GEM N·E·W·S

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TUCSON 1999

The 1990s ended with a quietly productive season at the various Tucson gem and mineral shows, where many new items were brought to our attention. The editorial team spent two weeks visiting almost all of the 27 shows. Information was also gathered by GIA Gem Trade Laboratory staff members Philip Owens, Cheryl Wentzell, Dr. Ilene Reinitz, Karin Hurwit, Maha DeMaggio, and contributing editors Dino DeGhionno and Shane McClure, as well as by Phil York and Wendi Mayerson of GIA Education, collection curator Jo Ellen Cole, and *G&G* senior editor Brendan Laurs. Highlights of the information we gathered, and some of the many items seen, are presented here. Additional reports from Tucson '99 will appear in future Gem News sections.

DIAMONDS

Fashioned diamonds from the Ekati mine, Northwest Territories, Canada. Faceted diamonds from Canada's first diamond mine, Ekati (see, e.g., Winter 1998 Gem News, pp. 290–292), were available in the United States for the first time, at the AGTA show. Craig de Gruchy of Sirius Diamonds (at the booth of Barker & Co., Scottsdale, Arizona) showed Dr. Ilene Reinitz several round brilliants. Six of the diamonds, which weighed from 0.75 to 1.01 ct, had been graded by the GIA Gem Trade Laboratory; they ranged in color from E to J, and in clarity from VVS_1 to VS_1 (figure 1). All had been cut by Sirius Diamonds, Vancouver, British Columbia, which is one of the first companies to manufacture Canadian diamonds in that country. According to Mr. de Gruchy, each Ekati diamond faceted by Sirius is laser inscribed with a polar bear logo (figure 2).

Synthetic diamonds widely available. Alex Grizenko of the Russian Colored Stone Co. (RCS), Golden, Colorado, reported that scientists working for RCS have improved their growth processes and quality control over the last year. They can now grow synthetic diamonds with few inclusions in relatively large sizes—up to 5.5 ct rough. A variety of colors are being produced: yellow, blue, and treated pink, red, orange, and color-change (figure 3), as well as near-colorless material. Yields for fancy shapes, especially rectangles, can be quite high, resulting in fashioned synthetic diamonds up to about 4.5 ct. Faceted goods are sold under the trademark "Ultimate Created Diamonds." The company currently produces 300–400 carats of crystals per month. However, they are poised to increase production at least 10-fold, in about equal amounts of near-colorless and saturated colors.

According to Mr. Grizenko, these synthetic diamonds have the same properties as those GIA has examined in the past (see, e.g., J. E. Shigley et al., "A chart for the sep-

Figure 1. These six diamonds (0.75–1.01 ct) represent some of the early production from the newly opened Ekati mine, Northwest Territories, Canada. They were fashioned in Canada as well. Courtesy of Sirius Diamonds; photo by Maha DeMaggio.

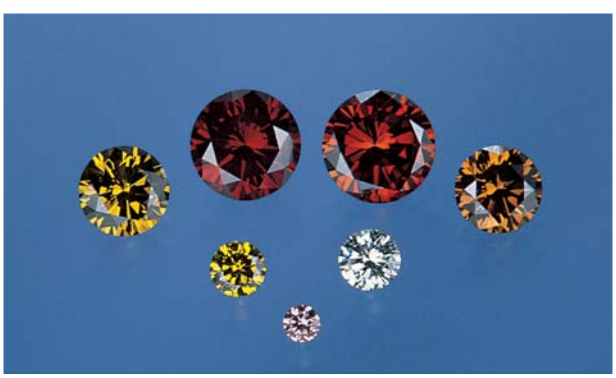
Figure 2. Sirius Diamonds laser inscribes a stylizedpolar bear on the girdle of each Ekati diamond they facet. This stone weighs about 1 ct; photo © Anthony de Goutière.

aration of natural and synthetic diamonds," Winter 1995 *Gems & Gemology*, pp. 256–264; Spring 1995 Gem Trade Lab Notes, pp. 53–54; and Winter 1998 Gem Trade Lab Notes, pp. 286–287). Dr. Ilene Reinitz, who spoke with Mr. Grizenko at Tucson, confirmed the reported properties. In particular, all of the RCS near-colorless synthetic crystals show phosphorescence after exposure to SWUV, although the strength of the reaction varies greatly from one sample to another.

Dr. Reinitz also spoke to another purveyor of synthetic diamonds, Dr. Leonid Pride of the Morion Co., Brighton, Massachusetts. This company works with crystal growers in the eastern Ukraine. Dr. Pride showed her (predominantly rough) yellow, blue, treated red, and heavily included near-colorless synthetic diamonds, ranging from 0.18 to 1.24 ct.

In addition, Gem News editor John I. Koivula saw a yellow synthetic diamond crystal at the GJX show that had triangular growth hillocks (resembling etched trigons, but raised above the surface of the crystal) on the octahedral faces. These hillocks showed a positive orientation to the host face—that is, the triangles were parallel to the triangular sides of the octahedral crystal face—instead of the negative orientation seen for the etched trigons on natural diamond crystals (a photograph of similar triangular growth hillocks on a synthetic diamond is shown as figure 5 on p. 48 of the Spring 1997 issue of *Gems & Gemology*). In conversations with dealers offering both materials at the show, Mr. Koivula was amused to note that synthetic moissanite was more expensive than synthetic diamond.

Figure 3. These 0.04–1.07 ct round brilliant synthetic diamonds illustrate some of the as-grown and treated colors available this year. Courtesy of Alex Grizenko; photo by Maha DeMaggio.



COLORED STONES AND ORGANIC MATERIALS

Cat's-eye andradite from San Benito County, California. Although this material is not new (see T. Payne, "The andradites of San Benito County, California," Fall 1981 *Gems & Gemology*, pp. 157–160), recently a lease was activated in the area by Steve Perry Minerals, Davis, California. Mr. Perry was marketing rough and cut material that had been mined at the Yellow Cat claim since November 1998 (figure 4). The deposit is located about 12 km northwest of the Benitoite Gem mine, within the same serpentinite body. The andradite occurs in fractures cutting the serpentinite, together with dark green chlorite (ripidolite) and traces of black perovskite and white apatite.

The deposit produces mineral specimens and limited amounts of cutting rough of the yellow-green to brownish orange variety of andradite. So far, about 300 grams of cat's-eye rough have been extracted, with cutting yields of about 10%–15%. Smaller quantities of facet-grade rough are recovered: Mr. Perry estimates that the year's production will yield about 50 carats of faceted material (see, e.g., figure 5). Of this, about 75% is "honey colored," 10% is orange, and 10% is yellow (all of these hues are sometimes called "topazolite" in the trade);

Figure 4. Small amounts of cat's-eye andradite (shown here, 0.65 and 6.09 ct) are being mined again in San Benito County, California. Courtesy of Steve Perry; photo by Maha DeMaggio.

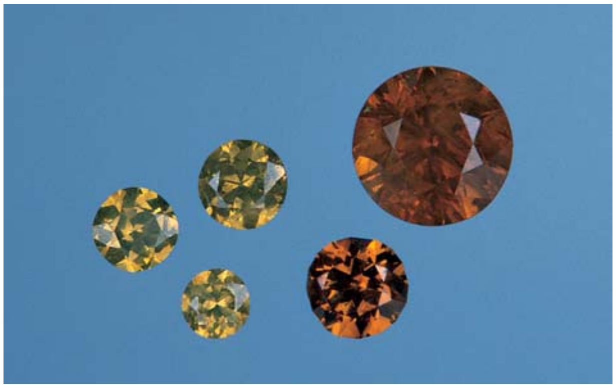


Figure 5. These faceted andradites (0.07–1.10 ct) illustrate the range of color in which the San Benito County material occurs. The greenish yellow stones are typically smaller than those with warmer yellow to-orange hues. Courtesy of Steve Perry and Len Pisciotta; photo by Maha DeMaggio.

another 5% is greenish yellow. Eye-clean finished stones are usually smaller than 0.5 ct, and faceted andradite larger than 1 ct from San Benito County is rare. Mr. Perry projects that small amounts of material will continue to be produced.

An "enhydro" emerald from Colombia. Although quartz crystals and agates are the usual hosts for large fluid inclusions with movable gas bubbles—"enhydros"—this rare feature can occur in other materials as well. For instance, enhydro gypsum crystals were seen at Tucson this year, and we reported previously on an enhydro tanzanite crystal (Spring 1997 Gem News, p. 66). At the 1999 AGTA show, Ray Zajicek of Equatorian Imports, Dallas, Texas, loaned us for examination a 20.95 ct doubly terminated emerald crystal (figure 6) he had acquired in Colombia that contained a large fluid inclusion with a movable gas bubble (figure 7). The fluid-and-gas-filled inclusion in the emerald was so large that the specific gravity of the stone was only 2.62 (rather than a more typical 2.72). Additional properties were: refractive indices—1.573–1.580; "Chelsea" color filter reaction—red; and inert to both long- and short-wave UV radiation. The inclusion appeared natural, and we saw no evidence of clarity enhancement in this emerald crystal.

Abundant eudialyte. Eudialyte is an uncommon mineral found in alkali- and zirconium-rich intrusive rocks, such as in Canada, Greenland, and the Kola Peninsula of Russia; it is rarely seen in gem quality. (The gemological properties of a faceted 0.36 ct eudialyte from southwestern Quebec, Canada, were reported in the Winter 1993 Gem News, pp. 287–288.) This year, Bill Gangi of Bill Gangi Multisensory Arts, Tucson, had unusually large quantities of fashioned eudialyte, which he showed contributing editor Shane McClure. Mr. Gangi has purchased the entire mine run of more than 45 kg of brightly colored eudialyte-rich rock from a mine in eastern Canada. The eudialyte was fashioned into free-form cabochons that incorporated portions of the matrix (figure 8). Other minerals present in this material were feldspar, tourmaline, fluorite, and galena.

New cuts for Oregon sunstone. Although not a new material, Oregon sunstone continues to intrigue cutters and carvers (see, for example, the "watermelon" sunstone carving in Summer 1997 Gem News, p. 145). Klaus Schäfer of Idar-Oberstein, Germany (who was in Tucson at the booth of Bernhard Edelsteinschleiferei, Idar-Oberstein), has faceted this material in a manner that highlights the copper inclusions (figure 9). Schäfer includes matte-finished facets in his fashioned sunstones to direct light through the stone so that some inclusion layers are prominent and others recede. To produce the matte facets, he uses silicon carbide applied with a brush to an iron lap wheel.

Near-colorless forsterite. K. K. Malhotra of K&K International, Falls Church, Virginia, loaned contributing editor Shane McClure a near-colorless 6.20 ct cushion-cut stone (figure 10) from Sri Lanka. The stone appeared

Figure 6. This Colombian emerald crystal (20.39 × 11.62 × 8.76 mm) contains a large fluid inclusion with a movable gas bubble. Specimen courtesy of Ray Zajicek; photo by Maha DeMaggio.

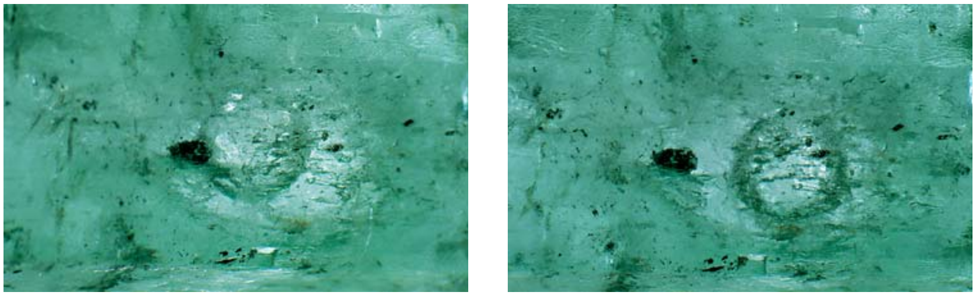


Figure 7. As the emerald is tilted (left, right), the gas bubble moves in the 2.4-mm-long fluid-filled cavity. Photomicrographs by John I. Koivula.

pale green when viewed table-down, but it was essentially colorless when viewed table-up. It had R.I. values of 1.639–1.670 and an S.G. of 3.25. Its absorption spectrum showed only a weak, sharp peak at 495 nm. The stone was inert to both long- and short-wave UV radiation. Microscopic examination revealed numerous parallel strings of whitish clouds. A Raman spectrum had major peaks at 857 and 825 cm^{-1}, and smaller peaks at 968, 919, 608, 434, and 306 cm^{-1}. All of these properties were consistent with olivine that contains little or no iron (i.e., end-member forsterite). EDXRF analysis of the forsterite by GIA Gem Trade Laboratory research associate Sam Muhlmeister revealed major amounts of magnesium and silicon, some iron, minor manganese, and traces of zinc and calcium. The trace elements suggested a natural origin for the stone (see, e.g., K. Nassau, "Synthetic forsterite and synthetic peridot," Summer 1994 *Gems & Gemology*, pp. 102–108).

The most common series in the olivine mineral group is that between forsterite (Mg_2SiO_4) and fayalite (Fe_2SiO_4). The common gem variety of olivine, peridot, is forsterite with about 12 atom percent iron substituting for magnesium (see, e.g., W. A. Deer et al., 1974, *An Introduction to the Rock-Forming Minerals*, Longman Group Ltd., London, pp. 1–7) and R.I. values of 1.654–1.690. This sample of colorless gem-quality forsterite contained only about one-third as much iron as typical peridot (as estimated from the EDXRF data), which would account for its colorless appearance. It was surprising to see a natural gem forsterite—not a peridot—of this large size.

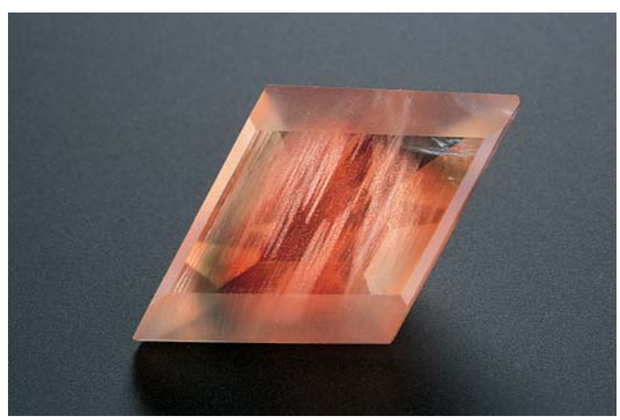
"Watermelon Garnet." The variety of elbaite tourmaline that has a pink center and green rind is familiar to most people in the gem trade as "watermelon" tourmaline. This form of tourmaline is routinely cut perpendicular to the length of the crystal and sold as polished slices for jewelry applications. Recently, Bill Heher of Rare Earth Mining Co., Trumbull, Connecticut, sent one of the Gem News editors (MLJ) a polished slab and a polished, tapered cabochon that were reminiscent of watermelon tourmaline in color but not pattern (figure 11). According to Mr. Heher, the material was mined in the 1940s in South Africa, and was represented to him as "hydrogrossular garnet" (commonly referred to as "Transvaal Jade"). He was also told that the material had "high concentrations of chromium and manganese."

Refractive index (spot) values of 1.712 were obtained for both the green and pink areas of the cabochon. We did not determine specific gravity because the samples contained a significant amount of matrix. Both the pink and green portions were inert to long- and short-wave UV radiation, but some areas of the matrix showed white fluorescence to long-wave UV.

The absorption spectrum (as seen with a handheld spectroscope) was interesting in that the green end of the cabochon showed a strong single line at 466 nm; howev-

Figure 8. These five cabochons of eudialyte-rich rock measure about 2–3 cm each. Courtesy of Bill Gangi; photo by Maha DeMaggio.

Figure 9. This Oregon sunstone (about 2 cm across) has been fashioned with some matte-finished facets to bring out the appearance of the copper inclusions. Courtesy of Klaus Schäfer; photo by Maha DeMaggio.



er, as the stone was moved from the green to pink portion across the spectroscope, this absorption line gradually became fainter. It completely disappeared in the pink area that was farthest from the green end.

Another interesting characteristic was noted when the cabochon was analyzed along its length with a laser Raman microspectrometer. By comparison with reference spectra, we identified the green end as vesuvianite and the pink end as hydrogrossular, which was consistent with the gemological properties. Raman spectra obtained at spots intermediate between the two ends indicated a mixture of these phases. This gradation in the Raman spectra down the length of the stone supports the observations of the visible-light absorption spectra, since a line at about 466 nm is characteristic of vesuvianite. As the hydrogrossular became the major phase in the mixture, toward the pink end of the cabochon, the 466 nm line faded out.

Because Mr. Heher had been told that the material contained high concentrations of chromium and manganese, we asked Sam Muhlmeister to measure the chemistry using EDXRF spectrometry. An analysis across the entire sample revealed no evidence of Cr. The chemical elements detected were aluminum, calcium, iron, manganese, silicon, strontium, and titanium.

This material presents an interesting nomenclature dilemma. The primary mineral in the green area, vesuvianite, is more familiar to gemologists as idocrase. The pink material is hydroxyl-rich garnet—hibschite, katoite, or hydrous grossular—and usually simply referred to as hydrogrossular. In the samples we saw, there appeared to be a dominance of hydrogrossular (pink) over idocrase (green), so that "hydrogrossular-idocrase" would be an appropriate name to apply to these bicolored, mixed-mineral gemstones. Mr. Heher had several hundred stones in Tucson. Because brightly colored bicolored gems are always popular, a consistent supply of good-quality material would create its own market in the areas of designer jewelry and small carvings.

Figure 10. This 6.20 ct cushion-cut near-colorless stone, reportedly from Sri Lanka, is natural forsterite. Courtesy of K. K. Malhotra; photo by Maha DeMaggio.

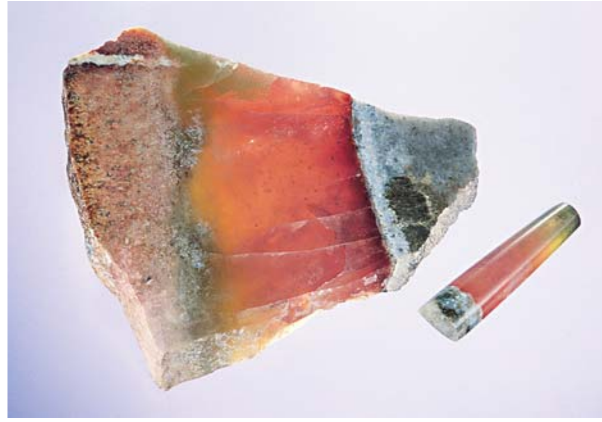


Figure 11. This 8.5 cm polished slab and 25.52 ct cabochon were both cut from hydrogrossular-idocrase rock that was mined in South Africa in the 1940s. Courtesy of Bill Heher; photo by Maha DeMaggio.

New deposits in India and Nepal. Anil Dohlakia of Anil Dohlakia, Inc., Franklin, North Carolina, had several interesting gems that were recently mined from new deposits in Asia. These included kyanite from Nepal; apatite from Rajasthan, India; and chrysoberyl from Andhra Pradesh, India.

The kyanite (figure 12) was found shortly before the Tucson show. Approximately 500 carats have been faceted from the 5% of the rough that was gem quality. The resulting fashioned stones are somewhat large (to more than 10 ct) and range from medium to dark in tone.

The apatite is also notable for the large pieces recovered; the largest fashioned stone Mr. Dohlakia had (which weighed more than 50 ct) is shown in figure 13. He reported that about 200 kg of apatite were available.

About 500 carats of fashioned cat's-eye chrysoberyl

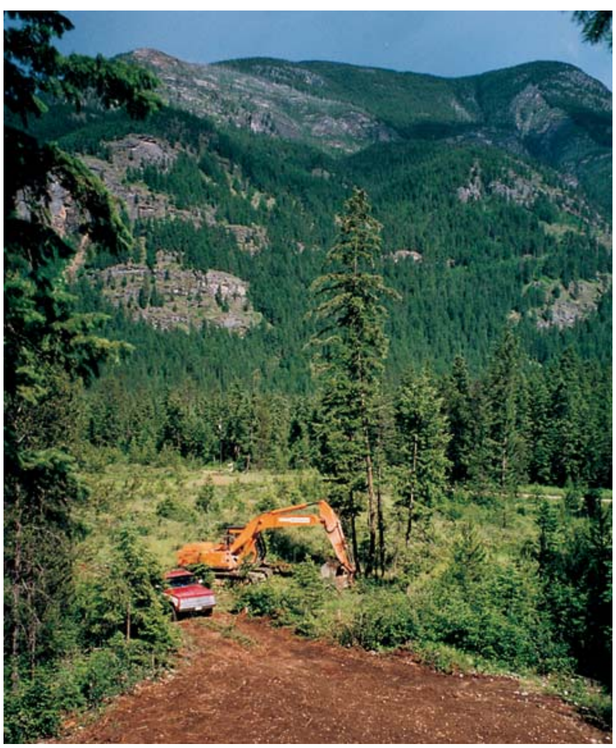
Figure 12. These kyanite ovals from Nepal weigh 6.07, 7.74, and 10.12 ct. Courtesy of Anil Dohlakia; photo by Maha DeMaggio.

Figure 13. Rajasthan, India, is the source of this faceted apatite, which weighs more than 50 ct and measures 29 × 24 mm. Courtesy of Anil Dohlakia; photo by Maha DeMaggio.

were available from the new find near Vishakhapatnam, Andhra Pradesh State. The cabochons ranged up to 20 ct.

Iolite and other gems from Canada. Canadian mining company Anglo Swiss Resources (Vancouver, British Columbia) is developing deposits of several colored gem minerals in the Slocan Valley of southeastern British Columbia. The company's claims cover an area of metamorphic host rock that measures 13,000 acres (about 45 km^2). The following information is based on discussions with Anglo Swiss president Len Danard—who was showing rough and cut material in Tucson—and information provided by geologist James Laird.

Figure 14. The Slocan Valley in British Columbia is being explored and mined for several gem minerals by Anglo Swiss Resources. Bulk sampling at the Blu Moon claim is shown here; the Blu Starr claims are visible on the hillside in the background. Photo courtesy of Anglo Swiss Resources.



The company began by examining their sapphire prospects, particularly at the Blu Moon and Blu Starr groups of claims (figure 14). Gray-to-black sapphires with good asterism (figure 15) were found in the host rock; Mr. Danard estimates grades of 30 carats of finished cabochons per ton of rock. Heat-treatment experiments produced some improvement in the color, but at the expense of the asterism. Mr. Danard hopes to recover more-profitable goods when they start mining their 1,853 acres of newly permitted placer deposits in the Slocan and Little Slocan Rivers this spring. Bright pinkish red pyrope-almandine garnets (again, see figure 15) were also found in the host rock at the Blu Starr claim. The garnet crystals can exceed 10 cm in diameter, but because they are often highly fractured, the largest stone fashioned to date weighs 3 ct. About 250,000 carats of rough garnet were collected during the 1998 mining season, and yields of 46% were realized from pre-trimmed ore.

In November 1998, iolite (again, see figure 15) was found in the host rock at two separate workings, then known as the Rainbow North and Rainbow South zones. These are believed to be part of one continuous rock unit that extends for more than 2 km along the surface. The largest crystal recovered weighed more than 1,500 ct. However, much of this material is also heavily fractured, so the largest iolite faceted thus far weighs only 0.64 ct. Nevertheless, the material shown to one of the Gem News editors (MLJ) was an attractive deep bluish violet, even in small sizes. The company estimates that about one billion carats can be recovered from the surface layers of the deposit.

Amethyst, light blue beryl, moonstone, titanite, and zircon have also been recovered by Anglo Swiss from the Slocan Valley; as of February 1999, all but the zircon had been faceted. Several varieties of quartz (e.g., smoky, star, rock crystal, and rose) have been recovered, as have Japan-law-twinned quartz crystals for use as mineral specimens. Clearly, this area has the potential to produce a large variety of gem materials.

Jasper "planets." One of the pleasures of the Tucson experience is finding materials that are reminiscent of other materials. Many of the resulting Gem News entries are cautionary tales, of the "Don't be fooled by this!" variety. Here is a case where the resemblance is unlikely to cause confusion, however. Two spheres of Mexican jasper (figure 16) were shown to one of the Gem News editors (MLJ) by Jorge A. Vizcarra of OK. Rock's & Minerals Whole, El Paso, Texas. The spheres are unlikely

Figure 15. Among the gems recovered from the Slocan Valley are star sapphires (upper left; largest stone 18 × 12 mm), pyrope-almandine garnets (upper right; rough 9 mm in diameter), and iolite (left; rough 17 mm long). Courtesy of Len Danard; photos by Jeff Scovil, © Anglo Swiss Resources, Inc.

to be confused with giant planets in the outer solar system, but their colors and markings greatly resemble those of Jupiter and Saturn.

Opal in matrix from Brazil. Carlos Vasconcelos of Vasconcelos Brasil, Governador Valadares, had a few samples of opal with good play-of-color (figure 17) from a new deposit near Tranqueira in Piauí State, northern Brazil. The area lies about 200 km south of previously known opal deposits in Piauí, and was discovered about 5 km southwest of another locality that is being mined for orange opal. The deposit was first found about three years ago, but organized mining is just beginning. About 200 carats of rough have been produced thus far.

White and pastel Chinese freshwater cultured pearls. At the AGTA show, Hussain Rezayee of Freiburg, Germany, and Tetsu Maruyama of C. Link International, Tokyo, showed the *G&G* editors several strands and loose samples of freshwater cultured pearls (figure 18) grown on farms in China. This material has been available in abundance lately, in much larger sizes and far better quality than the "rice pearls" of several years ago. The colors include orange, "lavender," pink, and white.

According to a company brochure supplied by Mr. Maruyama, the C. Link farms in China have nearly 500,000 pearl oysters each, and the pearls are tissue

Figure 16. These are not planets visible in the clear skies of Tucson, but jasper spheres (62.8 and 75.3 mm in diameter) from Mexico. Photo by Maha DeMaggio.

Figure 17. This 6 × 5.5 × 2 cm piece of opal in matrix comes from a new deposit in Brazil. Photo courtesy of Carlos Vasconcelos.

Figure 18. These tissue-nucleated freshwater cultured pearls are typical of the better-quality material recently produced in China. The white circled pearls are 11 mm (and larger) in diameter, and the cultured pearls in the other strands range from 9.5 to 11 mm. Courtesy of Hussain Rezayee; photo by Maha DeMaggio.

nucleated rather than bead nucleated. A 9 mm round cultured pearl takes about four years to grow, and those larger than 10 mm require five to seven years. However, 600 tons of 8 mm cultured pearls have been produced (from an unspecified number of farms and an unknown time period). Round tissue-nucleated cultured pearls are relatively rare: Only 3% of the production of 8 mm pearls are considered round by C. Link, and only 5% of this small group are considered top quality.

The largest cultured pearls in this sample measured 12.5 mm in diameter (for rounds) and slightly larger than 15 mm (for button shapes).

Drusy quartz "leaves." At the booth of Rare Earth Mining Co., Trumbull, Connecticut, Dr. Ilene Reinitz saw many colors of drusy agate that had been carved into leaf shapes by Greg Genovese of Cape May, New Jersey (figure 19). We found these shapes to be an interesting and attractive use of geode material—which was, in this case, reportedly from Rio Grande do Sul, Brazil. The leaves ranged from about 10 × 16 mm to over 7 cm long; Mr. Genovese carved 1,000 such pieces during the five months preceding the show. Colors in the rough were chosen for their resemblance to natural leaves, although some material was dyed blue or black.

Twelve-rayed star quartz from Sri Lanka. Star quartz was reported in *Gems & Gemology* several times in the 1980s. These entries included white and brown stones with six-rayed stars, a blue-gray stone with a 12-rayed star, quartz with one strong band (a cat's-eye) as well as less prominent rays, and Sri Lankan samples with multiple centers of asterism (see, e.g., Gem Trade Lab Notes: Winter 1982, p. 231; Summer 1984, pp. 110–111; Spring 1985, pp. 45–46; and Spring 1987, pp. 47–48). This year in Tucson, Michael Schramm of Michael Schramm Imports, Boulder, Colorado, showed Dr. Ilene Reinitz a 31.37 ct star quartz from Sri Lanka (figure 20) that had

Figure 19. These five leaf shapes were carved from drusy quartz by Greg Genovese; the large "oak leaf" on the lower right measures 7.2 × 2.8 cm. Courtesy of Rare Earth Mining Co.; photo by Maha DeMaggio.

Figure 20. This 31.37 ct star quartz from Sri Lanka shows many optical effects, including a 12-rayed star, multiple centers of asterism, and one bright band that looked like a cat's eye when the stone was viewed with low-intensity illumination. Courtesy of Michael Schramm; photo by Maha DeMaggio.

many of these optical effects. This stone contained a 12-rayed star, additional off-axis stars, and a bright central band that had the appearance of a cat's-eye when viewed with low-intensity illumination. As mentioned in the Summer 1984 Lab Note, Dr. Edward Gübelin had concluded that sillimanite was responsible for the asterism in Sri Lankan star quartz.

New finds of spessartine in Brazil. At least three dealers had Brazilian spessartines that were reportedly from new sources. James Dzurus of Franklin, North Carolina, had some spectacular orange spessartines from a deposit in Minas Gerais. He showed contributing editor Shane McClure and editor MLJ a 29 gram piece of rough (with dodecahedral and trapezohedral crystal faces), as well as fashioned stones ranging from 9 to 38.58 ct. The rough was mined during the last two years at an unspecified new pegmatite deposit. We hope to have more information about spessartine from this source in a future Gem News item.

Carlos Vasconcelos had mineral specimens of gem-quality spessartine from a new find at Barra de Cuieté, Minas Gerais. Mining of the pegmatite began about two years ago, initially for ceramic-grade feldspar and gem tourmaline. Since October 1998, about 50 kg of spessartine have been recovered, with 2,000 carats fashioned so far. The largest cut stones reportedly weigh more than 20 ct.

Brian Cook (Nature's Geometry, Graton, California) had samples and photos of a new spessartine find in northeastern Brazil that he is mining with partner Dean Webb (Pan-Geo Minerals, Sebastopol, California). The material was recovered from a granitic pegmatite at the

Figure 21. A number of new localities in Brazil have produced fine-quality gem spessartine. These samples, from northeastern Brazil, weigh 70.90 and 5.45 ct (rough) and 2.66 ct (faceted). Courtesy of Brian Cook; photo by Maha DeMaggio.

Mirador mine in Rio Grande do Norte State. About 5 kg of gem rough have been recovered from this pegmatite since January 1999 (figure 21). The find was so recent that only rough was available; however, a 2.66 ct stone was faceted by gem cutter Jacques Vireo (Precision Cutters of Los Angeles, California) while at the Tucson show. Limited amounts of gem-quality gahnite showing a light green color were also recovered with the spessartine.

TREATMENTS

"Blatant" dyed pearls. With the increasing availability of large freshwater cultured pearls, we saw large quantities of inexpensive cultured pearls that were obviously dyed. The strand in figure 22, acquired in Tucson by contributing editor Dino DeGhionno, consists of 71 drilled cultured pearls with a bright, light green color that is only vaguely similar to a color seen in untreated cultured pearls. Dye concentrations were readily apparent with a

Figure 22. Large quantities of dyed freshwater cultured pearls were seen in Tucson this year. The cultured pearls in this strand range from 7 × 5.5 mm to 8 × 6 mm in diameter. Photo by Maha DeMaggio.

Figure 23. This 99.90 ct free-form promoted as "cultured snow quartz" is actually fused silica glass with a high density of gas bubbles. It makes a convincing imitation of quartzite. Photo by Maha DeMaggio.

microscope. According to David Federman, in the March 1999 issue of *Modern Jeweler* ("Triple Crown," p. 38), Chinese freshwater cultured pearls are commonly bleached during processing. The "rejects" from the bleaching process are dyed "silver" or "pistachio."

SYNTHETICS AND SIMULANTS

Fused silica glass, sold as "cultured snow quartz." Fine-grained quartzite is sometimes tumbled or even fashioned into cabochons, but it is not a gem material that we would expect to see imitated. Nevertheless, Gems Galore of Mountain View, California, was marketing matte-finished tumbled pieces of so-called "snow quartz" (figure 23). According to their literature, the material was produced by "fusing quartz" and then rapidly cooling it to a "quasi-amorphous state." The sample we acquired was composed of two eye-visible layers. Magnification revealed that both layers contained dense concentrations of round bubbles of various sizes, and the boundary between the layers was simply a demarcation between different densities of bubbles. The sample had an R.I. of 1.46, and EDXRF analysis revealed only silicon. Although we could not discern any individual grains, the sample gave an aggregate reaction in the polariscope, probably because of scattering of light by the gas bubbles. On the basis of these properties, especially the low R.I. value and characteristic inclusions, we concluded that this material was silica glass.

Figure 24. This 338.6 ct piece of rough and 8.92 ct cabochon are manufactured slag glass from central Sweden. Photo by Maha DeMaggio.

Blue slag glass from Sweden, resembling opal. Slag glass is a material that seems to be particularly confusing to the amateur field collector. Over the past five years, we have seen several misidentifications of slag as meteorites, emeralds, and obsidian (see, e.g., "Obsidian imitation," Winter 1998 Gem News, p. 301). Still another controversial identity was claimed for a probable slag (manufactured) glass available at Tucson this year: CSD, or "Crash Site Debris," which supposedly had come from the site of a UFO impact at St. Joseph, Missouri, in 1947 ("UFO tale is rocky but rare: 'Alien' debris is just slag, skeptic says," *Arizona Daily Star*, February 5, 1999, pp. 1A, 6A).

It was, therefore, a pleasure to observe a dealer representing slag glass for what it actually is. We acquired a 17.48 × 13.46 × 4.75 mm (8.92 ct) cabochon and a 338.6 ct chunk of rough (figure 24) from Gun Kemperyd Olson of Ingeborgs Stenar AB, Stockholm, Sweden. According to Ms. Olson, this manufactured glass came from the Bergslogen region in central Sweden, where iron has been mined and processed since the 1600s. The cabochon was transparent yellowish green in transmitted light, but appeared milky blue in reflected light. With the microscope, we saw round gas bubbles, linear flow banding, and fluffy-looking aggregates of opaque particles with a metallic luster. The chunk of rough was opaque light blue and showed conchoidal fracture; the fractured surface cut through some of the gas bubbles. Although at first glance this material resembles blue opal (such as that mined in Peru), its microscopic features are distinctive.

The Materials Handbook (G.S. Brady and H.R. Clauser, McGraw-Hill, New York, 1986) defines slag as "molten material that is drawn from the surface of iron in the blast furnace. Slag is formed from the earthy materials in the ore and from the flux. Slags are produced from the melting of other metals, but iron blast-furnace slag is usually meant by the term." The *Handbook* gives a composition of 32[wt.]% SiO_2, 14% Al_2O_3, 47% CaO, 2% MgO, and small amounts of other elements, although there is considerable variation depending on the ore.

Imitation "Chinese freshwater" cultured pearls. Jack Lynch of Sea Hunt Pearls, San Francisco, California, loaned us four samples (figure 25) that had been represented to him as Chinese freshwater cultured pearls. The beads were purchased at a pearl farm about six hours' drive from Shanghai, China; they were supposedly natu-

Figure 25. This grayish purple bead (12.5 mm in diameter) resembles certain Chinese freshwater cultured pearls currently in the marketplace, but it proved to be an imitation consisting of a coated round bead. Photo by Maha DeMaggio.

Figure 26. The surface texture of the imitation pearls shown in figure 25 did not resemble that of either natural or cultured pearls. Photomicrograph by John I. Koivula; magnified 15×.

ral-color freshwater cultured pearls that had been processed to make them round after extraction, and all in the parcel shown to Mr. Lynch were the same color.

The greater availability and wide range of colors of freshwater cultured pearls from China were described in *G&G* in Fall 1998, in both the Gem Trade Lab Notes (pp. 216–217) and Gem News (pp. 224–225) sections. The former entry noted sizes up to 13 × 15 mm for oval cultured freshwater pearls; the latter mentioned treated-color blue-to-gray Chinese freshwater cultured pearls (similar to Tahitian products), as well as "pink, orange, and purple" color varieties. So on that basis, these 12.5-mm-diameter grayish purple round beads were somewhat plausible.

However, microscopic examination revealed a surface texture of many small, flattened bubbles on a uniform background (figure 26), resembling the effects of aerosol painting on a smooth surface, and very unlike the appearance of actual cultured pearls. The perfectly round shape of these undrilled samples was also suspicious. Mr. Lynch kindly gave us permission to slice one open. This revealed a painted shell over a featureless white bead.

Synthetic zincite possibly represented as sphalerite. Although we cannot confirm or refute every rumor that we hear in Tucson, one that came to us from two sources seems worth a comment. At Tucson this year, David and Maria Atkinson of Terra in Sedona, Arizona, mentioned a bright orange material that was being represented as sphalerite from northern Pakistan. They suspected that this material was Polish synthetic zincite, which is being distributed through Russia. Another dealer showed us a faceted oval of synthetic zincite, which was from a parcel of "collector" gems acquired in Sri Lanka.

Synthetic zincite was abundant at Tucson this year, as it has been in recent years, so there is quite a lot of material available for deceptive purposes. To prevent possible misidentifications in the trade, we felt it worthwhile to mention the properties that distinguish orange synthetic zincite from natural sphalerite. The simplest distinctions are: the singly refractive (sphalerite) versus doubly refractive (zincite) optic character; inclusions (fluid inclusions and sulfide crystals in sphalerite; dislocations, clouds of small particles, and small acicular crystals in synthetic zincite); and S.G. (4.09 for sphalerite, 5.70 ± 0.02 for synthetic zincite, although both are heavier than typical heavy liquids). For more on synthetic zincite, see the Spring 1995 Gem News, pp. 70–71, and R. C. Kammerling and M. L. Johnson, "An examination of 'serendipitous' synthetic zincite," *Journal of Gemmology*, Vol. 24, No. 8, 1995, pp. 563–568.

MISCELLANEOUS

Drill holes as design elements: Michael M. Dyber and "Luminaires." American gem carver Michael M. Dyber

Figure 27. This 22.20 ct bicolored African tourmaline was carved by Michael M. Dyber. The carved light tubes, or "luminaires," reflect the stone's color in interesting ways. Photo by Robert Weldon, © Michael M. Dyber.

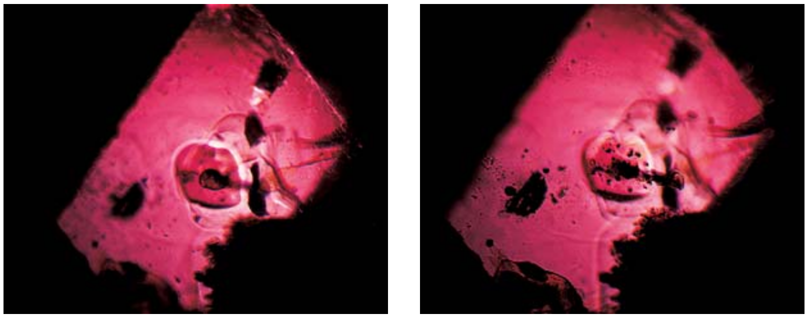


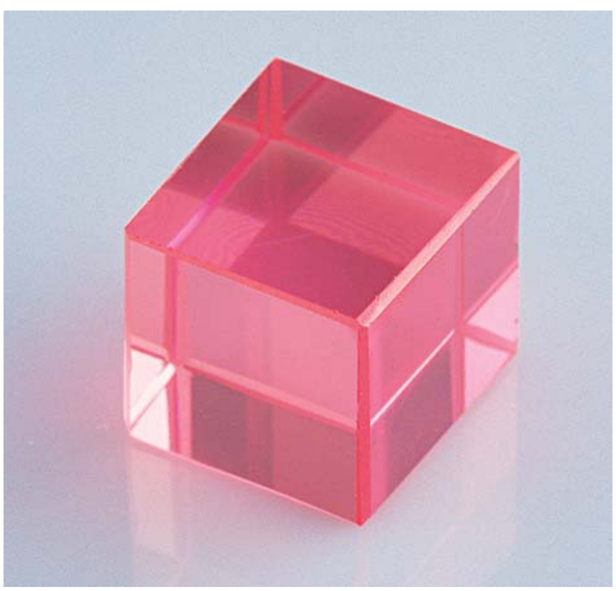
Figure 28. In shadowed transmitted light, a bright Becke line appeared like a halo surrounding the darker red 0.3 mm core (left) in this 0.19 ct spinel octahedron from Myanmar. As the objective was raised (right), the Becke line moved into the core, proving that it has a higher R.I. than the surrounding crystal. Photomicrographs by John I. Koivula.

of Rumney, New Hampshire, has been winning awards for his innovative designs for more than a decade. In the past, he has developed carved gems with "optic dishes"—concave polished curved facets—that reflect and refract light into interesting patterns. This year at Tucson, he introduced gems fashioned with polished cylindrical channels, for which he has trademarked the name "Luminaire." These particular manufactured "inclusions" (figure 27) might be mistaken at first glance for natural etch tubes, or even prismatic mineral inclusions; however, their polished cylindrical shape demonstrates their manufactured nature.

Using mineralogical techniques to solve gemological problems, part 1: Internal "Becke lines" in spinel. In the Winter 1998 Gem Trade Lab Notes section (pp. 288–289), Gem News editor John Koivula reported on a parcel of spinels from Myanmar that contained cores with higher refractive indices than the surrounding crystal. The relative R.I. values were observed using the Becke line method. The Becke line is a narrow band or rim of light that is visible along the boundary between materials with different refractive indices when they are examined with intermediate to high magnification (typically, at least 40×). As the distance between the sample and the objective lens of the microscope is increased (i.e., by raising the microscope objective), the Becke line moves into the region with the higher R.I. The Becke line can sometimes be enhanced by shadowing or other techniques (see, e.g., J. I. Koivula, "Shadowing: A new method of image enhancement for gemological microscopy," Fall 1982 *Gems & Gemology*, pp. 160–164).

The relative R.I. values in the zoned spinel crystals were determined by first focusing sharply on the darker core portion (figure 28, left), and then raising the microscope objective while watching the movement of the Becke line. In both of the samples examined, the Becke line moved into the darker red core (figure 28, right), thus proving that the core had a higher R.I. than the surrounding crystal.

Figure 29. This 60.49 ct block of pink flame-fusion synthetic sapphire was cut to emphasize dichroism. Photo by Maha DeMaggio.



Using mineralogical techniques to solve gemological problems, part 2: "Plato lines" and growth structures in synthetic corundum. During the recent examination of a rectangular block of flame-fusion pink synthetic sapphire belonging to contributing editor Dino DeGhionno, we observed a most unusual anomaly in polarized light. The 60.49 ct block (15.83 × 14.90 × 13.60 mm), which he had

Figure 30. Colorful "Plato lines" are observed in the synthetic sapphire block when it is viewed down the optic-axis direction in cross-polarized light. Photomicrograph by John I. Koivula; magnified 10× .


Figure 31. The subtle mosaic structure becomes visible when the synthetic sapphire block is rotated 90° from the optic-axis direction (left). As the microscope's analyzer is rotated, some of the blocks in the mosaic pattern become dark, while others appear lighter (right). Photomicrographs by John I. Koivula; magnified 10×.

purchased for classroom demonstrations, was oriented to display dichroism dramatically (figure 29). However, it also shows the colorful, strain-related "Plato lines" (Sandmeier-Plato striations; figure 30) that are often observed in flame-fusion synthetic corundum when it is viewed nearly parallel to the optic axis in cross-polarized light (see, e.g., W. F. Eppler, "Polysynthetic twinning in synthetic corundum" Summer 1964 *Gems & Gemology*, pp. 169–174, 191).

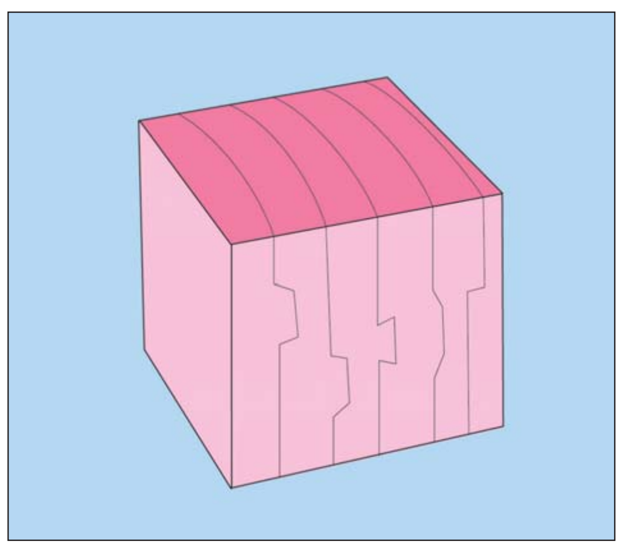
What was curious about this piece, however, is that in addition to the characteristic Plato lines, it shows a very distinctive, yet subtle, form of structurally induced optical activity. In polarized light, this activity appears as relatively thick, interconnected blocks with rectangular edges that, in some areas, give the appearance of a jigsaw puzzle (figure 31, left). When the analyzer of the microscope is rotated, some of the structural blocks in this pattern visibly darken, while others get lighter (figure 31, right). This puzzle-like pattern is crystallographically oriented at about 90° to the optic-axis direction and the Plato lines. Because the pattern is in direct rotational alignment with the long direction of the much more visible Plato lines, when the Plato lines are located—and the block is turned in the direction that they "point"—the next polished face that comes into view is the face that displays the more subtle puzzle-like pattern (figure 32).

This puzzle-like pattern is probably a form of what is known in X-ray crystallography as a mosaic structure; crystals containing such individual "pieces" are referred to as mosaic crystals. As explained by A. Taylor in *X-Ray Metallography* (John Wiley & Sons, New York, 1961, p. 233), mosaic crystals develop when "the lattice takes on the character of a mosaic, in which, without destroying the essential continuity, the mosaic blocks are tilted a few seconds or minutes of arc with respect to each other." This structural misalignment produces strain in the host crystal. In the case of the synthetic corundum, this strain is easily visible with cross-polarized light as the bright interference colors seen in the optic-axis direction, that is, the Plato lines. It therefore appears that the mosaic structure is the actual cause of Plato lines in flame-fusion synthetic corundum. This relationship was overlooked in the past because the visual effect is quite subtle, and gemologists do not usually work with oriented, polished blocks.

ANNOUNCEMENTS

***Nature of Diamonds* at the San Diego Natural History Museum.** The *Nature of Diamonds* exhibit, which debuted in New York at the American Museum of Natural History in 1997, is now in San Diego, California, through September 7, 1999. The comprehensive exhibit demonstrates many aspects of diamond, from its geologic origins to its place in history, art, and adornment, and its various uses in modern technology. Visitors will find a variety of displays ranging from world-famous gems and jewelry to unusual specimens and diamonds in their natural state. A walk-through mine tunnel, a dramatic walk-in vault, and computer animation enhance the interactive experience. Attendees of GIA's 3rd International Gemological Symposium will enjoy a special gala evening viewing at the museum Tuesday, June 22. Contact the San Diego Natural History Museum at 619-232-3821, or visit their Web site at http://www.sdnhm.org, for more information.

Figure 32. This drawing shows the orientation between the mosaic structure in the synthetic sapphire block and the strain-related Plato lines. The optic axis is perpendicular to the top of the cube.



New exhibit at the Royal Ontario Museum. The Inco Gallery of Earth Sciences, an interactive exhibit that explores the Earth's evolution and processes, is scheduled to open May 30, 1999, at the Royal Ontario Museum in Toronto, Canada. One of the exhibit's four main sections is *Treasures of the Earth*, which explains the formation and characteristics of minerals. This section will include the S. R. Perren Gem and Gold Room, which originally opened in 1993 and contains over 1,000 gems. For more details, contact Nikki Mitchell at 416-586-5565, or e-mail nikkim@rom.on.ca.

International Colored Gemstone Association Congress. ICA will hold its next Congress on May 16–19, 1999, in Abano Therme, Italy. Presentations, panels, and workshops will be complemented by a variety of social events. Contact the ICA office in New York at 212-688-8452 for more details.

International Gemological Symposium. The 3rd International Gemological Symposium (hosted by GIA) will take place June 21–24, 1999, at the Hyatt Regency Hotel in San Diego, California. The event, which is held only once every 8–10 years, is known as the "world summit" for the gem and jewelry industry. A distinguished lineup of trade and scientific leaders will speak on the major issues in the industry. Panel discussions, all-new "War Room" sessions, and dozens of poster presentations round out the academic portion of Symposium. To register, contact GIA's Symposium Office at 760-603-4406 (toll-free in the U.S. and Canada, call 800-421-7250, ext. 4406), or register online at http://www.gia.edu.

International Society of Appraisers conference. ISA will hold its 20th annual International Conference on Personal Property Appraising on May 2–5, 1999, in Troy, Michigan. There will be a wide array of lectures, seminars (including "Gemstone Enhancement: Effects on Pricing"), panel discussions, and social activities. For additional information, contact the ISA headquarters at their Web site at http://www.isa-appraisers.org, or call them at 888-472-4732.

Gemstones in upcoming scientific meetings. Special sections on diamonds and/or colored stones will be incorporated into several upcoming meetings on geology, mineral exploration, and advanced analytical techniques:

- The theme of the 4th Annual Penn State Mineral Symposium (May 21–23, 1999) will be *The Mineralogy of Gems and Precious Metals*. For more information, call Andrew Sicree at 814-865-6427, or write Penn State Mineral Museum, 122 Steidle Building, University Park, PA 16802.
- The Joint Annual Meeting of the Geological Association of Canada and the Mineralogical Association of Canada (GAC-MAC) will occur May 26–28, 1999, in Sudbury, Ontario, Canada. Special sessions will focus on the genesis of gemstone deposits and diamond exploration using kimberlite indicator minerals. A one-day short course for nonspecialists will review geophysical exploration techniques for several resources, including gold and diamonds. A separate field trip to the Wawa area in Ontario will focus on exploring for rare-element pegmatites and kimberlites using glacial till and modern alluvium. For more information, contact Laurentian University at 705-673-6572 (phone), 705-673-6508 (fax), or you can visit their Web site at http://www.laurentian.ca/www/geology/1STCIRC.htm.
- GEORAMAN'99: The 4th International Conference on Raman Spectroscopy Applied to the Earth Sciences will be held June 9–11, 1999, in Valladolid, Spain. Applications of Raman spectroscopy to gemology (and other disciplines) will be discussed. Further information can be accessed at http://www.iq.cie.uva.es/~javier/georaman/geoeng.html.

ERRATA:

1. In the Fall 1998 Gem News item "Rossmanite, a new variety of tourmaline" (p. 230), rossmanite should have been described as a new species of the tourmaline group.

2. On page 274 of the Sunagawa et al. article "Fingerprinting of Two Diamonds Cut from the Same Rough" (Winter 1998), figures 6 and 7 are mislabeled. The labels for the a_1 and a_2 directions in the right-hand photo of each figure should be reversed.

3. On pages 264–265 of the Nassau et al. article "Synthetic moissanite: A new diamond substitute" (Winter 1997), the thermal inertia data were printed incorrectly. The sentence at the bottom of page 264 should read: "Because the thermal conductivity ranges of diamond (1.6–4.8 cal/cm °C sec) and moissanite (0.55–1.17 cal/cm °C sec) nearly overlap. . . ." The table below presents the correct data for both thermal conductivity and thermal inertia of diamond and moissanite.

	Thermal conductivity		Thermal inertia
	(cal/cm °C sec)	(W/cm K)	(cal/cm^2 °C sec$^{1/2}$)
Diamond	1.6 – 4.8	6.6 – 20.0	0.82 – 1.42
Moissanite-6H	0.55 – 1.17	2.3 – 4.9	0.30 – 0.63

4. The announcement on page 302 of the Winter 1998 Gem News that the synthetic moissanite article had received an ASAE award should have mentioned Shane Elen as one of the authors.