

Although the colors of some of these samples resemble those seen in sapphires treated by Be diffusion, the samples showed no evidence of the high temperatures used in that process. According to Mr. Blauwet, much of this Indian sapphire is being sold on the market as heated Sri Lankan or Madagascar material.

Shane F. McClure (smcclure@gia.edu)
GIA Laboratory, Carlsbad

James E. Shigley
GIA Research, Carlsbad

BML

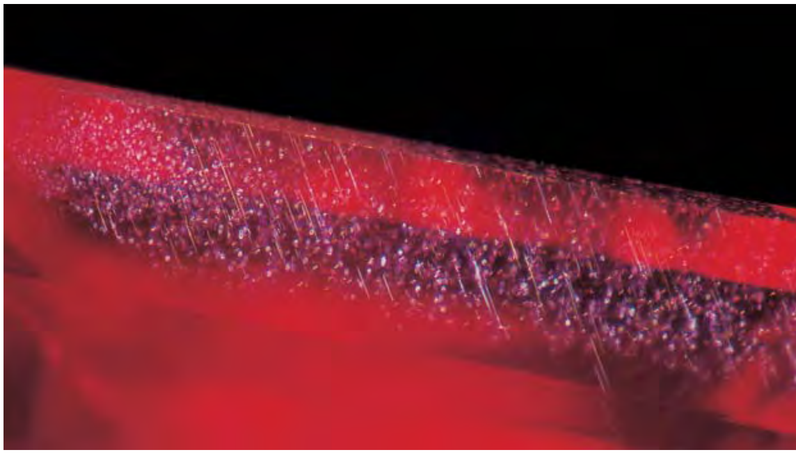


Figure 13. Clouds of tiny reflective platelets and short rutile needles are seen in this Tamil Nadu sapphire. Photomicrograph by S. F. McClure; magnified 37×.

Tenebrescent scapolite from Afghanistan. At the 2004 Tucson Gem shows, gem and mineral dealer Herb Obodda (H. Obodda, Short Hills, New Jersey) showed GIA personnel several rough and cut pieces of a colorless gem material from Badakhshan, Afghanistan, that was thought to be hackmanite on the basis of its reversible photochromism (or tenebrescence, a property in which some minerals darken in response to radiation of one wavelength and then reversibly lighten on exposure to a different wavelength). When "charged" under Mr. Obodda's strong UV source, the stones turned blue. When they were exposed to daylight or a strong incandescent light source, the color faded completely in seconds.

Mr. Obodda obtained the rough material during buying trips to Pakistan in early 2003 through early 2004. He said that the local dealers have habitually referred to the colorless sodalite from Badakhshan as "hackmanite"—even though they were unaware that any of the pieces showed tenebrescence. When he returned home and tested the initial parcel with a UV lamp, Mr. Obodda was pleased to find that a few pieces showed tenebrescent behavior. He also noted a subtle but distinctive feature that could be used to differentiate the tenebrescent stones from the other material in the parcel in the absence of a UV lamp: They showed a schiller effect when viewed with a strong pinpoint light source in certain orientations.

Hackmanite, a sulfur-rich variety of sodalite, was first discovered in Greenland in the early 1800s. A mineralogical curiosity, it can be made to change repeatedly from light yellow to pink when alternately exposed to sunlight and UV radiation (see, e.g., Summer 1989 Gem News, pp. 112–113). The coloration of this Afghan material was much different, however, in that it changed from colorless to blue on exposure to UV radiation (figure 14).

Figure 14. Remarkable tenebrescent behavior was exhibited by these scapolites (0.91–5.17 ct) from Afghanistan. The stones turned blue when exposed to short-wave UV radiation for approximately one minute, and faded to colorless within seconds when brought into light. Courtesy of H. Obodda; photos by C. D. Mengason.

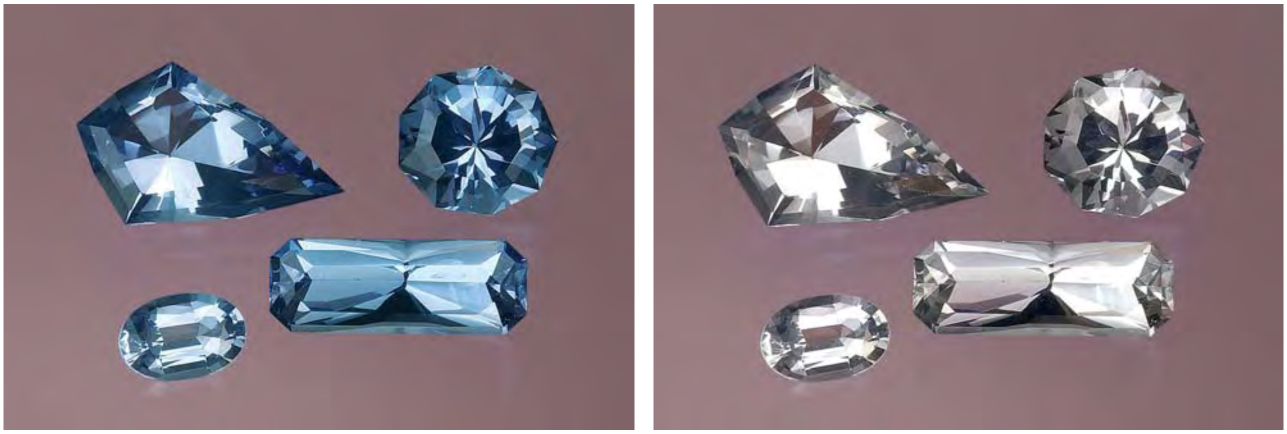
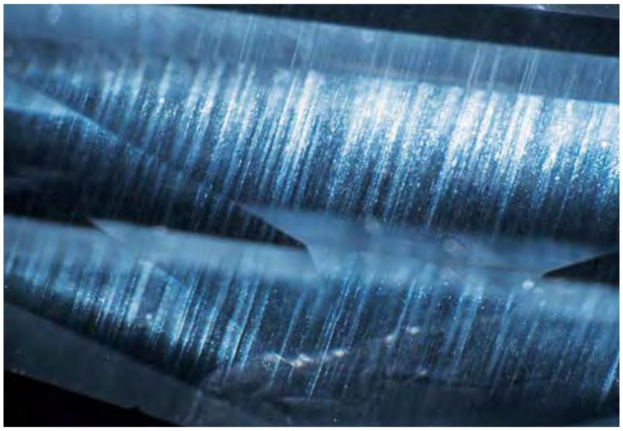


Figure 15. A dense network of parallel stringers was present in all of the tenebrescent scapolites. Photomicrograph by S. F. McClure; magnified 18×.

Mr. Obodda loaned four rough pieces (13.37–55.54 ct) and 14 faceted examples (0.17–5.17 ct) of the tenebrescent material to GIA for examination. He also donated some rough fragments to the GIA Collection. Gemological testing of four of the cut stones (0.91–5.17 ct) revealed consistent properties: R.I.'s—1.536 and 1.541, S.G.—2.58, and yellow-orange fluorescence to UV radiation (strong to long-wave and weak to short-wave). Hackmanite is optically isotropic with an R.I. of 1.483, whereas the properties of the four samples are consistent with those of scapolite (this identity was confirmed by Raman spectroscopy). When viewed with a gemological microscope, all four stones exhibited dense parallel stringers throughout (figure 15), and some contained planar clouds or "fingerprint" inclusions. The schiller effect noted by Mr. Obodda is caused by reflections from these features when viewed with a strong pinpoint light source (figure 16).

Figure 16. When viewed in certain orientations with a strong pinpoint light source, the scapolites exhibited a schiller effect that is caused by reflections from the network of parallel stringers. Photomicrograph by S. F. McClure; magnified 18×.



When the samples were exposed to short-wave UV radiation, with the 4-watt lamp positioned nearby for approximately one minute, they changed from colorless to deep blue. The larger stones showed this effect more dramatically. Shorter exposure times also produced the blue color, but it took at least a full minute to get a saturated blue. Long-wave UV radiation also produced this color modification, but the achieved color was not as saturated. The color was stable as long as the stones were kept in a dark or dimly lit room, but they began to fade as soon as they were exposed to light (much faster in incandescent than in fluorescent light). In fact, an intense incandescent light source caused their color to fade completely in a few seconds. The color modification was repeated on one stone at least five times, and each time the results were the same. A brief video showing the reversible color change is available online in the *G&G* Data Depository at www.gia.edu/gemsandgemology. Quantitative chemical analyses were obtained by one of us (GRR) using an electron microprobe on a polished fragment of the scapolite. The average formula derived from three analyzed points was $Na_4Al_3Si_9O_{24}Cl_{0.9}S_{0.09}$; traces of carbonate may also be present but could not be analyzed by this instrument. The formula shows that the scapolite species is marialite, with a minor sulfide component. Sulfide photochemistry is what produces the blue color of lapis lazuli and red coloration in hackmanite and tugtupite.

Mr. Obodda also loaned one rough sample that was representative of the non-tenebrescent material in the parcels he purchased in Pakistan. Preliminary Raman analysis was indicative of quartz. In addition, Mr. Obodda has faceted colorless sodalite that was reported to be from the same mining area in Badakhshan. Some purple sodalite from Badakhshan also shows tenebrescence, changing from "pale lilac/magenta in artificial light to a deep purple/magenta in sunlight" (T. Moore, "What's New in Minerals," *Mineralogical Record*, Vol. 33, No. 1, 2002, pp. 97–98). It should also be mentioned that purple scapolite has been produced recently from the same area of Badakhshan, but it does not exhibit tenebrescence.

During his August 2005 buying trip to Pakistan, Mr. Obodda could not find any more of the colorless "hackmanite" in the marketplace. So far, he estimates that he has cut approximately 20 stones weighing less than 1 ct, a dozen weighing near 1 ct, and 10 stones in the 5 ct range; the largest stone weighed 6.7 ct.

To the best of our knowledge, tenebrescence has not been reported previously in scapolite. In addition to hackmanite, only a few other gems show this feature, such as spodumene (E. W. Claffy, "Composition, tenebrescence, and luminescence of spodumene minerals," *American Mineralogist*, Vol. 38, 1953, pp. 919–931) and tugtupite (A. Jensen and O.V. Petersen, "Tugtupite: A gemstone from Greenland," Summer 1982 *Gems & Gemology*, pp. 90–94). Even some pink diamonds will

Figure 17. This quartz cabochon (19 × 13 mm) from Paraíba State, Brazil, contains color-zoned clusters of radiating fibers that were identified as gilalite. Photo by B. Rondeau.

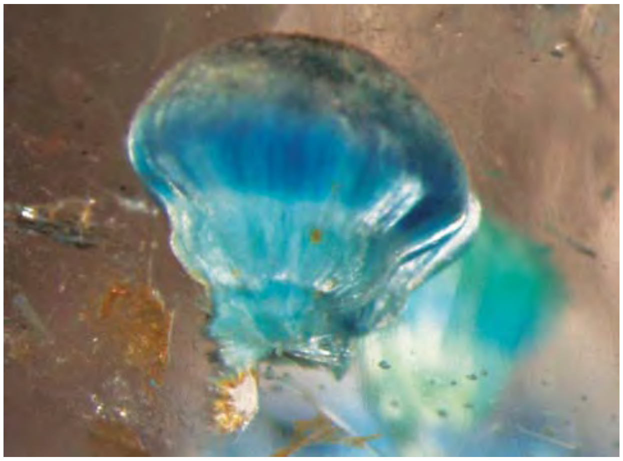


Figure 18. When viewed in certain directions, the gilalite inclusions resemble floating jellyfish medusas (here, 1.4 mm wide). Photomicrograph by B. Rondeau; magnified 16×.

change color temporarily under some conditions (see, e.g., J. Van Royan, "UV-induced colour change in pink diamonds," *Antwerp Facets*, March 1995, pp. 21–24).

Shane F. McClure (smcclure@gia.edu)
GIA Laboratory, Carlsbad

George R. Rossman
California Institute of Technology
Pasadena, California

James E. Shigley
GIA Research, Carlsbad

BML

INCLUSIONS IN GEMS

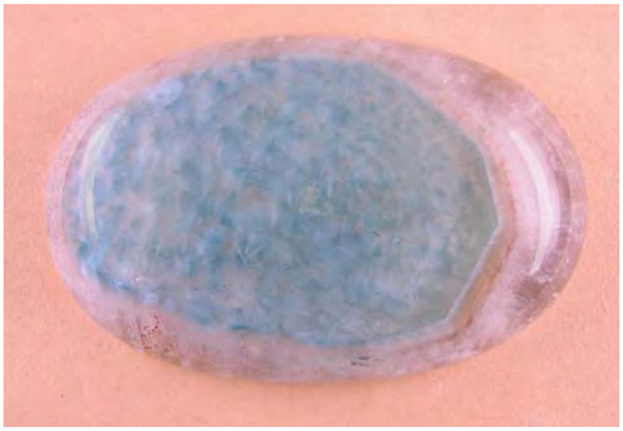
"Medusa quartz" with gilalite inclusions. Gem-quality quartz crystals containing interesting blue-to-green inclusions were discovered in Paraíba State, Brazil, in August 2004. Since then, about 10 kg have been extracted by local miners.

Several samples of this quartz were studied by these contributors, including some well-formed crystals, broken fragments, and cabochons. The quartz crystals were up to 10 cm long and exhibited striking color zoning: a few crystallographically oriented layers of light purple amethyst in otherwise colorless rock crystal, as well as distinct layers of eye-visible blue-to-green inclusions. Some of these blue-to-green inclusions occurred in the colorless cores of the crystals (figure 17); they were less than a millimeter in longest dimension, with shapes reminiscent of jellyfish (figure 18). All of these inclusions were located on the same growth plane, and each consisted of a cluster of very thin radiating fibers. The jellyfish-like inclusions were often color zoned, varying from light green to a vivid greenish blue, with some layers being nearly white (again, see figure 17). The overall appearance, similar to a floating colony of jellyfish, suggests the name *medusa* quartz, after the typical bell-shaped appearance of the free-floating (medusa) stage of this sea creature. Several centimeter-size cabochons have been cut from this material.

Also present in some of the quartz crystals was a near-surface phantom layer containing tiny blue-to-green acicular crystals. About a dozen flat cabochons, 1 to 6 cm long, have been cut from these layers (see, e.g., figure 19).

The identification of the jellyfish-like inclusions was performed at the National Museum of Natural History in Paris. Their crystal structure was determined using an Inel CPS 120 X-ray powder diffractometer with a curved detector, combined with a Gandolfi single-crystal camera and copper Kα1 emission. Both the green and blue areas had the

Figure 19. This quartz cabochon (60 × 35 mm) from Paraíba State, Brazil, contains a layer of acicular crystals that have a chemical composition consistent with gilalite. Since X-ray diffraction could not be performed on these inclusions, additional possibilities include the copper silicates apachite, planchéite, and shattuckite. Photo by B. Rondeau.



same diffractogram. The most accurate match (according to the InfoBank-MDAT database) was gilalite, a hydrated copper silicate ($Cu_5Si_6O_{17}\cdot 7H_2O$). The tiny acicular inclusions were too dispersed in the quartz matrix to be analyzed by X-ray diffraction. Chemical analysis was performed using a Jeol JSM 840A scanning electron microscope (SEM) equipped with an Oxford Link energy-dispersive detector. Both the acicular and jellyfish-like inclusions contained Si and Cu as the only major elements (water cannot be detected with this technique), along with traces of K and Mg. The composition was the same in the blue and green areas of the medusa inclusions. The major-element composition is also consistent with gilalite.

This is the first reported occurrence of gilalite in quartz of gemological interest. It is quite different in form and nature from other blue inclusions in quartz, such as papagoite or lazulite (see, e.g., J. Hyrsl and G. Niedermayr, *Magic World: Inclusions in Quartz*, Rainer Bode, Haltern, Germany, 2003).

Benjamin Rondeau (rondeau@mnhn.fr)
and Michele Macri
National Museum of Natural History
Paris, France

EF

SYNTHETICS AND SIMULANTS

Fake aquamarine crystals from Mogok. During a May 2005 buying trip to Mogok, Myanmar, gem and mineral dealer Bill Larson (Pala International, Fallbrook, California) saw several imitation aquamarine crystals. They were cleverly fabricated from a transparent light blue material that had been shaped into single hexagonal prisms and then etched or rounded to have the appearance of a naturally resorbed crystal of beryl (e.g., figure 20). A natural appearance was further suggested by the presence of dirt-filled "cracks," which actually penetrated only a small distance into the pieces. Mr. Larson first recognized them as fakes by noting that the overall shape (with a pyramidal "termination" on one end a flat surface on the other end) resembled the typical morphology of quartz, rather than the aquamarine crystals that are known from the Mogok area. In addition, their overall look and "feel" suggested that they were made of glass. The FTIR spectrum of a specimen that Mr. Larson donated to GIA confirmed that it was glass.

Figure 20. This glass imitation of an aquamarine "crystal" (7 cm long) was purchased in Mogok, Myanmar, in May 2005. GIA Collection no. 32382; photo by C. D. Mengason.

BML

More faked inclusions in Brazilian quartz. In the Fall 2004 GNI section (pp. 266–267), this contributor described finger-like inclusions in Brazilian rock crystal that were reportedly manufactured in Teófilo Otoni in 2004. During a visit to the 2005 Feira Internacional de Pedras Preciosas show, held in Teófilo Otoni in August, several local dealers had two new types of quartz with internal features that were reportedly created by the same person responsible for the finger-like inclusions. According to vendors, this new material sells very well, and in most cases the buyers are not aware of its artificial origin.

This contributor viewed at least 100 samples of this material, all of which were cut as cabochons in various shapes that ranged from 3 to 7 cm in longest dimension (see, e.g., figure 21). In the quartz containing finger-like inclusions (see Fall 2004 entry), the "artist" apparently drilled holes in the bottom of each cabochon that were then filled with dye (green, brown, pink, and yellow) and covered with a brown glue impregnated with mineral powder. In the new fakes seen in August 2005, several trenches were made in the bases of the cabochons with a cutting wheel. The bases were then dyed green and brown and covered with a mixture of glue and mineral powder. When viewed face-up, the colored areas protruding into the quartz mimicked the appearance of natural inclusions. In addition, some of these cabochons contained dozens of silvery-looking oval fractures, similar to "spangles" in heated amber. These fractures were probably created by thermal shock.

The best clue for recognizing these new fakes, other than their unnatural appearance, is the soft brown glue on the bottom, which can easily be indented with a needle or knife. In addition, the dye used in some of the fakes shows yellow-green luminescence to UV radiation (much stronger with long-wave UV), but the cement is inert. Note that many of these cabochons also contain natural inclusions such as chlorite, mica, or quartz crystals, which can help deceive inexperienced buyers.

Jaroslav Hyrsl (hyrsl@kuryr.cz)
Prague, Czech Republic

TREATMENTS

Natural pearl with "orient-like" coating. Recently, the SSEF Swiss Gemmological Institute received for testing a parcel of 13 loose button-shaped pearls weighing about

6 ct each. They showed moderate to good luster and orient, and ranged from white to light "cream." X-radiographs revealed that all were natural pearls, showing characteristic structures such as concentric circles, fine fissures, and darker central zones. Using X-ray luminescence (see H. A. Hänni et al., "X-ray luminescence, a valuable test in pearl identification," *Journal of Gemmology*, Vol. 29, No. 5/6, 2005, pp. 316–324), elevated Mn contents were noted in three of the samples, indicating that they were freshwater pearls, while the remainder were of saltwater origin.

Careful examination of one of the saltwater pearls (figure 22, left) revealed a somewhat patchy appearance and an unusual sticky surface. With magnification, a shiny coating was evident. The coating was transparent (with tiny trapped air bubbles) and contained minute reflective particles. When examined with a fiber-optic light, the pearl displayed a "dotted" texture similar to that seen in imitations. The coating was partially chipped off in spots (figure 23), which explained the patchy color distribution. Although not visible in figure 23, the surface of these exposed areas showed distinct polish marks.

When exposed to long-wave UV radiation, the pearl fluoresced dull yellow—except in areas where the coating was chipped off, in which the pearl surface fluoresced strong white. The reaction to short-wave UV was similar but less distinct.

Chemical analysis by EDXRF spectroscopy revealed a low concentration of Bi and traces of Sr. Bi has not been detected so far in any untreated pearl. Raman analyses of the coating with a 514 nm Ar laser were compared with spectra from the underlying pearl surface. The spectrum of the coating showed a distinct peak at 1602 cm^{-1}, in addition to the characteristic Raman peaks for aragonite. The 1602 cm^{-1} peak is indicative of an artificial resin.

Based on these observations, this contributor suspects that this pearl had been heavily polished, which would have removed most of its original luster and orient. The pearl was apparently coated with an artificial resin mixed with some *essence d'orient*, such as is used for imitation pearls, to restore its appearance. Judging from the rather scratched and chipped surface, it seems likely that this treatment was applied many years ago.

Michael S. Krzemnicki (gemlab@ssef.ch)
SSEF Swiss Gemmological Institute, Basel

Figure 21. These rock crystal cabochons (approximately 5 cm long) from Brazil contain fake inclusions that were apparently created in a three-step process. In addition, the cabochon in the center contains reflective oval fractures that were likely induced by thermal shock. The cabochon on the right shows the base, which is covered with a mixture of glue and mineral powder. Photo by J. Hyrsl.

Figure 22. The 6.18 ct natural pearl on the left (shown with an untreated natural pearl on the right) proved to be coated with a resin mixed with essence d'orient*. Photo by H. A. Hänni, © SSEF.*

Figure 23. With magnification, the coating on the pearl showed several round chipped areas. Note that the coating extends partially into the drill hole. Photomicrograph by H. A. Hänni, © SSEF; magnified 20×.

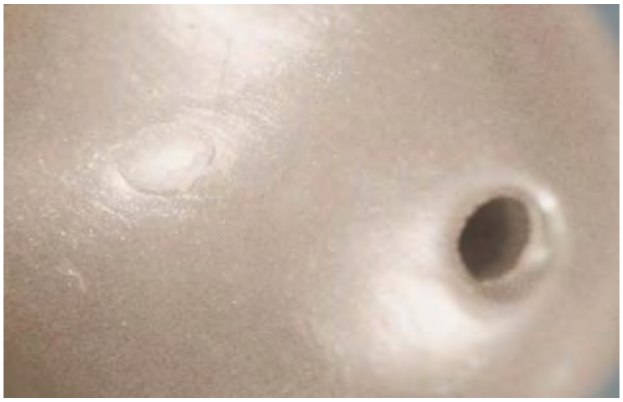
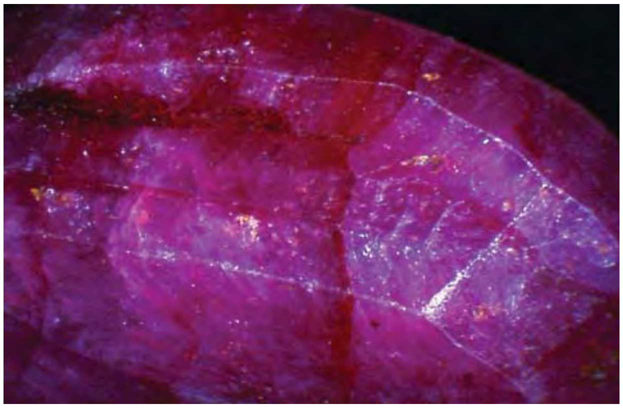


Figure 24. These two stones (9.61 and 11.40 ct) proved to be fibrolite (sillimanite) that had been dyed and impregnated to imitate ruby. Photo by S. Singbamroong, © Dubai Gemstone Laboratory.

Fibrolite (sillimanite) dyed and impregnated to imitate ruby. The Dubai Gemstone Laboratory received two translucent to partially transparent red oval mixed cuts for identification in mid-April 2005. At first, the 9.61 and 11.40 ct stones (figure 24) resembled low-quality rubies. When examined more closely, however, they showed an aggregate structure and uneven coloration that were visible even without magnification.

Standard gemological testing established the following properties: R.I.—1.659–1.679; birefringence—0.020; optic sign—biaxial positive; S.G. (determined hydrostatically)—3.22; Chelsea filter reaction—pink; absorption spectrum with desk-model spectroscope—600 nm cut-off; UV fluorescence—moderate red to long-wave with yellow emission along the fractures, and inert to short-wave, also with yellow emission along the fractures. These properties were consistent with fibrolite (sillimanite), but not corundum.

Figure 25. In reflected light, red dye concentrations can be seen within the fibrous structure of the sillimanite, as well as in surface-reaching fractures. The tiny yellow grains were identified as rutile by Raman analysis. Photomicrograph by S. Singbamroong, © Dubai Gemstone Laboratory; magnified 10×.



The yellow fluorescence indicated the presence of a foreign substance in the fractures, and microscopic examination revealed red dye concentrations in both stones, within their fibrous structure as well as in surface-reaching fractures (figure 25). Isolated grains and clusters of tiny "golden" yellow inclusions also were seen.

Further testing was used to verify the identification as fibrolite. Although Raman analysis failed to produce usable results because of interference from the red fluorescence, it identified the yellow surface-reaching inclusions as rutile. EDXRF chemical analysis showed the expected Al and Si as main components, along with traces of Fe and Ti. Zr also was detected, probably from the dye. In addition, V and Cr were slightly above the detection limit of the instrument. FTIR spectroscopy was performed in transmission and reflectance modes using a beam condenser and a diffuse reflectance (DRIFT) collector accessory, and the results were compared to reference spectra of cat's-eye sillimanite. The reflectance spectra confirmed the identity of these stones as sillimanite, while the transmission spectra indicated the presence of a polymer.

Sutas Singbamroong (labs@dm.gov.ae)
Dubai Gemstone Laboratory (DGL)
Dubai, United Arab Emirates

CONFERENCE REPORTS

Applied Diamond Conference 2005. The 8th International Conference on Applications of Diamond and Related Materials was held May 15–19 at Argonne National Laboratory, Argonne, Illinois. The conference included several presentations of interest to gemologists. Abstracts are available by downloading the Program Book from the conference Web site, http://nano.anl.gov/adc2005.

Dr. Mark Newton of the University of Warwick, U.K., and coauthors discussed two new hydrogen defects (vacancy-hydrogen and vacancy-nitrogen-hydrogen complexes) in CVD synthetic diamonds, their spectroscopic signatures, and their behavior during HPHT and low-temperature annealing. **Dr. Peter Doering** of Apollo Diamond, Boston, Massachusetts, reviewed the effect of HPHT treatment on defects and optical properties of single-crystal CVD synthetic diamond. In the question-and-answer session, he stated that Apollo plans to release their CVD synthetic diamonds into the gem market around the middle of 2006. **Dr. Chih-Shue Yan** and coauthors of the Geophysical Laboratory, Carnegie Institution, Washington, DC, described recent progress in growing large single-crystal CVD synthetic diamonds. The Carnegie group can now grow CVD synthetic diamonds (figure 26) at a rate of 100 microns/hour (compared to a traditional growth rate of 1 micron/hour) by using a focused plasma beam. The maximum thickness of the CVD layer achieved so far is 12 mm, and plates weighing up to 10 ct have been grown. Some of their CVD synthetic diamonds also have been annealed by HPHT methods.

Figure 26. This 0.2 ct near-colorless CVD synthetic diamond was cut from a 1 ct block produced at a high growth rate using a focused plasma beam. Courtesy of the Carnegie Institution, Washington, DC.

Dr. Wuyi Wang and coauthors from the GIA Laboratory, New York, discussed the common spectroscopic features and defects in three types of treated diamonds: (1) irradiated with or without annealing; (2) HPHT annealed; and (3) HPHT annealed, followed by irradiation and annealing. Various identification criteria were discussed, such as blue/yellow zones concentrated on the culet (indicating laboratory irradiation), green/brown radiation stains on "naturals" (indicating natural irradiation), and spectroscopic features (i.e., a height ratio of >2 for photoluminescence peaks at 637/575 nm is an indication of HPHT annealing, and the existence of both 595 and 666 nm absorptions in the visible-range spectra is a strong indication of laboratory irradiation). **Dr. Filip De Weerdt** of HRD, Antwerp, Belgium, and **Dr. Hisao Kanda**, of the National Institute of Research on Inorganic Materials, Tsukuba, Japan, described the color changes produced in type IaA and IaB diamonds by HPHT annealing. They used a cathodoluminescence (CL) unit attached to a scanning electron microscope for simultaneous imaging and spectroscopic analysis of their samples before and after HPHT annealing. A CL line at 490.7 nm was clearly associated with the untreated diamonds.

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

Goldschmidt05. The 15th Annual Goldschmidt Conference was held May 20–25 at the University of Idaho, Moscow. This is the premier annual geochemistry conference, and was attended by more than 1,400 delegates from around the world. Two sessions, "Geochemistry of Gem Deposits" and "Recent Advances in Microbeam Cathodoluminescence," plus a few individual talks and posters, were of interest to gemologists. Abstracts of all presentations are available online at www.the-conference.com/2005/gold2005/abstract_volume.php.

Dr. Emmanuel Fritsch of the University of Nantes, France, and colleagues presented a new geochemical method to separate basaltic from metamorphic blue sapphires: a plot of Fe content vs. Ga/Mg ratio. **Emilie Gaillou** of the University of Nantes and coauthors analyzed opals from seven countries using ICP-MS. Mexican opals showed Ce depletion, while Ethiopian opals had Ce enrichment, relative to the chondrite standard used by geochemists. In addition, geochemical profiling (i.e., plotting Ba vs. Ca) showed promise for identifying the geographic/geologic origin of opal: Those from Mexico, Honduras, and Ethiopia fell into a field for volcanic origin; those from Brazil and Australia occupied a field corresponding to a sedimentary origin.

Dr. Lee Groat and **Heather Neufeld** of the University of British Columbia, Vancouver, reviewed the geology of four emerald deposits in Canada: (1) Taylor 2, near Dryden, Ontario; (2) Red Mountain, near Stewart, British Columbia; (3) Tsa Da Glisza, southern Yukon Territory; and (4) Lened in the western Northwest Territories. **Andrea Cade** and coauthors, also of the University of British Columbia, studied sapphires from a calc-silicate lens within the Lake Harbour Marble unit at Kimmirut, Baffin Island, Canada, and indicated that they could have formed through the alteration of a protolith assemblage of diopside, phlogopite, calcite, anorthite, and albite. **Anthony LeCheminant** of Petrogen Consultants, Manotick, Ontario, and coauthors proposed a different origin for the sapphires from Kimmirut. Using field observations, oxygen isotope data, and zircon ages, they speculated that the sapphires formed through the interaction of a desilicated syenitic magma with the Lake Harbour Marble, accompanied by further retrograde reactions and subsequent infiltration of CO_2-rich liquids. **David Turner** of the University of British Columbia and coauthors studied the mineralogy and geochemistry of dark blue gem-quality aquamarine from the Pelly Mountains, southern Yukon Territory. They found that the beryl-bearing quartz veins were emplaced in an extensional environment about 172 million years ago, and were unrelated to their Late Paleozoic host syenite intrusion.

Dr. George Rossman of the California Institute of Technology, Pasadena, and coauthors described some waterworn crystals of the rare gem painite that were recovered from a new locality for the mineral, only the second ever reported, at Namya (Nanyaseik), Kachin State, Myanmar. **Dr. Mickey Gunter** of the University of Idaho and colleagues concluded that asterism in Idaho star garnets is caused by oriented rutile inclusions or tubular voids in the almandine. **Catherine McManus** of New Mexico State University and coauthors did a preliminary study of the trace-element content of gem beryl using LIBS (laser-induced breakdown spectroscopy).

A breakthrough in microbeam cathodoluminescence

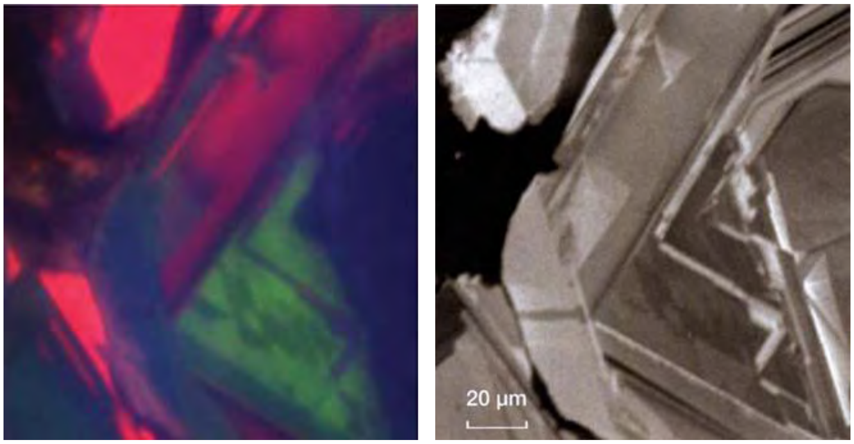


Figure 27. These CL images of jadeite from Guatemala were captured by a digital camera on a tabletop luminoscope (left) and by a Gatan MonoCL high-sensitivity photomultiplier tube mounted on a scanning electron microscope (right). On the left, the green CL area correlates to greater contents of Ca, Mg, Fe^{2+}, and Mn (and, in some cases, Cr) than in the red or blue CL areas. The image on the right shows the total CL intensity of the sample. Images collected by Tim Rose, Smithsonian Institution.

(CL) has been facilitated by attaching a newly developed digital CL unit to a scanning electron microscope, which allows researchers to obtain optical spectra (hyperspectral analysis) and a chemical analysis simultaneously. In Guatemalan jadeite, **Dr. Sorena Sorensen** and coauthors from the Smithsonian Institution, Washington, DC, documented patterns of red (675 nm), blue (475 nm), and green (550 nm) luminescence that corresponded to micron-scale compositional variations that formed during growth (figure 27). **Dr. George Harlow** of the American Museum of Natural History, New York, and colleagues used this technique to differentiate between the two major geologic settings for Guatemalan jadeite. Samples from south of the Motagua Fault Zone (MFZ) showed CL peaks at 270 and 480 nm, while those from north of the MFZ had a dominant CL peak at 700 nm and two smaller peaks at 500 and 480 nm. In addition, they documented extremely fine, bright bands (less than 10 µm thick) in rubies from Myanmar, indicating that their growth was influenced by pulses of fluid in the marble host.

In another presentation, **Dr. Harlow** also characterized four types of Guatemalan jadeitite: (1) material from north of the MFZ is a jadeite-omphacite-zoisite assemblage that formed at 300–400°C and 6–10 kbar; (2) San José material consists of a jadeite-omphacite-lawsonite-quartz assemblage, formed at 300–400°C and 12–20 kbar; (3) La Ceiba material contains jadeite-omphacite-diopside-quartz, and formed at 300–400°C and 10–14 kbar; and (4) La Ensenada material is jadeite-omphacite-pumpellyite, suggesting formation conditions of 200–300°C and 6–9 kbar. **Dr. Emilie Thomassot** of the Institut de Physique du Globe de Paris and coauthors studied the stable isotope composition of sulfide inclusions in diamond, and found that the sulfides had different origins than their host diamonds. They concluded that the sulfide-included diamonds were of metasomatic origin. **Lutz Nasdala** of Johannes Gutenberg Universität, Mainz, Germany, and colleagues showed the results of mapping strain around an inclusion in diamond using a laser Raman microspectrometer. Such analysis can be useful in estimating the P-T conditions of diamond formation.

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

MISCELLANEOUS

Historic U.S. sapphire and benitoite mines close. *G&G* author Keith Mychaluk (Calgary, Alberta, Canada) informed this contributor that the Vortex sapphire mine at Yogo Gulch, Montana, closed in late November 2004. According to Peter Ecker of Yogo Creek Mining (Hobson, Montana), the sapphire ore had become much less friable at depth (over 120 m), which made both the extraction and processing of the ore less economic. In addition, the thickness of the lateral dike formation being mined had pinched considerably. Most of the surface workings have been reclaimed, and the remaining sapphire inventory has been sold to Adair Jewelers in Missoula, Montana.

Also, this contributor has been informed by Bryan Lees (The Collector's Edge, Golden, Colorado) that his company permanently closed and reclaimed the Benitoite Gem mine (San Benito County, California) in June 2005. He indicated that both the lode and eluvial sources were commercially exhausted. A caretaker will remain on the property indefinitely to oversee the revegetation and dissuade trespassers. Mr. Lees indicated that he will now focus efforts on marketing the stockpile of benitoite gem rough that his firm has accumulated over the past five years of mining the property.

BML

ANNOUNCEMENTS

Conferences

Mineralien Hamburg. The International Show for Minerals, Fossils, Precious Stones and Jewellery will take place in Hamburg, Germany, on November 9–11, 2005. Special exhibitions will feature gems, jewelry, and mineral specimens owned by Russia's tsars, as well as Native American turquoise. Visit www.hamburg-messe.de/mineralien.

Visit *Gems & Gemology* in Tucson. Meet the editors and take advantage of special offers on subscriptions and back issues at the *G&G* booth in the publicly accessible Galleria section (middle floor) of the Tucson Convention Center during the AGTA show, February 1–6, 2006.

GIA Education's traveling Extension classes will offer hands-on training in Tucson with "Diamond Grading" (January 30–February 3). To enroll, call 800-421-7250, ext. 4001. Outside the U.S. and Canada, call 760-603-4001.

The GIA Alumni Association will host a Dance Party in Tucson on February 3, featuring a silent auction, an industry awards presentation, and a live auction. To reserve tickets, call 760-603-4204 or e-mail events@gia.edu.

CGA Gemmology Conference 2005. The Canadian Gemmological Association is holding its annual conference at the Ontario Club in Toronto on November 4–6. This year's conference, "Tricks and Treatments," will explore historical gemstone deceptions and the latest developments in treatments, enhancements, and detection. Visit www.canadiangemmological.com or call 416-785-0962.

Exhibits

Cameos at the Met. "Cameo Appearances," a display of more than 160 examples of the art of gem carving from Greco-Roman antiquity to the 19th century, will be on display until January 29, 2006, at the Metropolitan Museum of Art in New York City. A variety of educational programs will be offered in conjunction with the exhibition. Also on display at the Met (through February 12, 2006) is "The Bishop Jades," a selection of fine Chinese and Mughal Indian jades from the collection of Heber R. Bishop that was donated to the museum in 1902. Visit www.metmuseum.org or call 212-535-7710.

Diamonds in London. "Diamonds," an exhibit of some of the world's most important diamonds, is at the Natural History Museum in London through February 26, 2006. On display are the De Beers Millennium Star, the Steinmetz Pink, the Ocean Dream, and the Moussaieff Red (see J. M. King and J. E. Shigley, "An important exhibition of seven rare gem diamonds," Summer 2003 *Gems & Gemology*, pp. 136–143), in addition to a 616 ct rough diamond. Visit www.nhm.ac.uk/diamonds.

Pearls at the Tokyo National Science Museum. "Pearls: A Natural History," a traveling exhibition tracing the natural and cultural history of pearls that was organized by the American Museum of Natural History (New York) in collaboration with the Field Museum (Chicago), will be on display at the National Science Museum, Tokyo, October 8, 2005 to January 22, 2006. The many exhibits include pearl formation and culturing, as well as historical pearl jewelry that once belonged to Great Britain's Queen Victoria and Marie Antoinette of France. Call 81-03-3822-0111.

ERRATUM

The Winter 2004 Gem News International entry titled "A notable triplite from Pakistan" reported that the stone originated from the Shigar Valley in northern Pakistan, but information recently obtained from a reliable local miner indicates that the triplite came from the Namlook mine, which is above the village of Dassu in the Braldu Valley, also in northern Pakistan. We thank Dudley Blauwet for bringing this update to our attention.

IN MEMORIAM: CORNELIUS S. HURLBUT, JR. (1906–2005)

Gems & Gemology mourns the loss of longtime contributor and Editorial Review Board member Cornelius S. Hurlbut, Jr. Dr. Hurlbut passed away September 1 at the age of 99.

Connie Hurlbut was born June 30, 1906, in Springfield, Massachusetts. After receiving his undergraduate degree at Antioch College in Ohio, he obtained a master's degree and a doctorate in petrography from Harvard University. Dr. Hurlbut joined the Harvard faculty in 1934 as a petrography instructor and became Professor of Mineralogy six years later. He went on to chair the university's Mineralogy Department from 1949 to 1960 before retiring in 1972 and becoming Professor Emeritus.

In addition to his distinguished teaching career, Dr. Hurlbut was a widely published author with several important books and more than 100 scientific papers to his credit. Between 1941 and 1993, he edited the 15th through 21st editions of *Dana's Manual of Mineralogy*, a classic reference in the field. He was the author of *Minerals and Man* (1968), as well as coauthor of *The Changing Science of Mineralogy* (1964) and editor of *The Planet We Live On: An Illustrated Encyclopedia of the Earth Sciences* (1978).

In retirement, Dr. Hurlbut turned more to gemology, an affiliation that began in the 1940s when he joined GIA's Educational Advisory Board. He taught a gemology course at Boston University in the early 1970s and coauthored (with George Switzer) the first edition of *Gemology* in 1979 (the second edition, co-authored with Robert Kammerling, was published in 1991). Dr. Hurlbut contributed his intellect and expertise to *Gems & Gemology* as a member of the journal's Editorial Review Board from 1981 until his passing. He also wrote or coauthored several articles for the journal, including "A Simple Procedure to Separate Natural from Synthetic Amethyst on the Basis of Twinning" (Fall 1986, pp. 130–139), which received first place in that year's Most Valuable Article competition.

Among his many distinctions, Dr. Hurlbut was a 1955 Guggenheim Fellow, a former president of the Mineralogical Society of America, and a recipient of the 1994 Carnegie Mineralogical Award for his contributions to the field. Preceded in death by his wife, Margaret, Dr. Hurlbut is survived by three children, six grandchildren, and six great-grandchildren. Always the gentleman, in criticisms and compliments alike, his sharp wit, brilliant mind, and kind manner will be missed.