

GEM NEWS

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TUCSON '98

We always hope that the Tucson shows will unfold like a great novel, with one resounding gemological theme tying together all the disparate subplots. If there was one great theme this year, gemstone treatment certainly earned that title, although it was a subject for education rather than resolution in Tucson. The International Colored Gemstone Association (ICA) and the American Gem Trade Association (AGTA) sponsored a pre-AGTA-show "summit" meeting on treatments with representatives from various gemological laboratories. AGTA also put together an informative display on the main show floor concerning some better-known treatments in emeralds (clarity enhancement) and rubies (glass filling). Conversation throughout the shows often centered on the need for treatment disclosure and the efforts being made by AGTA, ICA, and other organizations to promote such disclosure.

Again, though, Tucson produced many new and/or different gem materials, or ways of using gem materials. We thank Giulia Goracci and Dr. Ilene Reinitz of the GIA Gem Trade Laboratory in New York, and Carlsbad GIA Gem Trade Laboratory regulars Maha DeMaggio, Cheryl Wentzell, and Philip Owens, in addition to our usual contributors, for their help in providing the following report. More information from the Tucson shows will be presented in upcoming Gem News sections.

DIAMONDS

Gem crystals from Russia and China. Because the Tucson shows concentrate on colored stones—or mineral specimens—rather than diamond as a gem material, diamonds at Tucson are commonly sold as mineral specimens, that is, as loose crystals or crystals in matrix (see,

e.g., Spring 1996 Gem News, p. 52). Continuing this tradition, Jack and Elaine Greenspan, of Woody Creek, Colorado, had crystals that displayed several different shapes, including cuboids, octahedra, dodecahedroids, and macles, that were reportedly from Russia (figure 1) and other sources. In addition, diamonds stated to be from China were also available (again, see figure 1) from Ande Jewelry and Mineral Co., of Tucson.

Figure 1. Diamonds were once again available at Tucson as natural crystals. The 0.84 ct dodecahedroid on the left is reportedly from the Mir Pipe, Russia; the 0.17 ct octahedron on the right is believed to be from China. Photo by Maha DeMaggio.



COLORED STONES AND ORGANIC MATERIALS

Andalusite (chiastolite) sphere. Andalusite is usually seen in the gem trade as green to orangy brown faceted stones showing strong pleochroism. However, andalusite is also an important rock-forming mineral, and most crystals in nature are opaque and included. One variety is named for its inclusions: Opaque carbonaceous inclusions form a cruciform pattern in the variety *chiastolite*, which is usually cut into cross-sections to display this pattern. Ande Jewelry and Mineral Co. was offering chiastolite from China fashioned in a different way, as spheres. We examined one 26.33-mm-diameter sphere (figure 2) and found the following gem properties: color—mottled purplish pinkish brown bodycolor with black “spokes”; diaphaneity—opaque; refractive index—1.63 (spot reading); and specific gravity—3.13 (measured hydrostatically).

The four-spoked pattern is typical for this variety of andalusite, and it is a strong clue to the identity of the piece. The dark material (remnants of the host rock) in chiastolite is concentrated at the center of the crystal and along the boundaries between prism faces; the usual explanation for this feature is that these remnants were swept aside by the rapidly growing prism faces (see, e.g., W. A. Deer et al., *Rock-Forming Minerals, Volume 1A: Orthosilicates*, 1982, Longman Group Ltd., London, p. 770).

Coral with a blue sheen from Alaska. Usually when we think of coral, what comes to mind is the white-to-red material produced by colonies of tiny invertebrates (*Corallium rubrum*) in warm waters. This material is pri-

Figure 2. This 148.50 ct (26.33 mm diameter) sphere has been fashioned from the chiastolite variety of andalusite, which is distinctive for the cross-shaped pattern formed by carbonaceous inclusions. Photo by Maha DeMaggio.



Figure 3. This yellowish brown coral (12.34 ct; 40.91 x 9.90 x 5.54 mm), which has areas with blue sheen, is from Alaskan waters. Photo by Maha DeMaggio.

marily made of carbonate minerals. However, there are also black, blue, and golden corals that are produced by different coral species, many of which are threatened or endangered; these materials are composed of conchiolin (a protein), and resemble horn in their gem properties. These latter types are also mainly found in tropical waters off central Africa and Hawaii, as well as Australia and Tasmania. (For more on corals, see R. Webster and P. G. Read, *Gems: Their Sources, Descriptions, and Identification*, 5th ed., 1994, Butterworth-Heinemann, Oxford, England, pp. 559–564.)

Bill Gangi of Bill Gangi Multisensory Arts, Tucson, showed the Gem News editors another variety of coral that is yellowish brown and horn-like in appearance; many samples have areas with a pronounced blue sheen (figure 3). Also unlike other coral materials, it was harvested from depths of 1,000 feet (more than 300 m) in the relatively cold waters of the Gulf of Alaska. According to Mr. Gangi, the source animal is the coral *Primus willemyi*. He is marketing the material as “Alaska Gem Coral.” His stock was legally harvested by a fisherman who was dredging in the 1970s. Mr. Gangi acquired about 100 kg from the tons of material recovered.

Bicolored corundum. Gillian Fitch Inskeep of Gilliana, Sonoma, California, showed the *Gems & Gemology* editors a faceted corundum that poses an interesting nomenclature problem. The 2.11 ct opposed-bar cushion cut was red on one end and blue on the other (figure 4). We have seen the terms *bicolored corundum* (see, e.g., C. P. Smith et al., “Rubies and Fancy-Color Sapphires from Nepal,” *Gems & Gemology*, Spring 1997, pp. 24–41), *bicolored sapphire*, and even *bicolored ruby/sapphire* attached to similar material. Ms. Inskeep believes



Figure 4. One end of this 2.11 ct corundum, reportedly from Vietnam, is blue sapphire, and the other is ruby. Photo by Maha DeMaggio.

that this particular example, which measures 9.12 × 5.26 × 4.38 mm, came from Vietnam.

Emerald from Tocantins, Brazil. Bear and Cara Williams of Bear Essentials, Jefferson City, Missouri, showed the editors several samples of emeralds from a new deposit in Tocantins State, Brazil, about 30 km from Paraíso. According to Mr. Williams, the deposit was found in mid-1996 and has been exploited intensively by *garimpeiros* (independent miners) since mid-1997. The emeralds occur in a schist “pipe” that is 2.5 km long, about 400–500 m wide, and dips downhill to the northwest at 24°. Although Mr. Williams did not know the total production from this new location, he commented that the deposit had been exploited only to a depth of about 1 m thus far. The largest faceted stones produced to date weigh about 5 ct. In the February 27, 1998, issue of *Mining Journal*, London (p. 165), it was stated that Verena Minerals of Toronto, Canada, has acquired an emerald claim near Paraíso for \$212,000 plus royalties. This may be the same property, although the *Mining Journal* describes the deposit as being a “series of pegmatite dykes” rather than a schistose source rock.

Mr. Williams described this material as being very similar in appearance to typical emeralds from Africa: that is, somewhat bluish and dark in color, with inclusions similar to those seen in Sandawana and Zambian emeralds. The stones we saw at his booth appeared bluish green, relatively dark (compared to Colombian stones), and slightly desaturated.

We examined two emeralds from Tocantins in detail, a 5.00 ct oval modified brilliant and a 1.12 ct emerald cut (figure 5). Gemological properties of the stones were as follows: color—green; diaphaneity—transparent; pleochroism—yellowish green to bluish green; optic character—uniaxial; (Chelsea) color filter reaction—very weak orange; refractive indices—1.591–1.600; birefringence—0.009; specific gravity—2.77 (large stone), 2.78 (small stone); very faint yellow luminescence to long-wave UV radiation in feathers only (large stone), or

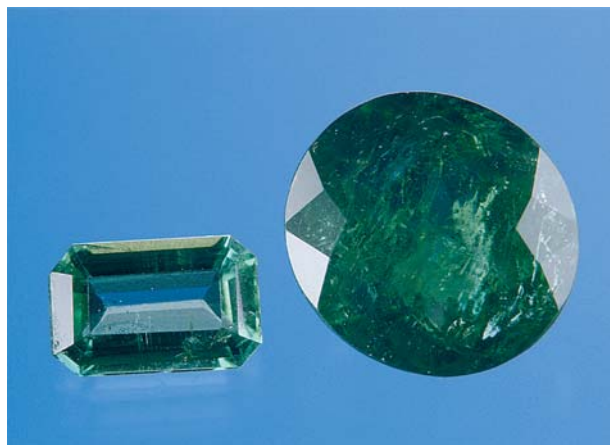


Figure 5. The 5.00 ct oval emerald is reportedly one of the largest stones to have come from the new deposit in Tocantins State, Brazil. The 1.12 ct emerald cut is representative of the cleaner material available from Tocantins State. Courtesy of Bear Essentials; photo by Maha DeMaggio.

inert (small stone); inert to short-wave UV; no visible luminescence; typical emerald spectrum when viewed with a handheld spectroscope (see, e.g., R. T. Liddicoat, Jr., *Handbook of Gem Identification*, 12th ed., 1993, GIA, Santa Monica, California, pp. 139–140). These properties are similar to those that have been recorded in Brazilian emeralds, but somewhat higher than those from other similar environments (see, e.g., J. C. Zwaan et al., “Update on Emeralds from the Sandawana Mines, Zimbabwe,” *Gems & Gemology*, Summer 1997, table 3, p. 97). Both stones contained blocky two-phase (liquid and gas) inclusions and “fingerprints”; the smaller stone also contained needle-like inclusions in parallel orientation, and the larger had iron-stained fractures. Both showed evidence of clarity enhancement.

Spessartine garnet from Madagascar. Spessartine from Madagascar was prominent in Tucson this year. Yellowish to reddish orange to orangy brown garnet from Maevatanana in north-central Madagascar was being marketed by Allerton Cushman & Co., Sun Valley Idaho, and—as “Fireball garnet”—by Hargem Ltd., of Ramat Gan, Israel. According to Mr. Cushman, the garnets are alluvial in origin and are found as a by-product of gold mining in the region. Samples analyzed by Colgem Ltd., of Ramat Gan, Israel, have a composition of 94 mol.% spessartine, 4–6 mol.% almandine, and 1–2 mol.% grossular, with no significant pyrope component.

One Hargem stone was particularly notable for its large size and workmanship. Beginning with a “windowed” block of rough weighing 98.51 ct—which had probably weighed over 100 ct before the window was cut—lapidarist Glenn Lehrer of Lehrer Designs, San Rafael, California, fashioned a 63.14 ct fantasy-cut stone (figure 6, left). This exceptional yield from the rough was due to at least two factors: the free-form shape, and the use of curved facets on the pavilion of the stone (figure 6,

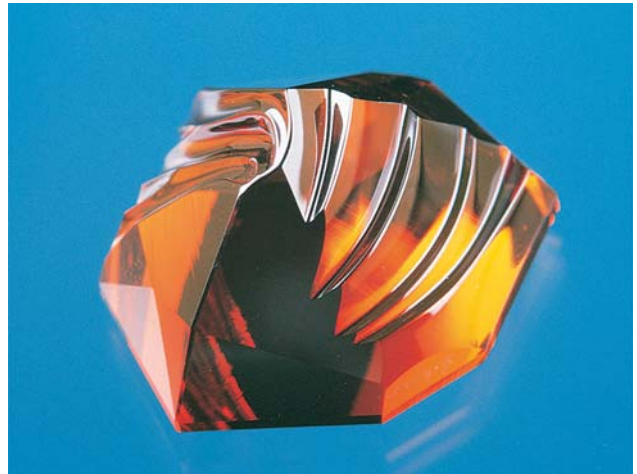
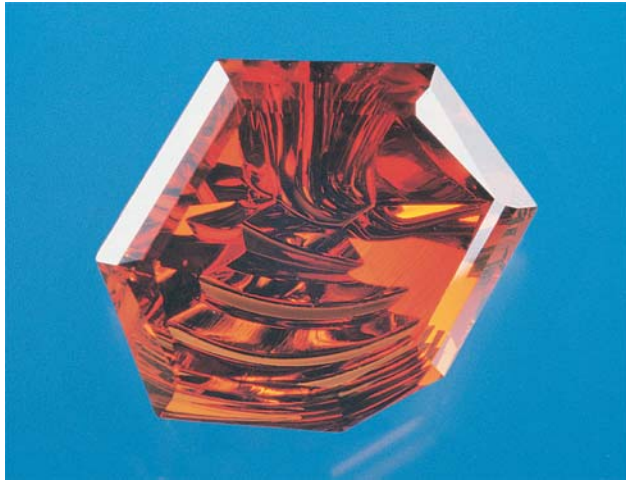


Figure 6. Glenn Lehrer fashioned a 98.51 ct piece of spessartine garnet from Madagascar into this 63.14 ct fantasy cut (left). The curved facets on the pavilion (right) carry the light into the stone. Courtesy of Hargem Ltd.; photos by Maha DeMaggio.

right), which also brought out the color and liveliness of the material. This cutting style is slightly reminiscent of the hollow cabochons in which dark garnets traditionally are cut, but it shows far greater sophistication.

Sphene from Madagascar. Large, gemmy pieces of green to yellowish brown sphene are being recovered from a new deposit in northern Madagascar. According to Tom Cushman, the Emily mine is at the northernmost point of Madagascar, in the region between Antsiranana and Vohemar. The sphene occurs with epidote and quartz crystals in Alpine-type veins cutting calc-silicate host rock; it must be removed using hard-rock mining techniques. A few tens of kilograms of gem material have been recovered since mining began about a year ago. The sphene is notable for its size (figure 7); the largest cut stone seen so far is about 29 ct. Much of the material

Figure 7. This 21.79 ct cushion cut was fashioned by Buzz Gray from a sphene mined recently in northern Madagascar. Courtesy of Allerton Cushman & Co.; photo by Maha DeMaggio.



looks pink when viewed through a (Chelsea) color filter, which suggests that it contains chromium.

Spinel from Vietnam. High-quality pink-to-red spinel was once again available from Luc Yen, in northern Vietnam (figure 8). According to Kent Pham, of International Marketing Consortium (IMC) in Placentia, California, the spinel is recovered as a by-product of ruby mining, so the production is unpredictable. However, some of the crystals are quite large. Mr. Pham displayed over 100 carats of fashioned spinel that were reportedly

Figure 8. These red and pink spinels were recovered recently in the course of ruby mining in the Luc Yen region of northern Vietnam. The crystal at the top weighs 12.81 ct, and the faceted stones weigh 4.46 ct (left) and 3.58 ct (right). Courtesy of IMC; photo by Maha DeMaggio.



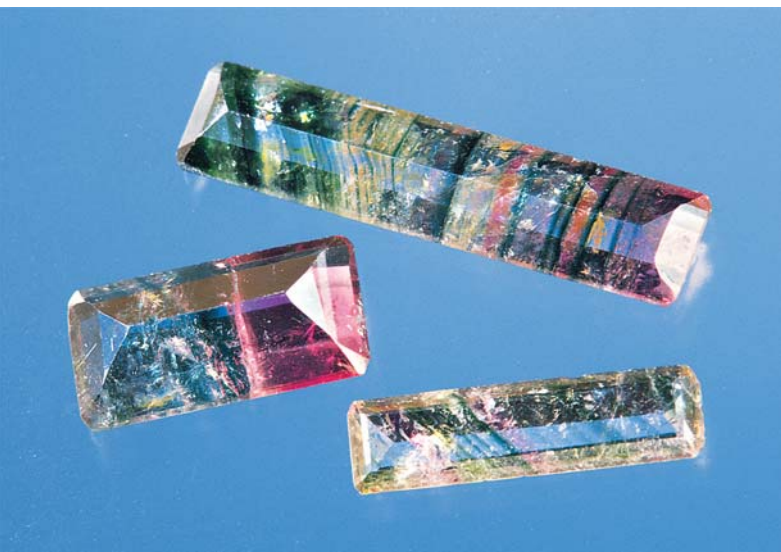


Figure 9. These three faceted liddicoatite tourmalines have been cut to emphasize their color zoning. The stone farthest to the left measures 12.68 x 6.61 x 3.71 mm and weighs 2.84 ct. Courtesy of Allerton Cushman & Co.; photo by Maha DeMaggio.

cut from a single 10 kg piece of rough from this locality. The largest stone faceted thus far weighed 27.25 ct; however, this rough is still being cut. Although we could not obtain gemological data on the stones shown in figure 8, spinel from this locality was described in the Fall 1993 Gem News section (pp. 213–214). The availability of this “by-product” spinel is also significant in that it shows that mining is continuing in the Luc Yen area.

Parti-colored faceted liddicoatite tourmaline. Liddicoatite from Madagascar is not new, but in general it has limited use as a gem material, because most crystals show pronounced color zones that would combine to “muddy” the color of a finished gem. (Because of this zoning, however, slices cut perpendicular to the c-axis are often dramatic, and therefore are sometimes used in jewelry.) Among the many gems from Madagascar that he was displaying, Tom Cushman also had liddicoatite that had been step-cut to emphasize the color zoning (figure 9), with an effect reminiscent of that seen in some fashioned parti-colored fluorite (see, e.g., Summer 1995 Gem News, p. 131). Mr. Cushman had about 50 examples of this material at Tucson, including several matched pairs.

Another tourmaline source in Namibia. Marc Sarosi of Marc Sarosi Co., Los Angeles, had several slightly bluish green faceted tourmalines that reportedly came from a single pocket found on a farm near Windhoek, Namibia (see, e.g., figure 10), which he showed at the booth of Andrew Sarosi. The locality was supposedly discovered by a farmer who was burying his dead dog. These tourmalines were very uniform in color (as was all the rough Mr. Sarosi saw) and quite transparent; the color was less

blue than most of the Neu Schwaben tourmaline described last year (Spring 1997 Gem News, pp. 66–67). About 3 kg of the rough material was recovered in April 1997, of which Mr. Sarosi managed to purchase about 1 kg; none has been discovered at this site since then.

SYNTHETICS AND SIMULANTS

Synthetic amethyst grown over round seeds. For more than a decade, the gem market has been inundated with synthetic amethyst. Again this year, a great deal of this material was available at the Tucson shows. Recently, however, we were informed of a new type of synthetic amethyst, seen in Beijing, China, that was grown on dome-shaped seed crystals. (As a consequence of this shape of seed crystal, the seed would not show an obvious flat plane when the crystals were examined from the side.) Ms. Shen Meidong, of the National Gemstone Testing Center (NGTC) in Beijing, reported on the examination of purple crystals that were recently sent to the Identification Department of the NGTC. All were deep purple and showed “natural” quartz crystal faces (figure 11), including those in the forms r {10 $\bar{1}$ 1}, m {10 $\bar{1}$ 0}, and z {01 $\bar{1}$ 1}. The crystals measured about 12 x 10 x 8–9 mm. Their gemological properties (as determined at the NGTC) were consistent with amethyst, both natural and synthetic.

Although all four samples looked like natural amethyst crystals, each had a dome-shaped colorless central region. These central regions contained two-phase (liquid and gas) inclusions typical of natural quartz. However, the purple overgrowths contained numerous “nailheads”: nail-like inclusions that extended from

Figure 10. This 30.57 ct green tourmaline is from a pocket found on a farm near Windhoek, Namibia. Courtesy of Marc Sarosi; photo by Maha DeMaggio.



small plates on the surfaces of the dome-shaped seeds (see inset figure 11); in addition, many white and brown “breadcrumb” inclusions were seen scattered on the surface of each dome. FTIR spectroscopy confirmed that the amethyst layers were synthetic (by, e.g., the presence of a 3545 cm^{-1} peak in the infrared spectrum; T. H. Lind and K. Schmetzer, “Infrarot Spektroskopie geschliffener Edelstein, dargestellt am Beispiel von echten und synthetischen Amethysten,” *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, Vol. 31, No. 3, 1982, pp. 143–150). Since the crystal forms looked natural, this material could easily confuse all but the most careful observers.

“Glass stones”: Imitation agates. One serendipitous result of the multiplicity of shows that overlap in Tucson in February is the opportunity to visit with our colleagues of the art-glass-making community, who are usually found at the bead shows there. In last year’s Tucson report, we wrote of glass cabochons that resembled opal (see Spring 1997 Gem News, p. 69). This year, we saw glass cabochons that resembled agate. Marilyn Jobe of Ellenton, Florida, makes what she calls “glass stones”: glass cabochons and beads that resemble agate, brecciated jasper, and tortoise shell. Two examples, measuring $37.65 \times 22.35 \times 6.44\text{ mm}$ and $31.06 \times 19.78 \times 6.59\text{ mm}$, are shown in figure 12. Ms. Jobe made these cabochons by fusing old glass that she acquired from an estate sale; the multi-layered appearance makes these agate imitations particularly realistic.

Synthetic moissanite from Russia. In Tucson, Ted Themelis of Gemlab (USA) Co., Athens, Greece, showed us a sample of synthetic moissanite from a source other than C3, Inc., the manufacturers of the material studied by Dr. Kurt Nassau and GIA investigators (see K. Nassau et al., “Synthetic Moissanite: A New Diamond

Figure 12. These 36.95 and 48.82 ct cabochons are not agate, but rather are imitations made from fused glass. Photo by Maha DeMaggio.

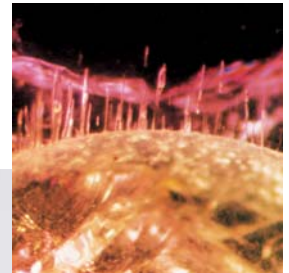


Figure 11. The shape of this approximately 1 cm wide synthetic amethyst crystal, one of several examined recently in China, resembles that of a natural crystal. Because these crystals are grown on dome-shaped seeds, there was no obvious seed plane. Inset: These “nail-head” inclusions extend from the curved seed into the synthetic amethyst. Macro photo by Zhang Tao, NGTC; photomicrograph by Shen Meidong, magnified 25x.

Substitute,” *Gems & Gemology*, Winter 1997, pp. 260–275). The faceted oval (figure 13) we saw in Tucson appeared brown and nearly opaque; with a microscope, we observed a yellow body color and abundant linear opaque black inclusions. Like the C3 material, however, it was still doubly refractive. According to Mr. Themelis, this sample was made in Russia using a vapor deposition technique. Although the sample is not particularly attractive, it indicates that other producers are getting involved in the creation of synthetic moissanite.

INSTRUMENTATION AND TECHNIQUES

Buff-top faceted stones cut from quartz spheres. Gem cutter Arthur Grant of Coast-to-Coast Rare Stones, Martville, New York, is best known for his ability to facet unusual gem materials (such as neodymium pentaphosphate: see, e.g., “Reversible Twinning in an Unusual Synthetic Material,” Winter 1997 Gem News, pp. 307–308). However, he informed the Gem News editors that his favorite material to facet is quartz, and he showed us some unusual cuts that he had designed, starting with fashioned quartz spheres. Figure 14 shows two examples of these “buff-top” stones. The 4.41 ct stone on

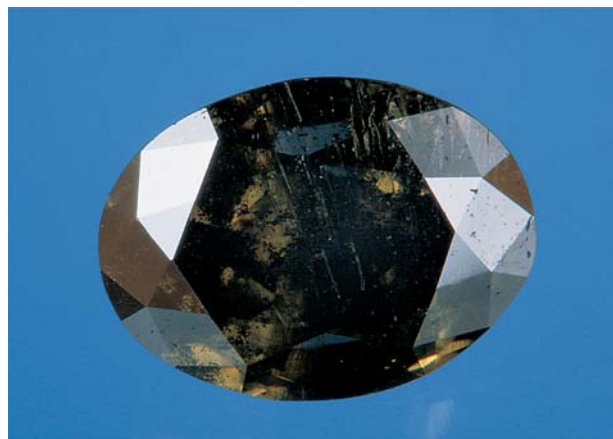


Figure 13. This heavily included faceted synthetic moissanite (approximately 8 mm long) was reportedly made in Russia using a vapor deposition process. Courtesy of Ted Themelis; photo by Maha DeMaggio.

the left—called “Celestial quartz” by Mr. Grant—was fashioned from a sphere that had been coated with a dichroic optical material that transmitted red light and was light greenish blue in reflected light (for more on gems with dichroic coatings, see “‘Tavalite,’ Cubic Zirconia Colored by an Optical Coating,” Summer 1996 Gem News, pp. 139–140). None of the optical coating remained on the faceted pavilion of the sample, and Mr. Grant polished windows through the coating on the crown. The 7.89 ct piece on the right began as a conven-



Figure 14. These buff-top fashioned stones (4.41 ct and 7.89 ct, respectively) were cut by Art Grant and his students from quartz spheres. Photo by Maha DeMaggio.

tional polished sphere; to achieve the effect shown here, Mr. Grant “frosted” the crown surface with sandpaper mounted on a handheld Dremel tool before polishing the windows in the crown.

Mr. Grant is using simple pieces such as these to teach faceting to local high school students; in fact, the pavilions of these pieces were fashioned by his student faceters. To provide the raw material for this work, he purchased the entire stock of dichroic-coated spheres (about 2,000 pieces) from Jewel Tunnel Imports of Baldwin Park, California.

A PRELIMINARY REPORT FROM THE FIRST WORLD EMERALD CONGRESS

The first World Emerald Congress was held in Bogotá, Colombia, February 23–25, 1998, with about 750 participants. The Congress featured over 30 invited talks from industry figures worldwide, as well as panel discussions, exhibits, an emerald auction, and a field trip to the mines at Muzo and Cosquez. The presentations covered every aspect of the emerald sector, including the geology of mining areas in Africa, Brazil, and Colombia, the manufacture and identification of synthetic emeralds, and future challenges facing the emerald industry. However, one of the most important sessions (figure 15) concerned emerald treatments, especially clarity enhancements. The highlights of this session are given below.

Dr. Henry Hänni of the SSEF Swiss Gemmological Institute was the opening speaker. He described a 90% success rate—using a combination of Raman and FTIR spectroscopic techniques—in identifying the substances used to fill fractures in clarity-enhanced emeralds (see, e.g., H. A. Hänni et al., “A Raman Microscope in the Gemmological Laboratory: First Experiences of Application,” *Journal of Gemmology*, Vol. 25, No. 6, 1996, pp. 394–406). Dr. Mary Johnson of the GIA Gem

Trade Laboratory warned that there are at least 10,000 substances that could be used as emerald fillers, so discriminating among them is not a simple task. She also provided standard definitions for many of the terms used in describing filling materials; “resin,” for instance, can be used to describe material that is natural or synthetic, and solid or liquid. Dr. Johnson also discussed the current GIA emerald treatment project, in which hundreds of stones—representing all major localities—will be examined both before and after filling with a variety of substances, with the stones then subjected to various durability tests. (This study is scheduled to be completed and published within the next year.) Emerald dealer Ray Zajicek (Equatorial Imports, Dallas, Texas) offered an important viewpoint from the trade: the desire for a permanent—or at least stable—treatment, which is not itself colored, does not completely mask existing fissures, and can be easily removed. A panel discussion followed, in which Jaime Rotlewicz (Gemtec, Bogotá), Daniel Sauer (Amsterdam Sauer, Rio de Janeiro, Brazil), Ron Ringsrud (Constellation Colombian Emeralds, Bogotá), Kenneth Scarratt (director of the new AGTA laboratory

in New York City), Dr. Dietmar Schwarz and Robert E. Kane (Gübelin Gemmological Laboratory, Lucerne, Switzerland), and GIA GTL manager of identification Shane McClure also took questions from the audience.

The Congress participants appeared to agree on two major courses of action needed with regard to the clarity enhancement of emeralds: (1) gemological laboratories should provide information about the degree to which an emerald has been treated (e.g., slight, moderate, or major levels of clarity enhancement); and (2) treaters, dealers, and even the final consumer should be informed what the optimal filling material (or materials) would be. Until results are made available from the current GIA study on the durability of various emerald treatments, attending delegates from Colombian facilities professed their willingness to use only cedarwood oil in the clarity enhancement of emeralds, unless their customers request another treatment. However, Mr. Rotlewicz pointed out that cedarwood oil is not itself a perfect filling material; the viscosity of available Merck cedarwood oil changed about 10 years ago, which led treaters to experiment with “palma” (araldite resin) and other substances.



Figure 15. Among the speakers at the First World Emerald Conference were (left to right): Dr. Rodrigo Giraldo (moderator), Dr. Henry Hänni, Dr. Dietmar Schwarz, Ray Zajicek, and Jaime Rotlewicz. Dr. Mary Johnson is on the screen in the background. Photo by Charles Carmona.

MORE FROM THE 26TH INTERNATIONAL GEMMOLOGICAL CONFERENCE

COLORED STONES AND ORGANIC MATERIALS

An unusual organic “gem”: Bezoar. Jean-Paul Poirot from Paris, France, presented photos of an amazing collection of “bezoars”—concretions, usually spherical, that are found chiefly in the digestive tract of grazing animals. Bezoars are composed of a mixture of materials, both inorganic (e.g., whitlockite, a calcium-iron-magnesium phosphate) and organic (hair). In some cultures, they were once believed to have magical properties. For example, Renaissance Europeans believed that bezoars could prevent arsenic poisoning. Placed in a beverage such as wine, the bezoar supposedly would absorb any heavy metal—such as arsenic—that might be present. Bezoars were also used as amulets and set into objects of art, especially during the 17th century. Today bezoars are rarely, if ever, found in jewelry outside of museums.

Gem-quality transparent feldspar from North America.

The well-known source for transparent and aventurescent labradorite in Plush, Oregon, is only one of a number of localities in North America for this gem material. Dr. Frederick H. Pough, a consulting mineralogist from Reno, Nevada, discussed several of these localities. A second occurrence in Oregon, near the town of Burns (the Ponderosa mine), is also producing quantities of transparent, gem-quality labradorite. Like the material from Plush, some of the rough gems contain small oriented

platelets of elemental copper that cause aventurescence when the stone is properly oriented during cutting. [Editor’s note: This material is commonly referred to as “sunstone” (see, e.g., C.L. Johnston et al., “Sunstone Labradorite from the Ponderosa Mine, Oregon,” *Gems & Gemology*, Winter 1991, pp. 220–233), although this term was originally reserved for aventurescent oligoclase feldspar with hematite—not copper—inclusions.]

Near-colorless plagioclase phenocrysts occur in scattered lava flows at Sunstone Hill, in Deseret, Utah. A similar feldspar-bearing lava flow has also been reported in Milford, Utah. Northern Mexico is home to a lava flow with even larger gem-quality feldspar crystals, some more than 2.5 cm long. Moonstone-like feldspar crystal clusters have also been found in a lava flow in this area of northern Mexico, as has dark brown, sometimes asteriated, spinel. Coincidentally, Gem News editor John Koivula recently identified (using Raman analysis) rounded blebs of black spinel as inclusions in some labradorite from Oregon that Dr. Pough provided.

Although most of the feldspar from these various localities is colorless to pale brownish yellow, some intensely colored gems are also recovered. The latter crystals are often color zoned, with an outer layer that is almost colorless and a red core. Between these two zones a narrow green rim is sometimes present (see, e.g., Summer 1997 Gem News, p. 145). Green is the rarest color of these feldspars, followed by red.



Figure 16. Maw-sit-sit is rock composed of several minerals, and is named for its locality of origin in northern Myanmar. The fashioned pieces range from 8.38 to 11.98 ct. Stones courtesy of Allen Jenny and Pala International; photo by Harold © Erica Van Pelt.

Libyan Desert glass. Dr. John Saul, an exploration geologist-gemologist from Paris, France, presented new information about “Libyan Desert glass.” This unusual, very-high-silica natural glass found at the Great Sand Sea in southwestern Egypt is sometimes faceted as a gem material. It is composed of 98% SiO_2 , with minor amounts of iron, aluminum, and titanium oxides. Samples are transparent to translucent (milky); and near-colorless to very light yellow, green, or brown. The R.I. ranges from 1.464 to 1.545, and the S.G. is 2.120–2.215. Common internal characteristics are gas bubbles and distinctive dark streaks, as well as “pseudo-bedding” (layers that resemble bedding features). Among the mineral inclusions identified thus far are quartz, cristobalite, elbaite tourmaline, titanomagnetite, zircon, and baddeleyite.

It is generally accepted that Libyan Desert glass formed 28.5 million years ago during a meteorite (or comet) impact into a quartz-rich formation, probably

loose sand. However, there is no observable crater; moreover, unlike impact-derived glasses (tektites) from other known craters, the material never exhibits aerodynamic shapes. As a result, alternative hypotheses have been suggested, such as formation due to hydrothermal activity or ancient forest fires.

Although volatiles are nearly absent from Libyan Desert glass, tiny amounts of organic compounds in the form of fragile, crudely preserved sporomorphs or microfossils (less than 0.5 mm in size) have been tentatively identified. If these features are confirmed to be fossils, as Dr. Saul believes, any theory for the mode of formation of this material must accommodate both the high temperature needed to form the glass and the presence of fragile carbon-rich “microfossils.” Dr. Saul supports the hypothesis that a meteorite or comet impact heated the quartz-rich sand or sandstone parent rock, but he also suggests that this event occurred extremely rapidly and at a very high temperature—melting the silica and volatilizing other elements while driving away any gases present, particularly oxygen. In the absence of oxygen, some of the carbon-rich “microfossils” would not have ignited, but rather they could have been encapsulated by the molten silica.

Maw-sit-sit from Myanmar. Gem News contributing editor Dr. Henry Hänni, of the SSEF Swiss Gemmological Institute in Basel, presented the results of unpublished research on maw-sit-sit that he carried out with J. Meyer in 1984. With the recent reappearance of this unusual gem material, this information is still pertinent. Visual examinations of the maw-sit-sit currently being mined indicate little difference from that previously studied.

Because maw-sit-sit is a rock composed of several different minerals that can vary greatly in their relative amounts, it may show considerable variation in both visual appearance and specific gravity. The color of maw-sit-sit ranges from light green to black; it can be monochromatic, mottled, or spotted, with black or white spots or veinlets (see, e.g., figure 16).

Maw-sit-sit is named for its locality of origin in northern Myanmar, but it has also been referred to as jade-albite or chloromelanite. Jadeite and albite are two possible constituents of maw-sit-sit, but both are subordinate, so they should not be used to name the stone. Chloromelanite is an older varietal name for iron-rich jadeite (A. M. Clark, *Hey's Mineral Index*, 1993, London, Chapman & Hall, p. 132), which is not found in maw-sit-sit, so this too is a misnomer.

There are several main constituents of maw-sit-sit. *Chromite* occurs as small black grains with a metallic luster that are usually seen as cores in black kosmochlor aggregates. *Kosmochlor*, long recognized only from meteorites, occurs as fine felty masses, the characteristic black spots in some maw-sit-sit. Formerly known as ureyite, kosmochlor ($\text{NaCrSi}_2\text{O}_6$) is the chromium analogue of jadeite ($\text{NaAlSi}_2\text{O}_6$). Cr-colored green *jadeite* is present as

blocky mosaics of large single crystals. (Jadeite and kosmochlor form a solid-solution series through the substitution of chromium for aluminum.) The *eckermannite* and *arfvedsonite* species of amphibole form coarse crystals that are green or gray, depending on their Cr content. *Symplectite*, a very fine-grained mixture of minerals that cannot be resolved microscopically, may also be present. In maw-sit-sit, the symplectite is also green due to the Cr content of its components.

The matrix consists of chlorite, albite, serpentine, and zeolites, which also fill interstitial spaces between the minerals named above. Fine veinlets also consist primarily of these minerals.

The maw-sit-sit deposit is located near the classic jadeite location at Tawmaw. It formed along the rim of a large peridotite body that was altered and serpentinized. The deposit is apparently the result of a metasomatic reaction between albitite dikes and the adjacent serpentinite during high-pressure metamorphism.

(Dr. Hänni and Mr. Meyer wish to express their thanks to the late Günther Weinz of Kirschwiles, Germany, who supplied them with sample material in 1982.)

An opal nomenclature. Dr. Grahame Brown, of the Gemmological Association of Australia (GAA), presented a paper introducing a system for opal nomenclature that resulted from three years of discussion among representatives of GAA, the Australian Gem Industry Association, and the Lightning Ridge Miners Association. The information from these discussions was compiled by Anthony Smallwood, chairman of GAA's Opal Nomenclature subcommittee, and was ratified by these organizations and by the Australian Gemstone Industry Council and the Jewellers Association of Australia.

Under this system, natural opal is initially classified into one of three groups: precious opal (that which shows play-of-color), common opal, and potch. The latter two do not show play-of-color and are separated from one another based on their formation and structure. Precious opal is further divided into three types: Solid single pieces of opal with substantially homogeneous chemical composition are classified as Type 1; Type 2 is boulder opal, solid opal that is naturally attached or layered with the rock in which it was formed, and this rock is of a different chemical composition; and Type 3 is matrix opal, in which opal fills pores between grains in the host rock (e.g., opal-cemented sandstone).

In this nomenclature system, different varieties of precious opal are specified on the basis of their body tone (relative lightness or darkness of the stone) and transparency. These varieties are designated as black, dark, or light, with the lightest tone being white opal; any opal that is transparent to semi-transparent is called crystal opal.

Specific criteria for defining opal treatments, opal composites, synthetic opal, and imitation opals have also

been established, so that reproducible classification reports can be prepared for any opal, regardless of its country of origin. (For more information on this system, see A. Smallwood, "A New Era for Opal Nomenclature," *Australian Gemmologist*, Vol. 19, No. 12, 1997, pp. 486-496.)

Identifying natural opal in the field. The techniques of gem identification routinely used in well-equipped gemological laboratories are not always practical when buying gems in the field or at the mine. The distinction between natural opal and its synthetic and imitation counterparts under these conditions was the subject of a paper presented by Geoffrey Tombs of Beacon Hill, New South Wales, Australia. Mr. Tombs also prepared a useful chart for the field identification of natural opal and its imitations by means of basic gemological instruments and techniques. He emphasized the use of magnification and proper illumination to show differences in play-of-color patterns and internal structure. Fluorescence (and phosphorescence) to both long- and short-wave UV radiation were also discussed as means of identification. This information is particularly useful to gemologists and gem traders when advanced instrumentation, such as infrared spectrophotometry, is unavailable.

Kashmir rubies. The Kashmir region has been world famous for extraordinarily fine blue sapphires since they were first discovered there in 1881. Robert E. Kane, of the Gübelin Gemmological Laboratory in Lucerne, Switzerland, reported on the first ruby deposit found in this region, almost a century later (in 1979), about 350 km by air northwest of the historic blue sapphire deposits. The ruby deposit (figure 17) is located in extremely remote and rugged mountainous terrain on Nangimali Mountain, high in the Himalayas, in the Azad Kashmir region of Pakistan. The mine consists of two main workings (at 14,300 feet [4360 m] and 12,500 feet [3810 m]) that can only be mined from May to October because of the severe climate.

The ruby crystals are found in light bluish gray bands of pure calcite, which follow the bedding pattern of the marble (figure 18). The ruby-bearing bands vary in thickness from less than 1 cm to 30 cm, and the distance between the bands varies from a few centimeters to several meters. Closely spaced bands, with a thickness greater than 1 m, have been designated as ruby ore zones. At the Nangimali Top area, these zones range from 3 to 6 m thick. Schists of various types flank the ruby-bearing marbles; garnet-bearing schists predominate. Although calcite predominates in the ruby-bearing marbles, 16 additional minor minerals have been identified thus far.

Mining started in 1990 on a limited (pilot) scale. During the author's 1995 visit, mining was carried out by both open pit (at the upper workings) and underground (at the lower area) methods. As of 1995, about 250 kg of gem material had been produced from ore averaging 55



Figure 17. The lower of the two Kashmir ruby deposits has been developed by underground workings with conventional tunneling, using drilling and blasting. Photo by Robert E. Kane.

carats per cubic meter. The gems consisted of cabochon-to facet-grade ruby (some comparable in quality to stones from Mogok) and pink sapphire. The largest facet-grade stone recovered weighed 85 ct. With increasing depth of mining, the percentage of deep red gems increased, as did the transparency and size of the stones. Inclusions reported to date in the gem-quality material include pyrite, calcite, rutile, chromium-bearing mica, pyrrhotite, and hematite.

The total estimated “resources” (not to be confused with measured “reserves”) of ruby and pink sapphire are about 125 million carats. However, the remoteness and ruggedness of the location, as well as its short working

Figure 18. Well-formed ruby crystals are sometimes present in the mineralized calcite at Kashmir’s ruby deposits. When such spectacular ruby crystals are encountered, the miners preserve them as mineral specimens. This sample is approximately 10 cm across. Photo by Robert E. Kane.



season, present major challenges for the economic development of these deposits.

Gemstones of Switzerland. Although well-known for a variety of interesting “Alpine-type” minerals (such as fluorite, quartz, and epidote), Switzerland and the Swiss Alps are generally not known for their gem materials. It was therefore surprising when Dr. Edward J. Gübelin, of Lucerne, Switzerland, described a number of different gems that have been found in that country. Among the better-known gems described were aquamarine and green beryl, ruby and sapphire, moonstone, garnets (almandine, andradite, grossular, pyrope, and spessartine), amethyst, topaz, and tourmaline. The collectors’ gems he mentioned included anhydrite (figure 19), apatite, axinite, cordierite, diopside, dolomite, epidote, fluorite (figure 20), idocrase, kyanite, scapolite, and sphene.

Dr. Gübelin had examples of each of these Swiss gems available for examination. Many were quite large, with several exceeding 5 ct. Dr. Gübelin also provided a short introduction to the geology of the Swiss Alps, which he related to the various gem deposits.

SYNTHETICS AND SIMULANTS

First commercial synthetic ametrine from Russia. Dr. Vladimir Balitsky, head of the Laboratory of Mineral Synthesis at the Institute of Experimental Mineralogy of the Russian Academy of Sciences at Chernogolovka (Moscow District), described the technology developed in Russia for growing single crystals of bicolored amethyst-citrine quartz, which resemble the natural gem “ametrine” found in Bolivia. This technology is based on the results of previous studies of the origin of amethyst and citrine coloration, as well as on discoveries concerning the effects of different physical-chemical and growth factors on the formation, stability, and character of color distribution in these crystals.

The first batch of crystals (on the order of 100 kg) was produced in 1994. As is the case with crystals of synthetic amethyst or citrine, ametrine is grown in autoclaves from strongly alkaline potassium carbonate solutions in the presence of ferric ions and an oxidizer, at temperatures of 350°–390°C and pressures up to 1.5 kbar. In one autoclave with a volume of 1,000 liters, 250–300 kg of ametrine crystals can be grown over a period of two to three months. [Editor’s note: According to Dr. Balitsky, the crystals are near-colorless and yellow as grown; with subsequent irradiation and heat treatment, the near-colorless portion turns purple and the yellow portion darkens. Both colors are due to iron.] Individual single crystals range from several grams (the most valuable faceting material) up to 1 kg.

As is the case for natural ametrine, the synthetic crystals are characterized by sector zoning, which results from a selective distribution of amethyst and citrine coloration in different growth zones (figure 21). Crystals



Figure 19. This faceted anhydrite is shown resting on a crystal of gem anhydrite from the Simplon Tunnel that is coated with ankerite. Swiss anhydrite is notable for its light purple color, as well as its size (crystals up to 7 cm long). Photo courtesy of Dr. Edward J. Gübelin.

grown on seeds parallel to the pinacoid {0001} are characterized by the simplest distribution of colors. The identification of gems cut from such crystals has previously been based on their characteristic internal structure and the distribution of color in growth sectors. However, in several recently produced crystals, these characteristics resemble natural ametrine more closely. Identification of synthetic ametrine requires evaluation of all distinguishing features of both synthetic amethyst and synthetic citrine, and it is not always easily accomplished. (For one method of distinguishing synthetic from natural amethyst and citrine, see T. H. Lind and K. Schmetzer, "Infrarot Spektroskopie geschliffener Edelstein, dargestellt am Beispiel von echten und synthetischen Amethysten," *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, Vol. 31, No. 3, 1982, pp. 143–150.)

INSTRUMENTATION

Cathodoluminescence and photoexcitation applications in gemology. Continuing his research on cathodoluminescence (CL), Dr. Johann Ponahlo of the Department of Mineralogy and Petrography at the Museum of Natural History in Vienna, Austria, described his latest observations. Dr. Ponahlo emphasized that cathodoluminescence is a nondestructive technique that can be useful in the separation of natural and synthetic gem materials.

Many CL instruments are designed to be mounted on a microscope stage. In addition to the visual images provided by this method, information on the luminescence of gemstones can be obtained by collecting CL spectra in the ultraviolet, visible, and near-infrared spectral ranges (figure 22) by means of computer-assisted CL spectrophotometers. Such instruments require only about 30 seconds to complete a spectral analysis in the visible plus near-infrared range; this time is reduced to just two thousandths of a second with newly developed diode array spectrometers. Rough or cut stones from 2 to ~40 mm can be accommodated in these instruments.

Another technique currently being explored by Dr.



Figure 20. Switzerland is also the source of attractive pink fluorite, as shown by these faceted stones (10–80 ct). Photo courtesy of Dr. Edward J. Gübelin.

Ponahlo is known as photoexcitation spectrometry (PECS). This method differs from CL analysis in that PECS does not use an electron beam to excite luminescence. Instead, the sample is excited by a beam of light

Figure 21. Synthetic ametrine grown in Russia is now commercially available. The smaller crystal measures 51 x 21 x 5 mm. Photo by Maha DeMaggio



(photons), and the energy emitted at each wavelength of excitation is measured as the wavelength of excitation is scanned. A photoexcitation spectrum is potentially more sensitive than CL for measuring the luminescence produced by a given activator ion. Preliminary results indicate that this photoexcitation method could be useful for detecting minor differences between natural gemstones and synthetics, as well as for determining locality of origin in some cases.

ANNOUNCEMENTS

New geologic maps of Sri Lanka. The Geological Survey and Mines Bureau of Sri Lanka has published seven maps in a new series titled *Geological Maps of Sri Lanka 1:100,000*. These detailed maps (figure 23) provide coverage of the central and southern parts of the country, and include most of its known gem-producing areas. In addition to a full-color geologic map, each sheet contains a description of the regional geology of Sri Lanka, along with the geology and mineral deposits (where applicable) of the mapped area. The maps are a considerable resource for anyone wishing to undertake geologic studies or prospecting in this gem-rich country. They are available for a nominal charge from the Geological Survey and Mines Bureau, No. 4 Senanayake Building, Galle Road, Dehiwala, Sri Lanka; fax 94-1-735752.

Nature of Diamonds exhibit extended. The American Museum of Natural History is extending the Nature of Diamonds exhibition, from the original closing date of

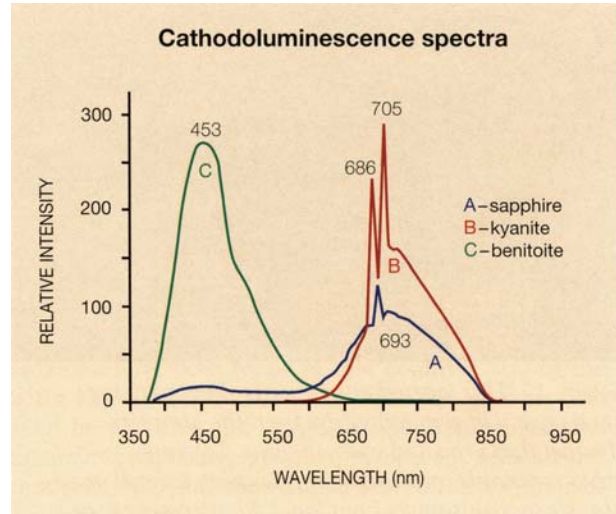


Figure 22. CL spectrophotometry is a fast, non-destructive technique, which was used here to separate beads of a similar saturated blue in a group of necklaces. The CL spectra showed that some of the necklaces contained only kyanite beads and some contained a mixture of kyanite and sapphire beads. The spectrum for benitoite is also shown for comparison as a gem material with a similar blue color.

April 26, to August 30, 1998. For more information on the exhibit, contact the Museum at Central Park West at 79th Street, New York, 10024-5192, phone 212-769-5099.



Figure 23. This geologic map, one of a series recently issued by the Geological Survey and Mines Bureau of Sri Lanka, covers an area of southern Sri Lanka where numerous gemstones are mined.

International Mineralogical Association meeting. The 17th General Meeting of the IMA will be held in Toronto, Canada, August 9–14, 1998. The meeting is being organized by the Mineralogical Association of Canada, the University of Toronto, and the Royal Ontario Museum. A symposium on “Gems and Diamonds” will be featured, in addition to the other scientific programs on mineralogy, petrology, geochemistry, and ore mineralogy. For more information, visit the web site at http://opal.geology.utoronto.ca/IMA98/second_circular/Second_Circular.html, or write IMA’98, Department of Geology, University of Toronto, Earth Sciences Center, 22 Russell Street, Toronto, Ontario, Canada, M5S 3B1.

IN MEMORIAM

Charles E. Ashbaugh III, 1944–1997. The editors were greatly saddened to learn that *Gems & Gemology* author Charles (“Chuck”) Ashbaugh passed away last July. A graduate of the University of California, Los Angeles, Chuck was hired by the GIA Gem Trade Laboratory in Santa Monica as an expert on radiation testing of gem materials. He set up the GTL radiation testing facility, which has been used to detect, characterize, and quantify induced radioactivity in several gem materials, most notably diamond and topaz. He eventually rose to the position of Manager of Radiation Testing at GTL, before moving on to become Manager of Health Physics at Isotope Products Laboratories in Burbank, California. Even after he left GIA, Chuck continued to offer advice on particularly challenging identification problems. He was a longtime member of the review board for *Gems & Gemology’s* Gemological Abstracts section and wrote three papers for *G&G*: “Gemstone Irradiation and

Radioactivity” (Winter 1988), which won the Most Valuable Article Award for that year; “Gamma-Ray Spectroscopy to Measure Radioactivity in Gemstones” (Summer 1992); and, with Dr. James E. Shigley, “Reactor-Irradiated Green Topaz” (Summer 1993).

Chuck is survived by his wife, Connie, and son, Charles E. Ashbaugh IV.

Eugene Edward Foord, 1946–1998. Eugene (“Gene”) Foord passed away on January 8, 1998, after a three-year battle with lymphoma. Gene was a longtime supporter of *Gems & Gemology*, co-authoring two articles (“Gem-Quality Red Beryl from the Wah Wah Mountains, Utah” in Winter 1984, and “Emeralds of the Panjshir Valley, Afghanistan” in Spring 1991) and reviewing many other papers.

Gene obtained degrees from Franklin and Marshall College (B.A. geology, 1968), Rensselaer Polytechnic Institute (M.S. geology/petrology, 1969), and Stanford University (Ph.D. mineralogy, 1976). Gene’s doctoral thesis was a detailed study of the gem-tourmaline-bearing Himalaya dike system in San Diego County, California. Through his studies of this and other pegmatites in Southern California and Colorado, Gene gained recognition as an expert on gem-bearing pegmatites. During his career as a geologist-mineralogist at the U.S. Geological Survey from 1976 until his death, Gene also made numerous other contributions, amounting to nearly 200 books, papers, abstracts, and maps. Gene’s collaborations with mineralogists from around the world took him to Russia, China, and Pakistan. His studies of gem materials included emerald, red beryl, topaz, tourmaline, and turquoise.

Gene is survived by his wife, Suzann, and their children, Laura and Robert.

1997 Manuscript Reviewers

Gems & Gemology requires that all articles go through the peer-review process, where the manuscript is reviewed by at least three experts in the field. This process is vital to the accuracy and readability of the manuscript, but it is also time-consuming for the reviewer. Because members of our Editorial Review Board cannot have expertise in every area, for some manuscripts we call on others in our community to share their intellect and expertise. In addition to the members of our Review Board, we extend a heartfelt thanks to the following individuals who provided us with their comments and reviews of manuscripts in 1997:

Dr. Peter Cooke
Dr. Eugene Foord
Dr. Jeff Harris
Mr. Hertz Hasenfeld
Dr. Don Hoover
Mr. Glen Lehrner

Mr. Nir Livnat
Mr. Shane McClure
Mr. Nicolai Medvedev
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