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2009 TUCSON

Despite the global economic downturn, the annual Tucson gem and mineral shows again offered a wide variety of materials, including a spectacular pendant set with an untreated 3 ct Colombian emerald and a 5 ct D-Flawless diamond (figure 1). In addition, the shows saw the debut of some interesting new gem materials and localities, many of which will be described in future issues of *G&G*.

Overall, dealers at the show had low sales expectations, but many were pleasantly surprised. Although show attendance was light compared to previous years, those dealers with unusual and attractive merchandise at good prices typically did okay. Likewise, *Gems & Gemology*'s sales of subscriptions, back issues, *In Review* books, and charts surpassed expectations, with special interest in the new *G&G* flash drives preloaded with back issue PDFs.

This year's theme for the Tucson Gem and Mineral Society show was "Mineral Oddities." Next year's Tucson Gem and Mineral Show will take place February 11–14, and the theme will be "Gems & Gem Minerals," which should be of particular interest to *G&G* readers.

G&G appreciates the assistance of the many friends who shared material and information with us this year, and also thanks the American Gem Trade Association for providing space to photograph these items during the AGTA show.

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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New play-of-color opal from Welo, Ethiopia. A new source of high-quality play-of-color opal was discovered in early 2008 in Welo Province, Ethiopia, about 500 km north of Addis Ababa. This deposit is geographically

Figure 1. One of many pieces of fine jewelry seen at the Tucson shows, this Van Cleef & Arpels diamond necklace features a detachable 3.03 ct untreated Colombian emerald and a 5.09 ct D-Flawless diamond. Courtesy of Robert E. Kane and Fine Gems International, Helena, Montana; photo by Tino Hammid.

Figure 2. These opals (7.55–23.48 ct) originate from a new deposit in Welo Province, Ethiopia. This material typically has a lighter bodycolor than opals from Shewa Province. Photo by Robert Weldon.

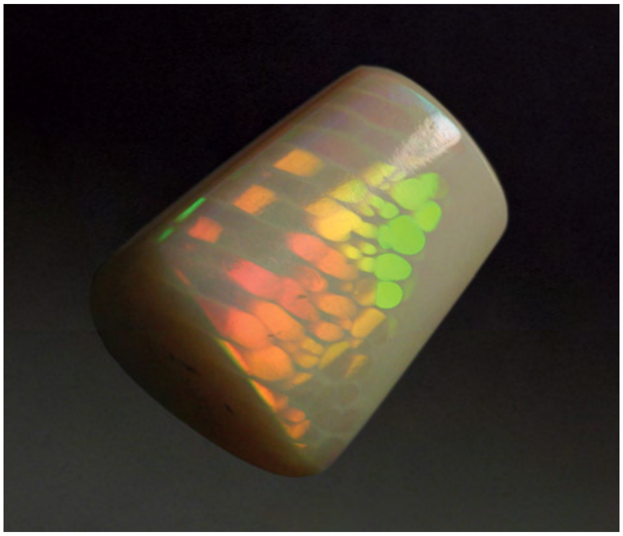

Figure 3. Several Welo samples, such as this 8.19 ct piece, showed a columnar structure of play-of-color opal within common opal, which is characteristic of opals from Ethiopia. Photo by B. Rondeau.

distinct from the Mezezo deposit in Shewa Province, which was discovered in the early 1990s (see, e.g., Spring 1994 Gem News, pp. 52–53).

These contributors examined a parcel of about five rough and 30 cut Welo opals supplied by Opalinda and Eyaopal, the main distributors of this material. The cabochons showed good play-of-color (figure 2); the vast majority were white and transparent, but some had a bodycolor varying from light yellow to dark "chocolate" brown. Compared to Mezezo opals (e.g., J.-P. Gauthier et al., "L'opale d'Ethiopie: Gemmologie ordinaire et caractéristiques exceptionnelles," *Revue de Gemmologie a.f.g.*, No. 149, 2004, pp. 15–23), those from the new deposit generally appear much whiter. We noted all spectral colors in the play-of-color in our samples. Most of the cabochons were similar in appearance to opals from Australia or Brazil. However, many samples displayed a columnar structure of play-of-color opal within common opal (figure 3), as first described in material from Mezezo (again, see Gauthier et al., 2004). This feature is only very rarely observed in opals from sources outside Ethiopia.

The hydrostatic SG of the opals ranged from 1.80 to 2.10. This broad range is in part due to the high porosity of some samples, as revealed by a significant weight increase after immersion in water (up to 8%). Fluorescence varied from inert to moderate yellowish white to both long- and short-wave ultraviolet (UV) radiation. Samples that were inert displayed an unexpected greenish phosphorescence of moderate intensity. No luminescence was observed in the opals with a yellow-to-brown bodycolor, even the light ones; these darker bodycolors are probably due to the presence of iron, which quenches luminescence. The yellow-to-green luminescence is likely due to the presence of uranium (E. Gaillou et al., "The geochemistry of gem opals as evidence of their origin," *Ore Geology Reviews*, Vol. 34, 2008, pp. 113–126). Fourier-transform Raman spectra were obtained for several samples using a Bruker RFS 100 spectrometer. All spectra were consistent with opal-CT, with Raman bands at about 1070, 780, 670, and 345 cm^{-1}, and water-related bands at about 3200 and 2950 cm^{-1}.

Welo opal is found in volcanic rock, possibly a rhyolite. The rough samples we examined consisted of opal (either common or play-of-color) cementing fragments of the host rock. By contrast, opal from Mezezo fills cavities in rhyolite, forming nodules. Despite these differences, the fact that columnar structures are seen in opals from both deposits (but very rarely from elsewhere) seems to indicate similarities in the conditions of their formation.

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Gem-quality rhodochrosite from China. The Wudong mine in China has long been thought to be a source of fine rhodochrosite, but mining operations have been sporadic and largely undocumented until recently. The mine is located in the Wuzhou area of Guangxi Zhuang Autonomous Region, approximately 480 km (300 miles) northwest of Hong Kong. In early 2007, a group of

Figure 4. This well-formed rhodochrosite crystal (5 × 4 cm) from China's Wudong mine is attached to a matrix of quartz, galena, pyrite, and very minor fluorite. Photo by Jeff Scovil.

Figure 5. Some fine stones (here, 3.61–29.56 ct) have been cut from the Chinese rhodochrosite. Courtesy of Collector's Edge Minerals Inc.; photo by Robert Weldon.

investors purchased the mine and shifted its emphasis from base metals (lead-zinc-silver) to specimen- and gem-grade rhodochrosite. In 2008, Collector's Edge Minerals Inc. made an arrangement with Wudong's owners to excavate the rhodochrosite pockets. The mine reaches a depth of over 150 m in a maze of tunnels, stopes, and shafts that have been excavated using jack-leg drills, explosives, and ore cars. Rhodochrosite and associated minerals from Wudong were recently described by B. Ottens ("Rhodochrosit aus dem Blei/Zink-Bergwerk Wudong bei Liubao, Guangxi, China," *Lapis*, Vol. 33, No. 10, 2008, pp. 53–56).

This contributor and colleagues mapped the site in August 2006. The mineralized veins vary from several centimeters to more than 2 m wide, and dip steeply to nearly vertical. Rhodochrosite occurs as solid fillings, making the veins appear like red streaks. Where the veins widen and the structure allows, an open pocket will contain fine crystals. There are several similarities to the mineralization patterns seen at the now-closed Sweet Home mine in Colorado (see K. Knox and B. K. Lees, "Gem rhodochrosite from the Sweet Home Mine, Colorado," Summer 1997 *G&G*, pp. 122–133). Although Wudong's host rocks are sedimentary and Sweet Home's are granitic, rhodochrosite crystals from both mines may be large and sometimes gemmy, occurring with fluorite, galena, wolframite, chalcopyrite, apatite, quartz, barite, and sphalerite. A major difference between the two is that the Wudong mine does not appear to contain tetrahedrite, which was abundant at the Sweet Home mine.

Most of the rhodochrosite crystals from Wudong are slightly to heavily etched, making them appear pink and opaque. A few lack this etching, however, and are quite attractive with good luster (e.g., figure 4). They range up to nearly 13 cm in maximum dimension and are rhombohedral, like those from Sweet Home, but often show thin, bladed habits. The internal characteristics of the Wudong rhodochrosites indicate a turbulent growth history. Many of the crystals have significant inclusions and banding, which makes faceting a challenge and severely limits the potential for large gems.

Mining so far has produced nearly 100 kg of lapidary-grade material, in addition to mineral specimens. The lapidary material is being cut into faceted stones (e.g., figure 5) and cabochons, as well as beads, eggs/spheres, and carvings. As of February 2009, processing of less than 10 kg of material by this contributor had yielded ~150 faceted stones weighing from <1 ct to 3 ct, ~20 faceted stones of 3–10 ct, and four stones weighing 10+ ct. In addition, there were ~50 cabochons up to 20 ct, ~20 polished rhombs up to 30 ct, and ~15 eggs of <50 ct each. These polished goods are being distributed by Paul Cory (Iteco Inc., Powell, Ohio), and it will probably take three years to cut the inventory on hand. The Wudong mine is producing enough rhodochrosite rough to continue supplying the market created by the Sweet Home mine, which has been closed since mid-2004 (Spring 2007 GNI, pp. 61–62).

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COLORED STONES AND ORGANIC MATERIALS

Gem-quality amethyst from Tata, Morocco. A new source of amethyst reportedly has been discovered in the Anti-Atlas Mountains. According to Jack Lowell (Colorado Gem & Mineral Co., Tempe, Arizona) and mine owner Ait Ouzrou Mohamed (Agadir, Morocco), production started in late 2007. Well-formed crystals of amethyst are recovered from soil on Bouodi Mountain (figure 6), located near the city of Tata. The deposit is mined by a small number of workers on an occasional basis, depending on the orders received for the amethyst. Each worker typically gathers 2 kg of material daily using simple hand tools, and about 30% of the production can be polished into cabochons or faceted stones. The material is mostly suitable for crystal specimens or cabochons, although some high-quality facet rough has been produced.

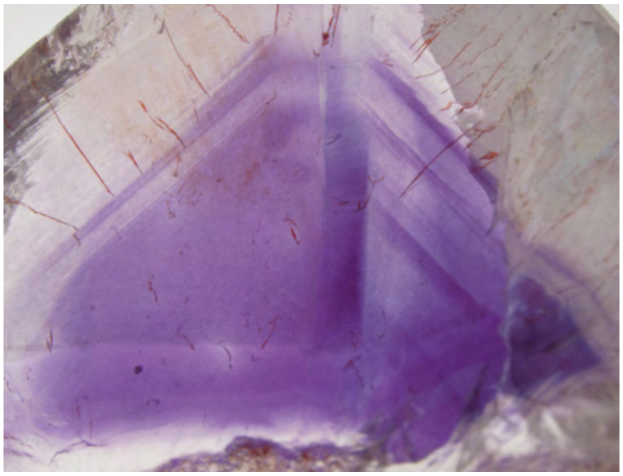
Mr. Lowell loaned one faceted pear-shaped modified step cut (13.74 ct) and five crystals (3.94–36.6 g) to GIA for examination (e.g., figure 7). The rough exhibited well-formed pyramidal terminations, with typical horizontal striations on the prism faces. The samples showed a characteristic deep purple triangular color zone within the crystal terminations that was surrounded by near-colorless quartz (figure 8). In the faceted stone, this color zone was carefully oriented to present a uniformly deep face-up color.

The following properties were obtained from the faceted stone and two of the crystals: diaphaneity—transparent to translucent (rough); pleochroism—weak, ranging from pinkish purple to bluish violet; RI—1.542–1.552; hydrostatic SG—average of 2.65 (measurements varied ±0.01); Chelsea filter reaction—none; fluorescence—primarily inert to both long- and short-wave UV radiation, though near-colorless areas did exhibit a faint white reac-

Figure 6. The new Moroccan amethyst deposit is located in weathered rock on a remote mountainside. Photo by Ait Ouzrou Mohamed.

Figure 7. Although the Moroccan amethyst is commonly color zoned, it can be fashioned to show an even face-up purple color, as seen in this 13.74 ct pear-shaped modified step cut (faceted by Alan Morgan of Mesa, Arizona). The Moroccan crystal weighs 11.1 g. Photo by Kevin Schumacher.

Figure 8. Two distinctive features of the Moroccan amethyst are near-colorless to deep purple color zoning and inclusions of reddish brown dendritic hematite. Photomicrograph by D. Beaton; magnified 10×.



tion to short-wave UV. No distinct absorption bands were observed with a desk-model spectroscope. The properties of the Moroccan amethyst are generally consistent with those listed for amethyst in R. Webster (*Gems*, 5th ed., revised by P. G. Read, Butterworth-Heinemann, Oxford, UK, 1994, pp. 225–229).

Viewed with crossed polarizers, the cut amethyst revealed bull's-eye and Airy spiral optic figures, as well as small areas of Brazil-law twinning. Microscopic examination revealed "fingerprints" composed of fluid remnants and two-phase fluid-gas inclusions, which are common in quartz. Distinctive inclusions of reddish brown dendritic hematite (again, see figure 8) and an unusually large primary two-phase inclusion were also observed. As noted in amethyst from Sri Lanka by E. J. Gübelin and J. I. Koivula (*Photoatlas of Inclusions in Gemstones,* Vol. 2, Opinio Publishers, Basel, Switzerland, 2005, p. 561), the hematite inclusions occurred in a colorless growth zone where they consumed the locally available iron, so the surrounding quartz was deficient in this chromophore.

Amethyst from Morocco is typically seen as drusy crystals in geodes that are mined from lava flows (W. Lieber, *Amethyst: Geschichte, Eigenschaften, Fundorte*, Christian Weise Verlag, Munich, Germany, 1994). This is the first occurrence of well-formed gem-quality amethyst crystals in Morocco.

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Anahí's "new" ametrine. The Anahí mine in southeastern Bolivia, near the border with Brazil, has enjoyed consistent production since coming under private control in 1990. The mine is best known for its ametrine (amethyst-citrine), a quartz variety that exhibits two principal colors, purple and yellow (see P. M. Vasconcelos et al., "The Anahí ametrine mine, Bolivia," Spring 1994 *G&G*, pp. 4–23). Bolivia is the world's only commercial source of this gem. Mine owner Ramiro Rivero has transformed operations in recent years to better control production, cutting, jewelry manufacturing, and retail activities, establishing a clear mine-to-market chain of custody for his product (see Winter 2001 GNI, pp. 334–335).

In August 2008, GIA staff members visited Anahí to videotape and report on the mine-to-market operations. The Anahí mine presently employs 74 workers and is active in five tunnels (e.g., figures 9 and 10). The company has also started to process the tailings piles to recover material that is now popular in the market, such as pale amethyst (called *anahíta* in Bolivia). Taking advantage of abundant groundwater supplies, workers wash the ore on location and then presort it before transport to Minerales y Metales del Oriente, Mr. Rivero's manufacturing arm in the Bolivian city of Santa Cruz.

Production at the Anahí mine is lower than it was a decade ago, but Mr. Rivero maintains that is because greater efficiencies in mining, sorting, and cutting have reduced the amount of rough needed for the value-added operations. Nevertheless, the mine still produces some 2,500–3,500 kg of gem-quality material, from a total 120 tonnes of quartz mined each year. Amethyst averages the highest production (44%), followed by ametrine (33%), and citrine (23%); ametrine remains the most lucrative product.

Figure 9. At Bolivia's Anahí mine, a worker removes an ore car loaded with quartz-bearing material that will then be washed and presorted. Photo by R. Weldon.

The proportion of ametrine has actually increased (from 20% a decade ago) because of Mr. Rivero's success in marketing gems that do not necessarily show the traditional split in amethyst and citrine colors. In the early years of the Anahí mine, ametrines were often faceted as emerald cuts showing a distinct color demarcation to mimic the appeal of bicolored tourmalines. But cutting ametrine for an even color split wastes much of the quartz. While "fantasy" cut gems have long ignored this purple-yellow color demarca-

Figure 10. This tunnel at the Anahí mine exhibits the richness of the quartz deposit. Photo by R. Weldon.

Figure 11. Anahí mine ametrine is cut to maximize yield while also blending the yellow and purple colors. The 33.55 ct gem on the left was cut by Dalan Hargrave; the 44.23 ct concave-cut stone on the right was faceted in Bolivia. Both gems courtesy of Minerales y Metales del Oriente; photos by R. Weldon.

tion in favor of free-form shapes, Minerales y Metales del Oriente today focuses on a blend of colors in more traditional shapes (i.e., round, oval, or pear). This strategy maximizes yield. In addition to purple, the resulting mix of colors may exhibit "peach" or deep orangy red hues when viewed face-up (e.g., figure 11).

For many years, Minerales y Metales del Oriente developed its own cutting styles and jewelry design prototypes, but contracted with overseas manufacturers for large-scale production. Until recently, it worked with a gem cutting and jewelry manufacturing plant in China. With the global economic downturn, today the company is producing all of its cut gems and finished jewelry in Santa Cruz.

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Azurite/malachite from Sonora, Mexico. The 2008 Tucson gem shows saw the notable availability of large quantities of well-crystallized specimens of azurite—and malachite pseudomorphs after azurite—from a new source, the Milpillas copper mine in the Cananea District of northern Sonora State, Mexico (see T. P. Moore, "What's New in Minerals—Tucson Show 2008," *Mineralogical Record*, Vol. 39, No. 3, 2008, pp. 236–237). In addition to these specimens, there was some massive material available consisting of intergrowths of azurite and malachite that were well suited for cutting cabochons. Bill Larson (Palagems.com, Fallbrook, California) obtained approximately 5 kg of this material, half of which has now been worked by lapidarist Bud Standley (Standley Collections, San Diego) into several hundred carats of cabochons and many free-form carvings, some ranging up to 20 cm in maximum dimension.

Mr. Larson loaned four of the cabochons to GIA for examination (e.g., figure 12). They consisted of curvilinear domains of granular blue azurite that were intergrown with felty aggregates of light- and dark-green malachite (figure 13; both minerals confirmed by Raman analysis of one sample). The malachite sprays typically radiated into the azurite, giving the appearance that the malachite partially replaced the azurite. This is consistent with the pseudomorphous nature of the malachite in the mineral specimens mentioned

Figure 12. These attractive cabochons consist of intergrowths of blue azurite and green malachite from a new source, the Milpillas mine in Sonora, Mexico. The larger stone measures 4.9 × 3.5 cm. Photo by Robert Weldon.

Figure 13. A closer view of the Milpillas material shows granular azurite intergrown with fibrous malachite. Photo by Robert Weldon; field of view 3.2 cm.

above. It is hoped that more of the colorful crystals and massive azurite/malachite intergrowths will be preserved from the crusher at the Milpillas copper mine.

Because of the relatively low hardness of azurite and malachite (Mohs 3½–4), care is required when cutting/polishing and wearing this material, as it may scratch easily and become dull. Azurite/malachite is therefore appropriate for jewelry such as necklaces and brooches, but not for rings or items exposed to daily wear.

Brendan M. Laurs

Light yellow-green grossular from Kenya. Deep green grossular (tsavorite) was discovered in East Africa's Mozambique Belt in the late 1960s (Tanzania) and 1970 (Kenya), as reported by C. R. Bridges ("Green grossular garnets ["Tsavorites"] in East Africa," Summer 1974 *G&G*, pp. 290–295). According to Bridges (p. 293), the material ranged from colorless to pale yellowish green to "rich grass or emerald green." Examination of the early finds indicated the bright green was due to vanadium with contributions from chromium. Manganese was also found in brightly colored stones, and iron in stones of more yellowish hue (Bridges, 1974). Later work correlated increasing concentrations of V and Cr to green coloration and increasing Fe to yellow coloration (D. V. Manson and C. M. Stockton, "Gem-quality grossular garnets," Winter 1982 *G&G*, pp. 204–213).

In November 2008, Dudley Blauwet (Dudley Blauwet Gems, Louisville, Colorado) loaned GIA four samples of light yellow-green grossular (figure 14) that were reportedly from the village of Kabanga in the Voi area of Kenya. Voi has traditionally produced much darker or more saturated green material (tsavorite), so we took this opportunity to characterize these lighter samples. The following properties were obtained from the four stones: color—light yellow-green to light yellowish green; RI—1.738 (three stones) or 1.736 (one stone); hydrostatic SG—3.58–3.60; fluorescence—weak to moderate red to moderate orange to long-wave UV radiation, and moderate orange-yellow to short-wave UV; and no features seen with the desk-model spectroscope. These properties are consistent with grossular (R. Webster, *Gems*, 5th ed., revised by P. G. Read, Butterworth-Heinemann, Oxford, UK, 1994, pp. 201–202). Between crossed polarizers, very weak to moderate anomalous double refraction was observed. Microscopic examination revealed short-to-long needles (apparently etch tubes; some fibrous) at ~70°/110° orientation, clusters of small transparent crystals, small thin films, and/or solid particles (figure 15); these resembled inclusions often seen in tsavorite (M. O'Donoghue, Ed., *Gems*, 6th ed., Butterworth-Heinemann, Oxford, UK, 2006, pp. 215–216). In contrast, a similarly colored large greenish yellow grossular from an unspecified location in East Africa reported in the Winter 2005 GNI section (pp. 352–353) had the strong roiled growth features characteristic of the hessonite variety of grossular.

All four stones were chemically analyzed by laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS). The results confirmed they were grossular, with minute amounts of Mn, Mg, and Ti (<0.7 wt.%), and traces of Fe, K, V, and Cr (<0.1 wt.%). These are common impurities in grossular, and the low concentrations of chromophores are consistent with the pale color of these samples. UV-Vis-NIR absorption spectra showed very weak bands at 409, 419, and 430 nm, attributed to Mn^{2+}, which correlates to yellow coloration (Winter 1991 Gem News, p. 258). Although these samples did contain the tsavorite chromophores Cr and V, their colors were not saturated enough for them to be classified as such gemologically.

Mr. Blauwet subsequently obtained some additional Kabanga material from the same supplier, consisting of several parcels totaling nearly 100 g (in pieces typically

Figure 14. These samples of grossular (2.96–9.96 ct) are reportedly from Voi, Kenya. Photo by Robert Weldon.

Figure 15. The Kenyan garnets in figure 14 contained inclusions such as needles, thin films, and transparent crystals. Photomicrograph by D. Beaton; magnified 30×.

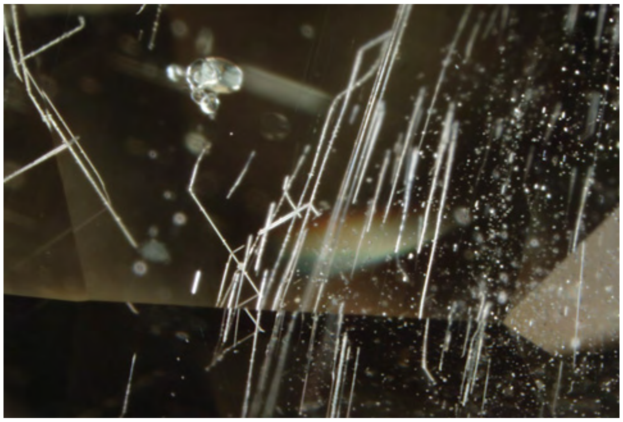

Figure 16. These attractive green kornerupines (0.25–0.84 ct), identified as the mineral prismatine, are reportedly from Tanzania. Photo by Robert Weldon.

weighing 1–2 g, and rarely up to 5 g). The rough consisted of broken fragments, with the exception of one parcel that also contained waterworn pieces. Similar to the material characterized for this report, the additional Kabanga rough ranged from light yellowish green to "mint" green.

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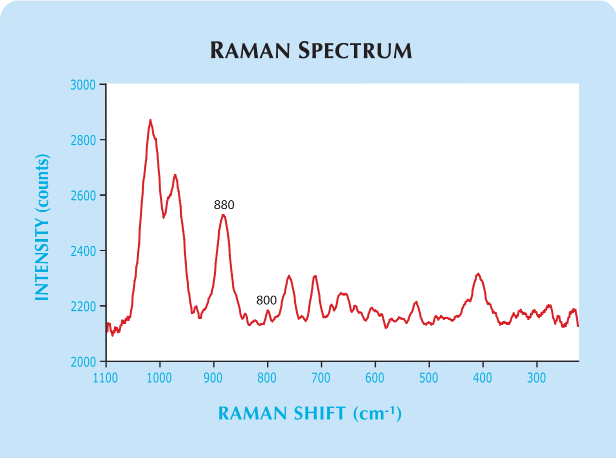
Kornerupine (prismatine) from Tanzania. East Africa produces a wide variety of unusual gem minerals, some of which are quite attractive as well as scientifically interesting. For example, the Kwale area in southern Kenya is known to produce a V-bearing kornerupine that is "bright apple-green" (M. O'Donoghue, Ed., *Gems*, 6th ed., Butterworth-Heinemann, Oxford, UK, 2006, p. 421). In September 2008, GIA received three similarly colored kornerupines (0.25–0.84 ct; figure 16) that were reportedly from Tanzania, loaned by Dudley Blauwet. According to his supplier, the material came from a single find in late 2007 in the Usambara Mountains, near Tanga. He obtained 20.6 g of rough that yielded 63 faceted stones, cut in calibrated sizes, totaling 13.25 carats.

Figure 17. The Raman spectrum of the 0.84 ct sample shows both of the key boron-related bands (~880 and ~800 cm^{-1}), thus identifying the stone as prismatine.



Gemological testing of the three faceted samples produced the following results: color—intense green; pleochroism—light brownish yellow, strong green, and light bluish green; RI—α = 1.660–1.662, β = 1.673–1.674, and γ = 1.675–1.678; birefringence—0.016–0.017; SG—3.28–3.32; fluorescence—strong chalky yellow to long-wave, and faint yellow to short-wave, UV radiation; spectrum—no absorption lines seen with the desk-model spectroscope. These properties are consistent with those reported by O'Donoghue (2006). Parallel growth tubules, partially healed fissures, and short needles were observed with magnification, as were included crystals (possibly apatite or zircon) and negative crystals. All of these have been reported in kornerupine by E. J. Gübelin and J. I. Koivula (*Photoatlas of Inclusions in Gemstones*, Vol. 1, ABC Edition, Zurich, 1986; Vol. 2, Opinio Verlag, Basel, Switzerland, 2005).

Minerals of the kornerupine group are ferromagnesian boron-bearing aluminosilicates that can be represented by the generic formula $(\square,\mathrm{Fe},\mathrm{Mg})(\mathrm{Mg},\mathrm{Fe},\mathrm{Al})_9(\mathrm{Si},\mathrm{Al},\mathrm{B})_5\mathrm{O}_{21}(\mathrm{OH},\mathrm{F})$. The group includes two minerals differentiated by their boron (B) content: kornerupine *sensu stricto* (B<0.5 per formula unit [pfu]) and prismatine (B>0.5 pfu; E. S. Grew et al. "Prismatine: Revalidation for boron-rich compositions in the kornerupine group," *Mineralogical Magazine*, Vol. 60, 1996, pp. 483–491).

EDXRF spectroscopy of our samples detected the major elements expected for kornerupine, along with traces of V. Boron cannot be detected by EDXRF, so we could not use this technique to determine whether our samples were kornerupine *sensu stricto* or prismatine. However, two Raman bands at ~884 and ~803 cm^{-1} in kornerupine group minerals are sensitive to the presence of B, and their relative intensities can be used to estimate B content. Prismatine shows both the 884 and 803 cm^{-1} bands, while kornerupine *sensu stricto* shows only the 884 cm^{-1} band (B. Wopenka et al., "Raman spectroscopic identification of B-free and B-rich kornerupine [prismatine]," *American Mineralogist*, Vol. 84, 1999, pp. 550–554).

Raman spectra of all three samples showed bands at ~880 and ~800 cm^{-1}, indicating the presence of significant boron (figure 17). LA-ICP-MS analysis performed on all three samples confirmed the presence of V and that B content was >0.5 pfu (see table 1). Consequently, these three kornerupines were B-rich and classified as prismatine.

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TABLE 1. LA-ICP-MS data for three prismatines from Tanzania.

Composition	0.25 ct	0.30 ct	0.84 ct
V average (ppm)	937	1053	1069
B average (ppm)	8740	6690	7679
B average (pfu)	0.720	0.941	0.828

Figure 18. These labradorites (1.10 and 0.75 ct) were cut from material that was sourced from beach gravels located near Ketchikan, Alaska. Photo by Robert Weldon; the 0.75 ct stone is GIA Collection no. 37787.

Transparent labradorite from Ketchikan, Alaska. In March 2008, GIA received some transparent very light yellow to very light brownish yellow samples that were represented as albite-oligoclase (sodic plagioclase) from Ketchikan, Alaska. Some were donated and others loaned by Dudley Blauwet, who received the material from a supplier who collected it by hand from beach gravels in an area about two hours by boat from the coastal town of Ketchikan. The supplier has visited the collecting area once a year for the past 10 years, in trips lasting 3–4 days, and typically recovers about 300–600 g of rough on each trip. The pebbles are mostly small, and he only collects material that will cut stones of 3 mm or larger; rarely, he has found pebbles up to nearly 5 g. Approximately 40% of the collected rough is facetable. More than 1,000 carats have been cut, typically weighing <1–2 ct, although some larger stones (up to 12 ct) have been cut. Most of the material has been sold to cruise ship tourists visiting Ketchikan, either loose or set into jewelry.

The samples supplied by Mr. Blauwet consisted of two oval brilliants (0.75 and 1.10 ct; figure 18) and four pieces of rough (0.6–2 g). The following properties were recorded on all samples (except that RI and birefringence were determined on the two faceted stones only): color—very light yellow to brownish yellow; RI—1.561–1.570; birefringence—0.009; hydrostatic SG—2.69–2.72; fluorescence—inert to long-wave and weak red to short-wave UV radiation; and no features seen with the desk-model spectroscope. These properties are consistent with those reported for labradorite (see, e.g., M. O'Donoghue, Ed., *Gems*, 6th ed., Butterworth-Heinemann, Oxford, UK, 2006, pp. 263–267; Winter 2006 GNI, pp. 274–275). Microscopic observation revealed a few small, dark brown to black, opaque crystals, as well as numerous needles in one plane.

All six samples were chemically analyzed by LA-ICP-MS, using the same procedure as for the labradorite from Mexico reported in the Winter 2006 GNI entry. As expected from the RI values listed above, all samples had a composition corresponding to labradorite: ~$Ab_{32–42}Or_{2-3}An_{55–66}$—referring to the end-members albite (Na-rich), orthoclase (K-rich), and anorthite (Ca-rich). All contained traces of iron, and we know that Fe^{3+} in the tetrahedral site of plagioclase produces a pale yellow color (http://minerals.caltech.edu/color_causes/metal_ion/index.htm). UV-Vis-NIR spectra showed a 380 nm peak and a very weak absorption at 420 nm. O'Donoghue (2006, p. 267) noted that absorptions at 380 and 420 nm in plagioclase are due to Fe^{3+}.

Labradorite is a calcium-dominant plagioclase ($An_{50–70}$), which can be separated from sodic plagioclase (albite-oligoclase, $An_{0–30}$) by its higher RI values. Gem-quality colorless to light yellow labradorite is known from various localities in western North America, such as Oregon, Utah, New Mexico, and Mexico (e.g., Winter 2006 GNI, pp. 274–275). This is the first time we have encountered such material from Alaska.

HyeJin Jang-Green

Gem news from Myanmar. From April to November 2008, this contributor received information on several new gem occurrences in Myanmar, as described below.

- Blue kyanite comes from Mohnyin Township in Kachin State, associated with garnet, tourmaline, and quartz. Cabochons (1–5 ct; see figure 19) and some faceted gems have been cut from this material, and such stones have been sold as sapphires in Yangon, Mandalay, and Taunggyi.
- Gem-quality blue sodalite has been found in Ohnbinyehtuat (~22°57′0″ N, 96°31′3″ E), which is located 6 km southwest of the previously known sodalite/hackmanite deposits in the Mogok area near Pein Pyit.
- Granitic pegmatites in the Sakangyi area (15 km west of Mogok, at ~22°54′00″ N, 96°20′30″ E) continue to produce large crystals of topaz (some exceeding 50 kg), as well as aquamarine, rock crystal quartz, and green fluorite.

Figure 19. Gem-quality blue kyanite (here, from 0.78 × 0.65 cm to 1.20 × 0.73 cm) is being produced from Mohnyin Township in northern Myanmar. Photo by U Tin Hlaing.

Figure 20. These spinels (left, 7.91 ct; right, 4.73 ct) proved to be natural and synthetic, respectively. In the natural spinel, note the large feature under the table that contains planar inclusions in two directions. Photos by G. Choudhary.

- Gem-quality yellow scheelite and large brownish purple zircon have been found ~55 km west of Mogok, near Thabeikkyin (~22°52′00″ N, 95°58′11″ E).
- Reddish brown garnet crystals (average 4 g) have been gathered from weathered gneiss in the Mogok region. The deposit is located about 13 km east of Momeik (~23°06′ N, 96°48′ E). Bright stones up to 15 ct have been cut from this material.
- Ruby mining at Mong Hsu is taking place in underground workings to a depth of 30 m beneath the original mining site (~21°48′30″ N, 97°29′50″ E). The present ruby production is estimated to be about one-tenth of the amount produced during the boom time in 1993–1994.
- Ruby cabochons from the John Saul mine in Kenya are popular in Yangon and Taunggyi, where they are marketed as African ruby. Some of them are glass filled.
- Most of the synthetic rubies seen recently by this contributor in Taunggyi show only very faint curved lines and evidence of heat treatment.
- There are several active gem markets in Mogok. The Garden Gem Market is the largest, with 3,000–5,000 merchants. Other markets include Le-U, Mogok Cinema, Mintado, and Kyatpyin Cinema.
- Total sales in the gem section of the Union of Myanmar Economic Holdings Ltd. (UMEHL) Gems & Jade Sales in January 2008 was ~$467,000.

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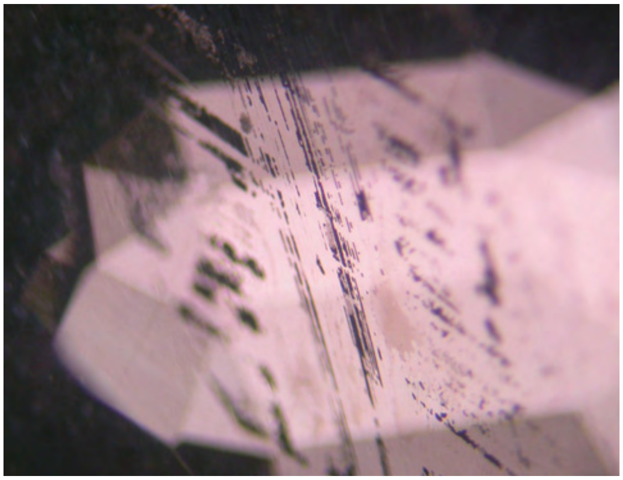
Interesting natural and synthetic spinels. Microscopic study is an important part of gem identification, and inclusions may add to the beauty of gems. Recently, the Gem Testing Laboratory of Jaipur, India, encountered two specimens that displayed interesting inclusion scenes. A purplish pink 7.91 ct oval (figure 20, left) was submitted for identification, while a 4.73 ct pale grayish yellow oval (fig-

Figure 21. At higher magnification, the planar structures in the natural spinel in figure 20 appeared to be composed of intermittent liquid films. Photomicrograph by G. Choudhary; magnified 35×.



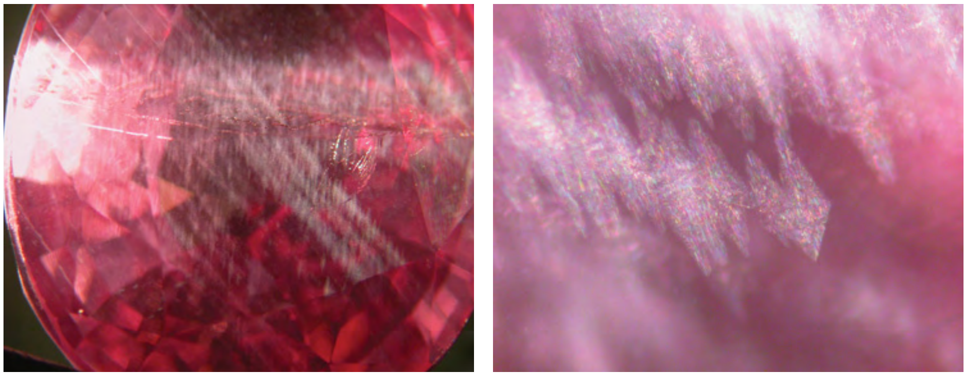


Figure 22. Milky zones formed lath-like structures in this spinel (left, magnified 35×). At higher magnification, the milky zones were composed of kite-shaped domains of fine iridescent films (right, magnified 80×). Note how the individual blades are all oriented in the same direction. Photomicrographs by G. Choudhary.

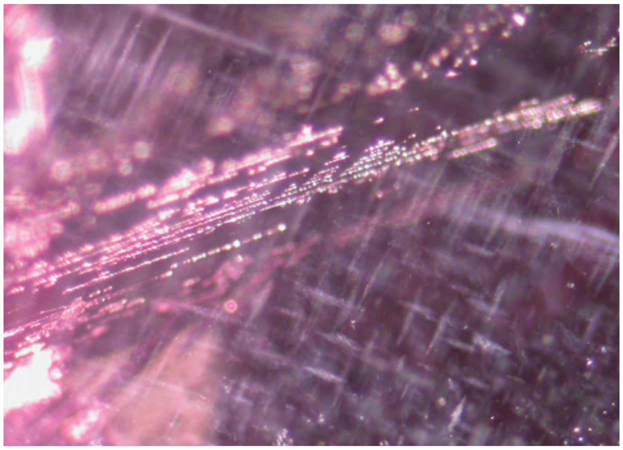


Figure 23. Lath-like inclusions were also concentrated in areas between the zones in figure 22. These inclusions were oriented in two directions intersecting at ~90°. Photomicrograph by G. Choudhary; magnified 60×.

ure 20, right) was represented as natural sapphire to the buyer, who requested an origin determination.

The 7.91 ct specimen had an RI of 1.720, gave a hydrostatic SG of 3.58, and exhibited red fluorescence to long- and short-wave UV radiation (with a stronger reaction to long-wave UV). It displayed a weak strain pattern in the polariscope. Fine lines in the red region and an absorption band in the yellow-orange region were visible with the desk-model spectroscope. These features identified the stone as natural spinel.

The inclusion features in this spinel were notable. A large, flat feature under the table displayed fine planar structures running in two directions. This inclusion was visible with the unaided eye (again, see figure 20, left). At higher magnification, the planar structures appeared as intermittent liquid films (figure 21) that gave the impression of partially healed fractures.

Additional features became apparent when the specimen was rotated and observed using a fiber-optic light source. Numerous parallel zones of fine whitish films or platelets created a lath-like effect (figure 22, left). These zones appeared to follow two different directions that were inclined to one another. At higher magnification, these lath-like zones formed kite-shaped domains composed of fine iridescent films in parallel orientation (figure 22, right). In addition, there were fine whitish inclusions oriented in two directions that intersected one another at ~90° (figure 23). Similar-appearing inclusions in spinel (identified as högbomite) were illustrated by E. J. Gübelin and J. I. Koivula (*Photoatlas of Inclusions in Gemstones*, Vol. 2, Opinio Publishers, Basel, Switzerland, 2005, pp. 693, 714).

The color of the pale grayish yellow specimen (again, see figure 20, right) was similar to that observed in many natural sapphires from Sri Lanka, which seemed to support the seller's claim. However, basic gemological testing revealed its true identity. It had a refractive index of 1.735, a hydrostatic SG of 3.61, and strong chalky blue fluorescence to short-wave UV, but was inert to long-wave UV. In the polariscope, it exhibited a strong strain pattern (ADR effect). The desk-model spectroscope displayed faint bands in the green, yellow, and orange-red regions, in a pattern that corresponded to cobalt. These properties indicated a synthetic spinel.

Circular to subhexagonal zones or bands composed of clouds of fine dotted inclusions were visible with magnification (figure 24, left). The subhexagonal features were very similar to inclusion patterns in natural corundum. A profile view showed that these zones were composed of parallel planes in a layered pattern (figure 24, right). When the sample was viewed with diffused illumination in immersion, subtle color zoning was observed. The center appeared pale blue, and the outer regions were pale yellow (figure 25).

Other features visible in the synthetic spinel included irregular thread-like inclusions and large spherical gas bubbles. The subhexagonal inclusion features could have caused this synthetic spinel to be mistaken for a natural stone. Although hexagonal patterns have been reported in other materials, such as synthetic star sapphire (see Summer 2007 GNI, pp. 177–178), it is quite unusual to see them in a gem belonging to the cubic system.

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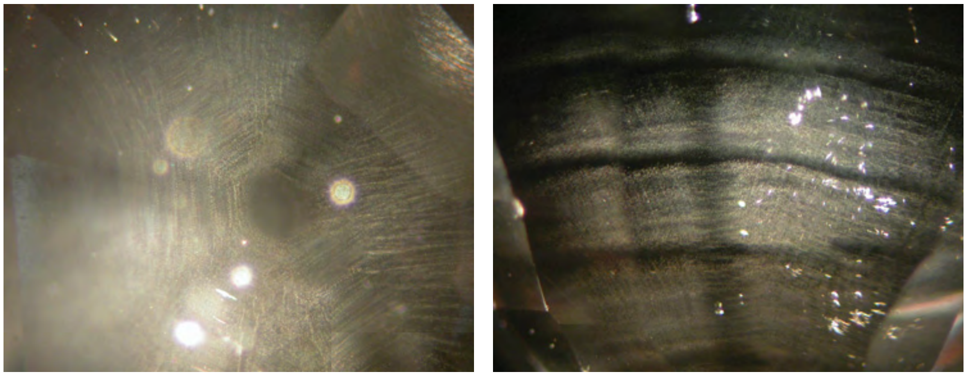

Figure 24. Clouds of fine dotted inclusions observed in the synthetic spinel formed subhexagonal zones or bands (left) that also appeared circular in some viewing directions. In profile view (right), these zones were arranged in parallel planes. Photomicrographs by G. Choudhary; magnified 65×.

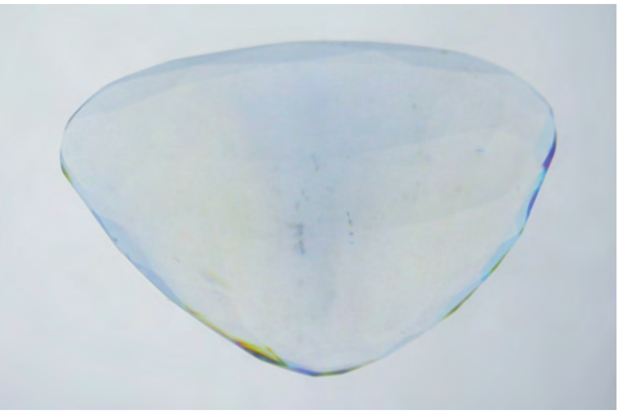

Figure 25. Viewed in immersion, the synthetic spinel displayed subtle color zones, with a blue central region and yellow outer portions. Photo by G. Choudhary.

Zoisite from Afghanistan. In mid-2008, gem dealer Mark Kaufman (Kaufman Enterprises, San Diego) loaned GIA some light purple samples that were sold to him as zoisite from the Shinwari tribal area, Nangarhar Province, Afghanistan. These consisted of four pieces of rough weighing up to 1.1 g and a 1.68 ct modified brilliant-cut cushion that he had faceted from this material (e.g., figure 26). He first encountered this zoisite in early 2001 at a gem show in France. From 1.2 kg of mixed-quality rough, Mr. Kaufman selected 100 g of material. Several years later (in 2006) he purchased another 850 g (of which ~300 g was cuttable) from the same parcel. So far, he has faceted four stones weighing up to 3.71 ct. Although he has pieces of rough that should cut larger stones, he reported that the material tends to crack during faceting due to internal stress.

Figure 26. These two zoisites, a 1.1 g crystal and a 1.68 ct modified cushion cut, are reportedly from Afghanistan. Photo by Robert Weldon.

The following properties were obtained from an examination of all five samples: color—very light brownish purple, with moderate light yellow, grayish blue, and grayish purple pleochroism; hydrostatic SG—3.35 ± 0.02; RI (measured on the faceted sample only)—$\alpha = 1.694$, $\beta = 1.695$, and $\gamma = 1.702$; fluorescence—inert to long- and short-wave UV radiation; Chelsea filter reaction—none; and absorption lines at 427 and 452 nm visible with a desk-model spectroscope. These properties are consistent with those reported for zoisite (e.g., J. E. Arem, *Color Encyclopedia of Gemstones*, 2nd ed., Van Nostrand Reinhold Co., New York, 1987). The material was confirmed as zoisite using Raman spectroscopy, which can distinguish between zoisite and closely related clinozoisite. EDXRF analysis showed that the nonintrinsic trace elements were dominated by Fe, with minor amounts of V, Cr, Zn, and Sr.

One of the rough pieces consisted of a well-formed crystal (again, see figure 26) that had a flat tabular prismatic morphology with pronounced striations along its length. One cleavage direction was obvious in the other rough pieces. All the samples were characterized by abundant, randomly oriented, prismatic inclusions (e.g., figure 27), which were identified as actinolite with Raman spectroscopy.

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Figure 27. Prismatic inclusions of actinolite were present in the zoisite from Afghanistan. Photomicrograph by D. Beaton; field of view 1.0 mm.

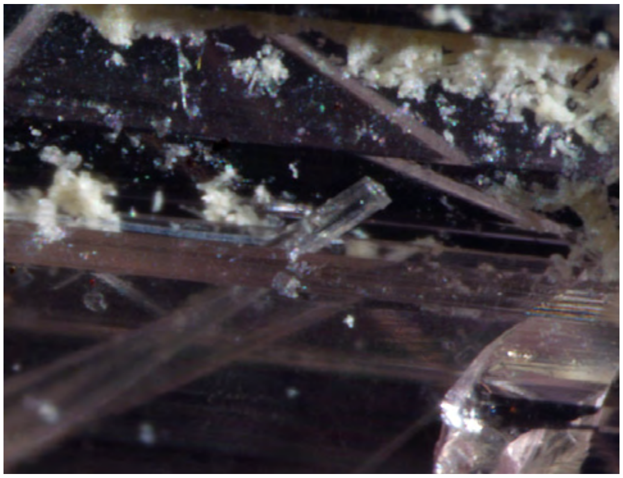

Figure 28. These freeform cabochons of Australian chrysoprase weigh 36.85 and 41.67 ct. Photo by Robert Weldon.

Figure 29. Interesting dendritic patterns are rarely seen in fashioned chrysoprase. In these samples, they were formed by inclusions of manganese oxides, which here appear red-brown in reflected light. Photomicrograph by R. Befi; image width 5.9 mm.

INCLUSIONS IN GEMS

Australian chrysoprase with dendritic inclusions. Two freeform cabochons (36.85 and 41.67 ct; figure 28) of Australian chrysoprase with unusual inclusions were loaned to GIA by Steve Perry (Steve Perry Gems, Davis, California). The rough material from which they were cut originally had been designated for use as a carving material, but was discarded because it contained dark-colored "blemishes."

Both samples displayed a yellowish green color typical of chrysoprase, as well as a few near-colorless areas. Standard gemological testing confirmed the identification: spot RI—1.54; hydrostatic SG—2.57; fluorescence—yellowish green, moderate to short-wave and weaker to long-wave UV radiation; Chelsea color filter—no reaction. No mosaic-like veining, as seen in dyed chalcedony, was observed. EDXRF chemical analysis detected Si and traces of Ni, but no Cr, which is consistent with the chemical formula of chrysoprase.

Chrysoprase can range from pale green through "apple" green to a deep rich green; the intensity of the color is directly related to Ni content (J. H. Brooks, "Marlborough Creek chrysoprase deposits," Fall 1965 *G&G*, pp. 323–330). LA-ICP-MS analysis of both cabochons showed Ni levels of 0.02–0.18 wt.% in near-colorless areas, and 0.53–0.90 wt.% in green areas.

Viewed with magnification, the inclusions in both stones showed interesting dendritic patterns (figure 29). Dendrites form along surface-reaching cracks and along flow layers in chalcedony and other minerals as a result of epigenetic fluids. These solutions typically deposit manganese oxides in characteristic branching shapes (in this case, with a more three-dimensional form than is typically seen in dendrites). The visual appearance of the inclusions was highly suggestive of manganese oxides, and this was supported by Raman spectroscopy of some dendrites that reached the surface. In addition, LA-ICP-MS analyses of the surface-reaching inclusions showed enriched Mn.

Most fashioned chrysoprase has uniform color without any dendritic inclusions. The presence of such a delicate dendritic pattern makes these cabochons rather special, by transforming a plain interior into exotic and vibrant material.

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Ankangite and celsian inclusions in quartz from Brazil. In January 2008, gem dealer Sergio Pereira de Almeida purchased (in Teófilo Otoni, Minas Gerais) a 20 kg parcel of colorless quartz crystals that contained radiating black needles and lesser quantities of euhedral white and colorless inclusions. The quartz crystals, which ranged from one to 10 cm long, were prismatic and most were terminated. The entire parcel was cut into cabochons and faceted gems, yielding approximately 20,000 carats total. Some of the stones (e.g., figure 30) were donated to the mineralogy museum at the University of Rome "La Sapienza" by Mr. Pereira de Almeida and examined for this report.

Four samples were characterized using standard gemological techniques, scanning electron microscopy with energy-dispersive spectroscopy (SEM-EDS), and electron-microprobe analysis. The gemological properties were consistent with quartz, except that the SG value of 2.67 was slightly high. The conspicuous black needles in these stones were 0.1–1 cm long and 5–10 μm in diameter (as indicated by SEM). Semiquantitative SEM-EDS analyses of these needles revealed the presence of Ti, Cr, and V. The white-to-colorless euhedral mineral inclusions varied from 10 μm to 1 mm in exceptional cases.

Using a Cameca SX-50 electron microprobe at the Italian National Research Council's Institute of Environmental Geology and Geoengineering (IGAG-CNR) in Rome, we identified the black needles as ankangite,

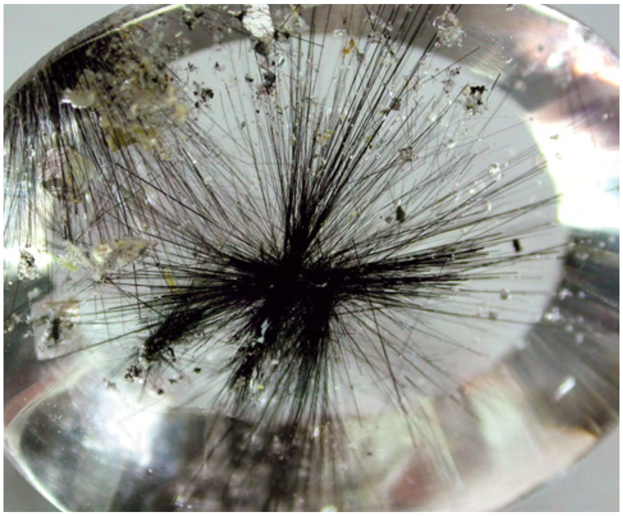

Figure 30. This 27.01 ct quartz cabochon contains black, needle-shaped sprays of ankangite and colorless-to-white crystals of celsian. Photo by M. Pantò.

$Ba(Ti,V^{3+},Cr^{3+})_8O_{16}$. This extremely rare oxide mineral is named after the discovery locality, Ankang County in Shaanxi Province, China. The white-to-colorless inclusions were celsian ($BaAl_2Si_2O_8$), a Ba-rich mineral of the feldspar group. Chemical analyses of both inclusion types are reported in table 1. (No Ba was detected by the SEM-EDS analyses described above because the instrument had not been calibrated for this element.)

The presence of both ankangite and celsian inclusions in this quartz suggests that it originated from a barium-rich deposit. The quartz's discoverer, a Mr. Nilsinho from Curvelo, Minas Gerais, is keeping the location within Brazil confidential.

To the best of our knowledge, this is the first reported occurrence of the minerals ankangite and celsian in quartz, and as such it further enriches the catalog of known quartz inclusions.

TABLE 1. Electron-microprobe analyses of inclusions in two quartz cabochons from Brazil.[a]

Oxides (wt.%)	Ankangite[b]	Celsian
SiO_2	0.39	41.84
TiO_2	56.84	bdl
Al_2O_3	0.17	23.84
V_2O_3	14.27	bdl
Cr_2O_3	6.02	bdl
CaO	0.02	bdl
FeO	0.05	0.01
BaO	20.76	29.19
Na_2O	0.07	0.23
K_2O	0.03	4.58
Total	98.62	99.69

[a] *The values given represent the average composition of two inclusions of each mineral, analyzed in two different samples. Mg and Mn were not detected. Abbreviation: bdl = below detection limit.*

[b] *The chemical composition of the ankangites was recalculated analytically because V interfered with both Cr and Ti in the electron microprobe.*

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"Paraíba" quartz with copper inclusions from Brazil. "Medusa" quartz from the Brazilian state of Paraíba is known to contain two types of inclusions (Fall 2005 GNI, pp. 271–272). The blue or green jellyfish-shaped inclusions near the colorless core of the quartz crystals were ascribed to gilalite, a rare Cu-silicate. In addition, tiny blue-to-green acicular crystals of an as-yet-unidentified Cu-silicate mineral were documented near the surface of the quartz. Recently, this author bought several polished pieces of this type of quartz in Brazil (where it is sold as "Paraíba" quartz) that contained a third type of inclusion.

Overall, this quartz appeared mottled red-brown (e.g., figure 31), but when viewed in profile with magnification, the material was seen to consist of a bottom layer of colorless-to-purplish quartz in sharp contact with an upper (genetically younger) layer containing abundant fine fibers that formed thin bundles up to about 1 mm long. The fibers typically had a copper color that was easily seen in reflected light (figure 32). A simple electrical conductivity test performed on some exposed fibers proved their identity as copper. Their shape is very unusual for native copper, and they almost certainly formed as pseudomorphs (replacements) of the original fibrous Cu-silicate. Additional evidence for this origin is provided by blue remnants present among the copper fibers. The conversion of a Cu-silicate to native copper is indicative of a strongly reducing environment.

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SYNTHETICS AND SIMULANTS

Artificial glass showing color change when exposed to light. The SSEF Swiss Gemmological Institute recently analyzed a faceted oval that was sold in India as an "extraterrestrial gemstone." The 9.57 ct specimen appeared light yellow when it was removed from the stone paper and viewed with incandescent light (figure 33, left). However, when exposed to a strong fiber-optic halogen lamp for a few seconds, it turned dark bluish gray (figure 33, center); daylight had a similar, if weaker, effect. Exposure to long-wave UV resulted in a less-pronounced color change; under short-wave UV, only a slight color shift was observed. When the sample was heated in water to about 80°C, the color change quickly reversed, but with an intermediate step in which the stone turned brown (figure 33, right). The same reversible color change sequence was also observed without heating when the sample was kept in the dark for

Figure 31. This 11.68 ct quartz cabochon from Brazil represents a new type of "Paraíba" quartz. Photo by J. Hyršl.

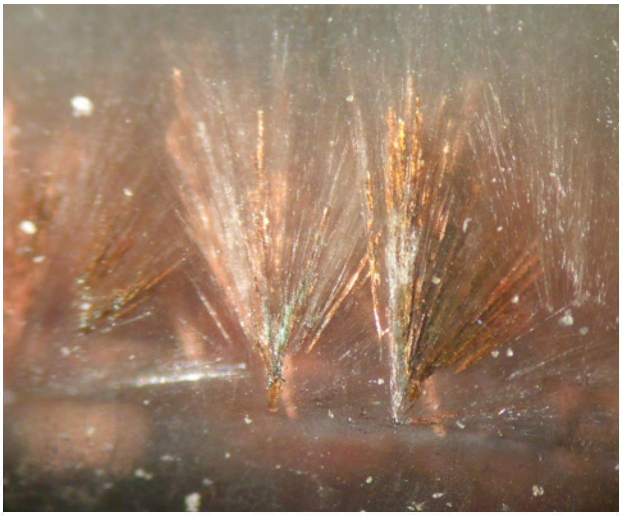


Figure 32. The new "Paraíba" quartz contains fibrous inclusions of native copper (here, 1 mm long). Photomicrograph by J. Hyršl.

several hours. In optics, this reversible color change on exposure to light is called a *photochromic* effect, with the reversal rate being temperature dependent (i.e., increasing the temperature speeds up the reversal).

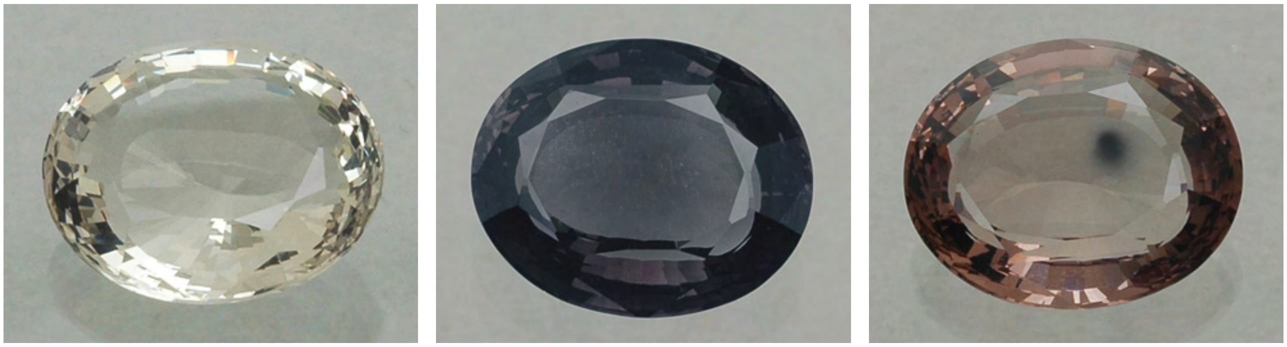
Standard gemological testing established the following properties: RI—1.524; hydrostatic SG—2.395; polariscope reaction—isotropic; UV fluorescence—slight green to long-wave and chalky yellow to short-wave. No radioactivity was detected with a Geiger counter, and microscopic examination revealed no inclusions.

EDXRF spectroscopy showed major amounts of Si and Al, along with K, Ca, and Ti as minor elements, and traces of Pb, Zr, Ag, and Br. Based on the gemological properties, chemical data, and the lack of inclusions, we identified the material as a photochromic artificial glass. The Raman spectrum showed no characteristic peaks, highlighting the specimen's amorphous state. Interestingly, the intense green laser beam (514 nm) of the Raman unit produced a reversible dark gray spot in the stone (again, see figure 33, right), similar to the color produced by exposure to the fiber-optic lamp.

Using SSEF's portable UV-Vis spectrometer (see www.ssef.ch/en/news/pdf/UV-Vis.pdf), we examined the characteristic absorption features for each color state: yellow, bluish gray, and brown (figure 34). With this instrument, absorption and luminescence can be measured simultaneously in a few seconds over the whole spectral range, which is especially important for photosensitive materials. Common sequential spectrophotometers would only show a mixture of the absorption spectra from the three color states.

The spectrum of the light yellow state showed only a very slight increase in absorption toward the blue region. The spectrum of the dark bluish gray state revealed a broad absorption at ~600 nm and two smaller bands at ~500 and 650 nm, respectively; a transmission window at ~450 nm was responsible for the bluish gray color. Finally, the brownish state spectrum showed no particular absorption at 600 nm but a general increase in absorption toward the shorter wavelengths, resulting in the brown color.

Figure 33. This 9.57 ct photochromic artificial glass appeared light yellow before (left) and dark bluish gray after (center) exposure to a fiber-optic lamp. This reversible color change had an intermediate brown stage (right). The dark spot in the right photo is due to the Raman laser. Photo by Luc Phan, © SSEF.



Such an effect is well known for industrial photochromic glass (e.g., for sunglasses) that is doped with halogenides such as silver bromide (AgBr). Exposure to light—particularly in wavelengths ranging from blue to long-wave UV—transfers an electron from the Br^- ion to the Ag^+ ion, which becomes light-absorbing metallic silver. When shielded from light, the glass slowly returns to its original state.

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Some unusual dyed imitations. Researchers at the University of Nantes recently examined two types of imitations fashioned from dyed materials that are rarely used as simulants. The first type consisted of two faceted ovals (5.52 and 7.12 ct; e.g., figure 35, left) sold as ruby in Jaipur, India. With magnification, it appeared that the red color was concentrated in fractures; the stones were otherwise virtually colorless (e.g., figure 35, right). The samples were singly refractive (RI = 1.738) and had a hydrostatic SG of 3.62. These values are consistent with grossular.

Fourier-transform Raman spectra obtained with a Bruker RFS 100 spectrometer showed peaks at 877, 828, 550, 419, and 374 cm^{-1}, also consistent with grossular. The chemical composition was measured with a JEOL 5800 SEM equipped with a high-resolution Princeton Gamma Tech IMIX-PTS germanium energy-dispersive detector operating with an accelerating voltage of 20 kV, a current of 1 nA, and a 37° take-off angle. We measured a composition (at.%) of ~14.8% Si, 15.0% Ca, 9.5% Al, 0.1% Mn, 0.7% Fe, and 59.7% O; analyses of both samples showed only slight variations of <0.2%. This indicated nearly pure end-member grossular, a material seen only rarely.

The second type was a red pierced disk, or *pi* (50 mm in diameter, 11 mm thick; figure 36), that was sold as red chalcedony. It was purchased intact and then accidentally broken. As the interior of the sample was largely colorless (figure 36, right), the owner correctly deduced that the stone had been dyed and she submitted it to our lab for confirmation. Again, the red color appeared to be concentrated in fractures. The sample was singly refractive (RI = 1.559) with a hydrostatic SG of 2.60, values consistent with serpentine. The Raman spectra showed peaks at 1048, 685, 644, 532, 461, 378, and 231 cm^{-1}, and the chemical composition (at.%) was 16.96% Si, 24.05% Mg, 0.42% Al, and 58.58% O. Both sets of data also indicated serpentine.

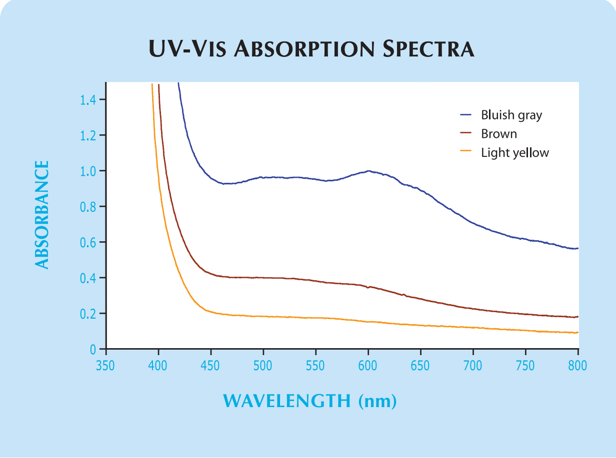

Figure 34. These UV-Vis absorption spectra illustrate the differences in the light yellow, bluish gray, and brown color states of the photochromic artificial glass sample.

Powder X-ray diffraction analysis, with an INEL CPS 120 X-ray diffractometer, gave a pattern for antigorite. In particular, the peak at 59.06° 2θ is unique to antigorite among the serpentine group minerals.

Both the garnets and the serpentine fluoresced vivid orange to both long- and short-wave UV radiation. Orange luminescence is uncommon for serpentine as well as for garnet species that typically occur in reddish hues. Cleaning the samples with acetone removed some of the red dye.

It is rare for garnet to be dyed to imitate ruby, or for serpentine to be dyed to imitate chalcedony. The use of unusual gem materials as starting materials—nearly pure grossular and antigorite—made these samples especially notable.

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Emmanuel Fritsch

Blanca Mocquet and Yves Lulzac
Centre de Recherches Gemmologiques, Nantes

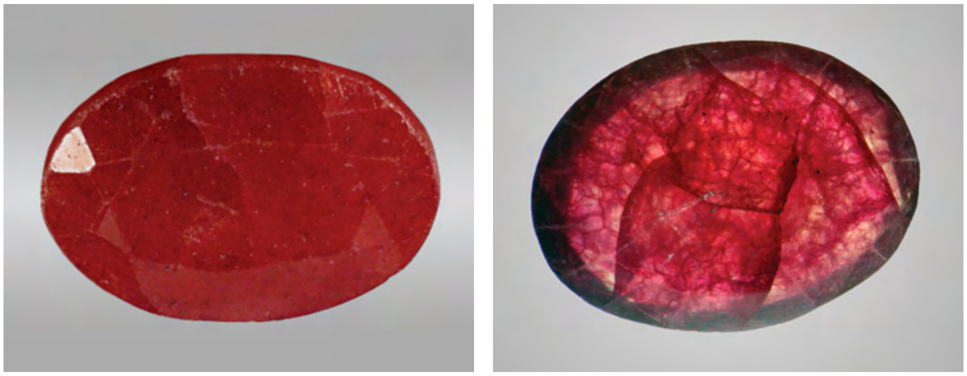

Figure 35. The faceted oval on the left (7.12 ct) was sold as ruby, but proved to be dyed grossular. Further examination revealed concentrations of red color in fractures (right). Photos by B. Rondeau (left) and B. Mocquet (right).

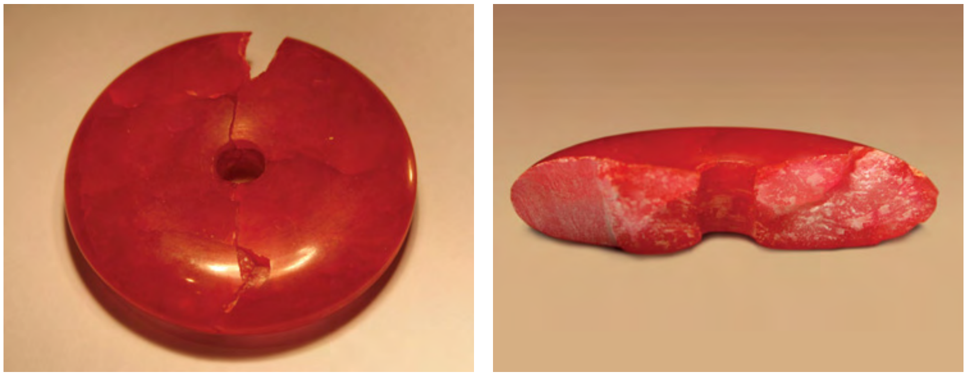

Figure 36. This pierced disc (left, 50 × 11 mm), sold as red chalcedony, is actually dyed antigorite. The sample was accidentally broken, revealing concentrations of red color in fractures (right). Photos by B. Mocquet.

CONFERENCE REPORTS

International Kimberlite Conference. The ninth IKC was held August 10–15, 2008, at Johann Wolfgang Goethe University in Frankfurt, Germany. This typically quadrennial meeting, the most important scientific conference on diamond geology, brought together nearly 500 geologists and other researchers to share the latest information on the conditions of diamond formation and current efforts to locate new diamond deposits. Several of the oral and poster presentations were of gemological interest. Abstracts of all presentations are available at www.9ikc.uni-frankfurt.de/scientific_program.html.

George Read (Shore Gold Inc., Saskatoon, Canada) opened the conference with a review of the current state of diamond exploration, mining, and marketing, while noting developments in the understanding of diamond geology since the 2003 IKC. **Dr. David Phillips** (University of Melbourne, Australia) discussed evidence that suggests the rich alluvial diamond deposits along the west coast of southern Africa were produced not only by the Orange River drainage system, but also by paleo-drainage in the general area of the present-day Karoo River, farther to the south. **Dr. Tania Marshall** (Exploration Unlimited, Johannesburg) presented a genetic model for the formation of the Ventersdorp alluvial deposit in South Africa, which has produced an estimated 14 million carats of rough diamonds over the past century. **Debbie Bowen** (Letšeng Diamonds Ltd., Maseru, Lesotho) described the characteristics of diamonds from the two Letšeng-la-Terae kimberlites, where some 75% of the mine production is gem-quality material and approximately 19% of the diamonds from the main kimberlite pipe are type IIa. Since 2003, the mine has produced 25 crystals larger than 100 ct; a 215 ct colorless type IIa diamond was found there in January 2007 and a 478 ct piece of rough was found in September 2008.

Dr. Sonal Rege (Macquarie University, Sydney, Australia) presented chemical data for more than 40 elements from the LA-ICP-MS analysis of approximately 500 diamonds. These trace elements are present in microscopic and submicroscopic inclusions that are believed to represent the fluid from which the diamonds crystallized; there was too much overlap for the data to be useful for geographic origin determination. From a study of diamonds from Yakutia, **I. Bogush** (ALROSA, Mirny, Russia) presented an analysis of IR spectroscopic data suggesting that diamonds from particular geographic sources might be distinguished by their unique spectral signatures and the relative proportions of various optical defects.

Dr. David Fisher (DTC Research Centre, Maidenhead, United Kingdom) reviewed the current understanding of the effect of HPHT treatment on brown diamonds. The brown color is thought to be due to absorptions related to vacancy clusters in the diamond lattice. According to this theory, HPHT annealing breaks up these clusters to release individual vacancies, removing the cause of the brown color or—if the vacancies interact with nitrogen impurities—creating other colors. **Dr. Victor Vins** (New Diamonds of Siberia, Novosibirsk, Russia) reported on the HPHT color alteration of type IaA and IaB brown diamonds that exhibited evidence of strong plastic deformation. Heating above 1800°C at 7 GPa for 10 minutes transformed their color to yellow-green, with accompanying changes in spectral features. **Dr. Lioudmila Tretiakova** (GCAL, New York) reviewed the use of IR and photoluminescence spectroscopy to characterize the distinctive optical defects of both natural brown and HPHT-treated type IaAB and IIa diamonds.

The 10th IKC will take place in 2012 in Bangalore, India.

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ERRATA

In figure 34 (p. 339) of the Winter 2008 article by D. Schwarz et al. titled "Rubies and Sapphires from Winza, Central Tanzania," the polarized UV-Vis-NIR spectra should have been labeled to indicate that the red line is for $E \parallel c$ and the black line is for $E \perp c$. In addition, the colors of the red and black lines in spectra A should have been reversed. See the *G&G* Data Depository (www.gia.edu/gemsandgemology) for the corrected version.

The Winter 2008 article on the Wittelsbach Blue (pp. 348–363) contained two minor errors: Laurence Graff's name was misspelled, and the final auction price including the buyer's premium for the diamond was incorrectly described as the "hammer price."

Gems & Gemology regrets the errors.