# GEM NEWS International 2007

## DIAMONDS

**Large diamond mine to be developed in Saskatchewan, Canada.** Kimberlite bodies were first discovered near Fort à la Corne in central Saskatchewan in 1989 by Uranerz, a German uranium exploration company. In contrast to the usual vertical pipe- or carrot-shaped morphology, the Fort à la Corne kimberlites form complexes of lens-like, horizontally elongated bodies lying underneath approximately 90–100 m of overburden (sand, mudstone, and glacial till). The original kimberlite volcanoes erupted into a shallow sea during the Cretaceous period (~100 million years ago), and the volcanic ejecta were preserved by quick burial under mud (now mudstone). The resulting shapes—extensive low domes, shallow bowls, and flat pancakes—constitute hundreds of millions of tonnes of kimberlite.

The kimberlite field is located in flat terrain about 60 km east of Prince Albert (see, e.g., figure 1). Uranerz discovered the kimberlites by drilling into airborne magnetic

*Figure 1. The large Fort à la Corne kimberlite field in Saskatchewan has demonstrated considerable promise as a future diamond producer. Shown here is the Orion exploration site and core/sample processing facility. Courtesy of Shore Gold Inc.*

anomalies discernable on government maps. As the Uranerz managers were not experienced with diamond exploration, they formed joint ventures, first with Cameco Corp. (a Canadian uranium exploration and mining company) and subsequently with Canada-based Kensington Resources and De Beers. Eventually, geologists identified a field of 72 kimberlites, of which 63 were located on the joint-venture Fort à la Corne (FALC) property. Initial FALC ownership was Kensington Resources 42.5%, De Beers 42.5%, Cameco 5%, and UEM (successor to Uranerz) 10%. FALC budgeted evaluation efforts at $15 million annually (increasing to $24 million) and focused on bodies 140/141 and 150, from which diamonds up to 10.23 ct were recovered in the top clay-rich layer.

In 1995, Canada-based Shore Gold Inc. acquired adjoining leases at the southeast end of what is now the FALC property and there discovered the Star kimberlite complex, which covers 240 ha in a shallow bowl shape and is up to ~88 m at its thickest part. Extensive drilling has shown that the deposit formed by successive layers of overlapping kimberlite pulses from one or more feeder pipes. Initial figures for the Star complex were ~276 million tonnes (Mt) at a grade of 14.25 carats per hundred tonnes (cpht), yielding 40 million carats (Mct) of diamonds with an average value of $135/ct, for an estimated worth of $5.5 billion (e.g., figure 2).

In October 2005, Shore Gold and Kensington Resources agreed to merge, as several of the kimberlite complexes overlapped their property boundaries. In September 2006, Kensington Resources, by then a subsidiary of Shore Gold, acquired the shares of Cameco, UEM, and, later that month, of De Beers as well. They then sold 40% equity to Newmont Canada; Shore Gold controls the remaining 60% in the new joint venture, called FALC-JV. Thus, the Star and FALC complexes are now merged into one operation. The most promising FALC kimberlites, 140/141 and 150, are now grouped into a unit called the Orion Belt, which is aligned with Star in a northwest trend. Kimberlite resources are estimated at 360–400 Mt in Orion South and 800 Mt in Orion North; these could yield up to 120 Mct at $160/ct.

Evaluation drilling and processing of samples from the Star complex in the period June to September 2007 led to the recovery of 10,251 diamonds from approximately 46,000 tonnes of kimberlite. The combined weight of the diamonds amounted to 1,269.58 carats, with at least 12 stones ranging from 4.21 to 49.5 ct (57 were >2 ct and 157 were >1 ct). In some drill core samples, up to 30–40% of the diamonds recovered were >1 ct. In general, approximately 70% of the diamonds recovered were classified as "white" and 20% as "off white."

*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. Original photos can be returned after consideration or publication.*

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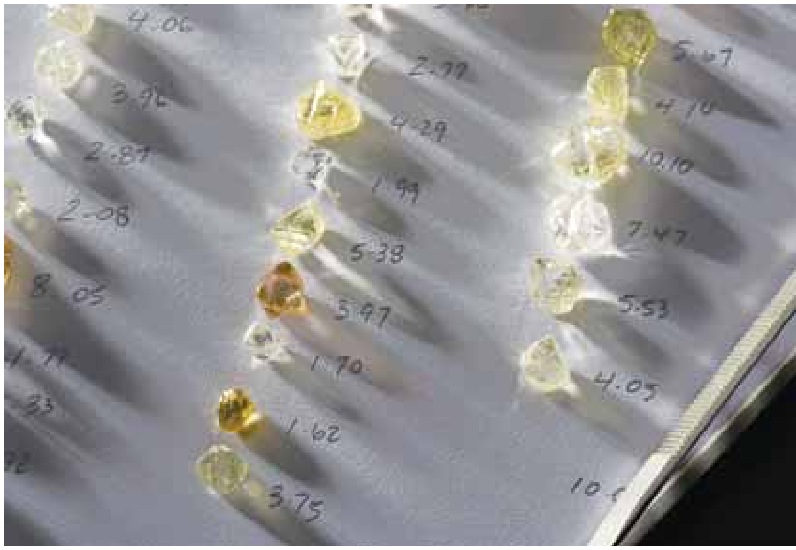

*Figure 2. This selection of diamond crystals (1.62–10.10 ct) was recovered from the Star complex during 2006. Courtesy of Shore Gold Inc.*

The combined yield of Star and Orion could be up to 200 Mct worth $30 billion, which would be mined in several open pits. The first mine in the Star complex is tentatively scheduled to open in 2012. As this is approximately when the predicted gap between world rough supply and demand should start to widen, this new production would be most welcome.

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**Spurious "spiral phantom" in diamond.** These contributors recently examined a faceted pink diamond from Australia's Argyle mine, in which we observed what appeared to be a spiral structure (figure 3). At first, we thought this feature was a screw dislocation decorated by impurities, such as those observed in beryl and topaz. Further, it was perfectly oriented along the diamond's octahedral direction, as evidenced by several incipient cleavages that were limited by graining planes (again, see the areas delineated on figure 3). We were very excited because such a structure has never been observed in diamond (either natural or synthetic), and is very rare in cubic minerals (see, e.g., Spring 2007 Lab Notes, p. 55).

However, while preparing the sample for Raman and infrared analysis, we discovered that the inclusion had mysteriously disappeared. We then realized that this "screw dislocation" was in fact nothing more than a dust particle adhering to the diamond's surface!

This episode underlines the fact that microscopic observation, although very useful in gemology, needs to be conducted with care even by experienced gemologists.

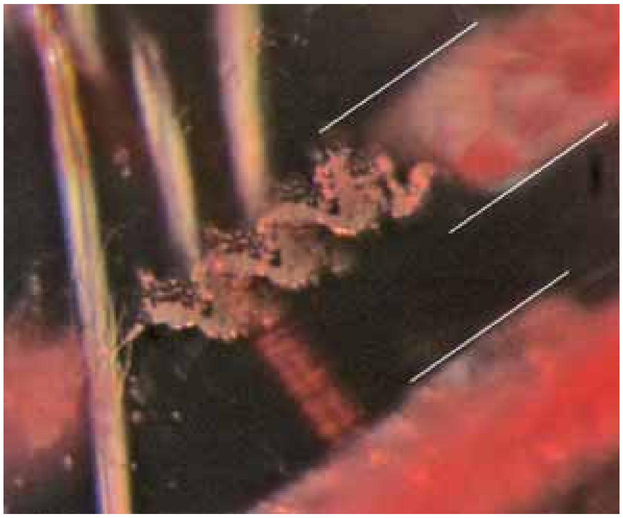

*Figure 3. What at first appeared to be an oriented screw dislocation in a pink diamond was in fact only a dust particle on the surface of the gem. The white lines indicate the diamond's octahedral direction. Photomicrograph by B. Rondeau; magnified 60×.*

Careful cleaning of samples before examination, while sometimes tedious, is an important step in any gemological investigation.

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*Figure 4. Axinite from Baluchistan, Pakistan (here, 2.32–18.62 ct), is notable for its unusual color zoning. All of these stones except for the pear shape were characterized for this report. Courtesy of Herb Obodda; photo by C. D. Mengason.*

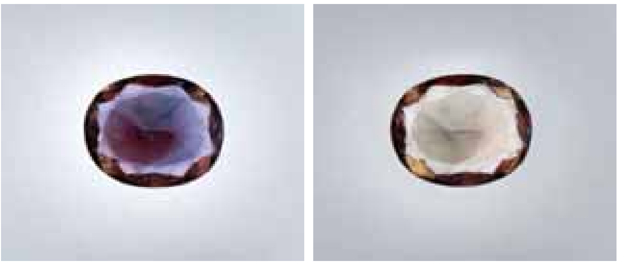
## COLORED STONES AND ORGANIC MATERIALS

**Color-zoned axinite from Pakistan.** In June 2005, Herb Obodda (H. Obodda, Short Hills, New Jersey) informed us about a new find of color-zoned axinite from Baluchistan, Pakistan. By November 2005, his supplier had purchased 6 kg of the material, which local shepherds had recovered over an eight-month period. The supplier described the locality as being in a remote part of the Taftan Mountains. Most of the production was heavily included, but Mr. Obodda selected ~100 g of transparent pieces of rough that were notable for their distinct patches of pleochroic color. The largest crystal measured 19 mm in longest dimension, and the largest stone he had cut weighed 18.62 ct (figure 4).

Mr. Obodda loaned or donated to GIA five crystals and eight cut axinites. Figure 4 shows the range of color seen in the faceted stones. Overall, the samples were medium to light brown, which was modified by strong pleochroism and color zoning in reddish purple, orangy red, blue to violet, green, and pink. The most common color zoning consisted of violetish blue areas that appeared strongest when the light was polarized in the reddish purple direction of the host axinite; these zones became much fainter as the polarizer was rotated 90° (figure 5). A particularly striking example of the pleochroic colors was shown by the axinite crystal in figure 6.

The following properties were determined on five cut stones: RI—$n_o$=1.668–1.671, $n_e$=1.679–1.680; birefringence 0.009–0.012; hydrostatic SG—3.28–3.30; Chelsea filter reaction—none; fluorescence—inert to long- and short-wave UV radiation; and weak absorption lines at approximately 440, 470, 495, 515, and 535 nm visible with the desk-model spectroscope. These properties are comparable to those reported for axinite by M. O'Donoghue (*Gems*, 6th ed., Butterworth-Heinemann, Oxford, UK, 2006, p. 386), except that we did not see an absorption peak at 415 nm. Microscopic examination revealed "fingerprints" composed of two-phase (fluid and gas) inclusions, as well as transparent angular growth zoning.

*Figure 5. Violetish blue color zones are seen in the reddish purple pleochroic direction (left) of this 2.97 ct axinite from Pakistan; the colors almost disappear when the polarizer is rotated 90˚ (right). Gift of Herb and Monika Obodda, GIA Collection no. 37121; photos by Robert Weldon.*



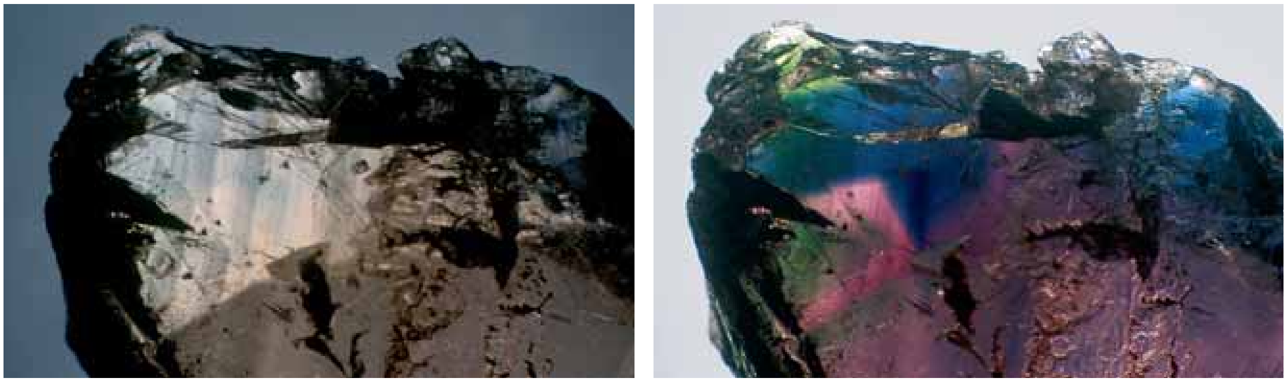


*Figure 6. The strong pleochroism and unusual color zoning in the Pakistani axinite are well illustrated by this crystal, seen in two views as the polarizer was rotated 90°. Courtesy of Herb and Monika Obodda; photomicrographs by S. F. McClure, magnified 10×.*

Electron-microprobe analyses of two of the crystals at the University of New Orleans showed they were ferro-axinite ($Ca_2Fe^{2+}Al_2BO[OH][Si_2O_7]_2$); the RI and SG values reported above are also consistent with this identification (W. A. Deer et al., *Rock-forming Minerals: Disilicates and Ring Silicates*, 2nd ed., Vol. 1B, Geological Society, London, 1997, pp. 603–623). One of the crystals contained blue zones that were accessible for microprobe analysis, but we could not discern any systematic differences in composition from the surrounding light brown area (table 1). Laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS) analyses of a similar color-zoned crystal at GIA revealed distinctly more Ti and Mn in the blue zone than in the light brown area (0.09 vs. 0.01 wt.% $TiO_2$; 0.31 vs. 0.18 wt.% MnO). UV-Vis spectroscopy of these same blue and light brown areas showed much stronger absorption at ~580 nm in the blue zone. Further research on precisely oriented samples would be required to evaluate the origin of the unusual coloration of this axinite.

**TABLE 1.** Representative electron-microprobe analyses of a color-zoned axinite crystal from Baluchistan, Pakistan.[a]

| Oxide (wt.%) | Light brown zone | Blue zone |
|---|---|---|
| $SiO_2$ | 42.81 | 42.74 |
| $TiO_2$ | 0.04 | 0.05 |
| $B_2O_3$[b] | 6.18 | 6.17 |
| $Al_2O_3$ | 17.49 | 17.47 |
| FeO[c] | 8.61 | 8.57 |
| MnO | 0.12 | 0.10 |
| MgO | 2.98 | 2.99 |
| CaO | 19.57 | 19.57 |
| $Na_2O$ | 0.03 | 0.06 |
| $K_2O$ | 0.02 | nd |
| $H_2O$[b] | 1.60 | 1.60 |
| Total | 99.46 | 99.30 |
| Ions per 16 (O,OH) | | |
| Si | 4.012 | 4.012 |
| Ti | 0.003 | 0.004 |
| B | 1.000 | 1.000 |
| Al | 1.932 | 1.933 |
| $Fe^{2+}$ | 0.675 | 0.672 |
| Mn | 0.010 | 0.008 |
| Mg | 0.417 | 0.418 |
| Ca | 1.965 | 1.968 |
| Na | 0.006 | 0.010 |
| K | 0.003 | nd |
| OH | 1.000 | 1.000 |

[a] *Data were collected using an ARL-SEMQ electron microprobe with 15 kV (for sodium) and 25 kV accelerating voltages, 15 nA beam current, and 3 μm beam diameter. The measurements were calibrated with natural mineral and synthetic compound standards, and a ZAF correction procedure was applied to the data. Cr, V, Bi, Pb, Zn, and F were analyzed for but not detected. Abbreviation: nd = not detected.*

[b] *Calculated by stoichiometry.*

[c] *All Fe reported as FeO.*

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**Multicolored fluorite from Brazil.** Although fluorite is generally not a good jewelry stone because of its low hardness (Mohs 4) and four perfect cleavages, its availability in large sizes and a wide variety of colors—sometimes within the same gem—makes it very popular with collectors. Argentina has produced large quantities of transparent multicolored fluorite in yellow, orange, green, purple, and brown, among other colors. It is found in veins that are hosted by granite at the Valcheta and Los Menucos mines, both in Rio Negro Province.

In early 2007, a new source of multicolored fluorite was found in Brazil, reportedly in Bahia State. This fluorite may show dozens of very thin layers in yellow and pink shades, but most striking is the presence of "sapphire"-blue zones. These occur near the surface of the crystals,

*Figure 7. These attractive samples of multicolored fluorite were recovered from a new source in Brazil. The larger stone in the left photo weighs 18.36 ct, and the fluorite in the right image is 77.36 ct. Photos by J. Hyrsl.*

with the inner portions usually pink or yellow. Depending on the orientation of the color zones, faceted stones can be produced with a resulting blue, pink, or multicolored (e.g., figure 7) face-up appearance.

This contributor recently examined several samples of this material. The rough was available only as cleavage fragments with few crystal faces and no matrix. Two of the pieces with crystal faces had small (≤1 mm in diameter) yellow metallic inclusions, visually identified as chalcopyrite, located about 1 mm beneath the surface. Such inclusions point strongly to an origin in a hydrothermal copper deposit.

As of May 2007, at least 1,000 carats of cut stones were available in Brazil, ranging from ~1 to 77 ct each, and more will almost certainly be produced in the future. Although this fluorite makes a nice collector's gemstone, there is also the possibility that the blue material may be offered as a sapphire imitation, in much the same way that some green fluorite has been found mixed with emeralds of the same color.

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**Cr/V-bearing kyanite from Madagascar and elsewhere.** Madagascar has become known for a wide variety of interesting and exotic gems. In 2004, an attractive blue kyanite was faceted by Fabrice Danet (Style Gems, Antsirabe, Madagascar) from a mixed parcel of mostly rhodolite, zircon, and amethyst that was represented as coming from the eastern coastal area of Madagascar. Preliminary testing showed that the stone contained Cr and V, so Mr. Danet donated it to GIA for further testing. We were unaware of the prevalence of Cr and V in kyanite, so we were pleased to investigate the properties of this stone.

The 0.98 ct oval modified brilliant (figure 8) had the following characteristics: color—medium-dark greenish blue; pleochroism—moderate greenish blue, gray-purple, and near colorless; diaphaneity—transparent to semitransparent; RI—1.716–1.731; birefringence—0.015; SG—3.69; Chelsea filter reaction—strong red; fluorescence—weak to moderate red to long-wave UV radiation and very weak green to short-wave UV. These properties are comparable to those reported for kyanite by R. Webster (*Gems*, 5th ed., revised by P. G. Read, Butterworth-Heinemann, Oxford, UK, 1994, pp. 348–349). Lines in the red end of the spectrum at 670 and 690 nm were visible with a desk-model spectroscope, along with a broad band centered at approximately 575 nm. Microscopic examination revealed fine needles in parallel orientation throughout the stone, small transparent doubly refractive crystals and needles, low-relief transparent crystals that appeared

*Figure 8. Gem-quality kyanite is available in a range of colors. The 0.98 ct greenish blue faceted oval in the center (gift of Fabrice Danet, GIA Collection no. 36693) is reportedly from eastern Madagascar; it was characterized in detail for this report. For comparison, chemical analyses were obtained for four additional kyanites: a 12.76 ct bluish green crystal from Namibia, a 6.31 ct blue rectangular step cut from Brazil, a 1.43 ct blue cabochon from Nepal, and a 1.05 ct dark greenish blue rectangular step cut from Andilamena, also in eastern Madagascar. Courtesy of Franck Notari (Namibia, Brazil, and Andilamena) and the GIA Collection (Nepal); photo by Robert Weldon.*

**TABLE 1.** Significant trace-element composition (in ppm) of kyanites from four countries, determined by LA-ICP-MS on two spots of each stone.[a]

| Element | Namibia (FN4253) | | Brazil (FN138) | | Nepal (GIA16111) | | Madagascar (FN5688) | | Madagascar (0.98 ct oval) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| Fe | 4,160 | 4,223 | 1,960 | 1,471 | 2,013 | 1,674 | 1,965 | 1,937 | 1,460 | 1,387 |
| Cr | 261 | 270 | 178 | 187 | 62 | 63 | 4,982 | 3,143 | 553 | 504 |
| V | 22 | 25 | 39 | 33 | 60 | 50 | 370 | 331 | 81 | 77 |
| Ti | 46 | 35 | 32 | 23 | 37 | 28 | 87 | 67 | 179 | 452 |
| Ga | 9 | 10 | 18 | 16 | 22 | 18 | 35 | 34 | 81 | 67 |
| Pb | nd | nd | nd | 1 | nd | nd | 2.1 | 2.4 | 5.3 | 6.5 |

[a] *Data collected using a Thermo X-Series ICP-MS equipped with a New Wave 213 nm laser-ablation sample introduction system. Laser parameters were 40 µm spot size, 7 Hz repetition rate, 60% power, and 25 second dwell time. Concentrations were calculated using NIST 610, 612, and 614 glasses as reference standards. Abbreviation: nd = not detected.*

to be singly refractive, cleavages, "fingerprints," and stringers of particles oriented perpendicular to the direction of the fine needles.

Energy-dispersive X-ray fluorescence (EDXRF) spectroscopy indicated the presence of major amounts of Si and Al, as expected, as well as traces of Fe, Cr, V, Ti, and Ga. Trace-element analyses by LA-ICP-MS were obtained from this kyanite and, for comparison, from four additional kyanite samples from Namibia, Brazil, Nepal, and Andilamena, Madagascar (again, see figure 8, and table 1). All of the samples contained Fe, Cr, V, Ti, and Ga, and very small amounts of Pb were measured in a few of the analyses. The stone provided by Mr. Danet contained more V and Cr than the three non-Madagascar samples, but significantly less of both elements than the (darker) kyanite from Andilamena. The Namibian sample showed relatively high Fe, and Fe was the only enriched trace element in the Nepalese kyanite. Compared to the other samples, both of the kyanites from Madagascar showed more elevated concentrations of Ti, Ga, and Pb. The color variations in these kyanites are apparently due to differences in their contents of the chromophoric elements Fe, Cr, V, and Ti, but establishing the precise coloration mechanisms would require additional research.

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**Blue-green opal from Iran.** Gem-grade blue-green opal has traditionally come from the Andes Mountains in Peru (see Summer 1991 Gem News, pp. 120–121; Spring 1994 Lab Notes, pp. 43–44). According to Makhmout Douman (Arzawa Mineralogical Inc., New York), a new deposit was recently found in Iran, about 110 km northwest of the town of Shahr-e Babak in Kerman Province. As of October 2007, mining efforts had nearly stopped due to groundwater seeping into the pits. Only a few stones have been polished, due to the cracked nature and shallow thickness of the pieces of rough that have been recovered so far.

Mr. Douman loaned two cabochons (2.40 and 2.59 ct; figure 9) and one rough sample to GIA, and the following properties were obtained on the polished stones (with those for the smaller cabochon given first here): color—bluish green and green-blue; diaphaneity—translucent; RI—1.45 and 1.47; hydrostatic SG—2.06 and 2.00; Chelsea filter reaction—none; fluorescence—inert to both long- and short-wave UV radiation; and a 600 nm cutoff seen in the desk-model spectroscope. Microscopic examination revealed milky white clouds in both samples. The smaller cabochon also showed a moss-like inclusion at the base. The 1.47 RI value is slightly high for opal, which typically ranges from 1.44 to 1.46 (R. Webster, *Gems*, 5th ed., revised by P. G. Read, Butterworth-Heinemann, Oxford, UK, 1994, p. 244).

The Raman spectra of both samples closely matched the opal reference spectrum. Opals intrinsically contain enough water to saturate the mid-infrared region of the spectrum. Therefore, spectroscopy in the near-IR range was used to examine the hydroxyl-related characteristics, and the results closely matched those of published spectra

*Figure 9. A new source of blue-green opal (here, 2.40 and 2.59 ct) has been discovered in Iran. Courtesy of Makhmout Douman; photo by Robert Weldon.*

for opal (H. Graetsch, "Structure of opaline and microcrystalline silica," in P. J. Heaney et al., Eds., *Silica. Physical Behavior, Geochemistry and Materials Applications,* Reviews in Mineralogy, Vol. 29, Mineralogical Society of America, Washington, DC, 1994, pp. 209–229). EDXRF spectroscopy of the two samples showed major amounts of Si, minor Cu, and traces of Fe. UV-Vis-NIR spectroscopy showed typical $Cu^{2+}$ absorptions at 527–1176 nm, indicating that copper is the cause of the blue-green coloration.

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**A remarkably large fire opal carving.** Fire opals are well known in the gem trade, and—based on the number of trade queries these contributors have received—they are becoming more popular in India. Fire opal is found in a range of orange, red, yellow, and brown hues, with or without play-of-color.

Recently, we had the opportunity to examine and test an unusually large specimen of semitransparent brownish orange fire opal (figure 10), which did not show play-of-color. This 492 g (2,460 ct) carving was fashioned after Lord Mahaveera (one of the ancient Indian sages who established the tenets of Jain Dharma). Its identification as fire opal was established by its spot refractive index of 1.46 and low heft (it was too large for specific gravity testing). The carving was inert to UV radiation.

Examination with a microscope and fiber-optic illumination revealed some milky zones composed of fine pinpoint inclusions. These zones gave a slight haze to the carving, although this was visible only with strong lighting. As the fiber-optic light was moved around the specimen, the milky zones appeared to radiate outward from the center (figure 11). Milky zones or clouds are commonly encountered in opals, but the radiating pattern has not

*Figure 10. This fire opal carving (13.90 × 10.30 × 4.30 cm) is unusual for its large size, attractive color, and translucency. Photo by G. Choudhary.*

*Figure 11. The fire opal carving displayed milky zones when illuminated with a strong fiber-optic source. As the light was moved around the sample, these zones appeared to radiate from its center. Photomicrograph by G. Choudhary; magnified 2×.*

*Figure 12. Tiny dendritic inclusions, some of which were encased in fluid-like bubbles, were also present in the fire opal carving. Photomicrograph by G. Choudhary; magnified 45×.*

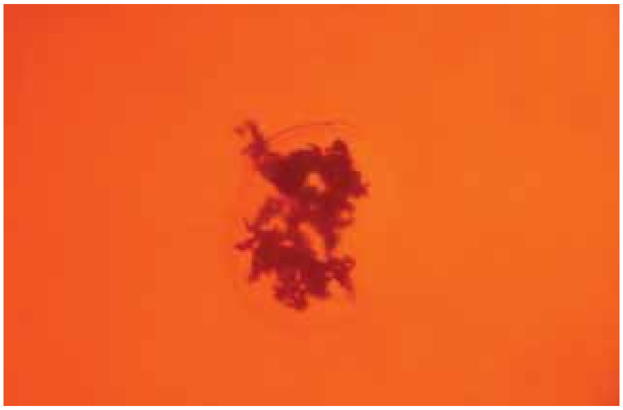

Figure 13. This 13.88 ct non-nacreous pearl exhibits some interesting surface and internal structures. Photo by N. Sturman.

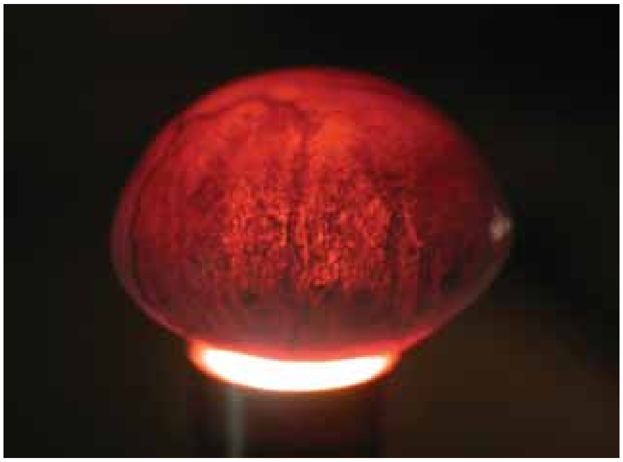

Figure 14. When viewed with a fiber-optic light, the pearl in figure 13 had unusual translucency. Photo by N. Sturman.

been documented previously to our knowledge. At higher magnification, dendritic inclusions were also seen; some of these were surrounded by what appeared to be fluid-filled bubbles (figure 12). Although dendritic inclusions are common in opals, it is unusual for them to be encased in such a fashion. A similar inclusion in an opal was illustrated by E. J. Gübelin and J. I. Koivula (*Photoatlas of Inclusions in Gemstones*, Vol. 2, Opinio Publishers, Basel, Switzerland, 2005, p. 492).

Although fire opal is known from many localities, especially Mexico and Brazil, the client did not know the source of this carving. Large specimens of fire opal, but with a much darker color, also have been reported from Juniper Ridge, Oregon (see Spring 2003 Gem News International, pp. 55–56). The carving documented in the present entry was exceptional due to its large size combined with its attractive color and translucency. In addition, despite the tendency of some fire opal to crack or "craze," this carving showed no evidence of such damage.

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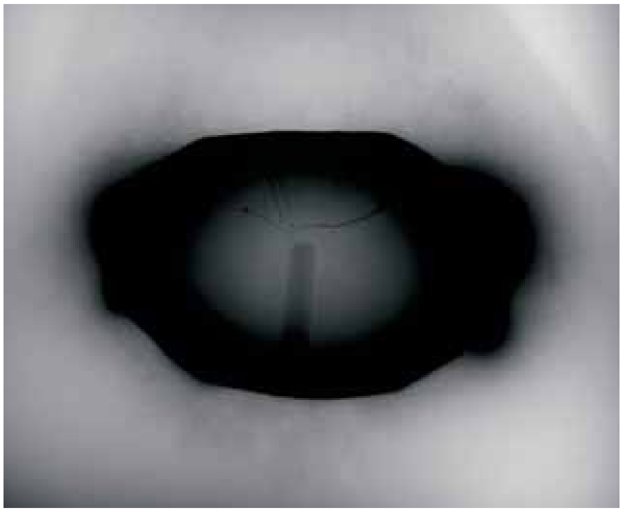
**An unusually translucent non-nacreous pearl.** Approximately 95% of the work submitted to the Gem & Pearl Testing Laboratory of Bahrain is pearl related. Hence, it is no surprise that from time to time a particularly interesting pearl makes its way to our laboratory. Such was the case with the 13.88 ct unevenly colored brown to dark brown non-nacreous pearl in figure 13. This specimen measured 14.46–14.73 × 10.58 mm and exhibited moderate-to-significant surface-reaching cracks. It was obtained in India by a client who noticed the sample's unusual translucency when viewed with a strong light source (figure 14), creating suspicion that the item might not be a pearl.

X-radiography revealed a distinct *radial* structure (figure 15), which in our experience is quite typical of some non-nacreous pearls, with a much less defined *concentric* structure following the exterior button shape. In general, the absence of large amounts of organic material (i.e. conchiolin) within the structure of non-nacreous pearls is the reason for the poorly defined concentric structure in such X-radiographs. However, this is not always the case, and obvious concentric structures may be observed in some non-nacreous pearls. Likewise, the prominence of the radial crystalline structure in X-radiographs may vary from pearl to pearl.

Microscopic observation showed that the pearl's radial columnar structure was manifested on its surface as a cellular pattern that was readily apparent with both transmitted and overhead fluorescent light (figure 16). The transmitted-light pattern varied slightly with orientation, but the form was consistent overall. Such patterns are typical of many non-nacreous pearls we have previously seen.

Figure 15. The X-radiograph of the non-nacreous pearl revealed a fine radial structure.



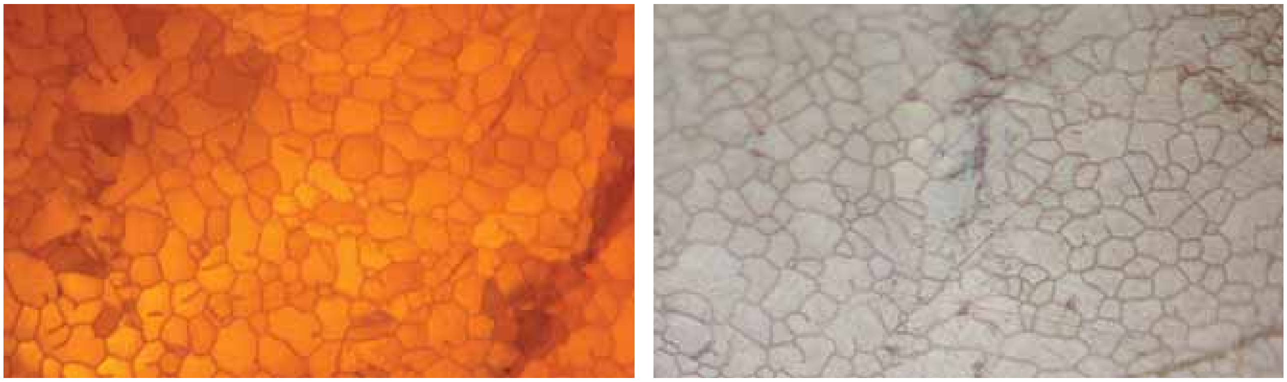


*Figure 16. The surface of the non-nacreous pearl showed a distinctive cellular pattern when viewed with the microscope in both transmitted (left) and overhead fluorescent (right) light. Photomicrographs by N. Sturman; magnified 40×.*

Exposure to long-wave UV radiation produced a moderate chalky "mustard"-yellow fluorescence, similar to what we have noted before, although fluorescence reactions in non-nacreous pearls are variable. The fluorescence, together with other visual observations, led us to believe that no artificial coloration was present, and a report was issued accordingly. Although we have seen pearls with a similar surface structure, we had never seen one as translucent as this sample.

Coincidentally, a group of similar looking non-nacreous pearls (~2–5 ct) were submitted to our laboratory shortly before this entry was finalized for publication. Their visual features were consistent with those reported above for the 13.88 ct pearl. We used our newly installed Renishaw inVia Raman spectrometer, equipped with a CCD-Peltier detector and argon-ion laser (514 nm), to analyze the spectra of the columnar structures where they intersected the surface. Raman peaks at 1087, 712, and 282 cm$^{-1}$ matched the most prominent peaks of a calcite sample from our reference collection, and were also consistent with information in the literature on differentiating calcite from aragonite in pearls (e.g., see K. Scarratt and H. Hänni, "Pearls from the lion's paw scallop," *Journal of Gemmology*, Vol. 29, No. 4, 2004, pp. 193–203). We therefore concluded that these pearls, like the earlier one, were formed of calcite rather than aragonite, as would be expected for such columnar structured non-nacreous pearls.

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**A possible diamond inclusion in quartz from Diamantina, Brazil.** Quartz has more recorded inclusions than any other mineral, and rock crystal quartz with interesting inclusions is a popular collector's stone. One long-held dream of this (and likely every) collector is finding an example of quartz containing a diamond inclusion. Although this possibility seems unlikely considering the geologic origins of diamond, a report published several decades ago mentioned three diamonds embedded in Brazilian quartz crystals—one from Bahia and two from Minas Gerais—but did not report their dimensions or other details (W. D. Johnson and R. D. Butler, "Quartz crystal in Brazil," *Bulletin of the Geological Society of America*, Vol. 57, No. 7, 1946, pp. 601–650). The current whereabouts of those crystals are unknown.

When considering a possible occurrence of diamond in quartz, a probable source is the area around Diamantina in northern Minas Gerais. Diamonds were first discovered there in 1725, and they are still mined today on a small scale. The diamonds are found in sedimentary rocks (conglomerates), as well as in younger reworked alluvial and eluvial deposits. This same area is also perhaps the world's largest producer of collectible transparent quartz with inclusions, and many tons of polished and faceted quartz (mostly with muscovite, chlorite, and rutile inclusions) are produced from Diamantina crystals every year. This material comes from Alpine-type (hydrothermal) veins that are hosted by quartzite. The quartzite formed via regional metamorphism of sandstone (the same event also metamorphosed the conglomerates), and fractures in the

*Figure 17. This quartz crystal (7 cm long) from Diamantina, Brazil, contains an inclusion that appears to be a diamond. Photo by J. Hyrsl.*

quartzite were subsequently filled with veins of low-temperature hydrothermal quartz. In this environment, it seems possible (although not likely) that a diamond crystal derived from the conglomerates could have been weathered-out into alluvial sands that were later metamorphosed into quartzites and then protogenetically incorporated into the cross-cutting quartz veins.

While in Brazil in June 2006, this contributor encountered a well-formed quartz crystal from the Diamantina area that contained an inclusion strongly resembling diamond (figure 17). The sample measured 7 cm long, and several millimeters under the surface it contained a hexoctahedral crystal (~6 mm) with an associated layer of light green fine-grained micaceous material (probably chlorite or Cr-bearing muscovite). The included crystal was very pale yellow and showed an adamantine appearance (figure 18), as is typical of diamond. The large difference in refractive indices between the inclusion and its quartz host (as would be expected for a diamond inclusion) made the included crystal's surface appear mirror-like, although its transparency was evident with a strong focused light source. The surface of the crystal was covered by small trigons, a typical feature for natural diamond crystals.

The author had only about 30 minutes to study the sample, and did not have access to advanced analytical techniques such as Raman spectroscopy that would be needed to confirm the identity of the inclusion as diamond. Nevertheless, all of the observed properties support this extremely rare occurrence, and a very close examination of the sample did not reveal any features indicating that it was manufactured. Unfortunately, the astronomic price of this piece reserved it for wealthy collectors only.

*Jaroslav Hyrsl*

*Figure 18. A closer view of the quartz inclusion (~6 mm in diameter) shows the hexoctahedral form and adamantine appearance that are typical of diamond. Photo by J. Hyrsl.*

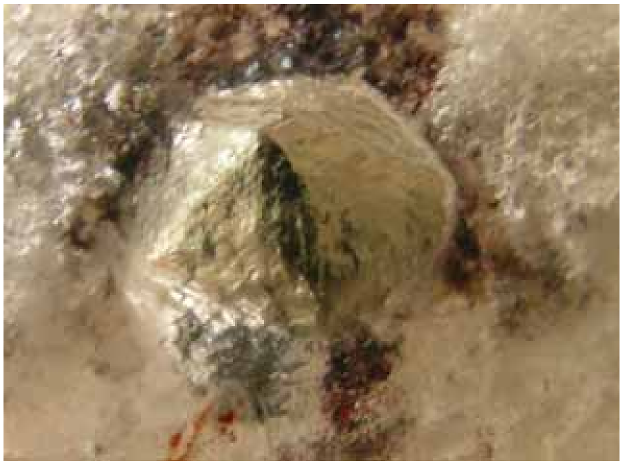

*Figure 19. Depending on the viewing angle or the location of the light source, several subtle chatoyant bands can be seen in this 44.85 ct quartz cabochon from Brazil (shown in three different viewing positions). In the center, the cabochon is seen face-up with the light source perpendicular to the dome. The views on the left and right show the effects of moving the light source and tilting the stone, respectively. Photos by T. Hainschwang.*

**An unusual type of phenomenal quartz.** This contributor recently examined five quartz cabochons (44.85–220.67 ct; e.g., figure 19) that displayed a weak cat's-eye or star effect when viewed in different orientations. According to the owner of the samples, the rough material was found in Brazil, but the precise location is not known.

With the light source directly overhead, each sample showed a subtle vertical ray that had—on closer examination—an additional, even weaker ray apparent at an angle of ~90° to the main chatoyant band (figure 19, center). When the samples were tilted or the light source was moved, four more rays became visible (figure 19, left and right). The samples could thus be called *2-ray* (face up) or *6-ray* star quartz, even though the appearance of these rays was quite unusual.

In all the cabochons, a dense aggregation of inclusions was present only at or near the base, while the top of the domes consisted of transparent colorless quartz. The inclusions were clearly responsible for the chatoyancy/asterism. Examination with magnification indicated that they were members of the chlorite group, and this was confirmed by specular reflectance infrared spectroscopy. The inclusions formed foliated worm-like aggregates, which is quite characteristic of the ripidolite variety of chlorite. For the most part, the chlorite-group mineral inclusions were pink to purple-red, with only small areas showing the more common green color (figure 20). Pink to red is mentioned in several references as a possible color of chlorite-group minerals, although it is much less common than green. Interestingly, the chatoyant bands were created by light reflecting only from the pink-to-red inclusions; the rays were interrupted wherever the green material was present. This was apparently due to the lower surface luster of the

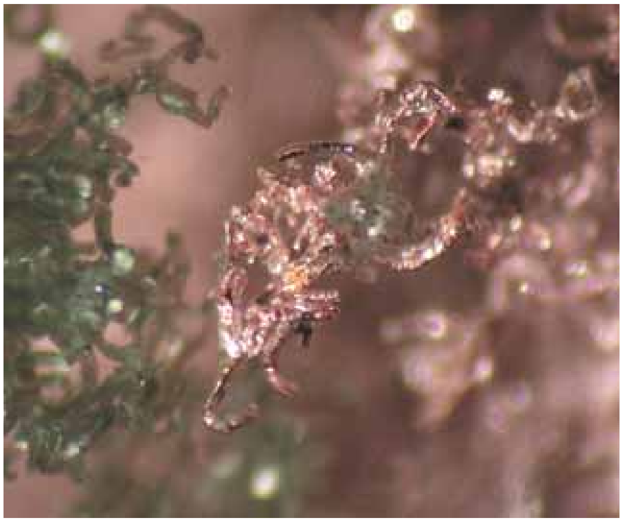

*Figure 20. The unusual phenomenal behavior shown by the quartz cabochons proved to be caused by light reflecting from foliated worm-like aggregates of a pink to purple-red chlorite-group mineral. The green chloritic inclusions were apparently not responsible for the chatoyant behavior because of their lower surface luster. Photomicrograph by T. Hainschwang; field of view 1.8 mm.*

green inclusions (as seen in figure 20); this distinct difference in luster suggests that the pink and green inclusions are different minerals of the chlorite group, rather than the same mineral with different coloration.

Star quartz has been known for more than a century, and most colorless material originates from Sri Lanka, while star rose quartz is known from various localities (e.g., Madagascar). Both phenomena are generally caused by fine included needles, which have been identified as rutile (especially in rose quartz), sillimanite, and dumortierite (see K. Schmetzer and M. Glas, "Multi-star quartzes from Sri Lanka," *Journal of Gemmology*, Vol. 28, No. 6, 2003, pp. 321–332). Schmetzer and Glas (2003) discussed quartz that showed up to five different groups of needle-like inclusions, resulting in up to 18 intersecting light bands.

All known star patterns in gems are caused by crystallographically oriented epigenetic needle-like inclusions that are formed by exsolution processes. In the present samples, however, the chatoyancy/asterism is apparently due to chloritic inclusions that pre-dated (or mostly so) the growth of the quartz (i.e., they are protogenetic). It is most unusual that irregular chloritic inclusions that do not form crystallographically oriented aggregates could cause the phenomenal behavior. The weakness of the rays made it impossible to determine from which faces of the chloritic inclusions the chatoyant bands were reflected, and therefore the precise mechanism for this interesting behavior remains a mystery.

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**A new gemstone from Italy: "Violan quartz."** *Violan* is a mineralogically obsolete term for violet-to-blue, Mn-bearing diopside and omphacite. The Praborna mine, near Saint-Marcel, Aosta Valley, northern Italy, is one of the only known localities for this type of clinopyroxene (A. Mottana et al., "Violan revisited: Mn-bearing omphacite and diopside," *Tschermaks Mineralogische und Petrographische Meitteilungen*, Vol. 26, No. 3, 1979, pp. 187–201), which occurs in euhedral crystals and massive lamellar-to-fibrous aggregates. "Violan" is also known from southern Baffin Island, Nunavut, Canada, where it is found as massive aggregates in calc-silicate lenses (C. D. K. Herd et al., "Violet-colored diopside from southern Baffin Island, Nunavut, Canada," *Canadian Mineralogist*, Vol. 38, 2000, pp. 1193–1199). The attraction of "violan" as a collectable mineral stems from its rarity and deep violet color, which may range into blue (presumably due to the presence of both $Mn^{2+}$ and $Mn^{3+}$; Mottana et al., 1979).

At the Verona Mineral Show in May 2007, an Italian geologist had two pear-shaped cabochons of colorless quartz with violet inclusions (12 and 20.5 ct; e.g., figure 21) that were sourced from a newly discovered quartz-rich vein in the Aosta Valley. A few tens of kilograms of gem-quality rough were available, and further production is expected as mining proceeds.

Standard gemological techniques and electron-microprobe analyses were used to characterize both cabochons. The gemological data identified the pieces as quartz:

*Figure 21. This 12 ct quartz cabochon contains deep violet and bluish violet inclusions of "violan" (Mn-bearing diopside and omphacite). Photo by M. Macrì.*

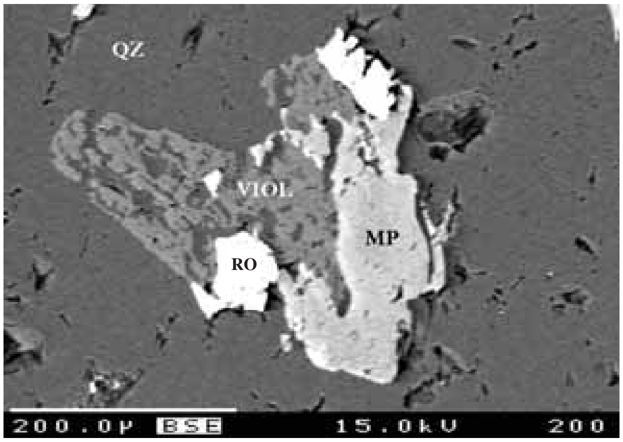

*Figure 22. This backscattered electron image shows a polymineralic inclusion in the quartz cabochon that consists of "violan," Mn oxide (romanèchite), and Mn-rich piemontite-Sr. Image collected by M. Serracino.*

color—colorless; diaphaneity—transparent to milky; spot RI—1.54; and SG—2.67. The samples contained conspicuous deep violet and bluish violet mineral inclusions that were 0.1–1 mm in diameter. Rare opaque black and translucent red inclusions also were present.

The violet inclusions were identified as "violan" using a Cameca SX-50 electron microprobe (accelerating voltage of 15 kV and sample current of 15 nA) at IGAG-CNR (Istituto di Geologia Ambientale e Geoingegneria—Consiglio Nazionale Delle Ricerche), Rome, Italy. Other inclusions present in smaller amounts were black Mn oxide (romanèchite) and red Mn-rich piemontite-Sr, a mineral of the epidote group (figure 22). Chemical analyses of the various inclusions are reported in table 1.

**TABLE 1.** Electron-microprobe analyses of inclusions in a cabochon of violan quartz from Aosta Valley, northern Italy.[a]

| Oxide (wt.%) | "Violan" | Romanèchite | Piemontite-Sr |
|---|---|---|---|
| No. analyses | 7 | 1 | 4 |
| $SiO_2$ | 55.10–57.00 | 0.11 | 32.80–34.29 |
| $TiO_2$ | 0.05–0.17 | 0.75 | nd–0.05 |
| $Al_2O_3$ | 1.17–8.76 | 0.25 | 8.64–14.32 |
| $Cr_2O_3$ | nd | nd | nd–0.05 |
| MgO | 7.61–12.43 | 0.01 | nd–0.04 |
| CaO | 11.20–18.18 | nd | 11.47–14.91 |
| MnO | 4.92–6.20 | 72.54 | 22.22–28.71 |
| FeO | 2.72–4.94 | nd | 0.20–0.45 |
| SrO | nd | nd | 10.87–15.66 |
| BaO | nd–0.06 | 17.68 | nd–0.45 |
| $Na_2O$ | 3.60–8.19 | 0.07 | nd–0.03 |
| $K_2O$ | nd–0.04 | nd | nd |
| Total | 98.76–100.85 | 91.42 | 96.93–97.88 |

[a] *Abbreviation: nd=not detected.*

To the best of our knowledge, this is the first occurrence of "violan" in quartz, and thus further enriches the gallery of known quartz inclusions (e.g., J. Hyrsl and G. Niedermayr, *Magic World: Inclusions in Quartz*, Bode Verlag, Haltern, Germany, 2003). This material may be interesting for gem collectors and jewelers alike because of the attractive color of the inclusions.

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**New sources of marble-hosted rubies in South Asia.** Beginning with the 2007 Tucson gem shows, information has become available on several new deposits of marble-hosted ruby in South Asia.

At the Tucson Gem & Mineral Society (TGMS) show, Dudley Blauwet (Mountain Minerals International, Louisville, Colorado) had a bright red ruby crystal embedded in white marble (figure 23) that reportedly came from the Khash district in Badakhshan, Afghanistan. He purchased the specimen in mid-December 2006 in Peshawar, Pakistan, from a Panjshiri dealer. Mr. Blauwet indicated that the marble matrix appeared much more granular than that typically seen hosting ruby from the well-known occurrence at Jegdalek, Afghanistan. He obtained several additional ruby specimens from the Khash district while in Peshawar in June 2007.

*Figure 23. This marble-hosted ruby specimen reportedly was mined in Badakhshan, Afghanistan. The ruby is ~2 cm wide. Courtesy of Dudley Blauwet; photo by Robert Weldon.*

Figure 24. The Basha Valley of northern Pakistan is the source of these rubies; the 1.09 ct stone was characterized for this report. Courtesy of Herb Obodda; photo by Robert Weldon.

Figure 26. The origin of this ruby (1.9 cm wide) is the Ahmadabad area in the Hunza Valley of northern Pakistan. Gift of Dudley Blauwet, GIA Collection no. 37127; photo by Robert Weldon.

In May 2007, Herb Obodda loaned GIA rough and cut specimens of ruby (figure 24) from a mining area near Bisil village in the Basha Valley of northern Pakistan. He obtained these samples during a buying trip to Peshawar, where he also saw 20 ruby specimens and ~50 carats of faceted stones from this mining area. The faceted rubies had been cut in Karachi, and ranged from clean 0.10 ct stones to rather included 2 ct pieces. According to Mr. Blauwet, this material was first seen on the market in 2004 with dealers in Skardu, Pakistan, who indicated it was from the Shigar Valley (which lies just downstream of the Basha Valley). Mr. Blauwet visited the Bisil ruby deposit in June 2007, and saw two mining areas located in steep mountainous terrain at an elevation of ~2900–3050 m (e.g., figure 25). A series of small open cuts explored a steeply dipping marble layer that locally contained pale blue bands enriched with kyanite. Mr. Blauwet saw a rough ruby weighing ~2 g that he estimated could yield a 5 ct faceted stone, and he obtained 48 g of "mine run" ruby rough that he donated to GIA. Raman analysis of the associated minerals by GIA staff gemologist Eric Fritz identified calcite (white matrix material), rutile (small black grains), a bright green amphibole, and a mica.

Figure 25. The Basha Valley rubies are mined from marble layers in steep terrain. Photo by Dudley Blauwet.

The faceted Basha Valley ruby that Mr. Obodda loaned to GIA (1.09 ct; again, see figure 24) was characterized by GIA senior staff gemologist Cheryl Wentzell, and the following properties were obtained: color—purplish red; RI—1.762–1.770; birefringence—0.008; hydrostatic SG—4.00; fluorescence—moderate red to long-wave UV radiation, and very weak red to short-wave UV; and a typical ruby absorption spectrum seen with the desk-model spectroscope. Microscopic examination revealed closely spaced repeated lamellar twinning, fractures, "fingerprints," translucent white inclusions on the surface (calcite identified by Raman analysis; probably part of the matrix), colorless mineral inclusions (magnesite), an elongate metallic inclusion (chalcocite), narrow flattened dark brown crys-

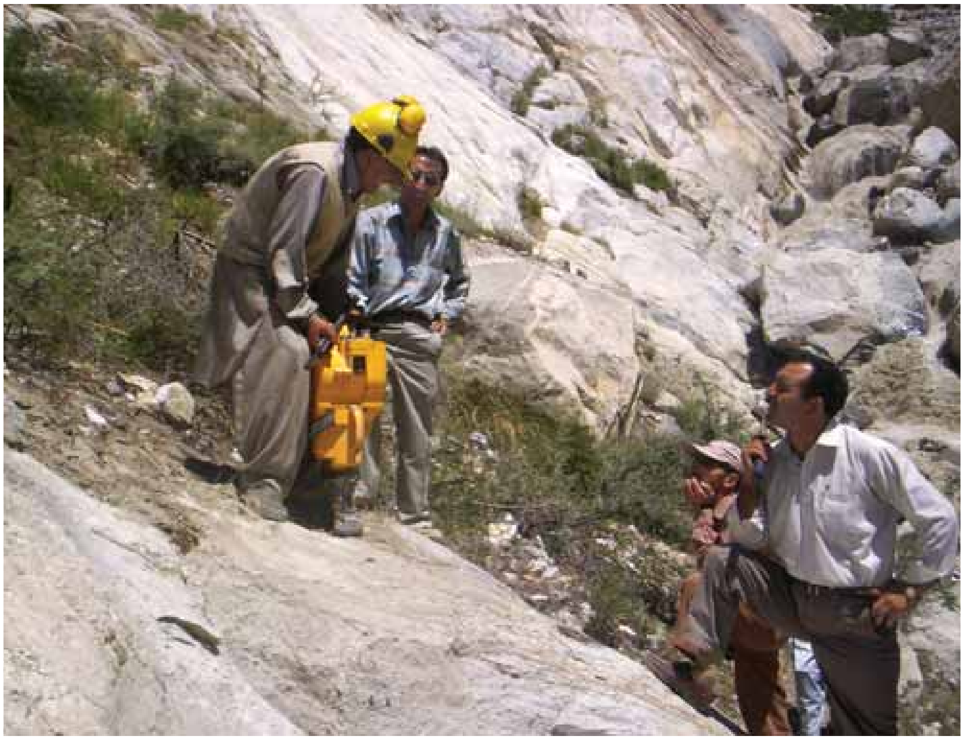


*Figure 27. Drilling and blasting are used to prepare for an underground mining operation at the Ahmadabad ruby mine. Photo by Jim Clanin.*

tals, rare short white needles, cotton-like linear clouds intersecting at 60°/120°, and long needles.

Mr. Blauwet also reported that one of the original ruby mining areas in the Hunza Valley, called Ahmadabad, had recently been reactivated. During his June 2007 trip to Pakistan, he obtained an attractive crystal specimen from this locality (figure 26). Drilling and blasting began in July 2007, shortly before the deposit was visited by Jim Clanin (JC Mining, Hebron, Maine). Mining is being done by Global Mining Corp. (part of the Shahzad International Group of Companies, Islamabad, Pakistan), using a gasoline-powered drill and dynamite. Mr. Clanin indicated that the company plans to explore a ruby-bearing marble layer that is 2.4 m thick and dips 35–60°. At the time of his visit, they were preparing a portal for an underground mining operation (figure 27). After obtaining some ruby production, the company plans to build a road to the area, which will allow them to expand their mining activities.

*Brendan M. Laurs*

**Cr/V-bearing green spodumene from Afghanistan.** Spodumene ($LiAlSi_2O_6$) is a clinopyroxene; its name is derived from the Greek *spodumenos* ("burnt to ash"), in reference to the gray/ash-colored, non-gem material that has been mined commercially as a source of lithium ore (J. Sinkankas, *Mineralogy*, Van Nostrand Reinhold, New York, 1964, pp. 494–497). Common colors for gem-quality spodumene include pink-to-"lilac" (kunzite), pale greenish yellow (triphane), pale violet-blue, pale green, and colorless. In addition, a distinctive chromium-bearing "emerald"-green spodumene (hiddenite) is known principally from Hiddenite, North Carolina (e.g., M. A. Wise and A. J. Anderson, "The emerald- and spodumene-bearing quartz veins of the Rist emerald mine, Hiddenite, North Carolina," *Canadian Mineralogist*, Vol. 44, 2006, pp. 1529–1541).

In late 2006, Dudley Blauwet and Herb Obodda informed us about a new find of a distinctly green spodumene in Afghanistan. Mr. Blauwet first encountered this material in June 2006 while on a buying trip to Peshawar, Pakistan. At that time, local traders did not know the identity of the gem rough. It was typically available as small cleavage fragments, quite unlike the large well-formed crystals of spodumene that are coveted from Afghanistan (e.g., L. Natkaniec-Nowak, "Spodumenes from Nuristan, Afghanistan," *Australian Gemmologist*, Vol. 23, 2007, pp. 51–57). Farooq Hashmi, who visited Peshawar in June 2007, saw a 30 kg mixed-quality parcel of the green spodumene, and another 2 kg lot of higher-quality material; most was pale colored but some pieces were "emerald" green and appeared pink with the Chelsea filter. The main supplier of the spodumene told him that it came from "Waigal," which is several hours' walk from the village of Wadigram in the Nuristan area. It was reportedly found at a small digging in a single pegmatite in an area where other pegmatites are mined for blue tourmaline and kunzite.

Mr. Blauwet and Mr. Obodda loaned or donated to GIA several pieces of rough and a 1.45 ct faceted sample of the green spodumene (e.g., figures 28 and 29). Examination of the cut stone gave the following properties: color—light green, with no visible pleochroism; RI—1.662–1.678; birefringence 0.016; hydrostatic SG—3.25; fluorescence—inert to long- and short-wave UV radiation; Chelsea filter—weak positive reaction (grayish pink); and no absorption lines visible with the desk-model spectroscope. These properties

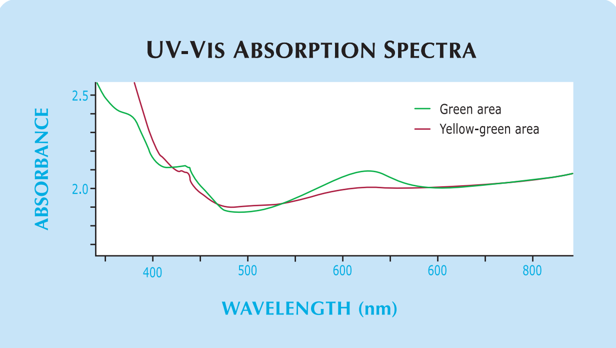
*Figure 28. This Cr/V-bearing spodumene from Afghanistan (1.3 g total weight) ranges from green to light yellow-green, and a portion of the green area was separated to retain as a reference for fade-testing experiments. Sunlight exposure for three weeks did not cause discernable fading; note that the yellow-green portion on the bottom appears relatively pale colored due in part to the narrow thickness of the sample in that area. Gift of Herb and Monika Obodda, GIA Collection no. 36750; photo by Robert Weldon.*

*Figure 29. This 1.45 ct spodumene was cut from the Afghan material. Gift of Dudley Blauwet, GIA Collection no. 37118; photo by Robert Weldon.*

are consistent with those reported for spodumene by J. W. Anthony et al. (*Handbook of Mineralogy*, Vol. 2, Mineral Data Publishing, Tucson, AZ, 1995, p. 747), except that the SG is slightly higher than published values (3.03–3.23). Microscopic examination revealed multiple fractures and one long needle-like inclusion.

Some of the rough samples (e.g., figure 28) showed a noticeable gradation from green to yellow-green. Green in spodumene can also be produced by artificial irradiation; however, the induced color fades when exposed to sunlight for a few hours (G. R. Rossman, "Color in gems: The new technologies," Summer 1981 *Gems & Gemology*, pp. 60–71; K. Nassau, "Treatments used on spodumene: Kunzite and hiddenite," *Colored Stone*, Vol. 1, No. 7, 1988, pp. 16–17). To test the color stability of this Afghan spodumene, the rough sample was divided into two pieces, the larger portion of which was left in the Southern California sun for three weeks. When compared to the control portion, it showed no indication of fading (again, see figure 28).

*Figure 30. UV-Vis absorption spectroscopy of the larger sample in figure 28 (thickness of 2–5 mm) showed a transmission window at ~420–600 nm that is responsible for the green color. This window is more pronounced in the darkest green portion.*



Further testing was conducted to determine the cause of color. EDXRF spectroscopy of the cut stone showed traces of the chromophoric elements Mn, Fe, Cr, and V. Electron-microprobe analyses of a rough sample donated to the University of New Orleans by Mr. Blauwet showed an average of 0.13 wt.% MnO and 0.02 wt.% FeO (all iron expressed as FeO; average of 6 analyses); Cr and V were below the detection limits of the instrument. (By comparison, Wise and Anderson [2006] reported up to 0.14 wt.% $Cr_2O_3$ and 0.08 wt.% $V_2O_3$ in spodumene from Hiddenite, North Carolina.) LA-ICP-MS analyses at GIA of another rough sample showed systematic variations in Cr and V, with the highest amounts measured in the green portions of the sample; there were no distinct differences in Fe and

**TABLE 1.** LA-ICP-MS analyses of three areas on a color-zoned spodumene from Afghanistan.[a]

| Element (ppm) | Green | Green | Yellow-green |
|---|---|---|---|
| Fe | 6,920 | 6,770 | 7,130 |
| Mn | 1,450 | 1,420 | 1,530 |
| Cr | 282 | 256 | 143 |
| V | 72 | 63 | 59 |

[a] *Data collected using a Thermo X-Series ICP-MS equipped with a New Wave 213 nm laser-ablation sample introduction system. Laser parameters were 40 μm spot size, 7 Hz repetition rate, 60% power, and 30 second dwell time. NIST 610 and 612 glasses were used as standards for calibration, and Si was used as the internal standard.*

Mn content according to color (table 1). The composition of the yellow-green portion was similar to data reported for a green-yellow spodumene from Afghanistan by Natkaniec-Nowak (2007).

The UV-Vis absorption spectrum of the sample in figure 29 showed that its coloration was caused by a transmission window at ~420–600 nm (figure 30), which is characteristic of Cr- ± V-bearing spodumene (E. W. Claffy, "Composition, tenebrescence and luminescence of spodumene minerals," *American Mineralogist*, Vol. 38, 1953, pp. 919–931). The greener portion of the sample had greater absorbance in the 550–700 nm region, which in spodumene is attributed to Cr and/or V (R. G. Burns, *Mineralogical Applications of Crystal Field Theory*, 2nd ed., Cambridge University Press, Cambridge, UK, 1993, pp. 188–189).

There may be some debate as to whether the Afghan samples could be properly referred to as hiddenite. A survey of the literature showed that there is no consistent definition for this variety of spodumene. Although this term is typically used to refer to yellow-green to green Cr-bearing spodumene, it is unclear if the saturation of the green color is important to the definition. To our knowledge, Cr-bearing spodumene is now known from Brazil, India, Siberia, and Afghanistan, in addition to the original area near Hiddenite, North Carolina.

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## SYNTHETICS AND SIMULANTS

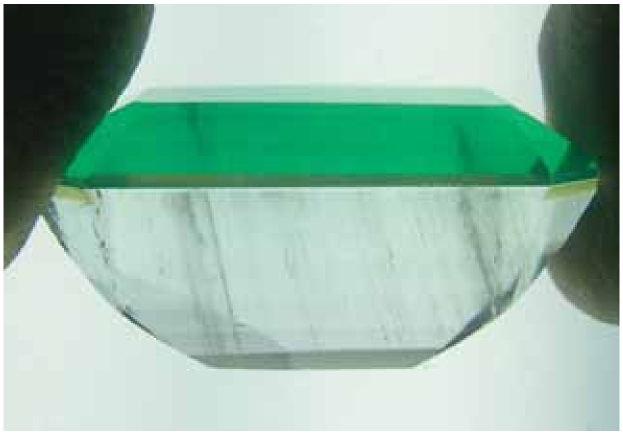
**Large beryl triplets imitating Colombian emeralds.** The Dubai Gemstone Laboratory recently received five large (~13.6–16.3 ct) transparent green emerald cuts for identification (figure 31). The client who submitted these samples prior to purchase had been informed that they were good-quality emeralds from Colombia.

*Figure 31. These large faceted samples (~13.6–16.3 ct), originally represented as Colombian emeralds, proved to be beryl triplets composed of two pieces of near-colorless beryl held together by green cement. Photo by S. Singbamroong, © Dubai Gemstone Laboratory.*

The following gemological properties were obtained: RI—$n_o$=1.588–1.596 and $n_e$=1.570–1.578; hydrostatic SG—2.69–2.71; fluorescence—inert to both long- and short-wave UV radiation; Chelsea filter—green reaction; and a smudgy band in the red region of the spectrum seen with a desk-model spectroscope. These properties were consistent with emerald except for the absence of chromium lines in the absorption spectra, which prompted a more detailed investigation of the cause of color.

Observation of the samples in profile view with diffused transmitted light showed green-appearing crowns and colorless pavilions (figure 32), which established that they were assemblages. Microscopic examination of both halves revealed the two-phase (liquid and gas) inclusions, "fingerprints," and parallel growth tubes that are typical of beryl, as well as small flattened, rounded, and irregularly shaped gas bubbles along the separation plane in each of the assemblages. Examination with immersion in a direction parallel to the girdle plane proved that the samples were triplets composed of two pieces of near-colorless beryl (crown and pavilion) held together by green cement (figure 33).

*Figure 32. Seen in profile view, with diffused transmitted light, the assembled nature of this triplet is evident. Note also the parallel growth tubes and fingerprints in both top and bottom pieces of the construct, which are typical for natural beryl. Photo by S. Singbamroong, © Dubai Gemstone Laboratory.*



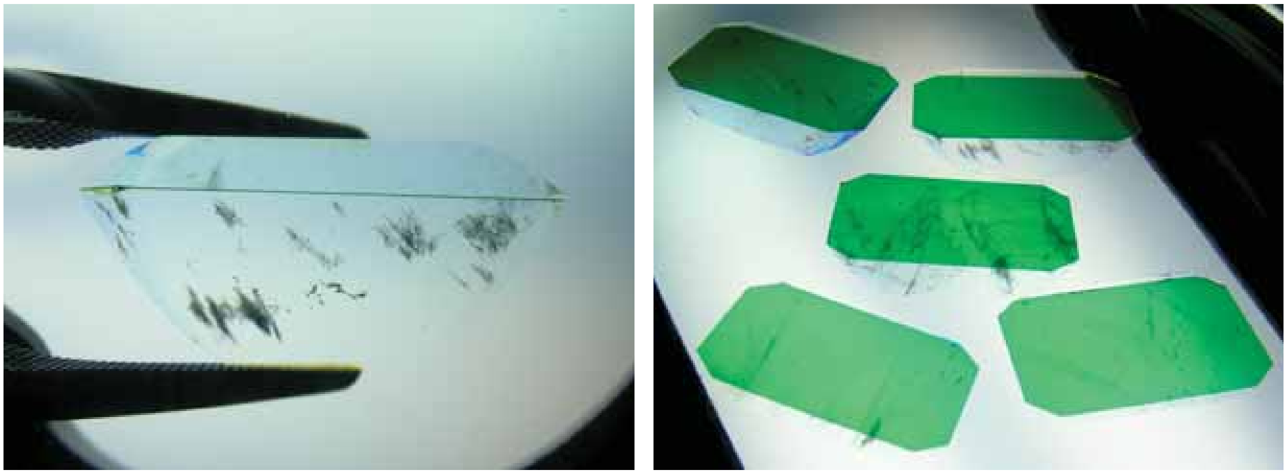


*Figure 33. Immersion in benzyl benzoate with diffused transmitted light readily revealed the layer of green cement in the beryl triplets. Photos by S. Singbamroong, © Dubai Gemstone Laboratory.*

FTIR spectroscopy performed on all samples (through the crown and pavilion) revealed features that were very similar to those of some synthetic resins used in the fracture filling of emerald.

The properties of these samples are consistent with those reported for beryl assemblages that have been produced by the firm Kämmerling of Idar-Oberstein, Germany, since 1966 and marketed under the trade name "Smaryll" (see R. Webster, *Gems*, 5th ed., revised by P. G. Read, Butterworth-Heinemann, Oxford, UK, 1994, p. 462). Beryl doublets and triplets have been used to imitate emerald since the early 20th century; though less common today, they continue to show up in the marketplace.

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**Glass imitation of blue spinel.** During a buying trip to Peshawar, Pakistan, in late 2004, Farooq Hashmi was offered a blue pebble with a waterworn appearance that was represented as spinel (figure 34). The piece reportedly came from an undisclosed river in northeastern Afghanistan. Mr. Hashmi obtained the piece, but its bright blue color and "alluvial" nature—both of which would be highly unusual for spinel from Afghanistan—caused him to doubt its authenticity.

Examination of the 5.5 g pebble showed the following properties: color—blue, with no pleochroism; spot RI—1.53; hydrostatic SG—2.48; Chelsea filter reaction—none; fluorescence—inert to long-wave, and weak yellow to short-wave, UV radiation; and a typical cobalt spectrum (absorption bands near 530, 590, and 650 nm) seen with the desk-model spectroscope. Microscopic examination revealed numerous gas bubbles, flow lines, white "breadcrumb" inclusions, and white crystalline masses. These properties are consistent with those reported for cobalt-bearing glass by G. Bosshart ("Cobalt glass as a lapis imitation" Winter 1983 *Gems & Gemology*, pp. 228–231). With only a cursory examination, the devitrified crystalline masses in the glass (figure 35) could be mistaken for natural inclusions.

To help supplement GIA's database of information on gem imitations, EDXRF analysis was performed. In addition to the expected major amount of Si, there were minor amounts of Fe and Ca, as well as traces of Al, K, Ti, Co, Zn, and As. These elements are comparable to those documented by Bosshart (1983). Even after more than two decades, Co-bearing glass imitations are still appearing in the gem market.

*Eric A. Fritz*

*Figure 34. This 5.5 g pebble was represented as blue spinel from a new deposit in Afghanistan, but proved to be Co-bearing glass. Gift of Intimate Gems, GIA Collection no. 37273; photo by Robert Weldon.*

Figure 35. The blue glass pebble contained devitrified crystalline masses, which could incorrectly suggest a natural origin. Photomicrograph by E. A. Fritz; field of view 1.6 mm.

## TREATMENTS

**Dyed greenish blue chalcedony from Brazil.** At the 2007 Tucson gem shows, Ketan Dholakia (J.D.S. Inc., Royal Palm Beach, Florida) showed one of us (BML) some bright greenish blue dyed chalcedony. Originally bluish gray, the chalcedony was reportedly treated in Europe by a new method that provides good color stability. Mr. Dohlakia indicated that unlike other dyed-blue chalcedony that may be susceptible to fading, this new material is stable to exposure to sunlight (tested for several months) as well as to alcohol and acids. Large pieces (>20 kg) of the bluish gray chalcedony are mined from an area in Brazil that is near the border between the Paraíba and Rio Grande do Norte states. Only small pieces of rough (from the translucent-to-transparent areas of the boulders) are treated, to ensure that the dye penetrates the entire stone. The material is marketed as "Paraíba chalcedony" because of its bright blue color and its source region in Brazil.

Figure 36. This dyed chalcedony (0.82 and 0.71 ct) was reportedly treated by a new process in Europe, using bluish gray material from Brazil. Gift of Ketan Dholakia, GIA Collection no. 36749; photo by Robert Weldon.

The first batches of this treated chalcedony were released in January 2007. In March, Mr. Dohlakia reported that he had begun machine cutting smaller pieces, yielding round brilliants and princess cuts ranging from 2 to 4 mm (stones <2.5 mm show good transparency). So far, he has sold 10,000 carats of machine-cut stones, as well as 40,000 carats that range from 6 × 4 to 12 × 10 mm.

Gemological properties were obtained on two faceted samples of the treated chalcedony that Mr. Dohlakia donated to GIA (figure 36): color—greenish blue; diaphaneity—translucent; RI—1.540 with little to no birefringence and 1.541–1.546 (birefringence 0.005); hydrostatic SG—2.57 and 2.59; fluorescence—inert to long- and short-wave UV radiation; Chelsea filter—yellowish reaction; and two absorption bands and a cutoff (at 660 or 690 nm, depending on the intensity of the light) were all seen in the red region of the spectrum with a desk-model spectroscope. Microscopic examination revealed homogeneous interiors with no inclusions, although one of the stones did exhibit very subtle banding. The properties of these stones are comparable to those listed for chalcedony in general by M. O'Donoghue (*Gems*, 6th ed., Butterworth-Heinemann, Oxford, UK, 2006, pp. 306–307), except that the range for the ordinary ray in that publication is lower (1.530–1.539). EDXRF analysis of both samples performed by staff gemologist Karen Chadwick detected significant amounts of Co, in addition to traces of Cu (which is the cause of color in natural chrysocolla chalcedony). UV-Vis spectroscopy did not show any features related to Cu, but it did reveal absorptions related to Co at 624, 660, and 690 nm. The presence of cobalt is consistent with a dye origin for the greenish blue color of this material.

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## CONFERENCE REPORTS

**First European Gemmological Symposium: "Presence and Future of Gemmology."** Approximately 200 attendees and guests celebrated the 75th anniversary of the German Gemmological Association at a gemological symposium in Idar-Oberstein, Germany, June 22–24, 2007. Extended abstracts of the presentations have been published in a special issue of *Gemmologie: Zeitschrift der Deutschen Gemmologischen Gesellschaft* (Vol. 56, No. 1/2, 2007); descriptions of selected technical presentations are presented here.

**Dr. Volker Lorenz** (University of Würzburg, Germany) discussed the geology and future potential of the Argyle diamond mine in northern Australia. He cited evidence for the formation of diamondiferous lamproite pipes at Argyle and elsewhere in northern Australia during phreatomagmatic volcanic eruptions (i.e., involving the contact between magma and groundwater). **One of the present contributors** (JES) described recent color coatings on diamonds, as well as the coating of other gem materials (including cultured pearls) with colorless "diamond-like carbon" thin films, which have so far proved difficult to detect with instrumentation typically found in gem-testing laboratories. Although marketed to allegedly improve the appearance and durability of these gem materials, such claims about these ultra-thin colorless coatings need to be substantiated by further studies.

**Christopher P. Smith** (American Gemological Laboratories, New York) described the properties of blue sapphires that were initially reported to have been diffusion treated with beryllium—but were found to have been surface treated with cobalt. A very thin layer (~250 nm) of cobalt aluminate ($Co_2Al_2O_5$) produced a blue surface coloration that appeared mottled when viewed with magnification and showed three distinctive broad absorption bands, at ~550, 585, and 625 nm. **Dr. Henry Hänni** (SSEF Swiss Gemmological Institute, Basel) reviewed modern pearl testing techniques, which employ X-ray imaging and luminescence, EDXRF, UV-Vis-NIR, and Raman spectroscopy, scanning electron microscopy, and LA-ICP-MS. **Another of these contributors** (JIK) discussed how inclusions can provide unique information on a gem's identity and origin, and described some of the challenges encountered when the gemologist must rely on nondestructive analytical methods for their identification.

**Dr. Dietmar Schwarz** (Gübelin Gem Lab, Lucerne, Switzerland) described the geologic settings and conditions of formation at a number of marble-hosted ruby deposits located between Afghanistan and Myanmar. These deposits are related to major geologic structures associated with the collision of the Indian and Eurasian continental plates. The rubies apparently formed by metamorphism of sediments containing evaporates; F and Cl in these layers acted to concentrate Al from the marbles for corundum formation. **Dr. Pornsawat Wathanakul** (Gem and Jewelry Institute of Thailand, Bangkok) reported on gem corundum from the Nam Khun–Nam Yuen area in Ubon Ratchathani Province, Thailand. Blue-green-yellow varieties of sapphire are recovered from alluvial sediments; violet-red rubies are much less common. The sapphires contain few inclusions, but typically display color zoning; heat treatment produces greenish yellow to yellow colors. **Dr. Hanco Zwaan** (Netherlands Gemmological Laboratory, Leiden) reviewed the theories of emerald origin in several geologic environments. He went on to describe the formation of emeralds at Sandawana, Zimbabwe, as the result of metamorphism along the contact of ultramafic rocks and pegmatites during a major deformation event that involved magmatic-hydrothermal activity and shearing. New gemological data on both emerald and alexandrite from the Malysheva mine near Ekaterinburg in the Ural Mountains, Russia, were summarized by **Dr. Lore Kiefert** (AGTA Gemological Testing Center, New York). **Dr. Margherita Superchi** (CISGEM, Milan, Italy) reported on the composition and Raman spectra of multicolored tourmalines from the Sahatany and Betafo areas in central Madagascar; the tourmalines were found to be predominantly liddicoatite. **Dr. Herbert Roeser** (University of Ouro Preto, Brazil) described recent work on the heat treatment of Brazilian beryls. A change or homogenization of beryl color was achieved by heating samples for 1–2 hours at temperatures of 350–900°C. The color changes were green to blue, yellow to blue or colorless, and pink to colorless. Beryl is not suitable for a color diffusion treatment that requires exposure to higher temperatures for longer periods of time, but it can be colored by a surface coating.

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**30th International Gemmological Conference.** Over 100 delegates, observers, and guests participated in the 30th IGC, July 15–19, 2007, at the Russian Academy of Sciences in Moscow. Highlights of some of the approximately 90 oral and poster presentations made during the conference are summarized here.

**Dr. Nikolai Bezmen** (Institute of Experimental Mineralogy, Chernogolovka, Russia), reported that slight improvements in the color grades of near-colorless gem diamonds could be obtained by apparently altering the state of their nitrogen impurities (using "hydrogen high diffusive mobility") and thereby reducing the yellow coloration. Progress in the long-standing effort to distinguish between natural and laboratory irradiation when assessing the color of green diamonds was reported by **George Bosshart** (Horgen-Zürich, Switzerland). A shallow green surface coloration on diamond crystals may be caused by natural exposure to alpha particles emitted by several radionuclides ($^{238}$U, $^{232}$Th, $^{222}$Rn, and $^{220}$Rn), while the much rarer green bodycolor is the result of natural gamma and possibly beta irradiation. **A. V. Buzmakov** (Institute of Crystallography, Moscow) described a three-dimensional X-ray tomography system that could be used to investigate the inclusions in opaque, fibrous diamond crystals. **John Chapman** (Rio Tinto Diamonds, Perth, Australia) reviewed the means of distinguishing natural, treated, and synthetic pink diamonds. He emphasized the particular difficulty presented by pink surface-colored diamonds, especially in small sizes. **Dr. Maya Kopylova** (University of British Columbia, Vancouver, Canada) discussed the properties (crystal shape, mineral inclusions, and infrared spectra) and inferred geologic conditions of formation (i.e., at depths of 160–200 km about 1.8 billion years ago from a source that contained a substantial contribution of carbon of crustal origin) of the eclogitic diamonds from the Jericho kimberlite in the Northwest Territories. **Dr. A. A. Marakushev** (Institute of

Experimental Mineralogy) described the conditions of formation that result in very large diamond crystals, and suggested that periods of recrystallization could contribute to their growth.

**Dr. Ichiro Sunagawa** (Tachikawa, Japan) discussed differences in diamond growth in natural and laboratory environments as evidenced by crystal morphology and surface features. Characteristics indicative of this difference in growth environment include crystal shape, internal growth sector structure, and perfection of crystal faces and edges. In contrast to synthetic diamonds, natural diamonds undergo deformation and dissolution processes during their long residence time in the mantle and subsequent eruption to the earth's surface. The identification of small yellow synthetic diamonds found mixed with natural-color diamonds in commercial pieces of jewelry in Japan was discussed by **Hiroshi Kitawaki** (Gemmological Association of All Japan, Tokyo). **Dr. Victor Vins** (New Diamonds of Siberia Ltd., Novosibirsk) reviewed the methods used in irradiation or HPHT annealing to change the color of diamonds. In a study of HPHT-treated brownish or greenish yellow and yellowish green diamonds produced by the Iljin Co. in Korea, **Boontawee Sriprasert** (Department of Mineral Resources, Bangkok) reported on photoluminescence features by which they can be identified (e.g., peaks at 637, 578 and 575 nm, with the 637/575 ratio being greater than 1).

In two presentations, **Dr. Carlo Aurisicchio** (Instituto de Geoscienze e Georisorse, Rome) described how a combination of chemical composition data obtained by the electron microprobe and secondary ion mass spectrometry techniques, along with gemological properties, could be used to determine the geographic origin of emeralds found in ancient pieces of jewelry. **Dr. Olga Balitskaya** (Russian State Geological Prospecting University, Moscow) presented a genetic gemological classification of natural, treated, and synthetic quartz. **Dr. Vladimir Balitsky** (Institute of Experimental Mineralogy) summarized the current production of treated gems (by irradiation, heating, diffusion, coatings, dyeing, and impregnation) and more than 30 synthetic gem materials from Russia. **T. V. Bgasheva** (Mendeleyev University of Chemical Technology, Moscow) described heating experiments—1100–1400°C, using mainly reducing atmospheres—conducted to reduce the orange component in Cr-Fe orange-red sapphires. **Dr. Aleksandr Bulatov** (Institute of Biochemical Physics, Moscow) reviewed the production and technological uses in Russia of silicon carbide (synthetic moissanite). **Nantharat Bunnag** (Chiang Mai University, Thailand) reported that the dark core in some rubies from Mong Hsu, Myanmar, has a chemical composition corresponding to eskolaite ($Cr_2O_3$), which forms a solid solution with corundum. **Dr. Henry Hänni** (SSEF Swiss Gemmological Institute, Basel) reviewed the current heating and filling treatments of ruby and sapphire, and the gemological means available to recognize them.

*Figure 37. In a process referred to as chromophore cannibalization, the color of this blue sapphire is bleached directly adjacent to the parallel needle-like inclusions, indicating that the inclusions possessed a higher affinity for the chromophoric elements (Fe and Ti) than their sapphire host. This provides proof that the host sapphire is of natural color and that no heat treatment has taken place. Photomicrograph by J. I. Koivula; field of view 1.1 mm.*

**Dr. P. V. Ivannikov** (Lomonosov Moscow State University) reviewed the limitations and advantages of color cathodoluminescence in gem identification. It is especially helpful when used in conjunction with a scanning electron microscope to identify the causes of this luminescence. **One of these contributors** (JIK) discussed evidence for both chromophore diffusion and infusion ("cannibalization"), where inclusions interact with their host gemstone to redistribute color-causing trace elements (figure 37). Efforts to improve the production of synthetic opal with natural-looking play-of-color patches were reviewed by **Dr. V. M. Masalov** (Macreol Ltd., Chernogolovka). **Dr. V. N. Matrosov** (Belarussian State Technical University, Minsk) described the growth, properties, and uses of synthetic alexandrite. **Dr. Visut Pisutha-Arnond** (Gem and Jewelry Institute of Thailand, Bangkok) described an unusual sapphire+hercynite+nepheline+zircon mineral assemblage from Kanchanaburi, Thailand. **One of these contributors** (REK) provided a preliminary report on the sapphires from Tasmania, Australia. Once the Scotia mine is fully operational, the Australian–U.S. joint venture expects to produce 250 kg of corundum per month. **Y. B. Shapovalov** (Institute of Experimental Mineralogy) reported on continuing experiments to synthesize gem-quality tourmaline in the laboratory by producing thin layers (less than 0.5 mm) of dark-colored material on natural elbaite seed crystals.

In separate presentations, **Dr. Pornsawat Wathanakul** (Gem and Jewelry Institute of Thailand) and **one of these contributors** (SFM) discussed evidence for the natural occurrence of trace amounts of beryllium associated with clouds of tiny inclusions in blue sapphires from Madagascar and Sri Lanka (up to 18 ppm and 13 ppm, respectively). **Dr. Michael Krzemnicki** (SSEF Swiss Gemmological Institute) reviewed the use of both the LIBS and LA-ICP-MS techniques for the chemical distinction of various colored stones and pearls. **Dr. Boris Shmakin** (Institute of Geochemistry, Russian Academy of Sciences, Irkutsk, Russia) described occurrences of amazonite feldspar in eastern Siberia at Slyudyanka, Priolkhonye, and Etyka. **Elisabeth Strack** (Gemmologisches Institut, Hamburg, Germany) described emeralds in jewelry objects of Mogul origin (mid-1700s) in the State Hermitage Museum in St. Petersburg, and presented evidence that suggests these emeralds were from Colombia. **Dr. Lin Sutherland** (Australian Museum, Sydney) indicated that gem corundum from the Mercaderes–Rio Mayo area in Colombia formed by crystallization of hydrous metasomatic fluids associated with Late Cenozoic Andean volcanism. **Dr. Chakkaphant Sutthirat** (Gem and Jewelry Institute of Thailand) discussed what appear to be two different geologic origins for rubies and sapphires from deposits in Thailand. In both instances, the corundum appears to have formed in particular layers within the upper mantle or crust prior to being transported to the surface by basaltic volcanism. **Theerapongs Thanasuthipitak** (Chiang Mai University) described the mineral composition of inclusions in blue sapphires from the Bo Ploi region of Kanchanaburi. These inclusions consist of several types of spinels along with pyrochlore, ilmenorutile, baddeleyite, and possibly other minerals.

**E. A. Akhmetshin** (Mendeleyev University of Chemical Technology, Moscow) reported on the chemical treatment of cultured pearls using cationic dyes that interact with their organic components to produce a range of colors with a uniform appearance.

The 31st IGC conference is planned for 2009 in Tanzania.

*James E. Shigley, John I. Koivula, and Shane F. McClure*

*Robert E. Kane*
*Fine Gems International*
*Helena, Montana*

**"Diamonds in Kimberley" symposium.** Approximately 350 people attended this symposium in Kimberley, South Africa, hosted by the Geological Society of South Africa on August 23–25, 2007. A main topic of discussion was alluvial diamond deposits of the Vaal and Orange rivers, which are mined by relatively small companies.

The formal presentations were opened by **Jerry Mndaweni**, of the Department of Minerals & Energy, Northern Cape Province, which is where Kimberley and many other pipe and alluvial deposits are located. He stressed the willingness of the government to facilitate the development of mines within the framework of the "new order" (i.e., mining licenses applied for after May 2004, when the new mining law came into effect, require projects to have a Black Economic Empowerment partner with at least 26% equity that is not free carried). **André Fourie** (De Beers Consolidated Mines, Kimberley) discussed recent changes at some De Beers properties, including the closure of their three Kimberley mines in the past few years, the sale of the Koffiefontein mine to Petra Diamonds, and the sale of a 26% equity in De Beers Consolidated Mines to Ponohalo Holdings (a Black Economic Empowerment group). He also described two new ventures: reopening of the Voorspoed mine (Free State Province) and launching of the new vessel *Peace in Africa*, which will mine ocean floor deposits off the coast of Namaqualand. **Gavin Armstrong** (Gondwanaland Diamonds, Kimberley), **Petrus Wolmarans** (Impulelo Technologies, Honeydew, South Africa), and **Ian Downie** (i to i Technologies, Stellenbosch, South Africa) discussed recent improvements in diamond recovery plants, including re-treating old tailings dumps. Processing tailings and developing or reopening alluvial deposits have much faster lead-in times (1–2 years) compared to developing primary pipe deposits (8–10 years).

Among the many excellent presentations on the second day, **Norman Lock** (Mineral Exploration and Evaluation Specialists [MSA], Parkhurst, South Africa) discussed differences in evaluating two pipe deposits: the Jwaneng pipe in Botswana, which required drilling through a 45 m overburden of Kalahari sands, and the Argyle pipe, which was exposed on the surface and could be evaluated by many shallow drill holes and the use of microdiamond (0.1–0.8 mm) to macrodiamond ratio diagrams. **Dr. Herman Grutter** (BHP Billiton, Vancouver, Canada) discussed new techniques for evaluating kimberlites in Canada using the thermobarometry of garnet and clinopyroxene; the latter is now considered a significant diamond indicator mineral, along with garnet, ilmenite, and chromite.

**Dr. John Bristow** (Rockwell Diamond Inc., Houghton, South Africa) gave a detailed review of alluvial deposits of the lower Vaal and middle Orange rivers, where many 100+ ct diamonds have been recovered from terraces and paleochannels up to 120 m above the present water level of the Vaal River. Mining is still taking place in areas where underlying gravels are buried under a hard calcrete cap that could not be penetrated by early diggers. Dr. Bristow concluded that compared to pipes, alluvial deposits present greater uncertainties with respect to continuity, grade, price consistency, and resource evaluation.

The symposium was preceded by a one-day field trip to the Letšeng diamond mine in Lesotho. The Letšeng mine is the world's highest altitude (3,100 m) and lowest-grade (1.5–2 cpht) diamond deposit, with the highest quality and largest average diamond size (>$1,200/ct). It has produced 18 diamonds >100 ct since the mine was resurrected in 2003. Stones of this size make up 2% of production; 10.8+ ct stones account for 14% by weight and 74% by value. The first large high-quality diamonds (95, 125, and 215 ct; the last sold for $38,000/ct) were recovered in 2003–2004 from nearby alluvial deposits in the Qaqa River, which drains the Letšeng Main pipe and Satellite pipe (15.9 and 5.2 ha in size, respectively). Recent production is derived from rubble and surface layers of kimberlite in the pipes. The quality of the diamonds is exceptional, cutting mainly D-Flawless or D-VVS$_1$ stones. A recently recovered 603 ct type IIa D-color diamond, named the "Lesotho Promise," is the 15th largest rough diamond ever found and sold for $20,500/ct. Such high diamond values are unusual for kimberlite mines: In general, such pipe diamonds have values of $50–200/ct, whereas those from the Vaal and Orange River alluvial deposits are $400–1200/ct.

The symposium concluded with a choice of field trips to the MSA indicator mineral laboratory or to nearby historical diggings, many of which are still operating.

*A. J. A. (Bram) Janse*

**Diamond 2007.** The 18th European Conference on Diamond, Diamond-Like Materials, Carbon Nanotubes, and Nitrides was held September 9–14 in Berlin. Topics of particular interest to the gemological community included the effects of irradiation and high-pressure, high-temperature (HPHT) treatments, silicon- and nickel-related optical defects, and pink diamond identification.

**Bozidar Butorac** and coauthors from King's College, London, presented results from the theoretical modeling of defect migration in diamond. The data indicate that defects like N-V and N-V-H are energetically very difficult to break apart, but they readily combine to form more complex structures at high temperatures. These results explain many lattice changes produced by HPHT treatment of gem diamonds. **Dr. Igor N. Kupriyanov** and coauthors from the Institute of Geology and Mineralogy, Novosibirsk, Russia, presented results from HPHT treatment experiments on mixed type Ib-IaAB and type IIb HPHT-grown synthetic diamonds. Their results indicate that HPHT annealing at temperatures lower than those typically used for treatment (~1800–2100°C) resulted in an increase in the concentration of isolated nitrogen and platelet defects. HPHT treatment to 2300°C did not affect single substitutional boron defects in the type IIb samples.

**J. G. Seo** from Hanyang University, Seoul, South Korea, and coauthors presented FTIR absorption and photoluminescence spectra of natural diamonds that were subjected to electron-beam radiation of varying intensity. Their results indicated that lattice defects associated with isolated nitrogen increased more than those located near aggregated nitrogen atoms due to differences in lattice bond energies. **Rolando Larico** and coauthors from the University of São Paulo, Brazil, introduced models of several possible configurations for nickel-nitrogen defects in diamond.

**Dr. James Rabeau** from Macquarie University, New South Wales, Australia, discussed single color centers (N-V, Si-V, and Ni) in CVD synthetic diamond and the nature of their occurrence. **This contributor** and coauthors discussed several natural colorless type IIa and type I gem diamonds that contained the Si-V defect center (737 nm), a feature previously reported only from CVD-grown synthetic diamond.

**Dr. M. D. Sastry** from the Gemmological Institute of India, Mumbai, and coauthors described photoluminescence features in heavily irradiated and annealed pink diamonds. **Branko Deljanin** and coauthors from the European Gemological Laboratory, Vancouver, Canada, summarized methods (including fluorescence, spectroscopy, and electrical conductivity) for separating natural, synthetic, irradiated and HPHT-treated, and surface-coated gem-quality pink diamonds. He discussed the Cross-referencing Identification System ("CIS") fluorescent method, involving micro-imaging of long- and short-wave UV fluorescence, as an effective tool for screening pink diamonds, particularly melee and those stones set in jewelry.

*Christopher M. Breeding*

## ANNOUNCEMENTS

**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 6–11, 2007. GIA Education's traveling Extension classes will offer hands-on training in Tucson with "Colored Stone Grading" (February 5–7), "Pearls" (February 8), and "Identifying Diamond Treatments" and "Identifying Ruby" (February 9). Several free seminars will also be offered by GIA staff February 10–11. To enroll, call 800-421-7250, ext. 4001. Outside the U.S. and Canada, call 760-603-4001. The GIA Alumni Association will host an auction, dance, and cocktail party (with heavy hors d'oeuvres) at the Marriott University Park Hotel in Tucson on February 8, starting at 6:30 p.m. To purchase tickets, call 760-603-4204 or e-mail events@gia.edu.

**MJSA Vision Awards competition.** The 2008 Manufacturing Jewelers & Suppliers of America Vision Awards Design Competition recognizes designers whose work has a profound influence on the future of jewelry design. The entry deadline is December 30, and winners will be honored on April 13, 2008, at the MJSA Expo New York show. For entry forms and more information, call 800-444-6572 or visit www.mjsa.org.

### Conferences

**Mineral Exploration Roundup 2008.** This international conference will take place in Vancouver, British Columbia, January 28–31. The program will include a short course titled "Kimberlites: Geological Principles Relevant to Evaluation, Resource Classification and Mining." Visit www.amebc.ca/roundupoverview.htm.

**NAJA Annual Conference.** The National Association of Jewelry Appraisers is holding its 29th annual *Winter Educational Conference* February 4–5, 2008, during the Tucson gem shows. Visit www.najaappraisers.com.

**Hasselt Diamond Workshop.** Held February 25–27, 2008 at Hasselt University, Diepenbeek–Hasselt, Belgium, this conference will cover a variety of diamond-related research subjects. Visit www.imo.uhasselt.be/SBDD2008.

**PDAC 2008.** The Prospectors and Developers Association of Canada convention will take place March 2–5 in Toronto. The technical session will include an update on the Canadian diamond industry (including progress at Snap Lake and Victor) and a review of current diamond prospecting in India. Visit www.pdac.ca/pdac/conv.

**Pittcon 2008.** The *59th Annual Pittsburgh Conference and Exposition on Analytical Chemistry and Applied Spectroscopy* will be held in New Orleans, Louisiana, March 2–6. Among the topics covered will be chemical analysis of art objects. Visit www.pittcon.org/technical/index.html.

**Bead Expo.** The 2008 International Bead Expo will be held in Portland, Oregon, March 27–30. Over 60 workshops and educational lectures on bead jewelry design and manufacture are scheduled. Visit www.beadexpo.com.

**BASELWORLD 2008.** The BASELWORLD show will be held April 3–10 in Basel, Switzerland. During the show, *Gems & Gemology* editor-in-chief Alice Keller will be available at the GIA Booth in Hall 2, Stand W23. Visit www.baselshow.com, call 800-922-7359, or e-mail visitor@baselworld.com.

**Sinkankas Garnet Symposium.** Garnet will be featured in the sixth annual John Sinkankas Memorial Symposium, held April 19, 2008, at GIA in Carlsbad. A variety of experts will speak on garnet localities, inclusions, treatments, appraising, lapidary work, and literature at this all-day educational event. E-mail merksjade@cox.net.

**Quebec 2008: GAC-MAC-SEG-SGA.** Held May 26–28 in Quebec City, Canada, this joint conference organized by the Geological Association of Canada, Mineralogical Association of Canada, Society of Economic Geologists, and the Society for Geology Applied to Mineral Deposits will include special sessions on "Diamonds: from Mantle to Jewellery" and "Challenges to a Genetic Model for Pegmatites," as well as a short course called "Rough Diamond Handling." Visit www.quebec2008.net.

## Exhibits

**Gemstone Treasures from Namibia.** The diversity and majesty of Namibia's gems are presented in a special exhibit at the Deutsches Edelsteinmuseum in Idar-Oberstein until December 2, 2007. Visit www.edelsteinmuseum.de/edelsteine_Namibia.htm.

**Wine and gems in Dijon.** "Colour Sparkles: Legendary Wines and Gemstones," a unique exhibition of fine gems and fine wines, is being held in the Sciences Garden at the Parc de l'Arquebuse, Dijon, France, through December 9, 2007. Items from the French National Museum of Natural History are on display with wines from the great vintners of Burgundy and beyond. The exhibit includes both wine tasting and hands-on experiments in light and color. Visit www.dijon.fr/fiche/eclats-de-couleurspierres-et-vins-de-legende.evt.5604.php.

**Jewelry of Ben Nighthorse.** Ben Nighthorse Campbell, who represented Colorado in the U.S. Senate from 1992 through 2004, has enjoyed a successful second career as an innovative jewelry designer. This collection of his work, which debuted at the Smithsonian Institution's National Museum of the American Indian in 2004, is on display at the Colorado History Museum in Denver through December 31, 2007. Visit www.coloradohistory.org.

**Exhibits at the GIA Museum.** On display through March 2008, "Reflections in Stone" showcases famed gem carver Bernd Munsteiner's work during the period 1966–2003. The exhibit includes carved quartz, tourmaline, and beryl, ranging from pieces set in jewelry to large table-top sculptures. Advance reservations are required; to schedule a tour, call 760-603-4116 or e-mail museum@gia.edu.

**Gems! Colors of Light and Stone.** The Michael Scott collection has returned to the Bowers Museum in Santa Ana, California, with an expanded display of rare colored stones, carvings, and sculptures. The exhibit will run until June 16, 2008. Visit www.bowers.org.

**The Lester and Sue Smith Gem Vault.** Opening November 17, 2007, at the Houston Museum of Natural Science in Texas, this new permanent exhibit hall will complement the museum's existing Cullen Hall of Gems and Minerals with extraordinary polished jewels, as well as a 1,869 ct emerald crystal specimen from North Carolina. Visit www.hmns.org/generic/Gem_Vault_press_room.asp?r=1.

## ERRATA

1. The caption for figure 1 of "Polymer impregnated turquoise" by K. S. Moe et al. in the Summer 2007 issue (pp. 149–151) should have included the name of the photographer: Jian Xin (Jae) Liao. *Gems & Gemology* regrets the omission.
2. The Summer 2007 GNI conference report on the Sinkankas jade symposium (pp. 181–182) pictured a Burmese slab that was indicated as jadeite. Subsequent Raman analysis of several spots on this slab, combined with UV-Vis spectroscopy, by Dr. George Rossman (California Institute of Technology, Pasadena, California) have shown that it was composed of diopside.