GEM N·E·W·S

DIAMONDS

Extreme wear on diamonds. A turn-of-the-century brooch was brought to one of the contributing editors (EF) by M. Bouchet—a Nantes, France, jeweler who specializes in estate pieces—to confirm that the gems in the piece were indeed diamonds. The brooch contained several near-colorless round brilliants, all of which showed extreme wear on the facet junctions surrounding their tables. Using a thermal probe diamond tester, Drs. Fritsch and B. Lasnier, of the University of Nantes, easily proved that all the stones were natural diamonds. The center stone, unmounted, is shown in figure 1. This stone is even more damaged than the one mentioned in the Fall 1983 Gem Trade Lab Notes (p. 172). Note that the wear is much greater on one side, where it extends almost halfway down the star facet. Most remarkably, all the stones in the brooch showed the same pattern of abrasion, with the most abraded parts of each in the same orientation relative to the brooch. Damage was also visible on the tables of most of the stones as scratches, nicks, and small feathers extending into the diamonds. The worn-down surfaces were quite smooth.

The jeweler told Dr. Fritsch that sometime after the purchase the customer had returned the brooch, claiming that the stones were not diamonds and asking to be reimbursed. The customer had shown the piece to another jeweler, who stated that faceted stones with so much wear could not possibly be diamonds, but were most likely zircon imitations. Aside from the issue of hardness, the abraded edges along the table of the diamond in figure 1 make it difficult to discern the table reflections in this stone. Thus, the important visual "test" for diamonds—that is, that many diamond imitations do not "look right" because the reflection of the table in the pavilion facets is the wrong size (for stones with different refractive indices) or even doubled (in most orientations of birefringent materials, such as zircon)—would not be reliable in this instance.

The reason for this extreme wear remains a mystery, as no information was available on the history of the brooch.

How many diamonds are there in Arkansas? Professor A. A. Levinson, of the University of Calgary, Alberta, Canada, has provided the following analysis of developments at the Crater of Diamonds State Park, near Murfreesboro, Arkansas.

Although diamonds were found in a pipe near Murfreesboro in 1906, various attempts to mine them from 1907 to 1932 always ended in financial loss. In 1972, the locality became the Crater of Diamonds State Park, a tourist attraction where members of the public could keep all the diamonds they found. Over the past 20 years, about two stones—with an average weight of approximately 0.2 ct—have been found daily (see, e.g., "Arkansas's Diamond Park: Challenge of the Hunt versus Chance for Big Profits" by R. Shor, *Jeweler's Circular-Keystone*, November 1993, pp. 56–57). In this era of frantic exploration for new diamond deposits, it was therefore natural to reconsider the Murfreesboro lamproite pipe for its economic potential. However, there had never been a reliable estimate of the ore grade (carats per ton) of the pipe, nor an accurate determination of the value of the stones.

In 1987, the Arkansas state legislature passed a law allowing commercial mining at the site. In September 1996, after approval was received from the U.S. National Park Commission, and after the failure of litigation by various third parties seeking to halt the project, a group under the auspices of the State of Arkansas Department of Parks and Tourism began to collect an approximately 10,000 ton bulk sample of the lamproite for evaluation of the ore. The final results of this evaluation were given in an Ashton Mining of Canada Inc. press release dated February 10, 1997.

Citing information that was provided in this and previous press releases, Professor Levinson noted that the bulk sample was collected from 18 trenches in those parts of the pipe that were the historical sources of most of the recorded diamonds. From a total of 8,819 tons of ore, 207 diamonds were recovered (total weight 45.75 ct, for an average weight per stone of 0.22 ct). This calcu-

lates to an average diamond content of 0.005 carat per ton of ore.

These results fall significantly short of the diamond content required to support a commercial mining operation (e.g., typical economic kimberlite pipes average 0.3–0.5 ct/ton). Clearly, this pipe can remain a tourist attraction without the complication of concurrent mining.

Professor Levinson suggests that the tourists are mining more diamonds than the bulk sample indicates the source should provide naturally. From the information given, he notes, about 0.40 ct of diamonds are recovered daily by tourists. This is equivalent to the diamond content of 80 tons(!) of lamproite at this deposit (i.e., 0.40 ct divided by 0.005 ct/ton), leading to an interesting question as to how some of these diamonds reached the site.

COLORED STONES AND ORGANIC MATERIALS

Prospecting for beryl in Saudi Arabia. There are many instances in the Arabic literature of emeralds and other beryls being found in Saudi Arabia; these were compiled in a 1989 report by B. A. Al-Fotawi ("A Brief Review of the Mines and Mineral Occurrences in the Arabian Peninsula (Hamad Al-Jasear)," Saudi Arabian Ministry for Mineral Resources Open File Report DGMR-of-09-18, Kingdom of Saudi Arabia, 19 pp.). While working for the Ministry of Petroleum and Mineral Resources, Faisal M. Allam investigated some of these occurrences, and reported his findings to the Saudi Arabian government in 1992 ("Gemological Investigation for Gemstone—Emerald/Aquamarine in the Arabian Shield," Technical Report DGMR-TR-91-9 of the Ministry of Petroleum and Mineral Resources). Mr. Allam recently became a GIA student, and generously agreed to share the results of this hard-to-find report with our readers.

Figure 1. Note the extreme and uneven wear on this diamond (about 4.5 mm in diameter), which was the centerpiece of a brooch in which all the diamonds showed similar abrasion. Photo by Bernard Lasnier.

Mr. Allam studied the Hadiyah area, which reportedly was a site of ancient emerald mining; however, the only green mineral he found was epidote, not emerald. Other varieties of beryl had been described from 12 localities (pegmatite dikes) in the Precambrian Arabian Shield rocks in Saudi Arabia between Riyadh and the Red Sea; these localities were explored in more detail. Although none showed potential for large-scale gem mining, some gem-quality aquamarine was obtained from the Karath Well pegmatite, and small faceted aquamarines could be fashioned from gemmy crystals (up to 8 cm long by 1.5 mm wide) found at Jabal Tarban. Specimen-quality aquamarine crystals may be recovered from both of these sites, as well as from Sarat Bishah and Jabal al Hawshah. Two other sites had smaller or scarcer beryl samples, while no beryl was found in the remaining six historic occurrences. Three good-quality aquamarines in the 1–2 ct range were cut from Karath Wells material.

Lab Alert: Radioactive cat's-eye chrysoberyls. Several hundred carats of radioactive cat's eye chrysoberyl are being offered on the Bangkok market, according to Kenneth Scarratt, president of the Centre for Gemstone Testing (the successor of the AIGS Laboratory) in that city. The material was discovered in late August 1997, when a Bangkok dealer (J. Bergman, of Gem Essence Co.), requested that some brown cat's-eye chrysoberyl be tested for radioactivity.

The Centre for Gemstone Testing examined one 3.5 ct stone and found it to be highly radioactive, with an activity level of 52 nCi/g. This is significantly higher than the legal release levels set by the relevant authorities in the United States (1.0 nCi/g), United Kingdom (2.7 nCi/g), and Asia (2.0 nCi/g). Using a Geiger-Mueller counter, Mr. Scarratt found that the stone had a contact radiation level of about 11 milliroentgens per hour. Subsequent tests showed that it had a half-life of approximately 103 days, indicating that this particular stone would not reach the legal release level in Asia before January 1999. Until then, it must be kept in a properly shielded radioactive materials storage container.

The chrysoberyl in question was described as having an "unusual dark brown" color (figure 2), which was found to be stable to a quick "fade test"—heating in the well of a microscope (until too hot to hold) for a period of one hour. The original material reportedly came from Orissa, India, and Mr. Scarratt believed that it was bombarded with neutrons in a nuclear reactor somewhere in Asia and then released illegally. According to one source with whom Mr. Scarratt spoke, "hundreds" of these stones have been available in Indonesia since April 1997, and by early September still more material had changed hands at the gemstone marketplace in Chantaburi,

Figure 2. Material similar to the pale green cat's-eye chrysoberyl on the left was irradiated to produce the 3.5 ct radioactive dark brown cat's-eye chrysoberyl on the right. Photo courtesy of Kenneth Scarratt.

Thailand. Robert E. Kane, director of the Gübelin Gemmological Laboratory in Lucerne, Switzerland, reported seeing several examples of this material at the September 1997 Hong Kong Show. Mr. Scarratt advised that members of the gem trade immediately check all cat's-eye chrysoberyls of an unusual dark brown color for excessive radioactivity.

Demantoid garnets from Russia . . . The greater availability of fine Russian demantoid was described by W. R. Phillips and A. S. Talantsev in the Summer 1996 *Gems & Gemology* ("Russian Demantoid, Czar of the Garnet Family," pp. 100–111). The editors saw an excellent demonstration of the return of this material earlier this year. Bear and Cara Williams of Bear Essentials, Jefferson City, Missouri, showed us several bright green demantoids that were reportedly from the Bobravka River, near Nizhniy Tagil. These stones had been fashioned in the nearby Ekaterinburg region. We borrowed two stones, weighing 1.34 and 1.18 ct (figure 3), for gemological characterization.

Gemological properties were as follows (largest stone first, where different): shape—oval brilliant, oval mixed cut; color—yellowish green; color distribution—even; pleochroism—none; optic character—singly refractive; Chelsea color filter reaction—deep orangy red, weak orangy red; R.I.—greater than 1.81; S.G.—3.87, 3.86; inert to both long- and short-wave ultraviolet radiation; no visible luminescence ("transmission luminescence"); absorption spectrum—460 nm cutoff, 620 nm line, 638 nm line, weak 690 nm line (difficult to see in the large stone), 680 nm cutoff (large stone only); inclusions—"horsetails" (both stones), fractures (both stones), large cavity on girdle (large stone only). An energy-dispersive X-ray fluorescence (EDXRF) spectrum taken on the largest stone showed major Si, Fe, and Ca, minor Cr, and trace V.

. . . . and from Namibia. A number of people have brought to our attention the fact that demantoid garnets—long thought to occur almost exclusively in Russia (see, e.g., the Phillips and Talantsev article cited in the previous entry)—are now commercially available from a new locality in the southern African nation of Namibia. Contributing editor Henry Hänni first brought these stones to our attention. In spring 1997, he received two demantoid garnet crystals that were reportedly from a new source in Namibia; they were sent by Mr. Hilmar Bosch, Hilton, Natal, South Africa. The two crystals weighed 13.52 and 3.87 ct (Mr. Bosch reported seeing crystals as large as 30 ct). They had the following properties (largest first, where different): shape—both were partial rhombic dodecahedra (figure 4); surface texture—stepped growth in small steps, with features resembling slight corrosion; color—light yellowish green,

Figure 3. These two demantoid garnets, 1.18 and 1.34 ct, were recently recovered from Russian deposits. Stones courtesy of Bear Essentials; photo by Maha DeMaggio

Figure 4. These two crystals (3.87 and 13.52 ct) are demantoid garnets from a new locality in Namibia. Photo courtesy of Henry Hänni.

grayish green (both resembling peridot in color); color distribution—yellower at the core (in the first stone), even (in the second); absorption spectrum—sharp band at 425; reaction to Chelsea filter—reddish. With magnification, we saw open fissures in both crystals and some tiny fluid inclusions in the smaller piece; however, no "horsetail" inclusions were seen in either crystal. EDXRF spectroscopy gave Si, Ca, and Fe—consistent with andradite—but very little chromium (the green chromophore), which was estimated at 0.05 wt.% Cr_2O_3. An article by Thomas Lind et al. in a recent issue of the *Zeitschrift der Deutschen Gemmologischen Gesellschaft* ("Neues Vorkommen von Demantoid in Namibia," Vol. 46, No. 3, 1997, pp. 153–160) reported between 0.02 and 0.13 wt.% Cr_2O_3 in this material.

Marc Sarosi, a gem dealer in Los Angeles, California, shared seven fashioned demantoids (0.71–3.42 ct), two small demantoid crystals (8.91 and 9.54 ct), and one 1.11 ct yellowish brown andradite from this locality with the Gem News editors (some of these stones are shown in figure 5). Gemological properties of the fashioned demantoids were as follows: color—green to yellowish green; refractive index—over the limits of our standard refractometer (greater than 1.81); optic character—singly refractive with strong anomalous double refraction; inert to both long- and short-wave ultraviolet radiation; Chelsea filter reaction—orange to red; specific gravity—3.83–3.85; absorption spectrum (using a handheld spectroscope)—band at 445 nm, general absorption below 450 nm, and (one stone only) diffuse 580 and 630 bands. Magnification revealed strong dispersion, "fingerprints," crystals (some of which could be resolved as prismatic in shape), a negative crystal with a two-phase inclusion, and needles in two samples. No sample contained "horsetail" inclusions, although the 1.11 ct yellowish brown andradite contained yellow needles (some of which curved slightly); Lind et al. also found no "horsetails" in the Namibian demantoids they examined. The stones showed pronounced angular or straight transparent growth zoning, and, in one case, iridescence along the growth planes (so-called "rainbow graining"). EDXRF analysis of the green fashioned stones revealed major Ca, Fe, and Si, and minor Mn and Cr. The two rough specimens we examined showed parallel growth of smaller crystals, with smooth dodecahedral faces and etched trapezohedral faces; one piece had grown on a 5 mm white "scepter" quartz crystal.

A published report in *Jewellery News Asia* (August 1997, p. 36) states that the source for these demantoids and other andradites is the Usakos mine in Namibia, and that the largest stone fashioned to date weighs 9.89 ct. The deposits are reportedly alluvial in nature.

A gem-quality ettringite group mineral, probably sturmanite. Each February, the gem and mineral shows in Tucson provide many interesting, sometimes important, gemological discoveries. Although some of these are relatively easy to analyze and describe, others are much more

Figure 5. The newly discovered Namibian deposit reportedly produced these rough and fashioned demantoids and yellowish brown andradite from the new find in Namibia. The largest crystal (right) measures 13.91 × 12.06 × 7.27 mm, and the largest pear-shaped demantoid weighs 1.95 ct. Stones courtesy of Marc Sarosi, Los Angeles, CA; photo by Maha DeMaggio.

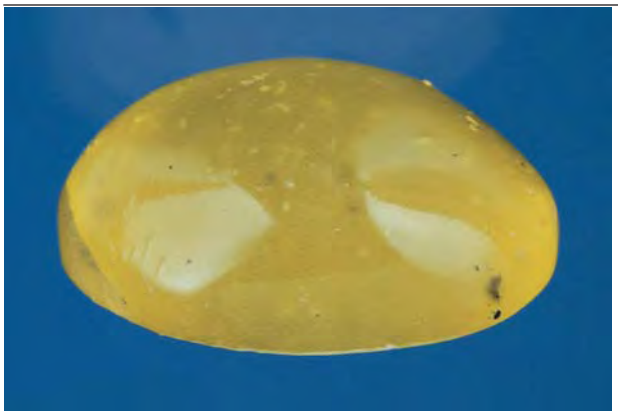


Figure 6. This 3.82 ct yellow cabochon is a mineral in the ettringite group, probably sturmanite. Photo by Maha DeMaggio.

challenging. Such was the case with the 3.82 ct bright yellow translucent oval cabochon shown in figure 6.

The original 10.12 ct piece of rough came from Kevin Lane Smith, a Tucson gem and mineral dealer. Mr. Smith also had a fist-size, highly translucent piece of this material; a large, well-polished translucent cabochon; and a small faceted stone. The material was reportedly from the Kuruman District in South Africa, and it was represented as ettringite, a member of the mineral group of the same name. Ettringite-group minerals are hydrous mixed sulfates/carbonates/borates/hydroxides of calcium and other elements (e.g., Al, Cr, Fe, Mn, and Si); identifying specific minerals in this group is difficult, so many specimens are simply labeled "ettringite group." Thus, we thought that gemological identification of this material would be a good exercise in gem-testing technique.

Gem Trade Lab staff gemologist Phil Owens fashioned the rough into a 14.00 × 10.22 × 5.12 mm oval cabochon (figure 6); he commented that the material was very soft (ettringite has a hardness of 2–2.5) and difficult to polish. In part, this latter difficulty was caused by numerous inclusions of tiny, transparent-to-translucent, near-colorless crystals, which were appreciably harder than the host material. As a result, the softer mineral undercut around the surface-reaching inclusions.

The basic gemological properties obtained from the cabochon were of little help in determining whether it was ettringite or sturmanite. The spot R.I. reading of 1.50 was consistent with a reading for either mineral. The specific gravity, determined by the hydrostatic method, was 1.86, slightly higher than the 1.847 value for sturmanite (see D. R. Peacor et al., "Sturmanite, a Ferric Iron, Boron Analogue of Ettringite," *Canadian Mineralogist*, Vol. 21, 1983, pp. 705–709) and considerably higher than the 1.77 value for the type specimen of ettringite. The slightly elevated value (relative to sturmanite) could be caused partly by the many tiny inclusions previously mentioned, which contributing editor Dino DeGhionno—using X-ray powder diffraction analysis—identified as calcite.

EDXRF analysis, performed on the finished cabochon by former GTL Research Technician Dijon Douphner, showed that the yellow material contained Al, Ca, Fe, Mn, and S, with possible traces of As, Cu, Pb, K, and Sr. The iron and manganese content appeared too high for ettringite, which nominally does not contain these elements. (Note that GIA's EDXRF system does not detect oxygen, hydrogen, or boron.) However, the qualitative chemistry fit very well with the chemical formula for sturmanite.

A small powder sample, scraped from the rough by Mr. DeGhionno, was used for X-ray powder diffraction analysis. The pattern that we obtained matched the line positions and relative intensities listed for sturmanite more closely than it matched those for the mineral ettringite.

Thus, much of our data pointed to sturmanite as the correct identity of this bright yellow cabochon. However, because the ettringite group is a solid solution (as is, for example, garnet), the chemistry and nature of the material can vary significantly, even within a single sample. Consequently, our conclusion on a GTL report would read: "A member of the Ettringite mineral group, probably Sturmanite."

Bicolored grossular-andradite garnets from Mali. When "Gem-Quality Grossular-Andradite: A New Garnet from Mali" (M. L. Johnson et al., Fall 1995 *Gems & Gemology*) was written, we had seen these garnets in three color types: orange to brown, somewhat desaturated yellow-green, and bright green (see the cover of the Fall 1995 issue for examples). In 1996, Bank et al. ("Gemmologie Aktuell," *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, Vol. 45, No. 1, pp. 1–4) predicted that bicolored yellowish green and dark brown grossular-andradite garnets were also possible. Coincidental with the publication of that article, in fact, two bicolored emerald-cut grossular-andradite garnets from Mali were loaned to the Gem News editors by David Knecht of RKG, Minneapolis, Minnesota. The larger, 2.57 ct, stone was a "classic" bicolor—brownish yellow on one side and greenish yellow on the other. The smaller, 1.22 ct, stone had a yellowish green core (figure 7) surrounded on all sides by green-yellow garnet; the core was especially distinct in polarized light. The gemological properties were (larger stone first, where different): optic character—singly refractive, with medium-order (2.57 ct) or high-order (1.22 ct) strain; color-filter reaction—brownish red, none; R.I.—1.770 (2.57 ct stone, greenish yellow region), 1.768 (2.57 ct stone, brownish yellow region), 1.761 (1.22 ct stone); S.G.—3.66, 3.64; fluorescence—inert to both long- and short-wave UV; absorption spectrum—415 nm cutoff, 440–450 nm band, faint absorption at 500 nm (2.57 ct stone); faint 415 nm band, 440–450 nm band (1.22 ct stone). According to EDXRF results, both stones contained Al, Si, Ca, Fe, Ti, Cr, and Mn. Green cores (like the one in the 1.22 ct stone) also have been seen in

some near-colorless grossular garnets from Asbestos, Quebec (see, for instance, W. L. Roberts, G. R. Rapp Jr., and J. Weber, *Encyclopedia of Minerals*, 1st ed., Van Nostrand Reinhold Co., New York, 1974, plate 60).

More on opal from Shewa, Ethiopia. Dr. Don Hoover (formerly of the U.S. Geological Survey) recently shared with us two samples of Ethiopian opals that have somewhat unusual properties, as compared to other opals and especially to those described in the Johnson et al. article on this locality (*Gems & Gemology*, Summer 1996, pp. 112–120). As illustrated in figure 8, thin "tubes"—such as the ones shown in figure 10 of the 1996 paper—pervaded the approximately 2 cm chunk of rough opal. The tubes occupied the same volume as patches of play-of-color in this opal; however, the play-of-color regions did not appear to be bounded, warped, or disturbed in any way by the presence of the tubes. This relationship implies that the tubes were older than the final aggregation of opal spheres into organized regions that caused the play-of-color diffraction effect.

The second piece, an approximately 5 ct chunk of white opal that also showed play-of-color, was interesting because of its very low apparent density. However, the specific gravity could not be measured by standard hydroscopic techniques, as the material rapidly took up water. With Dr. Hoover's permission, we attempted to slice a cube of the material in order to determine density by direct comparison of weight and volume (weight divided by volume equals density). Although the material crumbled while being sliced, we ended up with four fairly regular pieces of 1.90, 0.88, 0.45, and 0.41 ct. GTL weights-and-measures coordinator Christopher Lewis then ran each piece on the Sarin DiaMension, a noncontact measurement device (used for determining the proportions of faceted diamonds) that can calculate the volume of any appropriately sized sample having a fairly simple convex shape (that is, one having no holes or dimples; for instance, a heart-shaped brilliant is not convex). The four pieces had calculated densities of 0.81, 0.79, 0.68, and 0.67 grams per cubic centimeter. Such low densities have not been recorded for gem opals, but they have been seen in "tabasheer," opaline siliceous material formed in the stems of bamboos and other grasses (see, e.g., C. Frondel, *The System of Mineralogy of James Dwight Dana* [etc.], 7th ed., Vol. 3, 1962, pp. 287–306). The 0.45 ct piece was then placed in a beaker of water to see whether it sank or floated: It floated for about 30 seconds, then sank rapidly in a cloud of small bubbles. The piece became somewhat more translucent and grayer after half an hour in water, but it maintained its play-of-color and was not damaged by its soaking. It reverted to "normal" once it dried out.

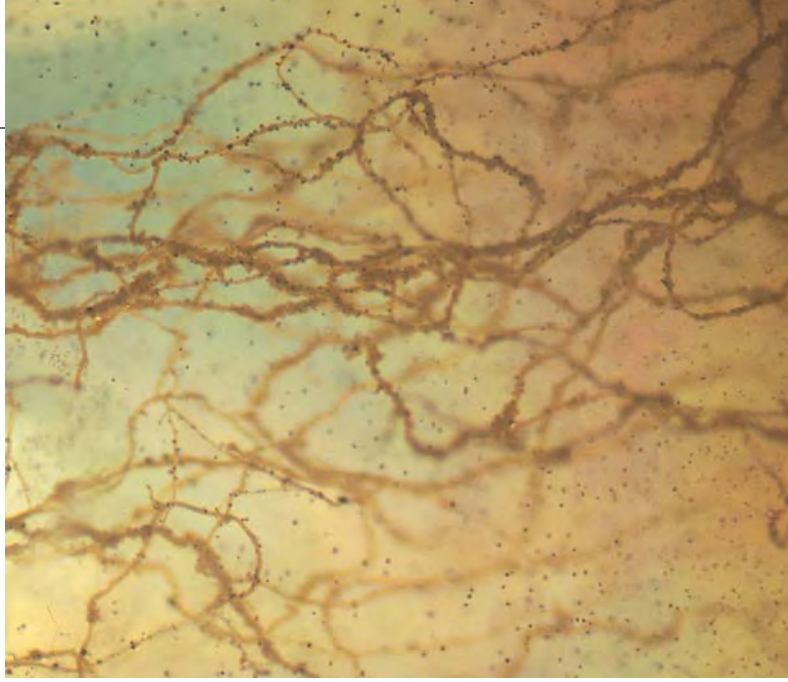


Figure 8. The tubular structures did not disturb the play-of-color in this rough opal from Shewa Province, Ethiopia. Photomicrograph by John I. Koivula; magnified 15×.

Figure 7. This 1.22 ct garnet from Mali has an intense yellowish green core. Photo by Maha DeMaggio.

Gem rhodonite from Australia. Many minerals have very similar gemological properties, and can only be separated with great difficulty. Examples include: the rare mineral genthelvite, which requires X-ray diffraction or chemical analysis to distinguish it from pyrope-almandite garnet (Fall 1995 Gem News, pp. 206–207); members of the amphibole group, which often cannot be distinguished from one another even with X-ray diffraction and EDXRF analysis; and members of the tourmaline group, which are usually identified simply as "tourmaline" instead of by the species name of elbaite, dravite, liddicoatite, and the like, because of the difficulty of separating the various species.

In August 1997, Randy Polk of Phoenix, Arizona, sent *Gems & Gemology* editor Alice Keller a parcel of both rough and fashioned examples of an intense pink

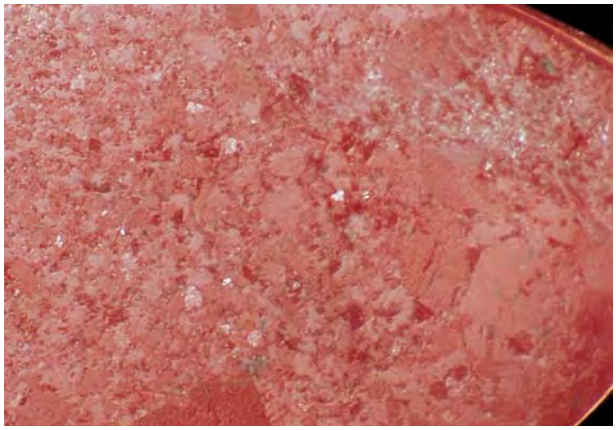
Figure 9. These rough and fashioned pieces of rhodonite from the Woods mine in Australia illustrate the range of color in this material. The largest piece measures 66.0 × 58.0 × 19.0 mm. Photo by Maha DeMaggio.

material (figure 9). This material came from the Woods mine in a remote area of New South Wales, Australia. When it was last seen on the market, about the early 1970s, it was believed to be rhodonite. However, in the past 20 years, new minerals have been characterized—including marsturite, nambulite, and natronambulite—which can be separated from rhodonite only with difficulty. In addition, certain previously identified minerals (pyroxmangite, bustamite) were commonly mistaken for rhodonite, or believed to be varieties of rhodonite, in the past. Thus, the question arose as to whether this material—especially the fine-grained crystalline aggregate (figure 10) constituting the darker pieces—was actually rhodonite or some other mineral nearly indistinguishable from it. Adding impetus to our examination was a statement from Mr. Polk that this material had been analyzed and tentatively identified as natronambulite.

Staff gemologist Philip Owens determined gemological properties for six (3.01–7.78 ct) cabochons. All six stones were translucent pink; four were evenly colored, and two (4.69 and 7.78 ct) were mottled with paler pink regions. All showed an aggregate optic character, and all were inert to the color filter. The four evenly colored stones had R.I. values of 1.73 (1.728 on a flat face of a rose cut stone) and S.G.'s between 3.41 and 3.72. The two mottled stones had spot R.I.'s of 1.54 and S.G. values of 3.00 and 3.17 (such low S.G. values are typical of massive rhodonite, which can have a significant admixture of quartz). The six stones were inert to both long- and short-wave UV, and they showed no luminescence to visible light ("transmission luminescence"). Five of the six stones showed absorption bands at 420 and 548 nm, as well as weaker bands at 440 and 455 nm; in the sixth, the 455 nm band was not observed. All of these properties were consistent with the material being rhodonite.

With magnification, all six stones showed a mottled texture, consisting of fine to medium grains. Shiny (sulfide?) and black opaque (manganese oxide?) patches were observed on one sample. Brown stains between grains were observed in two samples. The largest and most transparent crystals were found in a 3.01 ct pear-shaped cabochon (again, see figure 9), which was chosen for further testing. (This sample also had the highest specific gravity.) EDXRF revealed major Mn, Si, and possibly Ca; minor Sr and Ba; and traces of Zn and possibly Ni. An X-ray diffraction powder pattern was an excellent match to our rhodonite standard pattern (a sample from Australia, pattern measured in 1971) and also to JCPDS pattern 13–138, a rhodonite from Franklin, New Jersey. The latter was important because the sample that provided our rhodonite standard pattern also might have come from the Woods mine.

Figure 10. With magnification, it is evident that the dark samples in figure 9 are an aggregate of fine-grained deep pink crystals, showing random orientation. Photomicrograph by John I. Koivula; magnified 15×.



Although we are confident that the sample we tested is rhodonite (based on the relative intensities in its diffraction pattern), there is no guarantee that all of the material in this deposit is rhodonite.

Mr. Polk is the exclusive agent for this handsome pink material, which is being mined by John and Alex Taggart. Large quantities are available: About six tons of various qualities is expected to be on the market soon, and Mr. Polk tells us that at least two solid pieces weighing 2 tons each have been found. Mr. Polk and his colleagues have graded the material into several categories based on transparency and depth of color. "Pencil-sized" unterminated crystals have been found, and some of the material may be suitable for mineral specimens. Mr. Polk informs us that the Woods mine has produced several additional unusual minerals; the mineralogy of this deposit warrants further study.

TREATMENTS

"Pink geuda" sapphires from Vietnam and their treatment. Ted Themelis (Gemlab Inc., Athens, Greece) has provided the following information to the Gem News editors. During a March 1997 visit to Vietnam, he noted the abundance of geuda-type sapphires, locally referred to as "white sapphires," that had a very pale pink overtone. These reportedly are found in the Hoang Lien Son area, Lao-Cai Province, of northwest Vietnam. Most of the stones were opaque and cloudy, with pronounced milkiness; they ranged in size to a little over five grams. Rutile silk was seen in all specimens, either concentrated in patches or irregularly distributed throughout the stone. Some specimens were reminiscent of Sri Lankan geuda. Mr. Themelis observed that the milkier or more included the stone was originally, the more intense was the color produced by treatment.

Mr. Themelis performed three heat-treatment experiments on rough samples of this Vietnamese "pink geuda." First, he heated 118 pieces at 1650°C for five minutes in air, followed by rapid cooling (30°C/minute). Of these, 31 pieces turned blue, ranging from light to very dark; 54 developed patches or zones of blue; 21 turned pink or purple; and 12 pieces turned very light pink. Although the treatment noticeably improved the diaphaneity of all of these samples, they were still semi-translucent to opaque, suitable for cutting only as cabochons.

In a second experiment, Mr. Themelis heated 58 pieces of Vietnamese "pink geuda" that had a more noticeable pink tinge and obvious milkiness, at 1675°C for 10 minutes in pure oxygen, again followed by rapid cooling. Of these stones, 28 pieces turned medium-to-intense pink, with improved diaphaneity and luster (although still of cabochon quality); 13 pieces turned medium blue (also cabochon quality); and 17 pieces showed a shift in color from light purple in fluorescent light to very light pink under incandescent light (with improved diaphaneity, but still semi-translucent to opaque).

Last, Mr. Themelis heated 86 pieces of the Vietnamese "pink geuda" at 1700°C for 10 minutes in a reducing atmosphere, again followed by rapid cooling. Of these stones, all still opaque, 51 turned very dark blue, almost black; 23 turned purplish blue to blue; and 12 pieces turned mottled blue, with concentrated patches of blue color all over their surfaces. He believes that these newly discovered Vietnamese "pink geuda" sapphires show potential for commercial heat treatment, as a good percentage of the treated material is suitable for cutting low-quality cabochons.

SYNTHETICS AND SIMULANTS

Change-of-color synthetic sapphires represented as yet another "new find." The range of colors seen in most change-of-color synthetic sapphire is quite distinctive (described as "greenish blue in fluorescent or natural light and pinkish purple in incandescent light"; see, e.g., Gem Trade Lab Notes, Summer 1995, p. 127), and usually the material is represented to the unwary as alexandrite. However, the distinctive set of colors of these synthetic sapphires may cause suspicion in the mind of an experienced gemologist who sees such a stone, regardless of what it is stated to be.

The three synthetic sapphires in figure 11 were part of a lot of six samples (weighing from 1.32 to 2.28 ct) purchased from Afghani "freedom fighters"; these supposedly were natural sapphires from a new locality in the region. The "native cut" faceting they had undergone added to their air of authenticity. Examination with a microscope and a diffused transmitted light source quickly confirmed the suspicions of contributing editor Shane McClure: Curved striae were present in all three

Figure 11. These three "native cut" synthetic sapphires (weighing 2.03 to 2.28 ct) were represented as change-of-color sapphire from a new locality in or near Afghanistan. Courtesy of Dr. Horst Krupp, Firegems, La Costa, CA; photo by Maha DeMaggio.

Figure 12. These five samples of gadolinium gallium garnet (2.41–2.75 ct) were fashioned from material reportedly produced in a military facility in Russia. Photo by Maha DeMaggio.

stones. The source of our information, Dr. Horst Krupp, told us that clean pieces of rough as large as 40 grams were said to be available; no doubt larger pieces would have resembled their parent boules too closely for effective deception.

GGG from Russia. The Spring 1995 Gem News section (p. 70) contained an entry on a number of synthetic and imitation gem materials that were available at the 1995 Tucson show. These included materials being offered by the Morion Co. of Cambridge, Massachusetts; among those mentioned in that entry, but not described, was gadolinium gallium garnet (GGG) in a range of colors. The material was being sold primarily as unpolished disks about 80 mm in diameter by 5 mm thick. When asked why the material had been pre-formed in this fashion, the firm's president, Dr. Leonid Pride, stated that he purchased them in this shape from a factory in Russia that originally grew the crystals for use in electronic memory elements for military applications.

Since 1995, additional colors of GGG have become available. For instance, in September 1997 rough was available in: "intense pink, pink, light pink, almandine [red?], green-blue, aquamarine blue, sky blue, intense blue, raspberry, and lilac," according to Dr. Pride. The Morion Co. also has had a small number of faceted samples available at the annual Tucson shows; five of these (ranging in weight from 2.41 to 2.75 ct; figure 12) were obtained for characterization. We determined the following properties: color—various (see table 1); body color distribution—even; diaphaneity—transparent; R.I.—over the limits of the standard refractometer (greater than 1.81); S.G. (four of the five samples)—7.11 to 7.14, dark blue stone 6.64 (see below); singly refractive; pleochroism—none; magnification—no inclusions noted. Luminescence to ultraviolet radiation, Chelsea filter reaction, and the spectrum seen with the handheld prism spectroscope depended on the color of the stone (again, see table 1). On the basis of its appearance and these properties, GGG is easily separated from any natural gem materials.

EDXRF analysis showed that the dark blue specimen contained calcium and zirconium in addition to gadolinium and gallium. This detectable difference in chemistry most likely accounts for the significantly lower S.G. All of the specimens showed X-ray diffraction patterns consistent with GGG.

MISCELLANEOUS

***Gems & Gemology* author wins European cutting competition.** Arthur Lee Anderson of Speira Gems, Ashland, Oregon, recently won first prize in the gemstone cutting competition, the "28th German Award for Jewellery and Precious Stones Idar Oberstein 1997." Held every three years, the competition draws entries from all over the world and is juried by members from the European gemstone and jewelery industry. Mr. Anderson's winning entry was a 21.70 ct "Webbed Pear Cut" citrine (figure 13), a design that he developed over the past year. To create this design, Anderson employed several different cutting techniques, as well as the use of optics and reflections in the citrine. Mr. Anderson described some of his fashioning techniques in the article "Curves and Optics

TABLE 1. Color-dependent properties of five samples of GGG produced in Russia.

Color	UV fluorescence		Chelsea filter	Absorption spectrum (nm)
	Long-wave	Short-wave		
Purple	Weak orangy red	Weak orangy red	No reaction	Weak absorption at 500–520 and 530–550, strong bands at 570–580 and 610–620, 650 cutoff
Purplish pink	Weak orangy red	Weak orangy red	No reaction	Sharp lines at 465, 485, 515, 520, 540; weak 550; doublets at 530, 570, 580 and 590
Orangy red	Very weak red	Weak red	Red	Vague absorption at 400–440 and 500–600; 690 cutoff
Green-blue	Inert	Inert	No reaction	Weak 540 band; moderate bands at 570 and 620; 650 cutoff
Blue	Inert	Inert	Red	Weak 440 and 455 bands; 460–470, 590–620, and 640–690 bands

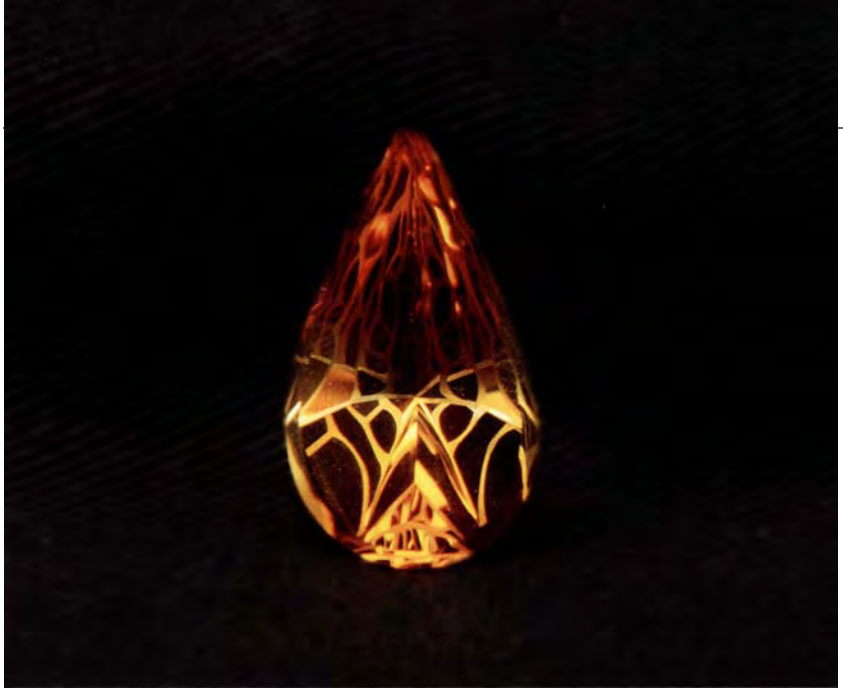


Figure 13. This 21.70 ct "Webbed Pear Cut" citrine brought gem cutter Arthur Anderson top honors in the 28th German Award for Jewellery and Precious Stones. Photo by Manfred Grebel.

in Nontraditional Gemstone Cutting," which appeared in the Winter 1991 issue of *Gems & Gemology* (pp. 234–239).

Standards issued for the jewelry industry in China. The Chinese State Bureau of Technological Supervision (CSBTS) issued three national standards for the jewelry industry on October 7, 1996; they went into effect throughout China on May 1, 1997. The three documents defining these standards (*GB/T 16552-1996 Gems—Nomenclature, GB/T 16553-1996 Gems— Testing, and GB/T 16554-1996 Diamond Grading*) were drafted by the National Gemstone Testing Center in Beijing, and are written in Chinese; research associate Yan Liu of GIA Research provided us with the following summary.

The first, *GB/T 16552-1996 Gems—Nomenclature*, specifies the rules for naming gemstones. This standard is usable for identifications, as well as for descriptions used for imports and exports, insurance, and the trade. The term *gems* refers to both natural and manufactured gem materials. Natural gems include single-crystal (or twinned) gem materials ("natural gemstones"); natural aggregate and amorphous materials, including jadeite, nephrite, chalcedony, opal, serpentine, and natural glass (all of these are included in the heading "natural jades," which could confuse Western purchasers); and "natural organic substances." Manufactured materials—including single-crystal synthetics, assemblages, "reconstructed stones," and imitations—are placed in the category of "artificial products." Enhancement is also defined, as are optical phenomena. The Chinese standard was created with AGTA, CIBJO, and All Japan Gem Society standards taken into consideration, and the document includes a table translating between English and Chinese gem names.

The second document, *GB/T 16553-1996 Gems—Testing*, provides terminology and methods for gem identification, and can be used as a gem identification manual. It contains identification criteria for 49 natural gemstones, 31 natural aggregate or amorphous materials, eight natural organic substances (including petrified wood, but not ivory), and 17 "artificial stones." Enhancements described include heating, bleaching, waxing, the use of colorless and colored oils, filling and impregnation, dyeing, irradiation, laser drilling, coating, and surface diffusion.

The last standard, *GB/T 16554-1996 Diamond Grading*, is a manual for the grading of the color, clarity, cut, and weight of a faceted diamond. This standard is only suitable for grading natural colorless to light yellow (or light brown, or light gray) diamonds of 0.20 ct or larger. Twelve color grades are used (D through N, and below N), and master stones are used to judge color and fluorescence. Clarity is evaluated under a 10× loupe, using "European" terminology: LC (loupe clean), two grades of VVS, two grades of VS, two SI grades and three P (piqué) grades. There are three cutting grades based on diamond proportions. The standard also specifies notation for diamond plots and explains how to grade mounted diamonds.

The term *natural jades*, used in the first two standards to classify aggregate or amorphous materials, requires some additional discussion. The Chinese term *yu*, although often considered equivalent to the English *jade*, in fact might be better translated throughout Chinese history as "most resistant carvable stone." Although many of the aggregate materials included in this classification might only cause puzzlement in the overseas gem trade if they were described as "natural jades" (for instance, turquoise or rhodochrosite), the description as "natural jade" of some materials discussed in these standards (e.g., serpentine, quartzite, aventurine quartz) could generate considerable, and potentially expensive, confusion. To prevent misuse of this term, the Nomenclature standard puts further restrictions on the use of "yu" or "jade" to describe materials. No material—even nephrite or jadeite—can be called simply

"jade" or "jade rock;" thus, nephrite is "nephrite jade"—but serpentine is also "serpentine jade." Materials cannot be described by their shapes: "round jade" is not an acceptable definition. Except for specific, well-defined materials cited in the standard, place names are not acceptable in jade descriptions. Hence, "Yunnan jade" is not a valid term. (One exception to the "no place names" rule is "Dushan jade," which is the accepted name in these Chinese standards for a specific zoisite/plagioclase feldspar rock.)

ANNOUNCEMENTS

Dates set for February 1998 Tucson shows. The American Gem Trade Association (AGTA) GemFair will run from Wednesday, February 4, through Monday, February 9, 1998, at the Tucson Convention Center. Following that show at the Convention Center will be the Tucson Gem and Mineral Society show from February 12 to 15. At the Holiday Inn City Center (Broadway), from February 4 to 11, will be the Gem & Lapidary Dealers Association (GLDA) show. The Gem and Jewelry Exchange (GJX) show will run from February 5 to 12, across Grenada Street from the Holiday Inn City Center. Other show venues featuring gem materials include the: Pueblo Inn, Rodeway Inn, Tucson Showplace, Sonoran Desert Marketplace, Discovery Inn, Holiday Inn Express, Quality Hotel and Suites, Tucson Scottish Rite Temple, Howard Johnson's, Tucson East Hilton & Towers, La Quinta Inn, The Windmill Inn, Southwest Center for Music, Holiday Inn Palo Verde/Holidome, and Days Inn. Times and dates of shows vary at each location. Consult the show guide, which will be available at the different Tucson venues, for further information.

Visit *Gems & Gemology* in Tucson. *Gems & Gemology* Editor Alice Keller and Senior Editor Brendan Laurs will be staffing the *Gems & Gemology* booth in the Galleria section (middle floor) at the Tucson Convention Center for the duration of the AGTA show, February 4–9. Stop by to ask questions, share information, or just say hello. Many back issues will be available.

International Society of Appraisers. The 19th Annual International Conference of the International Society of Appraisers (ISA) will be held March 22–25, 1998, in San Diego, California. The ISA is a multidiscipline professional association, with members in the United States, Canada, and other countries; it is dedicated to advancing the theory, principles, techniques, and ethics of appraising personal property. Founded in 1979, it is the largest association of its kind. At the upcoming 19th program, concurrent programs will focus on gems and jewelry, antiques and residential contents, as well as fine art. Further information about this conference is available on the internet at http://www.isa-appraisers.org.